



**Waterloo Region
District School Board**

Request for Tender

For

Tait St. Public School HVAC Renovations

Tender #7198-RW-22

Issued: Tuesday February 8, 2022

Closing Date: Tuesday February 22, 2022

Closing Deadline: 2:00:00 p.m. local time

Black-out Period:

From Deadline for Questions/queries to Bid Award Notification

- 1.1 The following professional seals and signatures are provided as required by Paragraph 1.21.1 (4) Division C of the Ontario Building Code and apply to the areas of expertise for which each consultant was commissioned.

- 1.1.1 Architect: ward99 architects inc.



- 1.1.2 Structural: VX Engineering Inc.



- 1.1.3 Mechanical: DEI Consulting Engineers



LIST OF DRAWINGS

Architectural – ward99 architects inc.

A0.0	PROJECT INFORMATION AND O.B.C. MATRIX
A1.1	EXISTING KEY PLANS, SITE MOBILIZATION PLAN, LEGEND AND NOTES
A2.1	PARTIAL GROUND FLOOR DEMOLITION PLAN, LEGEND AND NOTES
A2.2	PARTIAL PROPOSED GROUND FLOOR PLAN AND LEGEND
A2.3	PARTIAL ROOF PLAN, LEGEND AND NOTES
A3.1	PARTIAL DEMOLITION REFLECTED CEILING PLANS, LEGEND AND NOTES
A3.2	PARTIAL PROPOSED REFLECTED CEILING PLANS, LEGEND AND NOTES
A4.1	TYPICAL CLASSROOM INTERIOR ELEVATIONS AND PROPOSED EXTERIOR ELEVATIONS
A4.2	PROPOSED EXTERIOR ELEVATIONS AND TYPICAL INTERIOR ELEVATIONS
A5.1	WALL SECTIONS
A5.2	DETAILS

Structural – VX Engineering Inc.

S1	PART GROUND FLOOR PLAN
S2	PART ROOF FRAMING PLAN
S3	UNITS AND OPENING FRAMING DETAILS IN EXISTING WOOD DECK ROOF
S4	UNITS AND OPENING FRAMING DETAILS IN EXISTING STEEL DECK ROOF
S5	GENERAL NOTES

Mechanical – DEI Consulting Engineers

M101	BUILDING PLAN, SCHEDULES & GENERAL NOTES
M102	SCHEDULES
M201	GROUND & 2ND FLOOR BLOCK A PART PLANS HVAC DEMOLITION
M202	GROUND FLOOR BLOCK B PART PLAN HVAC DEMOLITION
M301	GROUND & 2ND FLOOR BLOCK A PART PLANS HVAC RENOVATION
M302	GROUND FLOOR BLOCK B PART PLAN HVAC RENOVATION
M401	ROOF BLOCK A PART PLAN HEATING & VENTILATION RENOVATION
M402	ROOF BLOCK B PART PLAN HEATING & VENTILATION RENOVATION
M501	GROUND & 2ND FLOOR FIRE SUPPRESSION PLAN
M601	BOILER ROOM DEMOLITION & RENOVATION
M701	MECHANICAL DETAILS & SECTIONS

Electrical – DEI Consulting Engineers

E101	KEY PLAN & LEGEND
E102	LIGHTING CONTROL DETAILS AND SCHEDULES
E103	LIGHTING CONTROL SCHEDULE

Section 00 01 03
LIST OF DRAWINGS

TAIT STREET PUBLIC SCHOOL
HVAC RENOVATIONS
TENDER #7198-RW-22

E201	GROUND FLOOR DEMOLITION PLANS BLOCK A
E202	GROUND FLOOR DEMOLITION PLANS BLOCK B
E301	GROUND FLOOR RENOVATION PLANS BLOCK A
E302	GROUND FLOOR RENOVATION PLANS BLOCK B
E303	ROOF RENOVATION PLANS
E304	ROOF RENOVATION PLANS
E401	SPECIFICATIONS
E402	SPECIFICATIONS

<u>SECTION NUMBER</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>

DIVISION 00 – BIDDING AND CONTRACT DOCUMENTS

00 01 01	Cover Sheet	1
00 01 02	Professional Qualifications	2
00 01 03	List of Drawings	2
00 01 10	Table of Contents	4
00 21 13	Instructions to Bidders	18
00 21 14	Vendors of Record	8
00 41 13	Bid Form Sample (Appendix B)	2
00 41 13A	Asset and Warranty Card (Appendix C)	2
00 41 13B	Vendor Performance Evaluation Form (Appendix D)	4
00 41 73	Supplementary Bid Information	4
00 72 13	Terms and Conditions	12
00 73 03	Supplementary Conditions	72

DIVISION 01 - GENERAL REQUIREMENTS

01 14 00	Work Restrictions	2
01 19 00	Specifications and Documents	2
01 21 00	Allowances	4
01 31 00	Project Management and Coordination	6
01 32 00	Construction Progress Documents	4
01 33 00	Submittal Procedures	6
01 35 17	Fire Safety Requirements	8
01 35 17A	Appendix 013517A – Hot Work Permit	2
01 35 23	Health and Safety	6
01 35 43	Hazardous Materials	4
01 35 43A	Appendix 01 35 43A – Asbestos Audit by MTE	48
01 35 43B	Appendix 01 35 43B – Asbestos Bulk Sampling by Onpoint	19
01 42 00	References	6
01 45 00	Quality Control	8
01 51 00	Temporary Utilities	6
01 53 00	Temporary Construction Facilities	6
01 61 00	Product Requirements	6
01 70 00	Examination and Preparation	4
01 73 30	Execution and Cutting and Patching	4
01 74 00	Cleaning and Waste Processing	4
01 78 10	Closeout Submittals and Requirements	6
01 78 40	Maintenance Requirements	4
01 79 00	Demonstration and Training	4

<u>SECTION NUMBER</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>
01 82 19	Fire Ratings and Assemblies	2
<u>DIVISION 02 – EXISTING CONDITIONS</u>		
02 40 00	Demolition	7
<u>DIVISION 03 – CONCRETE</u>		
03 20 00	Concrete and Masonry Reinforcement	5
03 35 00	Concrete Floor Finishing	3
<u>DIVISION 04 – MASONRY</u>		
04 05 00	Masonry Procedures	5
04 05 13	Masonry Mortar and Grout	4
04 05 19	Masonry Anchorage and Reinforcement	6
04 05 22	Concrete Unit Masonry	7
04 05 23	Masonry Accessories	3
04 21 00	Clay Unit Masonry	2
<u>DIVISION 05 – METALS</u>		
05 12 00	Structural Steel	15
<u>DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES</u>		
06 10 00	Rough Carpentry	4
06 41 13	Architectural Casework and Hardware	6
<u>DIVISION 07 – THERMAL AND MOISTURE PROTECTION</u>		
07 21 13	Board Insulation and Roofing Accessories	4
07 21 16	Batt and Blanket Insulation	4
07 26 00	Sheet Vapour Retarders	2
07 27 00	Air Barriers	6
07 42 10	Composite Aluminum Panels	7
07 62 00	Metal Flashing and Trim	5
07 84 00	Firestopping and Smoke Seal	12

<u>SECTION NUMBER</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>
07 92 00	Sealants	7
<u>DIVISION 08 – DOORS AND OPENINGS</u>		
08 11 13	Hollow Metal Doors and Frames	9
08 51 13	Aluminum Fixed Windows	8
<u>DIVISION 09 – FINISHES</u>		
09 22 00	Non-structural Metal Framing	6
09 29 00	Gypsum Board	10
09 51 00	Acoustic Ceilings	8
09 65 00	Resilient Flooring	7
09 90 00	Painting	16
<u>DIVISION 10 – SPECIALTIES</u>		
Not Used		
<u>DIVISION 11 – EQUIPMENT</u>		
Not Used		
<u>DIVISION 12 – FURNISHINGS</u>		
Not Used		
<u>DIVISION 13 – SPECIAL CONSTRUCTION</u>		
Not Used		
<u>DIVISION 14 –CONVEYING EQUIPMENT</u>		
Not Used		
<u>DIVISION 20 – COMMON REQUIREMENTS FOR MECHANICAL</u>		
20 00 01	Mechanical Specifications Index	2
20 02 51	Mechanical Contract Requirements	12

<u>SECTION NUMBER</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>
20 05 11	Mechanical Work Requirements	12
20 05 31	Expansion Fittings and Loops	2
20 05 32	Thermometers and Pressure Gauges	3
20 05 34	Base, Hangers and Supports	6
20 05 49	Vibration Control Measures	4
20 05 53	Identification of Mechanical Services	6
20 06 11	Testing, Adjusting and Balancing of Mechanical Systems	6

DIVISION 21 – FIRE SUPPRESSION

21 13 13	Wet Pipe Fire Suppression	6

DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONS (HVAC)

23 07 13	Duct Insulation	4
23 07 19	HVAC Piping Insulation	5
23 21 13	Hydronic Piping (Welding)	7
23 07 14	Hydronic Piping (Rolled Groove)	8
23 07 23	Pumps Hydronic	3
23 23 13	Refrigerant Piping Specialties	5
23 25 13	Water Treatment for Closed-Loop Hydronic Systems	4
23 31 13	Metal Ducts	6
23 33 13	Duct Accessories	4
23 31 13.13	Volume Control Dampers	3
23 33 18	Operating Dampers	2
23 33 46	Flexible Ducts	2
23 33 53	Duct Liners	3
23 34 23	Packaged Exhausters	2
23 37 13	Diffusers, Registers and Grilles	3
23 37 23	Louvres and Vents for Intake and Exhaust	2
23 72 18	Fixed Plate Air-to-Air Heat Recovery Ventilators (Residential)	2
23 81 26	Split System Air Conditioning	4
23 82 23A	Hydronic Unit Ventilators – Vertical Floor Mount – Pretender	4
23 82 23B	Hydronic Unit Ventilators – Vertical Ducted	4
23 82 29	Radiators, Convectors, and Cabinet Heaters	4

DIVISION 25 – INTEGRATED AUTOMATION

25 05 11	Variable Frequency Drives	7
25 40 11	Building Control System	11

<u>SECTION NUMBER</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>

DIVISION 26 – ELECTRICAL

Refer to Electrical Drawings.

DIVISION 27 – COMMUNICATIONS

Refer to Electrical Drawings.

DIVISION 28 – ELECTRICAL SAFETY AND SECURITY

Refer to Electrical Drawings.

DIVISION 31 – EARTHWORK

Not Used

DIVISION 32 – EXTERIOR IMPROVEMENTS

Not Used

DIVISION 33 – UTILITIES

Not Used

SECTION 00 21 13 – INSTRUCTIONS TO BIDDERS

1.0 INTRODUCTION

- 1.1. The Waterloo Region District School Board, herein after referred to as the “Board” would be pleased to receive a bid for Tender 7198-RW-22, Tait St. Public School HVAC Renovations.

Read the entire package very carefully before preparing a bid.

1.2. About the Waterloo Region District School Board

The Waterloo Region District School Board is a provincially funded institution reporting to the Ministry of Education of Ontario and is one of the larger school boards in Ontario, operating 121 school locations and serving approximately 64,000 students in the Region of Waterloo.

1.3. Electronic Bid Submission and Bid Results

WRDSB is soliciting Bids through the online portal (the “Bidding System”) <https://wrdsb.bidsandtenders.ca> All Bids shall be submitted through the Bidding System only. Bidders must have a Bidding System Vendor Account and shall ensure the account is created with the Bidders full legal company name.

It is the Bidder’s responsibility to read the tender document package thoroughly including all attachments and addenda, if any, as these contain information that is highly pertinent to this procurement and to clarify any details with the Designated Representative before submitting a Bid. Upon thorough review immediately notify through the “submit a question” feature in the bidding system findings of any design errors, inconsistencies, or omissions in the bid solicitation and/or site examination. The Board and/or Consultant will not accept claims for extras from the Bidder, based on the failure to detect and report same found in the Bid Solicitation, and/or site examination before Tender closing. To be considered, Bidders must respond to this Bid Solicitation.

Your company is strongly urged when creating or updating a Bidding System Vendor account to invite additional contacts to the vendor profile. This will permit these invited contacts that have created their own login to manage (register, submit, edit and withdraw) Bids which your Company is a Registered Plan Taker for. In the event of vacations or illness, these additional contacts may act on your Company’s behalf, have the authority to receive addendum notifications from the Bidding System, submit Bids electronically through the Bidding System and/or withdraw and/or edit and/or acknowledge addenda, on your behalf.

If you are an invited company contact, it is imperative that you create your login from the link contained in the email invitation. Do NOT go directly to the Bidding System website and create a separate vendor account.

Hard copy Bid Submission will not be accepted by the Board.

Bids will not be accepted after the Closing Date and Time.

There will be no public opening for this Bid.

Once an award is made, the successful Bidder will be named on the Bidding System, and an award notification will be sent.

1.4. Bid Submission

- .1 Bidders must include the appropriate submission requirements and mandatory forms specified in this section.
- .2 Bidders shall have a "Vendor Account" in the Bidding System and be registered as a "plan taker" for this Bid Solicitation Document. Only the plan takers will have access to download this Bid Solicitation Document, receive addenda email notifications, download addenda and to submit their Bid electronically through the Bidding System.
- .3 The onus is on the Bidder to ensure that the Bid is received and acknowledged in the Bidding System on or before the Closing Time. The Closing Time shall be determined by the Bidding System's web clock. The timing of the Bid submission shall be based on when the Bid is RECEIVED by the Bidding System, not when a Bid is submitted by a Bidder.
- .4 Bidders shall allow sufficient time to upload their Bid submission and attachment(s) (if applicable) and to resolve any issues that may arise as Bid transmission can be delayed in an "internet traffic jam" due to file transfer size, transmission speed, and other electronic considerations.
- .5 Upon receiving a Bid, the Bidding System will send a confirmation email to the Bidder advising that the Bid was submitted successfully. If a Bidder does not receive a confirmation email despite submitting a Bid, the Bidder should contact technical support of the service provider hosting the Bidding System via email: support@bidsandtenders.ca
- .6 The Bidding System will not accept Bids after the Closing Time as determined by the Bidding System's web clock. Bids submitted by fax or paper copy or any other format will not be accepted.

- .7 The Board hereby consent to the use of an Electronic Signature for the signing of all documents requested hereunder. Acceptable forms of signatures include, but are not limited to, the typing of the Bidder's authorized signing officer's name or the inclusion of an image of the Bidder's authorized signing officer's signature, so long as the electronic signature is sufficient to identify the Bidder's authorized signing officer. The Bidder's authorized signing officer agrees that whatever form of electronic signature is provided constitutes a signature for the purpose of executing all documents requested hereunder.

1.5. Withdrawal of Bid Submission

Bidders may withdraw or edit and resubmit a Bid in the Bidding System at any time prior to the Closing Date and Time. The most recent submission or withdrawal received in the Bidding System on or before the Closing Time shall prevail and shall overwrite all previous submission(s) and withdrawal(s). The Closing Time shall be determined by the web clock within the Bidding System. After such time, requests to withdraw Bid Submissions will not be considered.

1.6. Bid Review

- .1 All Bids received on or before the Closing Time will be reviewed for compliance based on this Bid Solicitation Document. Non-compliant Bids may be rejected. Bids not meeting any of the mandatory requirements included in this Bid Solicitation Document may be disqualified. Bidders may be contacted to clarify its submissions.
- .2 It is the Bidder's responsibility to satisfy the Board that the Bidder can comply with the requirements contained within this Bid Solicitation Document and that the Bidder possesses the necessary inventory, equipment, facilities, resources and staff to perform the Work specified in this Bid Solicitation Document. Bidders may be required to submit evidence of above in a form acceptable to the Board. Substitution of materials, equipment, or methods different from that outlined in the terms of reference will not be accepted unless provided for within this Bid Solicitation Document or with the written approval from the Board.
- .3 The Board also reserve the right to examine Bidder's facilities, equipment and visit the sub-contractors or sub-consultants proposed or Bidder's existing and past clients. The award decision may be revised based on the above.
- .4 The Board will not be responsible for travel costs (including, but not limited to, time and mileage) if travel is required. No additional charges will be accepted by the Board for any cost incurred by the Bidder or any other party in participating in the Bid evaluations.
- .5 The Board may, in their sole discretion, check references, conduct credit checks, review the litigation history and history of professional liability or other

insurance claims, and obtain any other type of information that might aid the Board in its selection. The Board reserve the right to consider all or any information received from all available sources, whether internally or externally obtained. The Board may disqualify any Bid from further consideration based on results of reference or credit checks or review of litigation or claim history. The foregoing may include the Board's own experiences with the respective Bidder(s) or any of the subcontractors and sub-consultants proposed in its Bid.

1.7. Tie Bids

Where two (2) or more Bids have been received reflecting the same, compliant lowest Bid price, the time stamp for date and time submission in the Bidding System will dictate the award (earliest submission shall prevail).

1.8. Award Recommendation

- .1 Subject to the reserved rights of the Board and availability of funds, the lowest compliant Bid will be recommended for award.
- .2 The documents listed below will be incorporated as deemed necessary by the Board, into the Contract with the Successful Bidder. If there is a discrepancy between the wording of one document and the wording of any other document that appears on the list, the wording of the document that first appears on the list shall take precedence:
- .3 Board approved change orders or Contract or Agreement amendment.
- .4 Purchase Order, Contract or Agreement executed with the Bidder including exhibits.
- .5 Bid Solicitation Document issued by the Board, including addenda, if applicable.
- .6 Bid submitted by the Bidder.
- .7 There shall be no obligation on the Board as a result of seeking Bids or conducting the procurement process and the Board reserve the right to cancel the Bid Solicitation, issue a revised request, or to pursue any other course of action which would aid in meeting their needs.

1.9. Documents Required for Award

Within ten (10) working days of receiving a request from the Board, the Bidder (the "Recommended Bidder") shall provide the following:

- .1 Insurance certificate with coverage specified in the Bid Solicitation Document.

- .2 WSIB clearance certificate valid on date of award or an exemption letter (if applicable and requested).
- .3 Contract security, if applicable as specified in the Bid Solicitation Document.
- .4 An executed Board issued Form of Agreement, duly signed by the authorized signatory.
- .5 Any other submittal specified in the Bid Solicitation Document as a requirement of award.

In addition to all of the Board's other remedies, if a Recommended Bidder fails to execute the Form of Agreement or satisfy any other applicable conditions within ten (10) days of notice of selection, the Board may, in their sole and absolute discretion and without incurring any liability, rescind the selection of that Bidder.

1.10. Confirmation to Proceed

No work shall commence until each of the Board's Procurement Services has issued a purchase order, contract, or letter of intent to the Successful Bidder. Goods/Service or Work, as described shall not commence until all the required documents have been submitted to Procurement Services and the Form of Agreement executed by the Successful Bidder and the Board. For payment purposes, a Purchase Order shall be generated and issued to the Successful Bidder. The Purchase Order number must appear on all invoices in order to ensure prompt payment.

1.11. Site Visit

Due to Covid-19, Proponents are to supply and wear medical grade masks and eye protection. Due to the nature of this Tender, a NON mandatory site visit has been deemed necessary. Failure to attend and register at the time and location(s) specified would NOT result in disqualification. Representatives for the Proponents are requested to sign in at the NON-mandatory site meet. The Board at its sole discretion may schedule additional non-mandatory site visits. Proponents are to reference 1.18 Timetable for site meet date and time.

The site visit will take place at: Tait Street Public School located at 184 Tait Street in Cambridge, Ontario, N1S 3G3.

The site meet is NON-mandatory for the following: Prime Contractors' Proponents are to meet at the Main Office.

Notify via the "submit a question" feature in this bidding system to the attention of: "Site Meet Request", the name of your company and staff that would like to attend a scheduled site meet.

Do not show up without submitting your request to attend the site meet.

The size of the groups at the site meet(s) will be limited as per current Public Health Recommendations.

An addenda prior to the site meet will be posted noting the companies and personnel and time for each scheduled site meet.

1.12. Supplemental Site Visits

Due to Covid-19, Proponents are to supply and wear medical grade masks and eye protection.

Supplemental site visits will be permitted for interested Proponents and subcontractors to gain access to the site in order to better prepare their bid submission and are not to be held prior to the mandatory or non-mandatory site visit.

When a supplemental site visit is required, the Proponent or subcontractors may only visit the school after 3:30 P.M., during a scheduled school day. The Proponent or subcontractors shall immediately report to the Main Office, sign in as per the school protocol and ask for the head custodian. The head custodian's role is to ensure that the Proponent or subcontractors are guided to the area of interest regarding this Tender document and to provide access where required.

Proponents or sub-trades may not direct any questions related to this Tender to the head custodian or any other Board staff present. Proponents asking the head custodian or Board staff questions related to the scope or Tender in general will be disqualified.

1.13. Communication

For the purpose of this Tender, the only contact for all Bidders, subcontractors if any, and any third-party suppliers of goods or services for all queries, questions and notifications, from the Tender issue date to the bid award notification date is to be directed to the submit a question feature in this bidding system:

Designated Representative: Rebecca Witteman

Responses will be via addenda

1.14. From Issue Date to Deadline for Questions/Queries

Questions must be received by the Designated Representative no later than the deadline for questions noted in the Anticipated Project Schedule.

If a Bidder finds any discrepancies, ambiguities or omissions within the Request for Tender (RFT) documents, or requires any clarifications regarding the RFT documents, questions and clarifications must be sent to the Designated

Representative through the Bidding System by clicking on the “Submit a Question” button found within the bid details page of that opportunity. Bidders are strongly encouraged to ask clear and concise question(s) citing the relevant section of the Bid Solicitation Document.

The Board has endeavoured to provide complete, correct information and estimates to enable Bidders to properly assess and determine the scope and complexity of the Work prior to submitting a Bid. Bidders are solely responsible for determining if they require additional information or if anything appears incorrect or incomplete. The onus is on the Bidder to contact the Designated Representative prior to the Deadline for Questions indicated in this document, if they have any questions or queries whatsoever or find omissions from or discrepancies in this Bid Solicitation document, unnecessary restrictions in the terms of reference, or should they be in doubt as to the meaning of any part of this document. Written answers or clarifications to issues of substance will be shared with all Bidders in the form of an Addendum.

1.15. Blackout Period: From Deadline for Questions/Queries to Bid Results Notification

A black out period shall exist between the deadline for questions and the date of award. During this period, there shall be no communication between the Bidders, the Board or any Board consultants, unless initiated by the Board’s Designated Representative.

1.16. After the release of the Bid Results Notification / Debriefing Requests

In accordance with the Broader Public Sector Procurement Directive, unsuccessful Bidders are entitled to a debriefing in order to receive feedback with respect to their Bid submission. In order to obtain a debriefing, Bidders shall contact the Designated Representative listed in this Bid Solicitation Document in writing with their request within sixty (60) days of the award notification.

1.17. Consequences of not following the Proponent Contact Protocol

Communication initiated by the Proponent, subcontractors, or third-party suppliers of goods or services during the blackout period, to the Board or consultant may be grounds for disqualification from the Tender.

Communication by Proponents, subcontractors, or third-party suppliers of goods or services, to the consultant or the Board, other than the Board contact from the issue date to the Tender to receiving the award non award notification, may be grounds for disqualification from the Tender.

1.18. Anticipated TimeTable

DESCRIPTION	DATE
Issue Date of Tender	February 8, 2022
Non-Mandatory Site Meeting	February 11, 2022, 4:15 pm local time
Deadline for Questions/Queries	February 14, 2022, 2:00 pm local time
Closing Deadline	February 22, 2022, 2:00 pm local time
Blackout Period	Deadline for Questions / Queries to Bid Award Notification
Anticipated Contract Start Work begins	July 4, 2022
Substantial Completion Date	August 29, 2022
Deemed Complete Date	September 12, 2022

1.19. Addenda

The Board reserves the right at any time prior to the closing time:

- .1 to withdraw or cancel the Request for Tender;
- .2 to extend the time for the submission of bids; or
- .3 to modify these instructions, the schedule of prices, the specifications, or the description of the project, work or supply;

By the publication of an addendum or other notice, and the Board shall not be liable for any expense, cost, loss or damage incurred or suffered by any bidder (or any other person) as a result of its so doing.

Bidders shall acknowledge receipt of any addenda when submitting their bid through the Bidding System. Bidders shall check the appropriate box for each addenda and any applicable attachments that have been issued. This must be done before a bidder can submit their bid submission. Addenda shall become part of the tender documents and will be considered in determining the bid price(s).

Addenda will be issued through the Bidding System. It is the responsibility of the bidder to have received all addendum/addenda that have been issued. Bidders should check online at <https://wrdsb.bidsandtenders.ca> prior to submitting their bid and up until bid closing date and time in the event additional addenda are issued.

If a bid has been submitted prior to an addendum/addenda being issued by the Board, the Bidding System shall automatically retract the bid submission. The bid submission status will be changed to an incomplete status (NOT accepted by the Board). The retracted bid can be viewed by the bidder in the “MY BIDS” section of the Bidding System. The bidder becomes solely responsible for the following actions:

- .1 make any required adjustments to their bid; and
- .2 acknowledge the addendum/addenda; and
- .3 Ensure the re-submitted Bid is successfully received by the Bidding System on or the bid closing date and time.

1.20. Warranty and Maintenance

The Awarded Bidder, at the time of substantial completion shall furnish a written warranty covering material, maintenance, and work performed under the contract for a minimum period of two (2) years from the date of completion. Individual sections may extend warranties beyond the two year time frame. The Awarded Bidder is responsible for all required maintenance complete with materials and labour during the warranty period.

2.0 BOARD PURCHASE ORDER

Goods/Service or Work, as described shall not commence until all of the required documents have been submitted to Procurement Services and the CCDC 2 executed by the Awarded Bidder(s) and the Board. For Payment purposes, a Purchase Order shall be generated and issued to the Awarded Bidder(s). The Purchase Order number must appear on all invoices in order to ensure prompt payment.

3.0 CONSULTANT

The Board has hired the following consultant to assist in the preparation of this Tender: Ward99 Architects Inc.

The Board will assemble addenda as required. Addenda will be the Board's only form of communication.

The consultant and any sub consultants are not to be contacted by any interested parties from the Tender issue date to the bid award notification. The consultant or any sub consultants will not respond to any direct communication.

The Board will be responsible for the contract administration of the project after the purchase order has been issued or the contract has been signed by the Board.

4.0 THE BID CONTRACT

- .1 The bidders and the Owner acknowledge that it is their intention to create a process contract (the "Bid Contract") between the Owner and any bidder whose Bid meets the Mandatory Requirements. The bidders and the Owner further acknowledge that, if a Bid Contract is created between the Owner and one or more of the bidders, the terms of the Bid Contract are represented by the Bid Documents.

5.0 DEFINITIONS

- 5.1. Capitalized terms not otherwise defined in this Section or elsewhere in these Instructions to Bidders shall have the meanings ascribed to them in the Contract. All references in these Instructions to Bidders to "Section" or "paragraph" shall, unless specifically indicated otherwise, refer to a Section or paragraph of these Instructions to Bidders.
 - .1 "**Bid**" means the Base Bid Form and all other documents submitted by a bidder in accordance with these Instructions to Bidders.
 - .2 "**Designated Representative**" means the Procurement Specialist of the WRDSB, NOT the prime Consultant.
 - .3 "**Bid Documents**" has the meaning set out in item 7, Instructions to Bidders.
 - .4 "**Bid Form**" means the Base Bid Form or any of the Supplementary Bid Forms listed in paragraph 6.1.2, section 00 21 13.
 - .5 "**Black-Out Period**" is the period between the deadline for asking questions or making queries, to the Bid Award Notification.
 - .6 "**Board**" means the Waterloo Region District School Board.
 - .7 "**Consultant**" means Prime Consultant retained by the Board and identified in these documents.
 - .8 "**Contract**" means the written agreement to be signed between the Owner and the successful bidder in the form of CCDC 2 – 2008 stipulated price contract, as amended by supplementary conditions.
 - .9 "**Evaluation Score**" has the meaning set out in item 12.0 Bid Evaluation, Section 00 21 13.
 - .10 "**Evaluation Team**" means the committee / team appointed to guide, monitor and direct this bid process and evaluate Bids.

- .11 **“Irrevocability Period”** has the meaning set out in Item 4.2, Section 00 72 13.
- .12 **“Mandatory Requirements”** has the meaning set out in item 12, Section 00 21 13.
- .13 **“Project Manager”** or Project Coordinator can be used interchangeably and is the Board’s representative for the project.
- .14 **“Submission Deadline”** is the date and time identified in Item 1.18, Section 00 21 13.

5.2. VENDORS OF RECORD

- .1 Bidders must be approved as a Vendor of Record by the Owner. Bids received from contractors who have not been approved prior to the Tender period will be returned unopened.
- .2 The Owner reserves the right to issue an addendum naming additional pre-qualified general contractors and additional pre-qualified Subcontractors and Suppliers.

6.0 BID DOCUMENTS

- .1 The following documents form the basis of this bid process (collectively the “Bid Documents”):
 - .1 Instructions to Bidders.
 - .2 Bid Forms comprising the Base Bid Form and, where required, the Supplementary Bid Form – List of Subcontractors, Supplementary Bid Form – Itemized, Separate and Alternative Prices, and Supplementary Bid Form – Unit Prices.
 - .3 CCDC 2 – 2008 stipulated price contract comprised of the Agreement Between Owner and Contractor, Definitions, and General Conditions of the Stipulated Price Contract.
 - .4 Supplementary Conditions.
 - .5 Specifications (as per table of contents).
 - .6 Drawings (as per list of Drawings).
 - .7 Any Reports or Studies, including, but not limited to, Asbestos, Hazardous Materials included with the specifications or addenda.
 - .8 Addenda issued prior to the Submission Deadline.
- 6.2. Check Bid Documents for completeness upon receipt. Inform the Designated Board Representative immediately, should any documents be missing or incomplete and/or upon finding any discrepancies or omissions.
- 6.3. The Bid Documents are made available only for the purpose of submitting Bids for the Project. Availability and/or use of the Bid Documents do not confer a license or grant for any other purpose.

7.0 PROHIBITION ON LOBBYING / COLLUSION

- 7.1.** Bidders and/or any representatives employed or retained by them are strictly prohibited from engaging in conduct which is or could reasonably be considered as any form of political or other lobbying, or as an attempt to influence the outcome of this bid process.
- 7.2.** A bidder shall not discuss or communicate directly or indirectly with any other bidder any information whatsoever regarding the preparation of a Bid. Bidders shall prepare and submit Bids independently and without any communication, knowledge, comparison of information, or arrangement, direct or indirect, with any other bidder.
- 7.3.** Failure of any bidder to comply with this Section may result in the disqualification of the bidder and the rejection of its Bid.

8.0 CONFLICT OF INTEREST

- 8.1.** Bidders shall disclose all perceived, potential and actual Conflicts of Interest. For the purposes of this bid process, "Conflict of Interest" includes:
 - .1 any situation or circumstance where, in relation to this bid process and/or the Contract, the bidder's other commitments, relationships or financial interests could or could be perceived to exercise an improper influence over the objective, unbiased and impartial exercise of independent judgment by any member of the Evaluation Team, the Board, or the Owner;
 - .2 any situation or circumstance where any person(s) employed by the Owner in any capacity, or any member of the Board:
 - .1 has a direct or indirect financial interest in the award of the Contract to any bidder;
 - .2 is currently employed by, or is a subcontractor or a consultant to a bidder;
 - .3 is negotiating or has an arrangement concerning future employment or contracting with any bidder;
 - .4 has an ownership interest in, or is an officer or director of, any bidder.
- 8.2.** If a bidder discovers, at any time, any perceived, potential or actual Conflict of Interest, the bidder shall promptly disclose the perceived, potential or actual Conflict of Interest by sending a written statement in the manner described in paragraph 8. Failure of any bidder to comply with this Section may result in the disqualification of the bidder and the rejection of its Bid.
- 8.3.** Without limiting the generality of Section 22, the Owner may, in its sole discretion:
 - .1 exclude any bidder and its Bid on the grounds of Conflict of Interest;

- .2 waive any and all perceived, potential or actual Conflicts of Interest upon such terms and conditions as the Owner, in its sole discretion, requires to satisfy itself that the Conflict of Interest has been appropriately managed, mitigated and minimized.

9.0 SITE INVESTIGATION

- .1 Any soils investigation, environmental, geotechnical or other reports prepared or obtained with respect to the Place of the Work (collectively the "Reports") are available from the Consultant. Where the Work involves existing buildings, structures, facilities, plant or equipment, any reports, data or as-built drawings concerning such buildings, structures, facilities, plant or equipment (collectively the "Data") are available from the Consultant. The Reports should not be considered a representation of the site conditions of the entire Place of the Work, and the Reports and Data are provided for general information and guidance purposes only. Neither the Owner nor the Consultant guarantees the accuracy or completeness of the Reports or the Data, nor does either assume any responsibility for any interpretations or conclusions that bidders may make or draw from the Reports or the Data.
- .2 Each bidder is solely responsible, at its own cost and expense, to carry out its own independent research and due diligence, or to perform any other investigations considered necessary by the bidder to satisfy itself as to all existing conditions, circumstances and limitations affecting the Work, including the existence and/or locations of utilities and underground services. The bidders' obligations set out in this paragraph apply irrespective of any Reports, Data or any information contained in the Bid Documents.
- .3 No allowances will be made for additional costs and no claims will be entertained in connection with conditions which could reasonably have been ascertained by investigation or other due diligence undertaken prior to the Submission Deadline, and/or in connection with Work which is required and which is reasonably inferable from the Bid Documents, the Reports and/or Data as being necessary.

10.0 DESIGNATED SUBSTANCES

- 10.1.** An Asbestos Audit, prepared by MTE Consultants Inc. for each facility is available at the school's main office, for review by the Contractor. A duplicate set is also available in the Facility Services department located in the Education Centre. Include in this contract the required removal of all asbestos containing material as identified in the audit, within 600mm of all new services, materials and equipment and as required to complete the Work. No claims for extra cost will be accepted for areas known to contain asbestos containing materials.

- 10.2. Comply with applicable legislation regarding asbestos. Should the Contractor encounter asbestos, not noted in the above Asbestos Audit, that would be disturbed during the course of the Work they should stop the Work in that immediate area and report the same to the Board Contact.
- 10.3. In addition, Lead, Mercury, Silica and Isocyanates are anticipated to be present in existing facilities. New construction, renovations or alterations require compliance by the Contractor with the applicable legislation.
- 10.4. In carrying out the Work under the Contract, bidders shall ensure they do not handle, deal with, disturb or remove any designated substance, whether identified in the OHS Reports or not, unless included in the Work. Should a bidder determine, prior to the Submission Deadline, that the Work cannot be completed without handling, dealing with, disturbing or removing any designated substance identified in the OHS Reports (and the Work does not otherwise require the bidder to handle, deal with, disturb and/or remove such substance), the bidder shall immediately notify the Designated Representative in the manner described in paragraph 8 so that, if necessary, instructions and/or clarifications may be issued in the form of an addendum.
- 10.5. All information provided to or obtained by bidders in connection with this bid process, including all Reports, Data and the OHS Reports, are and shall remain the property of the Owner and must be treated as confidential whether or not the Contract is awarded, and such confidentiality obligations shall survive termination of the bid process. Such information is not to be used for any purpose other than submitting a Bid.
- 10.6. The area of work may contain environmentally hazardous Building materials. The Owner's intention is to have the contractor hire an approved Board subcontractor for asbestos removal. This work will be done under the supervision of the contractor. All asbestos removal is part of the Contractor's base bid price, unless specifically noted otherwise on the drawings or in the specifications.

11.0 INSTRUCTIONS FOR COMPLETING THE BID

11.1. Listing of Subcontractors:

- .1 Where required by the Bid Documents, bidders shall complete and submit a Supplementary Bid Form – List of Subcontractors, naming the Subcontractors and Suppliers which the bidder will employ to perform an item of the Work called for by the Contract. Failure of the bidder to list Subcontractors and Suppliers, where required, may result in the Bid being declared non-compliant.
- .2 Where the Owner has provided a Vendor of Record list, for any one or more Subcontractors and/or Suppliers to perform or supply an item of the Work called for by the Contract, bidders shall select a subcontractor or supplier from

that Vendor of Record list to perform or supply that item of Work. Failure to do so shall result in the Bid being declared non-compliant.

- .3 Where a bidder lists more than one Subcontractor or Supplier to perform or supply an item of the Work listed, the Subcontractor or Supplier that is listed last shall be deemed to be the Subcontractor or Supplier to be employed by the bidder to perform or supply such item of the Work.
- .4 Where a bidder lists “own forces” in place of a Subcontractor, the bidder shall carry out such item of the Work with its own forces. Where “own forces” have been listed by a bidder, the Owner reserves the right to obtain information from the bidder and from third parties respecting the qualifications and experience of the bidder’s “own forces” for such item of the Work.

11.2. Itemized, Separate and Alternative Prices:

- .1 Where required by the Bid Documents, bidders shall complete and submit a Supplementary Bid Form – Itemized, Separate and Alternative Prices. The Owner reserves the right to accept or reject any or all itemized, separate and alternative prices submitted, and such prices shall remain in effect for the duration of the Contract. Failure to submit an itemized, separate or alternative price where required may result in the Bid being declared non-compliant.

11.3. Unit Prices:

- .1 Where required by the Bid Documents, bidders shall complete and submit a Supplementary Bid Form – Unit Prices. Unit prices shall be in effect for the duration of the Contract and may be used to calculate the cost of additional work under the Contract. The Owner reserves the right to accept or reject any or all unit prices submitted, and such prices shall remain in effect for the duration of the Contract. Failure to submit a unit price where required may result in the Bid being declared non-compliant.

12.0 BID EVALUATION

12.1. Mandatory Requirements. Only bidders that submit Bids which the Evaluation Team determines meet all of the mandatory requirements set out below (collectively the “Mandatory Requirements”) on a “pass/fail” basis will be eligible to be considered for an award of the Contract:

- .1 The Bid includes the Base Bid Form which bears the bidder’s original signature.
- .2 The bidder is a valid Vendor of Record.
- .3 Where a mandatory site meeting was scheduled and held, the bidder attended the mandatory site meeting.
- .4 The Bid includes the Security Documents.
- .5 The Bid includes valid Vendor of Record Subcontractors and/or Suppliers.

- .6 The Bid substantially complies with the other requirements of the Bid Documents.
- 12.2. Point Based Evaluation Criteria.** Only Bids which meet all of the Mandatory Requirements will be evaluated by the Evaluation Team and awarded points based on criteria set out below.
- .1 As few as zero (0) points will be awarded for each evaluation category; the maximum points available for each evaluation category are set out below.
- .2 The total points awarded to a bidder will be that bidder's "Evaluation Score".

CRITERIA	Points Available
<i>Mandatory bid documents</i>	Pass/Fail
Bid price offered / bid price as adjusted by the amount of any itemized, separate and/or alternative price(s) which the Owner, in its discretion, decides to accept.	100%
MAXIMUM POINTS AVAILABLE	100

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

- 13.1.** Within ten (10) Working Days of receiving an award letter from the Owner, and prior to commencing the Work, the successful bidder shall deliver to the Owner:
- .1 the performance bond and the labour and material payment bond described in the Bid Documents, the forms of such bonds to comply with the requirements of the Contract;
- .2 certified true copies of the insurance policies required by the Contract or certificates of insurance, at the option of the Owner;
- .3 a current WSIB clearance certificate;
- .4 the bidder's health and safety policy for the Project; and
- .5 a copy of the notice of project issued by the Ministry of Labour for the Project.
- 13.2.** The successful bidder shall execute the Contract and shall deliver the executed original to the Owner within ten (10) Working Days of the bidder's receipt of the same.

14.0 PUBLIC STATEMENTS, CONFIDENTIALITY, AND MFIPPA

- 14.1.** Bidders shall not publish, issue or make any statements or news release, electronic or otherwise, concerning their or any other Bid, this bid process, the

evaluation of the Bids, the award of the contract, or cancellation of this bid process, without the express written consent of the Owner. The Owner's award of the Contract to a bidder does not constitute a general endorsement of that bidder's products or services.

- 14.2.** All information provided by or obtained from the Owner in connection with this bid process is the sole property of the Owner and must be treated as confidential. Such information is not to be used for any purpose other than preparing a Bid.
- 14.3.** By submitting a Bid, bidders acknowledge that the contents of their Bids will be disclosed, on a confidential basis, to the Evaluation Team and may be disclosed to members of the Board and the Owner's staff, agents and advisors for the purpose of evaluating or participating in the evaluation of the Bids. The Owner will use reasonable efforts to protect pricing, commercial terms, and other sensitive and confidential information provided by the bidders as part of a Bid (the "Confidential Material"), however, the Owner accepts no liability in the event that the Confidential Material, or any part of it, is disclosed even if the Evaluation Team, the Owner, its staff, agents, advisors or any other person associated with the Board or the Owner may have been negligent with respect to such disclosure.
- 14.4.** Information provided in the Bids may be presented at public meetings of the Board and may be disclosed to the public. In addition, the Owner may be required to disclose information provided in the Bids pursuant to the provisions of the Municipal Freedom of Information and Protection of Privacy Act or other legislation. By submitting a Bid each bidder agrees to such disclosure and releases the Evaluation Team, the Owner, the Board, and the Consultant from any liability for the same.

15.0 RELEVANT POLICIES

- .1 The Board has a number of relevant policies regarding tenders and bidders should familiarize themselves with the following policies:
- .1 Purchasing Policy- www.wrdsb.ca/about-the-wrdsb/procurement-services
 - .2 Conflict of Interest - Employees or Trustees - <https://www.wrdsb.ca/wp-content/uploads/4005-Procurement.pdf>
 - .3 Acceptance of Hospitality or Gifts - <https://www.wrdsb.ca/wp-content/uploads/4005-Procurement.pdf>
 - .4 The Board also has emergency response procedures: - www.wrdsb.ca

END OF SECTION

SECTION 00 21 14 – VENDORS OF RECORD

1.0 INTRODUCTION

- 1.1. The **Waterloo Region District School Board**, in an effort to build an improved supplier database and to obtain exceptional long term value, has implemented a Vendors of Record list. This tender is open to those who are currently registered under the Board's Vendor Registration System.
- 1.2. Only those General Contractors and Subcontractors noted below may submit bids in their particular fields. Refer to specification sections for products, suppliers and installers that will be required in addition to the Vendors of Record noted below.

2.0 VENDOR REGISTRATION PROCESS

- 2.1. To become a Vendor of Record for future business opportunities, go to the Board's public website at www.wrdsb.ca and refer to *About Us - Purchasing Services - Vendor Registration*, and submit the completed application, as per instructions on the website.

3.0 PRIME / GENERAL CONTRACTORS

- 3.1. Any bid submission from bidders other than Vendors of Record contractors listed below or identified by Addendum will have their bid ruled informal.
- 3.2. The Owner reserves the right to issue an addendum naming additional general contractors as a Vendor of Record.
- 3.3. The following Prime / General Contractors are Vendors of Record with the Board and are invited to submit bids:

General Contractor	Phone	Email
Bestco Construction (2005) Ltd	(905) 304-4597	estimating@bestcoconstruction.com
Caird-Hall Construction Inc.	(905) 634-0903	caird-hall@bell.net
Collaborative Structures Limited	(519) 658-2750	jblackler@collaborativestructures.com
Complete Building Systems Inc.	(519) 576-5800	estimating@completebuildinsystems.ca
CRD Construction	(519) 822-1801	sbock@crdconstruction.on.ca
D. Grant Construction Limited	(519) 652-2949	swillis@dgrantconstruction.com
Dakon Construction	(519) 746-0920	james@dakon.ca
Eldale Structures Ltd	(519) 823-5500	bmcleod@eldale.com
Elgin Contracting and Restoration Ltd.	(519) 633-9969	info@elgincontracting.com

Gateman-Milloy Inc.	(519) 748-6500	info@gatemanmilloy.com
Golden Gate Contracting Inc	(905) 844-1122	estimation@ggcontracting.ca
K&L Construction (Ontario) Ltd	(519) 472-7164	todd.hodgins@kandlconstruction.com
Melloul Blamey Construction	(519) 886-8850	teresa.oreilly@melloul.com
Nith Valley Construction Ltd	(519) 662-1324	mail@nithvalley.com
PM Contracting Ltd	(519) 576-8327	sarahziegler@pm.on.ca
PRE-ENG CONTRACTING LTD.	(905) 738-6866	info@pre-eng.com
Reid & Deleye Contractors Ltd	(519) 688-2600	gregd@reid-deleye.com
RENOKREW	(416) 604-7042	info@renokrew.com
SG Cunningham Ltd	(519) 886-2730	allan@cunningham.on.ca
Sierra Construction	(519) 421-7413	info@sierraconstruction.ca
SPEC Construction Inc.	(519) 650-4030	info@spec-build.com
STM Construction Ltd	(519) 756-7030	robertbox@stmconstruction.com
Struct-Con Construction Ltd.	(905) 791-5445	harpreet@struct-con.ca
Tambro Construction	(519) 766-1234	btami@tambro.com
TRP Construction	(905) 336-1041	info@trpconstruction.ca
Van Horne Construction Ltd	(905) 677-5150	otekin@vanhorne.ca
Zehr Levesque Inc.	(519) 576-2233	estimating@zehrgroup.ca

4.0 SUBCONTRACTORS

- 4.1. Bidders shall select only a Subcontractor or Supplier listed below to perform or supply an item of Work indicated. Failure to do so shall result in a Bid being ruled informal.
- 4.2. The Owner reserves the right to issue an addendum naming additional Subcontractors and Suppliers as a Vendor of Record.
- 4.3. The following Subcontractors are Vendors of Record with the Board and are invited to submit bids to the General Contractors:

Mechanical Contractor	Phone	Email
AAA Air Conditioning Inc	(519) 747-9051	igrant.aaaac@gmail.com
AIM Industrial Inc.	(519) 747-2255	craigd@aimindustrial.ca
Arcadian Projects Inc.	(519) 804-9697	cory@arcadianprojects.ca
Black & McDonald Limited	(905) 560-3100	sfernandes@blackandmcdonald.com
Brenner Mechanical Inc	(519) 746-0439	clanglois@brenner.ca

C.N. Mechanical Contractors Limited	(519) 404-8235	mclaughlin5284@rogers.com
CJ's Express Plumbing & Electrical	(519) 621-3111	noliveira@cjsexpress.ca
Conestogo Mechanical Inc	(519) 579-6740	wquickfall@conestogomech.com
Dean Lane Contractors Inc	(519) 585-0903	dean@dean-lane.com
Dordan Mechanical Inc.	(519) 662-9900	danielg@dordanmech.com
Jas 3 Limited	(519) 741-8643	jeffs@jas3heatingcooling.ca
Jay Stewart Mechanical	(519) 576-2663	admin@jaystewart.ca
Keith's Plumbing & Heating Inc.	(905) 544-8118	andrena@keithsph.com
LJ Barton Mechanical Inc.	(905) 304-1976	estimating@ljbarton.com
Nelco Mechanical Ltd	(519) 744-6511	mhobson@nelcomech.com
Reitzel Heating & Sheet Metal	(519) 884-3510	alan@reitzelheating.ca
Roberts Bros Sheet Metal Contractors Ltd.	(519) 633-1507	robertsbros@bellnet.ca
Roberts Onsite Inc	(519) 578-2230	dmagnus@robertsonsite.ca
SCT Mechanical Inc.	(519) 626-0268	jscott@sctmechanical.com
Sutherland-Schultz Ltd	(519) 653-4123	info@sutherland-schultz.com
Touchstone Building Technologies Inc.	(519) 997-2792	info@touchstonebti.ca
Trade Mark Industrial Inc	(519) 570-1511	tmoore@trade-markind.com
Velocity Mechanical Inc	(519) 896-1119	quotes@velocitymechanical.com
Vollmer Inc.	(519) 966-6100	mshaw@vollmer.ca
Wellington Plumbing & Heating Ltd.	(519) 821-4130	kyle@wellington-plumbing-hvac.com
Yorktowne Air Inc.	(905) 532-9699	klipien@yorktowneair.ca

Electrical Contractor	Phone	Email
AIM Industrial Inc.	(519) 747-2255	craigd@aimindustrial.ca
Arcadian Projects Inc.	(519) 804-9697	cory@arcadianprojects.ca
Atlas Electric Corp.	(289) 386-3601	atlaselectricgta@gmail.com
Boshart Electric Ltd.	(519) 662-1220	patf@boshartelectric.com
CJ's Express Plumbing & Electrical	(519) 621-3111	noliveira@cjsexpress.ca
D&D Electric Ltd	(519) 603-2924	jquehl@ddelectric.ca

Eclipse Technology Solutions Inc.	(905) 593-1770	jbacon@eclipsetechnology.ca
Edge Electrical Solutions Inc.	(519) 747-3343	Kevin@EdgeElectricalSolutions.ca
Fairway Electrical Services Incorporated	(905) 304-1133	cherd@fairwayelectrical.com
Harold Stecho Electric Ltd	(519) 746-0047	steves@stechoc.ca
JM Electrical Contracting	(519) 572-3148	johnmader@sympatico.ca
Juno Electric	(519) 821-4890	steno@junoelectric.ca
KW E Inc Electrical Contractors	(519) 653-6989	jim@kweinc.com
Live Electric	(519) 265-8566	estimates@live-electric.ca
Millers Electric Ltd	(519) 742-3465	scottg@meltd.on.ca
MJM Electric Limited	(519) 824-1989	mlang.mjm@gmail.com
Nadelec Contracting Inc	(905) 875-5239	john.nadelec@gmail.com
Nelco Mechanical Ltd	(519) 744-6511	mhobson@nelcomech.com
Pfaff Electric Limited	(519) 235-0909	jeff@pfaffelectric.com
Roberts Onsite Inc	(519) 578-2230	dmagnus@robertsonsite.ca
Sentry Electric Inc	(705) 436-4530	info@sentryelectric.ca
Sutherland-Schultz Ltd	(519) 653-4123	info@sutherland-schultz.com
Toth Inc	(519) 696-3916	tothelectric@rogers.com
Trade Mark Industrial Inc	(519) 570-1511	tmoore@trade-markind.com
Trade Service Group Inc.	(519) 591-8851	mikewernie@tradeservicegroup.com
Vollmer Inc.	(519) 966-6100	mshaw@vollmer.ca

Abatement Contractor	Phone	Email
A & O Contracting Inc	(905) 828-6868	anthony@aandocontracting.com
Azbest Environmental	(226) 751-5059	hank@azbest.ca
Biggs & Narciso Construction	(905) 470-8788	james@biggsandnarciso.com
Caliber Environmental Construction Services Inc.	(905) 884-5500	jimball@caliberenv.com
EAN Construction	(519) 603-0109	info@eanconstruction.com
Enviro-cor Enterprises	(519) 753-0993	kelly@enviro-cor.ca
FPR Environmental Inc	(519) 568-8222	frank@asbestosmouldexperts.com
GB Environmental Services	(905) 984-3455	gflett@gbenvironmental.net

I&I Construction Services Ltd	(905) 884-1290	tbarron@iandi.ca
Jobi Construction Ltd.	(519) 227-1181	bparsons@jobiconstruction.com
Power Environmental Power Vac	(905) 318-0622	info@powervachamilton.ca
Puroclean Property Restoration	(519) 653-8030	jreis@puroclean.com
Reitzel Bros. Environmental	(519) 648-2237	ddeleon@ags-environmental.com
Schouten Environmental Inc	(519) 577-8989	brant@schouten.ca
Zero Environmental Inc.	(519) 772-5500	info@zeroenvironmental.com

Masonry Contractor	Phone	Email
Advanced Masonry Inc	(519) 846-2121	dkocher@advancedmasonry.ca
Brownstone Masonry	(905) 856-3115	brownstonemason@bellnet.ca
Core Tec. Contracting	(519) 620-7100	eddy@coretec.ca
Elgin Contracting and Restoration Ltd.	(519) 633-9969	info@elgincontracting.com
Flagstone Construction	(519) 579-8811	jr.flagstone@yahoo.ca
G & B Masonry Ltd	(519) 220-8437	matt@gandbmasonry.ca
GA Masonry	(519) 648-2285	bgeorge@gamasonry.com
Jeffrey Custom Masonry Ltd.	(519) 275-1279	brad_jeffrey@wightman.ca
Konia Masonry Corp.	(519) 664-1112	main@koniamasonry.com
R Dekoninck Masonry Inc.	(519) 582-3003	rdekoninckmasonry@gmail.com

Millwork Contractor	Phone	Email
Baywood Interiors Ltd	(519) 748-9577	johnl@baywoodinteriors.com
Bendt Kitchens and Millwork Inc.	(519) 743-7418	jody@bendt.ca
BEZ Industries	(519) 579-3880	john@bezindustries.com
CCW Inc	(519) 886-2728	hermes.alvarez@ccwinc.com
DM Millwork Ltd	(519) 743-1556	dmmillwork@gto.net
GL Industries Ltd	(519) 787-4379	gary@glindustries.ca
Harris Corporate Interiors Inc.	(905) 563-6111	danny@hciinc.ca
HSCJ Millwork Inc.	(226) 606-3171	sam@hscjservices.com
Interior Store Display Installations	(519) 895-0532	garry@interiorstoredisplay.com

Leedwood Ltd.	(519) 805-3556	ryan@leedwood.ca
Second Generation Furnishings	(905) 738-1403	robert@2ndgen.ca
Top Millwork Interiors Inc.	(416) 736-9868	topmillwork@msn.com
Vdcm Architectural Woodwork Inc.	(519) 743-4409	estimating@vdcn.ca
Wood design ltd	(905) 595-1281	wooddesign.ltd@gmail.com

Roofing Contractor	Phone	Email
Spinton Roofing Limited	(905) 575-3686	mira@spintonroofing.com

*Note: Roofing work

Window Contractor	Phone	Email
Aerloc Industries Ltd.	(905) 628-6061	peterdendekkerjr@aerloc.com
Alwind Industries Ltd	(905) 738-4266	gm@alwind.com
Barton Glass	(905) 385-3599	pdhbartonglass@quickclic.net
Festival City Glass Ltd.	(519) 271-5182	festivalcityglass@gmail.com
Glass Canada Limited	(519) 642-4100	rdamstra@glass-canada.com
Huron Glass Inc	(519) 565-5007	huron.glass@tcc.on.ca
Kitchener Glass Ltd	(519) 744-5201	paul@kitchenerglass.com
KW Glass Systems Inc	(519) 725-9305	rick@kwglass.com
Peninsula Glass Inc.	(905) 735-2901	tim@peninsulaglass.ca
Ridley Windows and Doors	(905) 854-2228	lsutherland@ridleywindows.com
Shantz Windows	(519) 669-2629	bruce@shantzwindows.com
Sherwood Windows Group	(416) 675-3262	bhorton@sherwoodwindows.com
Windspec Inc	(905) 738-8311	wferri@windspec.com

Flooring Contractor	Phone	Email
Flooring Plus	(519) 747-5131	vartan@flooringplus.ca
M&M Carpet Inc.	(905) 279-7875	mmcarpet@bellnet.ca
Nufloors Simcoe	(519) 426-2619	garnatfloor@eastlink.ca
Rick's Carpet and Flooring	(519) 449-2362	gcouwenberg@rickscarpet.ca
S L Marcella Carpets Ltd	(519) 885-2357	nick@marcellacarpets.ca
The Belluz Group Ltd.	(905) 385-8999	abraham@belluzgroup.ca

Twin City Tile Co Ltd	(519) 743-4179	matt@twincitytile.com
Voll's Contract Flooring	(519) 669-1151	dkirch@vollscontract.ca
Zet Master Limited	(905) 789-6560	konrad@zetmaster.com

Painting Contractor	Phone	Email
Aves & Shaw Painting	(519) 742-3486	avesandshawltd@rogers.com
CertaPro Painters of Waterloo	(519) 616-1167	adyck@certapro.com
Expert Painting Inc	(519) 635-8106	expertpainting@hotmail.com
Gateway Painting Ltd.	(519) 500-0772	info@gwpainting.ca
Mike McMahon's Painting Ltd	(519) 744-0169	mikes.painting.ltd@sympatico.ca
Northern Painters (div Connco Group Ltd)	(800) 465-6985	northpaint@conncogroup.com
Platinum Painting & Decorating Inc.	(905) 790-2111	sandro@platinumpaintdecor.com
Westwood Painting Services Inc.	(905) 575-8458	westwoodpainting@cogeco.net

END OF SECTION

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Waterloo Region
District School Board

Appendix B – Price Bid Form Sample

Bid price shall be submitted through the Bidding System only

SCHOOL	BID PRICE	HST	TOTAL
	\$	\$	\$
	\$	\$	\$
	\$	\$	\$

END OF SECTION

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Instructions:

- a. The WRDSB Project Asset & Warranty Card shall be filled out and completed for any project or work that calls for the replacement or new installation of any asset that has a warranty and requires ongoing preventative maintenance, as well as any asset that is being removed.
- b. The information for the WRDSB Project Asset & Warranty Card shall be collected and coordinated by the General Contractor responsible for the overall project. The WRDSB Project Asset & Warranty Card shall be filled out and submitted to the Board electronically to FAC_maintenance@wrdsb.ca and carbon copy the project coordinator at the point in time where the project is deemed "Substantially Complete" or at the start of the Warranty Period for said asset. For any project without a General Contractor, the Contractor or Trade responsible for the installation and/or removal of the asset shall complete the WRDSB Project Asset & Warranty Card and submit it to the Board in the same manner as mentioned above.
- c. All items shall include the asset identifier, asset description, location, manufacturer, model, serial number, and warranty end date (refer to example at bottom of page).
- d. NO Warranty Period shall start without the written permission of the Board prior to the point of Substantial Completion of the project.
- e. The Contractor that is responsible for the coordination and completion of the WRDSB Project Asset & Warranty Card shall ensure that the contractor or trade responsible for the installation of the item understands that the contractor or trade is responsible for the preventative and general maintenance of that item for the minimum 2 year warranty period as noted on the WRDSB Project Asset & Warranty Card.
- f. All items installed under this contract that require ongoing preventative maintenance (PM) shall be included on the WRDSB Project Asset & Warranty Card. The following list contains examples to be included but not limited to;
- | | | |
|----------------------------------|-------------------------------|--------------------------------|
| Air Compressor | Chiller | Grease Trap |
| Air Handler- ERV, Heat Pump, RTU | Cooling Tower | Gym Equipment |
| AC Split -Indoor/Outdoor Unit | Elevator/Lift | Hoods- Kitchen/Fume |
| Automatic Doors | Eyewash Station-location only | Operable Partitions |
| Backflow Preventer | Fire Panel | Sprinkler System -area covered |
| Boiler | | Tech Equipment |
- g. All maintenance during the warranty period shall be the responsibility of the contractor. This shall include, but not be limited to: air handling unit filter changes (3x min per year), or as per manufacturers recommendations; servicing testable backflow preventors, including fees; and any and all required maintenance.

Sample:

[illegible]

Project Name: _____

School / Location: _____

Date: _____

[illegible]

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Appendix D - VENDOR PERFORMANCE EVALUATION FORM AND GUIDELINES

The Board, in an effort to build an improved supplier base and to obtain exceptional long term value, has undertaken a project to register vendors. In conjunction, performance of vendors, either Prime and/or Sub that are involved with this project may be evaluated.

The evaluation may occur at or near substantial completion.

An evaluation may also occur at any stage of the project in order to request and implement a corrective action to facilitate the successful completion of the project.

The Board will evaluate prime contractors.

Prime contractors will evaluate sub-contractors that do not meet expectations and forward the results to the Board. The Board will initiate a request for corrective action to the subcontractor. This is separate from any corrective action that the prime contractor may have. Prime contractors may address the evaluation form and processes at the start up meeting, but it is the responsibility of the prime contractor and the subcontractors to communicate, understand and adhere to the evaluation form and guidelines.

The Board will forward Performance Evaluations to the evaluated prime contractor and/or Subcontractor, here after referred to as Vendor.

A Vendor Performance Evaluation that:

1) Meets or exceeds expectations:

Is a very powerful tool that the evaluated vendor can forward as references to prospective clients giving a very accurate indication of their performance and abilities.

As such, upon request, a vendor performance evaluation will be completed and forwarded to the same vendor, who can then forward it on to their prospective client.

2) Is below expectations:

Will be forwarded to the vendor with a Request for Corrective Action.

The Board will also lower the project size capability of the vendor at this time.

Upon the vendor's successful completion and demonstration of the Request for Corrective Action, the Board may increase the project size capability of the vendor.

The Board or vendor upon the successful completion of the Request for Corrective Action may request a meeting in order to move forward in a positive manner.

Procurement Services will provide clarification and/or direction regarding the Request for Corrective Action, if requested, however the Vendor Performance Evaluation will remain as issued.

The Vendor Performance Evaluation, Requests for corrective action, and the vendor's corresponding corrective action will be filed at the Board.

The Vendor Performance Evaluation may be revised and or modified at any time without notice.



Business Services Division

Procurement Services

VENDOR PERFORMANCE EVALUATION

Vendor Name: _____

Project Name: _____

Tender Number: _____

Classification: ☐ Prime Contractor ☐ Subcontractor

1. Safety & Security: (Understands & follows requirement guides)

Comments: _____

2. Site Supervision:

Comments: _____

3. Billing Accuracy:

Comments: _____

4. Ability to Minimize Deficiencies:

(Timing, follow up, documentation of actions)

Comments: _____

5. Ability to Maintain Schedule & React to Changes:

(Completeness of work, providing appropriate manpower)

Comments: _____

6. Ability to stay focused on Scope: (Does not seek additional work)

Comments: _____

7. Approximate dollar value evaluated:

8. Additional Comments: _____

CHECK ONE					
Not Applicable	Far below expectations: inadequate, containing little detail insufficient knowledge	Does not fully meet expectations: limited knowledge and requirements	Meets expectations: demonstrates ability and knowledge to address basic requirements	Exceeds expectations: demonstrates clear, concise knowledge of requirements	Far exceeds expectations: highly comprehensive, excellent response

	1		2		3		4		5	

	1		2		3		4		5	

	1		2		3		4		5	

	1		2		3		4		5	

	1		2		3		4		5	

	1		2		3		4		5	

0-50,000	50,000. – 500,000.	500,000. +

Score: _____

General Contractor: _____ Date: _____
(If evaluating subcontractor) (company name) (Project Manager) (signature)

Project Evaluator: _____ Date: _____
(print name) (signature)

Manager: _____ Date: _____
(print name) (signature)

Procurement Services action taken: File Corrective Action (overall average score <3/individual score <3)

Procurement Manager: _____ Date: _____
(or designate) (print name) (signature)

Original – Vendor File Electronic copy- to Vendor
Corrective Action documentation to be filed with Vendor Performance Evaluation
I:/Purchasing/Buyers/Bids/Templates/Doc Templates –All/RFT Construction/APPENDIX F –Vendor Performance Evaluation Form

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SECTION 00 41 73 - SUPPLEMENTARY BID INFORMATION

If requested, the **Supplementary Bid Information** must be completed and submitted at time of the tender closing. **All pricing where requested in this form is plus HST.**

GENERAL CONTRACTOR

- 1.1 The following personnel will be assigned to manage and supervise the Work. Personnel will be subject to approval by the Board, and cannot be changed without prior written approval from the Board.

Site Supervisor: _____

Project Manager: _____

Part 2 ALTERNATIVE PRICES

- 2.1 The following are the prices for the alternative work listed hereunder. Such Alternative Work and amounts are NOT included in the Bid Price.

ITEM	AMOUNT
	\$
	\$
	\$

Part 3 ITEMIZED PRICES

- 3.1 The following are the prices for the items of work listed hereunder. Such Work and amounts ARE included in the Bid Price.

- 3.2 The Board reserves the right to modify the Scope of Work and reduce the contract price accordingly, based upon the prices indicated

ITEM	AMOUNT
	\$
	\$
	\$

Part 4 IDENTIFIED PRICES

4.1 The following are the values of work listed hereunder. Such work and amounts ARE included in the Bid Price.

4.2 The Board has requested these prices for information purposes only and does not intend to modify any Scope of Work based on the prices indicated.

ITEM	AMOUNT
	\$
	\$
	\$

Part 5 TAX DECLARATION

Government of Ontario Tax Compliance Declaration

The Ontario Government expects all proponents to pay their provincial taxes on a timely basis. In this regard, proponents are advised that any contract with the Ontario Government will require a declaration from the successful proponent that his/her company's provincial taxes are in good standing.

In order for a company to be considered for a contract award, the proponent must complete and submit a signed copy of this Tax Compliance Declaration form along with its bid documentation.

Declaration:

I/We hereby certify that

_____,
(legal name of proponent company)

at the time of submitting its quotation, is in full compliance with all tax statutes administered by the Ministry of Finance for Ontario and that, in particular, all returns required to be filed under all provincial tax statutes have been filed and all taxes due and payable under those statutes have been paid or satisfactory arrangements for their payment have been made and maintained.

Consent to Disclosure:

I/We consent to the Ministry of Finance releasing the taxpayer information described in this Declaration to *The Waterloo Region District School Board* for the purpose of verifying that

_____,
(legal name of proponent company)

is in full compliance with all tax statutes administered by the Ministry of Finance.

Dated at _____, this _____ day of _____, 20_____.

(Signature of Authorized Signing Officer)

(Name and Title of Authorized Signing Officer)

(Phone number) _____

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1.0 GENERAL

1.1. DEFINITIONS DECLARATION

- .1 CCDC 2-2008 Edition, Stipulated Price Contract as may be amended, forms the basis of Definitions between the Owner and Contractor.
- .2 These Definitions are bound to the CCDC 2 Definitions and CCDC 2 General Conditions.

1.2. SUPPLEMENTARY WORDS AND TERMS TO CCDC 2-2008

- .1 The following words and terms are additional to the CCDC 2 Definitions.
- .2 Addendum: A document that amends the Bid Documents during the Bidding Period and becomes part of the Contract Documents when a Contract is executed. (Plural: Addenda).
- .3 Agreement: The signed and sealed legal instrument binding parties in a Contract, describing in strict terms their mutual arrangement, roles and responsibilities, commencement, and completion responsibilities.
- .4 Alternative Price: The amount stipulated by a Bidder for an Alternative and stated as an addition, a deduction, or no change to the Bid Price.
- .5 Authorities: Those having jurisdiction under law over Work or Parts thereof.
- .6 Bid: To offer as a Bid stating for what price a Contractor will assume a Contract.
- .7 Bid Documents: A set of documents consisting of the Instructions to Bidders, Bid Form, Contract Documents, and other information issued for the benefit of Bidders to prepare and submit a Bid.
- .8 Bid Form: The specific and detailed form used to collect information about a Bid.
- .9 Bidding: The process of preparing and submitting a Bid.
- .10 Construction Documents: The Drawings and Project Manual. When combined with a Contract and Contract conditions, these documents form the Contract Documents.
- .11 Contingency Allowance: An additional monetary amount added to a Project cost estimate and designated to cover unpredictable or unforeseen items of Work. The amount is usually based on some percentage of the estimated cost and expended and adjusted by Change Order. It is not intended to cover additions to the scope of Work.
- .12 General Conditions: That part of the Contract Documents which sets forth many of the rights, responsibilities and relationships of the parties involved in a Contract.

- .13 Exposed: Visible at completion of Work, in useable areas as well as interior of closets, cabinets, drawers, storage and service rooms, stairwells and exterior surfaces.
- .14 Instructions To Bidders: Instructions contained in the Bid Documents to convey an Owner's expectations and criteria associated with submitting a Bid.
- .15 Section: A portion of a Project Specification covering one or more segments of the total Work or requirements. Sections are included in a Project manual as required to meet Project requirements.
- .16 Standard: A document describing a grade or a level of quality, which has been established by a recognized agency or organization, utilizing an internal voting process.
- .17 Separate Price: A separate price for work to be added to the base price if selected by the Owner. This price type is not a part of the base bid price.
- .18 Stipulated Price: An amount set forth in a Stipulated Price Contract as the total payment for the performance of the Work. Sometimes referred to as a stipulated sum or a lump sum stipulated price.
- .19 Tender: Refer to definition of Bid.
- .20 Unit Price: The amount payable for a single unit of Work as stated in a Schedule of Prices.
- .21 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.
- .22 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.
- .23 Provide: To Supply and Install
- .24 Wherever words 'approved', 'selected', 'satisfactory', 'directed', 'permitted', 'inspected', 'instructed', 'required', 'submit', 'ordered', 'reviewed', 'reported to', or similar words or phrases are used in Contract Documents, it shall be understood, unless context provides otherwise, that words 'by Consultant' or 'to Consultants' follow.
- .25 Words 'by others' when used in Specifications or on Drawings shall not mean by someone other than Contractor. Only means by which something shown or specified shall be indicated as not being in Contract is by initials 'NIC' or words 'not in Contract', 'by Owner', or 'by Other Contractor'.

END OF SECTION

SECTION 00 72 13 – TERMS AND CONDITIONS

1.0 PROVISIONS

1.1. Proceedings Against the Board

- .1 The Proponent represents and warrants that the Proponent is not a party to any suits, actions, litigation proceedings, arbitration's, alternative dispute resolutions, investigations or claims by or against or otherwise involving the Board and the Proponent. The Board will reject the bid in the view of the current, pending or threatened litigation, arbitration, alternative dispute resolution or disputes involving the Board and Proponent. The Awarded Bidder may also be required, at the discretion of the Board, to sign a Certificate in a form satisfactory to the Board confirming that the Awarded Bidder is not associated with any company involved in litigation with the Board.

1.2. Standard of Behaviour

- .1 The Board will not knowingly purchase goods and/or services from Awarded Bidders who operate in contravention of local and international laws. Proponents submitting bids are in fact agreeing that they do not purchase or use products that are in contravention of local and international laws. If a product and/or service supplied to the Board is discovered to be in contravention, the Board reserves the right to rectify the issue with the Awarded Bidder that may include the cancellation of the contract.

1.3. Federal, Provincial, Regional and Municipal Laws

- .1 The Awarded Bidder must stay current and comply with, for the durations of the agreement, all current laws and bylaws.
- .2 No Smoking and Scent –Free
 - .1 The Province has legislated under the Smoke Free Ontario Act that smoking is not permitted on any Board owned properties. Furthermore, most Board properties are “scent free”. Smoking will not be permitted on-site. Offenders will be asked to leave the site, and infractions could result in corrective action and or fine.

1.4. Professional Conduct

- .1 All contractors must conduct themselves in a professional manner at all times when dealing with Board staff, with the public, and while working on site. Unprofessional conduct could result in immediate termination of the contract.

1.5. Sustainable Purchasing

The procurement needs of the Board represent a significant level of responsibility to demonstrate leadership and support for greener business practices. Integrating environmental performance and impact into supply chain decisions is a commitment to improvement of the environment and the quality of life.

Green procurement shall be viewed in the context of achieving value for money for the total life-cycle costs. It requires the inclusion of environmental impact considerations into the procurement process, including planning, acquisition, use and disposal. Value for money shall include the consideration of many environmental tangible and intangible factors when determining the total life-cycle costs and environmental impact.

1.6. Paramountcy Clause

- .1 Proponents who have additional and/or supplementary agreements that require the Board's signature prior to providing the required products and/or services to the Board must submit that said draft agreement with their bid. No additional agreements will be accepted by the Board after the closing date Tender time of the Tender. In the event of any conflict between the provisions of the terms of the Awarded Bidder's additional and/or supplementary agreement(s) and the provisions of this Tender document, the terms of the Tender contract shall govern.

1.7. Freedom of Information

- .1 To comply with the Freedom of Information and Protection of Privacy Act, all bids submitted to the Board become the property of the Board, and as such, are subject to the Freedom of Information and Protection of Privacy Act. Clearly identify any portion of the bid submission that could cause injury if disclosed.

1.8. Criminal Background Checks and Collection of Personal Information

- .1 The Board must comply with Regulation 521 (Collection of Personal Information) to the Education Act with respect to criminal background checks and offence declarations.
- .2 If required by the Board, the Awarded Bidder will provide the Board, or designate with a Criminal Background Check covering offences under the Criminal Code, the Controlled Drugs and Substances Act, and any other offences which would be revealed by a search of the automated Criminal Records Retrieval System.

- .3 An Offence Declaration in a Board-approved form for every individual or employee of the Awarded Bidder who may come into direct contact with Board staff and/or students on a regular basis at any Board site prior to the occurrence, and on or before September 1 each year thereafter is required. The Board will determine in its sole discretion whether an individual or employee of the Awarded Bidder come into direct contact with pupils on a regular basis.
- .4 Termination of contracts and indemnification by the Awarded Bidder will result from noncompliance.

1.9. Accessibility

- .1 Proponents shall comply with the provisions of the Accessibility for Ontarians with Disabilities Act, 2005, and the Regulations there under with regard to the provision of its goods or service to persons with disabilities. Proponents acknowledge that pursuant to the Accessibility for Ontarians with Disabilities Act, 2005, the Board must, in deciding to purchase goods or service through its procurement process, consider the accessibility for persons with disabilities to such goods or service.

2.0 COMMUNICATION

2.1. Verbal Communication

- .1 Neither the Board nor Board consultant will provide verbal direction or clarification during the tender process. As a result, verbal recollections will not be considered valid.

2.2. Addenda

- .1 All Addenda issued through the Bidding System shall form part of the Bid Solicitation Document. Any questions and clarifications regarding the Scope of Work shall be requested through the Bidding System by the date noted above. Those that are deemed pertinent to the Bid Solicitation Document will be addressed in the form of an Addendum.

Bidders shall acknowledge the receipt of all Addenda in the Bidding System prior to the submission of a Bid. Where Addenda has been issued, the system will not allow the Bidder to submit a Bid prior to acknowledging said Addenda.

Where an Addendum is issued after a Bid has been submitted, the Bidding System will automatically withdraw the submitted Bid. The Bid status will change to incomplete and will not be accepted by the Board as a submitted Bid. It is the responsibility of the Bidder to acknowledge all Addenda and ensure the Bid has been received by the Bidding System. Bidders should check the Bidding System for Addenda up until the Bid Closing Date and Time.

Addenda cannot be acknowledged after the Closing Date and Time.

2.3. Request for Clarification

- .1 The Board reserves the right to seek clarification and supplementary information from Proponents after the Bid Submission Deadline. The response received by the Board from a Proponent shall, if accepted by the Board, form an integral part of that Proponent's proposal.

3.0 SPECIFICATIONS

3.1. Materials

- .1 Bid only on new materials in perfect condition. Demonstrators, seconds or defective materials are unacceptable. Any materials found not to be in a new condition or as specified will be returned to the Awarded Bidder at the Awarded Bidder's expense.
- .2 Proponents, if requested by the Board, must furnish with their bid a materials safety data sheet (M.S.D.S.), for all products they are bidding on, where applicable. This is a requirement of the Occupational Health and Safety Act. Subsequently, should any business result from this Tender, the Board will not accept any additional charges or surcharges related to the supplying of M.S.D.S. for any item(s) on this Tender.
- .3 All electrical equipment and components must bear a C.S.A. or Electrical Safety Association (E.S.A.) label.
- .4 Bid prices must be for goods and/or services exactly as specified.

4.0 BID PREPARATION

The Board will not be liable for any costs incurred by the Proponent for the preparation of their bid.

4.1. Online Submission Forms

- .1 All forms are submitted online through the bidding system.

- .2 The bidder's signature has the authority to bind the Proponent.

4.2. Bid Price

- .1 Bid prices are to be shown as all applicable taxes extra.
- .2 Bid prices must be held firm until the project is completed to the satisfaction of the Board.
- .3 The bid price herein constitutes the total costs to the Board for all work involved in the respective items and that this cost also includes all insurance, transportation charges, use of all tools and equipment, supervision, bonds, overhead expense, warranty, all profits and all other work, services, conditions furnished in accordance with the requirements of the contract documents.
- .4 Bid prices must be in Canadian Funds.
- .5 Period for which bids are irrevocable after the tender submission deadline is: 60 days.

4.3. Bonding Requirements

- .1 Bid Amount

Bonding requirements are based on the total bid amount INCLUSIVE of ALL applicable taxes.

Bonding is not requested if the Board estimates that the project is less than \$200,000.00. The Board determines the Bonding requirements and specifies them on the Bid Sheet.

- .2 Bid Bond and Agreement to Bond

Bid submissions that request Bonding are inclusive of all taxes and must be accompanied by a bid deposit in the form of a digital Bid Bond in an electronically verifiable and enforceable (e-Bond) format in the amount(s) not less than 10% of the total Contract Value made payable to the Waterloo Region District School Board (the 'Board') as surety that, if the Bid is accepted, a Contract will be entered into for the proper performance of the work. For more information, contact your surety company or visit the Surety Association of Canada website: <https://www.surety-canada.com/en/ebonding/index.html>

Bidders shall upload their verifiable and enforceable Bid Bond to the Bidding System, in the bid submission file labeled "Bid Bond". All instruction and details for accessing authentication shall be included with the digital Bond uploaded in the Bidding System.

Bids that do not contain the bid deposit(s) in the required amount as specified in this paragraph will be declared non-compliant and will be rejected. A scanned PDF copy of bonds or original certified cheque, bank draft, money order, etc. are not acceptable as Bid deposit and will result in Bid rejection.

The bid deposit of the Bidder whose submission is accepted shall be forfeited by the Bidder should the Bidder fail to execute a Contract or provide the necessary documents as required within this Bid Solicitation document (including signed agreement, satisfactory security, insurance certificate, Workplace Safety and Insurance Board letter of clearance) within the time stipulated as a written notice from the Board.

For bid amounts where Bonding is not requested, the Awarded Bidder agrees to pay to the Board the difference in costs between the bid submitted and the final contract should the Awarded Bidder fail to either execute or deliver the contract documents in accordance with the Bid Solicitation within ten (10) working days of written notification of the award of the contract.

.3 Performance Securities

For bid amounts where bonding is required, inclusive of all taxes, upon award the successful Bidder shall provide a digital Bid Performance and Labour and Materials Bond in an electronically verifiable and enforceable (e-Bond) format in the amount(s) of not less than 50% Performance Bond and a 50% Labour and Materials Bond of the total Contract Value made payable to the Waterloo Region District School Board (the 'Board') as surety that, if the Bid is accepted, a Contract will be entered into for the proper performance of the work. For more information, contact your surety company or visit the Surety Association of Canada website: <https://www.surety-canada.com/en/ebonding/index.html>

If the successful Bidder fails to provide a performance bond when requested, the Board may declare the bid deposit forfeited and the Bidder will be held responsible for any increased costs or damages incurred by the Board. Any Bidder who fails to provide all required documents within the timelines provided, or otherwise fails to enter into an agreement with the Board upon notice of being the successful Bidder may be subject to future bidding constraints by the Board.

Performance surety shall guarantee all conditions as set out in the contract, including proper execution of the work and for all matters for which the successful Bidder is responsible for throughout the two (2) year period of maintenance and warranty.

Any costs associated with performance surety are the responsibility and cost of the Bidder.

The Awarded Bidder must email the bonds to procurement@wrdsb.ca, referencing "Bonding for tender # "in the subject line seven (7) working days of receiving a purchase order.

4.4. INSURANCE

.1 Proof of WSIB Coverage (Onsite work only)

If the Proponent does not provide a policy endorsement for Employer's Liability and Voluntary Compensation, the Proponent shall submit a valid certificate of WSIB coverage to the Board, with the tender submission and any subsequent policy renewal, referencing this Agreement. The Proponent shall ensure that each Subcontractor complies with the WSIB requirements set out in this Article by obtaining similar types of coverage if the Subcontractor does not provide a policy endorsement for Employer's Liability and Voluntary Compensation.

.2 Insurance (Onsite Construction work only)

The proponent is to reference CCDC2-2008 GC 11.1 Insurance and ensure that this section is adhered to.

.3 General & Vehicle

General and vehicle liability insurance covering incidents of property damage or bodily injury (including death) for owned and non-owned vehicle accidents occurring during the work in this Tender, or actions of the employees of the Awarded Bidder while acting within the scope of their duties as required in this Tender shall be maintained. Verification of current "Good Standing" may be requested.

The inclusive per incident minimum amount of coverage is: Two Million Dollars (\$2,000,000).

5.0 BID EVALUATION

Preference will be given to the lowest compliant bid.

The "lowest bid price" shall be used to determine the lowest compliant bid. Alternate prices, separate prices and any substitutions that may affect the contract price shall not be considered in determining the "lowest bid price".

The Proponent will not be awarded the tender if the Site Supervisor and/or Project Manager identified by the Proponent are not deemed suitable by the Board.

If the Board has a sense that the Proponent with “lowest bid price” has capacity issues, then the Board will meet with the Proponent after the tender closing date and prior to the Board awarding the Tender.

At the meeting the Proponent will present the following in written form:

1. The Proponent’s capacity resource plan documents which illustrates how the Proponent determines capacity.
2. The level of capacity the Proponent and its resources would be with the award of the Tender.
3. An evaluation of recent projects that the Proponent has completed, where the Proponent was at equal or greater capacity as it relates to the capacity resources available.

In order for the Proponent’s bid to be considered the lowest compliant bid the Proponent will to the Board’s satisfaction have presented in written from the information requested.

6.0 BID RESULTS NOTIFICATION

The Board will forward the results notification to <https://wrdsb.bidsandtenders.ca> listing the Awarded Bidder and Bid Price.

7.0 AWARD NOTIFICATION

No shipment is to be made or work to commence until a purchase order, contract, or letter of intent is issued by Procurement Services to the Awarded Bidder.

Construction Projects

For construction projects above \$200,000 the Awarded Bidder may be required to execute a “Canadian Standard Form of Construction Contract to a Stipulated Sum” (revised 2008) CCDC 2, 2008 including amendments thereto as set out in this Tender.

The Awarded Bidder shall execute the said formal contract as called for, within seven (7) working days after notification of acceptance of their Tender or forfeit the amount of Bid Bond enclosed in the Tender.

8.0 POST AWARD

8.1 Bonding (Construction)

The Awarded Bidder is solely responsible for forwarding the Bonding documents, original documents not a copy, to Procurement Services at the Board Education Centre. Payments to the Awarded Bidder will not be processed without bonding being submitted. Failure to submit bonding to Procurement Services within seven (7) working days may result in the cancellation of the contract.

8.2. Purchase Order

For Payment purposes, a Purchase Order shall be generated and issued to the Awarded Bidder(s). The Purchase Order number must appear on all invoices in order to ensure prompt payment.

8.3. Changes

The Board may order changes in the material or work, in writing, with the contract sum being adjusted accordingly. All changes for additional material or work must be agreed upon and submitted in writing to the Board.

9.0 SUBCONTRACTING

9.1. Subcontracting

Subcontracting, beyond the original list of subcontractors submitted with bid submission, of any portion of the work outlined in these specifications will not be permitted without prior written consent of the Board.

If approval is granted, any work undertaken by subcontractors shall be as set forth in this Tender document and the use of subcontractors shall in no way relieve the Awarded Bidder of their responsibilities.

The Board reserves the right to reject a proposed subcontractor for any reasonable cause.

9.2. Assignment

Any business resulting from this Tender call shall not be assigned to any other company (or individual) without prior written approval of the Board.

10.0 FORCE MAJEURE

If Delays in a failure of performance by either party under the Contract shall not constitute default hereunder or give rise to any claim for damages if and to the extent caused by occurrences beyond the control of the party affected, including but not limited to decrees of Government, acts of God, fires, floods, explosions,

pandemics, riots, war, rebellion, sabotage and atomic or nuclear incidents, lawful acts of public authorities, or delays caused by common carriers, which cannot reasonably be foreseen or provided against. However, lack of finances, strikes, or other concerted acts by workers, delay or failure arising out to the nature of the work to be done, or from the normal actions of the elements or from any normal difficulties which may be encountered in the performance of the Work, having regard to the nature thereof, shall in no event be deemed to be a cause beyond a party's control. If in the reasonable opinion of either party to this Contract that performance of the Contract is made impossible by force majeure, then either party shall notify the other in writing and the Board shall either terminate the Contract forthwith without any future payments being made or authorize the Vendor to continue performance of the Contract with such adjustments as may be required by the existence of the force majeure and agreed upon by both parties.

11.0 TERMINATION

11.1. Sufficient Cause

The Board reserves the right to terminate any contract Tender purchase order resulting from this Tender call for sufficient cause, such as: non-performance, late deliveries, inferior quality, pricing problems, customer service, etc. Should such action be necessary, the Board would provide written notice to the Awarded Bidder.

11.2. Funding Out

Should the Board fail to appropriate funds to enable payments including multi-year agreements, the Board may cancel the contract without termination charges, provided the Awarded Bidder receive thirty (30) days written notice of such termination from the Board.

12.0 RESULT DISPUTE PROCESS

Subsequent to a debriefing a Proponent may dispute the decision of the Board. The process outlined below is to be followed:

The Proponent is to file in writing their protest with the Manager of Procurement by certified mail, within force 15 business days of the Debriefing. The Protest Notice shall include:

- (i) The name and address of the Proponent.
- (ii) Identification of the RFX.

- (iii) Detailed and factual statement of the grounds for protest.
- (iv) Supporting documentation.
- (v) Desired relief, action ruling.

The Manager of Procurement will respond to the Proponent, by certified mail, within 20 business days of receiving the written notice.

If a resolution cannot be met, the Proponent must contact the Superintendent of Business and Financial Services by certified mail, within 10 business days of receiving the first response from the Manager of Procurement. The decision by the Superintendent of Business and Financial Services will be deemed final and the Proponent will receive written notice within 20 business days.

13.0 RIGHTS OF THE BOARD

In addition to any other express rights or any other rights which may be implied in the circumstances, the Board reserves the right to:

- (i) Reject any bid received from a Proponent which is party to any past or existing suits, actions, and litigation proceedings, arbitration's, alternative dispute resolutions, investigations, vendor performance evaluations that are below expectations or claims by or against or otherwise involving the Board and the Proponent. Note: the Awarded Bidder(s) may also be required, at the discretion of the Board, to sign a Certificate in a form satisfactory to the Board confirming that the Awarded Bidder(s) is not associated with any company involved in litigation with the Board.
- (ii) make public the names of any or all Proponents;
- (iii) request written clarification or the submission of supplementary written information from any Proponent;
- (iv) waive formalities and accept Bids which substantially comply with the requirements of this tender;
- (v) verify with any Proponent or with a third party any information set out in a Bid;
- (vi) disqualify any Proponent whose Bid contains misrepresentations or any other inaccurate or misleading information;
- (vii) disqualify any Proponent or the Bid of any Proponent who has engaged in conduct prohibited by this tender;

- (viii) make changes, including substantial changes, to this tender provided that those changes are issued by way of addenda in the manner set out in this tender;
- (ix) accept or reject a Bid if only one Bid is submitted;
- (x) accept or reject the lowest or any bid not necessarily accepted by the Board;
- (xi) select any Proponent other than the Proponent whose Bid reflects the highest compliant score to the Board;
- (xii) cancel this TENDER process at any stage;
- (xiii) cancel this TENDER process at any stage and issue a new TENDER for the same or similar services with a minimum substantial change in scope of 10%;
- (xiv) accept any Bid in whole or in part;
- (xv) discuss with any Proponent different or additional terms to those contemplated in this tender or in any Proponent's Bid;
- (xvi) reject any or all Bids in its absolute discretion;
- (xvii) negotiate with the leading Proponent prior to award;
- (xviii) evaluate and accept Proponent's alternatives whereby possible efficiencies may prove to be advantageous to the Board;
- (xix) to all Bids, responses, inquiries, or other related correspondence in reference to this tender , and all reports, charts, and other documentation submitted by Proponents shall become the property of the Waterloo Region District School the Board when received; and the Board shall not be liable for any expenses, costs associated with the preparation and submittal of any proposal(s), or for any travel and or per diem costs that are incurred including any or all product samples that may be requested during the evaluation stage of the proposal, losses or any direct or indirect damages incurred or suffered by any Proponent or any third party resulting from the Board exercising any of its rights under this TENDER or exercising any rights, which may be implied in the circumstances.

By submitting its Bid, the Proponent authorizes the collection by the Board of the information set out under (v), (vi) and (vii) in the manner contemplated in those subparagraphs.

13.1. Volume and Exclusivity

The Board makes no guarantee of the value or volume of work to be assigned to the Awarded Bidder. Any agreement executed with the Awarded Bidder may not be an exclusive contract for the provision of the described goods/services.

END OF SECTION

**SUPPLEMENTARY CONDITIONS & AMENDMENTS TO STANDARD CONSTRUCTION
DOCUMENT CCDC2 -2008 STIPULATED PRICE SUBCONTRACT**

(the “Supplementary Conditions”)

**AGREEMENT, DEFINITIONS, AND
GENERAL CONDITIONS**

The Standard Construction Document CCDC 2 2008 for a Stipulated Price Contract, 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, together with the changes with the new *Construction Act* is hereby made part of these *Contract Documents*, with the following amendments, additions and modifications:

AGREEMENT BETWEEN OWNER AND CONTRACTOR

SC1 ARTICLE A-3 – CONTRACT DOCUMENTS

SC1.1	3.1	<u>Add</u> the following documents to the list of <i>Contract Documents</i> in Article A-3.1: • Waterloo Region District School Board's Supplementary Conditions & Amendments to Standard Construction Document CCDC2 -2008 Stipulated Price Subcontract, November 2020 Version, including any Special Supplementary Conditions listed in Appendix 2 thereto • <i>Drawings</i> • <i>Specifications</i> • Performance Bond (Form 32 -Performance Bond under Section 85.1 of the <i>Act</i>) • Labour and Material Payment Bond (Form 31 – Labour and Material Payment Bond under Section 85.1 of the <i>Act</i>) [NTD: Remove documents and references if not applicable.]

SC2 ARTICLE A-5 – PAYMENT

SC2.1	5.1	In Article A-5.1 after the word "Subject to" <u>insert</u> the words "GC 13.2 and" -and- <u>delete</u> the words "and, where such legislation or regulations do not exist or apply, subject to a holdback of ten + two percent (10+2%)" and <u>replace</u> them with "and the <i>Owner's</i> right to issue <i>Notices of Non-Payment</i>."
SC2.2	5.1.1	<u>Delete</u> the words "amount certified by the <i>Consultant</i> together" in subparagraph 5.1.1 and <u>replace</u> them with "allowable amount set out in a <i>Proper Invoice</i>".

SC2.3	5.1.2	<u>Delete</u> subparagraph 5.1.2 in its entirety and <u>replace</u> it with the following: “.2 upon <i>Substantial Performance of the Work</i>, as certified by the <i>Consultant</i>, and on the 61st day after the publication of the certificate of <i>Substantial Performance of the Work</i> in accordance with the <i>Act</i>, there being no claims for lien registered against the title to the <i>Place of the Work</i>, pay the <i>Contractor</i> the unpaid balance of the holdback together with such <i>Value Added Taxes</i> as may be applicable to such payment, less any amount stated in the <i>Owner's Notice of Non-Payment</i>,”
SC2.4	5.1.3	<u>Delete</u> subparagraph 5.1.3 in its entirety and <u>replace</u> it with the following: “.3 upon receipt of the final certificate for payment from the <i>Consultant</i>, and on the 61st day after the date on which the <i>Contractor</i> completes the <i>Work</i>, there being no claims for lien registered against the title to the <i>Place of the Work</i>, pay the <i>Contractor</i> the unpaid balance of the <i>Contract Price</i> together with such <i>Value Added Taxes</i> as may be applicable to such payment , and”
SC2.5	5.3.1	<u>Delete</u> paragraph 5.3.1 in its entirety and <u>replace</u> it with the following: “.1 Should either party fail to make payments as they become due under the terms of the <i>Contract</i> or in an award by arbitration or court, interest shall also become due and payable on such unpaid amounts at the prejudgment interest rate prescribed by the <i>Courts of Justice Act</i> (Ontario), as it may change from time to time.”

SC3 *NEW* ARTICLE A-9 – CONFLICT OF INTEREST

SC3.1	Article A-9	<u>Add</u> new ARTICLE A-9 CONFLICT OF INTEREST as follows: “ARTICLE A-9 CONFLICT OF INTEREST 9.1 The <i>Contractor</i>, <i>Subcontractors</i> and <i>Suppliers</i> and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the <i>Owner</i>) with the provision of the <i>Work</i> pursuant to the <i>Contract</i>. The <i>Contractor</i> acknowledges and agrees that a conflict of interest, as

		described in this Article A-9, includes, but is not limited to, the use of <i>Confidential Information</i> where the <i>Owner</i> has not specifically authorized such use. 9.2 The <i>Contractor</i> shall disclose to the <i>Owner</i>, in writing, without delay, any actual or potential situation that may be reasonably interpreted as either a conflict of interest or a potential conflict of interest, including the retention of any <i>Subcontractor</i> or <i>Supplier</i> that is directly or indirectly affiliated with or related to the <i>Contractor</i>. 9.3 The <i>Contractor</i> covenants and agrees that it will not hire or retain the services of any employee or previous employee of the <i>Owner</i> where to do so constitutes a breach by such employee or previous employee of the <i>Owner's</i> conflict of interest policy, as it may be amended from time to time, until after completion of the <i>Work</i> under the <i>Contract</i>. 9.4 It is of the essence of the <i>Contract</i> that the <i>Owner</i> shall not have direct or indirect liability to any <i>Subcontractor</i> or <i>Supplier</i>, and that the <i>Owner</i> relies on the maintenance of an arm's-length relationship between the <i>Contractor</i> and its <i>Subcontractors</i> and <i>Suppliers</i>. Consistent with this fundamental term of the <i>Contract</i>, the <i>Contractor</i> will not enter into any agreement or understanding with any <i>Subcontractor</i> or <i>Supplier</i>, whether as part of any contract or any written or oral collateral agreement, pursuant to which the parties thereto agree to cooperate in the presentation of a claim for payment against the <i>Owner</i>, directly or through the <i>Contractor</i>, where such claim is, in whole or in part, in respect of a disputed claim by the <i>Subcontractor</i> or <i>Supplier</i> against the <i>Contractor</i>, where the payment to the <i>Subcontractor</i> or <i>Supplier</i> by the <i>Contractor</i> is agreed to be conditional or contingent on the ability to recover those amounts or a portion thereof from the <i>Owner</i>, failing which the <i>Contractor</i> shall be saved harmless from all or a portion of those claims. The <i>Contractor</i> acknowledges that any such agreement would undermine the required arm's-length relationship and constitute a conflict of interest. For greater certainty, the <i>Contractor</i> shall only be entitled to advance claims against the <i>Owner</i> for amounts pertaining to <i>Subcontractor</i> or <i>Supplier</i> claims where the <i>Contractor</i> has actually paid or unconditionally acknowledged liability for those claims or where those claims are the subject of litigation or binding arbitration between the <i>Subcontractor</i> or <i>Supplier</i> and the <i>Contractor</i> has been found liable for those claims.

		9.5 Notwithstanding paragraph 7.1.2 of GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT, a breach of this Article A-9 by the <i>Contractor</i> , any of the <i>Subcontractors</i> , or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the <i>Owner</i> to terminate the <i>Contract</i> , in addition to any other rights and remedies that the <i>Owner</i> has in the <i>Contract</i> , in law, or in equity."

SC4 *NEW* ARTICLE A-10 TIME OF THE ESSENCE

SC4.1	Article A-10	<u>Add</u> the following new Article A-10 as follows: "ARTICLE A-10 TIME OF THE ESSENCE 10.1 It is agreed that one of the reasons the <i>Contractor</i> was selected by the <i>Owner</i> for this <i>Contract</i> is the <i>Contractor's</i> representation and covenant that it will attain <i>Substantial Performance of the Work</i> within the <i>Contract Time</i> stated in Article A-1 of this <i>Contract</i>. 10.2 The <i>Contractor</i> acknowledges and agrees that it is responsible to marshal its resources and those of its <i>Subcontractors and Suppliers</i> in a manner which will permit timely attainment of the <i>Substantial Performance of the Work</i>. The <i>Contractor</i> agrees that time is of the essence of this <i>Contract</i>."

SC5 DEFINITIONS

SC5.1	Consultant	<u>Amend</u> the definition of "Consultant" by <u>adding</u> the following to the end of the definition: "For the purposes of the <i>Contract</i>, the terms "<i>Consultant</i>", "<i>Architect</i>" and "<i>Engineer</i>" shall be considered synonymous."
SC5.2	Act	<u>Add</u> the following definition: "27. Act <i>Act</i> means the <i>Construction Act</i>, R.S.O. 1990, c. C.30, as amended, including all regulations passed under it that are

		enforceable as of the date of execution of this <i>Contract</i> . For certainty, the first procurement process for the <i>Project</i> (i.e. the “improvement” as that term is defined in the <i>Act</i>) was commenced on or after October 1, 2019).”
SC5.3	Adjudication	<u>Add</u> the following definition: “28. Adjudication <i>Adjudication</i> means construction dispute interim adjudication as defined under the <i>Act</i>.”
SC5.4	Confidential Information	<u>Add</u> the following definition: “29. Confidential Information <i>Confidential Information</i> means all the information or material of the <i>Owner</i> that is of a proprietary or confidential nature, whether it is identified as proprietary or confidential or not, including but not limited to information and material of every kind and description (such as drawings and move-lists) which is communicated to or comes into the possession or control of the <i>Contractor</i> at any time, but <i>Confidential Information</i> shall not include information that: .1 is or becomes generally available to the public without fault or breach on the part of the <i>Contractor</i>, including without limitation breach of any duty of confidentiality owed by the <i>Contractor</i> to the <i>Owner</i> or to any third party, but only after that information becomes generally available to the public; .2 the <i>Contractor</i> can demonstrate to have been rightfully obtained by the <i>Contractor</i> from a third party who had the right to transfer or disclose it to the <i>Contractor</i> free of any obligation of confidence; .3 the <i>Contractor</i> can demonstrate to have been rightfully known to or in the possession of the <i>Contractor</i> at the time of disclosure, free of any obligation of confidence; or .4 is independently developed by the <i>Contractor</i> without use of any <i>Confidential Information</i>.”
SC5.5	Construction Schedule	<u>Add</u> the following definition: “30. Construction Schedule or construction schedule <i>Construction Schedule</i> means the schedule for the performance of the <i>Work</i> provided by the <i>Contractor</i> pursuant to GC 3.5,

		including any amendments to the <i>Construction Schedule</i> made pursuant to the <i>Contract Documents</i> .”
SC5.6	Construction Schedule Update	<u>Add</u> the following definition: “31. Construction Schedule Update <i>Construction Schedule Update</i> means an update to the <i>Construction Schedule</i> by the <i>Contractor</i> using Microsoft Project (or other approved scheduling software) that accurately depicts the progress of the <i>Work</i> relative to the critical path established in the <i>Construction Schedule</i> approved in GC 3.5.1 (or any approved successor <i>Construction Schedule</i>), aligns with the currently approved date for <i>Substantial Performance of the Work</i>, shows up-to-date projected major activity sequences and durations, and shows any changes or delays in anticipated completion dates of major activities in the <i>Work</i> relative to the last <i>Construction Schedule Update</i>, and includes the following minimum deliverables: (a) a record version of the updated <i>Construction Schedule</i> in .pdf format; (b) an editable copy of the updated <i>Construction Schedule</i> in native format (e.g. .mpp format for Microsoft Project).”
SC5.7	Direct Costs	<u>Add</u> the following definition: “32. Direct Costs <i>Direct Costs</i> are the reasonable costs of performing the contract or subcontract including costs related to the additional supply of services or materials (including equipment rentals), insurance and surety bond premiums, and costs resulting from seasonal conditions, that would not have been incurred, but do not include indirect damages suffered, such as loss of profit, productivity or opportunity, or any head office overhead costs.”
SC5.8	EFT	<u>Add</u> the following definition: “33. EFT <i>EFT</i> has the definition given to it under GC 5.3.2.”
SC5.9	Force Majeure	<u>Add</u> the following definition: “34. Force Majeure

		<i>Force Majeure</i> means any cause, beyond either parties' control, other than bankruptcy or insolvency, which prevents the performance by a party, or both, of any of their respective obligations under the <i>Contract</i> and the event of <i>Force Majeure</i> did not arise from a party's default and could not be avoided or mitigated by the exercise of reasonable effort or foresight. <i>Force Majeure</i> includes: <i>Labour Disputes</i>; fire; unusual delay by common carriers or unavoidable casualties; delays in obtaining permits or licenses; civil disturbance; emergency acts, orders, legislation, regulations or directives of any government or other public authority; acts of a public enemy; war; riot; sabotage; blockage embargo; lightning; earthquake; adverse weather conditions but only if substantially beyond the weather norms of the <i>Place of the Work</i>; acts of God; or declared epidemic or pandemic outbreak or other public health emergency (e.g. SARS, COVID-19)."
SC5.10	Install	<u>Add</u> the following definition: "35. Install <i>Install</i> means install and connect. <i>Install</i> has this meaning whether or not the first letter is capitalized."
SC5.11	Labour Dispute	<u>Add</u> the following definition: "36. Labour Dispute <i>Labour Dispute</i> means any lawful or unlawful labour problems, work stoppage, labour disruption, strike, job action, slow down, lock-outs, picketing, refusal to work or continue to work, refusal to supply materials, cessation or work or other labour controversy which does, or might, affect the <i>Work</i>."
SC5.12	Notice of Non-Payment	<u>Add</u> the following definition: "37. Notice of Non-Payment <i>Notice of Non-Payment</i> means a notice of non-payment of holdback (Form 6) or a notice of non-payment (Form 1.1) under the <i>Act</i>, as applicable to the circumstances."
SC5.13	OHSa	<u>Add</u> the following definition: "38. OHSa <i>OHSa</i> means the <i>Occupational Health and Safety Act</i>, R.S.O. 1990, c. O.1, as amended, including all regulations thereto."

SC5.14	Overhead	<u>Add</u> the following definition: “39. Overhead <i>Overhead</i> means all site and head office operations and facilities, all site and head office administration and supervision; all duties and taxes for permits and licenses required by the authorities having jurisdiction at the <i>Place of the Work</i>; all requirements of Division 1, including but not limited to submittals, warranty, quality control, calculations, testing and inspections; meals and accommodations; and, tools, expendables and clean-up costs.”
SC5.15	Payment Period	<u>Add</u> the following definition: “40. Payment Period <i>Payment Period</i> has the definition given to it under GC 5.2.1.”
SC5.16	Pre-Invoice Submission Meeting	<u>Add</u> the following definition: “41. Pre-Invoice Submission Meeting <i>Pre-Invoice Submission Meeting</i> has the definition given to it under GC 5.2.1.”
SC5.17	Proper Invoice	<u>Add</u> the following definition: “42. Proper Invoice <i>Proper Invoice</i> means a “proper invoice” as that term is defined in Section 6.1 of the Act, including the minimum requirements set out in Appendix “1” of the Supplementary Conditions.”
SC5.18	Proper Invoice Submission Date	<u>Add</u> the following definition: “43. Proper Invoice Submission Date <i>Proper Invoice Submission Date</i> has the definition given to it under GC 5.2.2.1.”
SC5.19	Request for Information (RFI)	<u>Add</u> the following definition: “44. Request for Information (RFI) <i>Request for Information</i> or <i>RFI</i> means written documentation sent by the <i>Contractor</i> to the <i>Owner</i> or to the <i>Owner’s</i> representative or the <i>Consultant</i> requesting written clarification(s) and/or interpretation(s) of the <i>Drawings</i> and/or <i>Specifications</i>, <i>Contract</i> requirements and/or other pertinent

		information required to complete the <i>Work</i> of the <i>Contract</i> without applying for a change or changes to the <i>Work</i> ."

GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

Where a General Condition or paragraph of the General Conditions of the *Contract* is deleted by these amendments, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, unless stated otherwise herein, and the numbering of the deleted item will be retained, unused.

PART 1 GENERAL PROVISIONS

sc6 GC 1.1 CONTRACT DOCUMENTS

SC6.1	1.1.6	<u>Add</u> the following to the end of paragraph 1.1.6: "The <i>Specifications</i> are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the <i>Contract Documents</i> will be construed to place responsibility on the <i>Owner</i> or the <i>Consultant</i> to settle disputes among the <i>Subcontractors</i> and <i>Suppliers</i> with respect to such divisions. The <i>Drawings</i> are, in part, diagrammatic and are intended to convey the scope of the <i>Work</i> and indicate general and appropriate locations, arrangements and sizes of fixtures, equipment and outlets. The <i>Contractor</i> shall obtain more accurate information about the locations, arrangements and sizes from study and coordination of the <i>Drawings</i>, including <i>Shop Drawings</i> and shall become familiar with conditions and spaces affecting those matters before proceedings with the <i>Work</i>. Where site conditions require reasonable minor changes where the change requires only the additional labour of one half hour or less, the <i>Contractor</i> shall make such changes at no additional cost to the <i>Owner</i>. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the <i>Contractor</i> shall include such relocation in the <i>Work</i>. The <i>Contractor</i> shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible. The schedules are those portions of the <i>Contact Documents</i>, wherever located and whenever issued, which compile information of similar content and may consist of drawings, tables and/or lists."
SC6.2	1.1.7.1	<u>Delete</u> paragraph 1.1.7.1 in its entirety and <u>replace</u> it with the following:

		“1 the order of priority of documents, from highest to lowest, shall be: - the Supplementary Conditions; - the Agreement between the <i>Owner</i> and the <i>Contractor</i>, - the Definitions - the General Conditions, - Division 1 of the <i>Specifications</i>, - technical <i>Specifications</i>, - material and finishing schedules - the <i>Drawings</i>.”
SC6.3	1.1.7.5 to 1.1.7.8	<u>Add</u> new subparagraphs 1.1.7.5, 1.1.7.6, 1.1.7.7 and 1.1.7.8 as follows: “1.1.7.5 Noted materials and annotations on the <i>Drawings</i> shall govern over the graphic representation of the <i>Drawings</i>. 1.1.7.6 Finishes in the room finish schedules shall govern over those shown on the <i>Drawings</i>. 1.1.7.7 Architectural drawings shall have precedence over structural, plumbing, mechanical, electrical and landscape drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts and architectural elements of construction, it being understood that the integrity and installation of the systems designed by the <i>Consultant</i> or its sub-<i>Consultants</i> are to remain with each of the applicable drawing disciplines. 1.1.7.8 Should reference standards contained in the <i>Specifications</i> conflict with the <i>Specifications</i>, the <i>Specifications</i> shall govern. Should reference standards and <i>Specifications</i> conflict with each other or if certain requirements of the <i>Specifications</i> conflict with other requirements of the <i>Specifications</i>, the more stringent requirements shall govern.”
SC6.4	1.1.8	<u>Delete</u> paragraph 1.1.8 in its entirety and <u>replace</u> it with the following: “1.1.8 The <i>Consultant</i>, on behalf of the <i>Owner</i> shall provide the <i>Contractor</i> without charge, PDF copies of the <i>Contract Documents</i>.

SC7 GC 1.3 RIGHTS AND REMEDIES

SC7.1	1.3.2	In paragraph 1.3.2 <u>delete</u> the word “No” from the beginning of the paragraph and <u>replace</u> it with the words: “Except with respect to the requirements set out in paragraphs 2.2.13, 6.4.1, 6.5.4, 6.6.1 and 8.2.2, no...”

SC8 *NEW* GC 1.5 EXAMINATION OF DOCUMENTS AND SITE

SC8.1	1.5	<u>Add</u> new GC 1.5 – EXAMINATION OF DOCUMENTS AND SITE as follows: “GC 1.5 EXAMINATION OF DOCUMENTS AND SITE 1.5.1 The <i>Contractor</i> declares and represents that in tendering for the <i>Work</i>, and in entering into a <i>Contract</i> with the <i>Owner</i> for the performance of the <i>Work</i>, it has investigated for itself the character of the <i>Work</i> to be done, based on information generally available from a visit to the <i>Place of the Work</i> and to the standard set out under GC 3.14.1 The <i>Contractor</i> has assumed and does hereby assume all risk of known conditions now existing or arising in the course of the <i>Work</i> which might or could make the <i>Work</i>, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the tender was made or the <i>Contract</i> signed. 1.5.2 The <i>Contractor</i> also declares that in tendering for the <i>Work</i> and in entering into this <i>Contract</i>, the <i>Contractor</i> did not and does not rely upon information furnished by the <i>Owner</i> or any of its agents or servants respecting the nature or confirmation of the ground at the site of the <i>Work</i>, or the location, character, quality or quantity of the materials to be removed or to be employed in the construction of <i>Work</i>, or the character of the construction machinery and equipment or facilities needed to perform the <i>Work</i>, or the general and local performance of the work under the <i>Contract</i> and expressly waives and releases the <i>Owner</i> from all claims with respect to the said information with respect to the <i>Work</i>. 1.5.3 <i>Contractor</i> further represents, warrants and acknowledges that it considered and took into account in the <i>Contract Price</i> all reasonably known impacts and restrictions arising from the COVID-19 pandemic, including without limitation corresponding legislative changes that may impact performance of the <i>Project</i>, various weather conditions that

		may affect the <i>Work</i> , the availability of supplies and labour or other conditions or risks that the <i>Contractor</i> knew about or reasonably ought to have known about prior to the date of the <i>Contract</i> .”

PART 2 ADMINISTRATION OF THE CONTRACT

SC9 GC 2.2 ROLE OF THE CONSULTANT

SC9.1	2.2.4	<u>Delete</u> paragraph 2.2.4 in its entirety.
SC9.2	2.2.5	<u>Delete</u> paragraph 2.2.5 and <u>replace</u> it with the following: “2.2.5 Upon receipt of an application for payment that satisfies the requirement of a <i>Proper Invoice</i> , based on the <i>Consultant's</i> observations and evaluation of the <i>Contractor's</i> application for payment, the <i>Consultant</i> will determine the amounts owing to the <i>Contractor</i> under the <i>Contract</i> and will issue certificates for payment as provided in Article A-5 - PAYMENT, GC 5.3 PROGRESS PAYMENT, GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK, and GC 5.7 - FINAL PAYMENT. If the <i>Consultant</i> determines that the amount payable to the <i>Contractor</i> differs from the amount stated in a <i>Proper Invoice</i> , the <i>Consultant</i> shall notify the <i>Owner</i> as provided in GC 5.3.1.2 and prepare a draft of the applicable <i>Notice of Non-Payment</i> for the amount in dispute.”
SC9.3	2.2.7	<u>Delete</u> the words “Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER”.
SC9.4	2.2.13	At paragraph 2.2.13, <u>insert</u> the following at end of that paragraph: “If, in the opinion of the <i>Contractor</i> , the <i>Supplemental Instruction</i> involves an adjustment in the <i>Contract Price</i> or in the <i>Contract Time</i> , it shall, within ten (10) <i>Working Days</i> of receipt of a <i>Supplemental Instruction</i> , provide the <i>Consultant</i> with a notice in writing to that effect. Failure to provide written notification within the time stipulated in this paragraph 2.2.13 shall be deemed an acceptance of the <i>Supplemental Instruction</i> by the <i>Contractor</i> , without any adjustment in the <i>Contract Price</i> or <i>Contract Time</i> .”

SC10 GC 2.3 REVIEW AND INSPECTION OF THE WORK

SC10.1	2.3.2	<u>Amend</u> paragraph 2.3.2 by <u>adding</u> the words “and <i>Owner</i> ” after the words “ <i>Consultant</i> ” in the second and third lines.
SC10.2	2.3.3	<u>Delete</u> paragraph 2.3.3 in its entirety and <u>replace</u> it with the following: “2.3.3 The <i>Contractor</i> shall furnish promptly two copies to the <i>Consultant</i> and one copy to the <i>Owner</i> of all certificates and inspection reports relating to the <i>Work</i> .”
SC10.3	2.3.4	In paragraph 2.3.4 <u>add</u> the word “review” after the word “inspections” in the first and second lines of paragraph 2.3.4.
SC10.4	2.3.5	In paragraph 2.3.5 in the first line after the word “ <i>Consultant</i> ”, <u>add</u> “or the <i>Owner</i> ”.
SC10.5	2.3.8	<u>Add</u> a new paragraph 2.3.8 as follows: “2.3.8 The <i>Consultant</i> will conduct periodic reviews of the <i>Work</i> in progress, to determine general conformance with the requirements of the <i>Contract Documents</i> . Such reviews, or lack thereof, shall not give rise to any claims by the <i>Contractor</i> in connection with construction means, methods, techniques, sequences and procedures, nor in connection with construction safety at the <i>Place of Work</i> , responsibility for which belongs exclusively to the <i>Contractor</i> .”

SC11 GC 2.4 DEFECTIVE WORK

SC11.1	2.4.1	<u>Amend</u> GC 2.4.1 by inserting “, the <i>Owner</i> and/or its agent” in the first sentence following “rejected by the <i>Consultant</i> ”.
SC11.2	2.4.1.1 to 2.4.1.2	<u>Add</u> new paragraphs 2.4.1.1 and 2.4.1.2 as follows: “2.4.1.1 The <i>Contractor</i> shall rectify, in a manner acceptable to the <i>Consultant</i> and to the <i>Owner through the Consultant</i> all defective work and deficiencies throughout the <i>Work</i> , whether or not they are specifically identified by the <i>Consultant</i> . 2.4.1.2 The <i>Contractor</i> shall prioritize the correction of any defective work, which, in the sole discretion of the <i>Owner through the Consultant</i> , adversely affects the day to day operations of the <i>Owner</i> or which, in the sole discretion of the <i>Consultant</i> , adversely affects the progress of the <i>Work</i> .”

SC11.3	2.4.2	<u>Delete</u> paragraph 2.4.2 in its entirety and <u>replace</u> it with the following: “2.4.2 The <i>Contractor</i> shall promptly pay the <i>Owner</i> for costs incurred by the <i>Owner</i> , the <i>Owner</i> ’s own forces or the <i>Owner</i> ’s other contractors, for work destroyed or damaged or any alterations necessitated by the <i>Contractor</i> ’s removal, replacement or re-execution of defective work.”
SC11.4	2.4.4	<u>Add</u> new paragraph 2.4.4 as follows: “2.4.4 Neither acceptance of the <i>Work</i> by the <i>Consultant</i> or the <i>Owner</i> , nor any failure by the <i>Consultant</i> or the <i>Owner</i> to identify, observe or warn of defective <i>Work</i> or any deficiency in the <i>Work</i> shall relieve the <i>Contractor</i> from the sole responsibility for rectifying such defect or deficiency at the <i>Contractor</i> ’s sole cost, even where such failure to identify, observe or warn is negligent.”

PART 3 EXECUTION OF THE WORK

SC12 GC 3.1 CONTROL OF THE WORK

SC12.1	3.1.2	Amend paragraph 3.1.2 by <u>inserting</u> the words “Construction Schedule” after the word “sequences”.
SC12.2	3.1.3 & 3.1.4	<u>Add</u> new paragraphs 3.1.3 and 3.1.4 as follows: “3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the <i>Contractor</i> shall verify at the <i>Place of the Work</i> , all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the <i>Work</i> and shall further carefully compare such field measurements and conditions with the requirements of the <i>Contract Documents</i> . Where dimensions are not included or exact locations are not apparent, the <i>Contractor</i> shall immediately notify the <i>Consultant</i> in writing and obtain written instructions from the <i>Consultant</i> before proceedings with any part of the affected <i>Work</i> . 3.1.4 Notwithstanding the provisions of paragraphs 3.1.1 and 3.1.2, the <i>Owner</i> shall have access to the site at all times to monitor all aspects of construction. Such access shall in no circumstances affect the obligations of the <i>Contractor</i> to fulfill its contractual obligations.”

SC13 GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

SC13.1	3.2.2.1	<u>Delete</u> paragraph 3.2.2.1 in its entirety.
SC13.2	3.2.2.2	<u>Delete</u> paragraph 3.2.2.2 in its entirety.
SC13.3	3.2.2.3	<u>Delete</u> paragraph 3.2.2.3 in its entirety.
SC13.4	3.2.2.4	<u>Delete</u> paragraph 3.2.2.4 in its entirety.
SC13.5	3.2.3.2	<u>Delete</u> paragraph 3.2.3.2 and <u>replace</u> it with the following: “.2 co-ordinate and schedule the activities and work of other contractors and the <i>Owner's</i> own forces with the <i>Work</i> of the <i>Contractor</i> and connect as specified or shown in the <i>Contract Documents</i> .”
SC13.6	3.2.3.4	<u>Add</u> new paragraph 3.2.3.4 as follows: “.4 Subject to GC 9.4 CONSTRUCTION SAFETY, for the <i>Owner's</i> own forces and for other contractors, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in force at the <i>Place of the Work</i> , including all of the responsibilities of the “constructor”, pursuant to the <i>OHSA</i> .”

SC14 GC 3.3 TEMPORARY WORK

SC14.1	3.3.2	In paragraph 3.3.2, in the second line after the words “where required by law”, insert “or by the <i>Consultant</i> ”.

SC15 GC 3.4 DOCUMENT REVIEW

SC15.1	3.4.1	<u>Delete</u> paragraph 3.4.1 in its entirety and <u>replace</u> it with the following: “3.4.1 The <i>Contractor</i> shall review the <i>Contract Documents</i> and shall report promptly to the <i>Consultant</i> any error, inconsistency, or omission the <i>Contractor</i> may discover. Such review by the <i>Contractor</i> shall be undertaken with the standard of care described in paragraph 3.14.1 of the <i>Contract</i> . Except for its obligation to make such review and report the result, the <i>Contractor</i> does not assume any responsibility to the <i>Owner</i> or to the <i>Consultant</i> for the accuracy of the <i>Contract Documents</i> . Provided it has exercised the degree of care and skill described in this paragraph 3.4.1, the <i>Contractor</i> shall not be liable for damage or costs resulting from such errors, inconsistencies, or

		omissions in the <i>Contract Documents</i> , which the <i>Contractor</i> could not reasonably have discovered through the exercise of the required standard of care.”
SC15.2	3.4.2 & 3.4.3	<u>Add</u> new paragraphs 3.4.2 and 3.4.3 as follows: “3.4.2 If, at any time, the <i>Contractor</i> finds errors, inconsistencies, or omissions in the <i>Contract Documents</i> or has any doubt as to the meaning or intent of any part thereof, including laying out of the Work, the <i>Contractor</i> shall immediately notify the <i>Consultant</i>, and request instructions, a <i>Supplemental Instruction</i>, <i>Change Order</i>, or <i>Change Directive</i>, as the case may require, and the <i>Contractor</i> shall not proceed with the work affected until the <i>Contractor</i> has received such instructions, a <i>Supplemental Instruction</i>, <i>Change Order</i> or <i>Change Directive</i>. Neither the <i>Owner</i> nor the <i>Consultant</i> will be responsible for the consequences of any action of the <i>Contractor</i> based on oral instructions. 3.4.3 Errors, inconsistencies and/or omissions in the <i>Drawings</i> and/or <i>Specifications</i> which do not allow completion of the <i>Work</i> of the <i>Contract</i> shall be brought to the <i>Consultant’s</i> attention prior to the execution of the <i>Contract</i> by means of an <i>RFI</i>.”

SC16 GC 3.5 CONSTRUCTION SCHEDULE

SC16.1	3.5.1	<u>Delete</u> paragraph 3.5.1 in its entirety and <u>replace</u> with the following: “3.5.1 The <i>Contractor</i> shall: .1 within five (5) calendar days of receiving written confirmation of the award of the <i>Contract</i>, prepare and submit to the <i>Owner</i> and the <i>Consultant</i> for their review and approval, a construction schedule in the format indicated below that indicates the timing of the activities of the <i>Work</i> and provides sufficient detail of the critical events and their inter-relationship to demonstrate the <i>Work</i> will be performed in conformity with the <i>Contract Time</i> and in accordance with the <i>Contract Documents</i>. Such schedule is to include a delivery schedule for <i>Products</i> whose delivery is critical to the schedule for the <i>Work</i> or are required by the <i>Contract</i> to be included in a <i>Products</i> delivery schedule. The <i>Contractor</i> shall employ construction scheduling software, being the latest version of “Microsoft Project”, that permits the progress of the <i>Work</i>

		to be monitored in relation to the critical path established in the schedule. The <i>Contractor</i> shall provide such schedule and any successor or revised schedules in both electronic format and hard copy. Once accepted by the <i>Owner</i> and the <i>Consultant</i>, the construction schedule submitted by the <i>Contractor</i> shall become the baseline “Construction Schedule”; .2 provide the expertise and resources, such resources including manpower and equipment, as are necessary on a best efforts basis to maintain progress under the accepted baseline <i>Construction Schedule</i> or revised construction schedule accepted by the <i>Owner</i> pursuant to GC 3.5 CONSTRUCTION SCHEDULE, which includes without limitation, the <i>Contractor's</i> use of all possible and, if necessary, extraordinary measures, to bring the progress of the <i>Work</i> into compliance with the <i>Construction Schedule</i>, such as (i) increasing the presence of its own forces at the <i>Place of the Work</i>; (ii) directing any <i>Subcontractors</i> or <i>Suppliers</i> to increase their labour forces and equipment; (iii) working overtime and extra shifts; and (iv) providing any additional supervision and coordination of the <i>Project</i>, all at the <i>Contractor's</i> own cost and expense save and except where GC 6.5.1, 6.5.2, or 6.5.3 apply; and, .3 monitor the progress of the <i>Work</i> on a weekly basis relative to the baseline <i>Construction Schedule</i>, or any revised <i>Construction Schedule</i> accepted by the <i>Owner</i> pursuant to GC 3.5 CONSTRUCTION SCHEDULE, deliver a <i>Construction Schedule Update</i> to the <i>Consultant</i> and <i>Owner</i> with each application for payment, at a minimum, or as may be reasonably required by the <i>Consultant</i> and advise the <i>Consultant</i> and the <i>Owner</i> weekly in writing of any variation from the baseline or slippage in the schedule; and, .4 if after applying the expertise and resources required under paragraph 3.5.1.2, the <i>Contractor</i> forms the opinion that the slippage in schedule reported in paragraph 3.5.1.3 cannot be recovered by the <i>Contractor</i>, it shall, in the same notice provided under paragraph 3.5.1.3, indicate to the <i>Consultant</i> if the <i>Contractor</i> intends to apply for an extension of <i>Contract Time</i> as provided in PART 6 — CHANGES IN THE WORK; and,

		.5 ensure that the <i>Contract Price</i> shall include all costs required to phase or stage the <i>Work</i> ."
SC16.2	3.5.2 & 3.5.3	<u>Add</u> new paragraphs 3.5.2 and 3.5.3 as follows: "3.5.2 If, at any time, it should appear to the <i>Owner</i> or the <i>Consultant</i> that the actual progress of the <i>Work</i> is behind schedule or is likely to become behind schedule, or if the <i>Contractor</i> has given notice of such to the <i>Owner</i> or the <i>Consultant</i> pursuant to subparagraph 3.5.1.3, the <i>Contractor</i> shall, either at the request of the <i>Owner</i> or the <i>Consultant</i>, or following giving notice pursuant to subparagraph 3.5.1.3, take appropriate steps to cause the actual progress of the <i>Work</i> to conform to the schedule or minimize the resulting delay. Within five (5) calendar days of the request by the <i>Owner</i> or the <i>Consultant</i> or the notice being given pursuant to subparagraph 3.5.1.3, the <i>Contractor</i> shall produce and present to the <i>Owner</i> and the <i>Consultant</i> a plan demonstrating how the <i>Contractor</i> will achieve the recovery of the last accepted schedule. 3.5.3 The <i>Contractor</i> is responsible for performing the <i>Work</i> within the <i>Contract Time</i>. Any schedule submissions revised from the accepted baseline construction schedule or revised schedule accepted by the <i>Owner</i> pursuant to GC 3.5 CONSTRUCTION SCHEDULE, during construction are not deemed to be approved extensions to the <i>Contract Time</i>. All extensions to the <i>Contract Time</i> must be made in accordance with PART 6 – CHANGES IN THE WORK. "

SC17 GC 3.6 SUPERVISION

SC17.1	3.6.1	<u>Delete</u> paragraph 3.6.1 in its entirety and <u>replace</u> with the following: "3.6.1 The <i>Contractor</i> shall employ a competent full-time superintendent, acceptable to the <i>Owner</i> and <i>Consultant</i>, who shall be in full time attendance at the <i>Place of Work</i> while the <i>Work</i> is being performed. The superintendent shall not be changed by the <i>Contractor</i> without valid reason which shall be provided in writing and shall not be changed without prior consultation with and agreement by the <i>Owner</i> and the <i>Consultant</i>. The <i>Contractor</i> shall replace the superintendent within 7 <i>Working Days</i> of the <i>Owner's</i> written notification, if the superintendent's performance is not acceptable to the <i>Owner</i>. The <i>Contractor</i> shall provide the <i>Owner</i> and the <i>Consultant</i> with the names, addresses and telephone numbers of the

		superintendent referred to in this paragraph 3.6.1 and other responsible persons who may be contacted for emergency and other reasons during non-working hours.”
SC17.2	3.6.2	<u>Delete</u> paragraph 3.6.2 in its entirety and <u>replace</u> with the following: “3.6.2 The superintendent, and any project manager appointed by the <i>Contractor</i>, shall represent the <i>Contractor</i> at the <i>Place of Work</i> and shall have full authority to act on written instructions given by the <i>Consultant</i> and/or the <i>Owner</i>. Instructions given to the superintendent or the project manager shall be deemed to have been given to the <i>Contractor</i> and both the superintendent and any project manager shall have full authority to act on behalf of the <i>Contractor</i> and bind the <i>Contractor</i> in matters related to the <i>Contract</i>.”
SC17.3	3.6.3 to 3.6.6	<u>Add</u> new paragraph 3.6.3, 3.6.4, 3.6.5 and 3.6.6 as follows: “3.6.3 The <i>Owner</i> may, at any time during the course of the <i>Work</i>, request the replacement of the appointed representative(s). Immediately upon receipt of the request, the <i>Contractor</i> shall make arrangements to appoint an acceptable replacement, which is approved by the <i>Owner</i>. SC40 3.6.4 The supervisory staff assigned to the <i>Project</i> shall also be fully competent to implement efficiently all requirements for scheduling, coordination, field engineering, reviews, inspections and submittals defined in the <i>Specifications</i>, and have a minimum 5 years documented “Superintendent/Project Management” experience. SC41 3.6.5 The <i>Consultant and Owner</i> shall reserve the right to review the record of experience and credentials of supervisory staff assigned to the <i>Project</i> prior to commencement of the <i>Work</i>. SC42 3.6.6 A superintendent assigned to the <i>Work</i> shall be “Gold Seal Certified” as per the Canadian Construction Association; or a superintendent that can demonstrate the requisite experience and success related to the <i>Project</i> to the sole satisfaction of the <i>Owner</i>.”

SC18 GC 3.7 SUBCONTRACTORS AND SUPPLIERS

SC18.1	3.7.1.1	In paragraph 3.7.1.1 <u>add</u> to the end of the second line the words "including any warranties and service agreements which extend beyond the term of the <i>Contract</i> ."
SC18.2	3.7.1.2	In subparagraph 3.7.1.2 after the words "the <i>Contract Documents</i> " <u>add</u> the words "including any required surety bonding".
SC18.3	3.7.2	<u>Delete</u> paragraph 3.7.2. in its entirety and <u>replace</u> it with the following: "3.7.2 The substitution of any <i>Subcontractor</i> and/or <i>Suppliers</i> after submission of the <i>Contractor's</i> bid will not be accepted unless a valid reason is given in writing to and approved by the <i>Owner</i> , whose approval may be arbitrarily withheld. The reason for substitution must be provided to the <i>Owner</i> and to the original <i>Subcontractor</i> and/or <i>Supplier</i> and the <i>Subcontractor</i> and/or <i>Supplier</i> shall be given the opportunity to reply to the <i>Contractor</i> and <i>Owner</i> . The <i>Contractor</i> shall be fully aware of the capability of each <i>Subcontractor</i> and/or <i>Supplier</i> included in its bid, including but not limited to technical ability, financial stability and ability to maintain the proposed construction schedule."
SC18.4	3.7.7, 3.7.8 & 3.7.9	<u>Add</u> new paragraphs 3.7.7, 3.7.8, and 3.7.9 as follows: "3.7.7 The <i>Consultant</i> or the <i>Owner</i> , acting reasonably, may from time to time require the <i>Contractor</i> to remove from the <i>Project</i> any personnel of the <i>Contractor</i> , including project managers, superintendents or <i>Subcontractors</i> . Such persons shall be replaced by the <i>Contractor</i> in a timely fashion to the satisfaction of the <i>Consultant</i> or the <i>Owner</i> , as the case may be, at no cost to the <i>Owner</i> . 3.7.8 Where provided in the <i>Contract</i> , the <i>Owner</i> may assign to the <i>Contractor</i> , and the <i>Contractor</i> agrees to accept, any contract procured by the <i>Owner</i> for <i>Work</i> or services required on the <i>Project</i> that has been pre-tendered or pre-negotiated by the <i>Owner</i> , and upon such assignment, the <i>Owner</i> shall have no further liability to any party for such contract. 3.7.9 The <i>Contractor</i> covenants that each subcontract or supply contract which the <i>Contractor</i> enters into for the purpose of performing the <i>Work</i> shall expressly provide for the assignment thereof to the <i>Owner</i> (at the option of the <i>Owner</i>) and the assumption by the <i>Owner</i> of the obligations of the <i>Contractor</i>

		thereunder, upon the termination of the <i>Contract</i> and upon written notice by the <i>Owner</i> to the other parties to such subcontracts or supply contracts, without the imposition of further terms or conditions; provided, however, that until the <i>Owner</i> has given such notice, nothing herein contained shall be deemed to create any contractual or other liability upon the <i>Owner</i> for the performance of obligations under such subcontracts or supply contracts and the <i>Contractor</i> shall be fully responsible for all of its obligations and liabilities (if any) under such subcontracts and supply contracts.”

SC19 GC 3.8 LABOUR AND PRODUCTS

SC19.1	3.8.2	<u>Delete</u> paragraph 3.8.2 and <u>substitute</u> with the following: “3.8.2 <i>Products</i> provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, provincial and municipal building codes, fire safety standards, and all governmental authorities and regulatory agencies having jurisdiction at the <i>Place of the Work</i>, unless otherwise specified. <i>Products</i> which are not specified shall be of a quality consistent with those specified and their use acceptable to the <i>Consultant</i>. <i>Products</i> brought on to the <i>Place of the Work</i> by the <i>Contractor</i> shall be deemed to be the property of the <i>Owner</i>, but the <i>Owner</i> shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever. The said <i>Products</i> shall be at the sole risk of the <i>Contractor</i>. Workmanship shall be, in every respect, first class and the <i>Work</i> shall be performed in accordance with the best modern industry practice.”
SC19.2	3.8.3	<u>Amend</u> paragraph 3.8.3 by <u>adding</u> the words, “..., agents, <i>Subcontractors</i> and <i>Suppliers</i>...” after the word “employees” in the first line.
SC19.3	3.8.4 to 3.8.8	<u>Add</u> new paragraphs 3.8.4, 3.8.5, 3.8.6, 3.8.7, and 3.8.8 as follows: “3.8.4 Upon receipt of a <i>Notice in Writing</i> from the <i>Owner</i>, the <i>Contractor</i> shall immediately remove from the <i>Place of the Work</i>, tradesmen and labourers or anyone whose conduct jeopardizes the safety of the <i>Owner’s</i> operations or who are considered by the <i>Owner</i> or the <i>Consultant</i> to be unskilled or otherwise objectionable. Immediately upon receipt of the

		request, the <i>Contractor</i> shall make arrangements to appoint an acceptable replacement. 3.8.5 The <i>Contractor</i> shall cooperate with the <i>Owner</i> and its representatives and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the <i>Work</i> at the <i>Place of the Work</i>, including cooperation to attempt to avoid <i>Work</i> stoppages, trade union jurisdictional disputes and other <i>Labour Disputes</i>. Any costs arising from labour disputes shall be at the sole expense of the <i>Contractor</i>. 3.8.6 The cost for overtime required beyond the normal <i>Working Day</i> to complete individual construction operations of a continuous nature, such as pouring or finishing of concrete or similar work, or <i>Work</i> that the <i>Contractor</i> elects to perform at overtime rates without the <i>Owner</i> requesting it, shall not be chargeable to the <i>Owner</i>. 3.8.7 All manufactured <i>Products</i> which are identified by their proprietary names or by part or catalogue number in the <i>Specifications</i> shall be used by the <i>Contractor</i>. No substitutes for such specified <i>Products</i> shall be used without the written approval of the <i>Owner</i> and the <i>Consultant</i>. Substitutes will only be considered by the <i>Consultant</i> when submitted in sufficient time to permit proper review and investigation. When requesting approval for the use of substitutes, the <i>Contractor</i> shall include in its submission any proposed change in the <i>Contract Price</i>. The <i>Contractor</i> shall use all proprietary <i>Products</i> in strict accordance with the manufacturer's directions. Where there is a choice of proprietary <i>Products</i> specified for one use, the <i>Contractor</i> may select any one of the <i>Products</i> so specified for this use. 3.8.8 Materials, appliances, equipment and other <i>Products</i> are sometimes specified by reference to brand names, proprietary names, trademarks or symbols. In such cases, the name of a manufacturer, distributor, <i>Supplier</i> or dealer is sometimes given to assist the <i>Contractor</i> to find a source <i>Supplier</i>. This shall not relieve the <i>Contractor</i> from its responsibility from finding its own source of supply even if the source names no longer supplies the <i>Product</i> specified. If the <i>Contractor</i> is unable to obtain the specified <i>Product</i>, the <i>Contractor</i> shall supply a substitute product equal to or better than the specified <i>Product</i>, as approved by the <i>Consultant</i> with no extra compensation.

		Should the <i>Contractor</i> be unable to obtain a substitute <i>Product</i> equal to or superior to the specified <i>Product</i> and the <i>Owner</i> accepts a different <i>Product</i> , the <i>Contract Price</i> shall be adjusted accordingly, as approved by the <i>Consultant</i> ."

SC20 GC 3.9 DOCUMENTS AT THE SITE

SC20.1	3.9.1	<u>Delete</u> paragraph 3.9.1 in its entirety and <u>substitute</u> the following: "3.9.1 The <i>Contractor</i> shall keep one copy of the current <i>Contract Documents</i> , <i>Supplemental Instructions</i> , contemplated <i>Change Orders</i> , <i>Change Orders</i> , <i>Change Directives</i> , cash allowance disbursement authorizations, reviewed <i>Shop Drawings</i> , submittals, reports and records of meeting at the <i>Place of the Work</i> , in good order and available to the <i>Owner</i> and <i>Consultant</i> ."

SC21 GC 3.10 SHOP DRAWINGS

SC21.1	3.10.1	<u>Delete</u> paragraph 3.10.1 in its entirety and <u>replace</u> with the following: "3.10.1 The <i>Contractor</i> shall provide shop drawings as described in the <i>Contract Documents</i> and as the <i>Consultant</i> may reasonably request."
SC21.2	3.10.3	<u>Delete</u> paragraph 3.10.3 and <u>replace</u> it with the following: "3.10.3 The <i>Contractor</i> shall prepare a <i>Shop Drawings</i> schedule acceptable to the <i>Owner</i> and the <i>Consultant</i> prior to the first application for payment. A draft of the proposed <i>Shop Drawings</i> schedule shall be submitted by the <i>Contractor</i> to the <i>Consultant</i> and the <i>Owner</i> for approval. The draft <i>Shop Drawings</i> schedule shall clearly indicate the phasing of <i>Shop Drawings</i> submissions. The <i>Contractor</i> shall periodically re-submit the <i>Shop Drawings</i> schedule to correspond to changes in the <i>Construction Schedule</i> ."
SC21.3	3.10.9	<u>Delete</u> paragraph 3.10.9 in its entirety and <u>substitute</u> the following: "3.10.9 At the time of providing <i>Shop Drawings</i> , the <i>Contractor</i> shall advise the <i>Consultant</i> in writing of any deviations in <i>Shop Drawings</i> from the requirements of the <i>Contract Documents</i> . The <i>Consultant</i> shall indicate the acceptance of such deviation expressly in writing. Where manufacturers' literature is submitted in lieu of scaled drawings, it shall be clearly marked

		in ink, to indicate the specific items for which review is requested.”
SC21.4	3.10.1 3 to 3.10.1 7	<u>Add</u> new paragraphs 3.10.13, 3.10.14, 3.10.15, 3.10.16, and 3.10.17 as follows: “3.10.13 Reviewed <i>Shop Drawings</i> shall not authorize a change in the <i>Contract Price</i> and/or the <i>Contract Time</i>. 3.10.14 Except where the parties have agreed to a different <i>Shop Drawings</i> schedule pursuant to paragraph 3.10.3, the <i>Contractor</i> shall comply with the requirements for <i>Shop Drawings</i> submissions stated in the <i>Specifications</i>. 3.10.15 The <i>Contractor</i> shall not use the term “by others” on <i>Shop Drawings</i> or other submittals. The related trade, <i>Subcontractor</i> or <i>Supplier</i> shall be stated. 3.10.16 Certain <i>Specifications</i> sections require the <i>Shop Drawings</i> to bear the seal and signature of a professional engineer. Such professional engineer must be registered in the jurisdiction of the <i>Place of the Work</i> and shall have expertise in the area of practice reflected in the <i>Shop Drawings</i>. 3.10.17 The <i>Consultant</i> will review and return <i>Shop Drawings</i> and submittals in accordance with the schedule agreed upon in paragraph 3.10.3, The <i>Contractor</i> shall allow the <i>Consultant</i> a minimum of 10 <i>Working Days</i> to review <i>Shop Drawings</i> from the date of receipt. If resubmission of <i>Shop Drawings</i> is required, a further 10 <i>Working Day</i> period is required for the <i>Consultant’s</i> review.”

SC22 GC 3.11 USE OF THE WORK

SC22.1	3.11.1	In the second line between the words “permits, or” <u>add</u> , “by direction of the <i>Owner</i> or <i>Consultant</i> ”.
SC22.2	3.11.3	<u>Add</u> new paragraph 3.11.3 as follows: “3.11.3 The <i>Owner</i> shall have the right to enter or occupy the <i>Work</i> in whole or in part for the purpose of placing fittings and equipment, or for other use before <i>Substantial Performance of the Work</i>, if, in the opinion of the <i>Consultant</i>, such entry and occupation does not prevent or substantially interfere with the

		<i>Contractor</i> in the performance of the <i>Contract</i> within the <i>Contract Time</i>. Such entry or occupation shall neither be considered as acceptance of the <i>Work</i>, nor in any way relieve the <i>Contractor</i> from its responsibility to complete the <i>Contract</i>.”

“

SC23 GC 3.12 CUTTING AND REMEDIAL WORK

SC23.1	3.12.5 & 3.12.6	<u>Add</u> new paragraphs 3.12.5 and 3.12.6 as follows: “3.12.5 Unless specifically stated otherwise in the <i>Specifications</i>, the <i>Contractor</i> shall do all cutting and making good necessary for the proper installation and performance of the <i>Work</i>. 3.12.6 To avoid unnecessary cutting, the <i>Contractor</i> shall lay out its work and advise the <i>Subcontractors</i>, when necessary, where to leave holes for installation of pipes and other work.”

SC24 GC 3.13 CLEAN UP

SC24.1	3.13.1	At the end of the paragraph 3.13.1, <u>add</u> the following: “The <i>Contractor</i> shall remove accumulated waste and debris at least once a week as a minimum or as required by the nature of the <i>Work</i>.”
SC24.2	3.13.2	In paragraph 3.13.2, in the fourth line <u>Add</u> the word “materials” between the word “tools” and the words “<i>Construction Equipment</i>”.
SC24.3	3.13.3	In paragraph 3.13.3, in the first and second lines <u>Add</u> the word “materials” between the word “tools” and the words “<i>Construction Equipment</i>” -and- In paragraph 3.13.3 <u>delete</u> the words “Prior to application for the final payment,” and <u>replace</u> them with “As a condition precedent to submitting its application for final payment,”.
SC24.4	3.13.4 & 3.13.5	Add new paragraphs 3.13.4 and 3.13.5 as follows: “3.13.4 The <i>Contractor</i> shall clean up garbage during and after construction and maintain the <i>Place of the Work</i> in a neat and orderly condition on a daily basis. Prior to leaving the <i>Place of the Work</i> and following completion of the <i>Work</i>, the <i>Contractor</i> shall make good all damage to the building and its components

		caused by the performance of the <i>Work</i> or by any <i>Subcontractor</i> or <i>Supplier</i>. The <i>Contractor</i> shall leave the <i>Place of the Work</i> in a clean and finished state; remove all <i>Construction Equipment</i> and materials; remove all paint, stains, labels, dirt, etc. from the <i>Place of the Work</i>; and touch up all damaged painted areas (if applicable). The <i>Contractor</i> shall be responsible for restoring those areas of the <i>Place of the Work</i>, impacted by the <i>Work</i>, to their original condition.” 3.13.5 Without limitation to or waiver of the <i>Owner’s</i> other rights and remedies, the <i>Owner</i> shall have the right to back charge to the <i>Contractor</i> the cost of damage to the site caused by transportation in and out of the <i>Place of the Work</i> by the <i>Contractor</i>, <i>Subcontractors</i> or <i>Suppliers</i>, if not repaired before final payment. 3.13.6 The <i>Contractor</i> shall dispose of debris at a location and in a manner acceptable to the <i>Owner</i> (and to the authorities having jurisdiction at the <i>Place of the Work</i> and at the disposal area) and the <i>Contractor</i> shall cover containers with tarpaulins.”

SC25 *NEW* GC 3.14 CONTRACTOR STANDARD OF CARE

SC25.1	3.14	<u>Add</u> a new GC 3.14 – CONTRACTOR STANDARD OF CARE as follows: “GC 3.14 CONTRACTOR STANDARD OF CARE “3.14.1 In performing its services and obligations under the <i>Contract</i>, the <i>Contractor</i> shall exercise the standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The <i>Contractor</i> acknowledges and agrees that throughout the <i>Contract</i>, the performance of the <i>Contractor’s</i> obligations, duties and responsibilities shall be interpreted in accordance with this standard. The <i>Contractor</i> shall exercise the same standard of care, skill and diligence in respect of any <i>Products</i>, personnel or procedures which it may recommend to the <i>Owner</i> or employ on the <i>Project</i>. 3.14.2 The <i>Contractor</i> further represents, covenants and warrants to the <i>Owner</i> that:

		.1 the personnel it assigns to the <i>Project</i> are appropriately experienced; .2 it has a sufficient staff of qualified and competent personnel to replace any of its appointed representatives, subject to the <i>Owner's</i> approval, in the event of death, incapacity, removal or resignation; and .3 there are no pending, threatened or anticipated claims, liabilities or contingent liabilities that would have a material effect on the financial ability of the <i>Contractor</i> to perform its work under the <i>Contract</i>."

SC26 *NEW* GC 3.15 OCCUPANCY OF THE WORK

SC26.1	3.15.1	<u>Add</u> a new GC 3.15 – OCCUPANCY OF THE WORK as follows: "GC 3.15 OCCUPANCY OF THE WORK 3.15.1 The <i>Owner</i> reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the <i>Project</i> even though the <i>Work</i> may not be substantially performed, progress of the work shall continue in such a way that it will not interfere with use of the occupied space or operation of the facility. The taking of possession or use of any such portion of the <i>Project</i> shall not be deemed to be the <i>Owner's</i> acknowledgement or acceptance of the <i>Work</i> or the <i>Project</i>, nor shall it relieve the <i>Contractor</i> of any of its obligations under the <i>Contract</i>. 3.15.2 Whether the <i>Project</i> contemplates <i>Work</i> by way of renovations in buildings which will be in use or be occupied during the course of the <i>Work</i> or where the <i>Project</i> involves <i>Work</i> that is adjacent to a structure which is in use or is occupied, the <i>Contractor</i>, without in any way limiting its responsibilities under the <i>Contract</i>, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, the operation of HVAC systems, to suppress dust and noise and to avoid conditions likely to propagate mould or fungus of any kind and all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of such structures or adjacent structures."

PART 4 ALLOWANCES

SC27 GC 4.1

CASH ALLOWANCES

SC27.1	4.1.1	<u>Delete</u> the second sentence in paragraph 4.1.1.
SC27.2	4.1.4	<u>Delete</u> paragraph 4.1.4 in its entirety and <u>replace</u> it with the following: “4.1.4 Where the actual cost of the <i>Work</i> under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the <i>Consultant's</i> direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the <i>Contract Price</i> for overhead and profit. Only where the actual cost of the <i>Work</i> under all cash allowances exceeds the total amount of all cash allowances shall the <i>Contractor</i> be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the <i>Contract Documents</i> .”
SC27.3	4.1.5	<u>Delete</u> paragraph 4.1.5 in its entirety and <u>substitute</u> the following: “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 <i>Contract Price</i> by <i>Change Order</i> without any adjustment for the <i>Contractor's</i> overhead and profit on such amount.”
SC27.4	4.1.8 & 4.1.9	<u>Add</u> new paragraphs 4.1.8 and 4.1.9 as follows: “4.1.8 The <i>Owner</i> reserves the right to call, or to have the <i>Contractor</i> call, for competitive bids for portions of the <i>Work</i> , which are to be paid for from cash allowances. 4.1.9 Cash allowances cover the net cost to the <i>Contractor</i> of services, <i>Products</i> , <i>Construction Equipment</i> , freight, unloading, handling, storage, installation, provincial sales tax, and other authorized expenses incurred in performing any <i>Work</i> stipulated under the cash allowances but does not include any <i>Value Added Taxes</i> payable by the <i>Owner</i> and the <i>Contractor</i> .”

PART 5 PAYMENT

SC28 GC 5.1

FINANCING INFORMATION REQUIRED OF THE OWNER

SC28.1	5.1	<u>Delete</u> GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER and all paragraphs thereunder, including any reference to GC 5.1 throughout the <i>Contract</i> .

SC29 GC 5.2

APPLICATIONS FOR PROGRESS PAYMENT

SC29.1	5.2.1	<u>Delete</u> paragraph 5.2.1 and <u>replace</u> it with the following: “5.2.1 Upon execution of the <i>Contract</i>, and in any event prior to the <i>Contractor</i> submitting its first application for payment, the <i>Owner</i> shall issue a purchase order to the <i>Contractor</i> for the performance of the <i>Contract</i>. The number indicated on such purchase order must be clearly identifiable on all applications for payment. Applications for payment shall be dated the last day of each month or an alternative day of each month agreed to in writing by the parties, with each month representing one payment period under the <i>Contract</i> (each a “Payment Period”). Within 3 calendar days of the end of each <i>Payment Period</i>, the <i>Contractor</i> will submit a draft application for payment to the <i>Owner</i> and the <i>Consultant</i>. Upon receipt of the draft application for payment, and within 7 calendar days, a representative of each of the <i>Contractor</i>, <i>Owner</i>, and the <i>Consultant</i> shall attend a meeting to discuss and review the work completed during the <i>Payment Period</i>, including quantities, if applicable (the “Pre-Invoice Submission Meeting”). In the event that the scheduled date for the <i>Pre-Invoice Submission Meeting</i> is not a <i>Working Day</i>, the <i>Pre-Invoice Submission Meeting</i> shall occur on the next <i>Working Day</i>. The <i>Contractor</i> shall bring with it to the <i>Pre-Invoice Submission Meeting</i> the following: .1 a copy of the draft application for payment; .2 any documents the <i>Contractor</i> is required to bring to the <i>Pre-Invoice Submission Meeting</i> as stipulated in the <i>Contract Documents</i> or as reasonably requested by the <i>Owner</i>; and .3 any other documents reasonably requested, in advance, by the <i>Owner</i> or the <i>Consultant</i>.”
SC29.2	5.2.2	<u>Delete</u> paragraph 5.2.2 in its entirety and <u>replace</u> it with the following:

		“5.2.2 Applications for payment shall be given in accordance with the following requirements: .1 within 5 calendar days following the <i>Pre-Invoice Submission Meeting</i>, the <i>Contractor</i> shall deliver its application for payment to the <i>Owner</i> and to the <i>Consultant</i> for <i>Work</i> performed during the <i>Payment Period</i> (“Proper Invoice Submission Date”) subject to the following: .1 if the fifth calendar day following the <i>Pre-Invoice Submission Meeting</i>, to which an invoice relates falls on a day that is not a <i>Working Day</i>, the <i>Proper Invoice Submission Date</i> shall be deemed to fall on the next <i>Working Day</i>. .2 the application for payment must be delivered to the <i>Owner</i> and to the <i>Consultant</i> in the same manner as a <i>Notice in Writing</i> during the hours of 9:00 am to 4:00pm (EST) on the <i>Proper Invoice Submission Date</i>. Delivery to the <i>Owner</i> shall be to the following address: finance-ap@wrdsb.ca .3 If an application for payment is received after 4:00 p.m. (EST) on the applicable <i>Proper Invoice Submission Date</i>, the application for payment will not be considered or reviewed by the <i>Owner</i> and <i>Consultant</i> until the next <i>Proper Invoice Submission Date</i>. Notwithstanding the foregoing, the <i>Owner</i> in its sole and absolute discretion may elect to accept an application for payment submitted after 4:00 p.m. on the applicable <i>Proper Invoice Submission Date</i>; however, such acceptance shall not be construed as a waiver of any of its rights or waive or release the <i>Contractor</i>’s obligations to strictly comply with the requirements prescribed in this subparagraph 5.2.2.3. .4 No applications for payment shall be accepted by the <i>Owner</i> prior to the <i>Proper Invoice Submission Date</i>.”
SC29.3	5.2.3	<u>Delete</u> paragraph 5.2.3 and <u>replace</u> it with the following: “5.2.3 The amount claimed shall be for the value, proportionate to the amount of the <i>Contract</i>, of <i>Work</i> performed and <i>Products</i> delivered and incorporated into the <i>Work</i> as of the last date of

		the applicable <i>Payment Period</i> . Materials may also be deemed to be supplied to an improvement, for payment purposes, when, in the <i>Owner's</i> opinion, they are placed and properly secured on the land on which the improvement is made, or placed upon land designated by the <i>Owner</i> or agent of the <i>Owner</i> , but placing the materials on the land so designated does not, of itself, make that land subject to a lien. No amount claimed shall include products delivered and incorporated into the work, unless the products are free and clear of all security interests, liens and other claims of third parties. No amount claimed shall include <i>Products</i> delivered to the <i>Place of the Work</i> unless the <i>Products</i> are free and clear of all security interests, liens, and other claims of third parties."
SC29.4	5.2.4	After the word " <i>Consultant</i> " in paragraph 5.2.4 <u>add</u> the words "and the <i>Owner</i> "
SC29.5	5.2.5	After the word " <i>Consultant</i> " in the first line of paragraph 5.2.5 <u>add</u> the words "or the <i>Owner</i> " -and- In the second line, <u>delete</u> the word " <i>Consultant</i> " and <u>replace</u> it with " <i>Owner</i> ".
SC29.6	5.2.7	<u>Delete</u> paragraph 5.2.7 and <u>replace</u> it with the following: "5.2.7 The <i>Contractor</i> shall prepare and maintain current as-built drawings which shall consist of the <i>Drawings</i> and <i>Specifications</i> revised by the <i>Contractor</i> during the <i>Work</i> , showing changes to the <i>Drawings</i> and <i>Specifications</i> , which current as-built drawings shall be maintained by the <i>Contractor</i> and made available to the <i>Consultant</i> for review with each application for progress payment. The <i>Consultant</i> shall recommend to the <i>Owner</i> that the <i>Owner</i> retain a reasonable amount for the value of the as-built drawings not presented for review."

SC30 GC 5.3

PROGRESS PAYMENT

SC30.1	5.3.1. 1	<u>Add</u> the following words to the end of subparagraph 5.3.1.1: "and confirm whether all of the criteria for a <i>Proper Invoice</i> are satisfied. If not, the application for payment will be returned to the

		<i>Contractor</i> with reasons from the <i>Owner</i> or the <i>Consultant</i> setting out why the application for payment is not a valid <i>Proper Invoice</i> .”
SC30.2	5.3.1.2	<u>Delete</u> paragraph 5.3.1.2 and <u>replace</u> it with the following: “5.3.1.2 Following receipt of a <i>Proper Invoice</i>, the <i>Consultant</i>: .1 will issue to the <i>Owner</i> with a copy to the <i>Contractor</i>, a certificate for payment in the amount applied for, or .2 if the <i>Consultant</i> finds that such other amount is properly due under the application for payment or otherwise finds that the application for payment must be amended, it shall notify the <i>Owner</i> and prepare an applicable <i>Notice of Non-Payment</i> (Form 1.1) with reasons for the amendment.”
SC30.3	5.3.1.3	<u>Delete</u> subparagraph 5.3.1.3 in its entirety and <u>substitute</u> as follows: “.3 the <i>Owner</i> shall make payment to the <i>Contractor</i> on account no later than 28 calendar days after the receipt by the <i>Owner</i> of a <i>Proper Invoice</i>, subject to the delivery by the <i>Owner</i> of a <i>Notice of Non-Payment</i> (Form 1.1).”
SC30.4	5.3.2 to 5.3.7	<u>Add</u> new paragraphs 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.3.6, and 5.3.7 as follows: “5.3.2 All payments to the <i>Contractor</i> shall be processed using electronic funds transfer (“EFT”) and deposited directly to the <i>Contractor</i>’s bank account unless agreed to otherwise by the <i>Contractor</i> and the <i>Owner</i> in writing. Prior to the <i>Contractor</i> submitting its <i>Proper Invoice</i>, the <i>Owner</i> shall provide the <i>Contractor</i> with the necessary documents to facilitate EFT payments. 5.3.3 Payment shall be deemed to have been made to the <i>Contractor</i> on the date in which funds are transferred via EFT to the <i>Contractor</i>’s bank account. 5.3.4 In the event that the <i>Owner</i> disputes the amount claimed as payable in the <i>Proper Invoice</i>, within 14 calendar days of receipt of the <i>Proper Invoice</i>, the <i>Owner</i> shall provide to the <i>Contractor</i>, a <i>Notice of Non-Payment</i> (Form 1.1). 5.3.5 Where the <i>Owner</i> has delivered a <i>Notice of Non-Payment</i>, as specified under paragraph 5.3.1.3 or 5.3.4, the <i>Owner</i> and the

		<i>Contractor</i> shall first engage in good faith negotiations to resolve the dispute. If within 10 calendar days following the issuance of a <i>Notice of Non-Payment</i>, the <i>Owner</i> and the <i>Contractor</i> cannot resolve the dispute, either party may issue a notice of adjudication in a form prescribed under the <i>Act</i>. The <i>Owner</i> and <i>Contractor</i> will then submit the dispute to <i>Adjudication</i> as set out under PART 8 – DISPUTE RESOLUTION. 5.3.6 The amounts disputed and described under the <i>Notice of Non-Payment</i> shall be held by the <i>Owner</i> until all disputed amounts of the <i>Proper Invoice</i> have been resolved pursuant to PART 8 – DISPUTE RESOLUTION. Any portion of the <i>Proper Invoice</i> which is not the subject of the <i>Notice of Non-Payment</i> shall be payable within the time period set out in paragraph 5.3.1.3. 5.3.7 The <i>Contractor</i> represents, warrants, and covenants to the <i>Owner</i> that it is familiar with its prompt payment and trust obligations under the <i>Act</i> and will take all required steps and measures to ensure that it complies with the applicable prompt payment and trust provisions under the <i>Act</i> including, without limitation, section 8.1 of the <i>Act</i>. Evidence of the <i>Contractor's</i> compliance under this GC 5.3.7, including evidence demonstrating that all EFTs by the <i>Owner</i> to the <i>Contractor</i> are kept in a bank account in the <i>Contractor's</i> name, will be made available to the <i>Owner</i> within 5 <i>Working Days</i> following receipt by the <i>Contractor</i> of a <i>Notice in Writing</i> making such request.”

SC31 GC 5.4

SUBSTANTIAL PERFORMANCE OF THE WORK

SC31.1	5.4.2	<u>Delete</u> paragraph 5.4.2 in its entirety and <u>substitute</u> the following: “5.4.2 The <i>Consultant</i> will review the <i>Work</i> to verify the validity of the application and shall promptly, and in any event, no later than 30 calendar days after receipt of the <i>Contractor's</i> complete deficiency list and application: .1 prepare a final deficiency list incorporating all items to be completed or corrected. Each item is to have an indicated value for correction or completion. Determination of the value for <i>Substantial Performance</i> of the <i>Work</i> is defined in GC 5.10 – DEFICIENCY HOLDBACK. The final deficiency list complete with values is to be included with

		the <i>Consultant's</i> draft verification and shall be reviewed with the <i>Owner</i> prior to 5.4.2.2. .2 having completed 5.4.2.1: .1 the <i>Consultant</i> shall advise the <i>Contractor</i> in writing that the <i>Work</i> or the designated portion of the <i>Work</i> is not substantially performed and give reasons why, or .2 the <i>Consultant</i> shall state the date of <i>Substantial Performance of the Work</i> in a certificate and issue a copy of that certificate to each the <i>Owner</i> and the <i>Contractor</i>."
SC31.2	5.4.3	<u>Delete</u> paragraph 5.4.3 in its entirety and <u>substitute</u> the following: "5.4.3 Following the issuance of the certificate of <i>Substantial Performance of the Work</i> referenced in subparagraph 5.4.2.2.2: .1 the <i>Contractor</i> shall complete the <i>Work</i> within sixty (60) calendar days; .2 no payments will be processed nor will any <i>Proper Invoices</i> be received by the <i>Owner</i> between <i>Substantial Performance of the Work</i> and the completion of the <i>Work</i>; .3 The <i>Owner</i> reserves the right to contract out any or all unfinished <i>Work</i> if it has not been completed within sixty (60) days of <i>Substantial Performance of the Work</i> without prejudice to any other right or remedy and without affecting the warranty period. The cost of completing the <i>Work</i> including <i>Owner</i> and <i>Consultant</i> wages and materials shall be deducted from the <i>Contract Price</i>."
SC31.3	5.4.4 to 5.4.6	<u>Add</u> new paragraphs 5.4.4, 5.4.5 and 5.4.6: "5.4.4 The <i>Contractor</i> shall publish, in a construction trade newspaper in the area of the location of the <i>Work</i>, a copy of the certificate of <i>Substantial Performance of the Work</i> referred to in GC 5.4.2.2.2 within seven (7) days of receiving a copy of the certificate signed by the <i>Consultant</i>, and the <i>Contractor</i> shall provide suitable evidence of the publication to the <i>Consultant</i> and the <i>Owner</i>. If the <i>Contractor</i> fails to publish such notice, the <i>Owner</i> shall be at liberty to publish said certificate and back-charge the <i>Contractor</i> its reasonable costs for doing so.

	5.4.5 Prior to submitting its written application for <i>Substantial Performance of the Work</i>, the <i>Contractor</i> shall submit to the <i>Consultant</i>: .1 statutory declaration in the form of CCDC 9; .2 WSIB clearance certificate showing good standing; .3 updated insurance certificate; .4 guarantees; .5 warranties; .6 certificates; .7 final testing and balancing reports; .8 distribution system diagrams; .9 spare parts; .10 maintenance manuals; .11 samples; .12 reports and correspondence from authorities having jurisdiction in the <i>Place of the Work</i>; .13 shop drawings; .14 inspection certificates; .15 red-lined record drawings from the construction trailer in two copies. sand other materials or documentation required to be submitted under the <i>Contract</i>, together with written proof acceptable to the <i>Owner</i> and the <i>Consultant</i> that the <i>Work</i> has been substantially performed in conformance with the requirements of municipal, governmental, and utility authorities having jurisdiction in the <i>Place of the Work</i>. The <i>Consultant</i> shall refuse to certify <i>Substantial Performance of the Work</i> if the submittals referred to in this paragraph 5.4.5 are not provided by the <i>Contractor</i>. 5.4.6 The <i>Owner</i> shall withhold, from amounts otherwise payable to the <i>Contractor</i>, an amount not to exceed one (1) percent of the <i>Contract Price</i> as security for the obligation of the <i>Contractor</i> to deliver two copies of the red-lined record drawings."

SC32 GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

SC32.1	5.5.1.3	<u>Add</u> new subparagraph 5.5.1.3 as follows: ".3 submit a statement that no written notices of lien have been received by the <i>Contractor</i> ."
SC32.2	5.5.2	<u>Amend</u> paragraph 5.5.2 by <u>adding</u> the following sentence to the end of that paragraph: "Where after thirty (30) days following the publication of the certificate of <i>Substantial Performance of the Work</i> , pursuant to GC 5.4.4, the value of the <i>Work</i> remaining to be complete under the <i>Contract</i> , plus the estimated cost to repair any remaining deficiencies, exceeds the amount of the unpaid balance of the <i>Contract Price</i> (as determined by the <i>Payment Certifier</i> , acting reasonably), the <i>Owner</i> may publish a <i>Notice of Non-Payment</i> of holdback in accordance with the <i>Act</i> (Form 6) and retain an amount from the holdback to supplement the unpaid value of the <i>Contract Price</i> to secure the correction of deficiencies and completion of the <i>Work</i> . Such amounts may include all <i>Consultant</i> and <i>Owner</i> costs including any and all staff and material costs, design, tendering and contractor and supplier costs related to the correction of deficiencies and/or warranty claims."
SC32.3	5.5.3	<u>Delete</u> paragraph 5.5.3 in its entirety.
SC32.4	5.5.4	<u>Delete</u> the first and second sentences in paragraph 5.5.4 and <u>replace</u> them with the following: "There being no claims for lien registered against title to the <i>Place of the Work</i> , as confirmed by a title search of the <i>Place of the Work</i> and there being no claims for lien or written notices of lien delivered to the <i>Owner</i> , the holdback amount authorized by the certificate for payment of the holdback amount issued by the <i>Consultant</i> , pursuant to GC 5.5.2, is due and payable on the 61st calendar day following the publication of the certificate of <i>Substantial Performance of the Work</i> referred to in GC 5.4.4. "
SC32.5	5.5.5	<u>Delete</u> paragraph 5.5.5 in its entirety and <u>replace</u> it with the following: "5.5.5 Notwithstanding the <i>Owner's</i> obligation to make payment of the holdback amount in accordance with GC 5.5.4, the processing of such payment remains subject to the <i>Owner's</i> internal EFT timing limitations. The <i>Owner</i> covenants, and the <i>Contractor</i> agrees, that payment of the holdback shall be made by EFT at the first opportunity during the <i>Owner's</i> normal processing of

		EFTs upon the holdback becoming due in accordance with GC 5.5.4.”

SC33 GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

SC33.1	5.6	<u>Delete</u> GC 5.6 in its entirety.

SC34 GC 5.7 FINAL PAYMENT

SC34.1	5.7.1	In paragraph 5.7.1, <u>delete</u> the words “an application for final payment” and <u>replace</u> them with the following: “an application for final payment that complies with the requirements for a <i>Proper Invoice</i>, accompanied by any documents or materials not yet delivered pursuant to paragraph 5.4.5, together with complete and final as-built drawings. The <i>Contractor</i> shall also provided written certification that there are no outstanding claims, pending claims or future claims from the <i>Contractor</i> or their <i>Subcontractors</i> or <i>Suppliers</i>. The <i>Consultant</i> shall promptly inform the <i>Owner</i> of the receipt the application for final payment and confirm whether all of the criteria for a <i>Proper Invoice</i> are satisfied. If not, the application for payment will be returned to the <i>Contractor</i> with reasons from the <i>Owner</i> or the <i>Consultant</i> setting out why it is not a valid <i>Proper Invoice</i>.”
SC34.2	5.7.2	<u>Delete</u> the words “10 calendar days” and <u>replace</u> them with “5 calendar days” from paragraph 5.7.2. -and- <u>delete</u> the words “advise the <i>Contractor</i> in writing that the application is valid or give reasons why it is not valid.” and <u>replace</u> them with the following: .1 no later than 5 calendar days after the receipt of the <i>Proper Invoice</i> for final payment, the <i>Consultant</i> will issue to the <i>Owner</i> and copy to the <i>Contractor</i>, a certificate for final payment in the amount applied for, or .2 if the <i>Consultant</i> finds that such other amount is properly due under the <i>Proper Invoice</i> for final payment or otherwise finds that the <i>Proper Invoice</i> for final payment must be amended, it

		shall notify the <i>Owner</i> and prepare a draft <i>Notice of Non-Payment</i> (Form 1.1) with reasons for the amendment.”
SC34.3	5.7.3	<u>Delete</u> paragraph 5.7.3 in its entirety and <u>replace</u> it with the following: “5.7.3 Where the <i>Owner</i> has delivered a <i>Notice of Non-Payment</i> , as specified under paragraph 5.7.2, the <i>Owner</i> and the <i>Contractor</i> shall first engage in good faith negotiations to resolve the dispute. If within 10 calendar days following the issuance of a <i>Notice of Non-Payment</i> , the <i>Owner</i> and <i>Contractor</i> cannot resolve the dispute, either party may issue a notice of adjudication in a form prescribed under the <i>Act</i> . The <i>Owner</i> and <i>Contractor</i> will then submit the dispute to <i>Adjudication</i> as set out under PART 8 – DISPUTE RESOLUTION.”
SC34.4	5.7.4	<u>Delete</u> from the second line of paragraph 5.7.4 the words, “5 calendar days after the issuance of” and <u>substitute</u> the words “28 calendar days after receipt of a <i>Proper Invoice</i> for final payment, subject to the delivery by the <i>Owner</i> of a <i>Notice of Non-Payment</i> (Form 1.1)”.
SC34.5	5.7.5	<u>Add</u> new paragraph 5.7.5 as follows: “5.7.5 The amounts disputed and described under the <i>Notice of Non-Payment</i> shall be held by the <i>Owner</i> until all disputed portions of the <i>Proper Invoice</i> for final payment have been resolved pursuant to PART 8 – DISPUTE RESOLUTION. Any portion of the <i>Proper Invoice</i> which is not the subject of the <i>Notice of Non-Payment</i> shall be payable within the time period set out in paragraph 5.7.4.”

SC35 GC 5.8 WITHHOLDING OF PAYMENT

SC35.1	5.8.1	<u>Delete</u> paragraph 5.8.1 and <u>replace</u> with the following: “5.8.1 If because of conditions reasonably beyond the control of the <i>Contractor</i> , there are items of work that cannot be performed, payment in full for that portion of the <i>Work</i> which has been performed as certified by the <i>Consultant</i> shall not be withheld or delayed by the <i>Owner</i> on account thereof, but the <i>Owner</i> may withhold, subject to its requirement to issue a <i>Notice of Non-Payment</i> under the <i>Act</i> , until the remaining portion of the <i>Work</i> is finished, only such an amount that the <i>Consultant</i> determines is sufficient and reasonable to cover the cost of performing such remaining work. The remaining work shall be valued as deficient work as defined in GC 5.10.1.”

SC36 *NEW* GC 5.10

DEFICIENCY HOLDBACK

SC36.1	5.10.1	<u>Add</u> new GC 5.10 – DEFICIENCY HOLDBACK as follows: “GC 5.10 DEFICIENCY HOLDBACK 5.10.1 Notwithstanding any provisions contained in the <i>Contract Documents</i> concerning certification and release of monies to the <i>Contractor</i>, the <i>Owner</i> reserves the right to establish a deficiency holdback, at the time of the review for <i>Substantial Performance of the Work</i>, based on a 200% dollar value of the deficiencies listed by the <i>Consultant</i>. The value of work outstanding for the calculation of <i>Substantial Performance of the Work</i> under the <i>Act</i> shall utilize the 100% dollar value. No individual deficiency will be valued at less than two hundred dollars (\$200.00). The deficiency holdback shall be due and payable to the <i>Contractor</i> on the 61st day following completion of all of the deficiencies listed by the <i>Consultant</i>, there being no claims for lien registered against the title to the <i>Place of the Work</i> issued in accordance with the <i>Act</i>, and less any amounts disputed under an <i>Owner's Notice of Non-Payment</i> (Form 1.1).”

PART 6 CHANGES IN THE WORK

SC37 GC 6.1

OWNER'S RIGHT TO MAKE CHANGES

SC37.1	6.1.2	<u>Add</u> the following to the end of paragraph 6.1.2: “This requirement is of the essence and it is the express intention of the parties that any claims by the <i>Contractor</i> for a change in the <i>Contract Price</i> and/or <i>Contract Time</i> shall be barred unless there has been strict compliance with PART 6 - CHANGES IN THE WORK. No verbal dealings between the parties and no implied acceptance of alterations or additions to the <i>Work</i> and no claims that the <i>Owner</i> has been unjustly enriched by any alteration or addition to the <i>Work</i>, whether in fact there is any such unjust enrichment or not, shall be the basis of a claim for additional payment under this <i>Contract</i> or a claim for any extension of the <i>Contract Time</i>.”
SC37.2	6.1.3 to 6.1.8	<u>Add</u> new paragraphs 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7 and 6.1.8 as follows: “6.1.3 The <i>Contractor</i> agrees that changes resulting from construction coordination, including but not limited to, site surface

		conditions, site coordination, and <i>Subcontractor and Supplier</i> coordination are included in the <i>Contract Price</i> and the <i>Contractor</i> shall be precluded from making any claim for a change in the <i>Contract Price</i> as a result of such changes. 6.1.4 Labour costs shall be actual, prevailing rates at the <i>Place of the Work</i> paid to workers, plus statutory charges on labour including WSIB, unemployment insurance, Canada pension, vacation pay, hospitalization and medical insurance. The <i>Contractor</i> shall provide these rates, when requested by the <i>Consultant</i>, for review and/or agreement. 6.1.5 Quotations for changes to the <i>Work</i> shall only include <i>Direct Costs</i> and be accompanied by itemized breakdowns together with detailed, substantiating quotations or cost vouchers from <i>Subcontractors</i> and <i>Suppliers</i>, submitted in a format acceptable to the <i>Consultant</i> and shall include any <i>Direct Costs</i> associated with extensions in <i>Contract Time</i>. 6.1.6 When both additions and deletions covering related <i>Work</i> or substitutions are involved in a change to the <i>Work</i>, payment, including <i>Overhead</i> and profit, shall be calculated on the basis of the net difference, if any, with respect to that change in the <i>Work</i>. 6.1.7 No extension to the <i>Contract Time</i> shall be granted for changes in the <i>Work</i> unless the <i>Contractor</i> can clearly demonstrate that such changes significantly alter the overall construction schedule submitted at the commencement of the <i>Work</i>. Extensions of <i>Contract Time</i> and all associated costs, if approved, shall be included in the relevant <i>Change Order</i>. 6.1.8 When a change in the <i>Work</i> is proposed or required, the <i>Contractor</i> shall within 10 calendar days submit to the <i>Consultant</i> for review a claim for a change in <i>Contract Price</i> and/or <i>Contract Time</i>. Should 10 calendar days be insufficient to prepare the submission, the <i>Contractor</i> shall within 5 calendar days, advise the <i>Consultant</i> in writing of the proposed date of submission of the claim. Claims submitted after the dates prescribed herein will not be considered."

SC38 GC 6.2 CHANGE ORDER

SC38.1	6.2.1	In paragraph 6.2.1 after the last sentence in the paragraph <u>add</u> the following: “The adjustment in the <i>Contract Time</i> and the <i>Contract Price</i> shall include an adjustment, if any, for delay or for the impact that the change in the <i>Work</i> has on the <i>Work</i> of the <i>Contractor</i>, and once such adjustment is made, the <i>Contractor</i> shall be precluded from making any further claims for delay or impact with respect to the change in the <i>Work</i>.”
SC38.2	6.2.3 to 6.2.5	<u>Add</u> new paragraphs 6.2.3, 6.2.4, and 6.2.5 as follows: “6.2.3 The value of a change shall be determined in one or more of the following methods as directed by the <i>Consultant</i>: .1 by estimate and acceptance of a lump sum; .2 by negotiated unit prices which include the <i>Contractor's</i> overhead and profit, or; .3 by the actual <i>Direct Cost</i> to the <i>Owner</i>, such costs to be the actual cost after all credits included in the change have been deducted, plus the following ranges of mark-up on such costs: .1 Contractor on Work of their own forces, 5% overhead, 5 % profit .2 Sub-Contractor on Work of their own forces, 5% overhead, 5% profit .3 Contractor on Work of Sub-Contractor, 5% overhead only, the above includes for all site and office related overhead costs. 6.2.4 All quotations shall include <i>Direct Costs</i> and be submitted in a complete manner listing: .1 quantity of each material, .2 unit cost of each material, .3 man hours involved,

		.4 cost per hour, .5 <i>Subcontractor</i> quotations submitted listing items 1 to 4 above and item 6 below. .6 mark-up. 6.2.5 The <i>Owner</i> and the <i>Consultant</i> will not be responsible for delays to the <i>Work</i> resulting from late, incomplete or inadequately broken-down valuations submitted by the <i>Contractor</i>."
SC38.3		

SC39 GC 6.3 CHANGE DIRECTIVE

SC39.1	6.3.6.1	<u>Amend</u> paragraph 6.3.6.1 by deleting the final period and adding the following: “.1 Five percent (5%) for profit plus five percent (5%) for overhead on work by the <i>Contractor's</i> own forces up to the value of \$15,000 and five percent (5%) for profit plus three percent (3%) for <i>Overhead</i> on work by the <i>Contractor's</i> own forces in excess of \$15,000 and, .2 5 percent (5%) fee on amounts paid to <i>Subcontractors</i> or <i>Suppliers</i> under subparagraph 6.3.7.9 for changes up to the value of \$15,000 and five percent (5%) on changes over \$15,000. Unless a <i>Subcontractor's</i> or <i>Supplier's</i> price has been approved by the <i>Owner</i>, the <i>Subcontractor</i> or <i>Supplier</i> shall be entitled to its actual net cost as determined in accordance with paragraph 6.3.7, plus ten percent (5%) for profit and five percent (5%) for <i>Overhead</i> on such actual net cost for changes in the <i>Work</i>, up to the value of \$15,000 and five percent (5%) for profit and three percent (3%) for overhead on such actual net cost changes in the <i>Work</i> in excess of \$15,000."
SC39.2	6.3.6.2	<u>Delete</u> paragraph 6.3.6.2 and <u>replace</u> it with the following: “.2 If a change in the <i>Work</i> results in a net decrease in the <i>Contract Price</i> in excess of \$15,000 the amount of the credit shall be the net cost, with deduction for <i>Overhead</i> and profit. If a change in the <i>Work</i> results in a net decrease in the <i>Contract Price</i> of \$15,000 or less, the amount of the credit shall be the net cost, without deduction for <i>Overhead</i> or profit.

SC39.3	6.3.7.1	In subparagraph 6.3.7.1 after the words "in the direct employ of the <i>Contractor</i> " <u>add</u> the words "while directly engaged in the work attributable to the change".
SC39.4	6.3.7	At the end of paragraph 6.3.7 <u>add</u> the following: "All other costs attributable to the change in the <i>Work</i> including the costs of all administrative or supervisory personnel are included in <i>Overhead</i> and profit calculated in accordance with the provisions of paragraph 6.1.5."

SC40 GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

SC40.1	6.4.1	<u>Delete</u> paragraph 6.4.1 in its entirety and <u>replace</u> with the following: 6.4.1.1 Prior to the submission of the bid on which the <i>Contract</i> was awarded, the <i>Contractor</i> confirms that it carefully investigated the <i>Place of the Work</i> and carried out such tests as it deemed appropriate and, in doing so, applied to that investigation the degree of care and skill required by paragraph 3.14.1. If the <i>Contractor</i> has not conducted such careful investigation, it is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the <i>Work</i> which could make the <i>Work</i> more expensive or more difficult to perform than was contemplated at the time the <i>Contract</i> was executed. No allowances will be made for additional costs and no claims by the <i>Contractor</i> will be entertained in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the <i>Contract</i>. 6.4.1.2 No claim by the <i>Contractor</i> will be considered by the <i>Owner</i> or the <i>Consultant</i> in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the <i>Contract</i>. 6.4.1.3 The <i>Contractor</i> expressly acknowledges that, prior to the submission of the bid on which the <i>Contract</i> was awarded, the <i>Contractor</i> may have been prevented from carefully investigating the <i>Place of the Work</i> as a result of <i>Force Majeure</i>. Understanding such limitations, the <i>Contractor</i> proceeded with its bid. The <i>Contractor</i> shall not, therefore, make any claim arising from <i>Force Majeure</i> conditions which

		may have prevented the <i>Contractor</i> from fulfilling its obligations under this GC 6.4.”
SC40.2	6.4.2	<u>Amend</u> paragraph 6.4.2 by <u>adding</u> a new first sentence as follows: “Having regard to paragraph 6.4.1, if the <i>Contractor</i> believes that the conditions of the <i>Place of the Work</i> differ materially from those reasonably anticipated, differ materially from those indicated in the <i>Contract Documents</i> or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, it shall provide the <i>Owner</i> and the <i>Consultant</i> with <i>Notice in Writing</i> no later than five (5) <i>Working Days</i> after the first observation of such conditions.” -and- <u>amend</u> the existing second sentence of paragraph 6.4.2 in the second line, following the word “materially” by <u>adding</u> the words “or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1,”.
SC40.3	6.4.3	<u>Delete</u> paragraph 6.4.3 in its entirety and <u>substitute</u> the following: “6.4.3 If the <i>Consultant</i> makes a finding pursuant to paragraph 6.4.2 that no change in the <i>Contract Price</i> or the <i>Contract Time</i> is justified, the <i>Consultant</i> shall report in writing the reasons for this finding to the <i>Owner</i> and the <i>Contractor</i>.”
SC40.4	6.4.5	<u>Add</u> new paragraph 6.4.5 as follows: “6.4.5 No claims for additional compensation or for an extension of <i>Contract Time</i> shall be allowed if the <i>Contractor</i> fails to give <i>Notice in Writing</i> to the <i>Owner</i> or <i>Consultant</i>, as required by paragraph 6.4.2.”

SC41 GC 6.5

DELAYS

SC41.1	6.5.1	In paragraph 6.5.1 <u>delete</u> the words after the word “for” in the fourth line and <u>replace</u> them with the words “...reasonable <i>Direct Costs</i> directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity).”
SC41.2	6.5.2	In paragraph 6.5.2,

		<u>delete</u> the words “not issued as the result of an act or fault of the <i>Contractor</i> or any person employed or engaged by the <i>Contractor</i> directly or indirectly,” and <u>replace</u> them with “issued on account of a direct breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes by the <i>Owner</i>, the <i>Owner’s</i> other contractor(s), or the <i>Consultant</i>, and relating to the <i>Work</i> or the <i>Place of the Work</i>,” -and- <u>delete</u> the words after the word “for” in the fourth line of paragraph 6.5.2, and <u>replace</u> them with the words “...reasonable <i>Direct Costs</i> directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity).”
SC41.3	6.5.3	<u>Delete</u> paragraph 6.5.3 in its entirety and <u>replace</u> with the following: “6.5.3 If either party is delayed in the performance of their obligations under this <i>Contract</i> by <i>Force Majeure</i>, then the <i>Contract Time</i> shall be extended for such reasonable time as the <i>Owner</i> and the <i>Contractor</i> shall agree. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the parties agree to a shorter extension. Neither party shall be entitled to payment for costs incurred by such delays. Upon reaching agreement on the extension of the <i>Contract Time</i> attributable to the <i>Force Majeure</i> event, the <i>Owner</i> and the <i>Contractor</i> shall execute a <i>Change Order</i> indicating the length of the extension to the <i>Contract Time</i> and confirming that there are no costs payable by the either party for the extension of <i>Contract Time</i>. However, if at the time an event of <i>Force Majeure</i> arises a party is in default of its obligations under the <i>Contract</i> and has received a notice of default pursuant to PART 7 – DEFAULT NOTICE, this paragraph 6.5.3 shall not excuse a party from its obligation to cure the default(s). For greater certainty, the defaulting party, to the extent possible, must continue to address and cure the default notwithstanding an event of <i>Force Majeure</i>.”
SC41.4	6.5.4	<u>Delete</u> paragraph 6.5.4 in its entirety and <u>replace</u> it with the following: “6.5.4 No extension or compensation shall be made for delay or impact on the <i>Work</i> unless notice in writing of a claim is given to the <i>Consultant</i> not later than ten (10) <i>Working Days</i> after the commencement of the delays or impact on the <i>Work</i>, provided

		however, that, in the case of a continuing cause of delay or impact on the <i>Work</i> , only one notice of claim shall be necessary.”
SC41.5	6.5.6 to 6.5.8	<u>Add</u> new paragraphs 6.5.6, 6.5.7 and 6.5.8 as follows: “6.5.6 If the <i>Contractor</i> is delayed in the performance of the <i>Work</i> by an act or omission of the <i>Contractor</i> or anyone directly or indirectly employed or engaged by the <i>Contractor</i>, or by any cause within the <i>Contractor</i>’s control, then (i) firstly, at its expense, and to the extent possible, the <i>Contractor</i> shall accelerate the work and/or provide overtime work to recover time lost by a delay arising under this paragraph 6.5.6, and (ii) secondly, where it is not possible for the <i>Contractor</i> to recover the time lost by implementing acceleration measures and/or overtime work, the <i>Contract Time</i> may be extended for such reasonable time as the <i>Owner</i> may decide in consultation with the <i>Consultant</i> and the <i>Contractor</i>. The <i>Owner</i> shall be reimbursed by the <i>Contractor</i> for all reasonable costs incurred by the <i>Owner</i> as the result of such delay, including, but not limited to, <i>Owner</i>’s staff costs, the cost of all additional services required by the <i>Owner</i> from the <i>Consultant</i> or any sub-consultants, project managers, or others employed or engaged by the <i>Owner</i>, and in particular, the costs of the <i>Consultant</i>’s services during the period between the date of <i>Substantial Performance of the Work</i> stated in Article A-1 herein, as the same may be extended through the provision of these General Conditions, and any later or actual date of <i>Substantial Performance of the Work</i> achieved by the <i>Contractor</i>. 6.5.7 Without limiting the obligations of the <i>Contractor</i> described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS or GC 9.4 – CONSTRUCTION SAFETY, the <i>Owner</i> or <i>Consultant</i> may, by <i>Notice in Writing</i>, direct the <i>Contractor</i> to stop the <i>Work</i> where the <i>Owner</i> or <i>Consultant</i> determines that there is an imminent risk to the safety of persons or property at the <i>Place of the Work</i>. In the event that the <i>Contractor</i> receives such notice, it shall immediately stop the <i>Work</i> and secure the site. The <i>Contractor</i> shall not be entitled to an extension of the <i>Contract Time</i> or to an increase in the <i>Contract Price</i> unless the resulting delay, if any, would entitle the <i>Contractor</i> to an extension of the <i>Contact Time</i> or the reimbursement of the <i>Contractor</i>’s costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.

		6.5.8 No claim for delay shall be made and the <i>Contract Time</i> shall not be extended due to climatic conditions or arising from the <i>Contractor's</i> efforts to maintain the <i>Construction Schedule</i> ."

PART 7 DEFAULT NOTICE

SC42 GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

SC42.1	7.1.3.4	<u>Add</u> a new subparagraph 7.1.3.4 as follows: ".4 an "acceptable schedule" as referred to in subparagraph 7.1.3.2. means a schedule approved by the <i>Consultant</i> and the <i>Owner</i> wherein the default can be corrected within the balance of the <i>Contract Time</i> and shall not cause delay to any other aspect of the <i>Work</i> or the work of other contractors, and in no event shall it be deemed to give a right to extend the <i>Contract Time</i> ."
SC42.2	7.1.4.1	<u>Delete</u> subparagraph 7.1.4.1 and <u>replace</u> it with the following: ".1 correct such default and deduct the cost, including <i>Owner's</i> expenses, thereof from any payment then or thereafter due the <i>Contractor</i> ."
SC42.3	7.1.4.2	<u>Delete</u> subparagraph 7.1.4.2 and <u>replace</u> it with the following: ".2 by providing <i>Notice in Writing</i> to the <i>Contractor</i> , terminate the <i>Contractor's</i> right to continue with the <i>Work</i> in whole or in part or terminate the <i>Contract</i> , and publish a notice of termination (Form 8) in accordance with the <i>Act</i> ."
SC42.4	7.1.5.3	In subparagraph 7.1.5.3 <u>delete</u> the words: "however, if such cost of finishing the <i>Work</i> is less than the unpaid balance of the <i>Contract Price</i> , the <i>Owner</i> shall pay the <i>Contractor</i> the difference"
SC42.5	7.1.6	<u>Delete</u> paragraph 7.1.6 in its entirety.
SC42.6	7.1.6 to 7.1.10	<u>Add</u> new paragraphs 7.1.6, 7.1.7, 7.1.8, 7.1.9 and 7.1.10 as follows: "7.1.6 In addition to its right to terminate the <i>Contract</i> set out herein, the <i>Owner</i> may terminate this <i>Contract</i> at any time for any other reason and without cause upon giving the <i>Contractor</i> fifteen (15) <i>Working Days Notice in Writing</i> to that effect. In such event, the <i>Contractor</i> shall be entitled to be paid for all <i>Work</i> performed including reasonable profit, for loss sustained

		upon <i>Products</i> and <i>Construction Equipment</i>, and such other damages as the <i>Contractor</i> may have sustained as a result of the termination of the <i>Contract</i>, but in no event shall the <i>Contractor</i> be entitled to be compensated for any loss of profit on unperformed portions of the <i>Work</i>, or indirect, special, or consequential damages incurred. 7.1.7 The <i>Owner</i> may suspend <i>Work</i> under this <i>Contract</i> at any time for any reason and without cause upon giving the <i>Contractor</i> <i>Notice in Writing</i> to that effect. In such event, the <i>Contractor</i> shall be entitled to be paid for all <i>Work</i> performed to the date of suspension and be compensated for all actual costs incurred arising from the suspension, including reasonable profit, for loss sustained upon <i>Products</i> and <i>Construction Equipment</i>, and such other damages as the <i>Contractor</i> may have sustained as a result of the suspension of the <i>Work</i>, but in no event shall the <i>Contractor</i> be entitled to be compensated for any indirect, special, or consequential damages incurred. In the event that the suspension continues for more than thirty (30) calendar days, the <i>Contract</i> shall be deemed to be terminated and the provisions of paragraph 7.1.6 shall apply. 7.1.8 In the case of either a termination of the <i>Contract</i> or a suspension of the <i>Work</i> under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the <i>Contractor</i> shall use its best commercial efforts to mitigate the financial consequences to the <i>Owner</i> arising out of the termination or suspension, as the case may be. 7.1.9 Upon the resumption of the <i>Work</i> following a suspension under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the <i>Contractor</i> will endeavour to minimize the delay and financial consequences arising out of the suspension. 7.1.10 The <i>Contractor's</i> obligations under the <i>Contract</i> as to quality, correction, and warranty of the <i>Work</i> performed by the <i>Contractor</i> up to the time of termination or suspension shall

		continue after such termination of the <i>Contract</i> or suspension of the <i>Work</i> ."

SC43 GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

SC43.1	7.2.2	<u>Delete</u> paragraph 7.2.2 and <u>replace</u> it with the following: "7.2.2 If the <i>Work</i> is suspended or otherwise delayed for a period of 40 consecutive <i>Working Days</i> or more under a stop work order issued by a court or other public authority on account of a breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes directly by the <i>Owner</i> , the <i>Owner's</i> other contractor(s), or the <i>Consultant</i> , and relating to the <i>Work</i> or the <i>Place of the Work</i> , the <i>Contractor</i> may, without prejudice to any other right or remedy the <i>Contractor</i> may have, terminate the <i>Contract</i> by giving the <i>Owner</i> Notice in <i>Writing</i> to that effect."
SC43.2	7.2.3 .1	<u>Delete</u> subparagraph 7.2.3.1 in its entirety.
SC43.3	7.2.3 .2	<u>Delete</u> subparagraph 7.2.3.2 in its entirety.
SC43.4	7.2.3 .4	In subparagraph 7.2.3.4, <u>delete</u> the words "except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER".
SC43.5	7.2.5	<u>Renumber</u> paragraph 7.2.5 as paragraph 7.2.6. and <u>add</u> a new paragraph 7.2.5 as follows: "7.2.5 If the default cannot be corrected within the 5 <i>Working Days</i> specified in paragraph 7.2.4, the <i>Owner</i> shall be deemed to have cured the default if it: .1 commences correction of the default within the specified time; .2 provides the <i>Contractor</i> with an acceptable schedule for such correction; and, .3 completes the correction in accordance with such schedule."

SC43.6	7.2.6	<u>Delete</u> paragraph 7.2.6 entirely and <u>replace</u> with the following: “7.2.6 If the <i>Contractor</i> terminates the <i>Contract</i> under the conditions described in GC 7.2 – CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the <i>Contractor</i> shall be entitled to be paid for all <i>Work</i> performed to the date of termination, as determined by the <i>Consultant</i>. The <i>Contractor</i> shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization and losses sustained on <i>Products</i> and <i>Construction Equipment</i>. The <i>Contractor</i> shall not be entitled to any recovery for any special, indirect or consequential losses, including loss of profit.”
SC43.7	7.2.7 to 7.2.9	<u>Add</u> new paragraphs 7.2.7, 7.2.8 and 7.2.9 as follows: “7.2.7 The <i>Contractor</i> shall not be entitled to give notice of the <i>Owner’s</i> default or terminate the <i>Contract</i> in the event the <i>Owner</i> withholds certificates or payment or both in accordance with the <i>Contract</i> because of: .1 the <i>Contractor’s</i> failure to pay all legitimate claims promptly, or .2 the failure of the <i>Contractor</i> to discharge construction liens which are registered against the title to the <i>Place of the Work</i>. 7.2.8 The <i>Contractor’s</i> obligations under the <i>Contract</i> as to quality, correction and warranty of the <i>Work</i> performed by the <i>Contractor</i> up to the effective date of termination shall continue in force and shall survive termination of this <i>Contract</i> by the <i>Contractor</i>. 7.2.9 If the <i>Contractor</i> suspends the <i>Work</i> or terminates the <i>Contract</i> as provided for in GC 7.2 – CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the <i>Contractor</i> shall ensure the site and the <i>Work</i> are left in a safe, secure condition as required by authorities having jurisdiction at the <i>Place of the Work</i> and the <i>Contract Documents</i>.”

SC44 GC 8.1

AUTHORITY OF THE CONSULTANT

SC44.1	8.1.3	<u>Delete</u> paragraph 8.1.3 in its entirety and <u>substitute</u> as follows:

		“8.1.3 If a dispute is not resolved promptly, the <i>Consultant</i> will give such instruction as in the <i>Consultant’s</i> opinion are necessary for the proper performance of the <i>Work</i> and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by doing so neither party will jeopardize any claim the party may have.”

SC45 GC 8.2

NEGOTIATION, MEDIATION AND ARBITRATION

SC45.1	8.2.1	<u>Amend</u> paragraph 8.2.1 by changing part of the second line from “shall appoint a <i>Project Mediator</i>” to “may appoint a <i>Project Mediator</i>, except that such an appointment shall only be made if both the <i>Owner</i> and the <i>Contractor</i> agree.”
SC45.2	8.2.4	<u>Amend</u> paragraph 8.2.4 by changing part of the second line from “the parties shall request the <i>Project Mediator</i>” to “and subject to paragraph 8.2.1 the parties may request the <i>Project Mediator</i>”.
SC45.3	8.2.6 to 8.2.8	<u>Delete</u> paragraphs 8.2.6, 8.2.7 and 8.2.8 in their entirety.
SC45.4	8.2.6	<u>Add</u> new paragraph 8.2.6 as follows: “8.2.6 The dispute may be finally resolved by arbitration under the Rules for Arbitration of Construction Disputes as provided in CCDC 40 in effect at the time of bid closing, provided that both the <i>Contractor</i> and the <i>Owner</i> agree. If the <i>Contractor</i> and the <i>Owner</i> agree to resolve the dispute by arbitration, the arbitration shall be conducted in the jurisdiction of the <i>Place of the Work</i>.”
SC45.5	8.2.9 , 8.2.1 0 & 8.2.1 1	<u>Add</u> a new paragraphs 8.2.9, 8.2.10, and 8.2.11 as follows: “8.2.9 Prior to delivering a notice of <i>Adjudication</i> in a form prescribed by the <i>Act</i>, the parties agree to first address all disputes by attending at least one meeting with the <i>Owner’s</i> representative, the <i>Consultant’s</i> representative, and the <i>Contractor’s</i> representative, prior to commencing an <i>Adjudication</i>. The parties agree that such steps will be taken to resolve any disputes in a timely and cost effective manner. If a resolution to the dispute(s) is not made at such a meeting, any party who plans to commence an <i>Adjudication</i> shall provide the other party with 5 <i>Working Days’ Notice in Writing</i> of its intention to issue a notice of <i>Adjudication</i>.

		8.2.10 Other than where the <i>Contractor</i> is obliged to commence an <i>Adjudication</i> pursuant to an undertaking under the <i>Act</i>, neither the <i>Owner</i> nor the <i>Contractor</i> shall commence an <i>Adjudication</i> during the <i>Restricted Period</i>. 8.2.11 Where either party has delivered a notice of <i>Adjudication</i> in a form prescribed by the <i>Act</i>, the procedures and rules set out under the <i>Act</i> and the regulations thereto shall govern the <i>Adjudication</i>.”

SC46 GC 9.1 PROTECTION OF WORK AND PROPERTY

SC46.1	9.1.1 .1	<u>Delete</u> subparagraph 9.1.1.1 in its entirety and <u>substitute</u> the following: “.1 errors in the <i>Contract Documents</i> which the <i>Contractor</i> could not have discovered applying the standard of care described in paragraph 3.14.1;”
SC46.2	9.1.2	<u>Delete</u> paragraph 9.1.2 in its entirety and <u>substitute</u> as follows: “9.1.2 Before commencing any <i>Work</i>, the <i>Contractor</i> shall determine the locations of all underground or hidden utilities and structures indicated in or inferable from the <i>Contract Documents</i>, or that are inferable from an inspection of the <i>Place of the Work</i> exercising the degree of care and skill described in paragraph 3.14.1.”
SC46.3	9.1.5	<u>Add</u> new paragraph 9.1.5 as follows: “9.1.5 With respect to any damage to which paragraphs 9.1.3 or 9.1.4 apply, the <i>Contractor</i> shall neither undertake to repair or replace any damage whatsoever to the work of other contractors, or to adjoining property, nor acknowledge that the same was caused or occasioned by the <i>Contractor</i>, without first consulting the <i>Owner</i> and receiving written instructions as to the course of action to be followed from either the <i>Owner</i> or the <i>Consultant</i>. Where, however, there is danger to life, the environment, or public safety, the <i>Contractor</i> shall take such emergency action as it deems necessary to remove the danger.”

SC47 GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

SC47.1	9.2.5 .5	<u>Add</u> a new subparagraph 9.2.5.5 as follows: “.5 in addition to the steps described in subparagraph 9.2.5.3, take any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances or materials.”
SC47.2	9.2.6	<u>Add</u> the following to paragraph 9.2.6, after the word “responsible” in the second line: “or whether any toxic or hazardous substances or materials already at the <i>Place of the Work</i> (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the <i>Contractor</i> or anyone for whom the <i>Contractor</i> is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the <i>Owner</i> or others,”.
SC47.3	9.2.8	<u>Add</u> the following to paragraph 9.2.8, after the word “responsible” in the second line: “or whether any toxic or hazardous substances or materials already at the <i>Place of the Work</i> (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the <i>Contractor</i> or anyone for whom the <i>Contractor</i> is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the <i>Owner</i> or others,”.
SC47.4	9.2.1 0	<u>Add</u> new paragraph 9.2.10 as follows: “9.2.10 The <i>Contractor</i> , <i>Subcontractors</i> and <i>Suppliers</i> shall not bring on to the <i>Place of the Work</i> any toxic or hazardous substances and materials except as required in order to perform the <i>Work</i> . If such toxic or hazardous substances or materials are required, storage in quantities sufficient to allow work to proceed to the end of any current work week only shall be permitted. All such toxic and hazardous materials and substances shall be handled and disposed of only in accordance with all laws and regulations that are applicable at the <i>Place of the Work</i> .”

SC48 GC 9.4 CONSTRUCTION SAFETY

SC48.1	9.4.1	<u>Delete</u> paragraph 9.4.1 in its entirety and <u>substitute</u> as follows: “9.4.1 The <i>Contractor</i> shall be solely responsible for construction safety at the <i>Place of the Work</i> and for compliance with the rules, regulations, and practices required by the <i>OHSA</i>, including, but not limited to those of the "constructor", and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the <i>Work</i>. Without limiting the foregoing, the <i>Contractor</i> shall be solely responsible for construction safety in respect of its <i>Consultants</i>, other <i>Consultants</i>, <i>Subcontractors</i> and <i>Suppliers</i>, the <i>Owner's</i> own forces, and other contractors, subcontractors, and suppliers during the course of the <i>Project</i>.”
SC48.2	9.4.2 to 9.4.10	<u>Add</u> new paragraphs 9.4.2 to 9.4.10 as follows: 9.4.2 Prior to the commencement of the <i>Work</i>, the <i>Contractor</i> shall submit to the <i>Owner</i>: .1 the evidence of workers' compensation compliance required by GC 10.4.1; .2 copies of the <i>Contractor's</i> insurance policies having application to the <i>Project</i> or certificates of insurance, at the option of the <i>Owner</i>; .3 documentation setting out the <i>Contractor's</i> in-house safety programs; .4 a copy of the "Notice of Project" filed with the Ministry of Labour; .5 copies of any documentation or notices to be filed or delivered to the authorities having jurisdiction for the regulation of occupational health and safety at the <i>Place of the Work</i>. 9.4.3 The <i>Contractor</i> shall indemnify and save harmless the <i>Owner</i>, its agents, trustees, officers, directors, employees, consultants, successors, appointees, and assigns from and against the consequences of any and all safety infractions committed by the <i>Contractor</i> under the occupational health and safety legislation in force at the <i>Place of the Work</i> including the

		payment of legal fees and disbursements on a substantial indemnity basis. 9.4.4 The <i>Owner</i> undertakes to include in its contracts with other contractors and in its instructions to its own forces the requirement that the other contractor or its own forces, as the case may be, comply with the policies and procedures of and the directions and instructions from the <i>Contractor</i> with respect to occupational health and safety and related matters. 9.4.5 If the <i>Owner</i> is of the reasonable opinion that the <i>Contractor</i> has not taken such precautions as are necessary to ensure compliance with the requirements of paragraph 9.4.1, the <i>Owner</i> may take any remedial measures which it deems necessary, including stopping the performance of all or any portion of the <i>Work</i>, and the <i>Owner</i> may use its employees, the <i>Contractor</i>, any <i>Subcontractor</i> or any other contractors to perform such remedial measures. 9.4.6 The <i>Contractor</i> shall file any notices or any similar document required pursuant to the <i>Contract</i> or the safety regulations in force at the <i>Place of the Work</i>. This duty of the <i>Contractor</i> will be considered to be included in the <i>Work</i> and no separate payment therefore will be made to the <i>Contractor</i>. 9.4.7 Unless otherwise provided in the <i>Contract Documents</i>, the <i>Contractor</i> shall develop, maintain and supervise for the duration of the <i>Work</i> a comprehensive safety program that will effectively incorporate and implement all required safety precautions. The program shall, at a minimum, respond fully to the applicable safety regulations and general construction practices for the safety of persons or property, including, without limitation, any general safety rules and regulations of the <i>Owner</i> and any workers' compensation or occupational health and safety statutes or regulations in force at the <i>Place of the Work</i>. 9.4.8 The <i>Contractor</i> shall provide a copy of the safety program described in paragraph 9.4.7 hereof to the <i>Consultant</i> for delivery to the <i>Owner</i> prior to the commencement of the <i>Work</i>, and shall, ensure, as far as it is reasonably practical to do so, that every employer and worker performing work in respect of the <i>Project</i> complies with such program.

		9.4.9 The <i>Contractor</i> shall arrange regular safety meetings, and shall supply and maintain, at its own expense, at its office or other well-known place at the job site, safety equipment necessary to protect the workers and general public against accident or injury as prescribed by the authorities having jurisdiction at the <i>Place of the Work</i>, including, without limitation, articles necessary for administering first-aid to any person and an emergency procedure for the immediate removal of any injured person to a hospital or a doctor's care. 9.4.10 The <i>Contractor</i> shall promptly report in writing to the <i>Owner</i> and the <i>Consultant</i> all accidents of any sort arising out of or in connection with the performance of the <i>Work</i>, whether on or adjacent to the job site, giving full details and statement of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the <i>Contractor</i> to the <i>Owner</i> and the <i>Consultant</i> by telephone or messenger in addition to any reporting required under the applicable safety regulations."

SC49 GC 10.1 TAXES AND DUTIES

SC49.1	10.1.2	<u>Amend</u> paragraph 10.1.2 by <u>adding</u> the following sentence to the end of the paragraph: "For greater certainty, the <i>Contractor</i> shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the <i>Owner</i> shall not be entitled to any credit relating to mark-up for overhead or profit on any decrease in such taxes. The <i>Contractor</i> shall provide a detailed breakdown of <u>Additional</u> taxes if requested by the <i>Owner</i> in a form satisfactory to the <i>Owner</i>."
SC49.2	10.1.3	<u>Add</u> new paragraph 10.1.3 as follows: "10.1.3 Where the <i>Owner</i> is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or <i>Value Added Taxes</i> applicable to the <i>Contract</i>, the <i>Contractor</i> shall, at the request of the <i>Owner</i>, assist with the application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the <i>Owner</i>. The <i>Contractor</i> agrees to endorse over to the <i>Owner</i> any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph."

SC50 GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

SC50.1	10.2.5	<u>Amend</u> paragraph 10.2.5 by <u>adding</u> the words "Subject to paragraph 3.4" at the beginning of the paragraph. -and- <u>Add</u> the following to the end of the second sentence: "...and no further <i>Work</i> on the affected components of the <i>Contract</i> shall proceed until these directives have been obtained by the <i>Contractor</i> from the <i>Consultant</i>."
SC50.2	10.2.6	<u>Amend</u> paragraph 10.2.6 by <u>adding</u> the following sentence to the end of the paragraph: "In the event the <i>Owner</i> suffers loss or damage as a result of the <i>Contractor's</i> failure to comply with paragraph 10.2.5 and notwithstanding any limitations described in paragraph 12.1.1, the <i>Contractor</i> agrees to indemnify and to hold harmless the <i>Owner</i> and the <i>Consultant</i> from and against any claims, demands, losses, costs, damages, actions suits or proceedings resulting from such failure by the <i>Contractor</i>."
SC50.3	10.2.7	<u>Amend</u> paragraph 10.2.7 by inserting the words "which changes were not, or could not have reasonably been known to the <i>Owner</i> or to the <i>Contractor</i>, as applicable, at the time of bid closing and which changes did not arise as a result of a public emergency or other <i>Force Majeure</i> event" to the second line, after the words "authorities having jurisdiction".
SC50.4	10.2.8	<u>Add</u> new paragraph 10.2.8 as follows: "10.2.8 The <i>Contractor</i> shall furnish all certificates that are required or given by the appropriate governmental authorities as evidence that the <i>Work</i> as installed conforms with the laws and regulations of authorities having jurisdiction, including certificates of compliance for the <i>Owner's</i> occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the <i>Work</i>, in the event that such governmental authorities furnish such certificates."

SC51 GC 10.4 WORKERS' COMPENSATION

SC51.1	10.4.1	<u>Delete</u> paragraph 10.4.1 and <u>replace</u> with the following:

		“10.4.1 Prior to commencing the <i>Work</i>, and with each and every application for payment thereafter, including the <i>Contractor's</i> application for payment of the holdback amount following <i>Substantial Performance of the Work</i> and again with the <i>Contractor's</i> application for final payment, the <i>Contractor</i> shall provide evidence of compliance with workers' compensation legislation in force at the <i>Place of the Work</i>, including payments due thereunder.”

SC52 GC 11.1 INSURANCE

SC52.1	11.1	<u>Delete</u> entirety of GC 11.1 and <u>replace</u> with the following: “GC 11.1 INSURANCE 11.1.1 Without restricting the generality of GC 12 – INDEMNIFICATION, the <i>Contractor</i> shall provide, maintain, and pay for the insurance coverages specified in GC 11.1 – INSURANCE. Unless otherwise stipulated, the duration of each insurance policy shall be from the date of commencement of the <i>Work</i> until the expiration of the warranty periods set out in the <i>Contract Documents</i>. Prior to commencement of the <i>Work</i> and upon the placement, renewal, <u>amendment</u>, or extension of all or any part of the insurance, the <i>Contractor</i> shall promptly provide the <i>Owner</i> with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any <u>amending</u> endorsements. .1 General Liability Insurance General liability insurance shall be in the name of the <i>Contractor</i>, with the <i>Owner</i> and the <i>Consultant</i> named as <u>Additional</u> insureds, with limits of not less than \$2,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property, including loss of use thereof, for itself and each of its employees, <i>Subcontractors</i> and/or agents. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent <u>replacement</u>, provided that IBC Form 2100 shall contain the latest edition of the relevant CCDC endorsement form. To achieve the desired limit,

		umbrella, or excess liability insurance may be used. All liability coverage shall be maintained for completed operations hazards from the date of <i>Substantial Performance of the Work</i>, as set out in the certificate of <i>Substantial Performance of the Work</i>, on an ongoing basis for a period of 6 years following <i>Substantial Performance of the Work</i>. Where the <i>Contractor</i> maintains a single, blanket policy, the <u>Addition</u> of the <i>Owner</i> and the <i>Consultant</i> is limited to liability arising out of the <i>Project</i> and all operations necessary or incidental thereto. The policy shall be endorsed to provide the <i>Owner</i> with not less than 30 days' notice, in writing, in advance of any cancellation and of change or <u>amendment</u> restricting coverage. .2 Automobile Liability Insurance Automobile liability insurance in respect of licensed vehicles shall limits of not less than \$2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, covering all licensed vehicles <i>owned</i> or leased by the <i>Contractor</i>, and endorsed to provide the <i>Owner</i> with not less than 30 days' notice, in writing, in advance of any cancellation, change or <u>amendment</u> restricting coverage. Where the policy has been issued pursuant to a government-operated automobile insurance system, the <i>Contractor</i> shall provide the <i>Owner</i> with confirmation of automobile insurance coverage for all automobiles registered in the name of the <i>Contractor</i>. .3 Aircraft and Watercraft Liability Insurance Where determined necessary by the <i>Contractor</i>, acting reasonably, aircraft and watercraft liability insurance will be obtained in accordance with the provisions of paragraph 11.1.3. Aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft if used directly or indirectly in the performance of the <i>Work</i>, including use of <u>Additional</u> premises, shall be subject to limits of not less than \$2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, including loss of use thereof and limits of not less than \$2,000,000.00 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the <i>Owner</i>. The policies shall be endorsed to provide the <i>Owner</i> with not less than 30 days' notice, in writing, in advance of cancellation, change or <u>amendment</u> restricting coverage. .4 Property and Boiler and Machinery Insurance

		(1) Builder's Risk property insurance shall be in the name of the <i>Contractor</i> with the <i>Owner</i> and the <i>Consultant</i> named as <u>Additional</u> insureds. The policy shall insure against all risks of direct physical loss or damage to the property insured which shall include all property included in the <i>Work</i>, whether owned by the <i>Contractor</i> or the owner or owned by others, so long as the property forms part of the <i>Work</i>. The property insured also includes all materials and supplies necessary to complete the work, whether installed in the work temporarily or permanently, in storage on the project site, or in transit to the project site, as well as temporary buildings, scaffolding, falsework forms, hoardings, excavation, site preparation and similar work. The insurance shall be for not less than the sum of the amount of the contract price and the full value of products that are specified to be provided by the owner for incorporation into the work, if applicable, with the deductible of \$10,000.00 payable by the contractor. The insurance shall include the foregoing and, otherwise, shall not be less than the insurance required by IBC Form 4042 or its equivalent <u>replacement</u> provided that the IBC Form 4042 shall include the latest <u>Addition</u> of the relevant CCDC endorsement form. The coverage shall be based on a completed value form and shall be maintained continuously until ten (10) days after the date of the final certificate of payment. (2) Boiler and machinery insurance shall be in the name of the <i>Contractor</i>, with the <i>Owner</i> and the <i>Consultant</i> named as <u>Additional</u> insureds, for not less than the <u>replacement</u> value of the boilers, pressure vessels and other insurable objects forming part of the <i>Work</i>. The insurance provided shall not be less than the insurance provided by the "Comprehensive Boiler and Machinery Form" and shall be maintained continuously from commencement of use or operation of the property insured and until 10 days after the date of the final certificate for payment. (3) The policies shall allow for partial or total use or occupancy of the <i>Work</i>. (4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the <i>Owner</i> and the <i>Contractor</i> as their respective interests may appear. The <i>Contractor</i> shall act on behalf of the <i>Owner</i> for the purpose of adjusting the amount of such loss or damage payment with the

		insurers. When the extent of the loss or damage is determined, the <i>Contractor</i> shall proceed to restore the <i>Work</i>. Loss or damage shall not affect the rights and obligations of either party under the <i>Contract</i> except that the <i>Contractor</i> shall be entitled to such reasonable extension of the <i>Contract Time</i>, relative to the extent of the loss or damage, as determined by the <i>Owner</i>, in its sole discretion. (5) The <i>Contractor</i> shall be entitled to receive from the <i>Owner</i>, in <u>Addition</u> to the amount due under the <i>Contract</i>, the amount at which the <i>Owner's</i> interest in restoration of the <i>Work</i> has been appraised, such amount to be paid as the restoration of the <i>Work</i> proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. In <u>Addition</u>, the <i>Contractor</i> shall be entitled to receive from the payments made by the insurer the amount of the <i>Contractor's</i> interest in the restoration of the <i>Work</i>. (6) In the case of loss or damage to the <i>Work</i> arising from the work of other contractors, or the <i>Owner's</i> own forces, the <i>Owner</i>, in accordance with the <i>Owner's</i> obligations under paragraph 3.2.2.4 of GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, shall pay the <i>Contractor</i> the cost of restoring the <i>Work</i> as the restoration of the <i>Work</i> proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. .5 Contractors' Equipment Insurance "All risks" contractors' equipment insurance covering construction machinery and equipment used by the <i>Contractor</i> for the performance of the <i>Work</i>, excluding boiler insurance, shall be in a form acceptable to the <i>Owner</i> and shall not allow subrogation claims by the insurer against the <i>Owner</i>. The policies shall be endorsed to provide the <i>Owner</i> with not less than 30 days' notice, in writing, in advance of cancellation, change or <u>amendment</u> restricting coverage. Subject to satisfactory proof of financial capability by the <i>Contractor</i> for self-insurance of his equipment, the <i>Owner</i> agrees to waive the equipment insurance requirement. 11.1.2 The <i>Contractor</i> shall be responsible for deductible amounts under the policies except where such amounts may

		be excluded from the <i>Contractor's</i> responsibility by the terms of GC 9.1 - PROTECTION OF WORK AND PROPERTY and GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY. 11.1.3 Where the full insurable value of the <i>Work</i> is substantially less than the <i>Contract Price</i>, the <i>Owner</i> may reduce the amount of insurance required to waive the course of construction insurance requirement. 11.1.4 If the <i>Contractor</i> fails to provide or maintain insurance as required by the <i>Contract Documents</i>, then the <i>Owner</i> shall have the right to provide and maintain such insurance and provide evidence of same to the <i>Contractor</i>. The <i>Contractor</i> shall pay the costs thereof to the <i>Owner</i> on demand, or the <i>Owner</i> may deduct the amount that is due or may become due to the <i>Contractor</i>. 11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the <i>Place of the Work</i>."

SC53 GC 11.2 CONTRACT SECURITY

SC53.1	11.2.1	<u>Delete</u> paragraph 11.2.1 and <u>replace</u> it with the following: "11.2.1 If required by the <i>Contract Documents</i>, the <i>Contractor</i> shall, prior to the execution of the <i>Contract</i> and within 7 calendar days of receiving <i>Notice in Writing</i> to do so, furnish a performance bond and labour and material payment bond which meets the requirements under paragraph 11.2.2."
SC53.2	11.2.2	<u>Delete</u> paragraph 11.2.2 and <u>replace</u> it with the following: "11.2.2 The performance bond and labour and material payment bond, if required, shall: .1 be issued by a duly licensed surety company, which has been approved by the <i>Owner</i> and is permitted under the <i>Construction Act</i>, .2 be issued by an insurer licensed under the <i>Insurance Act</i> (Ontario) and authorized to transact a business of suretyship in the Province of Ontario; .3 shall be in the form prescribed by the <i>Act</i>;

		.4 have a coverage limit of at least 50 per cent of the <i>Contract Price</i>, or such other percentage of the <i>Contract Price</i> as stated in the <i>Contract Documents</i>; .5 extends protection to <i>Subcontractors</i>, <i>Suppliers</i>, and any other persons supplying labour or materials to the <i>Project</i>; and .4 shall be maintained in good standing until the fulfillment of the <i>Contract</i>, including all warranty and maintenance periods set out in the <i>Contract Documents</i>."
SC53.3	11.2.3	<u>Add</u> new paragraph 11.2.3 as follows: "11.2.3 It is the intention of the parties that the performance bond shall be applicable to all of the <i>Contractor's</i> obligations in the <i>Contract Document</i> and, wherever a performance bond is provided with language which conflicts with this intention, it shall be deemed to be amended to comply. The <i>Contractor</i> represents and warrants to the <i>Owner</i> that it has provided its surety with a copy of the <i>Contract Documents</i> prior to the issuance of such bonds."

SC54 GC 12.1 INDEMNIFICATION

SC54.1	12.1	<u>Delete</u> GC 12.1 – INDEMNIFICATION in its entirety and <u>substitute</u> as follows: "12.1.1 The <i>Contractor</i> shall indemnify and hold harmless the <i>Owner</i>, its parent, subsidiaries and affiliates, their respective partners, trustees, officers, directors, agents and employees and the <i>Consultant</i> from and against any and all claims, liabilities, expenses, demands, losses, damages, actions, costs, suits, or proceedings (hereinafter called "claims"), whether in respect of claims suffered by the <i>Owner</i> or in respect of claims by third parties, that directly or indirectly arise out of, or are attributable to, the acts or omissions of the <i>Contractor</i>, its employees, agents, <i>Subcontractors</i>, <i>Suppliers</i> or any other persons for whom it is in law responsible (including, without limitation, claims that directly or indirectly arise out of, or are attributable to, loss of use or damage to the <i>Work</i>, the <i>Owner's</i> property or equipment, the <i>Contractor's</i> property or equipment or equipment or property adjacent to the <i>Place of the Work</i> or death or injury to the <i>Contractor's</i> personnel).

		12.1.2 The provisions of GC 12.1 - INDEMNIFICATION shall survive the termination of the <i>Contract</i> , howsoever caused and no payment or partial payment, no issuance of a final certificate of payment and no occupancy in whole or in part of the <i>Work</i> shall constitute a waiver or release of any of the provisions of GC 12.1."

SC55 GC 12.2 WAIVER OF CLAIMS

SC55.1	12.2.1	In paragraph 12.2.1 in the fourth line after the word "limitation" <u>add</u> the words "claims for delay pursuant to GC 6.5 DELAYS" -and- <u>add</u> the words "(collectively "Claims")" after " <i>Substantial Performance of the Work</i> " in the sixth line.
SC55.2	12.2.1 .1	In subparagraph 12.2.1.1 change the word "claims" to "Claims" and change the word "claim" to "Claim".
SC55.3	12.2.1 .2	In subparagraph 12.2.1.2 change the word "claims" to "Claims".
SC55.4	12.2.1 .3	<u>Delete</u> subparagraph 12.2.1.3 in its entirety.
SC55.5	12.2.1 .4	In paragraph 12.2.1.4 change the word "claims" to "Claims".
SC55.6	12.2.2	In paragraph 12.2.2 <u>delete</u> the words "in paragraphs 12.2.1.2 and 12.2.1.3" and <u>replace</u> them with "in paragraph 12.2.1.2" -and- change the word "claims" to "Claims" in both instances and change the word "claim" to "Claim".
SC55.7	12.2.3	<u>Delete</u> paragraph 12.2.3 in its entirety.
SC55.8	12.2.4	<u>Delete</u> paragraph 12.2.4 in its entirety.
SC55.9	12.2.5	<u>Delete</u> paragraph 12.2.5 in its entirety.
SC55.10	12.2.6	In paragraph 12.2.6 change the word "claim" to "Claim" in all instances in the paragraph.
SC55.11	12.2.7	In paragraph 12.2.7 change "The party" to " <i>The Contractor</i> "

		-and- change the word “claim” to “Claim” in all instances in the paragraph.
SC55.12	12.2.8	In paragraph 12.2.8 <u>delete</u> the words “under paragraphs 12.2.1 or 12.2.3” and <u>replace</u> them with “under paragraph 12.2.1” -and- change both instances of the words “the party” to “the <i>Contractor</i> ”. Change the word “claim” to “Claim” in all instances in the paragraph.
SC55.13	12.2.9	<u>Delete</u> paragraph 12.2.9 in its entirety.
SC55.14	12.2.10	<u>Delete</u> paragraph 12.2.10 in its entirety.

SC56 GC 12.3 WARRANTY

SC56.1	12.3.2	<u>Delete</u> from the first line of paragraph 12.3.2 the word, “The” and <u>substitute</u> with the words “Subject to paragraph 3.4.1, the...”
SC56.2	12.3.7 to 12.3.12	<u>Add</u> new paragraphs 12.3.7 to 12.3.12 as follows: “12.3.7 Where required by the <i>Contract Documents</i> , the <i>Contractor</i> shall provide a maintenance bond as security for the performance of the <i>Contractor’s</i> obligations as set out in GC 12.3 WARRANTY. 12.3.8 The <i>Contractor</i> shall provide fully and properly completed and signed copies of all warranties and guarantees required by the <i>Contract Documents</i> , containing: .1 the proper name of the <i>Owner</i> ; .2 the proper name and address of the <i>Project</i> ; .3 the date the warranty commences, which shall be at the “date of <i>Substantial Performance of the Work</i> ” unless otherwise agreed upon by the <i>Consultant</i> in writing. .4 a clear definition of what is being warranted and/or guaranteed as required by the <i>Contract Documents</i> ; and .5 the signature and seal (if required by the governing law of the <i>Contract</i>) of the company issuing the warranty, countersigned by the <i>Contractor</i> .”

		12.3.9 Should any <i>Work</i> be repaired or replaced during the time period for which it is covered by the specified warranty, a new warranty shall be provided under the same conditions and for the same period as specified herein before. The new warranty shall commence at the completion of the repair or replacement. 12.3.10 The <i>Contractor</i> shall ensure that its <i>Subcontractors</i> are bound to the requirements of GC 12.3 – WARRANTY for the <i>Subcontractor's</i> portion of the <i>Work</i>. 12.3.11 The <i>Contractor</i> shall ensure that all warranties, guarantees or other obligations for <i>Work</i>, services or <i>Products</i> performed or supplied by any <i>Subcontractor</i>, <i>Supplier</i> or other person in connection with the <i>Work</i> are obtained and available for the direct benefit of the <i>Owner</i>. In the alternative, the <i>Contractor</i> shall assign to the <i>Owner</i> all warranties, guarantees or other obligations for <i>Work</i>, services or <i>Products</i> performed or supplied by any <i>Subcontractor</i>, <i>Supplier</i> or other person in connection with the <i>Work</i> and such assignment shall be with the consent of the assigning party, where required by law, or by the terms of that party's contract. Such assignment shall be in addition to, and shall in no way limit, the warranty rights of the <i>Owner</i> under the <i>Contract Documents</i>. 12.3.12 The <i>Contractor</i> shall commence or correct any deficiency within 2 <i>Working Days</i> after receiving a <i>Notice in Writing</i> from the <i>Owner</i> or the <i>Consultant</i>, and shall complete the <i>Work</i> as expeditiously as possible, except in the case where the deficiency prevents maintaining security or where basic systems essential to the ongoing business of the <i>Owner</i> and/or its tenants cannot be maintained operational as designed. In those circumstances all necessary corrections and/or installations of temporary replacements shall be carried out immediately as an emergency service. Should the <i>Contractor</i> fail to provide this emergency service within 8 hours of a request being made during the normal business hours of the <i>Contractor</i>, the <i>Owner</i> is authorized, notwithstanding GC 3.1, to carry out all necessary repairs or replacements at the <i>Contractor's</i> expense."

***NEW* PART 13 OTHER PROVISIONS**

SC57 GC 13.1 OWNERSHIP OF MATERIALS

SC57.1	13.1	<u>Add</u> new GC 13.1 – OWNERSHIP OF MATERIALS as follows: “GC 13.1 OWNERSHIP OF MATERIALS “13.1.1 Unless otherwise specified, all materials existing at the <i>Place of the Work</i> at the time of execution of the <i>Contract</i> shall remain the property of the <i>Owner</i>. All <i>Work</i> and <i>Products</i> delivered to the <i>Place of the Work</i> by the <i>Contractor</i> shall be the property of the <i>Owner</i>. The <i>Contractor</i> shall remove all surplus or rejected materials as its property when notified in writing to do so by the <i>Consultant</i>.”

SC58 GC 13.2 CONSTRUCTION LIENS

SC58.1	13.2	<u>Add</u> new GC 13.2 – CONSTRUCTION LIENS as follows: “GC 13.2 LIENS 13.2.1 Notwithstanding any other provision in the <i>Contract</i>, the <i>Consultant</i> shall not be obligated to issue a certificate, and the <i>Owner</i> shall not be obligated to make payment, subject to the <i>Owner's</i> requirement to issue a <i>Notice of Non-Payment</i> (Form 1.1) to the <i>Contractor</i>, if at the time such certificate or payment was otherwise due: .1 a claim for lien has been registered against the <i>Project</i> lands by a <i>Subcontractor</i> or a <i>Supplier</i> that has not been vacated or discharged by the <i>Contractor</i> in accordance with the requirements of this <i>Contract</i>, or .2 if the <i>Owner</i> or a mortgagee of the <i>Project</i> lands has received a written notice of a lien that has not been resolved by the <i>Contractor</i> through the posting of security or otherwise. 13.2.2 In the event a construction lien arising from the performance of the <i>Work</i> is registered or preserved against the <i>Project</i> lands by a <i>Subcontractor</i> or a <i>Supplier</i>, or a written notice of a lien is given or a construction lien action is commenced

		against the <i>Owner</i> by a <i>Subcontractor</i> or a <i>Supplier</i>, then the <i>Contractor</i> shall, at its own expense: .1 within 10 calendar days of registration of the construction lien, vacate or discharge the lien from title to the premises (i.e. the <i>Place of the Work</i>). If the lien is merely vacated, the <i>Contractor</i> shall, if requested, undertake the <i>Owner's</i> defence of any subsequent action commenced in respect of the lien, at the <i>Contractor's</i> sole expense; .2 within 10 calendar days of receiving notice of a written notice of a lien, post security with the Ontario Superior Court of Justice so that the written notice of a lien no longer binds the parties upon whom it was served; and .3 satisfy all judgments and pay all costs arising from such construction liens and actions and fully indemnify the <i>Owner</i> against all costs and expenses arising from same, including legal costs on a full indemnity basis. 13.2.3 In the event that the <i>Contractor</i> fails or refuses to comply with its obligations pursuant to paragraph 13.2.2, the <i>Owner</i> shall, at its option, be entitled to take all steps necessary to address any such construction liens including, without limitation and in addition to the <i>Owner's</i> rights under paragraph 13.2.4, the posting of security with the Ontario Superior Court of Justice to vacate the claim for lien from title to the <i>Project</i> lands, and in so doing will be entitled to a full indemnity from the <i>Contractor</i> for all legal fees, security, disbursements and other costs incurred and will be entitled to deduct same from amounts otherwise owing to the <i>Contractor</i>. 13.2.4 In the event that any <i>Subcontractor</i> or <i>Supplier</i> registers any claim for lien with respect to all or part of the <i>Place of Work</i>, the <i>Owner</i> shall have the right to withhold, in addition to the statutory holdback, the full amount of said claim for lien plus either: (a) \$250,000 if the claim for lien is in excess of \$1,000,000 or (b) 25% of the value of the claim for lien and to bring a motion to vacate the registration of said claim for lien and any associated certificate of action in respect of that lien, in accordance with Section 44 of the <i>Act</i>, by paying into court as security the amount withheld.

		13.2.5 Nothing in this GC 13.2 serves to preclude the <i>Contractor</i> from preserving and perfecting its lien in the event of non-payment by the <i>Owner</i> ."

APPENDIX 1 to the Supplementary Conditions

Project-specific requirements for a “*Proper Invoice*”

To satisfy the requirements for a *Proper Invoice*, the following criteria, as may be applicable in each case, must be included with the *Contractor's* application for payment:

- .1 the written bill or request for payment must be in writing;
- .2 the *Contractor's* name and current address;
- .3 the *Contractor's* HST registration number;
- .4 the date the application for payment was prepared by the *Contractor*;
- .5 the period of time in which the services or materials were supplied to the *Owner*;
- .6 the purchase order number provided by the *Owner*;
- .7 reference to the provisions of the *Contract* under which payment is being sought (e.g. GC 5.3 – PROGRESS PAYMENTS for progress payments, GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK, GC 5.7 – FINAL PAYMENT for final payment, etc.);
- .8 a description, including quantities where appropriate, of the services or materials, or a portion thereof, that were supplied and form the basis of the *Contractor's* request for payment;
- .9 the amount the *Contractor* is requesting to be paid by the *Owner*, set out in a statement based on the schedule of values approved under GC 5.2.5, separating out any statutory or other holdbacks, set-offs and HST;
- .10 a sworn Statutory Declaration in the form CCDC 9A-2018, only for second and subsequent progress payments;
- .11 a current Workplace Safety Insurance Board clearance certificate;
- .12 a pre-approved schedule of values, supplied by the *Contractor*, for Divisions 1 through 14 of the *Specifications* (or equivalent Construction Specifications Institute Masterformat) of the *Work*, aggregating the total amount of the *Contract Price*, including all supporting invoicing;
- .13 a separate pre-approved schedule of values, supplied by each *Subcontractor*, for each of Division 15, 16, and 17 of the *Specifications* (or equivalent Construction

- Specifications Institute Masterformat) of the *Work*, aggregating the total amount of the *Contract Price*, including all supporting invoicing;
- .14 invoices and other supporting documentation for all claims against the cash allowance;
 - .15 a current, acceptable, and up to date *Construction Schedule Update*;
 - .16 if requested by the *Owner*, a current and valid certificate(s) of insurance as required under GC 11.1 – INSURANCE;
 - .17 the name, title, telephone number and mailing address of the person at the place of business of the *Contractor* to whom payment is to be directed;
 - .18 a current, up to date, and approved *Shop Drawing* log;
 - .19 in the case of the *Contractor's* application for final payment, in addition to the foregoing requirements (as applicable):
 - (a) any documents or materials not yet delivered pursuant to paragraph 5.4.5, together with complete and final as-built drawings;
 - (b) the *Contractor's* written request for release of the deficiency holdback, including a statement that no written notices of lien have been received by it;
 - (c) the *Contractor's* written certification that there are no outstanding claims, pending claims or future claims from the *Contractor* or their *Subcontractors* or *Suppliers*; and
 - (d) sufficient evidence of the *Contractor's* compliance with GC 3.13.3.

END OF AMENDMENTS TO CCDC 2 - 2008

SECTION 01 14 00 – WORK RESTRICTIONS

1.0 GENERAL

1.1. SECTION INCLUDES

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

1.2. RELATED SECTIONS

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

1.3. EXISTING SERVICES

- .1 Notify Owner and Consultant and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Consultant and Owner, forty-eight (48) hours of notice for necessary interruption of mechanical or electrical service throughout course of work.
 - .1 Keep duration of interruptions minimum.
 - .2 Perform interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for vehicular, pedestrian and personnel traffic.
- .4 Construct barriers in accordance with Section 01 53 00.

1.4. AFTER HOURS WORK

- .1 Schedule Work with school staff through the Board's contact so as to limit disruption to school operations. Include for any overtime, to ensure orderly and continuous progression of Work and operation of school.
- .2 Direct calls from Contractors to Board staff to adjust alarms and to arrange for access will not be accepted. All correspondence must be through the Project Manager.
- .3 Arrange 48 hours in advance with Board to obtain an access card and adjust security alarms for after hours Work.
- .4 Bidders are cautioned that the Board will be compensated by the Contractor for false alarms. Any costs associated with each false alarm will be levied against the Contractor for false fire alarm activation or security alarm activation. These costs may include, but are not limited to:

- .1 Fines or penalties imposed by the local Fire Services,
- .2 Fines or penalties imposed by the local Police Services,
- .3 Overtime costs borne by the Board.
- .5 Contractors are responsible for ensuring doors and windows are secured prior to leaving school.
- .6 Unless specifically stated otherwise school activities take precedence over Contractor's activities.

1.5. SPECIAL REQUIREMENTS

- .1 Schedule and perform work in occupied areas to Board Representative's approval.
- .2 Schedule and perform noise generating work to Board Representative's approval.
- .3 Submit schedule of special requirements or disruptions in accordance with Section 01 33 00.
- .4 All Contractor personnel are restricted to the job site and necessary access routes. No personnel shall visit other areas or buildings without specific authorization.

END OF SECTION

SECTION 01 19 00 – SPECIFICATIONS AND DOCUMENTS

1.0 GENERAL

1.1. RELATED DOCUMENTS

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

1.2. WORDS AND TERMS

- .1 Conform to definitions and their defined meanings in the Agreement and Definitions portion of CCDC 2 for Supplementary Words and Terms listed in Section 00 72 13.

1.3. COMPLEMENTARY DOCUMENTS

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

1.4. PRECEDENCE OF DOCUMENTS

- .1 In the event of conflict within and between the Contract Documents, the order of priority within specifications and drawings for this project are - from highest to lowest:
 - .1 the Agreement and Definitions between the Owner and the Construction
 - .2 the Defined Terms, Definitions;
 - .3 Supplementary Conditions;
 - .4 the General Conditions;
 - .5 Sections of Division 01 of the specifications;
 - .6 Technical specifications Sections of Divisions 02 through 49 of the specifications.

- .7 Schedules and Keynotes:
 - .1 Material and finishing schedules within the specifications, then;
 - .2 Material and finishing schedules on drawings, then;
 - .3 Keynotes and definitions thereto, then;
- .8 Drawings:
 - .1 Drawings of larger scale shall govern over those of smaller scale of the same date, then;
 - .2 Dimensions shown on drawings shall govern over dimensions scaled from drawings, then;
 - .3 Location of utility outlets indicated on architectural detail drawings takes precedence over positions or mounting heights located on mechanical or electrical Drawings.
- .9 Later dated documents shall govern over earlier documents of the same type.

1.5. SPECIFICATION GRAMMAR

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

END OF SECTION

SECTION 01 21 00 – ALLOWANCES

1.0 GENERAL

1.1. RELATED SECTIONS

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

1.2. GENERAL

- .1 Allowances included herein are for items of Work which could not be fully quantified prior to Bidding.
- .2 Expend each allowance as directed by the Consultant. Work covered by allowances shall be performed for such amounts and by such persons as directed by Consultant.
- .3 Funds will be expended by means of Cash Allowance allocations and contingency allowance allocations.
- .4 Progress payments for Work and Products authorized under allowances will be made in accordance with the payment terms set out in the Conditions of the Contract.
- .5 The Contractor shall bid the work involved and submit the Bids received to the Consultant and the Board, for approval
- .6 The Contractor shall submit 3 bids unless directed by the Board.

1.3. CASH ALLOWANCES

- .1 Cash allowances, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation where indicated, and other authorized expenses incurred in performing the Work. Cash allowances shall not be included by a subcontractor in the amount for their subcontract work.
- .2 Supply only allowances shall include:
 - .1 Net cost of Products.
 - .2 Delivery to Site.
 - .3 Applicable taxes and duties, excluding HST.
- .3 Supply and install allowances shall include:
 - .1 Net cost of Products.
 - .2 Delivery to Site.
 - .3 Unloading, storing, handling or products on site.
 - .4 Installation, finishing and commissioning of products.

- .5 Applicable taxes and duties, excluding HST.
- .4 Inspection and testing allowances shall include:
 - .1 Net cost of inspection and testing services.
 - .2 Applicable taxes and duties, excluding HST.
- .5 Other costs related to work covered by cash allowances are not covered by the allowance, but shall be included in the Contract Price.
- .6 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.
- .7 Progress payments on accounts of work authorized under cash allowances shall be included in the monthly certificate for payment.
- .8 Submit, before application for final payment, copies of all invoices and statements from suppliers and subcontractors for work which has been paid from cash allowances.

1.4. ALLOWANCES SCHEDULE

Include in the Bid Price a cash allowance of to address the cost of the following items: (Consultant to modify/edit list as required).

- .1 Designated Substance Removal not identified in the Asbestos Audit Reports.
(Additional removal not already identified in the ACM Summary report)
- .2 Independent Testing & Inspections (concrete, mortar, painting, air testing)
As directed by the Consultant
- .3 Public Address (PA) systems.
(Including all cabling and hardware)
- .4 Roofing Replacement Work by Spinton Roofing Limited in the Amount of \$441,995.00 and including associated asbestos and hazardous removals pertaining to roofing work.
- .5 Roofing Work by Spinton Roofing Limited in addition to Cash Allowance Item No.4 described above, as described in the contract documents.

Total of All Allowances:
\$ 500,000.00 (excluding HST).

END OF SECTION

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SECTION 01 31 00 – PROJECT MANAGING AND COORDINATION

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Section 01 32 00 - Construction Progress Documentation.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 53 00 – Temporary Construction Facilities
- .4 Section 01 61 00 – Product Requirements
- .5 Section 01 78 10 – Closeout Submittals and Requirements
- .6 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. PROJECT COORDINATION

- .1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities and construction Work, with progress of Work of other contractors, under instructions of the Consultant.
- .2 The Contractor shall have total control of the Work and shall effectively direct and supervise the Work so as to ensure conformity with the Contract Documents and within the Contract Time.
- .3 The Contractor shall be solely responsible for the construction means, methods, sequences, and procedures and for coordinating parts of the Work under the contract.
- .4 Co-ordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities, construction facilities, safety regulations and fire protection, as per authorities having jurisdiction codes.
- .5 The Consultant has the authority to stop the Work:
 - .1 whenever they observe or are made aware of unsafe conditions.
 - .2 whenever it is deemed necessary to protect the interests of the Board,
 - .3 whenever materials or workmanship are in contravention to the Contract Documents

1.3. SITE SUPERVISOR AND PROJECT MANAGER

- .1 If requested, the Contractor shall provide the Consultant, in writing, the name of the Project Manager and Site Supervisor, and proof of competent experience in similar projects.
- .2 Performance of the Contractors Project Manager and Site Supervisor
 - .1 If the Board and or the Consultant become concerned with any of: Site Safety, Project Schedule, or general compliance with the tender

- documents due to the performance of the Site Supervisor or Project Manager, the Consultant and or the Board will identify the concerns in writing to the Contractor.
- .2 The Contractor shall respond in writing to the Board and Consultant with a corrective action for each item within 24 hours.
 - .3 If it is found that any of the corrections are not immediately implemented, the Consultant and the Board shall meet with the General Contractor to review the credentials including curriculum vitae and comparable experience of a replacement Site Supervisor and or Project Manager proposed by that Contractor.
 - .4 All outstanding concerns initiating the replacement of the personnel will be immediately addressed to the satisfaction of the Consultant and the Board.
- .3 If the Board and or the Consultant become concerned with site safety, project schedule or general compliance with the tender documents due to the performance of the Site Supervisor or the Project Manager, the Consultant or the Board will issue the concerns in writing to the Contractor. The Contractor shall respond in writing within 24 hours to the Consultant and the Board. If any of the corrections are not immediately implemented, the Consultant or the Board will schedule a meeting with the Consultant, General Contractor and the Board. At this meeting the Contractor will introduce the new Project Manager, and or Site Supervisor and present the Curriculum Vitae for each showing proof of comparable experience in similar projects. The Contractor will then address the outstanding concerns to the satisfaction of the Consultant and the Board.
- .4 The Project Manager, and/or Site Supervisor shall not be replaced by the Contractor without prior written approval from the Board and the Consultant.

1.4. PERMITS

- .1 **The Board will obtain & pay for all building permits, but the Contractor is responsible for all other permits, including electrical inspection and fire alarm verification.**

1.5. CONSTRUCTION DOCUMENTS

- .1 The Consultant will provide the Contractor with PDF copies of both the drawings and the specification and CAD format files of the drawings at no charge to the Contractor. All printing will be at the cost of the Contractor including the AS-BUILT documents.

1.6. PRECONSTRUCTION MEETING

- .1 Immediately prior to construction and upon notification by the Consultant of a time and date, the Contractor shall attend the preconstruction meeting at a location as determined by the Consultant, along with authoritative representatives of certain key subcontractors as specifically indicated in the conference notice. Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Project communications procedures
 - .3 Schedule of Work, progress scheduling (including long lead items, cash allowance items) as specified in Section 01 32 00.
 - .4 Schedule of submission of shop drawings, samples, colour chips as specified in Section 01 33 00.
 - .5 Requirements for temporary facilities, washrooms, refuse bin, site sign, offices, storage sheds, utilities, fences as specified in Section 01 53 00.
 - .6 Delivery schedule of specified equipment as specified in Section 01 61 00.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
 - .8 Owner furnished products.
 - .9 Record drawings as specified in Section 01 78 10.
 - .10 Maintenance material and data as specified in Section 01 78 10.
 - .11 Take-over procedures, acceptance, and warranties as specified in Section 01 78 10.
 - .12 Monthly progress claims, administrative procedures, photographs, and holdbacks.
 - .13 Appointment of inspection and testing agencies
 - .14 Insurances and transcript of policies.
 - .15 Review Vendor Performance Evaluation for the Contractor and Subcontractors
 - .16 Hot Work Permit Process
 - .17 Security Access, Fire Alarm shut down procedures
 - .18 Any other items as required by owner, contractor or Consultant.

1.7. ON-SITE DOCUMENTS

- .1 Maintain at job site at all times, one copy (written or digital) each of the following:
 - .1 Complete set of Contract drawings.

- .2 Specifications.
- .3 All Addenda.
- .4 Site Instructions and Sketches
- .5 Reviewed shop drawings and samples.
- .6 Change Orders and Contemplated Change Orders.
- .7 Other modifications to Contract.
- .8 Site Instructions
- .9 Colour schedule
- .10 Field test reports.
- .11 Copy of approved Work schedule.
- .12 Manufacturers' installation and application instructions.
- .13 Progress reports and meeting minutes.
- .14 Approved building permit documents.
- .15 Copy of current Ontario Building Code and National Building Code.
- .16 CSA Standard, CGSB Specifications. ASTM Documents and other standards referenced to in the specifications.
- .17 Labour conditions and wage schedules.
- .18 Applicable current editions of municipal regulations and by-laws.
Current building codes, complete with addenda bulletins applicable to the Place of the Work.

1.8. SCHEDULES

- .1 Within three weeks following the award of the Contract, submit a detailed, trade by trade progress schedule for the work in a bar chart form acceptable to the Consultant.
- .2 Submit preliminary construction progress schedule as specified in Section 01 32 00 to Consultant coordinated with Consultant's project schedule.
- .3 After review, revise and resubmit schedule to comply with revised project schedule.
- .4 During progress of Work revise and resubmit as directed by Consultant.
- .5 Provide schedule updates every month with request for Payment, for duration of Contract.

1.9. CONSTRUCTION PROGRESS MEETINGS

- .1 Prior to the commencement of the Work, the Contractor together with the Consultant shall mutually agree to a sequence for holding regular "on site meetings".

- .2 The Contractor will organize site meetings. Ensure persons, whose presence is required, are present and relative information is available to allow meetings to be conducted efficiently.
- .3 Contractor, major subcontractors and consultants involved in Work are to be in attendance.
- .4 Post and forward copies of progress schedules for advice of Subcontractors, Owner and Consultant.
- .5 Notify parties minimum five (5) days prior to meetings.
- .6 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within two (2) days after meeting.
- .7 Agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for effect on construction schedule and on completion date.
 - .12 Review site security issues.
 - .13 Other business.
- .8 Schedule additional meetings, to expedite progress, should work require it.
- .9 Keep Owner and Consultant informed of progress, of delays and potential delays during all stages of Work. Do everything possible to meet progress schedule
- .10 Schedule and administer pre-installation meetings when specified in sections and when required to coordinate related or affected Work.

1.10. SUBMITTALS

- .1 Prepare and issue submittals to Consultant for review.
- .2 Submit preliminary Shop Drawings, product data and samples for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Consultant.
- .3 Submit requests for payment for review, and for transmittal to Consultant.

- .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Consultant.
- .5 Process substitutions through Consultant.
- .6 Process change orders through Consultant.
- .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Consultant.

1.11. RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

- .1 Procedures for record as-built documents and samples as specified in Section 01 78 10.
- .2 Keep as-built documents and samples available for inspection by Consultant.

1.12. CLOSEOUT PROCEDURES

- .1 Take-over procedures, acceptance, and warranties as specified Section 01 78 10
- .2 Notify Consultant and Board when Work is considered ready for Substantial Performance.
- .3 Accompany Consultant and Board on preliminary inspection to determine items listed for completion or correction.
- .4 Comply with Consultant's instructions for correction of items of Work listed in executed certificate of Substantial Performance.
- .5 Notify Consultant of instructions for completion of items of Work determined in Consultant's final inspection.

END OF SECTION

SECTION 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION

1.0 GENERAL

1.1. RELATED SECTIONS

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

1.2. SCHEDULES

- .1 Within seven 7 days following the award of the Contract, submit a detailed cash flow chart broken down on a monthly basis, in a manner acceptable to the Consultant. Cash flow chart shall indicate anticipated Contractor's monthly progress billings from commencement of work until completion.
- .2 Update cash flow chart whenever changes occur to scheduling and in manner and at times satisfactory to Consultant.
- .3 Submit schedule of values at least fourteen (14) days before the first application
- .4 Submit schedules as follows:
 - .1 Submittal Schedule for Shop Drawings and Product Data.
 - .2 Submittal Schedule for Samples.
 - .3 Submittal Schedule for timeliness of Owner-furnished Products.
 - .4 Product Delivery Schedule.
 - .5 Cash Allowance Schedule for acquiring Products and Installation.
 - .6 Shutdown or closure activity.

1.3. CONSTRUCTION PROGRESS SCHEDULING

- .1 Submit initial schedule to the Consultant and the Board in duplicate within seven (7) days after following the award.
- .2 Schedule Format.
 - .1 Prepare schedule in form of a horizontal bar chart.
 - .2 Split horizontally for projected and actual performance.
 - .3 Provide horizontal time scale identifying each Working Day of each week.
- .3 Schedule Submission.
 - .1 Consultant will review schedule and return reviewed copies within five (5) days after receipt.
 - .2 Submit schedules in electronic format, forward to the Consultant and Owner as a pdf. file.

- .3 Resubmit finalized schedule within five (5) days after return of review copy.
- .4 Submit revised progress schedule with each application for payment.
- .5 Distribute copies of revised schedule to:
 - .1 Job site office.
 - .2 Subcontractors.
 - .3 Other concerned parties.
- .6 Instruct Consultant to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.
- .4 Submit revised schedules with Application for Payment, identifying changes since previous version.
- .5 Select either of the following paragraphs to identify the type and format of schedule required.
- .6 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- .7 Indicate estimated percentage of completion for each item of Work at each submission.
- .8 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.
- .9 Include dates for commencement and completion of each major element of construction:
 - .1 Structural framing.
 - .2 Subcontractor Work.
 - .3 Equipment Installations.
 - .4 Finishes.
- .10 Indicate projected percentage of completion of each item as of first day of month.
- .11 Indicate progress of each activity to date of submission schedule.
- .12 Indicate changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .13 Provide a written report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other subcontractors.

1.4. PROGRESS PHOTOGRAPHS

- .1 Digital Photography:
 - .1 Submit electronic copy of progress photographs of project, Digital format, minimum 300 in megapixel resolution.
 - .2 Identification: Name and number of project and date of exposure indicated.
 - .3 Provide both interior and exterior photographs.
 - .4 Number of Viewpoints: Locations of viewpoints determined by Consultant.
 - .5 Frequency: Monthly with progress statement. Provide the required number of pictures to accurately reflect the submitted progress percentage.

1.5. SHOP DRAWING SUBMITTAL SCHEDULE

- .1 Include schedule for submitting shop drawings, product data, samples
- .2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.
- .3 Include dates when shop drawings and samples will be required for Owner-furnished products.
- .4 Include dates when reviewed submittals will be required from Consultant.
- .5 Provide final signed off copies of the shop drawings in digital format to the Board.

END OF SECTION

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SECTION 01 33 00 – SUBMITTAL PROCEDURES

2.0 GENERAL

2.1. RELATED SECTIONS

- .1 Section 01 32 00 - Construction Progress Documentation.
- .2 Section 01 78 10 - Closeout Submittals.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

2.2. ADMINISTRATIVE

- .1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present Shop Drawings, product data, samples and mock-ups in Metric (SI) units. Shop drawings containing imperial measurements will be rejected.
- .4 Where items or information is not manufactured or produced in SI Metric units, converted values within the metric measurement to the next largest imperial size available. Tolerances of .0625 acceptable.
- .5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.
- .6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
- .7 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before Consultant's final review.
- .8 No work, requiring a shop drawing submission, shall be commenced until the submission has received Consultant's final review. Only shop drawings bearing Consultant's review stamp are to be sent and used on the job site.
- .9 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

- .10 Shop drawings shall not contain substituted materials unless such substitutions have been requested in advance and approved by Consultant.
- .11 Verify field measurements and affected adjacent Work are coordinated.
- .12 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .13 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .14 Keep one (1) reviewed copy of each submission on site.

2.3. 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 The term "design team" means Consultant and Sub-consultants whether Sub-consultants are employees of Consultant or not, and includes structural, mechanical, electrical, etc.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow fourteen (14) working days for Consultant's review of each submission.
- .5 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .6 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions shall include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to other parts of the Work.
- .9 After Consultant's review, distribute copies.
- .10 Submit Shop Drawings in Pdf. format for each requirement requested in specification Sections and as consultant may reasonably request.
- .11 Submit product data sheets or brochures in Pdf. format for requirements requested in specification sections and as requested by Consultant where Shop Drawings will not be prepared due to standardized manufacture of product.
- .12 Delete information not applicable to project.
- .13 Supplement standard information to provide details applicable to project.
- .14 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, the drawings will be stamped as reviewed or reviewed as modified and will be returned. At this point fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .15 Signed drawings shall be returned to and retained by Contractor who is then responsible for distribution of copies of corrected shop drawing to

appropriate Subcontractors for appropriate action and to municipal building department for their records of those subjects required by authorities.

- .16 The Consultant's review is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and this review shall not relieve the Contractor of his responsibility for meeting the requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

2.4. SAMPLES

- .1 Submit for review to the Consultant three (3) samples as requested in respective specification Sections.
- .2 Submit samples with identifying labels bearing material or component description, manufacturer's name and brand name, Contractor's name, project name, location in which material or component is to be used, and date.
- .3 Deliver samples prepay any shipping charges involved for delivering samples to destination point and returning to point of origin if required.
- .4 Provide samples of special products, assemblies, or components when so specified.
- .5 No work requiring a sample submission shall commence until submission has received Consultant's final review.
- .6 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .7 Where colour, pattern or texture is criterion, submit full range of samples.
- .8 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .9 Make changes in samples which Consultant may require, consistent with Contract Documents.
- .10 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

2.5. MOCK-UP

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

2.6. CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, and prior to commencing the work submit the performance bond and the labour and materials payment bond as described in the bid documents.
- .2 Submit transcription of certified true copies of insurance immediately after award of Contract.
- .3 A current WSIB clearance certificate
- .4 The bidder's health and safety policy for the project.
- .5 A copy of the notice of project issued by the ministry of labour for the project
- .6 Building materials, components and elements specified without the use of trade or proprietary names shall meet requirements specified. If requested by Consultant, submit evidence of meeting requirements specified. Evidence shall consist of certification based on tests carried out by an independent testing agency. Certification based on previous tests for same materials, components or elements is acceptable. Certification shall be in form of written test reports prepared by testing agency.

END OF SECTION

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SECTION 01 35 17 – FIRE SAFETY PROCEDURES

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Section 01 14 00 – Work Restrictions.
- .2 Section 01 31 00 - Project Managing and Coordination.
- .3 Section 01 33 00 - Submittal Procedures.
- .4 Section 01 35 23 – Health and Safety
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. FIRE SAFETY PLAN

- .1 Contractors and their personnel will be familiar with this section and its requirements.
- .2 The contractor must take all necessary precautions during the carrying out of the work to prevent the possibility of fire occurring.

1.3. FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by the governing codes, regulations and bylaws.
- .2 The contractor will, at all times, when welding, brazing and performing any operation with an open flame, combustible adhesives or flammable solvents keep a portable, operable fire extinguisher within 3 meters of the operation.

1.4. HOT WORK

- .1 Take all precautions to Work safely and to provide the necessary protection to persons and property from Hot Work. This includes, but is not limited to Brazing, Cutting, Grinding, Soldering, Thawing Pipe, Torch Applied Roofing and Welding. With all such activity these steps are to be followed:
 - .1 Whenever possible, complete Hot Work in a welding shop or out of doors at the school.
 - .2 Flammable liquids, dust lint and oily deposits to be removed from within 50-ft (15m) of Work. Remove other combustibles where possible. Otherwise protect with fire-resistive tarpaulins or metal shields.
 - .3 Explosive atmosphere in area eliminated. Floors swept clean. Combustible floors wet down, covered with damp sand or fire-resistive tarpaulins.

- .4 All wall and floor openings covered. Fire-resistive tarpaulins suspended beneath Work.
- .5 For on-site Work (indoor and out of doors), advise the Head Custodian, Principal, Consultant (if assigned) and Project Coordinator prior to Work being performed, and of related dangers.
- .6 Where the Fire Alarm system is required to be set to stand-by to discourage false alarms from smoke detectors provide a firewatch throughout the building or structure being worked on. NEVER put the fire alarm system in stand-by mode when the building is occupied by staff or students.
- .7 In the event of a fire as a result of the Hot Work, notify the fire department immediately. Report incident to the head custodian, the Consultant, if assigned, and Project Coordinator immediately, whether extinguished or not. Provide a fire incident report to the Board.
- .8 Barriers must be set up to protect staff and students (i.e. pylons, shields, and caution tape) from exposure to arc flash and smoke migration.
- .9 Have all necessary doors, windows and/or drapes closed. Confer with the Head Custodian to shut down all fan systems in the area to reduce or eliminate smoke distribution.
- .10 Provide and keep fire extinguishers handy and in good Working condition. Temporarily cover all smoke detectors in area during time of Work.
- .11 Provide a fire watch/spot check for several hours after Work is completed. Uncover smoke detectors.
- .12 On new construction, the requirements of the Hot Work permit may be waived, until such time as either Substantial Completion or Occupancy is granted, whichever comes first.
- .13 On additions to existing buildings, the requirements for Hot Work permits shall remain in place.

1.5. HOT WORK PERMIT

- .1 **A sample Hot Work Permit is attached to the specifications – refer to Appendix 013517-A.**
- .2 Each permit is valid for seven (7) days only and must be renewed prior to its expiration date
- .3 The contractor must obtain Hot Work Permits from the School Board's representative prior to the start of work.

- .4 The contractor must complete the form as required and must keep the form on site.
- .5 Return each completed form to the School Board's representative on date of expiration.
- .6 The most current version of the Permit and its requirements shall be used for the purposes of the Work.

1.6. FIRE PROTECTION SYSTEMS

- .1 Any Modifications to Fire Alarm system and its devices including service, additions and changes in device location must be performed only by a Certified Fire Alarm Technician as per the Ontario Fire Code section 1.1, subsection 1.1.5.
- .2 The Contractor will receive from the Board's contact a contact number for the monitoring service and a school system number.
- .3 Bidders are cautioned that the Board will be reimbursed for the cost of false alarms. Refer to Section 01 14 00 Work Restrictions, Para. 1.4.4.
- .4 An approved inspection firm shall verify all new fire alarm devices, in accordance to CSA regulations. Certificate of Verification is required before occupancy.

1.7. FIRE ALARM SHUT-DOWN PROCEDURE

- .1 Do not shut the system down unless necessary. Plan the operation required to reduce system down time to the least amount possible.
- .2 Wherever possible, shut down only the zone needing Work and schedule this down time in unoccupied school hours. Allow for this in your bid pricing.
- .3 Discuss the possible down time with the head custodian and principal prior to any partial or whole system shut down.
- .4 The school or building administration shall advise all staff of fire alarm system shut down. This will include instructions to call 911 if they see a fire and when system is back on line.
- .5 Prior to alarm system shutdown and upon restoring the fire alarm system individuals supervising the shut down must contact Direct Detect at 519-741-2494 and have on hand the School System Account Number (this number can be found on the decal on the fire alarm panel). The School System Account Number will start with the prefix 209
 - .1 The Contractor shall provide full detail to the monitoring company as requested including building number and name (as identified on the fire alarm monitoring panel), contact name, company name, length of time system is down. Call shall be placed just prior to any shut down.

- .6 A fire patrol will need to be established and will include the following at the Contractor's expense:
 - .1 Patrol all halls and high-risk areas affected.
 - .2 Fire patrol shall have access to a phone and call 911 if they see a fire.
 - .3 Report all other problems they encounter.
 - .4 Remain on patrol until system is back on.
- .7 Contact Direct Detect at 519-741-2494 and inform them when the system is put back on line.
- .8 An activated system must not be reset until authorized by the Fire Department and the cause of the alarm has been investigated.

1.8. FIRE PROTECTION EQUIPMENT IMPAIRMENT

- .1 Fire Protection Equipment referred to in this section includes sprinkler systems, special fire suppression systems, and kitchen hood suppression systems.
- .2 The Contractor will take all precautions including restrict all Hot Work operations and shut down hazardous processes during all Fire protection equipment impairment.
- .3 Do not shut the Fire protection equipment down unless necessary Plan the operation required to reduce system impairment time to the least amount possible.
- .4 Wherever possible, shut down only the Fire protection equipment needing Work and schedule this impairment time for unoccupied school hours. Allow for this in your bid pricing.
- .5 Discuss the possible down time with the head custodian and principal prior to any partial or whole system impairment.
- .6 The school administration shall advise all staff of Fire protection equipment shut down. This will include instructions to call 911 if they see a fire and when system is back on line
- .7 The Contractor will plan to use temporary protection such as extra extinguishers, charged hose lines and temporary sprinkler protection during all Fire protection equipment impairment.
- .8 If the sprinkler system is restorable, either in whole or in part, the Contractor or sub-Contractor shall assign someone to restore the system promptly in the event of a fire.
- .9 A fire patrol may need to be established and will include the following at the Contractor's expense:
 - .1 Patrol all halls and high-risk areas affected.
 - .2 Fire patrol shall have access to a phone and call 911 if they see a fire.

- .3 Report all other problems they encounter.
- .4 Remain on patrol until system is back on.
- .10 The Contractor shall inform all sub trades that the Board has a Red Tag Permit System and it shall be used for all Fire protection equipment impairment.
- .11 For ease of use, a Factory Mutual hanging wall kit has been place at all Board Fire protection equipment locations. Supplies of Red Tag Permits are provided there.

1.9. FIRE ALARM MODIFICATIONS AND MAINTENANCE

- .1 Very important changes to Ontario Building Code as they relate to the Standard for the Verification of Fire Alarm Systems CAN/ULC-S537-M have taken effect December 24, 1999. (Minister's Ruling 99-BC-01)
 - .1 Clause 5.1; "Addition of conventional field device(s), or modification(s), to existing input circuit(s) or output circuit(s) shall require re-verification of all devices served by those input circuit(s) or output circuit(s)." If one device is added to a zone, the entire zone or in the case of a single zone panel the entire system is to be verified.
 - .2 Clause 5.2 "Addition of input circuit(s) or output circuit(s) to an existing fire alarm system shall require verification of the new circuit(s) in accordance with this standard, and shall also require all previously existing circuit(s) to be tested as follows:
 - .3 TEST: One conventional field device on each circuit shall be operated to confirm activation of all output circuits in accordance with the systems design." Even though no other zones have been touched, one device per input zone is to be tested when the Fire Alarm system is modified.
 - .4 Clause 5.5 "Where a transponder is added to an existing system, the transponder shall be verified in accordance with subsections 3.2, Wiring; and subsection 3.3 Control Units; and with CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems as well as re-verification of existing field devices and verification of new conventional field devices." If a new addressable device is added to a system, the new device is to be tested; as well a test must be conducted on all addressable devices on the loop.
 - .5 Clause 5.6 "Where an existing fire alarm system control unit is replaced with a new control unit, it shall be verified in accordance with CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems.

Replacement of any control panel will require the testing of all existing fire alarm devices.

- .2 The Contractor and sub-Contractors shall include in the bid price for the above ULC Standards requirements referenced in the Ontario Building Code.

1.10. INSTALLATION AND/OR REPAIR OF ROOFING

- .1 The Contractor will review with the Consultant and the Board's representative of the location of any asphalt kettles and the dates the kettles will be in use. The Contractor, in the course of performing roofing work, will ensure all personnel utilize the following precautions:
 - .1 Use only kettles equipped with thermometers or gauges in good working order.
 - .2 Locate kettles in a safe place outside of building.
 - .3 Maintain continuous supervision while kettles are in operation and provide metal covers for the kettles to smother any flames in case of fire.
 - .4 All roofing materials stored in locations no closer than 15 meters to any structures.

1.11. FIRE DEPARTMENT ACCESS

- .1 Designated fire routes must be maintained. Fire Department must be advised of any work that would impede fire apparatus response.

1.12. SMOKING PRECAUTIONS

- .1 Smoking is not permitted anywhere on Board properties. Workers who wish to smoke must leave the property, and not within sight of students. Any worker found to be in contravention of the Ontario Smoke Free Act will be subject to legislated fines.

1.13. FLAMMABLE LIQUIDS

- .1 The handling and storage on site of flammable liquids are to be governed by the current National Fire Code of Canada.
- .2 Flammable liquids such as gasoline, kerosene and naphtha may be kept for ready use in quantities not exceeding 10 imperial gallons provided they are stored in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval.
- .3 Transfer of flammable liquids is prohibited within buildings.

- .4 Transfer of flammable liquids must not be carried out in the vicinity of open flame or any type of heat producing devices.
- .5 Flammable liquids having a flash point below 100° F (37.7°C) such as naphtha or gasoline must not be used as solvents or cleaning agents.
- .6 Flammable waste liquids, for disposal, must be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum.

END OF SECTION

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Contractor Hot Work Permit

1. Take all precautions to Work safely and to provide the necessary protection to persons and property from Hot Work. This includes, but is not limited to Brazing, Cutting, Grinding, Soldering, Thawing Pipe, Torch Applied Roofing and Welding. With all such activity these steps are to be followed:
 - A. Whenever possible, complete Hot Work in a welding shop or out of doors at the school.
 - B. Flammable liquids, dust lint and oily deposits to be removed from within 50-ft (15m) of Work. Remove other combustibles where possible. Otherwise protect with fire-resistive tarpaulins or metal shields.
 - C. Explosive atmosphere in area eliminated. Floors swept clean. Combustible floors wet down, covered with damp sand or fire-resistive tarpaulins.
 - D. All wall and floor openings covered. Fire-resistive tarpaulins suspended beneath Work.
 - E. For Work on walls or ceilings, remove combustibles away on other side.
2. For on-site Work (indoor, out of doors), advise the Head Custodian and Principal prior to Work being performed, and of related dangers.
3. In the event of a fire as a result of the Hot Work, notify the fire department and the head custodian immediately, whether extinguished or not.
4. Barriers must be set up to protect staff and students (i.e. pylons, shields, and caution tape) from exposure to arc flash and smoke migration.
5. Have all necessary doors, windows and/or drapes closed. Request of the head custodian to shut down all fan systems in the area to reduce or eliminate smoke distribution.
6. Provide and keep fire extinguishers handy and in good Working condition. Temporarily cover all smoke detectors in area during time of Work.
7. Provide a fire watch/spot check for several hours after Work is completed. Uncover smoke detectors.



Waterloo Region
District School Board

Appendix - 013517-A

Facility Services

CONTRACTOR HOT WORK PERMIT

STOP!

Avoid hot work or seek an alternative method if possible.

This hot work permit is required for any temporary operation involving open flames or producing heat and/or sparks. This includes but is not limited to: brazing, cutting, grinding, soldering, torch-applied roofing and welding.

A SEPARATE PERMIT IS REQUIRED FOR EACH AREA

Board Supervisor/ Manager/Proj. Coordinator Responsibilities:

- i. Verify precautions taken in Section A
- ii. Complete and retain Part 1
- iii. Complete Section B prior to commencement of Hot Works
- iv. Issue Part 2 to Contractor completing Hot Work & Post
- v. Obtain Part 2 when Fire Monitoring complete
- vi. Return Part 1 and Part 2 to Controller, Facility Services

Contractor Responsibilities:

- i. Verify precautions taken in Section A
- ii. Complete Section C during each day that Hot Works takes place
- iii. Return Part 2 to Board Supervisor/ Manager/Proj. Coordinator

PART 1

Section A Indicate Precautions Taken	PART 1 Section B Authorization Granted																																					
☐ Available sprinklers, hose streams, and extinguishers available and in service	Board Supervisor/Manager/Proj. Coordinator: _____ Permit Valid from / to: (max. 7 days) Print Name _____ Signature _____ From This Date _____ To This Date _____ (Maximum 7 days or until end of hot work whichever is sooner)																																					
Within 35' or 11m of hot work ☐ Flammable liquid, dust, lint and oily deposits removed ☐ Explosive atmosphere in area eliminated ☐ Floors swept clean ☐ All wall and floor openings covered ☐ Combustible floors covered with fire resistant sheets ☐ Protect or shut down ducts that might carry sparks/smoke																																						
Hot work on walls, ceiling or roofs ☐ Construction is noncombustible and without combustible covering or insulation ☐ Combustible materials on other side of walls, ceilings or roofs moved away ☐ Combustible structure wetted down																																						
Hot work on enclosed equipment ☐ Enclosed equipment cleaned of all combustible material ☐ Containers purged of flammable liquid/vapour ☐ Pressurized vessels, piping & equipment removed from service, isolated & vented																																						
Fire watch/hot work and monitoring ☐ Fire watch will be provided <u>during</u> and for <u>1 hour</u> after work including break ☐ Fire watch is trained and supplied with suitable extinguishers ☐ Fire watch is trained in the use of sounding fire alarm ☐ Fire watch conducted in adjoining areas, above and below the space where appropriate ☐ Monitor hot work area for an additional <u>2 hours</u> after fire watch ☐ Other precautions taken (please detail): _____ _____ _____ _____ _____ _____																																						
	Section C Contractor and Location Affected <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 12%;">Dates: (max 7 days)</th> <th style="width: 23%;">Name of Contractor conducting hot work</th> <th style="width: 23%;">Name & signature of individual assigned to fire watch</th> <th style="width: 23%;">Name & signature of individual assigned to fire monitoring</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>		Dates: (max 7 days)	Name of Contractor conducting hot work	Name & signature of individual assigned to fire watch	Name & signature of individual assigned to fire monitoring																																
Dates: (max 7 days)	Name of Contractor conducting hot work	Name & signature of individual assigned to fire watch	Name & signature of individual assigned to fire monitoring																																			
	School: _____ Room/Area: _____ Nature of Job: _____																																					
	I verify the above location has been examined <u>each day</u> , the precautions listed in Section A have been taken <u>each day</u> , and permission is authorized for this work. I further acknowledge that if activity is during <u>school operational hours</u> , that appropriate <u>notification</u> has been given to <u>school</u> administration.																																					
	Hot Works Contractor: _____ Signature																																					
	School Administrator notified: _____ Print Name																																					
	In Case of Emergency call: 911 Then call: 519-570-0003 Ext. 4123																																					

Refer to WRDSB Administration Procedure 4200 Hot Works/Fire Watch (Copies Available on Request)

SECTION 01 35 23 – HEALTH AND SAFETY

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Section 01 31 00 - Project Managing and Coordination.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 35 17 – Fire Safety Requirements
- .4 Section 01 35 43 – Hazardous Materials
- .5 Section 01 41 00 – Regulatory Requirements
- .6 Section 01 53 00 – Temporary Construction Facilities
- .7 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. REFERENCES

- .1 Province of Ontario, including requirements for a "Prime Contractor" as defined by the Act.

1.3. SAFETY PLAN

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.
- .3 Be governed by pertinent safety requirements of Federal or Provincial Governments and of municipal bodies having authority, particularly the Ontario Construction Safety Act, The Occupational Health and Safety Act for Ontario, and regulations of Ontario Ministry of Labour, and work in conjunction with proper safety associations operating under the authority of Ontario Workers' Compensation Act. Protect Owner, Owner's employees, the public and those employed on the Work from bodily injury and to protect adjacent public and private property and Owner's property from damage. Furnish and maintain protection, such as warning signs, tarpaulins, guard rails, barriers, guard lights, night lights, railings around shafts, pits and stairwells, etc. as required. Remove temporary protective measures when no longer required.

1.4. TEMPORARY WORK

- .1 Temporary work requiring engineering proficiency for the design, erection, operation maintenance and removal shall be designed and bear stamp of the registered professional Engineer or Architect. Detail drawings will be submitted to the Consultant for review prior to commencing any work.
- .2 Before a temporary structure is used, person responsible for design, or their representative, shall inspect structure and certify it has been constructed according to their design.

1.5. RESPONSIBILITY

- .1 The "Prime Contractor" according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Health and Safety Act having jurisdiction. Advise the Board and the Consultant verbally and in writing.
- .4 The Contractor shall make their own arrangements for emergency treatment of accidents. Any accidents shall be reported immediately to the Board contact.
- .5 The Contractor agrees to hold the Board harmless of any and all liability of every nature and description, which may be suffered through bodily injuries, involving deaths of any persons, by reasons of negligence of the Contractor, his agents, employees, or his sub-Contractors.

1.6. SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Submit site-specific Health and Safety Plan: Within ten (10) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation

- .3 Submit one (1) copy of Contractor's authorized representative's work site health and safety inspection reports to Consultant and Owner.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit Material Safety Data Sheets (MSDS) to Consultant.
- .7 Consultant's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .8 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Consultant.
- .9 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.
- .10 File Notice of Project with the Ministry of Labour prior to commencement of Work.

1.7. SAFETY ACTIVITIES

- .1 Perform site specific safety hazard assessment related to project.
- .2 Schedule and administer Health and Safety meeting with Consultant prior to commencement of Work.
- .3 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements and this section.

1.8. HEALTH AND SAFETY COORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 have previous experience as a Health & Safety coordinator,
 - .2 have working knowledge of occupational safety and health regulations,
 - .3 be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work,
 - .4 be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan, and
 - .5 be on site during execution of Work.

1.9. POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Health and Safety Act having jurisdiction, and in consultation with Consultant.

1.10. CORRECTION OF NON-COMPLIANCE

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

1.11. PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Refer to Section 01 35 43 Hazardous Materials

1.12. HAZARDOUS WORK

- .1 Blasting or other use of explosives is not permitted at the place of work.

1.13. WORK STOPPAGE

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

1.14. LOCKOUT PROCEDURES

- .1 All Work to be done on electrical systems or machinery, where the unexpected switching on of the system or machinery could result in personal injury to a student, staff, employee, or the Contractor's employee, must be done in accordance with the Contractor's standard lockout procedure.
- .2 The Contractor shall provide his/her own locks for the above procedure.
- .3 The lock shall include contact information for the person(s) locking out such device.

1.15. OVERHEAD LIFTING

- .1 Under no circumstances will a crane or lifting device be used over a occupied space.
- .2 When working adjacent to occupied spaces, ensure a clearance of one (empty) classroom, or a minimum of 10m between any occupied space and the furthest possible reach of the crane.

1.16. WARNING SIGNS AND NOTICES

- .1 Notices shall be posted advising of the hazard but will not be considered a substitute for providing approved protection, separation, and space from the hazard.

1.17. FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by the governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.
- .3 Maintain placed or installed Fire Protection to protect the portions of the Work during construction.

1.18. SCENT-FREE ENVIRONMENT

- .1 The Board requires that, where advised, a building may be deemed scent-free and as such, the wearing of scented products is prohibited.
- .2 Any methods or materials that are found to create negative responses in staff or students shall cease and be removed under advisement of the Consultant and or the Board, until alternate methods can be determined.

END OF SECTION

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SECTION 01 35 43 – HAZARDOUS MATERIALS

2.0 GENERAL

2.1. RELATED SECTIONS

- .1 Section 01 35 23 – Health and Safety Requirements.
- .2 Section 01 41 00 – Regulatory Requirements.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

2.2. REFERENCES

- .1 Province of Ontario, including requirements for a "Prime Contractor" as defined by the Act.

2.3. ASBESTOS and OTHER REGULATED SUBSTANCES

- .1 An Asbestos Audit, as prepared by MTE Consultants Inc. for this facility, is attached under Appendix 01 35 43A. A duplicate set is also available in the Facilities Services Departments located in the Education Centre. Unless specifically covered by a Cash Allowance or Contingency Allowance that states otherwise, include in this Contract the required removal of all asbestos containing materials (ACM) to complete the work. No claims for extra costs will be accepted for areas known to contain ACM that are within the scope of this Work. Refer also to asbestos audit report provided by Onpoint Environmental Solutions Inc. regarding hazardous materials located at existing roof assemblies and attached under Appendix 01 35 43B.
- .2 Comply with applicable legislation regarding asbestos. Should the Contractor encounter asbestos not noted in the referenced Asbestos Audit that would be disturbed during the course of the Work, they should stop the work in that immediate area and report the same to the Consultant and Board contact.
- .3 In addition, Lead, Mercury, Silica, and Isocyanates are anticipated to be present in existing facilities. New construction, renovations, or alterations require compliance by the Contractor with the applicable legislation.

2.4. PROTOCOL FOR ABATEMENT WORK

- .1 This Protocol establishes the requirements to be followed by all Asbestos Abatement Contractors involved with the Board. It applies to Type 1, Type 2 and Type 3 Operations as stated in the Regulations and applies to

- emergency and non-emergency work (directly retained or working as a sub-contractor).
- .2 Asbestos Abatement Contractors must maintain appropriate insurance coverage and WISB certification.
 - .3 Contractors retained for asbestos abatement work shall use personnel certified by the Ontario College of Trades and must provide the Consultant and Board with proof of asbestos certification (AAS and AAW) for all supervisors / all staff involved.
 - .4 School Access
 - .1 During school hours all asbestos contractors are to report to the school office upon arrival. After school hours, ensure card-in / card-out procedures are followed and building security is maintained.
 - .5 Communication
 - .1 Establish communication contact list with email and phone numbers that shall include:
 - .1 Principal / Vice Principal
 - .2 Area Facility Manager
 - .3 Head Custodian
 - .4 Environmental Officer
 - .5 Manager of Mechanical, Electrical and Environmental Services
 - .6 Manager of Health Safety & Security
 - .7 Contractor staff
 - .8 Consultant
 - .2 Contact the School Principal / Vice to set up a firm date for the abatement (removal / repair). Schedule to allow at least 72 hours notice ahead of the work.
 - .3 Confirm the date by notifying via email the following:
 - .1 Principal / Vice-principal,
 - .2 Area Facility Manager, and
 - .3 Environmental Officer.
 - .4 Consultant
 - .4 Indicate the date, the start time, the anticipated completion time for the work and the work areas in the school.
 - .5 Identify personnel managing the project and provide current cell numbers for emergency contacts.
 - .6 For emergency work, as requested by Area Supervisors, Facility Managers or Environmental Officer, no notification to the school is required.
 - .7 Additionally, for Type 3 work also contact:

- .1 Manager of Health, Safety & Security, and
- .2 Notify the MOL (also for Type 2) where required by regulation.
- .3 Consultant
- .8 Discussions with other groups, school staff, media and others is discouraged and shall be directed to the Board Communication Officer where warranted.
- .6 Asbestos Operations
 - .1 Emergency work shall be carried out the same day (evening/night) or under exceptional conditions the following day / evening / night. Contractors shall exercise discretion when working in the school to minimize anxiety of staff/school community. Where warranted, contact Area Supervisor, Facility Manager or Environmental Officer to obtain further direction.
 - .2 For non-emergency work, contractor is to assess the work on site and provide a cost estimate to the Environmental Officer, (daniela_budure@wrdsb.on.ca) and Consultant. Some work will require discussion with the Facility Manager or Environmental Officer to assess if additional work should be done as to completely remove all ACM material from the area or similar.
 - .3 Where the MTE report shows ACM requiring repair, remove and re-insulate where required.
 - .4 Before beginning any Type 1, Type 2 or Type 3 Operations, the work area must be secured, doors closed, warning signs added to all entrances, caution tape used in open areas and signs used to restrict access to the work area so as to keep persons not involved in the work from entering in the work area.
 - .5 Provide "Construction" warning signs on solid barriers between the Work and public areas. Install a sufficient number of "asbestos abatement" warning signs behind the barriers, posted to warn of the hazard, and that access to the work area is restricted to persons wearing protective clothing and equipment.
 - .6 The contractor is responsible to disable the mechanical ventilation serving the work area and positively prevent operation using Lock-out / Tag-out devices for each air handling unit /fan. Exercise caution during heating season to ensure areas of the building are maintained above freezing and ensure equipment is turned back on after abatement / air clearance completed.

- .7 Contractor's employees shall put on / take off PPE within work area marked by construction signs. No employee shall leave the work area wearing PPE.
- .8 All dust and waste is to be cleaned up and removed at frequent / regular intervals as the work proceeds and immediately upon completion. No waste bags or similar are to be left behind.

2.5. SUBMITTALS

- .1 Once the abatement is completed, forward a Letter of Completion to the Environmental Officer, (daniela_budure@wrdsb.on.ca). This letter shall be received no later than 72 hours after completion and shall include any sample results.
- .2 For those projects requiring Air Clearance, ensure this info is sent without delay but in all cases no later than 24 hours after sampling. All Type 3 work must take into account that the initial samples may not pass and the contractor must allow one additional day to re-clean and re-sample before school is to resume operations. For those projects not under the direct supervision of a Environmental Consultant, the contractor is to expedite the air clearance sampling with the lab of their choice and carry these costs.
- .3 Forward Air Clearance results to:
 - .1 Principal / Vice-principal,
 - .2 Facility Manager,
 - .3 Environmental Officer,
 - .4 Manager of Mechanical, Electrical and Environmental Services, and
 - .5 Manager of Health, Safety & Security.
 - .6 Consultant

2.6. ACKNOWLEDGEMENT

- .1 The protocols for asbestos work must be read and understood by Asbestos Contractor.
- .2 Submit a signed copy of the most current copy of PROTOCOL FOR ABATEMENT WORK (ASBESTOS ABATEMENT CONTRACTORS) to the General Contractor, the Consultant, and the Board's Environmental Officer.

END OF SECTION



May 4, 2018
MTE File No.: C34532-914

Waterloo Region District School Board
51 Ardelt Avenue
Kitchener, ON N2C 2R5

**Re: 2018 Asbestos Audit Update – Tait Street Public School
184 Tait Street, Cambridge, Ontario**

1.0 INTRODUCTION

MTE Consultants Inc. (MTE) was authorized by the Waterloo Region District School Board (WRDSB) to conduct the 2018 Asbestos Audit Update for the subject building.

The purpose of the assignment was to re-assess and document the location, type, and condition of identified asbestos-containing materials (ACM) present within the building and make appropriate recommendations for management, abatement or remedial activities, as required.

The audit was conducted in accordance with the Ontario Ministry of Labour, *Regulation 278/05-Designated Substance-Asbestos on Construction Projects and in Buildings and Repair Operations* (O. Reg. 278/05). This report shall replace previous audit reports.

2.0 SCOPE OF WORK

The Scope of Work for this assessment was completed by MTE and included the following activities:

- Review of existing and historical reports and documentation pertaining to ACM within the building;
- Visual inspection to assess the condition of previously identified ACM, excluding portable structures;
- Collection of building material samples that are suspect ACM as applicable;
- Submission of samples to an accredited laboratory, as applicable;
- Photographic log of damaged materials; and
- Preparation of this report with findings and recommendations.

3.0 METHODOLOGY AND ASSESSMENT CRITERIA

This inspection was conducted by visual and laboratory identification methods for the assessment of ACM and their corresponding location, use, condition, and friability. The areas outlined in Section 2.0 were inspected limited to building components, materials and service connections. Notwithstanding that reasonable attempts were made to identify all ACMs, the possibility of concealed material exists and may not become visible until substantial demolition has occurred and therefore are currently undocumented and did not include the following.

- Locations that may be hazardous to the surveyor, such as electrical equipment;
- Where invasive inspection could cause consequential damage to the property or impair the integrity of the equipment, such as roof systems, underground services or components of mechanical equipment;
- Locations concealed by building finishes that require substantial demolition or removal for access or determination of quantities;
- Materials that is present in such an inconsistent fashion that without complete removal of finishes, the extent cannot be determined;
- Non-permanent items or personal contents, furnishings;
- Settled dust or airborne agents unless otherwise stated; and
- WRDSB Room 152 – this room was not accessible with any of the keys on site.

3.1 Condition of ACM

During the audit process the general condition of ACMs were observed and noted. Materials which are damaged can pose an increased exposure risk to workers, building occupants and the public. While assessing damage can be subjective, abatement items were grouped into two categories to aid in remedial prioritization.

Monitor Annually

These are items which display minor isolated damage; however do not pose an immediate risk to workers from exposure to asbestos fibres due to the current condition of the material and/or location. No remediation is required at this time; however these items should be monitored on a yearly basis for evidence of continued degradation. Should the condition of the material change an evaluation should be completed by a competent person to determine remedial action.

Abatement Action Required

These are items which display damage and may pose potential risk to workers from exposure to asbestos fibres due to the physical condition and/or location of the material. Clean-up, repair or removal of these materials is required as soon as reasonably possible.

4.0 FINDINGS

An inspection of the building was conducted by MTE on April 27, 2018. The two-storey school was constructed in 1958 with additions in 1964, 1971 and 2014. The inspection did not include areas of post 1986 new construction or renovation (where all building finishes have been removed and replaced).

The Asbestos Management Database is provided in **Appendix A** and associated Figures are provided in **Appendix B**. These together provide a current summary of the ACM identified throughout the building.

A summary of the damaged ACM identified at the time of the inspection is provided in **Appendix C**.

The bulk asbestos sample location and analytical summary is provided in **Appendix C**, and Laboratory Certificates of Analysis for any sampling conducted as part of the 2018 inspection are also provided, as applicable.

4.1 Analytical Results

During this inspection, a total of 9 building material samples that are suspect ACM were collected with a total of 5 analyses being performed. The threshold of equal to or greater than 0.5% asbestos by dry weight and is classified as ACM according to O. Reg. 278/05. Samples collected were submitted for analysis to Paracel Laboratories Ltd. (Paracel), in Mississauga, Ontario. Paracel is certified under the National Voluntary Laboratory Accreditation Program to perform asbestos analysis of bulk samples by PLM. Laboratory analysis was conducted in accordance with the United States Environmental Protection Agency, Test Method EPA/600-R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, June, 1993 by Polarized Light Microscopy as prescribed by O. Reg. 278/05.

Reported laboratory detections of asbestos ranged between 2% to 4% Chrysotile and are therefore confirmed as ACM.

4.2 Removed ACM

A summary of ACM that has been removed since the previous audit/inspection is provided in the abatement letters provided in **Appendix D**.

4.3 Discovery of Additional ACM

No additional ACM or suspect ACM was identified.

4.4 Damaged ACM

A summary of all ACM that has been identified as requiring annual monitoring or Type 1 Operations in accordance with O. Reg. 278/05 is provided in **Table 1** of **Appendix C**. Type 1 abatement Operations will be conducted internally by trained and qualified WRDSB staff.

A summary of all ACM that has been identified as requiring Type 2, Type 2 Glove Bag or Type 3 Operations in accordance with O. Reg. 278/05 is provided in **Table 2** of **Appendix C**. Abatement work will be conducted by certified asbestos contractors trained and qualified to conduct the type of work required.

5.0 RECOMMENDATIONS

5.1 Remedial

Damaged ACM was identified and requires removal or repair, and annual monitoring. At the time of the audit, all other ACM at the building was noted to be in good condition.

Type 1 abatement Operations will be conducted internally by trained and qualified WRDSB staff. All other abatement work will be conducted by certified asbestos contractors trained and qualified to conduct the type of work required.

All asbestos work must be conducted by staff and/or contractors who are trained and experienced in the type of asbestos operations required, and should be overseen by a qualified third party Health, Safety and Environmental professional. In order to conduct Type 3 asbestos operations, contractors must be certified as Asbestos Abatement Workers AAW (Trade code 253W) and Asbestos Abatement Supervisors AAS (Trade code 253S) by The Ministry of Training, Colleges and Universities (Ministry of Advanced Education and Skills Development) as prescribed by Section 20 of O. Reg. 278/05.

5.2 Long Term Management

This audit was conducted for the long term management of ACM within the building. Prior to future construction or renovation projects, additional assessments and/or sampling may be required.

There are no requirements under current legislation to remove ACM from a building simply because it is present. However, O. Reg. 278/05 requires that an Asbestos Management Plan be implemented and maintained. Asbestos awareness training should be provided for staff that may come in contact with ACM during routine duties or in emergency situations.



ACM that will be disturbed, or will likely be disturbed, during building maintenance, renovations, construction, or demolition activities must be handled and disposed of in accordance with the procedures prescribed by O. Reg. 278/05.

ACM may also be present in concealed locations. If any construction, renovation, alteration, or maintenance activities are required or planned, invasive inspections of concealed locations for potential ACM must be performed prior to such activities. Should any suspect ACM be discovered, work should cease and the materials should not be disturbed. Suspect ACM must be treated as asbestos-containing or sampled and proven to not contain asbestos. Any activities that require disturbance of ACM must be performed in accordance with O. Reg. 278/05.

6.0 LIMITATIONS

Services performed by **MTE Consultants Inc.** (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Environmental Engineering & Consulting profession. No other representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of MTE and the Client. It was completed in accordance with the approved Scope of Work referred to in Section 2.0. As such, this report may not deal with all issues potentially applicable to the site and may omit issues that are or may be of interest to the reader. MTE makes no representation that the present report has dealt with all-important environmental features, except as provided in the Scope of Work. All findings and conclusions presented in this report are based on site conditions, as they existed during the time period of the investigation. This report is not intended to be exhaustive in scope or to imply a risk-free facility.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such third parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by any third party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans.

It should be recognized that the passage of time might affect the views, conclusions and recommendations (if any) provided in this report because environmental conditions of a property can change. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may re-assess the contents of this report.

All of which is respectfully submitted,

MTE CONSULTANTS INC.

A handwritten signature in blue ink, appearing to read "Paul Semeniuk".

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Project Manager, Indoor Environments
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PXS:amc

Attach.



APPENDIX A

ASBESTOS MANAGEMENT DATABASE

		School Name		Legend:				Notes:		
		Tait Street Public School		HM - Homogenous Material - homogeneous with previously sampled material SL - Sample Location - Material Sampled VC - Visually Confirmed - Material not sampled, deemed ACM NF - Non-Friable F- Friable				All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.		
		Date Built:						Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.		
		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
Structure/Additions										
	Original Building	Structure	Deck	Steel	-	Non ACM	-	-	-	-
	Original Building	Structure	Concrete	Concrete	-	Non ACM	-	-	-	-
	Original Building	Façade	Brick Veneer	Brick and Mortar	-	Non ACM	-	-	-	-
	Original Building	Not Inspected	Not Inspected	Roofing Materials	NF	Suspect ACM	VC	-	-	-
	Original Building	Windows	Interior/Exterior Frames	Sealant	-	Non ACM	HM	S02	28-Mar-13	ND
	Original Building	Doors	Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	Original Building	Mastic	Mastic	Floor Tile Mastic	NF	ACM	HM	S09	17-Jul-09	2.4% Chrysotile
	Original Building	Mastic	Brown Mastic	1'x1' Long Fissure Ceiling Tile	NF	ACM	SL	S03ABC	13-Nov-18	ND
	1964 Addition	Structure	Deck	Steel	-	Non ACM	-	-	-	-
	1964 Addition	Structure	Concrete	Concrete	-	Non ACM	-	-	-	-
	1964 Addition	Façade	Brick Veneer	Brick and Mortar	-	Non ACM	-	-	-	-
	1964 Addition	Not Inspected	Not Inspected	Roofing Materials	NF	Suspect ACM	VC	-	-	-
	1964 Addition	Windows	Interior/Exterior Frames	Sealant	-	Non ACM	HM	S02	28-Mar-13	ND
	1964 Addition	Doors	Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	1964 Addition	Mastic	Mastic	Floor Tile Mastic	NF	ACM	HM	S02	4-May-18	4% Chrysotile
	1971 Addition	Structure	Deck	Steel	-	Non ACM	-	-	-	-
	1971 Addition	Structure	Concrete	Concrete	-	Non ACM	-	-	-	-
	1971 Addition	Façade	Brick Veneer	Brick and Mortar	-	Non ACM	-	-	-	-
	1971 Addition	Not Inspected	Not Inspected	Roofing Materials	NF	Suspect ACM	VC	-	-	-
	1971 Addition	Windows	Interior/Exterior Frames	Sealant	-	Non ACM	HM	S02	28-Mar-13	ND
	1971 Addition	Doors	Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	1971 Addition	Mastic	Mastic	Floor Tile Mastic	NF	ACM	HM	S01	4-May-18	2% Chrysotile
	Post-2014 Addition	Not Inspected	Not Inspected	Not Inspected						
Level 1										
7	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown (Post 2000)	-	Non ACM	-	-	-	-

		School Name		Legend:				Notes:		
		Tait Street Public School		HM - Homogenous Material - homogeneous with previously sampled material SL - Sample Location - Material Sampled VC - Visually Confirmed - Material not sampled, deemed ACM NF - Non-Friable F- Friable				All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.		
		Date Built:						Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.		
		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
7	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
7	Classroom	Window	Caulking	-	-	Non ACM	SL	36335-101-S02ABC	28-Mar-13	ND
7	Classroom	Ceiling	Drywall Joint Compound	-	NF	ACM	SL	36335-101-S01A	28-Mar-13	1.1% Chrysotile
7	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
7	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
8	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
8	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
8	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
8	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
8	Classroom	Deck	Wood	-	-	Non ACM	-	-	-	-
8A	Storage Room	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
8A	Storage Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
8A	Storage Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
8A	Storage Room	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
8A	Storage Room	Deck	Wood	-	-	Non ACM	-	-	-	-
8B	Washroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
8B	Washroom	Wall	Ceramic Tile	-	-	Non ACM	-	-	-	-
8B	Washroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
8B	Washroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
9	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
9	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
9	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
9	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
9	Classroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
10	Classroom	Floor	Vinyl Floor Tile 9"x 9"	Dark Grey with White Steaks	NF	ACM	SL	S14abc	17-Jul-09	2.1% Chrysotile
10	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
10	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
10	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
10	Classroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
11	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-

		School Name		Legend:				Notes:		
		Tait Street Public School		HM - Homogenous Material - homogeneous with previously sampled material SL - Sample Location - Material Sampled VC - Visually Confirmed - Material not sampled, deemed ACM NF - Non-Friable F- Friable				All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.		
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		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
11	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
11	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
11	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
11	Classroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
12	Classroom	Floor	Carpet	-	-	Non ACM	-	-	-	-
12	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
12	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
12	Classroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
12	Classroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
12	Classroom	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
13	Classroom	Floor	Carpet	-	-	Non ACM	-	-	-	-
13	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
13	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
13	Classroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
13	Classroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
13	Classroom	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
14	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
14	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
14	Classroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
14	Classroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
14	Classroom	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
14	Classroom	Piping	Pipe	Transite	NF	ACM	VC	-	-	-
15	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
15	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
15	Classroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	SL	S03abc	17-Jul-09	ND
15	Classroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
15	Classroom	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
15	Classroom	Piping	Pipe	Transite	NF	ACM	VC	-	-	-
16	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
16	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-

		School Name		Legend:				Notes:		
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		Date Built:						Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.		
		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
16	Classroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
16	Classroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
16	Classroom	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
17	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
17	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
17	Classroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
17	Classroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
17	Classroom	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
18	Classroom	Floor	Vinyl Floor Tile 9"x 9"	Green with White Streak	NF	ACM	SL	S09abc	17-Jul-09	7.4% Chrysotile
18	Classroom	Floor	Floor Tile Mastic	Black	NF	ACM	SL	S09abc	17-Jul-09	2.4% Chrysotile
18	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
18	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
18	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
18	Classroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
19	Classroom	Floor	Vinyl Floor Tile 9"x 9"	White with Grey Streak	NF	ACM	SL	S11abc	17-Jul-09	3.1% Chrysotile
19	Classroom	Floor	Vinyl Floor Tile 9"x 9"	Orange with Brown Streak	NF	ACM	SL	S12abc	17-Jul-09	2.4% Chrysotile
19	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown with Brown Fleck	-	Non ACM	SL	S13abc	17-Jul-09	ND
19	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
19	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
19	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
19	Classroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
20	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown Fleck	-	Non ACM	-	-	-	-
20	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
20	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
20	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
20A	Washroom	Floor	Ceramic Tile	-	-	Non ACM	-	-	-	-
20A	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
20A	Washroom	Wall	Drywall Joint Compound	-	NF	ACM	HM	S03	20-May-15	1% Chrysotile
20A	Washroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
21	Classroom	Floor	Vinyl Floor Tile 9"x 9"	Yellow with Red and Orange Streak	NF	ACM	HM	S17	17-Jul-09	8.3% Chrysotile

		School Name		Legend:				Notes:		
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		Date Built:						Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.		
		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
21	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
21	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
21	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
22	Classroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
22	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
22	Classroom	Ceiling	Drywall Joint Compound	-	NF	ACM	SL	36335-101-S01B	28-Mar-13	NA
22	Classroom	Deck	Wood	-	-	Non ACM	-	-	-	-
23	Classroom	Floor	Carpet	-	-	Non ACM	-	-	-	-
23	Classroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
23	Classroom	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
23	Classroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
120	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
120	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
120	Washroom	Wall	Ceramic Tile	-	-	Non ACM	-	-	-	-
120	Washroom	Deck	Concrete	-	-	Non ACM	-	-	-	-
120	Washroom	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
120	Washroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
121	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
121	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
121	Washroom	Wall	Ceramic Tile	-	-	Non ACM	-	-	-	-
121	Washroom	Deck	Concrete	-	-	Non ACM	-	-	-	-
121	Washroom	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
121	Washroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
122	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
122	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
122	Washroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
122	Washroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2008)	-	Non ACM	VC	-	-	-
123	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
123	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
123	Washroom	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND

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WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
123	Washroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2008)	-	Non ACM	VC	-	-	-
123	Washroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
123	Washroom	Piping	Pipe Insulation	Cellulose	-	Non ACM	SL	S08abc	17-Jul-09	ND
123	Washroom	Piping	Pipe	Transite	NF	ACM	VC	-	-	-
124	Storage	Floor	Vinyl Floor Tile 12"x12"	Oatmeal (Post 2008)	-	Non-ACM	-	-	-	-
124	Storage	Wall	Concrete	-	-	Non ACM	-	-	-	-
124	Storage	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
124	Storage	Ceiling	Ceiling Tile 2' x 4'	Medium-thick Random Pinhole	-	Non ACM	SL	S07abc	17-Jul-09	ND
124	Storage	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
124	Storage	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
124	Storage	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
125	Staff Work Room	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown Streak	NF	ACM	HM	S01	17-Jul-09	3.7% Chrysotile
125	Staff Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
125	Staff Work Room	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
125	Staff Work Room	Ceiling	Ceiling Tile 2' x 4'	Medium and Small Pinhole	NF	ACM	SL	S06abc	17-Jul-09	0.25% Amosite, 0.5% Chrysotile
125	Staff Work Room	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
125	Staff Work Room	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
125	Staff Work Room	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
126	Work Room	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown Streak	NF	ACM	HM	S01	17-Jul-09	3.7% Chrysotile
126	Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
126	Work Room	Wall	Wood	-	-	Non ACM	-	-	-	-
126	Work Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
126	Work Room	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
126	Work Room	Ducting	Duct Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
127	Work Room	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown Fleck	-	Non ACM	SL	S04abc	17-Jul-09	ND
127	Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
127	Work Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
128	Work Room	Floor	Vinyl Floor Tile 12"x 12"	White with Blue/Grey Fleck	-	Non-ACM	HM	S02	17-Jul-09	ND
128	Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
128	Work Room	Wall	Wood	-	-	Non ACM	-	-	-	-

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128	Work Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
128	Work Room	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
128	Work Room	Ducting	Duct Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
129	Storage Room	Floor	Concrete	-	-	Non ACM	-	-	-	-
129	Storage Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
129	Storage Room	Ceiling	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
129	Storage Room	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
129	Storage Room	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
129	Storage Room	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
130	Storage	Floor	Concrete	-	-	Non ACM	-	-	-	-
130	Storage	Wall	Concrete	-	-	Non ACM	-	-	-	-
130	Storage	Ceiling	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
130	Storage	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
130	Storage	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
130	Storage	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
131	Work Room	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown Streak	NF	ACM	SL	S01abc	17-Jul-09	3.7% Chrysotile
131	Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
131	Work Room	Wall	Wood	-	-	Non ACM	-	-	-	-
131	Work Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
131	Work Room	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
131	Work Room	Ducting	Duct Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
132	Work Room	Floor	Vinyl Floor Tile 12"x 12"	White with Blue and Grey Fleck	-	Non ACM	SL	S02abc	17-Jul-09	ND
132	Work Room	Floor	Floor Tile Mastic	Black Mastic	-	Non ACM	SL	S02abc	17-Jul-09	ND
132	Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
132	Work Room	Wall	Wood	-	-	Non ACM	-	-	-	-
132	Work Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
133	Work Room	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown Streak	NF	ACM	HM	S01	17-Jul-09	3.7% Chrysotile
133	Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
133	Work Room	Wall	Wood	-	-	Non ACM	-	-	-	-
133	Work Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-

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133	Work Room	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
133	Work Room	Ducting	Duct Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
134	Custodial Room	Floor	Concrete	-	-	Non ACM	-	-	-	-
134	Custodial Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
134	Custodial Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (2017)	-	Non ACM	-	-	-	-
134	Custodial Room	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
134	Custodial Room	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
135	Library	Floor	Carpet	-	-	Non ACM	-	-	-	-
135	Library	Floor	Vinyl Sheet Flooring	Red/Orange	-	Non-ACM	-	S02	20-May-15	ND
135	Library	Wall	Concrete	-	-	Non ACM	-	-	-	-
135	Library	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
135	Library	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
135	Library	Ceiling	Ceiling Tile 2' x 4'	Medium Fissure Random Pinhole	NF	ACM	HM	2551.846.004	25-Jan-91	1-5% Chrysotile
135	Library	Piping	Pipe	Transite	NF	ACM	VC	-	-	-
136	Library Office	Floor	Carpet	-	-	Non ACM	-	-	-	-
136	Library Office	Wall	Concrete	-	-	Non ACM	-	-	-	-
136	Library Office	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
136	Library Office	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
136	Library Office	Ceiling	Ceiling Tile 2' x 4'	Medium Fissure Random Pinhole	NF	ACM	HM	2551.846.004	25-Jan-91	1-5% Chrysotile
137	Work Room	Floor	Carpet	-	-	Non ACM	-	-	-	-
137	Work Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
137	Work Room	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
137	Work Room	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
137	Work Room	Ceiling	Ceiling Tile 2' x 4'	Medium Fissure Random Pinhole	NF	ACM	HM	2551.846.004	25-Jan-91	1-5% Chrysotile
138	Staff Washroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
138	Staff Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
138	Staff Washroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
139	Staff Washroom	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
139	Staff Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
139	Staff Washroom	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-

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WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
140	Staff Room	Floor	Vinyl Floor Tile 12"x12"	Brown Dense Fleck (Post 2008)	-	Non ACM	-	-	-	-
140	Staff Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
140	Staff Room	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
140	Staff Room	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
140	Staff Room	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2008)	-	Non ACM	VC	-	-	-
140	Staff Room	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
141	Custodial Room	Floor	Concrete	-	-	Non ACM	-	-	-	-
141	Custodial Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
141	Custodial Room	Wall	Ceramic Tile	-	-	Non ACM	-	-	-	-
141	Custodial Room	Deck	Concrete	-	-	Non ACM	-	-	-	-
142	Boiler Room	Floor	Concrete	-	-	Non ACM	-	-	-	-
142	Boiler Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
142	Boiler Room	Deck	Concrete	-	-	Non ACM	-	-	-	-
142	Boiler Room	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
142	Boiler Room	Piping	Pipe Fitting	Parged Cement	F	ACM	SL	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
143	Storage	Floor	Concrete	-	-	Non ACM	-	-	-	-
143	Storage	Wall	Concrete	-	-	Non ACM	-	-	-	-
143	Storage	Deck	Concrete	-	-	Non ACM	-	-	-	-
144	Storage Room	Floor	Vinyl Floor Tile 12"x 12"	Grey with White and Blue Fleck	-	Non ACM	SL	S16abc	17-Jul-09	ND
144	Storage Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
144	Storage Room	Deck	Concrete	-	-	Non ACM	-	-	-	-
144	Storage Room	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
144	Storage Room	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
145	Storage	Floor	Vinyl Floor Tile 9"x 9"	Yellow with Red Streaks	NF	ACM	HM	S15	17-Jul-09	1.9% Chrysotile
145	Storage	Wall	Concrete	-	-	Non ACM	-	-	-	-
145	Storage	Deck	Concrete	-	-	Non ACM	-	-	-	-
146	Kitchen	Floor	Vinyl Floor Tile 9"x 9"	Green with White Streak	NF	ACM	HM	S09abc	17-Jul-09	7.4% Chrysotile
146	Kitchen	Floor	Vinyl Floor Tile 9"x 9"	Mastic	NF	ACM	HM	S09abc	17-Jul-09	2.4% Chrysotile
146	Kitchen	Wall	Concrete	-	-	Non ACM	-	-	-	-
146	Kitchen	Ceiling	Concrete	-	-	Non ACM	-	-	-	-

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WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
147	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
147	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
147	Washroom	Ceiling	Drywall Joint Compound	-	NF	ACM	HM	S03	20-May-15	1% Chrysotile
148	Stage	Floor	Wood	-	-	Non ACM	-	-	-	-
148	Stage	Wall	Wood	-	-	Non ACM	-	-	-	-
148	Stage	Ceiling	Wood	-	-	Non ACM	-	-	-	-
150	Storage	Floor	Vinyl Floor Tile 12"x 12"	Beige with Brown (Post 2000)	-	Non ACM	-	-	-	-
150	Storage	Wall	Concrete	-	-	Non ACM	-	-	-	-
150	Storage	Deck	Concrete	-	-	Non ACM	-	-	-	-
150	Storage	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
151	Storage Room	Floor	Vinyl Floor Tile 9"x 9"	Yellow with Red Streaks	NF	ACM	HM	S15	17-Jul-09	1.9% Chrysotile
151	Storage Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
151	Storage Room	Deck	Concrete	-	-	Non ACM	-	-	-	-
151	Storage Room	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
152	Storage	Not inspected								
153	Office	Floor	Carpet	-	-	Non ACM	-	-	-	-
153	Office	Wall	Concrete	-	-	Non ACM	-	-	-	-
153	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	Non ACM	HM	S05	17-Jul-09	ND
153	Office	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole (Cellulose/Screwed In)	-	Non ACM	-	-	-	-
154	Storage Room	Floor	Vinyl Floor Tile 9"x 9"	Yellow with Red and Orange Streak	NF	ACM	SL	S17abc	17-Jul-09	8.3% Chrysotile
154	Storage Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
154	Storage Room	Ceiling	Ceiling Tile 1' x 1'	Large and Small Pinhole - Cellulose	-	Non ACM	-	-	-	-
155	Office	Floor	Vinyl Sheet Flooring	Grey (Post 2015)	-	Non ACM	-	-	-	-
155	Office	Wall	Concrete	-	-	Non ACM	-	-	-	-
155	Office	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
155	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
156	Office	Floor	Vinyl Sheet Flooring	Grey (Post 2015)	-	Non ACM	-	-	-	-
156	Office	Wall	Concrete	-	-	Non ACM	-	-	-	-
156	Office	Wall	Drywall	Post 2015	-	Non ACM	-	-	-	-
156	Office	Ceiling	Drywall	Post 2015	-	Non ACM	-	-	-	-

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157	Washroom	Floor	Ceramic Tile	-	-	Non ACM	-	-	-	-
157	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
157	Washroom	Wall	Drywall	Post 2015	-	Non ACM	-	-	-	-
157	Washroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
806	Gym Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
806	Gym Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
806	Gym Corridor	Wall	Drywall	Drywall Joint Compound	NF	ACM	SL	S03ABC	20-May-15	1% Chrysotile
806	Gym Corridor	Ceiling	Drywall	Drywall Joint Compound (Post 2015)	-	Non ACM	-	-	-	-
807	Corridor/Foyer	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
807	Corridor/Foyer	Wall	Concrete	-	-	Non ACM	-	-	-	-
807	Corridor/Foyer	Ceiling	Drywall	Drywall Joint Compound (Post 2015)	-	Non ACM	-	-	-	-
808	Gym Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
808	Gym Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
808	Gym Corridor	Wall	Drywall	Drywall Joint Compound	NF	ACM	SL	S03ABC	20-May-15	1% Chrysotile
808	Gym Corridor	Ceiling	Drywall	Drywall Joint Compound (Post 2015)	-	Non ACM	-	-	-	-
810	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
810	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
810	Corridor	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
810	Corridor	Piping	Pipe Insulation	Cellulose	-	Non ACM	-	-	-	-
810	Corridor	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
810	Corridor	Piping	Pipe Fitting & Seems	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
811	Exit #4 Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
811	Exit #4 Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
811	Exit #4 Corridor	Wall	Brick	-	-	Non ACM	-	-	-	-
811	Exit #4 Corridor	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2008)	-	Non ACM	VC	-	-	-
811	Exit #4 Corridor	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
811	Exit #4 Corridor	Piping	Pipe Insulation	Fiberglass insulation	-	Non ACM	-	-	-	-
811	Exit #4 Corridor	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
812	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
812	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-

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		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
812	Corridor	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
812	Corridor	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
813	Entrance	Floor	Carpet	-	-	Non ACM	-	-	-	-
813	Entrance	Floor	Vinyl Floor Tile 12"x12"	Oatmeal (Post 2008)	-	Non-ACM	-	-	-	-
813	Entrance	Wall	Concrete	-	-	Non ACM	-	-	-	-
813	Entrance	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
813	Entrance	Wall	Spray-on Fireproofing	Cellulose/Fibreglass	-	Non ACM	HM	S03	17-Jul-09	ND
813	Entrance	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2008)	-	Non ACM	VC	-	-	-
814	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
814	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
814	Corridor	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
814	Corridor	Piping	Pipe Fitting	Pipe Fitting & Seams	F	ACM	HM	2551.846.002 Pinchin	Jan-91	50-75% Chrysotile
815	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
815	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
815	Corridor	Ceiling	Drywall	Drywall Joint Compound (Post 2015)	-	Non ACM	-	-	-	-
820	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
820	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
820	Corridor	Ceiling	Drywall	Drywall Joint Compound (Post 2015)	-	Non ACM	-	-	-	-
821	Corridor	Floor	Carpet	-	-	Non ACM	-	-	-	-
821	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
821	Corridor	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
901	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
901	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
901	Corridor	Ceiling	Drywall	Drywall Joint Compound (Post 2015)	-	Non ACM	-	-	-	-
Level 2										
201	Office	Floor	Vinyl Floor Tile 12"x 12"	White with Blue and Grey Fleck	-	Non ACM	HM	S02abc	17-Jul-09	ND
201	Office	Wall	Concrete	-	-	Non ACM	-	-	-	-
201	Office	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile

		School Name		Legend:				Notes:		
		Tait Street Public School		HM - Homogenous Material - homogeneous with previously sampled material SL - Sample Location - Material Sampled VC - Visually Confirmed - Material not sampled, deemed ACM NF - Non-Friable F- Friable				All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.		
		Date Built:						Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.		
		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
201	Office	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
201A	Office	Floor	Vinyl Floor Tile 12"x 12"	White with Blue and Grey Fleck	-	Non ACM	HM	S02abc	17-Jul-09	ND
201A	Office	Wall	Concrete	-	-	Non ACM	-	-	-	-
201A	Office	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
201A	Office	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
202	Office	Floor	Carpet	-	-	Non ACM	-	-	-	-
202	Office	Wall	Concrete	-	-	Non ACM	-	-	-	-
202	Office	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
202	Office	Ceiling	Ceiling Tile 2' x 4'	Small Fissure Random Pinhole (Post 2015)	-	Non ACM	-	-	-	-
203	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
203	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
203	Washroom	Wall	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
203	Washroom	Ceiling	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
820	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
820	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
820	Corridor	Ceiling	Ceiling Tile 1' x 1'	Long Fissure	-	Non ACM	HM	S18abc	17-Jul-09	ND
821	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
821	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
821	Corridor	Ceiling	Ceiling Tile 1' x 1'	Long Fissure	-	Non ACM	HM	S18abc	17-Jul-09	ND
901	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
901	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
901	Corridor	Ceiling	Ceiling Tile 1' x 1'	Long Fissure	-	Non ACM	HM	S18abc	17-Jul-09	ND
902	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
902	Corridor	Wall	Concrete	-	-	Non ACM	-	-	-	-
902	Corridor	Ceiling	Drywall	Drywall Joint Compound	NF	ACM	HM	S01	20-May-15	1% Chrysotile
Summary of Potential ACM Hidden or Not Assessed										
142	Boiler Room	Chimney	Not Inspected	Refractory/Insulation						
	Original Building/1964/1971	Not Inspected	Not Inspected	Wall Cavity Insulation						

		School Name		Legend:				Notes:		
		Tait Street Public School		HM - Homogenous Material - homogeneous with previously sampled material SL - Sample Location - Material Sampled VC - Visually Confirmed - Material not sampled, deemed ACM NF - Non-Friable F - Friable				All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.		
		Date Built:						Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.		
		Original: 1958								
		Addition(s): 1964, 1971, 2014								
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
	Original Building/1964/1971	Not Inspected	Not Inspected	Door Core Insulation						



APPENDIX B

FIGURES

TABLES

TABLE 1 - INTERNAL ABATEMENT MANAGEMENT							
Tait Street Public School							
Material	WRDSB Fixed Reference Number	MTE Functional Space Number	Material Description	Approximate Quantity	Photograph - Context	Photograph - Detail	Required Action
Asbestos Non-Friable	19	1033	9"x9" White with Grey Streak Vinyl Floor Tiles	1 Tile	-		Monitor Annually
Asbestos Non-Friable	146	1056	9"x9" Green with White Streak Vinyl Floor Tiles	1 Tile	-		Monitor Annually
Asbestos Non-Friable	135	1018	2'x4' Medium Fissure Random Pinhole Ceiling Tiles	1 Tile	-		Monitor Annually
Asbestos Non-Friable	137	1016	2'x2' Medium Fissure Random Pinhole Ceiling Tiles	2 Tiles	-		Removal in accordance with O. Reg. 278/05 as a Type 1 Operation

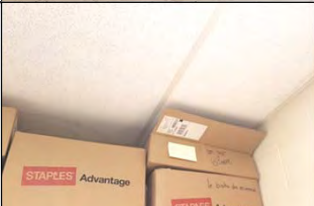
TABLE 1 - INTERNAL ABATEMENT MANAGEMENT							
Tait Street Public School							
Material	WRDSB Fixed Reference Number	MTE Functional Space Number	Material Description	Approximate Quantity	Photograph - Context	Photograph - Detail	Required Action
Asbestos Non-Friable	135	1018	2'x4' Medium Fissure Random Pinhole Ceiling Tiles	3 Tiles	-		Removal in accordance with O. Reg. 278/05 as a Type 1 Operation
					-		Removal in accordance with O. Reg. 278/05 as a Type 1 Operation
Asbestos Non-Friable	125	1025	2'x4' Medium and Small Pinhole Ceiling Tiles	2 Tiles	-		Removal in accordance with O. Reg. 278/05 as a Type 1 Operation
Notes: 1) A copy of this report should be provided to all prospective contractors prior to tender or quotation, in accordance with Section 30 of the Occupational Health and Safety Act. 2) Recommended actions are the minimum required actions, as prescribed by the appropriate Acts, regulations, guidelines, standards, codes and general best practice measures. The Contractor may choose to alter the approach and combine or break out sections of work. This is acceptable provided that the appropriate Acts, regulations, guidelines, standards and codes are followed and afford protection for the health and safety of workers, occupants and the public that is at least equal to the protection that would be provided by complying with the minimum requirements. 3) All waste generated is subject to characterization and disposal in accordance with Ontario Regulation 347.							

TABLE 2 - EXTERNAL ABATEMENT MANAGEMENT

Tait Street Public School							
Material	WRDSB Fixed Reference Number	MTE Functional Space Number	Material Description	Approximate Quantity	Photograph - Context	Photograph - Detail	Required Action
Asbestos Friable	142	1036	Insulation on Pipe Fittings	2			Removal/Repair in accordance with O. Reg. 278/05 as a Type 2 Glove Bag Operation
				2	-		Removal/Repair in accordance with O. Reg. 278/05 as a Type 2 Glove Bag Operation

Notes:

1) A copy of this report should be provided to all prospective contractors prior to tender or quotation, in accordance with Section 30 of the Occupational Health and Safety Act.

2) Recommended actions are the minimum required actions, as prescribed by the appropriate Acts, regulations, guidelines, standards, codes and general best practice measures. The Contractor may choose to alter the approach and combine or break out sections of work. This is acceptable provided that the appropriate Acts, regulations, guidelines, standards and codes are followed and afford protection for the health and safety of workers, occupants and the public that is at least equal to the protection that would be provided by complying with the minimum requirements.

3) All waste generated is subject to characterization and disposal in accordance with Ontario Regulation 347.

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	Location	Material Description	Asbestos Content (%)	Fibre Type	Is Material ACM
2009 Asbestos Audit Update					
32523-TAIT S.01A	1009	12" x 12" Floor Tile - Beige with brown streaks	3.7	Chrysotile	Yes
32523-TAIT S.01B			NA	Chrysotile	Yes
32523-TAIT S.01C			NA	Chrysotile	Yes
32523-TAIT S.02A	1010	12" x 12" Floor Tile - White with blue and grey fleck	Tile: ND Mastic: ND	-	No
32523-TAIT S.02B			Tile: ND Mastic: ND	-	No
32523-TAIT S.02C			Tile: ND Mastic: ND	-	No
32523-TAIT S.03A	1013	Firespray located above CT	ND	-	No
32523-TAIT S.03B			ND	-	No
32523-TAIT S.03C			ND	-	No
32523-TAIT S.04A	1005	12" x 12" Floor Tile - Beige with brown fleck	ND	-	No
32523-TAIT S.04B			ND	-	No
32523-TAIT S.04C			ND	-	No
32523-TAIT S.05A	1012	2' x 4' Ceiling Tile - Short Fissure Random Pinhole	ND	-	No
32523-TAIT S.05B			ND	-	No
32523-TAIT S.05C			ND	-	No
32523-TAIT S.06A	1025	2' x 4' Ceiling Tile - Small & Medium Pinhole	0.25 0.5	Amosite Chrysotile	Yes
32523-TAIT S.06B			NA	Amosite Chrysotile	Yes
32523-TAIT S.06C			NA	Amosite Chrysotile	Yes
32523-TAIT S.07A	1026	2' x 4' Ceiling Tile - Medium Thick Fissure Random Pinhole	ND	-	No
32523-TAIT S.07B			ND	-	No
32523-TAIT S.07C			ND	-	No
32523-TAIT S.08A	1027	Rainwater Leader Insulation	ND	-	No
32523-TAIT S.08B			ND	-	No
32523-TAIT S.08C			ND	-	No
32523-TAIT S.09A	1031	9" x 9" Floor Tile - Green with White Streaks	Tile: 7.4 Mastic: 2.4	Chrysotile Chrysotile	Yes Yes
32523-TAIT S.09B			NA	Chrysotile	Yes
32523-TAIT S.09C			NA	Chrysotile	Yes
32523-TAIT S.10A	1030	9" x 9" Floor Tile - Grey with White Streaks	1.9	Chrysotile	Yes
32523-TAIT S.10B			NA	Chrysotile	Yes
32523-TAIT S.10C			NA	Chrysotile	Yes
32523-TAIT S.11A	1033	9" x 9" Floor Tile - White with Grey Streaks	3.1	Chrysotile	Yes
32523-TAIT S.11B			NA	Chrysotile	Yes
32523-TAIT S.11C			NA	Chrysotile	Yes
32523-TAIT S.12A	1033	9" x 9" Floor Tile - Orange with Brown Streaks	2.4	Chrysotile	Yes
32523-TAIT S.12B			NA	Chrysotile	Yes
32523-TAIT S.12C			NA	Chrysotile	Yes
32523-TAIT S.13A	1033	12" x 12" Floor Tile - Brown with Brown Fleck	ND	-	No
32523-TAIT S.13B			ND	-	No
32523-TAIT S.13C			ND	-	No
32523-TAIT S.14A	1032	9" x 9" Floor Tile - Dark Grey with White Steaks	2.1	Chrysotile	Yes
32523-TAIT S.14B			NA	Chrysotile	Yes
32523-TAIT S.14C			NA	Chrysotile	Yes
32523-TAIT S.15A	1034	9" x 9" Floor Tile - Yellow with Red Streaks	1.9	Chrysotile	Yes
32523-TAIT S.15B			NA	Chrysotile	Yes
32523-TAIT S.15C			NA	Chrysotile	Yes
32523-TAIT S.16A	1037	12" x 12" Floor Tile - Grey with White and Blue Fleck	ND	-	No
32523-TAIT S.16B			ND	-	No
32523-TAIT S.16C			ND	-	No
32523-TAIT S.17A	1048	9" x 9" Floor Tile - Yellow with Red and Orange Streaks	1.9	Chrysotile	Yes
32523-TAIT S.17B			NA	Chrysotile	Yes
32523-TAIT S.17C			NA	Chrysotile	Yes
32523-TAIT S.18A	1061	1' x 1' Ceiling Tile - Long Fissure	ND	-	No
32523-TAIT S.18B			ND	-	No
32523-TAIT S.18C			ND	-	No

Table 3 - Sample Summary Table - Revised-Nov-14-18

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	Location	Material Description	Asbestos Content (%)	Fibre Type	Is Material ACM
2013 Asbestos Audit Update					
36335-101-S01A	1045	Drywall Joint Compound - 1964 Addition	1.1	Chrysotile	Yes
36335-101-S01B			NA	Chrysotile	Yes
36335-101-S01C			NA	Chrysotile	Yes
36335-101-S02A	1045	Window Caulking	ND	-	No
36335-101-S02B			ND	-	No
36335-101-S02C			ND	-	No
2015 Asbestos Audit Update					
S01A	1001	Drywall Joint Compound - 1971 Addition	1	Chrysotile	Yes
S01B	1013	Drywall Joint Compound - 1971 Addition	1	Chrysotile	Yes
S01C	1015	Drywall Joint Compound	1	Chrysotile	Yes
S02A	1018	Vinyl Sheet Flooring - Red and Orange	Tile: ND Mastic: ND	-	No
S02B			Tile: ND Mastic: ND	-	No
S02C			Tile: ND Mastic: ND	-	No
S03A	1061	Drywall Joint Compound	ND	-	No
S03B			ND	-	No
S03C	1061	Drywall Joint Compound - Original Building	1	Chrysotile	Yes
2016 Roof Material Sampling					
S01A	Roof	Roof Membrane - Gravel Tar	ND	-	No
S01B	Roof	Roof Membrane - Gravel Tar	<MDL	Chrysotile	No
S01C	Roof	Roof Membrane - Gravel Tar	ND	-	No
S01A	Roof	Roof Membrane - 4-Ply	0.64	Chrysotile	Yes
S01B	Roof	Roof Membrane - 4-Ply	NA	Chrysotile	Yes
S01C	Roof	Roof Membrane - 4-Ply	NA	Chrysotile	Yes
S01A	Roof	Roof Membrane - Cellulose Mastic	ND	-	No
S01B	Roof	Roof Membrane - Cellulose Mastic	ND	-	No
S01C	Roof	Roof Membrane - Cellulose Mastic	ND	-	No
S01A	Roof	Roof Membrane - Paper Mastic	ND	-	No
S01B	Roof	Roof Membrane - Paper Mastic	ND	-	No
S01C	Roof	Roof Membrane - Paper Mastic	ND	-	No
2018 Asbestos Audit Update					
S01A	1009	12x12 VFT - Black Mastic (1971)	2	Chrysotile	Yes
S01B	1011	12x12 VFT - Black Mastic (1971)	NA	Chrysotile	Yes
S01C	1006	12x12 VFT - Black Mastic (1971)	NA	Chrysotile	Yes
S02A	1048	12x12 VFT - Black Mastic (1964)	4	Chrysotile	Yes
S02B	1048	12x12 VFT - Black Mastic (1964)	NA	Chrysotile	Yes
S02C	1047	12x12 VFT - Black Mastic (1964)	NA	Chrysotile	Yes
S03A	1051	1'x1' Long Fissure Ceiling Tile - Brown Mastic	ND	-	No
S03B	1051	1'x1' Long Fissure Ceiling Tile - Brown Mastic	ND	-	No
S03C	1051	1'x1' Long Fissure Ceiling Tile - Brown Mastic	ND	-	No
NA: Not Analyzed due to stop positive method ND: No asbestos fibres detected above the laboratory minimum detection limit					
A bulk material sample containing 0.5% or more asbestos therefore establishes that material as asbestos-containing. In accordance with Table 1 of O. Reg. 278/05, a minimum number of samples for the material to be classified as non asbestos. A homogeneous material is defined by O. Reg. 278/05 "as material that is uniform in colour and texture". Homogeneous samples are identified by an alphabetical suffix to sample names to represent multiple samples of a homogeneous material. When a homogeneous material is analysed it is determined to be asbestos-containing upon the first positive detection of asbestos equal to or greater than 0.5%. Subsequent samples of the same material are therefore not analysed. Some bulk samples are comprised of multiple layers and as such will require multiple analysis. In such cases each layer is isolated at the laboratory and analysed individually to determine asbestos content. As a result the laboratory may report additional samples beyond the submitted number of samples or include multiple analyses as subsets within a sample.					

Table 3 - Sample Summary Table - Revised-Nov-14-18

Certificate of Analysis

MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.
Kitchener, ON N2B 3X9
Attn: Aisling Dennett

Client PO:

Project: 34532-914 2018 AAU - Trait PS

Custody:

Report Date: 29-May-2018

Order Date: 18-May-2018

Order #: 1820582

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1820582-01	S01A
1820582-02	S01B
1820582-03	S01C
1820582-04	S02A
1820582-05	S02B
1820582-06	S02C

Approved By:



Emma Diaz

Senior Analyst

Certificate of Analysis

Report Date: 29-May-2018

Client: MTE Consultants Inc. (Kitchener)

Order Date: 18-May-2018

Client PO:
Project Description: 34532-914 2018 AAU - Trait PS

Asbestos, PLM Visual Estimation **MDL - 0.5%**

<i>Paracel I.D.</i>	<i>Sample Date</i>	<i>Layers Analyzed</i>	<i>Colour</i>	<i>Description</i>	<i>Asbestos Detected:</i>	<i>Material Identification</i>	<i>% Content</i>
1820582-01	27-Apr-18	sample homogenized	Black	Mastic	Yes	Client ID: S01A	
						Chrysotile	2
						Non-Fibers	98
1820582-02	27-Apr-18					Client ID: S01B	
						not analyzed	
1820582-03	27-Apr-18					Client ID: S01C	
						not analyzed	
1820582-04	27-Apr-18	sample homogenized	Black	Mastic	Yes	Client ID: S02A	
						Chrysotile	4
						Non-Fibers	96
1820582-05	27-Apr-18					Client ID: S02B	
						not analyzed	
1820582-06	27-Apr-18					Client ID: S02C	
						not analyzed	

**** Analytes in bold indicate asbestos mineral content.**
Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code	*	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0		18-May-18

* Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Work Order Revisions / Comments

None



1820582



Mississauga Location
3 Kitimat Road, Unit # 15
Mississauga, ON L5N 5M1

Chain of Custody

(Lab Use Only)

Page 1 of 1

Client Name: MTE Consultants Inc.	Project Reference: 34532-914 2018 AAU - Tait PS	TAT:
Contact Name: Aisling Dennett	Quote #: 18-226 MTE Standing Offer	[X] Regular [] 3 Day
Address: 520 Bingemans Centre Drive, Kitchener	PO #: N/A	[] 2 Day [] 1 Day
	Email Address: adennett@mte85.com and psemeniuk@mte85.com	[] Same Day
Telephone: 519-743-6500		Date Required:

ASBESTOS ANALYSIS

Matrix: [] Air [X] Other Regulatory Guideline: O. Reg. 278/05				Required Analyses: [] PCM [X] PLM [] PLM 400PC [] PLM 1000PC [] Chatfield [] TEM				
Sample ID	Location	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **	
1	S01A	1009	12x12 VFT Black Mastic - 1971 Addition	27-Apr-18	-	Y	N	Black Mastic
2	S01B	1011	12x12 VFT Black Mastic - 1971 Addition	27-Apr-18	-	Y	N	Black Mastic
3	S01C	1006	12x12 VFT Black Mastic - 1971 Addition	27-Apr-18	-	Y	N	Black Mastic
4	S02A	1048	12x12 VFT Black Mastic - 1964 Addition	27-Apr-18	-	Y	N	Black Mastic
5	S02B	1048	12x12 VFT Black Mastic - 1964 Addition	27-Apr-18	-	Y	N	Black Mastic
6	S02C	1047	12x12 VFT Black Mastic - 1964 Addition	27-Apr-18	-	Y	N	Black Mastic
7								
8								
9								
10								
11								
12								
13								
14								
15								

* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments:				Method of Delivery PULVERATOR	
Relinquished By (Sign):	Received at Depot:	Received at Lab:	Verified By:		
Relinquished By (Print) & Date/Time: May 17/18 2:50pm	Date/Time:	Date/Time: 18 May 18 08:35	Date/Time:		

Certificate of Analysis

MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.
Kitchener, ON N2B 3X9
Attn: Aisling Dennett

Client PO:
Project: 34532-914 2018 AAU-Trait PS
Custody:

Report Date: 15-Nov-2018
Order Date: 15-Nov-2018

Order #: 1846355

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1846355-01	S03A
1846355-02	S03B
1846355-03	S03C

Approved By:



Emma Diaz
Senior Analyst

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis
Client: MTE Consultants Inc. (Kitchener)

Report Date: 15-Nov-2018

Order Date: 15-Nov-2018

Client PO:
Project Description: 34532-914 2018 AAU-Trait PS

Asbestos, PLM Visual Estimation **MDL - 0.5%**

<i>Paracel I.D.</i>	<i>Sample Dat</i>	<i>Layers Analyzed</i>	<i>Colour</i>	<i>Description</i>	<i>Asbestos Detected:</i>	<i>Material Identification</i>	<i>% Content</i>
1846355-01	13-Nov-18	sample homogenized	Brown	Mastic	No	Client ID: S03A	
						Cellulose	1
						MMVF	1
						Non-Fibers	98
1846355-02	13-Nov-18	sample homogenized	Brown	Mastic	No	Client ID: S03B	
						Cellulose	1
						MMVF	1
						Non-Fibers	98
1846355-03	13-Nov-18	sample homogenized	Brown	Mastic	No	Client ID: S03C	
						Cellulose	1
						MMVF	1
						Non-Fibers	98

* MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code	*	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0		15-Nov-18

* Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Work Order Revisions / Comments

None



Paracel ID: 1846355

ssauga Location
mat Road, Unit # 15
uga, ON L5N 5M1Chain of Custody
(Lab Use Only)

Page 1 of 1

Client Name: MTE Consultants Inc.

Project Reference: 34532-914 2018 AAU - Tait PS

TAT:

Contact Name: Aisling Dennett

Quote #: 18-226 MTE Standing Offer

☐ Regular ☐ 13 Day

Address: 520 Bingham Centre Drive, Kitchener

PO #: N/A

☐ 2 Day ☐ 1 Day

Email Address: adennett@mte85.com and psemiuk@mte85.com

☒ Same Day

Telephone: 519-743-6500

Date Required:

ASBESTOS ANALYSIS

Matrix: ☐ Air ☒ Other Regulatory Guideline: O. Reg. 278/05Required Analyses: ☐ PCM ☒ JPLM ☐ JPLM 400PC ☐ JPLM 1000PC ☐ Chatfield ☐ TEM

Sample ID	Location	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1 SQA	1051	1x1 LF Ceiling Tile - Brown Mastic	13-Nov-18	-	Y	N	Brown Mastic Only
2 SQB	1051	1x1 LF Ceiling Tile - Brown Mastic	13-Nov-18	-	Y	N	Brown Mastic Only
3 SQC	1051	1x1 LF Ceiling Tile - Brown Mastic	13-Nov-18	-	Y	N	Brown Mastic Only
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments:

Method of Delivery

Relinquished By (Sign):

Received at Depot:

Received at Lab:

Verified By:

Relinquished By (Print)& Date/Time:
Paul Semeniuk Nov 14, 2018 10am

Date/Time:

Date/Time: Nov 15-18 9:00

Date/Time: Nov 15-18 9:23



APPENDIX D

ABATEMENT LETTERS



107 Whitney Pl,
Kitchener, ON, Canada.
N2G 2X8

Phone: (519) 498-0077
Fax: (519) 568 8426
E-mail: frank@asbestosmouldexperts.com

March 27th, 2015

Attention: Daniela Budure (Environmental Officer) WRDSB

Re: Confirmation of Completed Asbestos Removal for the Waterloo Region District School Board

Location: Tait Street Public School – 184 Tait Street, Cambridge

Area: Room MTE#1062

Work Description:
Removal of Vinyl Asbestos Tile and Mastic

All work done in accordance with Ont. Reg. 278/05

Completion Date: March 18th 2015 with 01 AAS and 3 AAW certified staff.

Disposal of Asbestos Waste: Erb St. Dumping & Disposal Unit Waterloo ON

License # 7549-9EZL TL

Regards,

Frank Parronchi,
Owner/President
519 498-0077

FPR INC.
ASBESTOS MOULD EXPERTS
www.asbestosmouldexperts.com



107 Whitney Pl,
Kitchener, ON, Canada.
N2G 2X8

Phone: (519) 498-0077
Fax: (519) 568 8426
E-mail: frank@asbestosmouldexperts.com

April 6th, 2015

Attention: Daniela Budure (Environmental Officer) WRDSB

Re: Confirmation of Completed Asbestos Removal for the Waterloo Region District School Board

Location: Tait Street Public School – 184 Tait Street, Cambridge

Area: Room MTE#1036

Work Description:
Removal of 3 Elbows marked by GC

All work done in accordance with Ont. Reg. 278/05

Completion Date: April 6th 2015 with 01 AAS and 1 AAW certified staff.

Disposal of Asbestos Waste: Erb St. Dumping & Disposal Unit Waterloo ON

License # 7549-9EZL TL

Regards,

Frank Parronchi,
Owner/President
519 498-0077

FPR INC.
ASBESTOS MOULD EXPERTS
www.asbestosmouldexperts.com



519.772.5500 www.zeroenvironmental.com

Zero Environmental Inc. 100 Hanson Ave. Unit B, Kitchener, ON N2C 2E2

August 17, 2016
Waterloo Region District School Board
51 Ardelt Ave
Kitchener, ON

RE: Confirmation of Completed Asbestos Removal

NOTICE

Building: Tait St PS

Address: 184 Tait St Cambridge

Location: MTE Room Location # 1034 as per MTE Asbestos Audit Report dated November 25, 2009

Work Description:

All work performed in accordance with Ontario Regulation 278/05

- Type 1 removal of all vinyl floor tiles in Classroom 9 (MTE location 1034)

Start Date: July 29, 2016

Completion Date: July 29, 2016

Completed by (1) AAS and (2) AAW

After Hours Work: Yes ☐ No ☒

Disposal of Asbestos Waste: Waterloo Region Landfill

Sincerely,

A handwritten signature in black ink, appearing to be 'J. Van S.', written over a light blue rectangular background.

Zero Environmental Inc.

Certificate of Analysis

MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.
Kitchener, ON N2B 3X9
Attn: Steven Nieboer

Client PO:

Project: WRDSB Roof Inspection Sampling

Custody:

Report Date: 6-Dec-2016

Order Date: 2-Dec-2016

Revised Report

Order #: 1649410

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1649410-25	S01A - Tait Street Public School (Gravel Tar)
1649410-26	S01B - Tait Street Public School (Gravel Tar)
1649410-27	S01C - Tait Street Public School (Gravel Tar)
1649410-28	S01A - Tait Street Public School (4 Ply)
1649410-29	S01B - Tait Street Public School (4 Ply)
1649410-30	S01C - Tait Street Public School (4 Ply)
1649410-31	S01A - Tait Street Public School (Cellulose Mastic)
1649410-32	S01B - Tait Street Public School (Cellulose Mastic)
1649410-33	S01C - Tait Street Public School (Cellulose Mastic)
1649410-34	S01A - Tait Street Public School (Paper Mastic)
1649410-35	S01B - Tait Street Public School (Paper Mastic)
1649410-36	S01C - Tait Street Public School (Paper Mastic)

Approved By:



Emma Diaz

Senior Analyst

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis

Report Date: 06-Dec-2016

Client: MTE Consultants Inc. (Kitchener)

Order Date: 2-Dec-2016

Client PO:
Project Description: WRDSB Roof Inspection Sampling

Asbestos, PLM Visual Estimation **MDL - 0.5%**

<i>Paracel I.D.</i>	<i>Sample Date</i>	<i>Layers Analyzed</i>	<i>Colour</i>	<i>Description</i>	<i>Asbestos Detected:</i>	<i>Material Identification</i>	<i>% Content</i>
1649410-25	29-Nov-16	sample homogenized	Black	Tar	No	Client ID: S01A - Tait Street Public School (Gravel Tar) [AS-PRE]	
						Cellulose	5
						Non-Fibers	95
1649410-26	29-Nov-16	sample homogenized	Black	Tar	Yes	Client ID: S01B - Tait Street Public School (Gravel Tar) [AS-PRE]	
					[ASTrc]	Chrysotile	<MDL
						Cellulose	5
						Non-Fibers	95
1649410-27	29-Nov-16	sample homogenized	Black	Tar	No	Client ID: S01C - Tait Street Public School (Gravel Tar) [AS-PRE]	
						Cellulose	5
						Non-Fibers	95
1649410-28	29-Nov-16	sample homogenized	Black	4ply	Yes	Client ID: S01A - Tait Street Public School (4 Ply) [AS-PRE]	
						Chrysotile	0.64
						Cellulose	15
						Non-Fibers	84.36
1649410-29	29-Nov-16					Client ID: S01B - Tait Street Public School (4 Ply)	
						not analyzed	
1649410-30	29-Nov-16					Client ID: S01C - Tait Street Public School (4 Ply)	
						not analyzed	
1649410-31	29-Nov-16	sample homogenized	Black/Brown	Cellulose/Mastic	No	Client ID: S01A - Tait Street Public School (Cellulose Mastic) [AS-PRE, Z-01]	
						Cellulose	80
						Non-Fibers	20
1649410-32	29-Nov-16	sample homogenized	Black/Brown	Cellulose/Mastic	No	Client ID: S01B - Tait Street Public School (Cellulose Mastic) [AS-PRE, Z-01]	
						Cellulose	80
						Non-Fibers	20
1649410-33	29-Nov-16	sample homogenized	Black/Brown	Cellulose/Mastic	No	Client ID: S01C - Tait Street Public School (Cellulose Mastic) [AS-PRE, Z-01]	
						Cellulose	80
						Non-Fibers	20
1649410-34	29-Nov-16	sample homogenized	Black/Brown	Paper/Mastic	No	Client ID: S01A - Tait Street Public School (Paper Mastic) [AS-PRE, Z-01]	
						Cellulose	70
						Non-Fibers	30
1649410-35	29-Nov-16	sample homogenized	Black/Brown	Paper/Mastic	No	Client ID: S01B - Tait Street Public School (Paper Mastic) [AS-PRE, Z-01]	
						Cellulose	70
						Non-Fibers	30

Certificate of Analysis

Report Date: 06-Dec-2016

Client: MTE Consultants Inc. (Kitchener)

Order Date: 2-Dec-2016

Client PO:

Project Description: WRDSB Roof Inspection Sampling

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649410-36	29-Nov-16	sample homogenized	Black/Brown	Paper/Mastic	No	Client ID: S01C - Tait Street Public School (Paper Mastic) [AS-PRE, Z-01]	
						Cellulose	70
						Non-Fibers	30

**** Analytes in bold indicate asbestos mineral content.**

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code	*	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0		2-Dec-16

* Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

ASTrc: Trace asbestos was observed below the noted detection limit but could not be accurately quantified.

Z-01: Inseparable Layers

Work Order Revisions / Comments

Revision 1d - This report contains an updated sample list.

Client Name: MTE Consultants Inc	Project Reference: WRDSB Roof Inspection Sampling	Turnaround Time: ☐ Immediate ☐ 1 Day ☐ 4 Hour ☒ 2 Day ☐ 8 Hour ☐ 3 Day ☐ Regular Date Required: <u>FRIDAY END OF DAY</u>
Contact Name: Steven Nieboer	Quote #:	
Address: 520 Bingham Centre Drive, Kitchener, ON, N2B3X9	PO #:	
Telephone: 519-743-6500	Email Address: snieboer@mte85.com, adennett@mte85.com	

ASBESTOS & MOLD ANALYSIS

Matrix: ☐ Air ☐ Bulk ☐ Tape Lift ☐ Swab ☐ Other Regulatory Guideline: _____
Required Analyses: ☐ Microscopic Mold ☐ Culturable Mold ☐ Bacteria GRAM ☐ PCM ☐ PLM ☐ Chatfield ☐ TEM

Parcel Order Number: <u>1649410</u>		Asbestos - Bulk						
Sample ID	Sampling Date	Air Volume (L)	Analysis Required	Matrix Description	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **	
1 S01A - Sandowne Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Mastic on Paper	
2 S01B - Sandowne Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Mastic on Paper	
3 S01C - Sandowne Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Mastic on Paper	
4 S01A - Centennial Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Foam Mastic, Paper Mastic	
5 S01B - Centennial Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Foam Mastic, Paper Mastic	
6 S01C - Centennial Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Foam Mastic, Paper Mastic	
7 S01A - Stewart Avenue Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Cardboard Mastic, Paper Mastic	
8 S01B - Stewart Avenue Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Cardboard Mastic, Paper Mastic	
9 S01C - Stewart Avenue Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Cardboard Mastic, Paper Mastic	
10 S01A - Tait Street Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	See comment	
11 S01B - Tait Street Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	See comment	
12 S01C - Tait Street Public School	29-Nov	-	PLM	Roofing Materials	Y	Y	See comment	
13 S01A - <u>STANLEY PARK PUBLIC SCHOOL</u>	30-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Paper Mastic	
14 S01B - "	30-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Paper Mastic	
15 S01C - "	30-Nov	-	PLM	Roofing Materials	Y	Y	4Ply, Paper Mastic	

*Each layer will be analyzed and charged separately **Homogenize = All layers are blended into a single uniform sample.

Comments: Sample 10, 11, 12 layers are - Gravel Tar, 4Ply, Cellulose Mastic, Paper Mastic <u>Adjusted surcharge 1 Day Late via Parceltek</u>		Method of Delivery: <u>Parceltek</u>
Relinquished By (Sign): <u>[Signature]</u>	Received at Depot:	Received at Lab: <u>[Signature]</u>
Relinquished By (Print): Steven Nieboer	Date/Time: November 30, 2016	Verified By: <u>[Signature]</u> Date/Time: <u>Dec 2-16 9:20</u>

PROJECT INFORMATION

Inspection Date:	January 13, 2017	Report No.	001
Project Name:	Asbestos Air Monitoring		
Site Address:	Tait Street Public School – 184 Tait Street, Cambridge, ON		
Client:	Waterloo Region District School Board		
Contractor Supervisor:	Lou Lima		
OnPoint Inspector:	Sean Hauck		
Arrival Time:	4:15 pm	Departure Time:	7:55 pm
		No. of Workers:	n/a

DISTRIBUTION

Issued to:	Lou Lima	WRDSB	lou_lima@wrdsb.on.ca
	Daniela Budure	WRDSB	daniela_budure@wrdsb.on.ca
	Barry Kingsley	WRDSB	barry_kingsley@wrdsb.on.ca
	James Bond	WRDSB	james_bond@wrdsb.on.ca
	Cherree Roberts	WRDSB	cherree_roberts@wrdsb.on.ca
	Liz Torres	WRDSB	liz_torres@wrdsb.on.ca

WORK AREAS + DESCRIPTION OF WORK

Room 17 & adjacent Corridor (subject areas) OnPoint Environmental Solutions (OnPoint) was retained by the Waterloo Region District School Board (WRDSB) to perform air testing to document the airborne fibre levels (including asbestos) within the subject areas.

- **Air monitoring (ACCEPTABLE)**

METHODOLOGY & RESULTS

Room 17 & adjacent Corridor (subject areas)

Methodology

- OnPoint collected air samples for airborne fibre (including asbestos) analysis using 25mm Mixed Cellulose Ester (MCE) cassettes with 0.8 micrometer (µm) pore size and Allegro high volume sample pumps calibrated to a flow rate of approximately 15 litres per minute (L/min).
- All samples were analysed following the Phase Contrast Microscopy (PCM) method as specified in the NIOSH 7400 method. The PCM method does not allow discrimination between asbestos and non-asbestos fibres. All fibres that meet the counting criteria are included in the count. Using the fibre count data and the sampling volume, an estimate of the average airborne fibre concentration during the sampling period was made.

Results

- All air samples reported concentrations of total fibres to be less than 0.01 fibres per cubic centimetre (fibres/cc) of air. Ontario Regulation 490/09 Designated Substances prescribes an acceptable Time Weighted Average Exposure Value (TWAEV) for asbestos fibre of not more than 0.1 f/cc. The reported concentrations (<0.01 f/cc) indicate that airborne fibre (including asbestos) levels within the subject areas are

INSPECTION REPORT

well below the criterion noted above. One field blank was collected for quality control purposes. Analysis of the field blank showed 0 fibres per 100 fields counted.

- A photograph of the air monitoring equipment is provided below.

AIR MONITORING RESULTS – Phase Contrast Microscopy (PCM)*

Type	Sample No.	Sampling Location	Start Time	Stop Time	Flow Rate (L/min)	Duration (Minutes)	Air Volume (L)	Result (f/cc of air)
OC	249275	Room 17	4:30 pm	7:30 pm	15	180	2,700	< 0.01
OC	249255	Corridor adj. Room 17	4:40 pm	7:40 pm	15	180	2,700	< 0.01
QC	249256	Field Blank	N/A	N/A	N/A	N/A	N/A	0 fibres/100 fields

Notes:

OCCUPIED (OC)
QUALITY CONTROL (QC)

Area samples were collected in regularly occupied spaces (i.e. not within an asbestos abatement work area).

Field blank samples were collected in a manner representing the actual handling of associated samples in a sample set for quality control purposes.

f/cc
L/min

fibres per cubic centimeter of air
litres/minute

*

Air monitoring and analysis was performed following the NIOSH 7400 method using Phase Contrast Microscopy (PCM)

CONCLUSION

PCM analysis of the collected air samples confirmed airborne fibre concentrations (including asbestos) were within the acceptable range (i.e. below 0.1 fibres/ml of air). As such, the subject areas (Room 17 and the adjacent Corridor) are acceptable for continued occupancy.

PHOTOGRAPH



Photo 1: Air monitoring equipment, Room 17



11 Centennial Rd unit 5
Kitchener, ON, Canada.
N2B 3E9

Phone: (519) 498-0077
Fax: (519) 568 8426
E-mail: frank@asbestosmouldexperts.com

January 31, 2017

Attention: Environmental Officer - WRDSB

Re: Ceiling Tile Removal & Replacement

Location: Tait St. Public School – 184 Tait St., Cambridge

Area: Corridor MTE# 1007, 1024, 1029, & Partial 1060

Work Description:

Type 2 Abatement and disposal of Ceiling Tile, Replacement with Cortega Fireguard Acoustical Tile

All work done in accordance with Ont. Reg. 278/05

Completion Date: January 30, 2017 with 03 AAS and 07 AAW certified staff.

Disposal of Asbestos Waste: Erb St. Dumping & Disposal Unit Waterloo ON

License # 7549-9EZL TL

Regards,

**Frank Parronchi,
Owner/President
519 498-0077**

FPR INC.
ASBESTOS MOULD EXPERTS
www.asbestosmouldexperts.com



11 Centennial Rd unit 5
Kitchener, ON, Canada.
N2B 3E9

Phone: (519) 498-0077
Fax: (519) 568 8426
E-mail: frank@asbestosmouldexperts.com

March 21, 2017

Attention: Environmental Officer - WRDSB

Re: Ceiling Tile Removal & Replacement

Location: Tait St. Public School – 184 Tait St., Cambridge

Area: Classrooms MTE # 1000, 1001, 1002, 1013, 1014, 1015
- Pod Areas MTE # 1004, 1005, 1006, 1009, 1010, 1011

Work Description:

Type 2 Abatement and disposal of Ceiling Tile, Replacement with Cortega Fireguard Acoustical Tile

All work done in accordance with Ont. Reg. 278/05

Completion Date: March 17, 2017 with 03 AAS and 11 AAW certified staff.

Disposal of Asbestos Waste: Erb St. Dumping & Disposal Unit Waterloo ON

License # 7549-9EZL TL

Regards,

Frank Parronchi,
Owner/President
519 498-0077

FPR INC.
ASBESTOS MOULD EXPERTS
www.asbestosmouldexperts.com



11 Centennial Rd unit 5
Kitchener, ON, Canada.
N2B 3E9

Phone: (519) 498-0077
Fax: (519) 568 8426
E-mail: frank@asbestosmouldexperts.com

March 21, 2017

Attention: Environmental Officer - WRDSB

Re: Ceiling Tile Removal & Replacement

Location: Tait St. Public School – 184 Tait St., Cambridge

Area: Classrooms MTE # 1019, 1020, 1021, 1022, 1023

Work Description:

Type 2 Abatement and disposal of Ceiling Tile, Replacement with Cortega Fireguard Acoustical Tile

All work done in accordance with Ont. Reg. 278/05

Completion Date: March 17, 2017 with 03 AAS and 11 AAW certified staff.

Disposal of Asbestos Waste: Erb St. Dumping & Disposal Unit Waterloo ON

License # 7549-9EZL TL

Regards,

**Frank Parronchi,
Owner/President
519 498-0077**

November 3, 2021

OnPoint File: 100106.041ii

Waterloo Region District School Board
51 Ardelt Avenue
Kitchener, Ontario N2C 2R5

Attention: Jeff Cull, Environmental Officer

Re: Asbestos Bulk Sampling - Letter of Findings
Tait Street Public School, 184 Tait Street, Cambridge, Ontario

OnPoint Environmental Solutions Inc. (OnPoint) was retained by the Water Region District School Board (WRDSB / Client) to conduct bulk sampling of roofing materials for asbestos content at the above-noted school (subject building). The sampling was conducted on October 19, 2021 by Sean Hauck of OnPoint.

The purpose of the sampling was to determine if roofing materials contain asbestos in advance of scheduled sectional roof replacement.

The assessment was limited to Roofs R-B and R-D (subject roofs) as indicated in Drawing 1 provided in **Appendix A**. WRDSB reported the subject roofs were installed 1989/1990.



Photo 1: Roof R-B.



Photo 2: Roof R-D.

1.0 REGULATORY FRAMEWORK

Under Ontario Regulation 278/05 (O.Reg. 278/05) of the Occupational Health and Safety Act (OHSA), an asbestos-containing material (ACM) is defined as a material that contains 0.5 per cent or more asbestos by dry weight.

2.0 METHODOLGY

Roofing materials have been known to contain asbestos. The following common roofing materials may contain asbestos: felts; flashing; underlayment; roofing paper; vapour retardants; mastic; adhesives; caulking; coatings and sealants. Intrusive sampling of roofing materials was undertaken to test for asbestos content based on the ages of the roof systems. In accordance with the WRDSB scope of work for this project, only roofing materials installed prior to 1990 and caulking installed prior to 1995 were sampled and tested for asbestos.

Personnel from Tremco Roofing and Building Maintenance of Waterloo, Ontario conducted the intrusive sampling and the subsequent repair of the roof systems.

Bulk samples collected were submitted for analysis following EPA 600/R-93/116 test method. The samples were submitted to EMC Scientific Inc. (EMC), a NVLAP¹ accredited laboratory. Building materials identified to be non-asbestos are subject to the limitations of the analytical method used.

The number of bulk samples collected is based on the requirements of O.Reg. 278/05 (Table 1, Bulk Material Samples). The regulation specifies the minimum number of samples of a particular building material that should be collected and tested to consider a material non-asbestos-containing.

A “positive stop” option is used during the laboratory analysis of the bulk samples. The “positive stop” option involves consecutively testing a series of samples of a particular building material until test results indicate the presence of asbestos. When this occurs, the remaining samples are not tested. If none of the samples in a sample set test positive for asbestos, the building material under consideration is identified as non-asbestos.

Approximate locations where samples were collected are shown on Drawing 1 provided in **Appendix A**.

3.0 FINDINGS

The assessment involved a review of roofing materials suspected to contain asbestos. For ease of reference, each material assessed was assigned a unique “Building Component & Material” (BCM) number. A summary of all building components and materials that were assessed are provided in **Appendix B**. The summary includes the following information:

- BCM Reference #
- identification of each building component or material under review
- a description of the material
- whether the material is friable or not (based on the definition provided in the asbestos regulation)
- sample reference numbers and analytical results
- comments
- photographs depicting the material or building component

¹ National Voluntary Laboratory Accreditation Program

Where asbestos was confirmed to be present, the following additional details were provided for each building component or material:

- OnPoint Location ID Numbers (for cross reference with roof layout provided in **Appendix A**)
- location/area description
- approximate quantity
- condition
- damaged quantity (as a percentage of the total quantity)
- accessibility (i.e. criterion for how easily the asbestos-containing material can be accessed by building occupants, maintenance workers etc.)
- visibility (i.e. whether the building materials are hidden from view versus those that are visible without opening hatches or removing ceiling tiles)
- comments
- recommendations for the management of the particular building component or material

A summary of asbestos-containing materials is provided in **Appendix C**.

A copy of the laboratory Certificate of Analysis for asbestos testing is provided in **Appendix D**.

3.1 Asbestos-Containing Materials (Confirmed)

Asbestos was confirmed to be present in the following building materials:

- Brown caulking present at metal parapets, Roof R-D
- Black tar present at metal flashing and brick interface, Roofs R-B & R-D

3.2 Asbestos-Containing Materials (Presumed)

Asbestos is presumed to be present in the following building material:

- Grey caulking at metal flashing and brick interface, Roof R-D. Caulking and asbestos black tar cannot be safely separated, as such the materials must be treated as a composite.

Please refer to **Appendix B** and **Appendix C** for specific information on testing completed and associated recommendations.

4.0 CONCLUSIONS & RECOMMENDATIONS

Based on the findings of the assessment, the following conclusions and recommendations are provided:

- Asbestos caulking is present at metal parapets, Roof R-D.
- Asbestos tar is present at metal flashing and brick interface, Roofs R-B & R-D
- Grey caulking at metal flashing and brick interface of Roof R-D is presumed asbestos-containing.
- If asbestos caulking or tar will be removed/disturbed, remove following Type 1 procedures in accordance with Ontario Regulation 278/05 (using hand-held non-powered tools, wetting the material).
- Non-asbestos roofing materials are present elsewhere in areas examined.
- If additional concealed suspect materials are identified during the project, immediately stop work and test the suspect materials for asbestos content or presume the materials to be asbestos-containing. Materials presumed or confirmed to be asbestos-containing must be managed in accordance with the requirements of Ontario Regulation 278/05.

5.0 LIMITATIONS

The work performed by OnPoint is conducted by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time and geographic location the work is performed.

The findings of the assessment represent the best technical judgment of OnPoint based on the information made available by the Client and on the site conditions encountered by OnPoint at the date and time the work was performed. The findings are limited to the areas assessed based on the mutually agreed to scope of work. Asbestos-containing materials may be present in other areas of the building that were not assessed. The extent of the area that was assessed may be limited by various factors including building construction and conditions, subsurface conditions, concealed or obscured areas, weather, building usage, occupancy and other factors. Due to the nature of the investigation and the limited data available, OnPoint cannot warrant against undiscovered environmental liabilities. Conclusions presented in the report or other information provided should not be construed as legal advice.

No warranty is either expressed or implied, or intended by this agreement or by furnishing oral or written reports or findings. OnPoint's liability will be limited to the lesser of the fees paid or actual damages incurred by the Client. OnPoint will not be responsible for any consequential or indirect damages and can only be liable for damages resulting from the negligence of OnPoint.

6.0 CLOSURE

We trust this summary letter report is in accordance with your requirements. Should you have any questions or require clarification on any aspect of this submission please feel free to contact the undersigned.

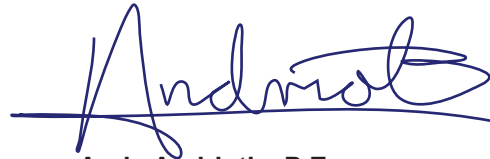
Yours truly,

ONPOINT ENVIRONMENTAL SOLUTIONS INC.



Sean Hauck, B.A., C.E.T.

Principal Consultant, Author
(519) 404-2886
shauck@onpointenvironmental.com



Andy Andriotis, P.Eng.

Principal Consultant, Reviewer
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aandriotis@onpointenvironmental.com

encl. **Appendix A** – Roof Layout

Appendix B – Building Components and Materials Assessed

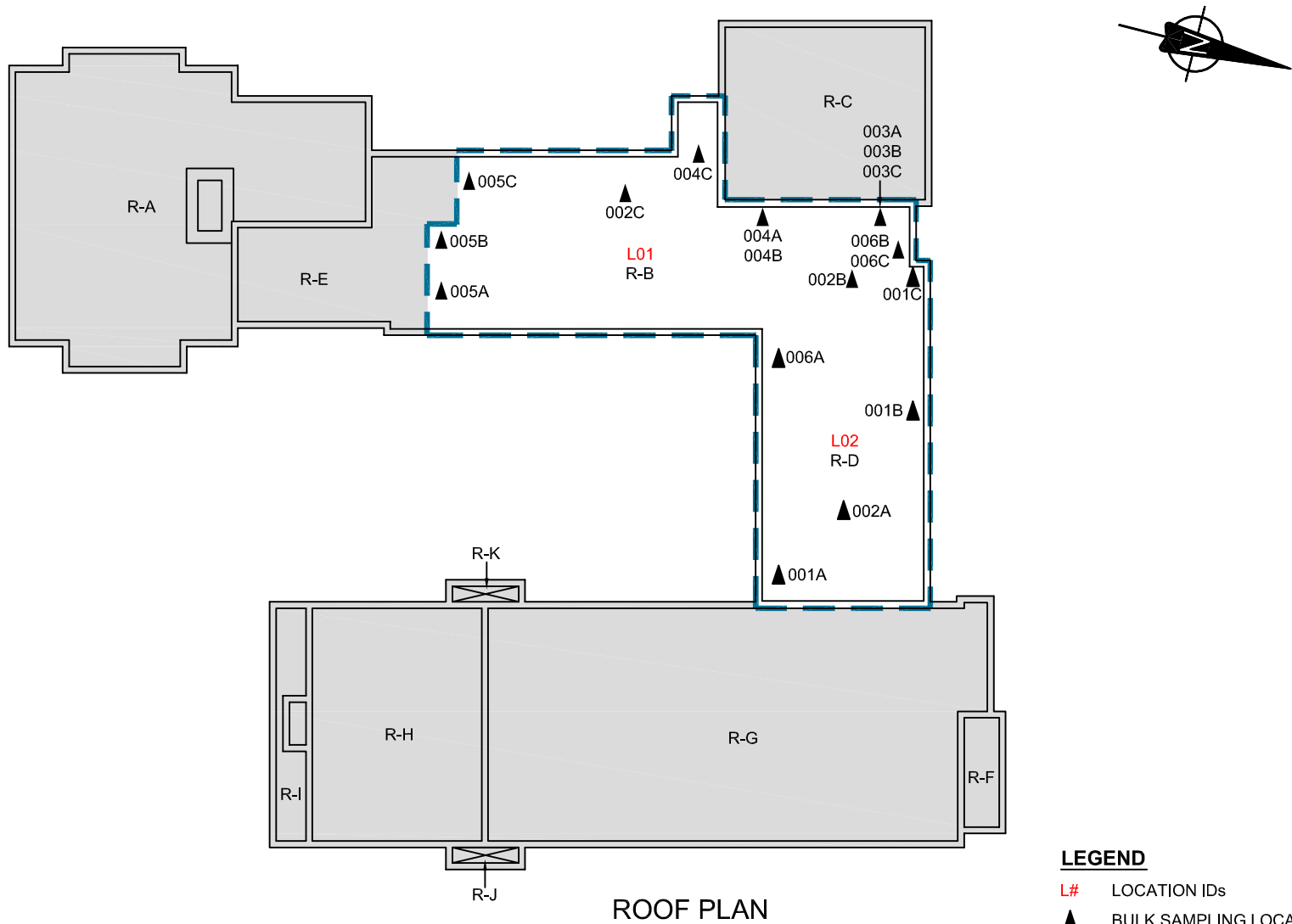
Appendix C – Summary of Asbestos-Containing Materials

Appendix D – Laboratory Analytical Report - Asbestos

[https://onpointes-my.sharepoint.com/personal/aandriotis_onpointenvironmental_com/Documents/OnPoint ES/Projects/100100/100106 WRDSB/041 RoofSamplingVarious2021/Sites/2- Tait PS/Report/100106.041ii Asbestos Sampling Rpt Tait PS Cambridge WRDSB Nov 3, 2021.docx](https://onpointes-my.sharepoint.com/personal/aandriotis_onpointenvironmental_com/Documents/OnPoint%20ES/Projects/100100/100106%20WRDSB/041%20RoofSamplingVarious2021/Sites/2-Tait%20PS/Report/100106.041ii%20Asbestos%20Sampling%20Rpt%20Tait%20PS%20Cambridge%20WRDSB%20Nov%203,%202021.docx)

APPENDIX A

Roof Layout



- NOTES:** 1. BROWN CAULKING AT METAL PARAPETS CONTAINS ASBESTOS, ROOF R-D.
2. BLACK CAULKING/TAR AT METAL FLASHING AND BRICK INTERFACE CONTAINS ASBESTOS, ROOFS R-B & R-D.
3. DRAWING CONTAINS COLOURED ELEMENTS THAT MAY NOT BE VISIBLE ON BLACK AND WHITE COPIES.
4. NOT ALL ASBESTOS-CONTAINING MATERIALS (ACM) MAY BE DEPICTED ON THE DRAWINGS. REFER TO THE REPORT FOR MORE INFORMATION.
5. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO AN ONPOINT ENVIRONMENTAL SOLUTIONS INC. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

ASBESTOS TESTING OF ROOFING MATERIALS TAIT STREET PUBLIC SCHOOL, 184 TAIT STREET, CAMBRIDGE, ONTARIO		Project No.:	100106.041II	Dwg. No.: 1	
		Scale:	N.T.S.		
		Date:	21/11/03		
		Dwn. By:	CD ^{OP2021110014} _{OK/CS}		
		App'd By:	SH		
Client:	WATERLOO REGION DISTRICT SCHOOL BOARD, 51 ARDELT AVENUE, KITCHENER, ONTARIO N2C 2R5				

APPENDIX B

Building Components and Materials Assessed

Building Component and Materials (BCM) Inventory

BCM # 1 CAULKING #1

Description: *Present on metal parapets, Roof R-D.*

Colour: *Brown*

Friable: No

Samples: 001a

Lab Result: *1% Chrysotile*

Comment: *Caulking tested contains asbestos.*



Summary of ACMs and PACMs

Location #	Area Description	Quantity	Condition	Damaged Qty.	Acc.	Vis.	Comments	Recommendation
L02	Roof R-D	~ 20 lf	good	0	A	Yes		Remove following O.Reg. 278/05 Type 1 operations (using hand-held non-powered tools, wetting the material).

Accessibility (Acc.)

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility (Vis.)

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted.

Notes:
nq - not quantified
na - not applicable
ns - not sampled
sf - square feet
lf - linear feet
F - friable
NF - non friable
PFM - potentially friable material
BCM - building component and material
ACM - asbestos-containing material
PACM - presumed asbestos-containing material

Building Component and Materials (BCM) Inventory

BCM # 2 CAULKING / TAR

Description: Present at metal flashing and brick interface, Roof R-D.

Colour: Grey black

Friable: No

Samples: 003a.b) (tar)
003a.a), 003b.a) & 003c.a) (caulking)

Lab Result: 3% Chrysotile (tar)
None detected (caulking)

Comment: Tar tested contains asbestos.
Caulking tested does not contain asbestos.



Summary of ACMs and PACMs

Location #	Area Description	Quantity	Condition	Damaged Qty.	Acc.	Vis.	Comments	Recommendation
L02	Roof R-D	~ 75 lf	good	0	A	Yes	Caulking and tar cannot be safely separated, as such the materials must be treated as a composite.	Remove following O.Reg. 278/05 Type 1 operations (using hand-held non-powered tools, wetting the material).

Accessibility (Acc.)

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility (Vis.)

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted.

Notes:
nq - not quantified
na - not applicable
ns - not sampled
sf - square feet
lf - linear feet
F - friable
NF - non friable
PFM - potentially friable material
BCM - building component and material
ACM - asbestos-containing material
PACM - presumed asbestos-containing material

Building Component and Materials (BCM) Inventory

BCM # 3 TAR #1

Description: *Present at metal flashing and brick interface, Roof R-B.*

Colour: *Black*

Friable: na

Samples: 004a

Lab Result: *1% Chrysotile*

Comment: *Tar tested contains asbestos.*



Summary of ACMs and PACMs

Location #	Area Description	Quantity	Condition	Damaged Qty.	Acc.	Vis.	Comments	Recommendation
L01	Roof R-B	~ 25 lf	good	0	A	Yes		Remove following O.Reg. 278/05 Type 1 operations (using hand-held non-powered tools, wetting the material).

Accessibility (Acc.)

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility (Vis.)

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted.

Notes:
nq - not quantified
na - not applicable
ns - not sampled
sf - square feet
lf - linear feet
F - friable
NF - non friable
PFM - potentially friable material
BCM - building component and material
ACM - asbestos-containing material
PACM - presumed asbestos-containing material

Building Component and Materials (BCM) Inventory

BCM # 4 ROOFING MATERIALS

Description: *Roofs R-B and R-D.*

Colour: *Black*

Friable: na

Samples: *002a to c*

Lab Result: *None detected*

Comment: *Roofing materials (tar with fibres)
tested do not contain asbestos.*

Summary of ACMs and PACMs

Location #	Area Description	Quantity	Condition	Damaged Qty.	Acc.	Vis.	Comments	Recommendation
								No action required.

Accessibility (Acc.)

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility (Vis.)

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted.

Notes:
nq - not quantified
na - not applicable
ns - not sampled
sf - square feet
lf - linear feet
F - friable
NF - non friable
PFM - potentially friable material
BCM - building component and material
ACM - asbestos-containing material
PACM - presumed asbestos-containing material

Building Component and Materials (BCM) Inventory

BCM # 5 TAR #2

Description: *Present at interface between Roofs R-B and R-E.*

Colour: *Black*

Friable: na

Samples: *005a to c*

Lab Result: *None detected*

Comment: *Tar tested does not contain asbestos.*

Summary of ACMs and PACMs

Location #	Area Description	Quantity	Condition	Damaged Qty.	Acc.	Vis.	Comments	Recommendation
								No action required.

Accessibility (Acc.)

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility (Vis.)

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted.

Notes:
nq - not quantified
na - not applicable
ns - not sampled
sf - square feet
lf - linear feet
F - friable
NF - non friable
PFM - potentially friable material
BCM - building component and material
ACM - asbestos-containing material
PACM - presumed asbestos-containing material

Building Component and Materials (BCM) Inventory

BCM # 6 CAULKING #2

Description: *Present on pipe penetrations, Roof R-D.*

Colour: *Brown*

Friable: na

Samples: 006a to c

Lab Result: *None detected*

Comment: *Caulking tested does not contain asbestos.*



Summary of ACMs and PACMs

Location #	Area Description	Quantity	Condition	Damaged Qty.	Acc.	Vis.	Comments	Recommendation
								No action required.

Accessibility (Acc.)

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility (Vis.)

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted.

Notes:
nq - not quantified
na - not applicable
ns - not sampled
sf - square feet
lf - linear feet
F - friable
NF - non friable
PFM - potentially friable material
BCM - building component and material
ACM - asbestos-containing material
PACM - presumed asbestos-containing material

APPENDIX C

Summary of Asbestos-Containing Materials

Summary of Asbestos-Containing and Presumed Asbestos-Containing Materials

Loc. #	Loc. Description	BCM #	ACM Type	ACM Description	ACM Colour	Total Quantity	Cond.	Damaged Quantity	Acc.	Vis.	Fri?	Comments	Recommendation
L01	Roof R-B	3	Tar #1	Present at metal flashing and brick interface, Roof R-B.	Black	~ 25 lf	good	0	A	Yes	na	Tar tested contains asbestos.	Remove following O.Reg. 278/05 Type 1 operations (using hand-held non-powered tools, wetting the material).
L02	Roof R-D	1	Caulking #1	Present on metal parapets, Roof R-D.	Brown	~ 20 lf	good	0	A	Yes	No	Caulking tested contains asbestos.	Remove following O.Reg. 278/05 Type 1 operations (using hand-held non-powered tools, wetting the material).
L02	Roof R-D	2	Caulking / Tar	Present at metal flashing and brick interface, Roof R-D.	Grey black	~ 75 lf	good	0	A	Yes	No	Tar tested contains asbestos. Caulking tested does not contain asbestos.	Remove following O.Reg. 278/05 Type 1 operations (using hand-held non-powered tools, wetting the material).

Accessibility

A - Areas of the building within reach (from floor level) of all building users
 B - Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder
 C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
 D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility

Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
 No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted.

Notes:
 nq - not quantified
 na - not applicable
 ns - not sampled
 F - friable
 NF - non friable
 PFM - potentially friable material
 ACM - asbestos-containing material
 BCM - building component and material
 Acc. - accessibility
 Vis. - visibility

APPENDIX D

Laboratory Analytical Report - Asbestos

Laboratory Analysis Report

To:

Sean Hauck
OnPoint Environmental Solutions
775 Lucerne Avenue
Waterloo, Ontario
N2T 2Y3

EMC LAB REPORT NUMBER: A73703r*

Job/Project Name: Tait P.S.

Analysis Method: Polarized Light Microscopy – EPA 600

Date Received: Oct 21/21

Date Analyzed: Oct 28/21

Analyst: Jayoda Perera

Reviewed By: Malgorzata Sybydlo, *Laboratory Manager*

Job No: 100106.041ii

Number of Samples: 18

Date Reported: Oct 28/21

Client's Sample ID	Lab Sample No.	Description/Location	Sample Appearance	SAMPLE COMPONENTS (%)			
				Asbestos Fibres		Non-asbestos Fibres	Non-fibrous Material
001a	A73703-1	Caulking at parapet / Roof R-D	Brown, caulking	Chrysotile	1		99
001b	A73703-2	Caulking at parapet / Roof R-D	NA	NA			
001c	A73703-3	Caulking at parapet / Roof R-D	NA	NA			
002a	A73703-4	Roofing materials / Roof R-D	Black, tar with fibres	ND		20	80
002b	A73703-5	Roofing materials / Roof R-D	Black, tar with fibres	ND		20	80
002c	A73703-6	Roofing materials / Roof R-B	Black, tar with fibres	ND		20	80
003a	A73703-7	Caulking at metal flashing and brick interface / Roof R-D	2 Phases: a) Grey, caulking b) Black, tar	ND Chrysotile	3		100 97
003b	A73703-8	Caulking at metal flashing and brick interface / Roof R-D	2 Phases: a) Grey, caulking b) NA	ND NA			100
003c	A73703-9	Caulking at metal flashing and brick interface / Roof R-D	2 Phases: a) Grey, caulking b) NA	ND NA			100
004a	A73703-10	Black tar at metal flashing and brick interface / Roof R-D	Black, tar	Chrysotile	1		99
004b	A73703-11	Black tar at metal flashing and brick	NA	NA			

EMC Scientific Inc. 5800 Ambler Drive • Suite 100 • Mississauga • Ontario • L4W 4J4 • T. 905 629 9247 • F. 905 629 2607

EMC Scientific Inc. is Accredited by NVLAP (NVLAP Code 201020-0) for Bulk Asbestos Analysis

EMC LAB REPORT NUMBER: A73703r*

Client's Job/Project Name/No.: 100106.041ii

Analyst: Jayoda Perera

Client's Sample ID	Lab Sample No.	Description/Location	Sample Appearance	SAMPLE COMPONENTS (%)			
				Asbestos Fibres		Non-asbestos Fibres	Non-fibrous Material
		interface/ Roof R-D					
004c	A73703-12	Black tar at metal flashing and brick interface/ Roof R-B	NA	NA			
005a	A73703-13	Tar/ Roof R-B	Black, tar	ND		2	98
005b	A73703-14	Tar/ Roof R-B	Black, tar	ND		2	98
005c	A73703-15	Tar/ Roof R-B	Black, tar	ND		2	98
006a	A73703-16	Caulking at pipe penetrations / Roof R-D	Brown, caulking	ND			100
006b	A73703-17	Caulking at pipe penetrations / Roof R-D	Brown, caulking	ND			100
006c	A73703-18	Caulking at pipe penetrations / Roof R-D	Brown, caulking	ND			100

Note:

1. Bulk samples are analyzed using Polarized Light Microscopy (PLM) and dispersion staining techniques. The analytical procedures are in accordance with EPA 600/R-93/116 method.
 2. The results are only related to the samples analyzed. **ND** = None Detected (no asbestos fibres were observed), **NA** = Not Analyzed (analysis stopped due to a previous positive result).
 3. This report may not be reproduced, except in full without the written approval of EMC Scientific Inc. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
 4. The Ontario Regulatory Threshold for asbestos is 0.5%. The limit of quantification (LOQ) is 0.5%.
- * This report has been revised as requested on November 2, 2021.

SECTION 01 42 00 – REFERENCES

1.0 GENERAL

1.1. SECTION INCLUDES

- .1 References and standards.
- .2 Standards producing industry organizations and their addresses.

1.2. RELATED SECTIONS

- .1 Section 01 61 00 – Product Requirements.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3. REFERENCES

- .1 For Products or quality specified by association, trade, or other references or consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- .2 Conform to reference standard by Ontario Building Code except where a specific date is established or required by code.
- .3 Obtain copies of standards where required by product specification sections.
- .4 Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Consultant shall be altered from the Contract Documents by mention or inference otherwise, in any reference document.

1.4. STANDARDS

- .1 The following associations and organizations are cited in specification sections. Acronym, name, address, and Internet URL addresses are as follows:
- .2 Canadian Organizations:
 - .1 **ACEC** - Association of Consulting Engineers of Canada, 130 Albert Street, Suite 616, Ottawa, ON K1P 5G4; URL: <http://www.acec.ca>.
 - .2 **AWMAC** - Architectural Woodwork Manufacturers Association of Canada, 516-4 Street West, High River, AB T1V 1B6; URL: <http://www.awmac.com>.
 - .3 **Canada Green Building Council**, 330 - 55 rue Murray Street, Ottawa, ON. K1N5M3; Tel: 613-241-1184, Fax: 613-241-5750; URL: <http://www.cagbc.org>.

- .4 **CCA** - Canadian Construction Association, 75 Albert St., Suite 400, Ottawa, ON K1P 5E7; URL: <http://www.cca-acc.com>.
- .5 **CCDC** – Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC; URL: <http://www.CCDC.org>.
- .6 **CGA** - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, ON M4R 1K8; URL: <http://www.cga.ca..>
- .7 **CGSB** - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, QC K1A 0S5; URL: <http://w3.pwgsc.gc.ca/cgsb>.
- .8 **CISC** - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, ON M2J 4G8; URL: <http://www.cisc-icca.ca>.
- .9 **CLA** - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, ON K1N 8C7; URL: <http://www.cla-ca.ca>.
- .10 **CNLA** - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, ON L9T 2X8; URL: <http://www.canadanursery.com>.
- .11 **CRCA** - Canadian Roofing Contractors Association, 155 Queen Street, Suite 1300, Ottawa, ON K1P 6L1; URL: <http://www.roofingcanada.com>.
- .12 **CSA** - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, ON M9W 1R3; URL: <http://www.csa-international.org>.
- .13 **CSC** - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, ON M5A 4K2; URL: <http://www.csc-dcc.ca>.
- .14 **CSDMA** - Canadian Steel Door Manufacturers Association, One Yonge Street, Suite 1801, Toronto, ON M5E 1W7; URL: <http://www.csdma.org>.
- .15 **CSPI** - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, ON N3H 4V6; URL: <http://www.cspi.ca>.
- .16 **CSSBI** - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, ON N3H 4V6; URL: <http://www.cssbi.ca>.
- .17 **CUFCA** - Canadian Urethane Foam Contractor's Association, Box 3214, Winnipeg, MB R3C 4E7; URL: <http://www.cufca.ca>.
- .18 **CWC** - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, ON K1J 9B8; URL: <http://www.cwc.ca>.
- .19 **EC** - Environment Canada, Conservation and Protection, Inquiry Centre, 351 St. Joseph Blvd, Hull, QC K1A 0H3; URL: <http://www.ec.gc.ca>.
- .20 **EFC** - Electro Federation of Canada, 5800 Explorer Drive, Suite 200, Mississauga, ON L4W 5K9; URL: <http://www.electrofed.com>.

- .21 **MPI** - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6; URL: <http://www.paintinfo.com>.
- .22 **NABA** - National Air Barrier Association, PO Box 2747, Winnipeg, MB R3C 4E7; URL: <http://www.naba.ca>.
- .23 **NLGA** - National Lumber Grades Authority, 406-First Capital Place, 960 Quayside Drive, New Westminster, BC V3M 6G2; URL: <http://www.nlga.org>.
- .24 **NRC** - National Research Council, Building M-58, 1200 Montreal Road, Ottawa, ON K1A 0R6; URL: <http://www.nrc.gc.ca>.
- .25 **QPL** - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, QC K1A 1G6; URL: <http://www.pwgsc.gc.ca/cgsb>.
- .26 **RAIC** - Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, ON K1N 5M3; URL: <http://www.raic.org>.
- .27 **SCC** - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, ON K1P 6N7; URL: <http://www.scc.ca>.
- .28 **TTMAC** - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, ON L4K 3E8; URL: <http://www.ttmac.com>.
- .29 **ULC** - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, ON M1R 3A9; URL: <http://www.ulc.ca>.
- .3 USA Organizations:
 - .1 **AA** - Aluminum Association, 900 19th Street N.W., Washington, DC 20006; URL: <http://www.aluminum.org>.
 - .2 **AASHTO** - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, DC 20001; URL: <http://www.aashto.org>.
 - .3 **AHA** - American Hardboard Association, 1210W Northwest Hwy, Palatine, IL 60067; URL: <http://www.hardboard.org>.
 - .4 **AITC** - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, CO 80112; URL: <http://www.aitc-glulam.org>.
 - .5 **AMCA** - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, IL 60004-1893; URL: <http://www.amca.org>.
 - .6 **ANSI** - American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036; URL: <http://www.ansi.org>.
 - .7 **APA** - The Engineered Wood Association, P.O. Box 11700, Tacoma, WA 98411-0700; URL: <http://www.apawood.org>.
 - .8 **API** - American Petroleum Institute, 1220 L St. Northwest, Washington, DC 20005-4070; URL: <http://www.api.org>.

- .9 **ARI** - Air Conditioning and Refrigeration Institute, 4100 N Fairfax Drive, Suite 200, Arlington, VA 22203; URL: <http://www.ari.org>.
- .10 **ASHRAE** - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, GA 30329; URL: <http://www.ashrae.org>.
- .11 **ASME** - American Society of Mechanical Engineers, ASME Headquarters, 3 Park Avenue, New York, NY 10016-5990; URL: <http://www.asme.org>.
- .12 **ASTM International**, 100 Barr Harbor Drive West, Conshohocken, PA 19428-2959; URL: <http://www.astm.org>.
- .13 **AWCI** - Association of the Wall and Ceiling Industries International, 803 West Broad Street, Suite 600 , Falls Church, VA 22046; URL: <http://www.awci.org>.
- .14 **AWPA** - American Wire Producer's Association, 801 N Fairfax Street, Suite 211, Alexandria, VA 22314-1757; URL: <http://www.awpa.org>.
- .15 **AWPA** - American Wood Preservers' Association, P.O. Box 5690, Granbury TX 76049-0690; URL: <http://www.awpa.com>
- .16 **AWS** - American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; URL: <http://www.amweld.org>.
- .17 **AWWA** - American Water Works Association, 6666 W. Quincy Avenue, Denver, CO 80235; URL: <http://www.awwa.org>.
- .18 **EIMA** - EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, GA 30260; URL: <http://www.eima.com>.
- .19 **ISAP** - International Society for Asphalt Paving, 400 Selby Avenue, Suite 1, St. Paul, MN 55102; URL: <http://www.asphalt.org>.
- .20 **IEEE** - Institute of Electrical and Electronics Engineers, IEE Corporate Office, 3 Park Avenue, 17th Floor, New York, NY 10016-5997; URL: <http://www.ieee.org>
- .21 **MSS** - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, VA 22180-4602; URL: <http://www.mss-hq.com>.
- .22 **NAAMM** - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, IL 60603; URL: <http://www.naamm.org>.
- .23 **NEMA** - National Electrical Manufacturers Association, 1300 N 17th Street, Suite 1847, Rosslyn, VA 22209; URL: <http://www.nema.org>.
- .24 **NFPA** - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101 Quincy, MA 02269-9101; URL: <http://www.nfpa.org>.

- .25 **NFSA** - National Fire Sprinkler Association, P.O. Box 1000, Patterson, NY 12563; URL: <http://www.nfsa.org>.
- .26 **NHLA** - National Hardwood Lumber Association, 6830 Raleigh-La Grange Road, Memphis, TN 38184-0518; URL: <http://www.natlhardwood.org>.
- .27 **NSPE** - National Society of Professional Engineers, 1420 King Street, Alexandria, VA 22314-2794; URL: <http://www.nspe.org>.
- .28 **PCI** - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, IL 60606-6938; URL: <http://www.pci.org>.
- .29 **PEI** - Porcelain Enamel Institute, PO Box 920220, Norcross, GA 30010; URL: <http://www.porecelainenamel.com>.
- .30 **SSPC** - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656; URL: <http://www.sspc.org>.
- .31 **TPI** - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI 53719; URL: <http://www.tpinst.org>.
- .32 **UL** - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096; URL: <http://www.ul.com>.

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SECTION 01 45 00 – QUALITY CONTROL

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Section 01 21 00 - Allowances.
- .2 Section 01 78 10 – Closeout Submittals and Requirements
- .3 Section 01 79 00 – Demonstration and Training
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. REFERENCES

- .1 **ISO/IEC 17025-2005** - General Requirements for the Competence of Testing and Calibration Laboratories.
- .2 **SCC** (Standards Council of Canada).

1.3. INSPECTION BY AUTHORITY

- .1 Allow Authorities Having Jurisdiction access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.
- .3 If 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.

1.4. REVIEW BY CONSULTANT

- .1 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.
- .2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.
- .3 If such Work is found in accordance with Contract Documents, The owner will pay cost of review and replacement.

1.5. INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection and Testing Agencies will be engaged by Contractor for purpose of inspecting and testing portions of Work.
- .2 The Board may, at their discretion, request that the Consultant direct the Contractor to engage independent inspecting and or testing agencies to review or test the Work.
- .3 Allocate Costs for inspections and testing to Section 01 21 00.
- .4 Provide equipment required for executing inspection and testing by appointed agencies.
- .5 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .6 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Contractor shall pay costs directly to the inspection agency for retesting and re-inspection.

1.6. ACCESS TO WORK

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

1.7. CONTRACTOR RESPONSIBILITIES

- .1 Notify appropriate agency minimum 48 hours in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.8. DUTIES & AUTHORITY OF TESTING AGENCY

- .1 Testing agency is expected to do the following:
 - .1 Act in a professional and unprejudiced basis and carry out inspection and testing functions to establish compliance with requirements of Contract Documents.
 - .2 Check work as it progresses and prepare reports stating results of tests and conditions of work and state in each report whether specimens

tested conform to requirements of Contract Documents, specifically noting deviations.

- .3 Distribute reports as follows
 - .1 Consultant
 - .2 Owner
 - .3 Contractor
- .2 Testing agency is not authorized to amend or release any requirements of Contract Documents, nor to approve or accept any portion of work.

1.9. REJECTED WORK

- .1 The Contractor shall remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the Owner may choose to accept the condition. The difference in value between Work performed and that called for by Contract Documents shall be deducted from the Contract value via Change Order. The amount of this change shall be determined by Consultant. The Contractor shall warrant the work performed for the time period specified as if it were performed in accordance with the Contract Documents.

1.10. INSPECTION OF STRUCTURAL STEEL

- .1 Ensure all steel has mill test reports that comply with the Specification prior to purchase.
- .2 Inspect fabrication of steel in plant.
- .3 Inspect erection work at site including fit-up, placing, plumbing, levelling, temporary bracing, field cutting and alterations.
- .4 Shop and field inspect welded and bolted connections and painting.
- .5 High strength bolts - the installation and testing of bolts shall conform to the requirements of CSA S16-1969. Check one representative connection in ten by torque testing every bolt, and check each bolt in every connection with a tap of hammer for soundness. Enforce requirements of connection type.
- .6 Examine visually all welded joints for inclusions, porosity, lack of fusion penetration or even contour, undercuts and cracks. Root passes shall be

checked for penetration and cracks from the back of the joint. Any suspect welds shall be checked ultrasonically.

1.11. BUILDING THERMOGRAPHIC SCAN

- .1 Upon completion of the Work, the Consultant and/or Owner may arrange for an independent agency to carry out a thermographic scan of the building to determine acceptability of thermal performance of the building envelope.
- .2 Consultant, prior to start of construction work, will designate a sample area of the building to include a portion of exterior wall and roof.
- .3 Consultant will implement a special inspection program for this sample area to be carried out as construction progresses. Contractor shall not cover any completed work until notifying Consultant and receiving acceptance of completed work. Contractor shall remove and replace any work which is installed in contravention of this requirement.
- .4 Results of thermographic scan of entire building will be evaluated and compared to those of the sample area to determine acceptance or rejection of any part of the building envelope.
- .5 Contractor shall carry out remedial work as required to bring quality of any rejected portion of the building envelope to that of the sample area. Contractor shall pay for costs of any follow-up thermographic scans required to determine acceptability of remedial work. This procedure shall be repeated until all parts of the building envelope have been accepted.

1.12. TESTS AND MIX DESIGNS

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

1.13. MOCK-UP

- .1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Prepare mock-ups for Consultants review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .3 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.
- .4 If requested, Consultant will assist in preparing a schedule fixing dates for preparation.

- .5 Remove mock-up at conclusion of Work or when acceptable to Consultant.
Repair any damage and clean-up at place of mock-up.
- .6 Approved mock-up may remain as part of Work.

1.14. EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical and electrical systems to the consultant.
- .2 Refer to Sections 01.78.10 and 01.79.00 for definitive requirements.

END OF SECTION

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SECTION 01 51 00 – TEMPORARY UTILITIES

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.
- .2 Section 01 53 00 - Temporary Construction.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Location of temporary facilities shall be subject to Consultant's approval.
- .3 Salvage and assist in recycling products for potential reuse wherever possible.
- .4 Remove temporary facilities from site when directed by consultant.

1.3. WATER SUPPLY

- .1 Provide continuous supply of potable water for construction use until such time as permanent municipal water supply is available.
- .2 Hose extensions to be provided by subcontractors requiring them.
- .3 For New Builds arrange for connection with appropriate utility company and pay all costs for installation, maintenance, removal and usage costs until occupancy has been achieved.
- .4 For Additions and renovations the contractor can use existing Board service unless noted otherwise.

1.4. TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including unit rental costs, maintenance.
- .2 Provide temporary heating fuel, if not already available on site, until such time as a permanent natural gas line is installed, and thereafter fuel costs shall be borne by the Board. The Contractor shall provide all connections and piping between the permanent fuel source and the heating appliance(s).
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.

- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum:
 - .1 10 degrees C in areas where construction is in progress, until takeover by Board. Contractor to ensure temporary enclosures remain sealed and penetrations are repaired or closed in a timely fashion.
 - .2 16 degrees C in areas where finishes are in progress.
 - .3 16 degrees C in building once it is enclosed.
 - .4 Refer to other Sections for intermittent heating requirements up to 21 degrees C. Provide insulated tarp enclosures for openings as required to enclose the building after completion of main building shell components and roof.
 - .5 If the Contractor fails to ensure the temporary enclosures remained sealed (including temp doors when not in use) the Consultant and or the Board shall require the contractor to pay 40% of that months usage charge
- .5 Use forced hot air heaters. Open-flame type heaters or salamanders are not permitted. Ventilate direct fired heating units to the outside.
- .6 Uniformly distribute heat to avoid hot and cold areas and to prevent excessive drying.
- .7 Early heating of the building shell will be required to expedite interior finishing to meet the project schedule.
- .8 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
 - .7 Provide minimum 1 air change per hour for enclosed areas receiving architectural finishes.
 - .8 Do not allow excessive build-up of moisture inside building.

- .9 The permanent mechanical systems for the new building, when installed in safe operating conditions, may be used for temporary heating or cooling if approved in writing by the Consultant, without penalty to the warranty.
- .10 Follow the requirements of "Temporary Use of New Permanent Services and Equipment" if the permanent heating system installed under the contract is intended to be used for temporary heating during the construction.
- .11 Provide competent persons to operate and maintain permanent systems for duration of temporary use period.
- .12 Perform required repairs and maintenance immediately after each inspection. Pay for operating costs. Upon termination of temporary use period, services and equipment shall be inspected, tested, adjusted, fitters replaced, balanced, cleaned and lubricated.
- .13 Permanent services and equipment shall be turned over to Owner in new and perfect operating condition.
- .14 Use of permanent systems and equipment as temporary facilities shall not affect the guarantee conditions and guarantee period for such systems and equipment. Make due allowance to ensure Owner will receive full benefits of equipment manufacturer's warranty from the date of Substantial Performance.
- .15 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.
- .16 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.
- .17 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.5. TEMPORARY POWER AND LIGHT

- .1 Provide temporary electrical service and system including lighting and power system for use by all Sections.
- .2 Contractor will provide a source for, and pay the costs of temporary power during construction for temporary lighting and operating of power tools until such time as permanent source is available.

- .3 Contractor to ensure that the use of power from a source provided by the Board shall not exceed the capacity of the current use required for the operation of any existing facility.
- .4 Install and maintain temporary electrical service and systems in accordance with Construction Safety Association's "Temporary Wiring Standards on Construction Sites", the Ontario Electrical Code and other authorities having jurisdiction.
- .5 Provide at least one temporary panel on each floor with service capacity suitable for construction requirements and to authorities and utilities approval.
- .6 Provide temporary wiring with lighting to all areas of each floor to provide adequate lighting.
 - .1 Lighting levels must be maintained at a minimum of 10 foot candles, or to suit the particular location or operation, whichever is greater.
 - .2 Do not use materials of the temporary service in permanent installation.
 - .3 Increase lighting levels equivalent to the final requirements when finishing operations are underway.
- .7 Extension cords, lights, etc., required by various subcontractors and run from above outlet positions will be supplied and maintained by the party or parties requiring same.
- .8 Follow requirements of "Temporary Use of New Permanent Services and Equipment" if electrical power and lighting systems installed under the contract are intended to be used for temporary electricity and lighting during the construction.
- .9 Electrical power and lighting systems installed under this contract can be used for construction provided damages are made good and all lamps that have been used for more than two months are replaced with new lamps.
- .10 For New Builds arrange for connection with appropriate utility company and pay all costs for installation, maintenance, removal and usage costs until occupancy has been achieved.
- .11 For Additions and renovations the contractor can use existing Board service unless noted otherwise.
- .12 Provide and pay for temporary power for electric cranes and other equipment requiring temporary power in excess of above noted requirements.

1.6. TEMPORARY COMMUNICATION FACILITIES

- .1 Contractor to provide and pay for temporary Phone, e-mail and printer hook up, for the duration of contract until completion for use by the contractor.
- .2 The site superintendent is to have e-mail access and a printer on site.

END OF SECTION

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SECTION 01 53 00 – TEMPORARY CONSTRUCTION FACILITIES

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 Section 01 35 23 – Health and Safety
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. INSTALLATION AND REMOVAL

- .1 Provide temporary construction facilities in order to execute work expeditiously.
- .2 Remove temporary facilities from site when directed by Consultant.

1.3. 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.

1.4. PROTECTION OF SURROUNDING WORK

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

1.5. ROOF AND STRUCTURE PROTECTION

- .1 Ensure no part of Work or existing structures are subjected to a load, which will endanger its safety or will cause permanent deformation.
- .2 The Contractor when indicated by the Board Contact or Consultant shall provide roof protection. Ensure all precautions are taken to avoid liability for roof damage.
- .3 Typical roof protection shall consist of a layer of 1inch rigid foam insulation set directly on the roof surface and a layer of 19 mm (3/4 inch) plywood in all places under scaffold legs, ladder legs and in areas of foot traffic or falling debris.

1.6. WORK SITE ENCLOSURE & SAFETY BARRIERS

- .1 Erect and maintain for the duration of the work:

- .1 a minimum 1800 mm high chain link fence or self-supporting, heavy duty, interconnected fence panels (commonly referred to as Insta-fence) for a temporary site enclosure (hoarding) completely around perimeter of work site,
- .2 any temporary posts shall be completely removed by the contractor prior to occupancy,
- .3 under no circumstance shall t-bar posts be used on board property
- .4 any additional safety devices including full hoarding as required and noted on the drawings, to protect the students, staff, public and private property from injury and damage,
- .5 any additional requirements as regulated by authorities having jurisdiction, local by-laws and zoning.
- .2 The Contractor is to assume full responsibility for any injury or damage caused due to failure to comply with Paragraph 1 above.
- .3 Any hazardous conditions identified outside of the main fenced area will be barricaded with a fence complying to the above.
- .4 Provide lockable truck entrance gate/gates and at least one (1) pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys with restricted availability, in the project office.
- .5 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
- .6 Provide barriers around trees and plants designated to remain.
- .7 Protect from damage by equipment and construction procedures.

1.7. TREE PROTECTION

- .1 Protect all existing trees to remain from damage during construction period. Make good, at Contractor's expense, trees damaged during construction.
- .2 Confine movement of heavy equipment, storage of same, and storage of materials to a predetermined area. Do not store materials or place equipment over root systems of any existing trees to remain.
- .3 Install fencing or approved equal at limits of drip line of existing trees to remain unless directed otherwise. Where this case is not practical, and only if approved by the Consultant, the trunks shall be protected with an approved tree guard.
- .4 No rigging cables shall be wrapped around or installed in trees. Do not flush concrete trucks or cement mixing machines over root systems or near trees. Flush concrete trucks or cement mixing machines in areas approved by Consultant.

- .5 Areas where root systems of trees are exposed directly adjacent to a structure will be backfilled with good loam only.
- .6 Whenever excavating is required within branch spread of trees that are to remain, the contractor shall contact the consultant for direction prior to the start of work.
- .7 If any existing tree to remain is injured and does not survive the following year, it will, as determined by the Board, be removed in its entirety and be replaced with a tree of similar size and value, as directed by the Consultant.
- .8 Should the destroyed tree be of such a size or shape that it cannot be feasibly replaced, the Contractor shall compensate the Owner for the minimum sum of five thousand dollars (\$5,000.00) per destroyed tree.

1.8. GUARD RAILS AND BARRIERS

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Erect and maintain for the duration of the Work, safety devices and barricades including hoarding, as required, to protect the staff, students, public and private property, from injury and damage.
- .3 The Contractor is to ensure that all requirements from authorities having jurisdiction and all requirements from the Owner are met.
- .4 The Contractor is to assume full responsibility for any damage caused due to his failure to comply with paragraph 2 above.
- .5 Hazardous conditions on the exterior shall be fenced.

1.9. WEATHER ENCLOSURES

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

1.10. DUST TIGHT BARRIERS

- .1 Provide dust tight barriers and screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.
- .3 Where required adjust air handling units to eliminate migration of dust.

1.11. SCAFFOLDING

- .1 Erect scaffolding independent of walls and use in such a manner limiting interference with other work. When not in use, move scaffolding as necessary to permit installation of other work. Construct and maintain scaffolding in a rigid, secure and safe manner. Remove it promptly when no longer required. Protect surface on which scaffolding is bearing.

1.12. SHORING, BRACING, PILING

- .1 Provide shoring, bracing, piling, sheeting and sheet piling and underpinning required to support soil banks, existing work and property in accordance with Construction Safety Act and other applicable regulations. Maintain shoring until building is strong enough and sufficiently braced to withstand pressure of backfilling. Make construction aids free of permanent work so they may be removed entirely when no longer required, without damaging the Work. Locate construction aids so adequate room is left for damp-proofing foundation walls, laying substructure drainage and other work.
- .2 Shoring and false work over one tier in height shall be designed and shall bear the stamp of a registered professional engineer, having experience in this field.

1.13. HOISTING

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

1.14. OVERHEAD LIFTING

- .1 Any condition requiring the use of a crane or lifting device over a Board structure must follow the requirements of Health and Safety Section 01 35 23, Paragraph 1.15 Overhead Lifting.

1.15. ELEVATORS/LIFTS

- .1 When elevators/lifts are to be used by construction personnel, provide protective coverings for finish surfaces of elevator cabs and entrances.
- .2 Co-ordinate use of elevator cabs with Consultant and the Board.

1.16. USE OF THE WORK

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

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

1.17. CONSTRUCTION PARKING

- .1 Construction personnel vehicle parking, to be confined to the work site enclosure, or.
- .2 Parking will be permitted on site only where and if it does not disrupt the employees of the place of work as directed by the Board
- .3 Permission to park vehicles on site does not imply any liability or responsibility for safe keeping of vehicles and contents thereof by the School Board.

1.18. ACCESS TO SITE

- .1 Provide and maintain adequate access to project site.
- .2 Build and maintain temporary roads where necessary and provide snow removal within the area of work, and access to the work, during period of Work. The area shall be restored to the satisfaction of the Board at the completion of the project.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .4 Clean roadways and taxi areas where used by Contractor's equipment.

1.19. SECURITY

- .1 The Contractor shall ensure the security of the work site, contents, and built structures for the duration of the project.
- .2 The Contractor shall be responsible to provide and pay for security personnel to guard site and contents of site after working hours and during holidays as required.
- .3 Notify the Board of the use of security guards or systems.
- .4 The Board shall not be responsible for the loss, theft, or vandalism.

1.20. OFFICES

- .1 Provide and maintain, until completion of Contract, for Contractor's use, a temporary office, large enough to accommodate site administrative activities and site meetings, complete with light, heat, air conditioning, ventilation, table and chairs. Do not store materials in office area; keep clean and tidy.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

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

1.21. EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds and platforms for storage of tools, equipment and materials.
- .2 Review storage areas on site with the Consultant. Store materials and equipment to ensure preservation of quality of product and fitness for the Work. Store materials and equipment on wooden platforms or other hard, clean surfaces, raised above the ground or in water tight storage sheds of sufficient size for storage of materials and equipment which might be damaged by storage in open. Locate stored materials and equipment to facilitate prompt inspection.
- .3 Store packaged materials and equipment undamaged, in their original wrappings or containers, with manufacture's labels and seals intact.
- .4 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.
- .5 Storage sheds required by subcontractors shall be provided by them.

1.22. SANITARY FACILITIES

- .1 Provide weatherproof temporary toilet/sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Service temporary toilet/sanitary facilities as required by authorities but not less than weekly.
- .3 Post notices and take such precautions as required by local health authorities.
- .4 The use of existing washroom facilities is not allowed unless specifically approved by the Board. The Contractor will be required to clean and maintain the existing washrooms to Board standards.
- .5 Except where connected to municipal sewer system, periodically remove wastes from Site.
- .6 Keep toilet/sanitary facilities clean and sanitary and protect from freezing.
- .7 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

END OF SECTION

SECTION 01 61 00 – PRODUCT REQUIREMENTS

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 49.
- .2 Section 01 31 00 – Project Managing and Coordination

1.2. TERMINOLOGY

- .1 New: Produced from new materials.
- .2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
- .3 Defective: A condition determined exclusively by the Consultant.

1.3. PRODUCT QUALITY

- .1 The term 'new' in the following paragraph does not exclude re-manufactured products that have some or all of the materials recycled from other sources. Preference in recycling is for post-consumer recycled materials.
- .2 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work:
- .3 New Product, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.
- .4 Defective Products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .5 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Consultant.
- .6 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

1.4. AVAILABILITY

- .1 Immediately upon receipt of Boards Purchase Order, review Product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 Immediately upon receipt of Boards Purchase Order the Contractor shall issue Purchase Orders and or Contracts to all Sub-trades. Provide proof to

the Consultant and the Board within 3 days. The Sub-Contractors shall identify in writing any delivery issues within 14 days of receiving the Contractors purchase order or contract. The Schedule noted in 01-31 00 1.7.1 shall incorporate all deliveries and installation.

- .3 If delays in supply of Products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .4 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.5. STORAGE AND PROTECTION

- .1 Store and protect Products in accordance with manufacturers' written instructions.
- .2 Store with seals and labels intact and legible.
- .3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.
- .4 For exterior storage of fabricated Products, place on sloped supports above ground.
- .5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.
- .6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- .7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- .8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.6. TRANSPORTATION AND HANDLING

- .1 Transport and handle Products in accordance with manufacturer's written instructions.
- .2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
- .3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.
- .4 Suitably pack, crate and protect products during transportation to site to preserve their quality and fitness for the purpose intended.

- .5 Store products in original, undamaged condition with manufacturer's labels and seals intact until they are being incorporated into completed work.
- .6 Protect materials from damage by extreme temperatures or exposure to the weather.

1.7. EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to the owner.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.8. MANUFACTURER'S WRITTEN INSTRUCTIONS

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

1.9. QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Consultant and or Board reserves right to require dismissal from site any workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.
- .4 Products, materials, systems and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the applicable manufacturer's printed directions.

- .5 Where specified requirements are in conflict with manufacturer's written directions, follow manufacturer's directions. Where specified requirements are more stringent than manufacturer's directions, comply with specified requirements.

1.10. COORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- .3 Contractor is responsible to ensure suppliers or distributors of materials specified or alternatives accepted, which he intends to use, have materials with original schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.
- .4 Contractor shall contact Consultant immediately upon receipt of information indicating materials or items, will not be available on time, in accordance with the latest approved schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.
- .5 The above, in no way releases the Contractor, or their subcontractors and suppliers of their responsibility for ensuring timely ordering of materials and items required, including the necessary expediting, to complete the Work as scheduled in accordance with the Contract Documents including temporary accommodations and or materials to ensure occupancy date is achieved.

1.11. CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Consultant if there is interference. Install as directed by Consultant at no additional cost to the Board.

1.12. REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13. LOCATION OF FIXTURES

- .1 Inform Consultant of conflicting installation. Install as directed.

1.14. FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.15. PROTECTION OF WORK IN PROGRESS

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

END OF SECTION

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SECTION 01 70 00 – EXAMINATION AND PREPARATION

1.0 GENERAL

1.1. RELATED SECTIONS

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

1.2. REFERENCES

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

1.3. SUBMITTALS

- .1 Submit name and address of Surveyor to Consultant.
- .2 On request of Consultant, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying that elevations and locations of completed Work conforms with Contract Documents.

1.4. QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practise in the Place of the Work.

1.5. SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on Drawings.
- .2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Consultant.
- .4 Report to Consultant when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.6. SURVEY REQUIREMENTS

- .1 Establish existing and new permanent bench marks on site, referenced to established bench marks by survey control points.
- .2 Record locations, with horizontal and vertical data in Project Record Documents.
- .3 Establish lines and levels, locate and lay out, by instrumentation.

- .4 Establish pipe invert elevations.
- .5 Stake batter boards
- .6 Establish foundation and floor elevations.
- .7 Establish lines and levels for mechanical and electrical work.

1.7. SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.
- .2 Advise the Consultant of a reasonable assumption of probable conditions when determined.
- .3 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work.

1.8. EXAMINATION

- .1 The Contractor is expected to be totally familiar with site conditions and shall assume full responsibility for the cost involved in repairing any damage to the building, site and services, city property, adjacent buildings, etc., during general construction, regardless of the extent of the damage.
- .2 Inspect existing conditions, including elements or adjacent Work subject to irregularities, damage, movement, including Work during cutting and patching.
- .3 The Contractor shall provide all equipment necessary to make a full and detailed site evaluation. This shall include but not be limited to ladders, flashlights and hand tools.
- .4 The Contractor expressly agrees that conditions above existing suspended acoustic ceilings, but below fixed structure, unless obscured by an additional ceiling above, shall be considered exposed conditions for the purposes of making findings under the provisions of the Contract. There shall be no claims for extra costs for extra Work in these areas.
- .5 After uncovering, inspect conditions affecting performance of the Work.
- .6 Beginning of cutting or patching means acceptance of existing conditions.

1.9. PREPARATION

- .1 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .2 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.10. EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.
- .2 Remove abandoned service lines running through within existing and new structures. Cap or seal lines at cut-off points as directed by Consultant.

1.11. LOCATION OF EQUIPMENT AND FIXTURES

- .1 Inform Consultant of conflicting installations, install as directed.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Consultant of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

1.12. SURVEY RECORD

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

END OF SECTION

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SECTION 01 73 30 – EXECUTION AND CUTTING AND PATCHING

2.0 GENERAL

2.1. RELATED SECTIONS

- .1 Section 01 32 00 - Construction Progress Documentation: Submittals and scheduling.
- .2 Section 01 61 00 - Product Requirements.
- .3 Section 01 70 00 – Examination and Preparation
- .4 Individual Product Specification Sections:
 - .1 Cutting and patching incidental to work of the section.
 - .2 Advance notification to other sections of openings required in Work of those sections.

2.2. SUBMITTALS

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

2.3. TOLERANCES

- .1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.
- .2 Do not permit tolerances to accumulate beyond effective or practical limits.
- .3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Consultant before proceeding.

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

3.0 PRODUCTS

3.1. MATERIALS

- .1 Primary Products: Those required for original installation.
- .2 Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 33 00.

4.0 EXECUTION

4.1. EXAMINATION

- .1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering existing Work, assess conditions affecting performance of work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

4.2. PREPARATION

- .1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- .2 Provide protection from elements for areas which may be exposed by uncovering work.
- .3 Maintain excavations free of water.

4.3. CUTTING

- .1 Execute cutting and fitting as needed to complete the Work. Prior to any cutting and or coring of concrete floors the contractor shall confirm the area is free of services or rebar. Notify the Consultant of any interferences.
- .2 Uncover work to install improperly sequenced work.
- .3 Remove and replace defective or non-conforming work.
- .4 Remove samples of installed work for testing for Hazardous materials.
- .5 Provide openings in the Work for penetration of mechanical and electrical work.
- .6 Employ experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- .7 Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

- .8 Do all cutting, patching and making good, to leave a finished condition and to make the several parts of the work come together properly. Coordinate work to keep cutting and patching to a minimum.
- .9 Make cuts with clean, true, smooth edges. Fit unit to tolerance established by test standard practice for applicable work. Make patches invisible in final assembly.
- .10 Cutting shall be done in a manner to keep patching to minimum. Obtain Consultant's approval of method to be used to conceal new mechanical and electrical services before beginning cutting. Chasing of concrete surfaces is not permitted.
- .11 Cutting or coring of any structural concrete is to be reviewed and approved by the Consultant.
- .12 Do not endanger any work by cutting, digging or otherwise altering, and do not cut nor alter any load bearing element without written authorization by Consultant. Provide bracing, shoring and temporary supports as required to keep construction safely supported at all times
- .13 Any cost caused by omission or ill-timed work shall be borne by party responsible therefore.
- .14 Regardless of which Section of work is responsible for any portion of cutting and patching, in each case tradesmen qualified in work being cut and patched shall be employed to ensure it is correctly done.

4.4. PATCHING

- .1 Execute patching to complement adjacent Work.
- .2 Fit Products together to integrate with other Work.
- .3 Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- .4 Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.
- .5 Restore work with new Products in accordance with requirements of Contract Documents.
- .6 Fit work with adequate support to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .7 At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with firestop material.
- .8 Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- .9 Complete and tightly fit all construction to pipes, ducts and conduits which pass through construction to completely prevent the passage of air.

- .10 Patching and making good shall be done by trade specialists in material to be treated, and shall be made undetectable in finished work when viewed from distance of 1.5m under normal lighting.

END OF SECTION

SECTION 01 74 00 – CLEANING AND WASTE MANAGEMENT

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Common Work by All Trades
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.
- .3 Conduct cleaning and disposal operations to comply with local ordinances and environmental protection legislation.
- .4 Store volatile wastes in covered metal containers, and remove from premises at end of each working day.
- .5 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

2.0 PRODUCTS

2.1. CLEANING PRODUCTS

- .1 Cleaning Agents and Materials: Low VOC content wherever possible. The Consultant and the Board shall be notified prior to use of any exception.

3.0 EXECUTION

3.1. CLEANING DURING CONSTRUCTION

- .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the Owner or other Contractors.
- .2 Remove waste material and debris from the work areas and deposit in waste container at the end of each working day.
- .3 Vacuum clean interior areas prior to start of finishing work. Maintain areas free of dust and other contaminants during finishing operations.
- .4 Individual Subcontractors are responsible for the daily clean-up and removal of debris related to, or generated by, their own work. The overall responsibility for project cleanliness rests with the Contractor.
- .5 The Contractor shall be responsible for snow removal within the construction area.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Wherever possible recycle materials
- .8 Containers:

- .1 Provide adequate number and sizes of on-site garbage and recycling containers within designated work site as required for collection of waste materials and debris on a daily basis.
- .2 Provide additional waste containers when extent of work warrants.
- .3 Provide and use clearly marked, separate bins for recycling.
- .9 Dispose of waste materials and debris at registered waste disposal and recycling facility.
- .10 Remove oily rags, waste and other hazardous substances from premises at close of each day, or more often when required.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

3.2. WASTE MANAGEMENT

- .1 Audit, separate and dispose of construction waste generated by new construction or by demolition of existing structures in whole or in part, in accordance with Ontario Regulations 102/94 and 103/94 made under the Environmental Protection Act.
- .2 Containers:
 - .1 Provide adequate number and sizes of on-site garbage and recycling containers within designated work site as required for collection of waste materials and debris on a daily basis.
 - .2 Provide additional waste containers when extent of work warrants.
 - .3 Provide and use clearly marked, separate bins for recycling.
- .3 Fires, and burning of rubbish or waste on site is strictly prohibited.
- .4 Burying of rubbish or waste materials on site is strictly prohibited.
- .5 Disposal of waste or volatile materials such as mineral spirits, oil, gasoline or paint thinner into ground, waterways, or sewer systems is prohibited.
- .6 Empty waste containers on a regular basis to prevent contamination of site and adjacent properties by wind-blown dust or debris

3.3. PREPARATION FOR FINAL CLEANING

- .1 Prior to final cleaning the General Contractor shall:
 - .1 remove all surplus products, tools, construction machinery and equipment not required for the performance of remaining work, and thereafter remove any remaining materials, equipment, waste and debris,
 - .2 replace all filters installed on any equipment in operation in the area of work,

- .3 remove all paint spots or overspray from all affected surfaces, and

3.4. FINAL CLEANING PRIOR TO ACCEPTANCE: INTERIOR

- .1 Prior to applying for Substantial Performance of the Work, or, prior to Owner occupancy of the building or portion of the building affected by the Work, whichever comes first, conduct full and complete final cleaning operations for the areas to be occupied.
- .2 Final cleaning operations shall be performed by an experienced professional cleaning company, possessing equipment and personnel sufficient to perform full building cleaning operations. Contractors "broom cleaning" is not acceptable as a "Final Clean". The cleaning contractor shall:
 - .1 clean interiors of all millwork and surfaces of any furniture and equipment present,
 - .2 use only cleaning materials recommended by the manufacturer of the surface to be cleaned,
 - .3 remove all stains, spots, scuff marks, dirt, dust, remaining labels, adhesives or other surface imperfections,
 - .4 clean and polish all glass and mirrors and remove remaining manufacturer's and safety "X" labels,
 - .5 clean and polish all finished metal surfaces such as enamelled or stainless steel, chrome, aluminum, brass, and bronze,
 - .6 clean and polish all vitreous surfaces such as plumbing fixtures, ceramic tile, porcelain enamel, or other such materials,
 - .7 clean all ceramic tile surfaces in accordance with the manufacturer's instructions,
 - .8 vacuum, clean and dust behind grilles, louvres and screens,
 - .9 steam clean all unprotected carpets immediately prior occupancy by Owner, and
 - .10 clean all equipment and fixtures to a sanitary condition.
- .3 For any areas to be occupied after the owner's initial occupancy, provide full cleaning operations as outlined above prior to turning over to owner,
- .4 The Board's supplies and equipment must not be used for any cleaning operations including, but not limited to: garbage cans, mops, brooms, rags, ladders, chemicals etc.

3.5. FINAL CLEANING PRIOR TO ACCEPTANCE: EXTERIOR

- .1 For areas effected by construction final exterior cleaning operations shall be performed by the General Contractor or competent sub-contractor. Contractor's "broom cleaning" only is not acceptable.

- .2 Final exterior cleaning shall include:
 - .1 broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds,
 - .2 remove dirt and other disfiguration from exterior surfaces,
 - .3 sweep and wash clean paved areas,
 - .4 replace filters of mechanical equipment for all equipment that was in use during construction,
 - .5 clean all roofs, gutters, downspouts, areaways, drywells, and drainage systems,
 - .6 remove debris and surplus materials from crawl areas and other accessible concealed spaces.
 - .7 remove overspray

END OF SECTION

SECTION 01 78 10 – CLOSEOUT SUBMITTALS AND REQUIREMENTS

1.0 GENERAL

1.1. RELATED SECTIONS

- .1 Section 01 78 10 – Appendix 1 and 2 – WRDSB Warranty Card

1.2. TAKE-OVER PROCEDURES

- .1 Take over procedures will be in strict accordance with the requirements as set out in this Section.

1.3. SUBSTANTIAL PERFORMANCE

- .1 Prior to requesting a Substantial Performance deficiency inspection submit 2 hard copies, 1 digital copy of the Operating and Maintenance Manuals for Consultants approval.
- .2 Application for Substantial Performance must include.
 - .1 One (1) electronic copy of inspection and acceptance certificates required from regulatory agencies, including but not limited to.
 - .1 Certificates of Approval of the Work by the local Building Department.
 - .2 Electrical Inspection Certificate of Inspection.
 - .3 Fire Alarm Verification Certificate.
- .3 Advise Consultant in writing, when project has been substantially completed. If Consultant agrees this stage has been reached, the Consultant shall prepare a complete list of deficiencies and submit copies of this list to Contractor and the Board.

1.4. COMMENCEMENT OF LIEN PERIODS

- .1 The date of publication of the Certificate of Substantial Performance of the Work, provided to the contractor by the Consultant, shall be the date for commencement of the lien period.

1.5. TOTAL PERFORMANCE

- .1 Prior to requesting a final inspection submit written certificate that the following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents and is ready for final inspection
 - .2 Defects have been corrected and deficiencies have been completed.

- .3 Equipment and systems have been tested and are fully operational.
Submit two copies of the balancing reports
- .4 Certificates required by the contractor have been submitted.
- .5 Operation of systems have been demonstrated to Owner's personnel.
- .6 Submit Record drawings.
- .7 Submit maintenance materials.
- .8 Provide certified site survey
- .2 When items noted above are completed, request final inspection of Work by consultant, and building inspector. If Work is deemed incomplete by Consultant, complete outstanding items and request re-inspection.

1.6. PAYMENT OF SUBSTANTIAL PERFORMANCE HOLDBACK

- .1 Prior to the release of lien holdback provide one copy of the following by the Contractor and each subcontractor:
 - .1 Statutory Declaration or Declaration of Last supply
 - .2 Workplace Safety and Insurance Board "Certificate of Clearance".
- .2 The Contractor shall submit an application for payment of the holdback amount.
- .3 After the receipt of an application for payment which will include a Statutory Declaration and WSIB Clearance from the, the Consultant will issue a certificate for payment of the holdback amount.

1.7. FINAL PAYMENT

- .1 When the Contractor considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.
- .2 When the Consultant finds the Contractor's application for final payment valid, the Consultant will issue a final certificate of payment
- .3 The Board reserves the right to charge the Contractor for school access card(s) that have not been returned.
- .4 The cost to reprogram or replace the card(s) access system is estimated at \$50.00 (fifty dollars) for each card issued, \$30.00 (thirty dollars) for each keybox key, plus \$35.00 (thirty five dollars) administration fee.

1.8. CLOSEOUT SUBMITTALS

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products and submit to Consultant for review.
- .2 Copy will be returned to contractor with Consultant's comments.
- .3 Revise content of documents as required prior to final submittal.

- .4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant, the final copies of operating and maintenance manuals.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.9. OPERATION AND MAINTENANCE MANUAL FORMAT

- .1 Provide two copies of operating and maintenance data, prepared on 215 X 280mm sheets in printed or typewritten form, contained in 3-ring binders with soft vinyl covers for materials and equipment which require special maintenance or operating procedures.
- .2 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder at the front of each volume.
- .3 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .4 Arrange content by the divisions of the specifications under Section numbers and sequence of Table of Contents.
- .5 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .6 Include the following in each manual:
 - .1 Complete list of subcontractors and suppliers, their addresses and telephone numbers. Provide 24 hour emergency telephone number for such subcontractors as Plumbing, Electrical, Sprinklers, Fire System, Heating, etc.
 - .2 Specified warranties for contractor, each subcontractor and supplier.
 - .3 WRDSB Warranty Card
 - .4 Copy of finish hardware list, complete with all amendments and revisions and lock manufacturer's descriptive and service literature.
 - .5 Schedule of paints and coatings. Include sufficient explanation to fully identify each surface with the applicable paint or coating used. Enclose copy of colour schedule.
 - .6 Maintenance instructions for finished surfaces.
 - .7 Brochures, cuts of equipment and fixtures.
 - .8 Operating and maintenance instructions for equipment.

- .9 Submit copies of letters from manufacturers of equipment and systems indicating their technical representatives have inspected and tested systems and are satisfied with methods of installation, connection and operations. These letters shall state names of persons present at testing, methods used and list of functions performed.
- .10 Submit one complete set of reviewed shop drawings of architectural, structural, mechanical and electrical items, folded to 215 x 280mm size, contained in heavy duty manila envelopes, numbered and labelled. Follow specification format with no more than one Section per envelope, hard copy and PDF.
- .11 Relevant certificates issued by authorities having jurisdiction
- .12 Computer disc or flash drive with all the above documentation in PDF format

1.10. RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and within the Project Manual.
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: Maintain warranties, test reports and samples required by individual specifications sections.

1.11. RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

- .1 Store AS-BUILT documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .2 Label AS-BUILT documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document AS-BUILT DOCUMENTS in neat, large, printed letters.
- .3 Maintain AS-BUILT documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.
- .4 Keep as-built documents and samples available for inspection by Consultant.

1.12. RECORD DRAWINGS

- .1 Prior to Substantial Performance of the Work, update the marked up information from the AS-BUILT documents to a master set of drawing.
- .2 Submit one set of completed AS-BUILT documents to the Consultant for review.
- .3 Documents will be returned to contractor with Consultant's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 After the review is completed resubmit to the Consultant for Consultant to produce electronic record drawings for the owner to use.

1.13. SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .4 Obtain receipt for delivered products and submit prior to final payment.

1.14. REPLACEMENT (MAINTENANCE) MATERIALS

- .1 Deliver to site, unload and store where directed, replacement (maintenance) materials as required elsewhere in these Specifications. Obtain signed receipt from Owner's Representative for delivered materials and include copy of receipt in Operation and Maintenance manuals.
- .2 Package materials so they are protected from damage and loss of essential properties.
- .3 Label packaged materials for proper identification of contents.

1.15. SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.

- .2 Provide items with tags identifying their associated function and equipment.
- .3 Receive and catalogue all items. Submit inventory listing to Consultant.
Include approved listings in Maintenance Manual

1.16. FINAL SITE SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 70 00, certifying that elevations and locations of completed Work are in conformance Contract Documents.

1.17. WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined. The date of Substantial Performance of the Work shall be the date for commencement of the warranty period.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittals.

END OF SECTION

SECTION 01 78 40 – MAINTENANCE REQUIREMENTS

1.0 GENERAL

1.1. SECTION INCLUDES

- .1 Equipment and systems.
- .2 Materials and finishes.
- .3 Spare parts
- .4 Maintenance manuals.
- .5 Special tools.
- .6 Storage, handling and protection.
- .7 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.
- .2 Section 01 78 40 – Maintenance Requirements.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3. EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete
- .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 coordination Drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00.
- .15 Additional requirements: As specified in individual specification sections.

2.0 PRODUCTS

2.1. MATERIALS AND FINISH

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Building Envelope: include copies of drawings of building envelope components, illustrating the interface with similar or dissimilar items to provide an effective air, vapour and thermal barrier between indoor and outdoor environments. Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.
- .5 Additional Requirements: as specified in individual specifications sections.

2.2. SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .4 Obtain receipt for delivered products and submit prior to final payment.

2.3. MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .4 Obtain receipt for delivered products and submit prior to final payment.

2.4. SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

3.0 EXECUTION

3.1. DELIVERY TO SITE

- .1 Deliver to place of work and store.
- .2 General Contractor to receive and acknowledge delivery from contractors and sub-contractors of all parts and materials assembled for maintenance requirements. Provide a summary inventory list to the Consultant and/or the Board after all materials are gathered and verification of location. Signatures of receipt will not be accepted from anyone except the General Contractor's representative.

3.2. STORAGE, HANDLING AND PROTECTION

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

END OF SECTION

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SECTION 01 79 00 – DEMONSTRATION AND TRAINING

1.0 GENERAL

1.1. SECTION INCLUDES

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

1.2. RELATED SECTIONS

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

1.3. DESCRIPTION

- .1 At Substantial Performance, at a time acceptable to Owner and Consultant, but not before operations and maintenance manual have been reviewed and accepted by the consultant; contractor shall give a complete demonstration in the presence of consultant; Sub-consultants, Owner and Owner's personnel of operation and maintenance of systems and equipment once they are 100% complete.
- .2 Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

1.4. COMPONENT DEMONSTRATION

- .1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.
- .2 Instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.5. SUBMITTALS

- .1 Submit schedule of time and date for demonstration of each item of equipment and each system one (1) week prior to designated dates, for Consultant's approval.
- .2 Submit reports within forty eight (48) after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.6. CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with manufacturer's instructions and contract requirements.
- .2 Testing, adjusting, and balancing have been performed in accordance with manufacturer's instructions and contract requirements, and equipment and systems are fully operational.
- .3 Provide information packages as required for use in demonstrations and instructions.

2.0 PRODUCTS

2.1. NOT USED

- .1 Not used.

3.0 EXECUTION

3.1. PREPARATION

- .1 Verify that suitable conditions for demonstration and instructions are available.
- .2 Verify that designated personnel are present.
- .3 Prepare agendas and outlines.
- .4 Establish seminar organization.
- .5 Explain component design and operational philosophy and strategy.
- .6 Develop equipment presentations.
- .7 Present system demonstrations.
- .8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2. PREPARATION OF AGENDAS AND OUTLINES

- .1 Prepare agendas and outlines including the following:
 - .1 Equipment and systems to be included in seminar presentations.
 - .2 Name of companies and representatives presenting at seminars.
 - .3 Outline of each seminar's content.
 - .4 Time and date allocated to each system and item of equipment.
 - .5 Provide separate agenda for each system.

3.3. SEMINAR ORGANIZATION

- .1 Coordinate content and presentations for seminars.
- .2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.

- .3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.
- .4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4. EXPLANATION OF DESIGN STRATEGY

- .1 Explain design philosophy of each system. Include following information:
 - .1 An overview of how system is intended to operate.
 - .2 Description of design parameters, constraints and operational requirements.
 - .3 Description of system operation strategies.
 - .4 Information to help in identifying and troubleshooting system problems.

3.5. DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

END OF SECTION

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PART 1 – GENERAL

1.1 GENERAL

- .1 Test methods used to determine fire hazard classification and fire endurance rating shall be as required by Ontario Building Code.
- .2 Upon request, furnish the Consultant with evidence of compliance to fire protection requirements as noted in documents or specified codes, etc.
- .3 Materials and components used to construct fire rated assemblies and materials requiring fire hazard classification shall be listed and labelled, or otherwise approved, by fire rating authority. Labelled materials and their packaging shall bear fire rating authorities label showing product classification.
- .4 Note: The existing school building is only partially sprinklered. The portion of the school building that is not sprinklered should provide for corridor walls constructed to a one hour fire resistance-rating. Fire ratings must be maintained at existing corridor walls and roofs in building areas that are not and will not be sprinklered. Provide for mechanical fire dampers where mechanical ductwork penetrates existing corridor walls. Provide continuous fire-sealant at all mechanical piping and electrical piping conduits penetrating corridor walls and roofs. The project will include for sprinklering additional building areas which will accommodate the removal of the requirement of a one hour fire resistance-rating at corridors and roofs. Refer to mechanical fire protection drawings indicating the additional building areas to be sprinklered. Contractor is responsible to carry the sprinkler work in their Contract Price.purge
- .5 Construct fire rated assemblies in accordance with applicable fire test report information issued by fire rating authority. Deviation from fire test report will not be allowed.
- .6 Construct fire rated assemblies as continuous, uninterrupted elements except for permitted openings. Extend fire rated walls and partitions from floor to underside of structural deck above.
- .7 Materials which have a fire hazard classification shall be applied or installed in accordance with fire rating authority's printed instructions.
- .8 Provide firestopping as specified in Section 07 84 00.

- .1 Firestopping shall be a tested system consisting of non-combustible materials, smoke sealant, and means of support, used to fill gaps between fire-rated separations or between fire separations and other assemblies, and used around items that penetrate a fire separation.
 - .2 Fill and patch voids and gaps around openings and penetrations in and at perimeter of assemblies so as to maintain continuity and to produce a fire resistant, smoke tight seal, acceptable to jurisdictional authorities.
- .9 Provide fire blocks to compartmentalize concealed spaces as required by the OBC.
- .1 Fire block means a material, component or system that restricts the spread of fire within a concealed space or from a concealed space to an adjacent space.
 - .2 Fire blocks are also referred to as fire stops in the OBC.
- .10 The Contractor shall ensure that all fire safety features called for in the Contract Documents are supplied and installed to meet fire safety standards established by those authorities having jurisdiction. The Contractor shall ensure that the work of Subcontractors is properly coordinated to achieve the intent of this Specification.
- .11 Nothing contained in the Drawings or Specifications shall be construed as to be in conflict with any law, by-law, or regulations of municipal, provincial, or other authorities having jurisdiction. Work shall be performed in conformity with all such laws, by-laws, and regulations.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED WORK

.1	Temporary Utilities	Section 01 51 00
.2	Execution and Cutting and Patching	Section 01 73 30

1.2 REFERENCES

- .1 Conform to all laws, By-Laws and regulations of the authorities having jurisdiction and, in particular, the Ontario Occupational Health and Safety Act; The Environmental Protection Act; The Ontario Building Code, Ontario Regulation 332/12; The Ontario Fire Code; The National Building Code, 2010; and the National Fire Code.
- .2 CSA S350-M, code of practice for safety in demolition of structures.
- .3 Ontario regulations under the Environmental Protection Act:
 - .1 O.Reg. 102/94 Waste Audits and Waste Reduction Work Plans
 - .2 O.Reg. 103/94 Industrial, Commercial and Institutional Source Separation Programs
 - .3 O.Reg. 347/90 General - Waste Management; refer to "Definitions"
- .4 Ontario regulations under the Occupational Health and Safety Act:
 - .1 O.Reg. 213/91 Construction Projects
 - .2 All regulations regarding "Designated Substances"
 - .3 O.Reg. 860/90 Workplace Hazardous Materials Information System (WHMIS)
- .5 Conform to "Guidelines for Maintaining Fire Safety During Construction in Existing Buildings", provided by the Office of the Ontario Fire Marshal.
- .6 RFCI Recommended Work Practices for Removal of Resilient Floor Coverings

1.3 EXAMINATION OF EXISTING SITE AND STRUCTURE

- .1 Examine the existing site and building before tendering to be familiar with the detailed extent of demolition, dismantling, relocation and reassembly required.
- .2 Examine the drawings and include all costs associated with the demolition work, including after-hours work and remobilization costs. Coordinate all work with the Owner to ensure that the site and building can remain operational, in use and occupied during construction.
- .3 No allowance will be made for failure to obtain complete information prior to close of tenders.

1.4 SUMMARY OF WORK

- .1 Carry out all alteration and demolition work required to accommodate new work indicated on drawings. Make good any damage caused by alterations required.
- .2 Remove HVAC equipment, electrical fixtures and all other items so noted on drawings as required for the addition, unless otherwise noted.
- .3 Unless noted otherwise, building materials resulting from demolition under this contract shall become the property of the Contractor, and shall be removed by the Contractor.
- .4 Supply and install temporary dust proof membranes at junctions with work area, at all adjoining doorways and corridor walls between the existing building areas and the proposed building areas to be renovated. Dust proof membranes shall be minimum thickness of 10 MIL polyethene sheet. Sheets are to be overlapped a minimum of 300mm and taped at complete perimeter of openings and provided at a height from top of finished floor to underside of ceiling and or exposed roof deck. At doorways where access is required, provide double layer of membranes with zippers to accommodate access.
- .5 Dust proof membranes shall be erected outside of building operating hours and shall remain in place until the work is fully commissioned and accepted by the Owner. Membranes shall be removed, reconfigured and relocated as required to maintain the security of the site and the existing building and ensure that construction noise and dust does not penetrate into the existing building and disturb building occupants.

1.5 SCHEDULE OF WORK

- .1 Safety and required exiting from the existing building must be maintained at all times, particularly during operating hours and scheduled events. Work must be suspended if the Owner advises that noise and/or dust is interfering with the building operation.
- .2 Work which will generate excessive noise, dust or vibration must be undertaken outside of the building's hours of operation, during the times when the building is normally occupied. Confirm the building hours of operation with the Owner.
- .3 Dust proof partitions must be installed prior to any work being undertaken.
- .4 Refer to drawings for the complete scope of work. Confirm any required construction phasing sequences with the Owner and the Consultant prior to commencing the work.

1.6 PROTECTION

- .1 Protect adjacent properties against damage which might occur from falling debris or other cause. Make good damage to adjacent public or private properties resulting from Work of this Contract.
- .2 Protect existing building from damage and contamination during demolition activities. All openings must be made weatherproof. Provide temporary barriers, dust control measures, security controls, supports, and such additional protection as may be required by specific demolition work.

- .3 Prevent movement, settlement, and damage to existing building to remain, including services, paving, landscaped areas to remain, and adjacent structures. Provide temporary supports, including shoring and bracing, as required. All shoring must be designed by a professional engineer licensed in the Province of Ontario.
- .4 Employ licensed rodent and vermin exterminators to destroy all discovered vermin and rodents.
- .5 Remove contaminated and dangerous material from the site and dispose of safely and legally. Meet all M.O.E. requirements.
- .6 Take precautions to guard against movement or settlement of adjacent land, existing building, and remaining services and utilities. Provide and place bracing or other means of support.
- .7 Take precaution against contamination of air and adjacent properties.

1.7 MAINTAINING FIRE SAFETY IN EXISTING BUILDING

- .1 Maintain all required exiting for safe operations within the existing building. Where an exit is closed off due to construction activities, provide alternate exit acceptable to both the Consultant and to Authorities Having Jurisdiction. Any temporary exits must be clearly identified with appropriate signage.
- .2 Maintain access roadways for fire department vehicles, acceptable to the fire department. Access must be approved prior to commencement of construction activities.
- .3 Store all combustible materials in accordance with the Fire Code and the Occupational Health and Safety Act. Do not store combustible materials within the existing building or against the building. All combustibles shall be stored in a manner which minimizes risks to building and occupants.
- .4 Maintain dust proof membranes and protection at openings, as specified above, with fire separation ratings as required by Authorities Having Jurisdiction.
- .5 Maintain fire alarm system in operating condition in existing building. Notify the fire department and Owner of any temporary shutdowns of service and provide alternative measures during such periods of time.
- .6 Coordinate with Owner and Authorities Having Jurisdiction for all changes to fire emergency procedures as may be required during construction.

1.8 SERVICES

- .1 Seal and cap mechanical and electrical services in order to facilitate removals indicated on drawings. Mark location and type of service of all capped services at the site. Submit record drawing showing locations and dimensions of all capped services.

PART 2 – PRODUCTS

2.1 Not Used

PART 3 – EXECUTION

3.1 GENERAL

- .1 Remove and dispose of any fixtures, fittings and equipment remaining in the work area, which are not shown to be relocated or reused in the completed project.
- .2 Protect all items indicated to be removed and later reinstalled. These items shall be removed prior to demolition work wherever possible. It will be the responsibility of the Contractor to repair or replace any such items damaged by careless handling.
- .3 Refer also to demolition and alteration notes on drawings.

3.2 DEMOLITION

- .1 Demolish any masonry walls in small sections. Do not permit masonry to fall in mass.
- .2 Remove and carefully lower wood or steel framing as applicable.
- .3 Remove interior masonry walls, partitions, ceilings, bulkheads, as indicated on drawings, and as required to accommodate new construction.
- .4 Cut concrete floor slab as required to accommodate installation of new services.
- .5 Remove glass, metals and combustible materials from walls being demolished.
- .6 Remove all items not indicated or noted to remain or be re-used.
- .7 Remove mechanical and electrical equipment and piping indicated to be abandoned. Refer to mechanical and electrical demolition drawings.
- .8 Any items noted to be re-used or re-located are to be removed carefully, cleaned, packaged appropriately, and handed over to Contractor.
- .9 Upon discovery of mold or moldy materials remove and dispose of these separately.
- .10 If any materials suspected to contain asbestos and other designated substances are encountered, do not disturb these materials. Inform the Consultant of the location and extent of suspect material. Do not resume work in this area until it has been cleared by an Abatement Consultant.
- .11 At the end of each day's work, leave work in a safe condition so that no part of the remaining structure is in danger of collapse.
- .12 Do not burn any refuse or debris at the site.

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- .13 Complete scanning and x-rays of any and all walls and floors, as required to complete the work and carry all required procedures as part of the base bid price.

3.3 NEW OPENINGS IN EXISTING WALLS

- .1 Where new openings are shown to be cut into existing walls, break open the wall to the sizes required, provide new lintels over the opening, and patch all adjacent materials.
- .2 Refer to the Asbestos Audit Report, included in the Project Manual, to confirm where wall finishes contain asbestos. Some existing drywall partitions contain asbestos and are required to be partially abated to complete the work. Provide new gypsum board finish as required to patch, repair and make good existing partition and walls. Abatement of asbestos containing materials, as required to complete the work, is to be carried by the Contractor in their base bid price.
- .3 Carefully remove existing exterior brick and stone sills and protect and store for reinstallation to accommodate new mechanical wall louvres. Clean existing brick and sills before reinstallation into wall assemblies. Cut existing brick and stone sills are required to suit new mechanical penetrations and structural lintels above new wall openings. Coordinate the work the structural drawings and specifications and with the mechanical work noted on the mechanical drawings and in the mechanical specifications.

3.4 REMOVAL OF EXISTING FLOOR FINISHES

- .1 Existing floor finishes shall be removed and old adhesive removed from the existing concrete slab by scraping or solvent, in accordance with Health & Safety requirements. Grind existing concrete floors as required to make concrete slabs smooth, flush and good prior to the installation of new flooring materials. Flooring mastics and some floor tiles contain asbestos, as described in the Asbestos Audit included in the Project Manual. Abatement of asbestos containing materials, as required to complete the work, is to be carried by the Contractor in their base bid price.
- .2 Existing concrete floors shall be prepared according to manufacturer's instructions for new adhesive applied finishes where new flooring finishes are indicated on the drawings.

3.5 REMOVAL OF CEILINGS AND ROOF ASSEMBLIES

- .1 Remove existing ceilings and bulkheads in areas where new ceilings and bulkheads are indicated, and as shown on drawings.
- .2 Ceilings to be demolished shall be removed complete with all finishes, framing, suspension system, trim, fasteners, and accessories.
- .3 Where ceilings are to be removed to accommodate work, and later reinstalled, carefully disassemble ceilings to the extent required. Clean all components, wrap for protection, clearly label package contents, and store in a safe location until they are to be reinstalled.
- .4 Where ceilings are to remain after adjacent walls or bulkheads are demolished, remove ceiling components as required to complete demolition work. Coordinate with forces

02 40 00 – DEMOLITION

- doing new ceiling work, to confirm what components are to be retained for reuse. Cut ceiling tiles may not be used; new full or appropriately cut tiles will be required.
- .5 Where ceiling mounted equipment is indicated to be removed and reused, or where it must be temporarily removed to accommodate the Work, it is to be carefully removed, cleaned, wrapped, labelled as to contents, and stored in a safe location, ready for reinstallation.
- .6 Penetrations are required in the existing roof assemblies. Roofing materials are assumed to contain asbestos. The asbestos bulk sampling report included in the Project Manual also indicates that asbestos is contained in roofing caulking and tar. Abatement of asbestos containing materials is to be completed through the roof replacement work. The roofing replacement work and any associated roofing work, as described in the contract documents, is carried in the project cash allowance, to be completed by the Owner's Roofing Contractor.
- .7 Asbestos containing pipe fittings exist throughout each room within the area of the renovation. Refer to the Asbestos Audit Report, included in the Project Manual, to confirm where pipe fittings containing asbestos are located and include the required asbestos abatement as part of the Contractor's base bid price, as required to complete the work.
- .8 Refer to the Asbestos Audit Report, included in the Project Manual, to confirm where gypsum board ceiling finishes contain asbestos. Some existing gypsum board ceilings within the renovation area contain asbestos and are required to be partially abated to complete the work. Provide new gypsum board finished ceilings and patch, repair and make existing gypsum board ceiling as required. Abatement of asbestos containing materials, as required to complete the work, is to be carried by the Contractor in their base bid price.

3.6 MECHANICAL AND ELECTRICAL WORK

- .1 Mechanical and Electrical services must be temporarily capped or terminated to permit renovation in existing areas to proceed.
- .2 Refer to mechanical and electrical drawings for the extent of removals, relocations, and alterations required.
- .3 Ceiling mounted mechanical and electrical equipment which is to be removed and reused is to be carefully removed and stored as specified above.
- .4 Cutting of holes up to 100mm in size in the existing structure and surfaces required by the mechanical and electrical trades shall be by those Subcontractors. Cutting and patching of openings greater than 100mm in size shall be by the Contractor in co-ordination with those trades. PATCHING OF ALL HOLES IN EXPOSED FINISHED SURFACES SHALL BE BY THE CONTRACTOR. Mechanical and Electrical trades shall do their own coring of existing slabs as required.

3.7 COMPLETION OF WORK

- .1 Remove all surplus materials, equipment and rubbish from the site.
- .2 Leave site in condition to meet approval of the Consultant.
- .3 On completion of Demolition work, thoroughly clean all existing surfaces to remain, including ceiling space. No debris or dirt shall remain to be enclosed by new construction.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- .1 All reinforcement for cast-in-place concrete.
- .2 Supply of reinforcing bars for masonry.

1.2 RELATED WORK

- .1 Concrete Formwork, Section 03 10 00.
- .2 Cast in Place Concrete, Section 03 30 00.
- .3 Precast Structural Concrete, Section 03 41 00.
- .4 Masonry, Division 4.

1.3 REFERENCES

- .1 Reinforcing Steel Manual of Standard Practice published by the Reinforcing Steel Institute of Canada.
- .2 ACI SP-66, ACI Detailing Manual published by the American Concrete Institute.
- .3 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
- .4 CSA-A23.3, Design of Concrete Structures.
- .5 ASTM A82, Standard Specification for Steel Wire, Plain, for concrete reinforcement.
- .6 ASTM A185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- .7 CSA G30.18, Billet-Steel Bars for Concrete Reinforcement.
- .8 CAN/CSA G40.21, Structural Quality Steels.
- .9 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .10 ASTM D3963/D3963M, Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.

1.4 SOURCE QUALITY CONTROL

- .1 Upon request, provide the Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
- .2 Upon request, inform the Consultant of proposed source of material to be supplied.
- .3 Upon request, provide the Consultant with a copy of plant certificate by the Concrete Reinforcing Steel Institute for epoxy coating of reinforcement.
- .4 Upon request, provide the Consultant with a copy of manufacturer's instructions for patching factory applied epoxy coating.
- .5 Use welding firm certified by the Canadian Welding Bureau under the requirements of CSA W186.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00 - Submittals. This applies to all reinforcement including reinforcing bars for masonry to be installed by the Masonry Trade.
- .2 Submit to the Consultant for review before the start of Work, 4 white prints of shop drawings. Leave room on drawings for the stamps of the Consultant and the Structural Engineer. Check and sign before submission. Only 2 copies will be returned to General Contractor.

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- .3 Allow a minimum of 10 working days for review of each submission of shop drawings in the Structural Engineer's office. Shop drawings received after noon will be date-stamped as received the following working day.
- .4 If required, CAD diskettes of the Structural Drawings are available "as-is", and at cost, for use in the preparation of shop drawings provided that the title blocks are removed and provided that the Owner and the Owner's Consultants are not held responsible for any errors or omissions on the drawings. These CAD drawings are not to be scaled.
- .5 Submit plans, elevations, sections, and bar lists necessary to show reinforcing and to facilitate review and placing. Show location of construction joints and detail reinforcement at joints. Dimension strips for flat slabs and flat plates. Draw elevations of walls including reinforced masonry walls. Show concrete cover on the diagrams. Draw to scale not smaller than 1:50.
- .6 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and splices with identifying code marks to permit correct placement without reference to Structural Drawings.
- .7 Conform to CSA A23.1 and the Reinforcing Steel Manual of Standard Practice, unless the Contract Documents contain a more stringent requirement, in which case the latter shall govern. Provide accessories as required by the Standard. Conform to ACI, SP-66 Detailing Manual whenever a detail condition is not covered by any of the above, but is covered by the ACI Manual.
- .8 Design and detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated. Provide standard hooks at ends of hooked bars.
- .9 Do not release for fabrication reinforcing bars whose length may be affected by field conditions, such as the final elevation of footings, until the governing field dimensions have been ascertained.
- .10 Review of shop drawings by the Consultant is on a sampling basis for general conformity with contract documents. It is not a detailed check and must not be construed as relieving the Contractor of responsibility for making the work accurate and in conformity with the Contract Documents.
- .11 Design for which the Contractor is responsible under the contract will not be reviewed. Work done prior to the receipt of the reviewed shop drawings will be at the risk of the Contractor. Review comments are not authorization for changes to the contract price.
- .12 After review, drawings will be returned to the Contractor stamped to show one of the following:
- | | | | |
|----|----------|---|---|
| .1 | Reviewed | - | Released for fabrication. |
| .2 | Noted | - | Released for fabrication after revisions noted are made. Submit revised drawing for Consultant's records. |
| .3 | Resubmit | - | Correct and resubmit for review. |
- .13 Conform to the requirements of each authority that has reviewed the drawings. Keep on site at all times a set of reviewed shop drawings and use only these drawings and the Structural Drawings to place reinforcing steel. Neatly mark on the Structural Drawings changes issued during the course of construction.

1.6 TOLERANCES

- .1 Conform to CSA A23.1.
- .2 Cover to be not less than required for fire rating.
-

1.7 **SUBSTITUTES**

- .1 Substitute different size bars only if permitted in writing by the Consultant.

1.8 **ALLOWANCE**

- .1 Include an allowance of five tonnes of additional reinforcing bars in the Contract. Allowance to include all costs including supply, detailing, fabricating and placement of rebars. Provide detailed records of use. Provide credit for unused portion based on unit prices.

PART 2 - MATERIALS

2.1 **MATERIALS**

- .1 Reinforcing steel: billet steel, grade 400 MPa, deformed bars to CSA-G30.18, unless otherwise indicated.
- .2 Weldable reinforcing steel: weldable steel, grade 400MPa, deformed bars to CSA G30.18. Required only where welding is indicated.
- .3 Cold-drawn annealed steel wire ties: to CSA G30.3.
- .4 Welded wire fabric: to CSA G30.5. Provide in flat sheets only.
- .5 Epoxy coated reinforcement: Apply fusion bonded epoxy coating conforming to the requirements of ASTM D3963/D3963M. Provide colour which contrasts sharply with reinforcing steel and rust colours. Brown is not acceptable. All bars must be supplied by plants certified by the Concrete Reinforcing Steel Institute for epoxy coated steel. Certified plants include:
 - .1 Harris Rebar - Stoney Creek, Ontario
 - .2 Teme Rebar Concepts - Fruitland, OntarioProvide patching material for areas where the epoxy coated is damaged or omitted in accordance with the coating manufacturer's written instructions using material supplied by the manufacturer.
- .6 Bar supports and side form spacers: to CSA-A23.1. For exposed concrete surfaces and for floor and roof slabs with directly applied ceiling finish: use either plastic bar supports or plastic tipped bar supports for at least the bottom 25mm; use plastic side form spacers; and use plastic with colour to match concrete. For epoxy coated reinforcement, use plastic bar supports, epoxy coated support bars and plastic coated tie wires.
- .7 Epoxy coating of existing reinforcement: Amerlock 400 High-Solids Epoxy by Amercoat Canada Inc. or an equivalent material acceptable to the Consultant. Provide colour which contrasts sharply with steel and rust colours.

2.2 **FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.
- .3 Where indicated, weld reinforcement in accordance with CSA-W186. Use weldable reinforcing steel.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar lists.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

- .1 Handle epoxy coated bars in accordance with CSA S413.
- .2 Place reinforcing steel in accordance with CSA-A23.1.
- .3 Concrete cover to be not less than required for fire rating.
- .4 Use only reviewed shop drawings and the Structural Drawings for placing of reinforcement. Report discrepancies to the Consultant before proceeding.
- .5 Before placing, remove all loose scale, dirt, oil or other coatings, which would reduce bond.
- .6 Turn the ends of tie wire towards the interior of the concrete.
- .7 Use bar supports for beams and slabs. Use precast concrete chairs where supports rest on the ground. Where welded wire fabric is used in slabs-on-grade, place precast concrete chairs at 600 mm on centre each way. Use side form spacers for walls and columns.
- .8 No splicing of reinforcement is permitted other than shown on the Structural Drawings.
- .9 Do not cut reinforcement without written approval of Consultant.
- .10 Ensure concrete cover to reinforcement is maintained during concrete pour.

3.2 FIELD BENDING

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

3.3 FIELD WELDING

- .1 Do not field weld reinforcement except where indicated or authorized by the Consultant. Do not weld epoxy coated reinforcement.
- .2 Conform to CSA A23.1 and CSA W186.

3.4 PATCHING FACTORY APPLIED EPOXY COATING

- .1 If factory applied epoxy coating is damaged or omitted, patch in accordance with coating manufacturer's written instructions using material supplied by manufacturer.

3.5 REVIEW OF CONSTRUCTION

- .1 Provide the Consultant with a minimum of 24 hrs notice of intended concrete pours to allow review of reinforcement.
- .2 Review of construction by Consultant is to ascertain general conformity with contract documents. It does not relieve the Contractor of his contractual responsibilities. The review is based on representative samples of the work and does not relieve the Contractor from carrying out his own quality control and making the work in conformity with the drawings and specifications.
- .3 Reviews are undertaken so that the Owner may be informed in writing as to the quality of the Contractor's performance and for the protection of the Owner.
- .4 The Contractor will receive copies of the construction review reports and the results of material tests. He will thereby be informed of any defects or deficiencies found.
- .5 Bring to the attention of the Consultant, any defects or deficiencies in the Work, which may occur during construction together with a proposal for remedy. The Consultant will decide what corrective action may be taken and will issue the necessary instructions.

3.6 REINFORCED MASONRY

- .1 Supply reinforcing bars required for the construction of masonry lintels, beams, walls, columns and piers. Provide shop drawings. Note that Structural Drawings do not show all openings. Refer to lintel notes on structural drawings.

3.7 **PITS, CURBS, BASES**

- .1 Construct all concrete sumps, pits, trenches, curbs and machinery bases forming part of floor construction that are required within the building by other trades.
- .2 Unless otherwise shown on drawings, reinforce curbs with 10M @ 400 dowels plus 2 - 10M continuous horizontal.
- .3 Unless otherwise shown on drawings, reinforce bases with 10M at 300 each way placed 50 mm below top of concrete.

END OF SECTION

PART 1 – GENERAL

1.1 SECTIONS INCLUDES

- .1 Finishing concrete floor surfaces.

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Sealants	Section 07 92 00
.3	Resilient Flooring	Section 09 65 00

1.3 REFERENCES

- .1 ACI-302.IR-96, Guide for Concrete Floor and Slab Construction.
- .2 ASTM-C171-97a, Sheet Materials for Curing Concrete.
- .3 ASTM-C309-98a, Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
- .4 CSA-A23.1/A23.2-00, Concrete Materials and Methods of Concrete Construction I Methods of Test for Concrete.

1.4 SUBMITTALS

- .1 Submit Product data and Shop Drawings under provisions of Section 01 33 00 - Submittals.
- .2 Provide list of Products proposed for use on Project where such Products are not specified by trade name or where Specification permits choice or alternatives. Include descriptive manufacturer or Supplier literature.
- .3 Include application instructions for concrete curing compound.

1.5 QUALITY ASSURANCE

- .1 Conform to CSA-A23.1/A23.2 and ACI 302.IR.

1.6 QUALIFICATION

- .1 Concrete Finishes Company specializing in commercial floor finishing with a minimum of five years documented experience, approved by the Consultant.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver Products to site under provisions of General Requirements Division 01.
- .2 Store and protect Products under provisions of General Requirements Division 01.
- .3 Take delivery of and store packaged materials on site in original undamaged condition with manufacturers' packing, labels and seals intact.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary Lighting: Minimum one 200 W light source, placed 2.5m above the floor surface, for each 40m² of floor being finished.
- .2 Temporary Heat: Ambient temperature of 10 degrees C minimum.
- .3 Ventilation: Sufficient to prevent carbon monoxide or high levels of carbon dioxide and other injurious gases from affecting concrete.
- .4 Electrical Power: Sufficient to operate equipment normally used.

1.9 WARRANTY

- .1 Provide a warranty for the work of this section in accordance with the General Conditions but for a period of three years.
- .2 The warranty shall cover defects in concrete floor finishing due to faults in workmanship or materials provided in this section.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Water: clean, potable and not detrimental to quality of concrete.

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Verify that substrate surfaces are ready to receive work and elevations are as indicated on Shop Drawings and as instructed by the finish flooring manufacturer.
- .2 Beginning of installation shall mean acceptance of substrate and site conditions.

3.2 PREPARATION

- .1 Clean existing concrete slabs left exposed or to receive resilient flooring, and applied floor finishes.

3.3 FINISHING CONCRETE FLOORS

- .1 Not Used for existing concrete floors.

3.4 CURING

- .1 Not used for existing concrete floors.

3.5 TOLERANCES

- .1 Correct defects in the existing concrete floor only by grinding or removal and replacement of the existing defective slabs. Areas requiring corrective work will be identified by the Consultant.

3.6 FIELD QUALITY CONTROL

- .1 Not required for existing concrete floors.

3.7 PROTECTION

- .1 Protect concrete slabs in accordance with the requirements of General Requirements – Division 01.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- .1 Procedures for unit masonry work.
- .2 Procedures for incorporating products to be built into unit masonry.

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Masonry Mortar and Grout	Section 04 05 13
.3	Masonry Anchorage and Reinforcement	Section 04 05 19
.4	Concrete Unit Masonry	Section 04 05 22
.5	Masonry Accessories	Section 04 05 23
.6	Structural Steel	Section 05 12 00
.7	Board Insulation	Section 07 21 13
.8	Air Barriers	Section 07 27 00
.9	Firestopping and Smoke Seals	Section 07 84 00
.10	Sealants	Section 07 92 00

1.3 REFERENCES

- .1 CAN/CSA-A179-04(R2009) Mortar and Grout for Unit Masonry
- .2 CAN/CSA-A371-04(R2009) Masonry Construction for Buildings

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 – Submittals.
- .2 Submit samples:
 - .1 One of each type of masonry unit specified.
 - .2 One of each type of masonry accessory specified.
 - .3 One of each type of masonry reinforcement, tie and connector proposed for use.
 - .4 As required by inspection and testing company for testing purposes.

1.5 TEST REPORTS

- .1 Submit laboratory test reports in accordance with Division 01 – General Requirements.
- .2 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.
- .3 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption.

1.6 QUALITY ASSURANCE AND JOB MOCK-UP

- .1 Masonry work shall be carried out by experienced masons under the continuous supervision of a competent foreman with a minimum of 5 years' experience with work of similar size and complexity.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to job site in dry condition.
- .2 Keep materials dry until use except where wetting of bricks is specified.
- .3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Cold Weather Requirements: Supplement Clause 5.16.2 of CAN/CSA-A371 with following requirements:
 - .1 Maintain temperature of mortar between 5°C and 50°C until batch is used.
 - .2 Protect masonry work from cold weather in accordance with clause 5.16.3 of CAN/CSA-A371, but for a minimum of 72 hours after construction.
- .2 Hot Weather Requirements: Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
- .3 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .4 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .5 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Masonry materials are specified in related Sections indicated in Article 1.3.

PART 3 – EXECUTION

3.1 INSTALLATION

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- .4 Construct portions of walls, below and adjacent to existing windows, to match adjacent wall construction unless noted otherwise on Drawings.
- .5 Refer to Structural Drawings for structural requirements.

3.2 CONSTRUCTION

- .1 Exposed Masonry: Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.
- .2 Jointing:
 - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, true to line, compressed, uniformly concave joints unless other jointing is indicated or specified.
 - .2 Where raked joints are indicated allow joints to set just enough to remove excess water, then rake joints uniformly to 6mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth.
 - .3 Strike flush all joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
 - .4 Wall surfaces and joint treatment for concealed portions of walls behind wall mounted fitments and mechanical units shall match exposed surfaces.
- .3 Cutting:
 - .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
 - .2 Make cuts straight, clean, and free from uneven edges.
- .4 Building-In:
 - .1 Prevent displacement of built-in items during construction. Check for plumb, location and alignment frequently, as work progresses.
 - .2 Build-into existing window sills and frames.
 - .3 Where structural steel members penetrate masonry walls fill-in spaces with neatly cut pieces of masonry units set in event mortar beds with tooled joints. Do not use rubble or broken pieces and mortar combinations as in-fill.

- .5 Wetting of Bricks:
 - .1 Except in cold weather, wet bricks having an initial rate of absorption exceeding 1g/minute/1000mm², wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
 - .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .6 Support of Loads:
 - .1 Use concrete specified on the structural drawings, where concrete fill is used instead of solid units.
 - .2 Use grout to CAN/CSA-A179 where grout is used instead of solid units. Cells with reinforcement shall be grouted.
 - .3 Install building paper below voids to be filled with concrete or grout; keep paper 25mm back from faces of units.
- .7 Provision for Movement:
 - .1 Leave 10mm space below shelf angles.
 - .2 Leave 25mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
 - .3 Build masonry to tie in with stabilizers, with provision for vertical movement.
- .8 Loose Steel Lintels: Install loose steel lintels as described on the structural drawings. Centre over opening width.
- .9 Bearing Plates and Anchors: Install loose steel bearing plates and anchors as described on the structural drawings.
- .10 Control Joints for Non-loadbearing Masonry Walls:
 - .1 Construct continuous full height control joints as indicated.
 - .2 Fill void at control joint with 20 MPa concrete grout to form continuous key.
 - .3 Locate exterior wall control joints as indicated on elevations.
 - .4 Locate interior wall control joints at a maximum spacing of 6000mm, and where non-loadbearing walls meet loadbearing walls.
- .11 Provide control joints in loadbearing masonry walls only at locations approved by the structural consultant or where shown on Structural Drawings.
- .12 Expansion Joints: Build-in continuous expansion joints as indicated.

3.3 SITE TOLERANCES

- .1 Tolerances in notes to Clause 5.3 of CAN/CSA-A371 apply.

3.4 RE-INSTALLATION

- .1 Cut openings in existing work as indicated.

- .2 Openings in walls to be approved by Consultant.
- .3 Make good existing work. Use materials to match existing.

3.5 FIELD QUALITY CONTROL

- .1 Inspection and testing of masonry work will be carried out by an inspection and testing company designated by the Consultant.
- .2 Cost of masonry inspection and testing will be paid by the Owner through the project cash allowance.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- .1 Mortar for Unit Masonry

1.2 RELATED SECTIONS

1. General Requirements	Division 01
2. Masonry Procedures	Section 04 05 13
3. Masonry Anchorage and Reinforcement	Section 04 05 19
4. Concrete Unit Masonry	Section 04 05 22

1.3 REFERENCE STANDARDS

.1	CAN/CSA A179	Mortar and Grout for Unit Masonry
.2	CAN/CSA A371	Masonry Construction for Buildings
.3	CSA A3000	Cementitious Materials Compendium
.4	ASTM C 780	Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
.5	ASTM C 1357	Standard Test Methods for Evaluating Masonry Bond Strength

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures
- .2 Submit two 75mm size samples of each mortar type and colour.

1.5 QUALITY ASSURANCE

- .1 Mortar prepared on-site based on proportion specifications:
 - .1 Prior to the commencement of masonry work prepared on-site, under the supervision of the inspection and testing company, mortar mixes for each mortar type specified.
 - .2 The inspection and testing company will sample and test the mortar mixes to determine a site aggregate/cement ratio Control Value for each mortar type.
 - .3 Once Site Control Values are established these will form the basis of acceptance for all subsequent Sample Ratio Tests conducted during the course of the work.
- .2 Mortar prepared off-site based on property specifications:
 - .1 Prior to the commencement of masonry work the inspection and testing company will sample and perform laboratory test for each mortar type prepared off-site to verify compliance with the specifications.
 - .2 Testing shall consist of the determination of:
 - .1 Aggregate/cement ratio.
 - .2 Water retention.
 - .3 Compressive strength.

04 05 13 – MASONRY MORTAR AND GROUT

- .4 Air Content
- .3 Once acceptable values are established these will form the basis of acceptance for tests conducted during the course of the work.
- .3 Arrange for representative of mortar manufacturer to meet with mason on site prior to commencement of masonry work, to review proper mixing procedures of mortar. Mixing must conform to instructions from supplier of pre-mixed mortar materials.
- .4 Submit test data as specified below.

1.6 COLD WEATHER REQUIREMENTS

- .1 During cold weather, lower than 5 degrees C, when danger of freezing exists, heat all masonry materials using methods accepted in the industry, in conformance to CSA-A371, and approved by the Consultant.

1.7 SUBMITTALS

- .1 Submit three (3) copies of performance data sheet for mortar mixtures. Indicate related standards and mortar properties in terms of compressive strength, water retention and air content. Provide all test certificates required for mortar mixture lots delivered to site.

1.8 TESTING

- .1 Testing of mortar materials will be carried out by Testing Laboratory designated by Consultant.
- .2 Inspection and testing to be paid by Owner.
- .3 Submit samples of sand and water for testing to ensure that mortar will not produce efflorescence.
- .4 Test for compliance with the performance requirements for integral mortar water-repellence. Mortar shall be capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514.
- .5 Perform compressive strength tests on all mortar and grout in accordance with the requirements of CSA S304.1. Compressive strengths must conform to the property specifications of CSA-A179.
- .6 Perform tests for flexural bond strength of masonry in accordance CSA S304.1. Flexural bond strengths shall not be less than 0.20MPa, in conformance with CSA-A179.

PART 2 – MATERIAL

2.1 MATERIALS

- .1 Sand: fine grain aggregate, graded in accordance with CSA A179
- .2 Water: potable, free off ice and any contaminants, to CSA A179.
- .3 Portland cement: to CAN/CSA-A5 normal Type 10
- .4 Hydrated lime: type 'S', in accordance with ASTM C207

2.2 MORTER

- .1 Mortar:
 - .1 Betomix Plus by Daubois or bulk preblended silo mix as supplied by Max-Mix, or equal approved by Consultant. Colourants to be premixed with mortar materials. Colour to be selected by Consultant.
- .2 Mortars for concrete unit masonry to be Portland cement/ hydrated lime/ sand mortars to the property standards of CSA A179.
- .3 Mortar for masonry load bearing walls and partitions to be Type 'S' as per property specifications of CSA A179.
- .4 Mortar for non-load bearing walls and partitions to be Type 'N' as per property specifications of CSA A179, unless indicated otherwise on the Structural Drawings.
- .5 Compressive strengths of mortars shall conform to the values indicated on Tables 8 and 9, for solid brick and concrete block respectively, of CSA Standard A179. Compressive strength of mortars must not exceed the compressive strength of the masonry units with which they are being used.
- .6 Except where specified otherwise, the basis of acceptance for mortar prepared on-site shall be the proportion specifications in CAN/CSA-A179
- .7 The basis of acceptance for mortar prepared off-site shall be the property specifications in CAN/CSA-A179

2.3 GROUT

- .1 Grout:
 - .1 Coarse grout to CSA A179, with maximum aggregate size of 12.5mm.
 - .2 Use fine grout where least dimension of void is less than 50mm.
 - .3 All grout to CSA A179, with sufficient water to produce pouring consistency without segregation of ingredients, but to retain cohesiveness.
 - .4 Slump is to be 200mm to 250mm. Minimum compressive strength is to be 20 MPa. Refer to structural drawings for additional grout requirements at reinforcing steel.

2.4 SOURCES

- .1 Use same manufactured brands and sources of mortar materials for entire project, in order to ensure uniformity of mix and coloration.

2.5 PARGING

- .1 Cement mortar parging: 1 part cement, 1 part lime to 6 parts sand by volume with sufficient water for a trowelable mix.

PART 3 – EXECUTION

3.1 CONSTRUCTION

- .1 Do masonry mortar work in accordance with CAN/CSA-A179 except where specified otherwise.
- .2 Apply parging in uniform coating coating not less than 8mm thick, where indicated and where dampproofing is to be applied on masonry walls.
- .3 Cove parging at junction of foundation wall with footing.

3.2 FIELD QUALITY CONTROL

- .1 As masonry work progresses, the inspection and testing company will test and report on mortar properties as follows:
 - .1 Mortar prepared in accordance with proportion specifications: Aggregate/Cement ratio.
 - .2 Mortar prepared in accordance with property specifications: compressive strength.
- .2 Provide six 50mm by 50mm by 50mm mortar samples taken at random for each test when requested by inspection and testing company.

3.3 MIXING OF MORTARS

- .1 Mason to review mixing procedures with mortar manufacturer.
- .2 Mix mortar thoroughly, in quantities only as needed for immediate use.
- .3 Mix mortar in mechanical mixer operated until homogeneously blended, but not less than 3 minutes after all materials are in mixer.
- .4 Obtain manufacturer's approval for any additives.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- .1 Reinforcement for masonry walls and lintels
- .2 Connectors for masonry walls

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Masonry Procedures	Section 04 05 00
.3	Masonry Mortar and Grout	Section 04 05 13
.4	Concrete Unit Masonry	Section 04 05 22
.5	Masonry Accessories	Section 04 05 23
.6	Clay Unit Masonry	Section 04 21 00
.7	Structural Steel	Section 05 10 00

1.3 REFERENCES

.1	ASTM-A153/A153M-95	Standard Specified for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
.2	CAN/CSA-A23.1-04	Concrete Materials and Methods of Concrete Construction.
.3	CAN/CSA-A370-04 (R2009)	Connectors for Masonry
.4	CAN/CSA-A370-04 (R2009)	Masonry Construction for Buildings
.5	CAN/CSA-G30.18-M92 (R2007)	Billet-Steel Bars for Concrete Reinforcement.
.6	CSA-S304.1-04	Design of Masonry Structures
.7	CSA-W186-M1990 (R2007)	Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.4 DESIGN REQUIREMENTS

- .1 Seismic Loads: Design size and spacing of masonry reinforcement and masonry veneer connectors to withstand seismic loads in accordance with the Ontario Building Code, Subsection 4.1.8.
- .2 Structural Design of masonry reinforcement and masonry veneer connectors shall be by a qualified Professional Engineer licensed to practice in the Province of Ontario

1.5 SUBMITTALS

- .1 Submit product data sheets for all reinforcement types proposed for use in this project, in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Include a copy of the data sheets in the shop drawing manual at the conclusion of the project.

- .3 Submit samples of anchors, ties, and fasteners for approval of Consultant.

1.6 SOURCE QUALITY CONTROL

- .1 Upon request, provide the Consultant with a certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.
- .2 Upon request inform Consultant of proposed source of material to be supplied.

1.7 SHOP DRAWINGS

- .1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings shall consist of bar bending details, lists and placing drawings.
- .3 On placing Drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.
- .4 Shop Drawings shall bear the seal and signature of the Professional engineer providing structural design for reinforcement and connectors.

PART 2 – MATERIAL

2.1 REINFORCEMENT

- .1 Bar reinforcement: to CAN/CSA-A371 and CAN/CSA-G30.18.
- .2 Wire Joint Reinforcement - Single Wythe Walls: to CAN/CSA-A371, ladder type, 4.76mm diameter wire, size to suit wall thickness.
 - .1 Blok-Lok Limited: BL-10 Ladder Reinforcement.
 - .2 Dur-O-Wal: DA3200 Single Wythe Ladur.
- .3 Wire Joint Reinforcement - Cavity Walls: to CAN/CSA-A371, ladder type, 4.76mm diameter wire, size to suit wall thickness. Blok-Lok Limited: BL-42 Ladder Reinforcement.
- .4 Cavity Wall Connectors: to CAN/CSA-A370. Hot dip galvanized, to ASTM-A153/A153M, Class B2, 458g/ m2 minimum coating.
 - .1 Concrete masonry unit backings:
 - .1 Blok-Lok Limited: 4.76mm diameter, System 2000 Tie installed at 400mm on centre vertical spacing and used in conjunction with wire joint reinforcement specified in subparagraph 2.01.3 for cavity walls and Blok-Lok Limited, Wedge-Lok cavity-wall insulation fasteners.
 - .2 Fero Corporation: Block Shear Connector complete with V-Tie and insulation supports, installed at 800mm on centre horizontal spacing and 400mm on centre vertical spacing and used in conjunction with wire joint

reinforcement as specified in sub-paragraph 2.01.2 installed at 400mm on centre vertical spacing.

- .2 Cast-in-Place Concrete Backings:
 - .1 Install dovetail anchor slots at 800mm on centre spacing and dovetail anchors at 400mm on centre.
 - .2 Blok- Lok Limited, BL-305 Dovetail Anchor Slot with BL-303 Dovetail Anchors, complete with Blok-Lok Limited, Wedge-Lok cavity wall insulation fasteners.
- .5 Corrosion Protection for Wire Joint Reinforcement: galvanized to ASTM-A153/A153M.
 - .1 Exterior Wall: Hot dip galvanized, Class 82, 458g/m 2 minimum coating.

2.1 FABRICATION

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.
- .2 Fabricate connectors in accordance with CAN/CSAA-370.
- .3 Obtain the Consultants approval for locations of reinforcement splices other than those shown on placing drawings.
- .4 Upon Consultants approval, weld reinforcement in accordance with CSA-W186.
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

PART 3 – EXECUTION

3.1 GENERAL

- .1 Do masonry connector and reinforcement work in accordance with CAN/CSA-A370, CAN/CSA-A371, CAN/CSA-A23.1 and CSA-S304.1 unless indicated otherwise.
- .2 Accurately place reinforcement, support, and secure against displacement as indicated on structural drawings and in accordance with CAN/CSA-A371
- .3 Prior to placing grout, obtain Consultant's approval of placement of reinforcement and connectors.
- .4 Do additional reinforcement of masonry as indicated.
- .5 Supply dovetail anchor slots for casting into concrete work where required as indicated on the structural drawings and specifications.

3.2 INSTALLATION OF MASONRY ANCHORAGE AND REINFORCEMENT

- .6 Refer to Section 04 05 19 for installation of masonry anchorage and reinforcement.

- .7 Refer to structural drawings for additional requirements. All reinforcing shall conform to structural requirements as a minimum. Where structural requirements differ from these specifications, the most stringent requirements shall apply.
- .8 Note that “solid wall” describes a masonry wall consisting of 1 or more wythes of brick and/or block (which may be solid or hollow core) with mortar joint only between wythes - no air space.
- .9 Install reinforcement as indicated above for the materials specified, in conformance with structural drawings and manufacturer’s instructions.
- .10 For single wythe interior masonry walls, truss type reinforcing is required at every second course for walls 190mm wide or less, and ladder type reinforcing is required at each course at walls wider than 190mm.
- .11 Provide and install prefabricated tees and corners at wall corners and intersections.
- .12 Install ties in accordance with Ontario Building Code.
- .13 Pre-drill for anchors using appropriate type and size of bit. Provide two anchors per tie with minimum embedment of 25mm. Conform to manufacturers specifications.
- .14 Test at least two anchors to failure. Test must be carried out by a Professional Engineer and must certify tension load test to anchor failure. Cost of test will be paid by the Owner.

3.3 JOINT REINFORCEMENT

- .1 Locations of Joint Reinforcement:
 - .1 Concrete masonry unit wythe in cavity walls.
 - .2 Single wythe masonry walls and partitions.
- .2 Install joint reinforcement horizontally at 400mm on centre vertical spacing, unless indicated otherwise.
- .3 Place additional reinforcement extending 600mm beyond jambs in courses 200mm, 400mm and 800mm above and below wall openings.
- .4 Lap joint reinforcement 300mm at splices.
- .5 Reinforce and grout loadbearing masonry walls as shown on the Structural Drawings.

3.4 BONDING AND TYING

- .1 Bond walls of two or more wythes using wire joint reinforcement and metal connectors in accordance with the OBC, CSA-S304.1, CAN/CSA-A371 and as indicated.
- .3 Tie masonry veneer to backing in accordance with OBC, SCA-S304.1, CAN/SCA-A371 and as indicated.
- .4 Install continuous single wire brick joint reinforcement connected to brick ties.

3.5 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry lintels and bond beams as indicated on Structural Drawings. Make joints in lintels and bond beams to match adjacent walls.
- .2 Place and grout reinforcement in accordance with CAN/CSA-A371, and the Structural Drawings.

3.6 GROUTING

- .1 Grout masonry in accordance with SCA-S304.1 and as indicated on Structural Drawings.

3.7 METAL ANCHORS

- .1 Do metal anchor work as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

- .1 Do lateral support and anchorage in accordance with SCA-S304.1 and as indicated.
- .2 Lateral Support Anchors (for attachment to structural steel): Blok-Lok, Flex-o-Lok.

3.9 CONTROL JOINTS

- .1 Terminate reinforcement 25mm short of each side of control joints unless otherwise indicated.

3.10 FIELD BENDING

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

3.11 FIELD TOUCH-UP

- .1 Touch-up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED WORK

.1	Masonry Mortar and Grout	Section 04 05 13
.2	Masonry Anchorage and Reinforcement	Section 04 05 19

1.2 REFERENCE STANDARDS

.1	CAN/CSA-A165 Series	CSA Standards for Concrete Masonry Units
.2	CAN/CSA-S304.1	Design of Masonry Structures
.3	CAN/CSA-A371	Masonry construction for Buildings
.4	CAN/CSA-A370	
.5	National Concrete Masonry Association	
	1. NCMA TEK 10-2C	Control Joints for Concrete Masonry Walls - Empirical Method
	2. NCMA TEK-3A	Control and Removal of Efflorescence
	3. NCMA TEK-3A	Cleaning Concrete Masonry

1.3 PROTECTION

- .1 Protect adjacent surfaces from marking or damage due to masonry work.

PART 2 – MATERIAL

2.1 MATERIALS

- .1 Concrete blocks:
- .1 to CAN/CSA-A165 Series, metric modular, Type H/15/A/M in concealed spaces, and H/15/D/M lightweight for exposed walls.
 - .2 Provide block of higher compressive strength where indicated on structural drawings.
 - .3 Blocks for fire rated partitions to have required percentage of solid material necessary to provide rating.
 - .4 Sizes as indicated on drawings.
- .2 Curing of lightweight block:
- .1 Autoclave or low-pressure steam curing is acceptable, provided that masonry units comply with linear shrinkage and moisture content requirements of CSA A165.1 for type M units at time of delivery to site.
 - .2 Age all units, prior to delivery to site, as follows:
 - .1 Autoclaved units: minimum 7 days.
 - .2 Low pressure steam cured units: minimum 28 days

04 05 22 – CONCRETE UNIT MASONRY

- .3 Special Shapes:
 - .1 Bond beam, lintel beam, corner and other shapes as required or indicated on drawings.
 - .2 Provide external corner units as a single unit, with required architectural face appearance on one side and one end.
- .4 Metal Anchors: Conforming to Ontario Building Code and Section 04 05 19.
- .5 Control Joint Filler: Blok-Lok “Exp-Joint”, closed cell neoprene expansion joint material.

2.2 EXPOSED MASONRY FACES

- .1 Notwithstanding visual inspection requirements of CSA standards, masonry units shall be free of surface indentations, surface cracks due to manufacture, or chipping. Units so delivered shall be culled from use for exposed purposes but may be used where concealed.
- .2 Concrete masonry units exposed both sides, such as at interior partitions walls, must be visibly uniform in width, so that both faces of the wall are smooth, with all block faces in plane. Total variation in width must not exceed 2mm. Mason shall reject blocks which do not conform to this size requirement.

PART 3 – EXECUTION**3.1 WORKMANSHIP**

- .1 Build masonry work true-to-line, plumb, square and level, with vertical joints in proper alignment.
- .2 Assume complete responsibility for dimensions, plumbs and levels of this work and constantly check same with graduated rod.
- .3 Masonry courses to be of uniform height, and both vertical and horizontal joints to be of equal and uniform thickness.
- .4 Extend non-loadbearing partitions to underside of floor structure above, providing 25mm deflection clearance. Install lateral support angles, as specified on the structural drawings, and acoustic insulation filler at top of wall.
- .5 Carry wall up in uniform manner, no one portion being raised more than 1200mm above another at any time. Build no more than 1500mm of wall measured vertically in any one day.
- .6 Buttering corners of units, throwing mortar into joints, deep or excessive furrowing of bed joints not permitted. Do not shift or tap units after mortar has taken initial set. Where adjustments must be made after mortar has started to set, remove mortar and replace with fresh supply.

- .7 Where new masonry abuts old or fully set masonry, clean existing surfaces and dampen if necessary to obtain bond.
- .8 Evidence of noncompliance with Contract Documents including the following will require replacement and/or repair:
 - .1 Shrinking
 - .2 Curling
 - .3 Spalling
 - .4 Poor colour blend
 - .5 Poor texture blend
 - .6 Discolouration of mortar
 - .7 Chipping

3.2 BLOCKWORK

- .1 Lay concrete block in running bond, except as noted on Drawings, with thicker end of face shell upward. Standard coursing to be modular 200mm for one block and one joint.
- .2 Use lightweight concrete blocks for exposed interior surfaces of walls and partitions. Regular concrete blocks may be used for concealed surfaces.
- .3 Use special shaped, and finished units where indicated, specified or required. Use bull-nosed units for exposed external corners, window jambs, etc. Exposed open cells not permitted.
- .4 Concrete masonry units shall have face shells and their end joints fully filled with mortar, and joints squeezed tight. Also fill webs at cores, to be reinforced and grouted, and strike flush at core taking care to prevent mortar from falling into core.
- .5 Tie intersecting non-bearing walls together with masonry reinforcing every second course.
- .6 Do not tie intersecting bearing walls together in masonry bond, except at corners.
- .7 Exercise special care laying up concrete block in locations where plastic wall coating finish is indicated. Block walls in these locations shall be plumb with joints tooled, concave.
- .8 Where resilient base is indicated, tool the joints to within 100mm of the floor. Cut joints flush behind the base.

3.3 MORTAR AND POINTING

- .1 Mortar is specified in Section 04 05 13.
- .2 Make all joints uniform in thickness, straight, in line, with mortar compressed to form concave joints.
- .3 Strike joints flush where walls are to receive insulation, ceramic tile, or similar finishes.

- .4 Point faced blockwork by filling holes and cracks in exposed mortar joints. Cut out defective joints, refill solidly with mortar and tool to form neat concave joint.

3.4 BUILDING IN COMPONENTS

- .1 Build in door, screen, and window frames, steel lintels, sleeves, anchor bolts, anchors, nailing strips and other items to be built into masonry.
- .2 Do not distort frames. Bed anchors of frames in mortar and fill frame voids with mortar or grout as wall is erected.

3.5 BEARING POINTS

- .1 Fill concrete block solid with 20 MPa concrete grout at the following locations:
 - .1 for two courses below bearing points of structural members;
 - .2 behind wall-hung mechanical fixtures;
 - .3 and elsewhere as indicated on drawings.
- .2 Install building paper over wire mesh reinforcing in the beds below solid block section.
- .3 Use 100% solid concrete blocks where indicated.

3.6 CONTROL JOINTS

- .1 Provide continuous vertical control joints in concrete block and brick partitions and walls at locations indicated, and at maximum 4.0m O.C. Control joints may be at 6.0m O.C. for autoclaved block only.
- .2 Control joints are required at changes in wall height, at pilasters and changes in wall thickness, at movement joints in foundations and floors and roofs, at one side of door or window openings under 1.8m wide, on both sides of openings over 1.8m wide, and adjacent to corners.
- .3 Confirm all control joint locations with the Consultant prior to wall construction. Provide drawings marked up to show locations of all control joints.
- .4 Form control joints as detailed. Stop masonry reinforcing each side of joints; except where structural reinforcing is required, such as at bond beams.
- .5 Provide bond breaker at each control joint, of building paper or black polyethylene. Continue bond breaker over lintels at openings.

3.7 HORIZONTAL REINFORCING

- .1 Cavity wall and concrete block walls shall be continuously reinforced and tied together with horizontal masonry reinforcing in every second block bed joint.

- .2 Additionally, place masonry reinforcing in first and second bed joints above and below openings. Reinforcing in first bed joint shall be continuous. Second bed joint reinforcing shall extend 600 mm beyond each side of opening.
- .3 Place continuous reinforcing in second bed joint below top of wall.
- .4 Lap reinforcement minimum of 150mm at splices. Supply & install prefabricated sections at corners and intersection of walls to insure continuity of reinforcing.

3.8 FIRE-RATED PARTITIONS

- .1 Block shall be of density required to achieve fire rating, in accordance with the Ontario Building Code.
- .2 At door openings in fire rated masonry partitions, fill concrete block solid with 20 MPa concrete for a distance of 400mm at each side and 400mm above openings.

3.9 REINFORCED MASONRY WALLS

- .1 Construct reinforced masonry walls to conform to the requirements of the Ontario Building Code and CSA-A371, and as indicated on Structural drawings.
- .2 Lay units so as to maintain an unobstructed vertical continuity in the cells. All walls and cross webs shall be fully bedded. No over-hanging mortar or debris shall be allowed inside the reinforced cells unless otherwise on the drawings.
- .3 Vertical reinforcing shall be provided full length without splicing. It may be installed after the first 1200mm of masonry is erected. Locate rods accurately in the cells as shown on the Drawings. Hold in position top and bottom. Fill cells containing reinforcement solidly with 20 MPa concrete grout, unless noted otherwise on Structural drawings. Consolidate by puddling when placing and again reconsolidate before plasticity is lost. Place concrete grout in lifts not exceeding 1200mm. Stop each lift 38mm below the top of a masonry unit.
- .4 Refer to Structural and Architectural drawings for locations and grout strength.

3.10 CUTTING MASONRY

- .1 Cutting of masonry units exposed in finished work shall be done with approved type power saw. Where electrical conduit outlet or switch boxes occur, grind and cut units before services installed. Quick saw not permitted for cutting block above grade.
- .2 Obtain Consultants approval before cutting any part or area which may impair appearance or strength of work.
- .3 Patching of masonry not permitted without Consultants approval.

3.11 BOND BEAMS

- .1 Install concrete block bond beams where indicated and where required for bearing of structural members.
- .2 Unless more stringent requirements are noted on Structural drawings, make bond beams of special channel blocks with two 15M reinforcing bars placed in bottom, and filled with 20 MPa concrete grout. Extend a minimum length of 200mm, each side of structural member.

3.12 REINFORCED LINTELS

- .1 Install reinforced concrete block lintels at openings where steel lintels are not indicated.
- .2 Cast and cure lintels on a plank. Set special channel lintel blocks using specified mortar. Place wood stops at each end of lintel to prevent movement.
- .3 Refer to Structural drawings for lintel sizes and dimensions. As a minimum, place 25mm of 20 MPa concrete grout in voids, lay in two 15M reinforcing bars and place concrete to level of block sides. Rod and tamp concrete well without disturbing reinforcing. Allow lintels to cure 7 days before loading.

3.13 COORDINATION

- .1 Provide openings in masonry walls where required or indicated. Provide reinforced lintels over all openings in both loadbearing and non-loadbearing walls.
- .2 Accurately locate chases and openings, and neatly finish to required sizes. Refer to Mechanical and Electrical drawings and co-operate with all trades.
- .3 Where masonry encloses conduit or piping, bring to proper level indicated and as directed. Do not cover any pipe or conduit chases or enclosures until advised that work has been inspected and tested.
- .4 Build in frames and anchor bolts, and metal brackets for fitments, louvres, etc.

3.14 CLEANING

- .1 On completion, remove excess mortar and smears using wood paddles or scrapers.
- .2 Point or replace defective mortar to match existing, as required or directed.
- .3 Clean concrete masonry walls exposed in the finished work in accordance with manufacture's recommendations and NCMA TEK Bulletin #8-4A.
- .4 Remove dirt and stains from masonry walls exposed in the finished work in accordance with manufacturer's recommendations and NCMA TEK Bulletin #8-2A.

- .5 Remove efflorescence from masonry walls exposed in the finished work in accordance with manufacturer's recommendations and NCMA TEK Bulletin #8-3A.
- .6 Repeat cleaning operations until work is satisfactory.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- .1 Masonry accessories.
- .2 Masonry flashing.

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Masonry Procedures	Section 04 05 00
.3	Masonry Mortar and Grout	Section 04 05 13
.4	Masonry Anchorage and Reinforcement	Section 04 05 19
.5	Concrete Unit Masonry	Section 04 05 22
.6	Clay Unit Masonry	Section 04 21 00
.7	Air Barriers	Section 07 27 00
.8	Firestopping and Smoke Seals	Section 07 84 00

1.3 REFERENCES

- .1 CAN/CSA-A371-04 (R2009), Masonry Construction for Buildings.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Horizontal Control Joint Filler: purpose-made elastomer for minimum compression of 25% of uncompressed size. Emseal Corporation: Greyflex.
- .2 Vertical Control Joint Filler: preformed expanding elastomer for minimum compression of 25% of uncompressed size. Emseal Corporation: Greyflex.
- .3 Lap Adhesive: recommended by masonry flashing manufacturer.
- .4 Weep Hole Vents: purposed-made PVC:
 - .1 Clear plastic tube: Dur-O-Wal Limited: DA1005 Weephole Tube.
 - .2 Plastic Vent: Goodco Ltd: Goodco Brick Vent: J.V. Building Products: PVC Brick Vent.
- .5 Vent Holes: minimum 100mm high.
 - .1 Dur-O-Wal Limited: DA 1069 Cell Vent.
 - .2 Block-Lok Limited: Wilco Weephole Ventilator.
- .6 Compressible Joint Filler at Penetrations and Top of Masonry Partitions:
 - .1 AD Fire Protection System Inc.: A/D Firebarrier Mineral Wool Firestopping Insulation.
 - .2 Fibrex Insulations Inc.: Fibrex Safing Insulation.

- .3 Roxul Inc.: RXL Safe Fire Stop Batt.
- .7 Mechanical Fasteners: stainless steel, self-tapping.
- .8 Metal Drip Flashing: Cold drawn and annealed stainless steel, Type 304, 50mm wide by 2400mm long, with 10mm hemmed edge.
- .9 Cavity Wall Flashing: 1.0mm minimum thickness SBS modified self-adhesive or adhesive applied membrane.
 - .4 Henry/Bakor Inc.: Blueskin TWF.
 - .5 Soprema: Sopraseal Membrane Flashing.
 - .6 W.R. Grace and Co. of Canada Ltd.: Perm-A-Barrier Wall Flashing.
 - .7 W.R.Meadows of Canada Ltd.: Sealtight Air-Shield Flashing Membrane.
- .10 Flexible Through-Wall Flashing:
 - .8 Lexsuo Canada Limited.: F-20 membrane with CA-105 adhesive.
 - .9 W.R. Meadows of Canada Ltd.: Sealtight Flex-Guard PVC Masonry Flashing with Vinyl Flash Adhesive Compound.
- .11 Cavity Wall Air Space Filler: compressible, closed cell neoprene.
- .12 Mortar Dropping Control Device: Trapezoidal-shaped polyester mesh with integral insect barrier. Mortar Net USA Ltd.: Mortar Net with Insect Barrier.

PART 3 – EXECUTION

3.1 INSTALLATION

- .1 Install continuous control joint fillers in control joints at locations indicated and under shelf angles.
- .2 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600mm on centre.
- .3 Install vent holes at top of cavities to line-up with weep holes.
- .4 Install cavity wall air space filler at corners and as indicated to compartmentalize air space.
- .5 Install compressible joint filler at the top of masonry partitions that are not fire separations. Refer to Section 07 84 00 – Firestopping and Smoke Seals for joint treatment and fire separations.
- .6 Install compressible joint filler and acoustical sealant at penetrations through walls and partitions between classrooms, both above and below ceilings.
- .7 Install one row of mortar dropping control devices above all flashings at base of wall and above wall openings. Install in accordance with the manufacturer's printed instructions.

- .8 Prior to applying cavity wall flashing and flexible wall flashing, install metal drip flashing at front edge of steel angles or masonry units. Coat surface of steel angles with bituminous paint prior to setting metal drip flashing. At splices, overlap metal drip sections by 100mm, apply butyl water resistant sealant between spliced pieces, and crimp hemmed edges.

3.2 CONSTRUCTION

- .1 Build in flashings in masonry in accordance with CAN/CSA-A371 and as follows:
 - .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.
 - .2 In cavity walls and veneered walls, carry flashings, starting 15mm back from front edge of masonry, under outer wythe, then up backing not less than 200mm, and as follows:
 - .1 For masonry backing, bond to wall, using manufacturer's recommended adhesive where required. Overlap flashing with air barrier membrane.
 - .2 For concrete backing, bond to wall, using manufacturer's recommended adhesive where required. Overlap flashing with air barrier membrane.
 - .3 For wood frame backing, staple flashing to walls behind sheathing paper.
 - .4 For gypsum board backing, bond to wall using manufacturer's recommended adhesive where required and overlap with air barrier membrane.
- .2 Lap joints 150mm and seal with adhesive.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- .1 Brick unit masonry.
- .2 Procedures specific to installing brick.

1.2 RELATED SECTIONS

.1	General Requirements.	Division 01
.2	Masonry Procedures	Section 04 05 00
.3	Masonry Mortar and Grout	Section 04 05 13
.4	Masonry Anchorage and Reinforcement	Section 04 05 19
.5	Concrete Unit Masonry	Section 04 05 22
.6	Masonry Accessories.	Section 04 05 23

1.3 REFERENCES

- .1 BIA, Technical Notes on Brick Construction No. 20, Cleaning Brick Masonry, November 1990.
- .2 CAN/CSA-A82-06, Fired Masonry Brick Made From Clay or Shale.

PART 2 – PRODUCTS

2.1 MANUFACTURED UNITS

- .1 Face Brick: Burned clay brick, to CAN/CSA-A82.
 - .1 Grade: EG (Exterior Grade)
 - .2 Type: X.
 - .3 Size: Refer to schedule below.
 - .4 Colour and texture: Refer to schedule below.

2.2 MASONRY UNIT SCHEDULE

- .1 Masonry Unit Brick:
 - .1 Existing brick salvaged, protected, stored until reinstallation. Cut brick to suit wall assembly and associated structural lintel.

PART 3 – EXECUTION

3.1 INSTALLATION

- .1 Bond: To match existing brick wall.
- .2 Coursing Height: Existing brick coursing.
- .3 Jointing: concave where exposed or where paint or similar thin finish coating is specified unless indicated otherwise.
- .4 Mixing and Blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.
- .5 Clean unglazed clay unit masonry as work progresses.

3.2 CLEANING

- .1 Clean clay unit masonry mock-up panel specified in Section 04 05 00 – Masonry Procedures as directed below and leave for one week.
- .2 If no harmful effects appear and after mortar has set and cured, protect windows, sills, doors, trim and other work, and clean brick masonry as follows:
 - .1 Remove large particles with wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.
 - .2 Scrub with solution of 25 ML trisodium phosphate and 25 ML household detergent dissolved in 1 L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose. Alternatively, use proprietary compound recommended by brick masonry manufacturer in accordance with manufacturer's directions.
 - .3 Repeat cleaning process as often as necessary to remove mortar and other stains.
 - .4 Use acid solution treatment for difficult to clean masonry as described in BIA Technical Note No.20.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

- .1 Coordinate this work with the work of the steel joist supplier. Provide all necessary dimension and structural steel shop drawings to the steel joist supplier for the completion of their work.

1.2 WORK FURNISHED AND INSTALLED

- .1 Separate column base plates
- .2 Columns, beams, purlins, and girts
- .3 Bracing
- .4 Steel framing around roof and floor openings
- .5 Diagonal supports at columns for deck or slabs
- .6 Stair landing beams and hangers for steel stairs
- .7 Structural steel door frames and sill angles
- .8 Hoist beams
- .9 Weldable reinforcing steel bars attached to structural steel
- .10 Field connections to concrete and masonry

1.3 WORK FURNISHED AND NOT INSTALLED

- .1 Anchor bolts
- .2 Connection assemblies set in concrete
- .3 Loose angle lintels that bear on concrete or masonry
- .4 Shelf angles/plates and wall plates that bear on or are attached to concrete or masonry

1.4 WORK INSTALLED ONLY

- .1 Installation of steel joists and steel bridging

1.5 RELATED WORK SPECIFIED SHEWHERE

.1	Grouting under base plates,	Section 03 30 00.
.2	Supply of steel joists,	Section 05 21 00.
.3	Steel deck,	Section 05 31 00.
.4	Metal fabrications,	Section 05 50 00.
.5	Cementitious Fireproofing,	Section 07 81 16.

1.6 REFERENCES

- .1 CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Quality Steel /

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- Structural Quality Steels.
 - .2 CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA S16.1, Limit States Design of Steel Structures.
 - .4 CSA S136, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .5 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
 - .6 CSA W48.1, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W59, Welded Steel Construction (Metal Arc Welding).
 - .8 CAN/CGSB 1.171, Inorganic Zinc Coating.
 - .9 CAN/CGSB 1.181, Ready Mixed Organic Zinc Coating.
 - .10 CISC/CPMA 1.73a, A Quick-Drying One-Coat Paint for Use on Structural Steel.
 - .11 CISC/CPMA 2.75, A Quick-Drying Primer for Use on Structural Steel.
 - .12 ASTM A53/A53M, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - .13 ASTM A108, Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
 - .14 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
 - .15 ASTM A325, Standard Specification for Bolts for Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
 - .16 ASTM A570/A570, Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
 - .17 SSPC, Steel Structures Painting Council.

1.7 QUALITY ASSURANCE

- .1 Structural steel fabrication shall be carried out by a firm that has been in structural steel business (for buildings) for at least five years and that is certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2.
- .2 Erection of the structural steel and steel joists shall be carried out by the steel fabricator's own forces, unless written permission to sublet the Work is obtained from the Consultant. Welding shall be carried out by CWB approved welders under the supervision of a CWB approved firm.
- .3 Engage a Professional Engineer to be responsible for the design, detailing and installation of all connections related to structural steelwork. Before submitting shop drawings, submit a letter signed and sealed by that Engineer stating that he has been engaged to undertake the responsibility for the above. Also submit a copy of that Engineer's Certificate of Authorization, and proof of his liability insurance. When requested, submit calculations signed and sealed by that Engineer. On completion of erection, submit a letter signed and sealed by that Engineer to certify that Work has been completed in accordance with all shop drawings reviewed by the Consultant and the Structural Engineer.
- .4 Before the start of fabrication, supply the independent inspection and testing agency with mill test certificates or producer's certificates satisfactorily correlated to the materials or products to which they pertain. The onus for ensuring that the materials and products can be properly identified according to grade or specification rests with the Contractor.

- .5 Do not splice sections without the prior acceptance of the Consultant and the submission of pertinent shop drawings. Accepted splices will be required to develop the section. Each splice shall be given a non-destructive test by an independent inspection company acceptable to the Consultant. Testing shall be at the Contractor's expense. Evaluate results in accordance with CSA W59 and report to the Consultant.

1.8 TOLERANCES

- .1 Conform to the fabrication and erection tolerances of CAN/CSA S16.
- .2 In addition if more stringent tolerances are specified elsewhere to suit interfacing materials, the latter shall govern in such cases.

1.9 SHOP DRAWINGS

- .1 Refer to Section 01 33 00 - Submittals. "Shop drawings" means erection diagrams and shop details. Shop drawings received after noon will be date-stamped as received the following working day.
- .2 Submit to the Consultant for review before fabrication, 4 white prints of erection diagrams. Leave room on drawings for the stamps of the Consultant and the Structural Engineer. Check and sign before submission. Only 2 copies will be returned to General Contractor. The first submission of the erection diagrams to include a complete materials list indicating steel grades, paints, etc.
- .3 Show orientation of bearing plates on erection drawings.
- .4 In addition to beam designation marks, show beam sizes on erection drawings.
- .5 Submit to the Consultant for review before the start of Work, 4 white prints of shop drawings. Leave room on drawings for the stamps of the Consultant and the Structural Engineer. Check and sign before submission. Only 2 copies will be returned to General Contractor.
- .6 All shop drawings shall bear the seal and signature of the Professional Engineer responsible for designing the connections.
- .7 The Professional Engineer designing the connections shall hold a Certificate of Authorization, and shall carry min. \$1,000,000.00 in liability insurance.
- .8 It is advisable to submit erection diagrams for review before preparing shop details. Include details of special conditions. Make erection diagrams. Copies of section details developed by VX Engineering Inc. will not be accepted as erection diagrams. If required, structural plans will be available "as-is" for use in the preparation of shop drawings provided that the title blocks are removed and provided that the Owner and the Owner's

Consultants are not held responsible for any errors or omissions on the drawings. CAD files of the structural sections, elevations and schedules will not be made available for the preparation of shop drawings.

- .9 Show the sizes, spacing and the locations of structural steel, connections, attachments, reinforcing and anchorage. Include all necessary plans, elevation and details. Indicate size and type of fasteners. For welded connections use welding symbols in compliance with CISC and indicate clearly the length of weld. Prepare shop drawings using metric sizes and units. All documents shall carry the seal of a Registered Professional Engineer licensed to practice in the Province of Ontario, who shall be responsible for the design of connections and details, and the fabrication, temporary shoring and erection of all structural steel. Show also vent holes required for galvanizing process.
- .10 Review of shop drawings by the Consultant and Structural Engineer is a precaution against oversight or error and solely to review conformance with general design intent. It is not a detailed check and must not be construed as relieving the Contractor of responsibility for making the Work accurate and in conformity with the Contract Documents. Design for which the Contractor is responsible under the Contract will not be reviewed. Work done prior to the receipt of the reviewed drawings will be at the risk of the Contractor. Review comments are not authorization for changes to the Contract price.
- .11 Provide the office preparing shop drawings with a complete set of Contract Drawings and Specifications plus all Addenda and Change Orders.
- .12 Do not release column shop details for fabrication before establishing on site the final elevations of the tops of supporting piers.
- .13 Make corrections required by previous review before resubmitting drawings. Clearly indicate all changes and additions to previous submission. Do not add new details to drawings which have been stamped as reviewed or noted.
- .14 After review, erection diagrams will be returned to the Contractor stamped to show one of the following:
 - .1 Reviewe - Reviewed with no comments.
 - .2 Note - Reviewed with comments noted on drawing. Submit two final record prints as soon as corrections are made.
 - .3 Resubmit - Reviewed with comments noted on drawing. Correct and resubmit for review.Conform to the requirements of each authority that has reviewed the drawings.
- .15 Allow a minimum of 15 working days for review of each submission of shop drawings in the Structural Engineer's office. Allow more time when large quantities of shop drawings are submitted. Submit in general conformity with the sequence of construction intended. Co- ordinate with the Consultant. Shop drawings received after noon will be date-stamped as received the following working day.
- .16 Keep on site at all times a set of shop drawings bearing the review stamps of the Consultant and the Structural Engineer and use only these drawings and the Structural Drawings to erect structural steel. Neatly mark on the Structural Drawings changes issued during the course of construction.

- .17 Show details by which steel assemblies, which are set in concrete, are to be connected to the formwork.
- .18 If additional instructions are required from the Consultant, allow a minimum of five working days for the Structural Engineer to review and respond to the request for instruction.

1.10 SUBSTITUTIONS

- .1 Submit all proposals for substitutions to the Consultant in writing in advance of shop drawings. Identify each item clearly. Do not proceed with a proposed change unless it is accepted in writing
- .2 Substitution of alternative sections will be allowed provided the new members have equal or greater capacity and stiffness and are of dimensions acceptable at proposed locations.

1.11 SITE CONDITIONS

- .1 Determine any potential interference with existing services and protect from disruption and damage.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Rolled shapes and plates.
 - .1 Wide flange sections: CAN/CSA G40.21, Grade 350W.
 - .2 Hollow structural sections: CAN/CSA G40.21, Grade 350W, Class C.
 - .3 Channels, angles and plates: CAN/CSA G40.21, Grade 300W
 - .4 Cold formed shapes: ASTM A570/A570M Grade 50, $F_y=345\text{MPa}$
 - .5 Standard S beams: ASTM A992, A572, Grade 50, $F_y=345\text{MPa}$
 - .6 Structural pipe: ASTM A53, Grade B, $F_y=241\text{MPa}$
- .2 Welded wide flange shapes: CAN/CSA G40.21, Grade 350W.
- .3 Weldable reinforcing steel: weldable steel, grade 400W, deformed bars to CSA G30.18.
- .4 Arc welding electrodes and equipment: CSA W48.1. Electrode Classification Number: E480XX.
- .5 High-strength bolts: ASTM A325M and CAN/CSA S16. Bolts shall be identifiable by their head markings and galvanized whenever used to connect members which are galvanized or painted with zinc-rich paint.

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- .6 Machine bolts: ASTM A307.
 - .7 Anchor bolts: CAN/CSA G40.21, Grade 300W
 - .8 Stud anchors, headed: ASTM A108, Grades 1010 through 1020, $F_y=345$ MPa (50 ksi). Lengths of studs given on drawings are the lengths after welding.
 - .9 Load indicating washers: Coronet - Cooper + Turner
 - .10 Cast-in-place concrete anchor with threaded bolt: Structural Connection Insert Type EC-2FW - Acrow - Richmond.
 - .11 Drilled concrete anchor:
 - .1 Kwik-Bolt 3 – Hilti Carbon steel anchors to be used unless otherwise noted.
 - .12 Drilled masonry anchor:
 - .1 Hilti HIT HY20 with threaded HIT-A Rods and screen tube (for hollow masonry).
 - .2 Hilti HIT HY150 with HAS –E Standard rods (for solid or grouted masonry).
 - .13 Joint filler for exposed steelwork: Epoxy resin.
 - .14 Shop primer paint for steel receiving finish coat of paint on site: CISC/CPMA 2-75 except no lead- based paints allowed.
 - .15 Shop primer paint for steel receiving intumescent paint on site: Primer compatible with intumescent paint to be used. See Section 07800 (Fireproofing).
 - .16 Shop paint for steel without finish coat: CISC/CPMA 1-73a except no lead-based paints allowed.
 - .17 Zinc-rich primer and touch-up paint:
 - .1 inorganic: CGSB 1-GP-171M, or
 - .2 organic, ready mixed: CAN/CGSB 1.181-92.
 - .18 Ensure compatibility with specified topcoat.
 - .19 Galvanizing: CAN/CSA G164
 - .20 Grating: Galvanized safety grating. Minimum thickness of material 2mm. Banded ends. Bolted connections. Capacity 4.8 kPa unless noted otherwise on drawings. Maximum deflection 1/180th of span. Provide:
 - .1 Type W/F by Borden Products (Canada) Ltd.
 - .2 Type 19-2 by Fisher and Ludlow
 - .21 Checker plate: CAN/CSA G40.21, Grade 300W. Plate with rolled-in embossments to provide non- slip surface.
 - .22 Sliding bearing assembly: Galvanized top steel plate with a type 304 stainless steel highly polished lower surface and bottom elastomeric pad with a polytetrafluoroethylene (Teflon) upper surface. Static and kinetic coefficients of friction not to exceed 5% under 7MPa to 14MPa working stress. Assembly to have a working stress capacity of 7 MPa)
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on lower pad. Elastomeric bottom pad to allow a 2% rotation of upper plate and still maintain a substantially uniform bearing pressure between plate and pad. . Manufactured by:

- .1 Fabreeka Canada Ltd.
- .2 Goodco Ltd.
- .3 Structural Tech Corp. Ltd.

- .23 Elastomeric bearing pad: Structural grade 50 durometer neoprene.
- .24 Zinc-Rich Shop Primer Paint: CAN/CGSB-1.132.

2.2 CONNECTIONS

- .1 Design connections to conform to CAN/CSA S16. Conform also to the CISC Handbook of Steel Construction, except as otherwise required by the specifications.
- .2 Retain a Professional Engineer to be responsible for the design of all connections.
- .3 In general, make shop and field connections with high-strength bolts or by welding. Use machine bolts only for secondary connections and at slotted holes with finger-tight bolts that are intended to accommodate movement.
- .4 Pretension all high-strength bolts used in:
 - .1 wind bracing connections;
 - .2 connections where bolts are subject to tensile loadings;
 - .3 connections using oversized or slotted holes unless finger-tight bolts are required to accommodate movement; and
 - .4 connections required by CAN/CSA S16 to be pretensioned.
- .5 Design non-composite beam connections for an end reaction due to the uniformly distributed load capacity of the member unless a greater reaction is noted on the Drawings.
- .6 Use double angle headers or end connection plates whenever possible. Do not use single angle headers for beams greater than 530mm deep. Make minimum depth of headers and end plates one-half the beam depth. Provide seated beam connections with top clip angles. Cantilevered plate connections will only be accepted for secondary members carrying minor loads. Provide all eccentrically loaded spandrel beams with top and bottom flange connections for torsional restraint.
- .7 Provide connections designed for a pass-through force equal to the smaller axial force where axial forces occur in beams framing in on opposite sides of a supporting member. Axial force is centred in smaller beam if beam sizes differ.
- .8 Install web and flange stiffener plates at moment connections as required by connection design and detail but in every case when indicated on the drawings. If the shear generated in column web exceeds its shear capacity, reinforce the web.
- .9 Provide at least one stiffener plate each side of web of beams continuous over columns unless another type of stiffener is shown on the Drawings.

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- .10 Design gusset plates at compression members for the force equivalent to twice the specified compression member force, or provide stiffeners to prevent gusset plate buckling.
 - .11 Provide moment connections at splices to maintain continuity of cranked beams. Provide stiffener plates to resist unbalanced flange forces at splices.
 - .12 Provide all wall supporting members (shelf angles, hangers, stubs, back braces, etc) which are attached to floor beams with adjustable connections capable to compensate for the deflection of the floor beams due to self-weight of concrete slabs. Anticipate beam deflection to be 20 mm. Alternatively, fabricate based on actual deflected shape of the beams as measured after concrete slabs are installed.
 - .13 Complete welded shop connections prior to galvanizing.
 - .14 Where slotted holes are required to accommodate deflection, provide slotted holes long enough to allow for deflection indicated plus construction tolerance assuming bolts are in centre of slots. Use A307 bolts. Bolts are to be finger-tight with burred threads to allow for movement during life of structure without bolts loosening.
 - .15 Where indicated on the drawings, connect to concrete using cast-in weld plates with headed stud anchors. Design and supply assemblies. Determine capacity of each anchor group considering edge distance, spacing and embedment.
 - .16 Connect new steel members to masonry or concrete using drilled anchors. Design, supply and install anchors. Determine the capacity of each anchor group considering edge distances, spacing, and a factor of safety of 4 minimum against failure. Activate wedge type anchors by applying pre-determined torque recommended by the manufacturer. Do not use epoxy anchors unless approved by Consultant. Do not field weld at connections with epoxy anchors.
 - .17 Where drilled anchors are shown on the drawings, but the embedment length is not shown, provide manufacturer's standard embedment length.

2.3 FABRICATION

- .1 Conform to CAN/CSA S16 and CSA W59.
- .2 Orientate straight beams, which have cambers within allowable mill tolerances so that the resulting beam camber is up.
- .3 Install stud anchors in the shop with end welds in accordance with the recommendations of the stud manufacturer. Lengths of studs given on drawings are the lengths after welding. Replace studs that crack in the weld or shank.
- .4 Increase thickness of curved sections at no extra cost where necessary to fabricate and galvanize the required curvature or fabricate curved sections from plates at no extra cost where necessary to accommodate the required curvature.
- .5 Reinforce holes through webs of beams as indicated on drawings or in accordance with design procedure set forth in the CISC Handbook of Steel Construction provided calculations are submitted as part of the shop drawings.

- .6 Provide 16 mm diameter weep holes in base plates at all HSS columns, which are not made watertight or that are to be exposed to temperature changes.
- .7 Provide vent holes in HSS sections where required for galvanizing process. Holes are not to exceed 16 mm diameter and are to be located so that any water inside HSS will drain away when HSS is in its final position. After galvanizing, fill vent holes with weld material, grind smooth and touch-up with two coats of zinc-rich paint.
- .8 Where shop inspection is required, do not ship material to the site before it has been inspected.

2.4 LINTLS

- .1 Structural Drawings do not show all lintels required. Refer to lintel notes and Typical Details on the Drawings.
- .2 Provide lintels with a minimum of 150 mm bearing at each end but not less than the length of any specified bearing plate.
- .3 Weld or bolt together multiple member lintels. Provide spacers if separated. If angle seats are at different elevations provide steel packing.
- .4 Connect ends of suspended lintels to the structure and/or build into masonry to provide adequate restraint.
- .5 Connect ends of steel lintels to columns where openings are adjacent to columns.

2.5 PLATES AND ANCHORS

- .1 Provide beams bearing on walls with bearing plates and wall anchors as specified.
- .2 Weld steel members to bearing plates as required.
- .3 Where bearing plate sizes are not noted on the Drawings, design bearing plates for a maximum factored bearing pressure of 1.65 MPa (240 psi) on masonry and 7.5 MPa (1100 psi) on concrete.
- .4 Set beam bearing plates 12 mm back from edge of support.
- .5 Extend beams for full length of bearing plates.

2.6 SUPPORTS AT COLUMNS

- .1 Provide cap plates at tops of columns where required for support of deck, slab, joists or beams.
- .2 Provide diagonal or cantilevered angles at sides of columns where required for support of deck or slab.

- .3 Provide seat angles for support of masonry lintels above openings adjacent to columns. Unless otherwise noted on the Drawings, provide 76 x 76 x 9.5 steel angles attached to sides of columns. Length of seat to equal width of lintel minus 25 mm.
- .4 Provide additional angle welded to column for support of precast or deck interrupted by column.

2.7 PAINTING AND GALVANIZING

- .1 Clean steelwork prior to application of paint. Refer to CAN/CSA S16.
- .2 Surface preparation in shop for paints shall be as follows:
 - .1 Shop paint CISC/CPMA 1-73a: Clean off all grease and oil to SSPC SP1 and remove all loose rust, loose scale, dirt, weld flux, etc. by any suitable method.
 - .2 Shop primer paint CISC/CPMA 2-75: Clean off all grease and oil to SSPC SP1. Clean steel to SSPC SP7 Brush-Off Blast Cleaning.
 - .3 Zinc-rich primer paint and intumescent paint: Clean off all grease and oil to SSPC SP1. Clean steel to SSPC-SP6 Commercial Blast Cleaning, to an average surface profile of 0.04 mm (1.5 mils) or more.
- .3 Apply paint under cover. Steel shall be dry when painted and paint shall be dry before loading for shipment.
- .4 Apply zinc-rich primer paint not more than 24 hours after blast cleaning, but prior to any visible rust occurring on the surfaces. Do not apply when relative humidity exceeds 80%. Apply to achieve a dry film thickness of 0.08 mm (3 mils).
- .5 Apply one coat of shop paint CISC/CPMA 1-73a to steelwork in the shop with the exception of:
 - .1 Members to receive a finish coat of paint on site for which a CISC/CPMA 2-75 shop primer is required
 - .2 Members to receive intumescent paint on site for which a compatible shop primer is required
 - .3 Members for which zinc-rich paint is specified
 - .4 Galvanized members
 - .5 Surfaces encased in or in contact with cast-in-place concrete including top flanges of beams supporting slabs
 - .6 Surfaces and edges to be field welded for a distance of 50 mm from the joint.
 - .7 Contact surfaces of slip-resistant type joints assembled with high-strength bolts.
 - .8 Surfaces to receive spray fireproofing
- .6 Unless otherwise noted, apply one coat of primer paint (CISC/CPMA 2-75) in the shop for steel to receive a finish coat of paint on site.
- .7 Unless otherwise noted, apply one coat of compatible primer paint in the shop for steel to receive intumescent paint on site.
- .8 Only paints tested to ASTM E736 and approved by the spray fireproofing supplier may be used for steel which will receive spray fireproofing.
- .9 Apply galvanizing to:
 - .1 Shelf angles and hangers in exterior walls
 - .2 Lintels in exterior walls
 - .3 Exposed exterior steel members
 - .4 Other steel noted on the Drawings
- .10 When welding after galvanizing is in place, grind away galvanizing at areas to be welded. Touch up with two coats of zinc-rich paint.

- .11 Apply primer paint to architecturally exposed surfaces without runs or sags. Sand down and repaint areas not acceptable to the Consultant.
- .12 Apply touch-up paint after erection to all areas which have been missed, field welded, scraped or chipped using the same paint as the shop coat or primer.
- .13 Clean surfaces down to bare metal and apply two coats of zinc-rich touch-up paint to any galvanized surface, which has been damaged or field welded, and which is accepted by the Consultant as being capable of repair without galvanizing.
- .14 Clean and prepare surfaces of bolts, which will receive a finished coat of paint in the same manner as the connected steelwork.
- .15 At exposed exterior structural steel framing members which are to receive a fire-resistant coating, as specified in Section 09 96 43, apply one coat of zinc-rich primer paint, compatible with specified coating. Over zinc-rich primer, apply "Carboguard 888" primer supplied under Section 09 96 43. Comply with product manufacturer's printed instructions for preparation of steel, application of product (over zinc-rich primer), and handling after application.

2.8 EXPOSED STEEL

- .1 Conform to the requirements of the A.I.S.C. Specification for Architecturally Exposed Structural Steel and to the additional requirements given below when fabricating and erecting steel members which will remain permanently exposed to view.
- .2 Remove all imperfections which are unsightly from members permanently exposed to view. Remove mill and shop marks.
- .3 Provide continuous welding at exposed joints or fill between welds with an approved epoxy resin filler finished to the same profile as the adjacent weld. Joint shall be weathertight and suitable for painting.
- .4 Exposed welds shall be smooth. Hide bolts in bolted connections. Where exposed bolted connections are permitted, adjacent bolt heads shall be on same side and extensions of shank beyond nuts shall be uniform and not exceed 20 mm.
- .5 Do not mark surface with marks that are visible after painting.

PART 3 – EXECUTION

3.1 CONSTRUCTION REVIEW

- .1 General Review during Construction by the Consultant and Structural Engineer and the services of the independent inspection and testing agencies appointed by the Owner are undertaken so that the Owner may be informed as to the quality of the Contractor's performance and for the protection of the Owner. They will be carried out by examination of representative samples of the Work.
- .2 The Contractor will receive copies of the construction review reports and the results of material tests. He will thereby be informed of any defects or deficiencies found. The provision of this information does not relieve the Contractor of his responsibility for the performance of the Contract and he shall implement his own supervisory and quality control procedures.

- .3 Bring to the attention of the Consultant and Structural Engineer any defects or deficiencies in the Work, which may occur during construction together with a proposal for remedy. The Structural Engineer will decide what corrective action may be taken. The Consultant will issue the necessary instructions.

3.2 COOPERATION

- .1 Cooperate with all engaged on the Project. Exchange with related trades shop drawings and other data required to coordinate and schedule Work. Deliver material for installation by other trades when required.
- .2 Provide where shown or required, holes and copings for connection and clearance of the Work of other trades. Show on shop drawings before submitting for review. Holes in members shall not cause any appreciable reduction in strength.
- .3 Do not cut holes in the field unless sizes and locations are accepted by the Consultant in each case. Accepted field cutting and welding shall be undertaken by this Trade.
- .4 Supply and install framing around openings in steel roof and steel floor decks in accordance with Typical Details and Drawing Notes.
- .5 Maintain horizontal bracing and its connections below the underside of the deck so as not to interfere with the seating of the latter.

3.3 EXAMINATION OF WORK

- .1 Do not begin operations before making a thorough examination of existing conditions and the Work of related trades. Report inconsistencies before proceeding.

3.4 INSPECTION AND TESTING

- .1 The Consultant will appoint an independent inspection and testing agency. Notify the Consultant two weeks in advance of the date when the first Work will be ready for inspection.
- .2 Pay for the cost of inspection from the Cash Allowance.
- .3 Assist the agency in its work. Do not commence fabrication until details of inspection have been worked out with the inspection agency.
- .4 Work will be inspected when erected. Items to be cast into concrete will be inspected on site before being installed.
- .5 The inspection agency will submit reports to the Consultant, Structural Engineer, Contractor and Municipal Authorities covering the Work inspected and provide details of errors or deficiencies observed.
- .6 Inspection will include:

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- .1 Checking that the mill test certificates or producer's certificates are satisfactorily correlated to materials and products supplied for the project or that legible markings were made on the material and products by the producers in accordance with the applicable material or product standards. Where this is not possible, notify the Structural Engineer and carry out sample tests as described below when required by the Structural Engineer.
 - .2 Confirming that all materials meet specifications.
 - .3 Sampling fabrication and erection procedures for general conformity with the requirements of the Contract.
 - .4 Checking welders' CWB Certification.
 - .5 Checking fabricated members against specified member shapes.
 - .6 Checking fabricated members against allowable sweep and camber.
 - .7 Checking fabricated members against specified camber.
 - .8 Visual inspection of all welded connections including spot checking of joint preparation and fit up.
 - .9 Sample checking bolted joints.
 - .10 Sample checking stud anchors.
 - .11 Sample checking of drilled concrete and masonry anchors.
 - .12 Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.
 - .13 Inspection of field cutting.
 - .14 Shop paint, including surface preparation, and field touch-up.
 - .15 Galvanizing and field touch-up.
 - .16 Grouting under base plates and bearing plates.
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- .7 Arrange for the inspector to be present during the welding of 25% of moment connections and 25% of butt welds in direct tension.
 - .8 Sample testing: When required, test coupons will be taken and tested in accordance with CSA G40.20 to establish identification. Cut samples from member locations selected by Structural Engineer and provide to inspection and testing agency. Make good the locations if requested, at no extra cost, by adding new plates and welds acceptable to the Structural Engineer. The agency will have the samples tested for mechanical properties and for chemical composition and will classify the steel as to specification.
 - .9 Arrange for the inspector to start field inspection as soon as each section of the Work is completed, plumbed, bolts tightened and field welding finished.
 - .10 The inspector will check high-strength bolts in a representative 10% of bolted connections by torque testing each bolt. He will torque test 10% of the remaining bolts at random, but not less than 2 bolts in each connection. He will remove nuts from 1% of all bearing bolts and check that thread is excluded from the shear planes.
 - .11 The inspector will randomly select and pull test 5% of all types and sizes of drilled in anchors installed on a weekly basis, but not less than one anchor of each type and size. Pull test to twice the design tension capacity of the anchor given by the manufacturer. Submit reports to Consultant within one week of testing. Reports to indicate each anchor location, test load and mode of failure, if applicable. Notify Consultant immediately if any anchor fails the pull test.
 - .12 The inspector will visually check all the adjustable connections at wall supporting members to ensure the connections have been finalized after the concrete is poured.
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3.5 FILED MEASUREMENTS

- .1 Make field measurements necessary to ensure the proper fit of members.
- .2 Identify on shop drawings dimensions, which have been obtained by field measurement.

3.6 ERECTION

- .1 Comply with the requirements of CAN/CSA S16.
- .2 Submit a description of proposed erection methods and sequence to the Consultant for his records if requested.
- .3 Make adequate provision for all loads acting on the structure during erection. Provide erection bracing to keep the structure stable, plumb and in true alignment until the completion of masonry Work and the completion of floor and roof decks which together provide the permanent bracing. Prepare erection bracing drawings signed and sealed by a professional engineer and keep these drawings on site until erection bracing is no longer required.
- .4 Set column base plates with levelling screws to the proper elevation ready for grouting. Lift base plates for inspection when so directed.
- .5 Column base plates and beam bearing plates shall be grouted as soon as steelwork is completed. Do not add load on steelwork until grouting is completed and grout strength has reached at least 20 MPa.
- .6 Do not make permanent connections until as much of the structure as will be stiffened thereby has been properly aligned.
- .7 Adjust and finalize connections at wall supporting elements affected by floor beam deflections after concrete is poured.
- .8 Report ill-fitting connections to the Consultant before taking corrective measures.
- .9 Do not weld in an ambient temperature below -17°C. Preheat material adjacent to welding areas when ambient temperature is between -17°C and +4oc.
- .10 Remove slag from all completed welds so that they may be visually inspected.

3.7 DRILLED ANCHORS

- .1 Conform to requirements of manufacturer. Use hammer drill to make holes. Turn off hammer when drilling masonry with voids. Hole diameters must never exceed those required by manufacturer. Tighten all expansion anchors using a torque wrench unless finger-tight is required by the Drawings to allow for movement. Unless otherwise noted on drawings, provide manufacturer's standard embedment length into solid concrete.

- .2 Do not cut reinforcement to accommodate anchors. Relocate anchors, at no extra cost to the Contract, when obstructions prevent drilling holes to required depth in locations specified. Obtain Consultant's approval of new location before drilling hole. Fill all abandoned holes with grout.
- .3 Arrange for manufacturer's technical representative to be present during installation of first few anchors of each size and type. Submit site reports by manufacturer to Consultant within one week of each visit. Reports to indicate anchor sizes and types installed, locations, and names of those present during installation.

3.8 SUSPENDED LOADS

- .1 Do not overstress members supporting suspended loads. Hanger loads shall not exceed one kN (220 pounds). Loads from mechanical and heavy electrical services suspended from the steelwork shall not exceed the load allowance provided for such services and shall be distributed uniformly. Prevent torsion from hangers connected to beams by alternating their positions on either side of members. Do not apply twisting loads to joists and make attachment using U-bolts with double hangers or other devices that will centre the hanger load on the joist. Loads shall only be suspended directly at the panel points of joists, unless the chords of the joists have been specifically designed to support the concentrated loads.
- .2 Steel Beams: Vertical loads must be applied so that they do not cause twisting of the beams or excessive bending of the flanges. Lateral loads are not to be applied to beams unless approved in writing by the Consultant's structural engineer.

3.9 REJECTED WORK

- .1 Do not deliver to the site materials, which are known not to meet the requirements of the Specifications. If rejected after delivery, remove immediately from site.
- .2 Where review reveals materials or workmanship which appear to have failed to meet the specified quality or tolerances, the Consultant shall have the authority to order tests made of materials; to order detailed field surveys and measurements; to order a structural analysis of the existing elements and to load test the structure. All such Work will be carried out in order to assist in determining whether the structure may, in the opinion of the Consultant, be accepted, with or without strengthening or modification. Testing shall meet the requirements of the Ontario Building Code. All expense incurred shall be chargeable to the Contractor regardless of the results.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1	Painting and Coating	Section 09 90 00
.2	Electrical	Division 26, 27, 28

1.2 REFERENCES

.1	CAN/CSA O80-Series	Standards for Wood Preservation
.2	CSA O121	Douglas Fir Plywood
.3	CSA O141	Softwood Lumber
.4	CSA O151	Canadian Softwood Plywood
.5	CSA B111	Wire Nails, Spikes and Staples.
.6	National Lumber Grading Authority (NLGA), Standard Grading Rules for Canadian Lumber	

1.3 DELIVERY AND STORAGE

- .1 Do not deliver materials until they are required for incorporation into the work.
- .2 Protect materials, under weatherproof cover, both in transit and on site.
- .3 All exterior and interior finish materials shall, upon delivery, be neatly stored in a dry place and shall be protected from damage due to weather, water, or any other cause.

1.4 PROTECTION

- .1 Protect fire-retardant materials against high humidity and moisture.
- .2 Protect cabinets with 6 mm plywood or other suitable sheet material.
- .3 Protect installed hardware from damage and blemishes.

PART 2 – MATERIALS

2.1 MATERIALS

- .1 Wood materials: straight, sawn square, true, dressed four sides, properly sized and shaped to correct dimensions from nominal sizes indicated or specified.
- .2 Lumber grade and moisture content:
 - .1 Comply with the official grading rules of NLGA for the particular lumber and grade, and structurally complying with the latest requirements of the Ontario Building Code.

- .2 Comply with CSA Standard O141 Softwood Lumber. Use only grade marked lumber.
- .3 All wood materials:
 - .1 well-seasoned NLGA, free from defects which impair strength and durability.
 - .2 Moisture content limit:
 - .1 S-GRN: Unseasoned
 - .2 S-DRY: Maximum 19% moisture content
 - .3 KD: Maximum 15% moisture content
- .4 Pressure Treated Lumber to CSA O80.
- .5 Blocking, cant strips, grounds, nailing strips:
 - .1 NLGA No. 2 Ontario White Pine, No. 2 Red Pine, all complying with the grading rules of the NLGA for Construction,
 - .2 Douglas Fir dense complying with COFI standard grading and dressing rules.
- .6 Douglas Fir plywood:
 - .1 comply with CSA Standard O121, COFI Exterior.
 - .2 Western softwood plywood - comply with CSA Standard O151, COFI Waterproof glue WSP. Exposed two sides shall be grade G2S, and exposed one side shall be grade G1S.
- .7 Wood preservative
 - .1 Pentox Green preservative and Osmose Cut End preservative, as manufactured by Osmose Pentox Inc.; Pentox Conservator Clear for painted wood.
 - .2 For painted surfaces use clear type and for concealed surfaces use green tinted type.
- .8 Fire Retardant Treatment: To ULC S102; flame spread rating 25 or less.
- .9 Rough hardware:
 - .1 nails, screws, bolts, lag screws anchors, special fastening devices and supports as required for the erection of all carpentry items.
 - .2 For preservative treated wood, use only stainless steel hardware, with the following exception:
 - .1 where galvanized steel items, such as gates, flashings, etc., are being attached to wood, galvanized steel fasteners shall be used.
 - .3 Do not mix stainless steel with galvanized steel; contact of these dissimilar metals can cause galvanic corrosion.
 - .4 Stainless steel hardware to be type 317.
 - .5 Galvanized hardware must be hot-dipped galvanized as follows:
 - .1 fasteners meeting CAN/CSA-G164 minimum zinc coating of 600 g/m² (ASTMA153 Class A or B1 G 185)
 - .2 connectors meeting CAN/CSA-G164 minimum zinc coating of 600 g/m² (ASTM A653 Class G-185 sheet) or better.
 - .3 Electroplated galvanized hardware is not permitted.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Examine surfaces to receive the work of this Section and proceed only when conditions are satisfactory for a proper installation.
- .2 Lay out work carefully and to accommodate work of other trades. Accurately cut and fit; erect in proper position true to dimensions; align, level, square, plumb, adequately brace, and secure permanently in place. Join work only over solid backing.

3.2 INSTALLATION – GENERAL

- .1 Provide running members of the longest lengths obtainable.
- .2 Slowly feed machine-dressed members using sharp cutters. Provide finished members free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding.
- .3 Machine sand surfaces exposed in the finished work and hand sand to an even smooth surface free of scratches.
- .4 Properly frame material with tight joints and rigidly secure in place. Use glue-blocks where necessary.
- .5 Design construction methods for expansion and contraction of the materials.
- .6 Conceal joints and connections wherever possible. Locate prominent joints only where directed.
- .7 Match joints made on the site with joints made in the shop.
- .8 Unless otherwise specified glue and blind screw or nail all work. Set and fill and plug surface screws using matching wood plugs.
- .9 Accurately scribe, cope and mitre members where required to produce hairline joints.
- .10 Erect work plumb, level, square and to the required lines.
- .11 Do not regard blocking, strapping and other rough carpentry indicated as complete or exact. Provide rough carpentry items required for the installation of the Work of other Sections.
- .12 The use of pressure treated wood is required for the following:
 - .1 Wood in direct contact with the ground or framed into concrete below ground level.
 - .2 Structural wood elements within 150mm of ground.
 - .3 In termite areas, for all structural wood elements within 450mm of ground.
 - .4 Wood framing members without a dampproof membrane separating the wood framing member from concrete in contact with the ground.
 - .5 Building components where moisture may accumulate.

- .13 Aluminum must not be in direct contact with pressure treated wood. Provide minimum 6mm spacing between aluminum products and treated wood, with 10mil polyethylene barrier and polyethylene or nylon spacers.

3.3 INSTALLATION - ROUGH CARPENTRY

- .1 Blocking and Grounds: Fasten wood nailers, blocking, bucks, grounds curbs, copings and strapping solidly to supporting materials in true planes so that they will remain straight and not be loosened by work of other Trades.
- .2 Framing: Do all wood framing in accordance with the Ontario Building Code -latest version, and to CAN 3 086 as applicable.
- .3 Wood Cants, Copings: Fasten wood cant blocking to structure with 19 mm. dia. bolts 760mm o.c. Fasten curbs as indicated. Wood cants, curbs and copings to be preservative treated. Plywood to be exterior grade.
- .4 Preservative:
- .1 Apply preservative to concealed wood members in contact with exterior walls and roof before fixing in place.
- .2 Apply preservative to all cut ends of pressure treated wood.
- .3 Preserve all other wood indicated to be preserved. Use clear preservative for items to be painted.
- .4 Preserve wood by immersing in preservative for at least one hour.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- .1 Provide all casework indicated on drawings. Casework shall have melamine finish at both exposed panels and concealed interior faces and edges.

1.2 RELATED WORK

1.	Rough Carpentry	Section 06 10 00
2.	Resilient Base	Section 09 65 00
3.	Painting and Coating	Section 09 90 00
4.	Electrical Work	Division 26, 27, 28

1.3 QUALIFICATIONS

- .1 The Work of this Section shall be provided by one of the prequalified firms listed in Section 00 21 13, Instructions to Bidders.
- .2 All Work to conform to minimum standard for premium Grade Work as specified in Quality Standards for Architectural Woodwork prepared by Architectural Woodwork Manufacturers Association of Canada.

1.4 INTENT

- .1 The intent of this Section is that the casework shall be manufactured and finished at the plant, delivered to the Site and immediately installed by this Section including provision of necessary strapping, backings, bearers, rough hardware and finish hardware. Touch up finish immediately prior to completion of the Work and leave in perfect condition.
- .2 It is also the intent of this Section that all casework be manufactured with low or no VOC products, to minimize VOC emissions in the finished products.

1.5 SUBMITTALS

- .1 Submit Shop Drawings of all finish carpentry and in accordance with Section 01 30 00.
- .2 Draw Shop Drawings in related and/or dimensional positions with sections. Scale minimum 1:10.
- .3 Shop Drawings shall show fabrication details, materials, jointing, description of anchorage and hardware. Dimensions shall be based on actual measurements taken at the Site.

Provide details and dimensions for all fittings and the like for mechanical and electrical connections to this work.

- .4 Submit product data for all finishes.
- .5 Submit samples of materials, construction method and finishes for Consultant's approval. The colour of stain shall be selected by the Consultant; submit prepared 300mm x 300mm finished samples for approval.
- .6 Submit samples of all hardware.
- .7 Submit one full size sample of proposed units of Type selected by Consultant prior to proceeding with the remainder of cabinet work.

1.6 CO-OPERATION

- .1 Co-operate with other Sections and do all cutting, fitting and making good of own work for all Sections as may be necessary to carry out the true intent of the Drawings and Specifications. Examine the work and materials installed by others insofar as it affects this Work, and report to Consultant any such work not done properly.

1.7 OWNER'S EQUIPMENT

- .1 Confirm the standard equipment dimensions with the OWNER prior to fabrication for all printer/copiers.

1.8 MEASUREMENTS

- .1 Take necessary measurements at the Building of spaces and conditions to which work must conform or through which access is required. Take such measurements prior to fabrication of the Work of this Section and in ample time to avoid delays in the Work.

1.9 DELIVERY AND STORAGE

- .1 Do not deliver finished material during rain or damp weather or until "Wet Trades" have completed their work and windows are glazed or covered. Carefully protect from damage of any kind.

1.10 WARRANTY

- .1 Provide an extended Warranty to the General Conditions of the Contract to two (2) years from date of Substantial Performance of the Contract.
- .2 The warranty shall cover replacing, reworking and/or refinishing to make good defects in architectural woodwork due to faulty workmanship or defective materials, which appear

during this two (2) year period. Work showing defects during this period shall be replaced or made good without delay and at no cost to Owner.

PART 2 – MATERIALS

2.1 MATERIALS

1. All wood must be straight and true, dressed 4 sides and conform to details. It must conform to official grading rules of Canadian Lumberman's Association for quality and moisture content. It must conform to NBC Structural requirements and be grade stamped according to CSA Standards 0140 or 0151. Stained woods and plywoods must be selected for colour and grain uniformity.
2. All materials shall be low VOC products.
3. Softwood Lumber: Conform to CAN/CSA 0141 and National Lumber Grades Authority requirements.
4. Hardwood Lumber: Conform to National Hardwood Lumber Association (NHLA) requirements. Provide stain finish to AWMAC Premium Grade. Select white hard maple moisture content 7% or less in accordance with:
 - .1 National Hardwood Lumber Association (NHLA)
 - .2 AWI/AWMAC premium grade, moisture content as specified.
5. Hardwood Plywood: Conform to CSA 0115 and AWMAC. Select white hard maple, plain sliced and bookmated face veneer core as specified. Exposed faces to be natural grade per AWMAC. Interior of cupboard and closet doors to be classified as exposed faces.
6. Canadian Softwood Plywood: Veneer plywood conforming to CSA 0151.
7. Douglas Fir Plywood: Veneer plywood conforming to CSA 0121.
8. Poplar Plywood: Veneer plywood conforming to CSA 0153.
9. Wood Particleboard:
 - .1 Conform to CAN3-0188.1.
 - .2 fabricated from 100% recycled or recovered wood fibre, containing no added urea formaldehyde, and certified by the Forest Stewardship Council (FSC). Conform to ANSI A208.1/Grade M-2, with formaldehyde emissions of 0.09 ppm or less.
 - .1 Nu Green 2 Particleboard as manufactured by Uniboard, or equal by Panolam Industries or Flakeboard.
10. Hardboard: Conform to CGSB 11-GP-3M.
11. Nails and Staples: Conform to CSA B111.
12. Glue: Waterproof synthetic resinous glue, of approved type for general carpentry work and thermo-setting type for plastic laminate work, low VOC emitting. Adhesives shall be free of urea formaldehyde. All adhesives to conform to CSA 0112 Series.
13. Melamine Faced Particleboard: Melamine Faced Particleboard: to CAN3-0.188.1-M78, grade "H" particleboard sanded faces, 13 mm, 16 mm, 19 mm, 28.6 mm and 32 mm thickness, faced with laminated plastic. Melamine resin impregnated

14.	Melamine Faced Particle Board Edge Banding:	cover sheet with coloured and/or patterned paper inner layer. Melamine shall be thermally fused to rigid particle board substrate. Melamine faces shall be 120 Gram Weight Paper. Colour to be Hardrock Maple. Solid polyvinylchloride (PVC), 3 mm thickness x full width of board, wood core, wood grain type to match melamine face by Canada Wood tape or approved colour equal. Edging rigid PVC with a measured degree of hardness of "95 shore D" and thickness of "3mm (+0.15mm, -0.2mm)" with the primer side having a concave measuring 0.10 to 0.25mm.
14.	Finish at Base Framing:	Rubber base. Refer to Section 09 65 00.

2.2 CABINET HARDWARE

- .1 The hardware specified herein is to be provided as listed. Any proposed substitutions must be submitted to the Consultant for approval prior to shop drawing submission. Proposed substitutions must be equal or better quality than the specified items and will be considered at the Consultant's discretion. Hinges must be as specified.

- .2 Furnish and install all hardware to custom millwork as follows:

<u>Hardware for 19mm thick millwork access panels</u>			<u>Finish</u>
Hinges at cupboards	Hettich	Selekta Pro 2000	619
Cupboard Deadbolt Lock	Hafele	235.08.358	Polished nickel
complete with lock cores 210.04.606 and cylinder rosettes 210.04.062			

*Provide locks at all millwork gable access panels.

- .3 Keying:
- .1 All locks in a room to be keyed alike.
- .2 Provide 6 extractor keys.

2.3 FABRICATION – GENERAL

- .1 Check job dimensions and conditions and notify the Consultant in writing of unacceptable conditions. Do not proceed until remedial instructions are received.
- .2 As far as practical, assemble work at the shop and deliver to the job ready for installation. Leave ample allowance for fitting and scribing on the job.
- .3 Fabricate work square and to the required lines. Recess and conceal fasteners and anchor heads. Fill with matching wood plugs. All fixed elements must be glued and screwed or dowelled to ensure rigid construction.

- .4 Comply with glue manufacturer's recommendations for lumber moisture content, glue life, pot life, working life, mixing spreading, assembly time, time under pressure and ambient temperature.
- .5 Provide exposed end grain of solid members and edges of exposed plywood and particleboard with matching solid hardwood edging at least 6.4mm thick.
- .6 Make all necessary cut-outs in the millwork for mechanical duct work, electrical switch and outlet boxes and pre-drill all mounting holes for equipment, fittings and outlet boxes. Refer to electrical and mechanical Drawings and specifications.
- .7 Provide and install pipe covers, scribing pieces, top, bottom and/or and closures and filler panels where necessary, including wherever units require furring out or blocking to existing conduits, pipes, etc.
- .8 Provide trim around mechanical and electrical equipment and other equipment and after installation of equipment.
- .9 Provide removable panels to be provided at all pipe chases. End closing panels to be provided at all exposed ends of millwork units and assemblies. Front filler panels to be provided where called for on Drawings and as required by field conditions.
- .10 Resilient base around all toe spaces where indicated on the drawings is specified in Section 09 65 00.

2.4 CASEWORK COUNTERS AND CHASE UNITS TO CONCEAL PIPING

- .1 Casework shall be melamine finish.
- .2 All door fronts, front panels, exposed gables and all shelving in open shelving units, shall be thermofused melamine finish. Interiors and concealed gables cabinetry shall be thermofused melamine panels. Melamine to be hardrock maple in colour. Panels to be installed with vertical grain pattern.
- .3 All exposed edges of melamine panels to have 3mm PVC edging, in colour to match laminate. All other edges to be sealed and moisture proofed before assembly.
- .4 Unless noted otherwise on drawings, provide all floor cabinets with 115mm high base of 19 mm water resistant plywood; melamine panels are not to come into contact with the floor. Provide 115mm high toe space set back from front face of cabinets 115 mm minimum. Provide one coat of sealer to cabinet base; ensure compatibility with base adhesive. Plywood base must be concealed by base.
- .5 All cabinet work shall be factory assembled in modular, unitized construction. Carefully machine with dovetailed mortised and tenoned or blind dado joints. Each unit shall be self-supporting and designed to be bolted together with fasteners inside units with plastic plugs over fasteners. All joints to be securely glued. Fabricate units as per Drawings and as specified.
- .6 Gables to be 19mm thick panels, with PVC edging on all exposed edges.

- .7 Provide top front, top back rails and posts of solid maple hardwood 19mm x 50mm framing members, tongue and grooved together and dadoed to gables.
- .8 Bottoms to be 19mm melamine panels, with PVC edging.
- .9 Access panel doors generally to be flush overlay 19mm melamine faced panels with matching pvc edges all four sides.
- .10 Back panels shall be minimum 13mm thick melamine panels, removable within unit where access is required behind. Removable panels to have PVC edge trim, four sides. Where back panels are exposed to view, they shall be 19mm melamine faced panels.
- .11 Shelves to be 19mm melamine panels, finished all 4 sides edges, with pvc edging on all four edges.
- .12 Sit all adjustable shelves on pilaster clips. Pilasters to be recessed into gables and fastened with screws.
- .13 Depth of shelving in cabinets and closets are to be as noted on the drawings; full depth of cabinets and shelving except provide a 10mm gap minimum between shelf edge and interior face of doors. Provide centre pilaster to all shelves 1200mm long or over.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Set and place all materials and components in place, rigid, plumb and secure.
- .2 Provide heavy duty fixture attachments for wall mounted cabinets.
- .3 Install all shelving and doors.
- .4 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

After installation, fit and adjust operating hardware for wood cabinet access door panels.

END OF SECTION

PART 1 – GENERAL

1.1 SECTIONS INCLUDES

- .1 Rigid Insulation at Interior of Exterior Walls in Rooms
- .2 Rigid Insulation and Concrete Pavers at Roof Level

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Masonry Procedures	Section 04 05 00
.3	Rough Carpentry	Section 06 10 00
.4	Sheet Vapour Retarders	Section 07 26 00
.5	Mechanical	Division 22 and 23

1.3 REFERENCES

- .1 ASTM-E96-95, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 CGSB 71-GP-24M-77, Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.
- .3 CAN/ULC-S701-1997, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .4 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings.

1.4 SUBMITTALS

- .1 Submit 200mm by 300mm samples under provisions of Section 01 33 00 – Submittal Procedures.
- .2 If requested by Consultant, submit under provisions of Section 01 78 10 - Closeout Submittals, manufacturer's certificate stating that products meet or exceed specified requirements.

1.5 MOCKUP

- .1 Mockup is specified in Section 04 05 00 - Masonry Procedures.
- .2 Coordinate with all trades involved in exterior wall work to incorporate specified insulation and insulation accessories in the mockup panel.

1.6 PRE-INSTALLATION MEETING

- .1 Convene a pre-installation meeting one week prior to commencing work of this section.
- .2 Request attendance of parties directly affecting work of this section.
- .3 Review conditions of installation, installation procedures, procedure for inspection and coordination of work with related sections.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Store, handle and protect products under provisions of Division 01 – General Requirements.
- .2 Minimize the time polystyrene insulation products are stored or exposed to sunlight at project site.
- .3 Store products away from construction activity and sources of ignition.
- .4 Protect products from damage during handling, installation and at point of installation.

1.8 WARRANTY

- .1 Submit a warranty for insulation work in accordance with the Contract Requirements, but for a period of two (2) years.
- .2 The warranty shall cover defects in materials, installation, and workmanship.
- .3 Warranties shall be issued to the Owner within two (2) Working Days following the date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 INSULATION

- .1 Concrete Pavers and Rigid Insulation at Roof Level:
 - .1 Light-weight concrete 450mm by 450mm or 600mm by 600mm nominal concrete pavers with 50mm high-density rigid Styrofoam SM insulation pad below concrete pavers, for loose installation with 25 mm gap between pavers.
 - .2 Extruded polystyrene to CAN/ULC-S701, Type 4, thickness as indicated on mechanical drawings.
 - .3 Thermal Resistance: RSI Value of 0.87 per 25mm thickness.
 - .4 Dow Chemical Canada Inc.: Styrofoam SM.
 - .5 Owens Corning Canada Inc.: Celfort 300.
- .2 Rigid Insulation for Interior Applications at exterior walls and at mechanical dog house:
 - .1 Extruded polystyrene to CAN/ULC-S701, Type 3, thickness as indicated on architectural drawings.
 - .2 Thermal Resistance: RSI value of 0.87 per 25mm thickness.
 - .3 Dow Chemical Canada Inc.: Styrofoam Styrospan.
 - .4 Owens Corning Canada Inc.: Celfort 200.

2.2 ADHESIVES

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24. Bakor Inc.: Air-Bloc 21.
- .2 Adhesive (for insulation clips): Rubber resin, solvent type. Bakor Inc.: 230-35 Insulation Clip Adhesive.

2.3 ACCESSORIES

- .1 Air Seal: As specified in Section 07 26 00 – Sheet Vapour Retarders.

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Verify that building substrate surfaces, adjacent materials and installation conditions are ready to accept the work of this section. Ensure insulation materials and surfaces are dry.
- .2 Verify that substrate is flat, sound, clean and free of objectionable air surface voids, fins, irregularities, and materials or substances that may impede adhesive bond.
- .3 Notify Consultant upon completion of installation of vapour retarder and air seal to allow inspection before insulating material is installed or work is obscured.
- .4 Beginning of installation shall mean acceptance of substrate.

3.2 PREPARATION

- .1 Clean substrates of substances harmful to insulation.

3.3 INSTALLATION – GENERAL

- .1 Keep insulation a minimum of 75mm from light fixtures and heat emitting devices.
- .2 Use boards of largest possible dimensions to reduce the number of joints. Boards with chipped and broken edges are unacceptable.
- .3 Offset both vertical and horizontal joints in multiple layer applications
- .4 Apply adhesives in accordance with manufacturer's instructions. Attach boards prior to skinning of adhesive.

3.4 INTERIOR APPLICATIONS

- .1 Apply adhesive in three continuous beads each board length. Apply adhesive fully around protrusions.
- .2 Install boards on wall surface, vertically between steel "Z" - stud furring.

- .3 Stagger end joints. Butt edges and ends tight to adjacent boards and to protrusions.
- .4 Extend boards across control and expansion joints, unbonded to substrate for 75mm on one side of joint.
- .5 Install vapour retarder in accordance with Section 07 26 00 - Sheet Vapour Retarders.

3.5 PROTECTION

- .1 Protect insulation and vapour retarders under provisions of Section 01 51 00 - Temporary Barriers and Controls.
- .2 Do not permit work to be damaged prior to covering insulation. Protect from harmful weather exposures and physical abuse.
- .3 Provide temporary coverings or enclosures when insulation will be subject to damage and cannot be protected by permanent construction immediately after installation.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDED

- .1 Batt Insulation.

1.2 RELATED SECTIONS

.1	Division 1 - General Requirements.	
.2	Rough Carpentry	Section 06 10 10
.3	Sheet Vapour Retarders	Section 07 26 00
.4	Fire Stopping and Smoke Seals	Section 07 84 00
.5	Non – Structural Metal Framing	Section 09 22 00
.6	Mechanical	Division 23

1.3 REFERENCES

- .1 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings.

PART 2 – PRODUCTS

2.1 INSULATION

- .1 Batt Insulation:
 - .1 Mineral fibre to CAN/ULC-S702, Type 1-unfaced, thickness as indicated.
 - .2 Thermal Resistance: RSI value of 2.1 per 89mm thickness.
 - .3 Acceptable Products:
 - .1 CertainTeed Insulation Canada Inc.: Sustainable Insulation Fibre Glass Building Insulation.
 - .2 Owens Corning Canada Inc.: EcoTouch Pink Fiberglas Insulation.

2.2 ACCESSORIES

- .1 Insulation Clips: Impale type, perforated 50mm by 50mm cold rolled galvanized carbon steel 0.8mm thick, spindle of 2.5mm diameter annealed steel, length to suit insulation, 25mm diameter washers of self-locking type.
- .2 Retaining Mesh: Galvanized steel, hexagonal wire mesh.

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Verify that substrate surfaces, adjacent materials and installation conditions are ready to accept the work of this section. Ensure insulation materials and surfaces are dry.
- .2 Beginning of installation means acceptance of substrate and conditions.

3.2 INSULATION INSTALLATION

- .1 Supply insulation to Section 06 10 10 - Rough Carpentry as required for building-in to work of that section.
- .2 Install insulation to maintain continuity of thermal protection and acoustical separation of building elements and spaces.
- .3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation. Trim insulation neatly to fit spaces.
- .4 Do not compress insulation to fit into spaces. Install in spaces without gaps or voids.
- .5 Install friction fit insulation tight to framing members.
- .6 On sloping surfaces or in ceiling applications retain insulation in place with impale type fastener spaced at 600mm on centre. Adhere fastener to substrate with adhesive compatible with fastener and substrate.
- .7 In unfinished unexposed applications retain insulation in place with wire mesh secured to framing members with fasteners appropriate for framing material.
- .8 Keep insulation minimum 75mm from heat emitting devices such as recessed light fixtures.
- .9 Notify the Consultant upon completion of insulation installation to allow for inspection before work is enclosed and obscured.

3.3 PROTECTION

- .1 Protect insulation under provisions of Section 01 56 00 -Temporary Controls.
- .2 Protect insulation from harmful weather exposures and physical abuse.
- .3 Provide temporary coverings or enclosures when insulation will be subject to damage and cannot be protected by permanent construction immediately after installation.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDED

- .1 Sheet vapour retarders.
- .2 Vapour retarder accessories.

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Board Insulation	Section 07 21 13

1.3 REFERENCES

- .1 CAN/CGSB-19.21-M87, Sealing and Bedding Compound, Acoustical.
- .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

PART 2 – PRODUCTS

2.1 SHEET VAPOUR RETARDER

- .1 Polyethylene Film: to CAN/CGSB-51.34, 0.15mm thick.

2.2 ACCESSORIES

- .1 Joint Sealing Tape: air resistant pressure sensitive adhesive tape, type recommended by vapour retarder manufacturer, 50mm wide for lap joints and perimeter seals, 25mm wide elsewhere.
- .2 Sealants: Non-drying, non-hardening synthetic rubber to CAN/CGSB-19.21. Acceptable Product: Tremo Ltd., Tremco Acoustical Sealant.
- .3 Staples: minimum 6mm leg.

PART 3 – EXECUTION

3.1 INSTALATION

- .1 Ensure services are installed and inspected prior to installation of retarder.
- .2 Install sheet vapour retarder where indicated on warm side of exterior wall, ceiling and floor assemblies prior to installation of wall finish to form a continuous vapour retarder.
- .3 Use sheets of largest practical size to minimize joints.

- .4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 EXTERIOR SURFACE OPENINGS

- .1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.3 PERIMETER SEALS

- .1 Seal perimeter of sheet vapour retarder as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 At metal stud substrate apply bead of sealant at each stud. Lap sheet over sealant and press into sealant bead. Affix sheet temporarily with joint sealing tape.
 - .3 At wood substrate install staples through lapped sheets at sealant bead into substrate.
 - .4 Use only enough fasteners to ensure sheet remains in place until wall finish is installed.
 - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

- .1 Seal lap joints of sheet vapour barrier as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150mm and press into sealant bead.
 - .4 At metal stud substrate install joint sealing tape to cover joint completely.
 - .5 At wood substrate install staples through lapped sheets at sealant bead into substrate.
 - .6 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDED

- .1 Membrane air seal materials and installation methods.
- .2 Air seal materials to bridge and seal openings and penetrations of window frames and at roofing penetrations.

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Masonry Procedures: Masonry wall construction	Section 04 05 00
.3	Masonry Accessories	Section 04 05 23
.4	Board Insulation	Section 07 21 13
.5	Sealants: Sealant materials and installation techniques	Section 07 92 00
.6	Fire Stopping and Smoke Seals: Fire stopping materials	Section 07 84 00

1.3 REFERENCES

- .1 CAN/CGSB-19.13M-M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
- .2 CGSB-19-GP-14M-84, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .3 CAN/CGSB-19.18M-M87, Sealing Compound, One Component, Silicone Base, Solvent Curing.
- .4 CAN/CGSB-19.24-M90, Multi-Component, Chemical Curing Sealing Compound.
- .5 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- .1 Submit samples of air barrier material in accordance with Section 01 33 00 - Submittals.
- .2 Manufacturer's Installation Instructions: Submit indicating preparation, installation requirements and techniques, product storage and handling criteria.
- .3 Inspection Company Reports: Submit reports on air barrier membrane installation as it progresses.

1.5 QUALITY ASSURANCE

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.
- .2 Air barrier applicators shall be licensed or approved by the membrane material manufacturer.

- .3 Air barrier materials and accessory materials shall be from the Product line of one manufacturer.

1.6 QUALIFICATIONS

- .1 Applicator: Company specializing in performing work of this section approved and trained by materials' manufacturers.
- .2 The applicator shall have proven experience in the work of this section for jobs of similar size.

1.7 MOCKUP

- .1 Co-ordinate with Section 04 05 00 - Masonry Procedures to provide mockup of air barrier materials under provisions of Section 01 45 00 - Quality Control.
- .2 Allow 48 hours for inspection of mockup by Consultant before proceeding with air barrier work.

1.8 PRE-INSTALLATION CONFERENCE

- .1 Convene one week prior to commencing work of this section.
- .2 The meeting shall cover the work of other sections directly affecting this section, substrate preparation and acceptance, material storage and handling, air barrier installation and interfaces with other wall components, criteria for air barrier system acceptance, and any special conditions that may affect this work.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.
- .2 Maintain temperature and humidity recommended by materials manufacturers before, during and after installation. Ensure materials are stored at a minimum temperature of 5C.

1.10 SEQUENCING AND COORDINATION

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.
- .2 Coordinate work of this section with all sections referencing this section.

1.11 WARRANTY

- .1 Provide a warranty in accordance with the Contract Requirements, but for a period of two (2) years.

- .2 The warranty shall cover defects in material, installation, and workmanship.
- .3 Warranties shall be issued to the Owner within two (2) Working Days following the date of Substantial Performance of the Work.

PART 2 – PRODUCTS

2.1 AIR BARRIER MATERIALS

- .1 Membrane Air Barrier - Typical: Self-adhesive, rubberized asphalt bonded to sheet polyethylene, nominal total thickness of 1mm to 1.5mm.
 - .1 Henry Company Canada: Blueskin SA.
 - .2 Soprema Inc.: Sopraseal Stick 1100T.
 - .3 W.R. Grace & Co. of Canada Ltd.: Perm-A-Barrier.
 - .4 W.R. Meadows of Canada Ltd.: Sealtight Air-Shield.
- .2 Vapour Permeable Air Barrier: Fluid-applied vapour permeable air barrier membrane.
 - .1 BASF Corporation: Enershield-1.
 - .2 Henry Company Canada: Air-Bloc 31.
 - .3 Tremco Incorporated: ExoAir 220.
 - .4 W.R. Grace & Co. of Canada Ltd.: Perm-A-Barrier VP.
 - .5 W.R. Meadows of Canada Ltd.: Air-Shield LMP.
- .3 Sheet Steel Air Barrier: Galvanized steel, 2275 zinc coating, 1.5mm core steel thickness.

2.2 SEALANTS

- .1 Sealants: Refer to Section 07 92 00 - Sealants.
- .2 Sealant Primer: Recommended by sealant manufacturers.
- .3 Substrate Cleaner: Non-corrosive, type recommended by sealant manufacturer, compatible with adjacent materials.

2.3 MASTIC AND PRIMER

- .1 Mastic: Compatible with membrane air barrier and substrate, thick mastic of uniform consistency.
 - .1 Henry Company Canada: Blueskin Sealant.
 - .2 Soprema Inc.: Sopramastic 200.
 - .3 W.R. Grace & Co. of Canada Ltd.: Bituthene Mastic.
 - .4 W.R. Meadows of Canada Ltd.: Sealtight Pointing Mastic.
- .2 Primer: Compatible with membrane air barrier and substrate.
 - .1 Henry Company Canada: Bakor Blueskin Primer.
 - .2 Soprema Inc.: Elastocol 700 Primer.

07 27 00 – AIR BARRIERS

- .3 W.R. Grace & Co. of Canada Ltd.: Perm-A-Barrier Primer.
- .4 W.R. Meadows of Canada Ltd.: Sealtight Mel-Prime.

PART 3 – EXECUTION**3.1 EXAMINATION**

- .1 Verify that substrate surfaces are dry and clean and conditions are ready to accept the work of this section.
- .2 Commencement of work implies the acceptance of substrate surfaces.

3.2 PREPARATION

- .1 Remove loose or foreign matter which might impair adhesion of materials.
- .2 Clean and prime substrate surfaces to receive air barrier membrane in accordance with manufacturer's instructions.
- .3 Prime only substrate surface that can be covered with membrane the same day.

3.3 INSTALLATION OF MEMBRANE AIR BARRIER

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Seal joints and perimeter edges of sheet steel air barrier.
- .3 Co-operate with other trades to ensure continuity of air barrier membrane at junctions of different components and constructions.
- .4 Stagger end laps to avoid four-way joints in air barrier membrane.
- .5 Apply a bead of mastic to end laps, application terminations, and around all penetrations of the membrane.
- .6 Ensure air barrier membrane is lapped and sealed onto window, curtain wall, and door frames.
- .7 At the end of each day ensure that the work of this section is protected from adverse weather and other mechanical damage.

3.4 APPLICATION OF VAPOUR PERMEABLE AIR BARRIER

- .1 Mix air barrier material until thoroughly blended in conformance with the manufacturer's printed instructions.
- .2 Spot all fasteners and sheathing joints, terminations, inside and outside corners with mixed air barrier material.

- .3 Place and centre the manufacturer's recommended sheathing fabric at all sheathing joints, terminations, inside and outside corners. Ensure sheathing fabric extends evenly on both sides of sheathing joint.
- .4 Lap sheathing fabric 65mm minimum at intersections.
- .5 Allow to dry to the touch before applying the air barrier membrane to the entire wall surface.
- .6 Apply air barrier membrane to wall surface with roller, brush, or spray gun to a consistent even coating that is free of voids and pin holes. Follow the manufacturer's printed application recommendations.
- .7 Thickness of membrane shall be sufficient to achieve the required air barrier performance requirements.

3.5 PROTECTION OF FINISHED WORK

- .1 Protect finished work under provisions of Section 01 61 00 - Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.

3.6 FIELD QUALITY CONTROL

- .1 Inspection: An inspection and testing company selected by the Owner will inspect and report on the installation of the air barrier system.
- .2 The cost of inspection services will be paid from the cash allowance specified in Section 01 21 00 – Allowances.

3.7 SCHEDULE

- .1 Wall Air Seal Over Outer Surface of Inner Wythe of Masonry or Concrete: Membrane air barrier over masonry unit or concrete surface, seal masonry anchor and other penetrations air tight.
- .2 Window Perimeter: Lap and seal air barrier membrane onto window frames and fill space between frames and wall with air barrier foam sealant and elastomeric sealant as specified in Section 07 92 00 - Sealants.
- .3 Wall and Roof Junction: Lap wall membrane air barrier onto roof deck with 150mm of contact over firm bearing. Lap roof air seal membrane over wall membrane air barrier with 100mm of full contact.
- .4 Junctions between dissimilar materials: Where shown on Drawings install sheet steel air barriers to configuration shown. Lap and seal air barrier membranes over sheet steel air barrier providing a minimum of 100mm contact.

END OF SECTION

PART 1 – GENERAL

1.1 SECTIONS INCLUDES

- .1 Composite wall panels composed of face sheet, core, and back sheet at mechanical dog houses.
- .2 Metal panel hardware, accessories, extrusions, trims, and sealant.

1.2 RELATED SECTIONS

.1	General Requirements	Division 01
.2	Board Insulation	Section 07 21 13
.3	Air Barriers	Section 07 27 00
.4	Metal Flashing and Trim	Section 07 62 00
.5	Sealants	Section 07 92 00

1.3 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- .1 Supply flat stock sheet metal for all aluminum sheets and roof flashing to Section 07 62 00 - Metal Flashing and Trim.
- .2 Sheet metal shall match face sheet material, colour, and finish and be from the same production run.

1.4 REFERENCES

- .1 AAMA-605-98, Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels.
- .2 ASTM-A653/A653M-97, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM-A924/A924M-96a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.5 DESIGN CRITERIA

- .1 Design metal panel system to provide for thermal movement of component materials caused by ambient temperature range of 80EC without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

07 42 10 – COMPOSITE ALUMINUM PANELS

- .2 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .3 Design members to withstand dead load and wind loads calculated in accordance with the OBC and applicable local regulations, to a maximum allowable deflection of 1/180th of the span without causing rattling or vibration and other detrimental effects on the wall system.
- .4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints to exterior face of wall. Design system as "Pressure Equalized Rainscreen."
- .5 Design wall system to accommodate specified erection tolerances of structure.
- .6 Joints between panels shall be 12mm maximum.
- .7 System shall be non-progressive, allowing removal of any individual panel without requiring the removal of adjacent work.

1.6 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit colour samples for colour selection from the industry standard colour range.
- .3 Submit duplicate 300mm by 300mm samples of panel system, representative of materials, finishes and colours selected.

1.7 SHOP DRAWINGS

- .1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate elevations, profiles, thickness of panels, dimensions, wall openings, head, jamb, sill and mullion details, materials and finish, anchor details, compliance with design criteria and requirements of related work.
- .3 Each Shop Drawing submitted shall bear the seal and signature of a qualified Professional Engineer licensed to practice in the Province of Ontario.

1.8 MAINTENANCE DATA

- .1 Submit maintenance data in conformance to Section 01 78 10 - Closeout Submittals.

- .2 Provide maintenance data for cleaning and maintenance of aluminum finishes, and instructions for touch-up, repair, and removal of panels.

1.9 QUALIFICATIONS

- .1 The metal panel subcontractor shall have a minimum of five years experience in the installation of metal panel systems and shall be approved by the panel manufacturer.
- .2 The manufacturer shall have a single source capability to provide:
 - .1 Drafting and engineering;
 - .2 Fabrication of all panels and components;
 - .3 Job site supervision.

1.10 WARRANTY

- .1 Provide a warranty for the metal panel system in accordance with the General Conditions, but for a period of five (5) years.
- .2 The warranty shall cover material, installation and workmanship.
- .3 Warranties shall be issued to the Owner within two (2) working days following the date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Composite Aluminum Panel System Manufacturers and Products:
 - .1 Flynn Canada Ltd.: Accumet FR 2000 Panel System.
 - .2 Kanalco Ltd.: Reynobond Aluminum Composite Building Panels, Rainscreen Cladding System.
 - .3 Ontario Panelization: Alucotex Aluminium Composite Building Panels, Joint System III Rainscreen.
 - .4 Sobotec Ltd.: Alucobond Aluminum Composite Building Panels, SI-2000 Dry-Joint Filler System.

- .5 Vicwest: Mitsubishi Chemical America, Inc., Alpolic/fr panels, System 3.
- .6 Cladco Ltd.,: ACM Panelized Wall System
- .2 Composite Aluminum Panels - 4mm thick:
 - .1 Aluminum face and back sheets: 0.8mm base metal thickness fabricated from AA1100-H14 quality aluminum alloy for paint finish.
 - .2 Panel Core: 2.4mm solid fire resistant thermoplastic resin core.
 - .3 Finish: Conform to AAMA-605, organic fluoropolymer, Kynar 500 three coat finish (Duranar XL).
 - .4 Colour: to match clear anodic finish.
- .3 Acceptable Composite Aluminum Panels:
 - .1 Alcoa Architectural Products: Reynobond Aluminum Composite Panels.
 - .2 Alucoil North America: IarsonRF panels
 - .3 Alcotex Inc.: Aluminum Composite Panels.
 - .4 Mitsubishi Plastics Composites America Inc., Alpolic/fr Aluminum Composite Panels.
 - .5 3A Composites: Alucobond Plus Aluminum Composite Panels.
- .4 For copings and roof edge flashings provide 1.0mm thick prefinished material to match face sheet finish.
- .5 Screws: as recommended by the panel manufacturer, concealed and non-corroding.
- .6 Sealants: Refer to Section 07 92 00 - Sealants.
 - .1 Joints: Three Part Epoxidized Polyurethane.
 - .2 Back of Panel: One part Silicone.
- .4 Touch-up Paint: as recommended by panel manufacturer.
- .5 Isolation Coating: bituminous paint.

2.2 COMPONENTS AND FABRICATIONS

- .1 Provide for complete installation on structural substrate, including proprietary aluminum extrusions compatible with panel edges, manufacturer's standard profiles, vertical and horizontal joint closures, and perimeter trim as required.
- .2 Wall Panels:

- .1 Form face sheet to profiles shown on drawings.
- .2 Seal all face sheet corners.
- .3 Form panels with integral flanges or clips for concealed fastening.
- .4 Factory laminate with prefinished metal face sheet, plastic core, and metal back sheet as specified. Rout back surfaces at bend points for sharp edges.
- .5 Caulk perimeter of back of panel with silicone sealant.
- .6 Tolerances:
 - .1 Length and width: ± 2 mm.
 - .2 Squareness: 5mm maximum diagonally.
- .3 Exterior Corners: of same profile, material and finish as adjacent cladding material, factory built and brake formed to required angle with concealed corner brace.
- .4 Provide dry-fit exterior joints. Joints between panel system and adjacent construction shall be sealed with sealant on backer rods as shown on details.
- .5 Extrusions and Extrusion Clips for Panel Attachment: purpose made aluminum. Provide a separator between extrusions and subgirts.
- .6 Accessories: cap flashings, drip flashings, internal corner flashings, and closures for head, jamb, sill and corners, of same material, thickness and finish as face sheet, brake formed to shape.
- .7 Adjustable Angles, Z-bars, and Channel Sub-girts: of base metal thickness to suit wall design, structural quality steel to ASTM-A653/A653M, with Z275 zinc coating to ASTM-A924/A924M, profile as indicated to accept wall panels with structural attachment to building frame. Design to accommodate expansion, contraction, dynamic movements, and design load requirements.
- .8 Soffit Vents: aluminum, 3105 alloy, with silicone polyester finish. Colour shall be selected by the Consultant to match soffit colour. Fry Reglet Corporation: Soffit Vent E.I.F.S. Flat Stock with 5 Rows of Vents, model VFS-600.

PART 3 – EXECUTION

3.1 EXAMINATION AND PREPARATION

- .1 Examine the substrate to which the metal panel system is to be attached and report any unsatisfactory conditions to the Consultant prior to commencing installation. Do not start the work of this Section until unsatisfactory conditions are rectified.

07 42 10 – COMPOSITE ALUMINUM PANELS

- .2 Protect with isolation coating, metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface.
- .3 Cooperate with air barrier and insulation installers to achieve the proper sequence of work.

3.2 INSTALLATION

- .1 Install sub-girts to structural wall substrate and supports, using panel manufacturer's recommended fasteners and installation instructions.
- .2 Ensure wall insulation is installed prior to installing wall panels.
- .3 Install wall panels to sub-girts with concealed fasteners and panel attachment extrusions.
- .4 Use concealed fastenings, except where exposed fasteners are specifically permitted in writing by the Consultant.
- .5 Install panels plumb, true, level, and in alignment to established lines and elevations.
- .6 Provide formed closures, sealed to arrest direct weather penetration. Ensure continuity of "Pressure Equalized Rainscreen."
- .7 Provide alignment bars, brackets, clips, inserts, shims as required to securely and permanently fasten panel system to building structure.
- .8 Install joint backer rod and sealant where shown on details and where panel system abutts adjacent dissimilar construction. Provide weep holes for air space behind panels as required.
- .9 Finished work shall be securely anchored, free of distortion and surface imperfections, uniform in colour and glass.

3.3 CONTROL/EXPANSION JOINTS

- .1 Construct control and expansion joints as indicated.
- .2 Use cover sheets, of brake formed profile, of same material and finish as adjacent material.
- .3 Use mechanical fasteners to secure sheet materials.
- .4 Assemble and secure wall system to structural frame so stresses are within manufacturers' recommended limits.

3.4 CLEANING

- .1 Wash down exposed surfaces using a solution of mild domestic detergent in warm water, applied with soft clean wiping cloths and in accordance with the manufacturer's instructions.
- .2 Remove excess sealant with recommended solvent.
- .3 Remove all excess material, debris and equipment.
- .4 Replace damaged panels and components that, in the opinion of the Consultant, cannot be satisfactorily repaired.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDED

- .1 Metal flashings, reglets and flashing receivers.
- .2 Metal copings.
- .3 Metal coverings and associated flashing at mechanical dog houses and exhaust gooseneck roof penetrations.

1.2 RELATED SECTIONS

1.	General Requirements.	Division 01
2.	Masonry Procedures	Section 04 05 00
3.	Rough Carpentry	Section 06 10 00

1.3 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- .1 Metal flashing receivers and recessed reglets supplied to Section 04 05 00 – Masonry Procedures.

1.4 REFERENCES

1.	AAMA-611-98	Voluntary Specification for Anodized Architectural Aluminum.
2.	ASTM-A653/A653M-11	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3.	ASTM-A924/A924M-10a	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
4.	ASTM-B32-96	Standard Specification for Solder Metal.
5.	ASTM-D523-89 (1994)e1	Standard Test Method for Specular Gloss.
6.	ASTM-D822-96	Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-arc Exposure Apparatus.
7.	CAN/CGSB-37.5-M89	Cutback Asphalt Plastic Cement.
8.	CAN/CGSB-51.32-M77	Sheathing, Membrane, Breather Type.
9.	Canadian Roofing Contractors Association (CRCA), Roofing Specifications Manual, 2011.	
10.	CSA-A123.3-M1979	Asphalt or Tar Saturated Roofing Felt.
11.	CSA-B111-1974	Wire Nails, Spikes and Staples.
12.	SMACNA Architectural Sheet Metal Manual, Fifth Edition, 1993	

1.5 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit 100mm by 100mm samples of each type of sheet metal material, colour and finish.

1.6 WARRANTY

- .1 Provide a warranty for metal flashing work in accordance with the Contract Requirements, but for a period of five (5) years.
- .2 The warranty shall cover materials, installation and workmanship.
- .3 Warranties shall be issued to the Owner within two (2) Working Days following the date of Substantial Performance of the Work.

PART 2 – PRODUCTS

2.1 PREFINISHED SHEET METAL MATERIAL

- .1 Prefinished steel sheet with factory applied 2-coat silicon modified polyester finish system, Perspectra Series on exposed surfaces.
 - .1 Zinc coated steel sheet: commercial quality to ASTM-A653/A653M, with 2275 designation zinc coating to ASTM-A924/A924M.
 - .2 Class: F2S.
 - .3 Specular gloss: 30 units+/- 5 degrees in accordance with ASTM-D523.
 - .4 Coating thickness: not less than 25 micrometers.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 7 units or less and erosion rate less than 20% to ASTM-D822 as follows:
 - .1 Outdoor exposure period 1000 hours.
 - .2 Humidity resistance exposure period 1000 hours.
 - .6 Unexposed or reverse side shall have a clear wash coat finish.
 - .7 Manufacturers:
 - .1 Stelco Steel.
 - .2 Dofasco Inc.
- .2 Prefinished aluminum, supplied by Section 07 42 10 - Composite Aluminum Panels for forming and installation by this section.

2.2 PREFABRICATED FLASHING

- .1 Stack Jack Flashing: pre-insulated aluminum flashing sleeve with integral flange coated with bituminous paint, aluminum hood and perforated collar, and EPDM base seal. Thaler Metal Industries: Model SJ-31 Vandal Proof Stack Jack Flashing.
- .2 Flexible Conduit Flashing: liquid-tight, gooseneck shaped aluminum flashing pipe sleeve with integral flange coated with bituminous paint, and EPDM end cap and base seals. Thaler Metal Industries: Model MEF-2A liquid Tight Flexible Conduit Flashing.
- .3 Rigid Conduit Flashing: aluminum flashing sleeve with integral flange coated with bituminous paint, EPDM base seal, removable cap, and EPDM grommet seal. Thaler Metal Industries: Model MEF-1 Rigid Conduit Flashing.
- .4 Square Post Flashing: split stainless steel flashing sleeve with integral flange coated with bituminous paint, contoured vented cap filled with EPDM pressure grommet seal, and continuous EPDM seals at split junctures of sleeve and flange. Thaler Metal Industries: Model SP J-4 Square Split Flashing (Vented Cap).
- .5 Mechanical Doghouse and Exhaust Gooseneck Roof Penetrations of Aluminum Sheet Panels and Flashing: pre-insulated aluminum sheet and associated flashing.

2.3 ACCESSORIES

- .1 Isolation Coating: alkali resistant bituminous paint.
- .2 Plastic Cement: to CAN/CGSB-37.5.
- .3 Underlay for Metal Flashing: dry sheathing to CAN/CGSB-51.32 or No. 15 perforated asphalt felt to CSA-A123.3.
- .4 Sealants: Refer to Section 07 92 00 – Sealants.
- .5 Cleats and Starter Strips: of same material, and temper as sheet metal, minimum 50mm wide. Thickness 1.0mm.
- .6 Fasteners: of same material as sheet metal, to CSA-8111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1mm thick with rubber packings.
- .8 Touch-up Paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.
- .2 Form pieces in 2400mm maximum lengths. Use lock type joints between sections. Make allowance for expansion at joints.

07 62 00 – METAL FLASHING AND TRIM

- .3 Hem exposed edges on underside 12mm. Miter and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

- .1 Form flashings, and flashing receivers to profiles indicated of 0.5mm thick prefinished galvanized steel sheet. Colour: QC2624 – Bright Silver
- .2 Form copings and fascias to profiles indicated of 0.7mm thick prefinished galvanized steel sheet and 1.0mm thick prefinished aluminum.
 - .1 Prefinished Metal Flashing at Existing Building. Colour: Charcoal Grey. Colour to be confirmed by Consultant.

2.6 REGLETS AND CAP FLASHINGS

- .1 Form recessed and surface mounted reglets and metal cap flashing of 0.5mm thick galvanized steel sheet metal to be built-into masonry work for base flashings as detailed.
- .2 Provide slotted fixing holes and steel/plastic washer fasteners.
- .3 Colour: QC2624 – Bright Silver.

PART 3 – EXECUTION**3.1 INSTALLATION**

- .1 Install sheet metal work in accordance with CRCA FL series details, SMACNA Architectural Sheet Metal Manual, and as detailed.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal. Secure in place and lap joints 100mm.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock seams forming tight fit over hook strips.
- .5 Lock end joints and caulk with sealant.
- .6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .7 Insert metal flashing under cap flashing to form weathertight junction.

- .8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25mm. Lead wedge flashing securely into joint.
- .9 Caulk flashing at reglet with sealant.
- .10 Supply metal flashing receivers and recessed reglets to Section 04 05 00 – Masonry Procedures for building into masonry walls.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDED

- .1 Firestopping of Penetrations in Rated Assemblies.
- .2 Fire Resistive Joint Systems.
- .3 Perimeter Fire Containment Systems.
- .4 Firestopping of Penetrations in Fire Blocking Compartments.
- .5 Smoke Seals
- .6 It is the intent of this section of the specifications to establish a single, competent source to be responsible for providing all labour, materials, products, equipment and services, to supply and install firestopping and smoke seals for the area of work, including at the following locations:
 - .1 Openings in fire rated walls, floors and roofs both empty and those containing penetrations.
 - .2 Gaps between fire rated floor slabs and exterior curtain walls.
 - .3 Gaps between fire rated walls and exterior curtain walls.
 - .4 Gaps located within expansion joints.
 - .5 Openings at each floor level in fire rated shafts or stairwells.
 - .6 Gaps between the tops of fire rated walls and underside of fire rated floor or roof assemblies.
 - .7 Penetrations through construction enclosing compartmentalized concealed areas (fire blocks), involving both empty openings and openings containing penetrating items.
 - .8 Penetrations through smoke barriers.
- .7 Note: It is not the intention of this section to delete firestopping work fully specified in the mechanical and electrical specifications. Coordinate with all mechanical and electrical sections to ensure the complete firestopping of the area of work. All firestopping not specifically called for in the mechanical and electrical specifications is to be included under this section.

1.2 RELATED WORK

- .1 Fire blocking of concealed spaces:
 - .1 Fire separation of concealed spaces shall be provided under applicable specification sections, and as indicated on drawings.
- .2 Non-Rated Openings through Floors and Walls:
 - .1 Non-rated openings through floors and walls shall be sealed under applicable architectural, mechanical, and electrical specification sections.

- .3 Metal sleeves for fire rated openings through floors and walls shall be provided under applicable mechanical and electrical specification sections.
- .4 Firestopping and smoke seals within mechanical (i.e. inside ducts, dampers) and electrical assemblies shall be sealed under applicable mechanical and electrical specifications sections and only in accordance with the equipment or device manufacturers' installation instructions.

1.3 RELATED SECTIONS

.1	Concrete Unit Masonry	Section 04 22 00
.2	Sealants	Section 07 92 00
.3	Gypsum Board	Section 09 29 00
.4	Mechanical work requiring firestopping	Division 20, 22
.5	Electrical work requiring firestopping	Division 26, 27, 28

1.4 REFERENCE STANDARDS/DOCUMENTS

.1	ASTM E814	Test Method of Fire tests of Through Penetration Firestops
.2	ASTM E 2174	Standard Practice for On-Site Inspection of Installed Fire Stops
.3	ASTM E 2393	Standard Practice for On-Site Inspection of Installed Fire Stop Joint System.
.4	ASTM E 2307	Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
.5	ASTM C 920	Standard Specification for Elastomeric Joint Sealants systems
-
.1	UL	.1 American Society for Testing and Materials (ASTM): Fire Resistance Directory
.2	UL 263	Fire Tests of Building Construction and Materials
.3	ANSI/UL 1479	Fire Tests Of Through-Penetration Firestops
.4	ANSI/UL 2079:	Standard for Tests for Fire Resistance of Building Joint Systems
-
- .2 Underwriters Laboratories, Inc. (UL):
- | | | |
|----|--------------|---|
| .1 | ULC | List of Equipment and Materials, Firestop Systems and Components |
| .2 | CAN/ULC-S101 | Standard Methods of Fire Endurance Tests of Building Construction and Materials |
| .3 | CAN/ULC-S115 | Standard Method of Fire Tests of Firestop Systems |
-
- .3 Underwriters Laboratories of Canada (ULC):
-
- .4 Intertek: WH Mark Product Directory

.5 Factory Mutual Approval Guide

1.5 PERFORMANCE REQUIREMENTS

- .1 Provide firestopping systems of sufficient thickness, width and density to provide and maintain a fire resistance rating, as indicated on drawings and in accordance with ULC, cUL or WH design numbers.
- .2 Provide a seal completely filling all annular spaces to prevent the passage of flame, smoke and gases through the opening in the fire separation in which it is installed.
- .3 Provide materials which are compatible with all materials used in the system including materials used in or on penetrating items as well as all construction materials used in conjunction or contiguous with the system.
- .4 Accessories:
 - .1 Provide components for each firestopping system that are needed to install fill materials.
 - .2 Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated systems.
 - .3 Accessories include but are not limited to the following items:
 - .1 Permanent forming/damming/backing materials temporary forming materials
 - .2 substrate primers
 - .3 collars
 - .4 steel sleeves
- .5 Provide products that upon curing, do not re-emulsify, dissolve, leach, and breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- .6 Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
- .7 Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.
- .8 Openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.
- .9 Penetrations through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall.
- .10 Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.

- .11 Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standard ANSI/ UL 2079.
- .12 Provide through penetration firestop systems and fire-resistive joint systems subjected to an air leakage test conducted in accordance with Standards, ANSI/UL1479 and ANSI/ UL2079, respectively, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the through penetration firestop system or fire-resistive joint system to restrict the movement of smoke. Provide fire-resistive joint systems subjected to an air leakage test conducted in accordance with Standard, ANSI/ UL2079 with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

1.6 SUBMITTALS

- .1 Manufacturer's Data:
 - .1 Submit manufacturer's specifications, installation instructions and product data for each material required, in accordance with Section 01 33 23.
 - .2 Include ULC, cUL, or WH tested systems or designs, to show compliance with the Contract Documents.
- .2 Shop Drawings: Submit shop drawings showing typical installation details, including reinforcement, anchorage, fastenings and method of installation for each type of firestopping condition.
- .3 Samples: If requested, submit samples of each type of firestopping systems, smoke seals and accessories. Indicate location where material/system shall be utilized.
- .4 Qualifications: Submit certificate indicating qualifications of installer.

1.7 QUALITY ASSURANCE

- .1 Manufacturer: Manufacturer shall be one of the approved manufacturers listed below.
- .2 Applicator: Company having a minimum of three (3) years' experience in the installation of materials specified herein, on projects comparable to this project, who is certified, licensed or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with the specified requirements. Installer shall be certified by ULC, or other approved agency.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to the Ontario Building Code for fire resistance ratings.
- .2 Provide materials, accessories and application procedures which have been listed by ULC, cUL, or tested by a nationally recognized independent testing agency in accordance with ASTM E814, ANSI/UL 1479, CAN4-S115 or ANSI/UL 2079 to achieve the required fire protection rating(s).

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Do not proceed with the installation of firestopping materials when temperatures or weather conditions exceed the manufacturer's recommended limitations for installation.
- .2 Ventilate solvent based and moisture-cure firestopping per firestopping manufacturer's instructions by natural means or, where this is inadequate, by forced air circulation.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to Site in manufacturer's sealed, undamaged containers, with labels intact. Labels shall identify product and manufacturer, date of manufacture; lot number; shelf life, qualified testing and inspection agency's classification marking, and mixing instructions for multi-component materials.
- .2 Handle and store materials in accordance with manufacturer's instructions.

1.11 PROJECT/SITE CONDITIONS

- .1 Comply with manufacturer's recommended requirements for temperature, relative humidity and substrate moisture content during application and curing of materials.
- .2 Maintain minimum temperature before, during, and for minimum 3 days after installation of materials.
- .3 Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

1.12 SEQUENCING AND SCHEDULING

- .1 Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- .2 Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate through-penetration firestop systems.
- .3 Do not install firestopping system until Work within opening has been completed. Coordinate with other applicable Sections.
- .4 Schedule installation of safing materials in linear opening at curtain wall prior to construction that limits access to safing slot.
- .5 Schedule work of other trades so that firestopping applications can be inspected prior to being covered by subsequent construction.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURERS

- .1 Provide firestopping silicone sealants, water-based sealants, intumescent sealant, mortars, or firestop devices from one of the following manufacturers:

- .1 A/D Fire Protection Systems Inc.
- .2 Tremco Fire Protection Systems Group
- .3 Hilti (Canada) Corporation
- .4 Nuco Inc., Self-Seal Firestops

2.2 MATERIALS

- .1 Firestop systems:
 - .1 Provide a complete system of asbestos-free firestop systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115, ASTM E814, ANSI/UL 1479, or ANSI/UL 2079, and listed by ULC, cUL, or Warnock Hersey, and approved by jurisdictional authorities and the Consultant.
 - .2 Comply with applicable Building Code requirements for locations and ratings.
- .2 Materials specified below are as manufactured by A/D Fire Protection Systems Inc. Equivalent products manufactured by one of the approved manufacturers listed above are acceptable.
- .3 Silicone Sealants:
 - .1 Primerless, single component silicone sealant, curing to durable, flexible, silicone rubber; to ASTM C 920, Type S, Grade NS, class 25; A/D Fire barrier Silicone Sealant or equivalent.
 - .2 For use in: openings with penetrating items subject to high movement; multiple penetration systems; for combustible pipes up to 2-in. diameter; in control joints; in curtain wall joints; expansion joints; floor/wall joints; wall/wall joints; head of wall joints; and as a sealant for smoke barrier construction.
- .4 Pourable Sealant:
 - .1 Single component, water based, elastomeric sealants, forming durable, flexible, watertight bonds; A/D Firebarrier Seal (pourable) and Seal NS (non-slumping) or equivalent.
 - .2 Use non-slumping type for vertical applications.
 - .3 Water based firestop sealants for use with: control joints; head of wall joints; floor/wall joints; wall/wall joints; multiple penetration systems; plumbing; mechanical; electrical; and where sprayed sealant application is required or desired.
- .5 Intumescent Caulk:
 - .1 Single component, water based, elastomeric sealant for use in interior building locations; A/D Firebarrier Intumescent Caulk or equivalent.
 - .2 For general use as a firestop sealant with: insulated pipes; pipes; electrical cables and conduit; ducts.
- .6 Mortar:
 - .1 Non-combustible, fibre reinforced, foamed cement mortar; A/D Fire barrier Mortar or equivalent.
 - .2 For use in: large openings; static non-moving penetrations such as cable trays; for multiple penetration systems; electrical and communication bundles; conduits; non-combustible sleeves; and insulated pipes.
- .7 Collars:

- .1 Steel collars with intumescent silicone strip, in diameters to suit pipe sizes; A/D Firebarrier Collar or equivalent.
- .2 For use in openings with single combustible pipe penetrations greater than 50mm diameter; confirm maximum pipe diameter (for applicable tested assemblies) with manufacturer.
- .8 Pillows:
 - .1 Self-supporting, sealed polyethylene bags containing intumescent materials and non-combustible insulation; A/D Firebarrier Pillows or equivalent.
 - .2 For use in openings with: cable tray; multiple cable penetrations; where retrofitting of penetrating items is anticipated; and as a temporary firestop system.
- .9 Mineral Wool:
 - .1 Non-combustible, semi-rigid, preformed mineral wool strips and sheets; A/D Firebarrier Mineral Wool or equivalent.
 - .2 For use in tested firestop systems, as fire barrier and forming material.
- .10 Additional Materials:
 - .1 All materials shall be by the manufacturer's listed above and shall be components of tested assemblies, acceptable to local authorities having jurisdiction, for the fire rating required.
- .11 Fire Stopping:
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame and heat in compliance with requirements of CAN4-S115 and not to exceed opening sizes for which they are intended.
 - .2 Acceptable Products:
 - .1 A/D Fire Protection Systems Inc.: A/D Firebarrier Mineral Wool Fire Stopping Insulation.
 - .2 Roxul Inc.: RXL Safe Fire Stop Batt.
- .12 Smoke Seals: fire resistant material capable of maintaining an effective barrier against smoke and gases.
 - .1 Fire Rated Sealant - Type 1 (for joints in vertical surfaces): non-sagging, fire rated silicone listed for use in fire separations:
 - .3 Hilti (Canada) Corporation: CP 601S Elastomeric Firestop Sealant.
 - .4 3M Canada Inc.: Firebarrier 2000.
 - .5 Tremco Construction Products: TREMstop Fyre-Sil.
 - .2 Fire Rated Sealant - Type 2 (for head of wall applications): sprayable single component, water-based, acrylic fire stop sealant.
 - .6 Hilti (Canada) Corporation: CP672 Firestop Joint Spray.
 - .7 3M Canada Inc.: 3M FireDam Spray.
 - .8 Tremco Construction Products: TREMstop Acrylic SP.
 - .3 Fire Rated Sealant - Type 3 (for joints in horizontal surfaces): self-leveling, fire rated silicone, listed for use in fire separations.
 - .1 Hilti (Canada) Corporation: CP604 Self-leveling Firestop Sealant.
 - .2 3M Canada Inc.: Firebarrier 2003.
 - .3 Tremco Construction Products: TREMstop Fyre-Sil Self Leveling

2.3 ACCESSORIES

- .1 Damming and backup materials, supports and anchoring devices: Non-combustible, to manufacturer's recommendations and in accordance with the tested system being installed, and as acceptable to local authorities having jurisdiction.
- .2 Primers: As required by firestopping manufacturer and compatible with selected system and contiguous materials.
- .3 Water: Potable.
- .4 Tape: Pressure sensitive masking tape as recommended by the firestopping manufacturer.
- .5 Fasteners: Provide suitable fasteners, for applicable substrates, for all collars and other field fastened firestopping components.

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, openings, voids, adjoining construction and conditions under which the Work is to be installed. Confirm compatibility of surfaces scheduled to receive firestopping.
- .2 Verify that penetrating elements are securely fixed and properly located with the proper space allowance between penetrations and surfaces of openings.
- .3 Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Surfaces to receive firestopping shall be free of dirt, dust, grease, oil, rust, loose materials, form release agents, frost, moisture or any other matter which would impair the bond of firestopping material to the substrate of penetrating item(s).
- .2 Prime substrates in accordance with manufacturer's written instructions or recommendations. Confine primers to areas of bond; do not allow spillage or migration onto exposed surfaces.
- .3 Do not apply firestopping and smoke seals to surfaces previously painted or treated with sealers, curing compounds, water repellent or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure that anchoring devices, back-up materials, clips, sleeves, supports and other related materials used in the actual fire tests are provided.
- .5 Mask where necessary to prevent firestopping materials from contacting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so without disturbing firestopping seal with substrates.

- .6 Installation is not to proceed until submittals have been reviewed and returned by the Consultant.

3.3 INSTALLATION

- .1 Manufacturer's Instruction:
 - .1 Comply with ULC, cUL, or Warnock Hersey listings and manufacturer's instructions for the type of material and condition of opening in each case.
 - .2 Consult with the manufacturer's technical representative to determine proper procedure for conditions not fully covered by printed instructions.
 - .3 Record in writing any oral instructions received, with copy to manufacturer.
- .2 Firestopping for vertical applications: Non-sag caulk or spray grade sealants, Mortar, Collars or Pillows.
- .3 Firestopping for horizontal applications: Non-sag caulk or self-levelling or spray grade sealants, Mortar, Collars or Pillows.
- .4 Firestopping for overhead applications: Non-sag caulk or spray grade sealants or Mortar.
- .5 Install firestopping with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal. Tool or trowel exposed surfaces. Remove excess firestopping material promptly as the Work progresses and upon completion.
- .6 Damming: Provide leak-proof dams as required to seal openings and contain liquid sealants, putty or mortar until cured. Install damming in accordance with manufacturer's instructions.
- .7 Damming Boards: Install forming/damming materials and other accessories of type required to support fill materials during their application and in the position needed to produce the shapes and depths required to achieve fire ratings of through-penetration firestop systems.
 - .1 Combustible Type: For temporary dams only. Remove after firestopping material has cured.
 - .2 Non-Combustible Type: For temporary or permanent dams. Provide non-combustible type wherever damming material cannot be removed after applying firestopping materials.
- .8 Void Filler: Use materials recommended by the firestopping manufacturer to seal gaps created by non-combustible type damming boards and to seal around cables, conduits, pipes and where void filler material becomes part of the fire rated assembly.
- .9 Sealant:
 - .1 Install damming material or mineral wool as required.
 - .2 Apply sealant so air voids are not present and sealant is in full contact with penetrating items. Tool sealant to ensure substrate contact.

- .3 Remove excess sealant in accordance with manufacturer's recommendations.
- .10 Mortar:
 - .1 Install damming material as required.
 - .2 Mix mortar in strict accordance with manufacturer's instructions.
 - .3 Pump, trowel or hand pack mortar through openings to minimum thickness as recommended by manufacturer and as listed by ULC, or cUL, to achieve required fire rating.
- .11 Firestopping Mineral Wool:
 - .1 Install firestopping by compressing material to the minimum required by ULC, cUL, or WH listing.
 - .2 Apply firestopping in sufficient thickness, depth and density so as to achieve the required fire resistance rating.
 - .3 Use impaling clips to support and secure firestopping where required by tested system.
- .12 Where joint application is exposed to the elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications.

3.4 FIELD QUALITY CONTROL

- .1 Notify Consultant when completed installations are ready for inspection prior to concealing or enclosing an area containing firestopping materials.
- .2 Arrange for inspections by the Owners independent inspection and testing company, appointed and paid for by Owner.
- .3 Following field inspections, provide all repair as required to ensure compliance with the Contract Documents.
- .4 Keep areas of work accessible until inspection by authorities having jurisdiction

3.5 SCHEDULE

- .1 Fire stop for full depth or thickness of the assembly or component being fire stopped.
- .2 Apply smoke seal material to both sides of vertical assemblies required to have smoke seals. This applies to all fire separations, whether rated or unrated.
- .3 Fire Stop and Smoke Seal At:
 - .1 Penetrations through vertical fire separations of masonry, concrete, or gypsum board construction.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire separations of masonry construction at underside of fluted steel deck assemblies:
 - .1 Option No. 1: cUL Design No. HW-D-0098.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Hilti Type 2 fire rated sealant.
 - .2 Option No. 2: ULC Design No. HW23.

- .1 Fire stopping: all specified fire stopping Products.
- .2 Smoke seal: 3M Type 2 fire rated sealant.
- .3 Option No. 3: cUL Design No. HW-D-0092.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Tremco Type 2 fire rated sealant.
- .4 Top of fire separations of gypsum board construction at underside of fluted steel deck assemblies:
 - .1 Option No. 1: cUL Design No. HW-D-0042.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Hilti Type 2 fire rated sealant.
 - .2 Option No. 2: ULC Design No. HW21.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: 3M Type 2 fire rated sealant.
 - .3 Option No. 3: ULC Design No. HW71.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Tremco Type 2 fire rated sealant.
- .5 Intersection of fire separations of masonry or gypsum board construction.
- .6 Control joints in fire separations of masonry construction.
 - .1 Option No. 1: ULC Design No. JF83.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Hilti Type 1 fire rated sealant.
 - .2 Option No. 2: ULC Design No. JF 13.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: 3M Type 1 fire rated sealant.
 - .3 Option No. 3: ULC Design No. JF 18.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Tremco Type 1 fire rated sealant.
- .7 Control joints in fire separations of gypsum board construction: ULC Design No. JF 70.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: 3M Type 1 fire rated sealant.
- .8 Joints in horizontal fire separation assemblies - concrete floor slabs:
 - .1 Option No. 1: ULC Design No. JF82.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Hilti Type 3 fire rated sealant.
 - .2 Option No. 2: ULC Design No. JF13.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: 3M Type 3 fire rated sealant.
 - .3 Option No. 3: ULC Design No. JF18.
 - .1 Fire stopping: all specified fire stopping Products.
 - .2 Smoke seal: Tremco Type 3 fire rated sealant.
- .9 Penetrations through fire-resistance rated floor slabs, ceilings and roofs, and horizontal fire separations.
- .10 Openings and sleeves installed for future use through fire separations.
- .11 Mechanical assemblies penetrating fire separations: Refer to Division 23 - Heating, Ventilating, and Air Conditioning (HVAC).
- .12 Electrical assemblies penetrating fire separations: Refer to Division 26 - Electrical.

3.6 CLEANING AND PROTECTION

- .1 Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

- .2 Upon completion of this work, remove all materials, equipment and debris from the site. Leave work area and adjacent surfaces in a condition acceptable to the Consultant.
- .3 Leave installed work with sufficient protection to enable it to remain untouched until project turnover.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Sealants and caulking for exterior wall openings and joints.
- .2 Sealants and caulking for interior wall openings and joints.
- .3 Sealants and caulking for floor joints.

1.2 RELATED WORK

.1	General Requirements	Division 01
.2	Masonry Procedures	Section 04 05 00
.3	Firestopping and Smoke Seal	Section 07 84 00
.4	Aluminum Windows	Section 08 51 13
.5	Non-Structural Metal Framing	Section 09 22 00

1.3 REFERENCES

.1	CGSB-19-GP-5M-84	Sealing Compound, One Component, Acrylic Base, Solvent Curing.
.2	CAN/CGSB-19.13-M87	Sealing Compound, One-Component, Elastomeric, Chemical Curing.
.3	CAN/CGSB-19.17-M90	One-Component Acrylic Emulsion Base Sealing Compound.
.4	CAN/CGSB-19.21-M87	Sealing and Bedding Compound, Acoustical.
.5	CAN/CGSB-19.22-M89	Mildew Resistant Sealing Compound for Tubs and Tiles.
.6	CAN/CGSB-19.24-M90	Multi-Component, Chemical Curing Sealing Compound.
.7	CAN/ULC-S711.1-05	Standard for Thermal Insulation – Bead-Applied One Component polyurethane Air Sealant Foam, Part 1.
.8	CAN/ULC-S711.1-05	Standard for Thermal Insulation – Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1 : M.

1.4 APPROVED MANUFACTURERS

- .1 The products of the following manufacturers are approved for use subject to meeting the specifications for the particular type of sealants listed below. However, this is not an approval to substitute another type of sealant for those specified unless the material manufacturer requests change in his product in writing to the Consultant.
 - .1 Canadian General Electric Company Ltd.
 - .2 Dow Corning Canada Inc.
 - .3 Tremco
- .2 Material manufacturers must be willing to review Shop Drawings and drawing details, visit the site to review sealant installation and provide written reports to the Consultant.

1.5 INSTALLER QUALIFICATIONS

- .1 Sealants and caulking shall be installed by a specialized Subcontractor, having skilled mechanics thoroughly trained and competent in all aspects of caulking work, with minimum 5 years experience.
- .2 Sealants shall be appropriate for the application and materials to be caulked.

1.6 SUBMITTALS

- .1 Submit samples of each sealant, in conformance with Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Provide colour cards for Consultants selection.
- .3 Submit written adhesion and compatibility approval from the sealant manufacturer for all materials to be sealed.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 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.

1.8 ENVIRONMENTAL AND SAFETY REQUIREMENTS

- .1 Comply with requirements of Workplace Hazard Materials Information System (WHIMIS) regarding use, handling, storage, and disposal of hazardous materials, and regarding labelling and provision of material safety data sheets acceptable to the authority having jurisdiction.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3 Ventilate area of work as required and as may be directed by the Consultant by use of approved portable supply and exhaust fans.

1.9 WARRANTY

- .1 Extend Contractor's warranty to five (5) years, in writing. Warranty shall commence on the date of Substantial Performance.

- .2 Defective work shall include, but not be restricted to, joint leakage, cracking, crumbling, melting, running, loss of adhesion, loss of cohesion, or staining of adjacent surfaces.
- .3 Provide manufacturer's project-specific twenty (20) year non-staining warranty and ten (10) year weather seal warranty for "Type A" sealant listed below.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Sealant Type A: For exterior locations. Non-Staining, primer less, silicone weather-proofing sealant:
 - .1 SilPruf SCS9000 NB, manufactured by Canadian General Electric Company Limited, Dow Corning 756 SMS, manufactured by Dow Corning Canada Inc., or
 - .2 Spectrem 3, manufactured by Tremco Ltd., and
 - .3 conforming to the product properties published.
- .2 Sealant Type B: For interior locations. Non-staining, primer less, silicone hybrid sealant:
 - .1 SCS7000, manufactured by Canadian General Electric Company Limited.
 - .2 Dow Corning 756 SMS, manufactured by Dow Corning Canada Inc., or
 - .3 Spectrem 3, manufactured by Tremco Ltd., and
- .3 Sealant Type C: For interior locations where conditions of high humidity exist such as washrooms, showers, Mildew resistant, one component silicone conforming to CGSB 19-GP.22M and ASTM C920:
 - .1 CGE SCS1700 Sanitary Sealant,
 - .2 Dow Corning 786, or
 - .3 Tremco Tremsil 200 White
- .4 Sealant Type D: For interior locations. Paintable, non-staining, primer less, silicone hybrid sealant:
 - .1 SCS7000, manufactured by Canadian General Electric Company Limited.
- .5 Sealant Type E:
 - .1 Multi-component, epoxidized polyurethane sealant conforming to CAN/CGSB-19.24, Type 2, Class B, SWRI Certified.
 - .2 Dymeric 240, manufactured by Tremco Ltd.
 - .3 Contractors Weatherproofing Sealant (CWS) Contractors Concrete Sealant by Dow Corning.
- .6 Colours of sealants and caulking when exposed in the finished work to later selection by the Consultant. Allow different colours for different situations and materials. Allow for custom colours for exterior sealants.
- .7 Primers for sealing: As manufactured or recommended by the manufacturer of the sealing materials for the specific applications.

- .8 Joint backing material:
 - .1 circular foam strips, of approved manufacture, compatible with sealant and 50% greater width than joint width;
 - .2 Vertical Surfaces: extruded polyolefin foam, Sof Rod by Tremco Ltd.
 - .3 Horizontal Surfaces: closed cell polyethylene foam, Standard Backer Rod by Tremco.
- .9 Bond Breaker: pressure sensitive plastic tape backing material, which will not bond to sealant; 3M #226 or #481, or Valley Industries #40.
- .10 Acoustical Sealant.
 - .1 To CAN/CGSB-19.21.
 - .2 Acceptable Product: Tremco Commercial Sealants & Waterproofing, Tremco Acoustical Sealant.
- .11 Air Barrier Foam Sealant - One Part.
 - .1 One part polyurethane insulating foam sealant, to CAN/ULC-S710.1.
 - .2 Acceptable Products:
 - .1 Adfast Inc.: ADFOAM 1885-2
 - .2 Dow Chemical Canada ULC: GREAT STUFF PRO Gaps & Cracks Insulating Foam Sealant.
 - .3 Zerodraft Products Inc.: Zerodraft Foam Sealant.
- .12 Air Barrier Foam Sealant - Two Part.
 - .1 Two part polyurethane insulating foam sealant, to CAN/ULC-S711.1.
 - .2 Acceptable Products:
 - .1 Dow Chemical Canada ULC: FROTH-PAK Foam Sealant.
 - .2 Zerodraft Products Inc.: Zerodraft Insulating Air Sealant.
- .13 Preformed Compressible and Non-Compressible Back-up Materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50%.
 - .2 Neoprene or Butyl Rubber: Round solid rod, Shore A hardness 70.
 - .3 High Density Foam: Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200kPa, extruded polyolefin foam, 32kg/m; density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond Breaker Tape: Polyethylene bond breaker tape which will not bond to sealant.
- .14 Cleaning material for surfaces to receive sealant to be as recommended by the manufacturer of the sealant.

PART 3 – EXECUTION

3.1 LOCATIONS

- .1 Seal all exterior junctions and joints wherever required to close gap and wherever sealant is essential to maintain the continuity of air barrier, water barrier, or non-rated smoke separation of wall with Sealant Type A. Areas to be caulked include:

- .1 Concrete to metal, masonry, concrete and precast concrete.
 - .2 Masonry to metal, concrete, precast concrete, and masonry.
 - .3 Metal to metal, masonry, concrete, and precast concrete.
 - .4 Around pipes and conduit through foundation walls.
 - .5 Between hollow metal frames and screens and adjacent materials.
 - .6 Between metal panels and adjacent materials.
 - .7 Between window and louvre frames and sills and adjacent materials.
 - .8 At all control and expansion joints.
- .2 Seal all interior junctions and joints wherever required to close gap and wherever sealant is essential to maintain the continuity of air barrier, water barrier, or non-rated smoke separation of wall with Sealant Type B. Areas to be caulked include:
- .1 Concrete to metal, masonry, concrete and precast concrete.
 - .2 Masonry to metal, concrete, precast concrete, and masonry.
 - .3 Metal to metal, masonry, concrete, and precast concrete.
 - .4 Around pipes and conduit through walls.
 - .5 Between hollow metal frames and screens and adjacent materials.
 - .6 Between window and louvre frames and sills and adjacent materials.
 - .7 At all joints between millwork and masonry, to provide neat junction.
 - .8 At junction between all counters and/or splashbacks and adjacent substrate with neat 3mm bead.
 - .9 At all control and expansion joints.
- .3 Seal with Sealant Type C at the following locations:
- .1 Around access panels in ceramic tile faced walls with a neat 3mm bead.
 - .2 Around perimeter of piping penetration at tile work.
 - .3 At junctions between all counter tops and/or splashbacks and adjacent substrate in washrooms, with neat 3mm bead.
 - .4 At junctions of lavatories, toilets, and other plumbing fixtures and adjacent substrate.
- .4 Seal with Sealant Type D at all interior non-moving joints to be painted.
- .5 Seal at all other vertical and horizontal joint locations with Sealant Type E.
- .6 Refer to Section 07 84 00, Firestopping and Smoke Seal, for location of fire stopping and fire-resistant caulking.
- .7 Refer to Section 09 29 00, Gypsum Board, for acoustic sealant work.

3.2 SUPERVISION

- .1 Unless specified otherwise herein comply with the recommendations and directions of the manufacturer whose materials are being used on the work.
- .2 Arrange for the sealant manufacturer's technical representatives to visit the site prior to the commencement of the sealing to meet with the Contractor and the Consultant.

- .3 Sealant manufacturer to visit site periodically and to provide written reports to Consultant ensuring sealant is in accordance with good trade practice, the manufacturer's recommendations and the intent of this Specification.

3.3 PROTECTION

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

3.4 PREPARATION

- .1 Install sealants only when surfaces and ambient temperatures are suitable for the material used, as per manufacturer's recommendations.
- .2 Clean all joints and spaces to be sealed.
- .3 Ensure that surfaces are structurally sound, free from grease, chalk or other contaminants which may adversely affect the adhesion of the sealing materials. Use dry oil free clean compressed air stream if necessary to clean out the joint.
- .4 Clean surfaces with a solvent or cleaner recommended by the manufacturer of the sealant materials.
- .5 Remove chalk lines completely. Do not place clear sealant over coloured chalk lines.
- .6 Test materials for indications of staining or poor adhesion before any sealing is commenced.
- .7 Submit colour chart to Consultant and obtain his written instructions for colours and locations of colours.

3.5 PRIMING

- .1 If recommended by the manufacturer of the sealing materials, prime joints to prevent staining, or to assist the bond, or to stabilize porous surfaces.
- .2 Apply primer with a brush which will permit the priming of all joint surfaces.

3.6 BACKUP MATERIAL

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

3.7 MIXING

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

3.8 MASKING

- .1 Where necessary to prevent contamination of adjacent surfaces, mask the areas adjacent to the joints with masking tape.

3.9 INSTALLATION

- .1 Install joint backing materials at all locations as detailed or where required by sealant manufacturer's printed directions.
- .2 Install a bond breaker tape or packing over asphalt impregnated fibre board as recommended by sealant manufacturer.
- .3 Ensure that the correct sealant depth is maintained.
- .4 Finished joints shall be free of wrinkles, sags, air pockets, ridges and embedded impurities.
- .5 Tool all sealant surfaces to produce a smooth surface.
- .6 Remove droppings and excess sealant as work progresses and before material sets.
- .7 Sealing materials shall be gun grade or tool grade consistency to suit the joint conditions.
- .8 Commence sealing only after all adjacent surfaces have been painted under Painting Section.

3.10 CLEANING

- .1 Clean adjacent surfaces immediately and leave work neat and clean. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after joint tooling.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1	Concrete Unit Masonry	Section 04 22 00
.2	Sealants	Section 07 92 00
.3	Door Hardware	Section 08 71 00
.4	Gypsum Board	Section 09 29 00
.5	Painting and Coating	Section 09 90 00
.6	Electrical	Division 26, 27, 28

1.2 WORK INCLUDED

- .1 Supply and install all hollow metal products including paneled or louvered openings, non-labelled, as scheduled or shown on the Drawings.
- .2 Work shall including the following:
 - .1 Door cutouts, complete with reinforcing, stops and closers required for louvres.
 - .2 Reinforcing for Finishing Hardware.
 - .3 Supply all necessary fastening and anchoring devices for above items.
 - .4 Metal panels in hollow metal frames.
 - .5 Provision of zinc-rich coating on all exterior steel doors, frames and screens.
 - .6 Supply and install HSS and channel reinforcing members where shown at screens and door frames/sidelights.
 - .7 Installation of transfer grilles and door louvres.

1.3 REFERENCES

- .1 CAN4-S105 Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104
- .2 CAN4-S106 Standard Method for Fire Tests of Window and Glass Block Assemblies
- .3 Canadian Steel Door Manufacturers Association (CSDMA)
 - .1 Recommended Specifications for Commercial Steel Doors and Frames
 - .2 Recommended Dimensional Standards for Commercial Steel Doors and Frames
 - .3 Recommended Specifications for Sound Retardant Steel Doors and Frames
 - .4 Canadian Fire Labelling Guide for Commercial Steel Door and Frame Products
 - .5 Guide Specification for Installation and Storage of Hollow Metal Doors and Frames
- .4 CGSB 82.5 Insulated Steel Doors
- .5 CSA A101 Mineral Fiber Thermal Insulation for Buildings

DIVISION 08 – OPENINGS**TAIT STREET PUBLIC
SCHOOL HVAC RENOVATION
TENDER #7198-RW-22****08 11 13 – HOLLOW METAL DOORS AND FRAMES**

.6	CSA W59	Welded Steel Construction (Metal Arc Welding)
.7	ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
.8	ANSI A250.4	Test Procedure and Acceptance Criteria for Physical Endurance For Steel Doors Frames and Frame Anchors
.9	ANSI A115.IG	Installation Guide for Doors and Hardware
.10	ANSI A250.11	Recommended Erection Instructions for Steel Frames

1.4 PERFORMANCE

- .1 Doors, panels and frames covered by this specification shall be certified as meeting Level "A" acceptance criteria when tested in strict conformance with ANSI-A250.4-2011. Swing Test duration shall be 1,000,000 cycles. For door twist tests maximum deflection is not to exceed 32mm (1¼") when loaded to 136kg (300 lbs), and permanent deflection is not to exceed 3.2mm (1/8"). Tests shall be conducted by an independent nationally recognized accredited laboratory.
- .2 Core materials for exterior doors and panels shall attain a thermal resistance rating RSI 1.06 (R6.0) when tested in accordance with ASTM C518.
- .3 Product quality shall meet standards set by the Canadian Steel Door Manufacturers Association.

1.5 QUALITY ASSURANCE

- .1 Supply all steel door and frame product from one manufacturer Member Company of the CSDMA.
- .2 CSDMA Specification 08 11 13 "Commercial Steel Doors and Frames" is the minimum fabrication standard for this section, as if printed in its entirety herein, except where specified otherwise.
- .3 Handle and install product in strict compliance with CSDMA 08 11 13, DHI A115.IG and NFPA 60.
- .4 A cash allowance is included in the tender price to cover cost of an independent inspection company, to be selected by Consultant. Allowance is the responsibility of the Contractor and any ensuing deficiency correction costs are the responsibility of the supplier and/or the installer(s), as determined by the inspection report. The Owner reserves the right to have inspection include manufacturing facilities, and work in progress for this project, prior to award of contract or Substantial Performance of the contract.

1.6 SUBMITTALS

- .1 Prepare and submit shop Drawings in accordance with Section 01 33 23, and show the following:
 - .1 Door and frame schedules, identifying each unit, with door numbers referencing the numbering in the contract documents.
 - .2 Provide columns for Stock Code Numbers for both doors and frames.
 - .3 Typical and special details; including mortises, reinforcements, anchorages, locations of exposed fasteners, openings (glazed, panelled or louvered) and arrangement of hardware.
 - .4 Materials and finishes; including steel, core, material thickness.
 - .5 Hardware preparation.
 - .6 Frame anchorage details.
 - .7 Submit manufacturer's standard catalogue data for specified products demonstrating compliance with referenced standards.
 - .8 Other pertinent information
- .2 Submit information on standard shop drawing sheets as approved by the Canadian Steel Door and Frame Manufacturers Association.
- .3 Shop drawings for hollow metal screens over 8m² in size, and for all screens which are required by code to be designed as guards at variations in floor level, must be sealed by a professional engineer, registered in the Province of Ontario.
- .4 Submit manufacturer's printed installation instructions.
- .5 Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.7 PRODUCT HANDLING

- .1 Matchmark doors, panels, frames and windows with Stock Code Numbers as shown on the Door Schedule. If Stock Code Numbers are not shown on the Schedule, matchmark with Door Numbers.
- .2 Deliver, store and handle components so as to prevent damage, distortion and corrosion.
- .3 Store Steel Frames under cover, raised on wood skids at least 100mm above grade, and as required to prevent damage and rusting. Store assembled frames in an upright position. Stack frames to prevent twisting; maximum 5 units per stack. Provide minimum 6mm airspace between frames to permit air circulation. Covers must be vented so as to avoid a build-up of humidity within.
- .4 Doors to be delivered to site immediately prior to installation. Store doors protected at corners to prevent damage or marring of finish. Store in upright position, in enclosed, dry space, in a manner to prevent rust and damage. Use vented covers.

1.8 WARRANTY

- .1 Provide an extended warranty of three (3) years from date of Substantial Performance against defects of workmanship including failure of welded seams or of reinforced hinge anchorage plates. Work showing defects during this period shall be repaired or replaced without cost to the owner.

PART 2 – MATERIALS**2.1 MATERIALS**

- .1 General: All materials shall be new and suitable for their various purposes and shall be free from flaws and imperfections.
- .2 All doors, frames, and screens shall be from one manufacturer. Only the following manufacturers will be accepted:
 - .1 Manufacturers:
 - .1 Fleming Baron Door Products (Assa Abloy)
 - .2 Daybar Industries Ltd.
 - .3 All Steel Doors
 - .4 Gensteel Doors
 - .5 Trillium Steel Doors
 - .6 Vision Hollow Metal
 - .2 Sheet Steel:
 - .1 General: cold rolled, carbon steel, stretcher levelled. Steel to have hardness of Rockwell 'B' maximum 65 (ASTM E103) suitable for forming and bending without metal or coating fracture.
 - .2 ASTM A653/A653M commercial grade tension levelled hot-dipped galvanized steel sheet, coating designation Z275
 - .3 Steel Thicknesses:
 - .1 Doors and Panels:
 - .1 1.6mm (16 ga) for exterior, high use and oversize doors
 - .2 1.3mm (18 ga) for other interior doors
 - .2 Frames: 1.6mm (16 ga)
 - .3 Hinge Reinforcement: 3.5mm (10 ga)
 - .4 Door and Panel Materials:
 - .1 Exterior, High Use and Oversize Doors:
 - .1 all doors over 3m² and over 1200mm wide or over 3000mm in length

- .2 Semi-rigid glass fibre insulation fastened between continuous interlocking steel ribs to prevent sagging or movement.
- .3 Doors to be Fleming H-Series, 16 gauge, with continuous welded edge seams.
- .5 Door Reinforcement: Reinforce all steel doors with 20 ga. vertical interlocking weld steel stiffeners at 150mm o.c., spot welded to face sheets.
- .6 Frame reinforcement:
 - .2 Reinforce frames for high frequency hinge preparation.
 - .3 Stiffen all mullions and hinge jambs with continuous 3.5mm channel where continuous hinges are required.
 - .4 Reinforce and provide cut outs and boxes for security devices.
 - .5 Reinforce for overhead stops.
- .7 Exterior Top Caps: galvanized steel caps, flush with top of door.
- .8 Zinc Rich Coating: ZRC 221 Cold Galvanizing Compound by ZRC Worldwide, low VOC coating, or equivalent approved by the Consultant.
- .9 Metal Filler: Two component epoxy type.
- .10 Primer: Rust inhibitive primer

2.2 FABRICATION

- .1 General
 - .1 Dissimilar metals in contact, or metals which will be in contact with concrete or masonry when installed, shall be insulated one from another by methods and materials required for such results, as approved by the Consultant.
 - .2 Components shall be the types and sizes shown on the Drawings.
 - .3 Reinforce components, where required, for the installation of Finishing Hardware. Drill and tap to suit templates.
 - .4 Prepare doors and frames for the installation of the security system. Confirm requirements with Consultant.
 - .5 Ensure adequacy of anchoring devices.
 - .6 No patching, plugging, skimming or other such means of overcoming defects, discrepancies or errors shall be resorted to without written permission of the Consultant.
 - .7 Fabricate components from clean steel, free of rust and scale, which has been thoroughly degreased.
 - .8 The dimensions shown on the Drawings are the full rebate size of the frame.
 - .9 In addition to specified requirements for hollow metal doors and frames, fire doors and frames shall comply with the Underwriters Laboratories requirements for the specified rating and be provided with the appropriate labels.
 - .10 All seams in exterior doors, stairwell doors, and all doors over 3m² and over 1200mm wide or over 3000mm in length, and seams in all frames must be continuously welded. No spot welding will be permitted. All welds must be ground flush. No visible seams will be accepted.
 - .11 All exterior steel doors, frames and screens to be painted with 2 coats of zinc-rich coating after fabrication and before delivery to site.

08 11 13 – HOLLOW METAL DOORS AND FRAMES

- .12 All areas where shop applied zinc-rich coating has been damaged on site shall immediately be cleaned and touched up with the same zinc-rich coating product.
- .2 Edge Clearances
 - .1 Unless otherwise specified, allow edge clearances in accordance with Canadian Manufacturing Specifications for Steel Door and Frame Manufacturers Association.
 - .2 Where hardware items are to be attached to, or mortised into, bottom edges of doors, provide proper clearance between door and floor or threshold to accommodate such hardware.
- .3 Hardware Preparation
 - .1 Refer to Hardware Schedule, included in Section 08 71 00, and prepare doors for hardware listed.
 - .2 Templated hardware: prepare work in accordance with templates supplied in Section 08 71 00. Prepare doors for mortice locksets according to Hardware Schedule
 - .3 Reinforce doors and frames for concealed, mortised and surface mounted hardware in accordance to "Thickness of Steel for Component Parts" in the "Canadian Manufacturing Standards for Steel Doors and Frames", published by the Canadian Steel Door and Frame Manufacturers' Association.
 - .4 Prepare doors and frames for security system where noted.
 - .5 At oversized door locations, provide minimum 4 butt hinge preparations.
 - .6 Prepare all exterior doors and vestibule doors and frames for four hinges.
- .4 Hollow Metal Doors and Panels
 - .1 Doors and panels shall be of seamless, continuously welded construction with no visible seams or joints on faces. Doors to be 44.4mm minimum thickness.
 - .2 Secure edge seams with suitable continuously welded seams to the approval of the Consultant.
 - .3 Interlocking seams for doors shall be fully seam welded, for full length of door. All welding to be ground smooth.
 - .4 Core construction:
 - .6 Exterior doors to be filled with glass fibre insulation between steel reinforcing. All Type H doors to be steel stiffened as specified herein.
 - .7 All interior doors shall have steel reinforcing.
 - .8 Temperature Rise Rated (TRR): 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 Consultant
 - .5 Welds shall be ground, filled, and dressed smooth to provide an invisible joint and smooth flush surface.
 - .6 Fully reinforce doors as required for specified hardware. All exterior, stairwell, and washroom doors and all doors noted as "high frequency" shall be reinforced with S.W. Fleming high frequency angle top hinge reinforcement, welded to door skin.

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- .7 Close top and bottom edges of doors with a continuous, recessed, minimum 1.5mm thick steel channel, extending full width of door and welded to both faces. At exterior doors, provide an additional flush closing channel at top edge and, where required for attachment of weather stripping, a flush closure at bottom edge. Provide similar closure channel at all stair doors.
 - .8 Surround openings in doors with minimum 1.5mm thick steel edge channels, welded to both face sheets.
 - .9 Vertical edge profile for single acting swing doors: bevelled 3mm in 50mm.
 - .10 Glazing Stops:
 - .9 Equip glazed doors with minimum 0.9mm steel glazing stops, mitred and welded at corners. Where least dimension of stop is less than 12mm, make stop from solid square bar.
 - .10 Glazing stops at outside of exterior doors and at secure side of interior doors shall be rendered non-removable by welding to door. Secure removable stops with screws.
 - .11 Glazing stops may be mechanically locked in place, providing details have been reviewed on Shop Drawings.
 - .12 Glazing stops at fire rated doors and screens shall conform to the requirements of the tested assemblies.
 - .11 Fabricate exterior panels with a full width steel drip on the outer, lower edge.
 - .12 Doors for installation in channel frames shall be double-depth mortised to accommodate both butt flanges.
 - .13 Construct fire rated doors to meet fire test requirements and provide U.L.C. labels.
- .5 Steel Frames
- .1 Frames shall be of sheet steel, formed profiles shown on the Drawings. Fleming D Series for interior, Fleming H Series for exterior.
 - .2 Fabricate frames in sections as large as practicable to minimize field jointing. Internally reinforce all mullions and hinge jambs with 1.3mm channel.
 - .3 Steel thickness: 1.6mm (16 ga.) galvanized steel.
 - .4 Glazing stops shall be as specified for doors above.
 - .5 Sidelight framing shall be of same metal and thickness as adjacent door frame.
 - .6 Assemble components with accurately cut joints. Mitre outside corner joints of frames. Continuously weld joints on inside of profile; grind welds flush and sand to smooth uniform surface. Provide semi-rigid insulation to exterior frames.
 - .7 Tack weld two (2) removable 1.2mm steel spreader channels to inside faces of door frames at base, for protection during shipping.
 - .8 Provide adjustable base clips at bottom of each door jamb for anchorage to floor.
 - .9 Provide button type rubber silencers; three per strike jamb of single doors: two per head member of double door frames.
 - .10 Prepare door frames for ANSI strike, where doors to be fitted with latchsets or lockets.
 - .11 Provide removable mullions where noted. Reinforce removable mullions with 3.5mm channel to prevent forcing of latching hardware.
 - .12 Masonry Anchors:

08 11 13 – HOLLOW METAL DOORS AND FRAMES

- .13 At interior frames, provide masonry anchors of 1.5mm galvanized corrugated tee anchors or 3mm diameter galvanized wire anchors - supplied loose, at rate of 3 per jamb up to 2.2m high; one additional per jamb for each 0.6m over 2.2m high. Frames for observation windows shall be provided with 2 anchors per jamb.
- .14 At exterior frames, provide galvanized tee anchors fabricated from 3mm steel plates, installed at rate of 3 per jamb up to 2.2m high; one additional per jamb for each 0.6m over 2.2m high
- .13 Provide two 38mm by 38mm by 4.8mm thick steel stiffening angles in the head member of frames for two or more doors totalling over 1980mm, wide. Provide necessary vertical stiffeners where required and carry to structure above. Provide stiffener angles in all exterior door jamb with sidelights and in all centre mullions between doors.
- .14 Mounting bars for sidelights shall be as detailed on the Drawings and shall be completely filled with glass fibre insulation.

PART 3 - EXECUTION**3.1 GENERAL**

- .1 Store doors and frames as specified under item 1.7, Product Handling, above.
- .2 When installing frames during cold weather, installer to coat inside of frames with a corrosion inhibiting bituminous product, prior to installation, to protect against cold weather additives in masonry grout.
- .3 Silencers, gaskets, etc., are to be installed in holes in frames prior to installation of frames; so to avoid filling these holes with grout during installation.
- .4 Keep steel surfaces free of grout, tar, other bonding materials, and sealers; clean surfaces immediately following installation.

3.2 INSTALLATION

- .1 Frame and Screen Installation
 - .1 Remove all steel spreaders, which are provided to avoid damage during shipping. Provide wood spreaders at base and midpoint of frames. Wood spreaders to be min. 38 x 89mm lumber, notched to clear frame stops; width to be equal to opening between jambs at header level. Wood spreaders to remain in place until frames are set permanently in walls.
 - .2 Set frames and screens plumb, square, aligned, without twist and at correct elevation. Maximum allowable limits of distortion shall be as follows:
 - .1 Plumbness: Not more than 1.6 mm out of plumb, measured using a line from the intersection of vertical members and the head to the floor.
 - .2 Squareness: Not more than 1.6 mm difference between diagonal measurements between corners.
 - .3 Alignment: Not more than 1.6 mm, measured on jambs, through a horizontal line parallel to the plane of the wall.

- .4 Twist: Not more than 1.6 mm, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall.
- .3 At masonry walls, build in frames using the corrugated or wire masonry anchors. Brace frames solidly in position while being built in, with wood spreaders as noted above. Provide vertical support at centre of head for openings exceeding 1200 mm in width.
- .4 After installation, fill countersunk screw heads flush with frame and sand smooth ready for painting. Fill exterior frames with glass fibre batt insulation. Cooperate with masonry trade to fill interior frames with mortar.
- .5 Where large screens are assembled on site, they must be joined by continuously welded seams, ground smooth. Provide formed covers for structural columns built into screens.
- .2 Door Installation
 - .1 Install hollow metal doors plumb and true.
 - .2 Co-ordinate installation of hardware.
 - .3 Adjust operable parts to ensure proper operation. Lubricate using a suitable lubricant compatible with door and frame coatings.
 - .4 Install hollow metal panels with concealed fastenings.

3.3 TOUCH UP

- .1 Remove rust, clean and touch up any damaged galvanizing with "ZRC 221" coating.
- .2 Remove rust, clean and touch up any damaged paint with approved rust inhibitive primer.

3.4 CLEANING AND PROTECTION

- .1 Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged products. Clean installed products in accordance with manufacturer's instructions before Owner's acceptance.
- .2 Remove construction debris associated with this work from project site, and dispose of in accordance with applicable laws.
- .3 Protect installed products and finished surfaces from damage during construction.

END OF SECTION

PART 1 - GENERAL

1.2 RELATED REQUIREMENTS

.1	Joint Sealing	Section 07 92 00
.2	Mechanical	Division 20

1.3 REFERENCE STANDARDS

- .1 Aluminum Association (AA)
 - .1 DAF 45 2003, Designation System For Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA).
 - .1 AAMA-2603-2002, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - .3 AAMA-2604-2005, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - .4 AAMA-2605-2005, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - .1 AAMA CW-10-2004, Care and Handling of Architectural Aluminum From Shop to Site.
- .3 ASTM International (ASTM).
 - .1 ASTM B209-07, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM B221-08, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .3 ASTM D2240 – 05, Standard Test Method for Rubber Property—Durometer Hardness.
- .5 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.8-97, Insulating Glass Units.
 - .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.
 - .3 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.
- .6 CSA International (CSA)
 - .2 CAN/CSA-S157-2005, Strength Design in Aluminum.
 - .3 CAN/CSA W59.2-M1991(R2003), Welded Aluminum Construction.
- .7 NAFS – AAMA/WDMA/CSA 101/I.S.2/A440-08
- .8 Environmental Choice Program (ECP)
 - .1 CCD-45-1995, Sealants and Caulking Compounds.
- .9 Underwriter's Laboratories of Canada (ULC)

- .1 CAN/ULC-S710.1 2005, Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials Standard for Thermal Insulation - Bead - Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: Co-ordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays.
- .2 Pre-installation Meeting: Convene pre-installation meeting after Award of Contract and one week prior to commencing work of this Section to verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer's written installation instructions.
 - .1 Notify attendees 2 weeks prior to meeting and ensure meeting attendees include as minimum:
 - .1 Owner;
 - .2 Consultant;
 - .3 Manufacturer's Technical Representative.
 - .2 Ensure meeting agenda includes review of methods and procedures related to aluminum window installation including co-ordination with related work.
 - .3 Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit product data including manufacturer's literature for aluminum window frames, insulated metal panel, components and accessories, indicating compliance with specified requirements and material characteristics.
 - .1 Submit list on window manufacturer's letterhead of materials, components and accessories to be incorporated into Work.
 - .2 Include product names, types and series numbers.
 - .3 Include contact information for manufacturer and their representative for this Project.
- .3 Design Data:
 - .1 Provide framing member structural and physical characteristics, dimensional limitations, special installation requirements. Structural calculations shall bear the seal and signature of qualified Professional Engineer licensed to practice in the Province of Ontario.
- .4 Shop Drawings: Submit drawings as follows:
 - .1 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, description of related components and exposed finishes, fasteners, and caulking.
 - .2 Indicate location of manufacturer's nameplates.
 - .3 Shop Drawings shall bear the seal and signature of a qualified Professional Engineer licensed to practice in the Province of Ontario.

- .5 Thermal Performance: Submit verification that Insulating Glass Units used meet (U) values specified.
- .6 Test Reports:
 - .1 Submit test reports showing compliance with specified performance characteristics and physical properties including air and water infiltration.
- .7 Field Reports: Submit manufacturer's field reports within 3 days of manufacturer representative's site visit and inspection.
- .8 Installer Qualifications:
 - .1 Submit letter verifying installer's experience with work similar to work of this Section.

1.6 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: Supply maintenance data for windows for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.
- .2 Record Documentation: In accordance with Section 01 78 10 - Closeout Submittals.
 - .1 List materials used in windows work.
 - .2 Warranty: Submit warranty documents specified.

1.7 DELIVERY STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Deliver material in accordance with manufacturers written instructions.
 - .2 Deliver aluminum windows in manufacturer's original packaging with identification labels intact and in sizes to suit project.
 - .3 Brace frames to maintain squareness and rigidity during shipment.
- .2 Material Handling: To AAMA CW-10.
- .3 Storage and Handling Requirements: Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - .1 Material storage: To AAMA CW-10.

1.9 WARRANTY

- .1 Project Warranty: Refer to Contract Conditions for project warranty provisions.
- .2 Manufacturer's warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.
- .3 Warranty period: 5 years commencing on Date of Substantial Performance of Work.

PART 2 - PRODUCTS

2.1 SCOPE OF WORK, MANUFACTURER AND PRODUCTS

- .1 Aluminum Window Insulated Panel - Exterior: manufactured and assembled by one of the companies listed below.
- .2 Scope of Work:
 - .1 Remove existing insulated window panel and associated framing within a section of the existing aluminum window as required to remove an existing abandoned wall exhaust . Site verify existing window panel section.
 - .2 Install new aluminum insulated panel and perimeter sealant as required to seal and to match the existing window system..
- .3 Window Components:
 - .1 Colour of aluminum panel to match existing window frames; Exterior exposed aluminum surfaces: To AA DAF-45-M12C22A44, Architectural Class I, Clear anodized 18 µm (0.0007 inches) minimum thickness. Acceptable material: Alumicor Ltd., Class I Anodic Finish.
 - .3 Equivalents acceptable by the following manufacturers:
 - .1 Kawneer
 - .2 Sherwood Windows Group.
 - .3 Aerloc Industries Ltd.

2.2 DESCRIPTION

- .1 Thermally broken, rain screen designed, aluminum framed, integral, windows with insulated metal panels, exterior applied feature caps and concealed tamperproof fasteners.

2.3 DESIGN CRITERIA

- .1 Design aluminum components to CAN/CSA S157.
- .2 Window Classification: To NAFS – AAMA/WDMA/CSA 101/I.S.2/A440-08
 - .1 Air tightness: FW-CW – Canadian level: Fixed.
 - .2 Water tightness: [FW-CW100].
 - .3 Wind load resistance: [FW-CW70].
 - .4 Forced entry resistance test: Grade 10.

2.4 WINDOW MATERIALS

- .1 Insulated Metal Panel: Factory-laminated, comprised of exterior face and substrate, core, and interior face and substrate.
 - .1 Exterior face: 1.3 mm thick aluminum.
 - .2 Exterior substrate: 2.5 mm hardboard.
 - .3 Core: rigid polyisocyanurate foam insulation, thickness as indicated.
 - .4 Interior substrate: 2.5 mm hardboard.
 - .5 Interior face: 1.3 mm thick aluminum.

- .3 Sealants:
 - .1 Perimeter Sealant:
 - .1 Three part epoxidized polyurethane to CAN/CGSB-19.24.
 - .1 Tremco Construction Products: Dymeric. Colour selected by the Consultant from the manufacturer's special colour range.
 - .2 One-part neutral cure silicone to CAN/CGSB-19.13.
 - .1 Dow Corning Corporation: 795 Silicone Building Sealant.
 - .2 General Electric Canada Inc.: Silpruf Sealant.
 - .2 Air Barrier Foam Sealant: Refer to Section 07 92 00 - Sealants.
 - .3 Infill Panel Sealant: One-part neutral cure silicone to CAN/CGSB-19.13, custom colour selected by the Consultant.
 - .1 Dow Corning Corporation: 795 Silicone Building Sealant.
 - .2 General Electric Canada Inc.: Silpruf Sealant.
- .3 Thermal Break: Glass fibre reinforced polyamide porthole extrusion.
- .4 Primary seal gasket: Dual Durometer PVC
- .5 Rain screen gasket: EPDM, 60 Durometer
- .7 Metal flashing and sills: Extruded aluminum in Clear anodic finish, designation AA DAF-45-M12C22A44, Architectural Class I, , of type and size to suit project conditions; complete with joint covers, jamb drip deflectors, chairs, anchors and anchoring devices.

2.7 WINDOW FABRICATION

- .1 Construct units square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
 - .1 Brace frames to maintain squareness and rigidity during installation.
- .2 Fabricate units square and true with tolerance of plus or minus 1.5 mm maximum for units with diagonal measurement of 1800 mm maximum and plus or minus 3 mm maximum for units with diagonal measurement greater than 1800 mm.
- .3 Accurately fit and secure joints and corners.
 - .1 Ensure joints are flush, hairline, and weatherproof.
 - .2 Seal joints and corners in accordance with manufacturer's instructions
- .4 Face dimensions detailed are maximum permissible sizes.
- .5 Use only concealed tamperproof fasteners
 - .1 Where fasteners cannot be concealed, countersunk screws finished to match adjacent material may be used upon receipt of written approval from Consultant.
- .6 Visible manufacturer's labels are not permitted.

2.6 FINISHES

- .1 Finish: Clear anodic finish, designation AA DAF-45-M12C22A44, Architectural Class I.
- .2 Exterior Exposed Aluminum Surfaces: Clear anodic finish, designation AA DAF-45-M12C22A44, Architectural Class I.
- .3 Interior Exposed Aluminum Surfaces: Clear anodic finish, designation AA DAF-45-M12C22A44, Architectural Class I.
- .4 Touch-up Primer for Galvanized Steel Surfaces: SSPC Paint 20, zinc rich coating.
- .5 Concealed Steel Items: galvanized in accordance with CAN/CSA-G16 4 to 600 gm/m².

2.8 ACCESSORIES

- .1 Gasketing: To CCD-45 Black EPDM and PVC gaskets.
- .2 Setting Blocks: To CCD-45 and ASTM D2240, silicone, 80 - 90 Shore A Durometer hardness. Manufacturer's standard, notched to permit water drainage through the glazing cavity.
- .3 Spacers: To CCD-45 and ASTM D2240, silicone, 50 - 60 Shore A Durometer hardness.
- .4 Sealant: To CAN/CGSB-19.13, Class 40, one-component, cold-applied, non-sagging silicone.
 - .1 Acceptable material: Dow Corning 795.
- .5 Sealant Bond Breaker: Open cell foam backer rod sized to suit project requirements.
- .6 Liquid Foam Insulation: Single component, moisture cure, low expansion rate spray-in-place polyurethane liquid foam insulation to ULC-S710.1 and in accordance with manufacturer's written recommendations.
- .8 Fasteners: Tamperproof, cadmium plated stainless steel 300 or 400 series to meet window requirements and as recommended by manufacturer.

PART – EXECUTION

3.1 INSTALLERS

- .1 Use only installers with 2 years minimum experience in work similar to work of this Section. Installers to be approved by manufacturer.

3.2 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for window installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Consultant.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.3 WINDOW INSTALLATION

- .1 Install windows in accordance with manufacturer's written instructions and to CAN/CSA A440/A440.1.
- .2 Install perimeter prime seal gasket in accordance with manufacturer's instructions, seal corners. Continuous wet seal heel beads are not permitted.
- .2 Arrange components to prevent abrupt variation in colour.
- .3 Co-ordinate attachment and seal of perimeter vapour retarder in accordance with Section 07 26 00 – Vapour Retarders.

3.5 CAULKING

- .1 Apply sealant in accordance with Section 07 92 00 - Joint Sealing. Conceal sealant within window units except where exposed use is approved in writing by Consultant.
- .2 Seal joints between louvres frames and flashing with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound.
 - .1 Caulk between sill upstand and window frame. Caulk butt joints in continuous sills.

3.6 FIELD QUALITY CONTROL

- .1 Field Inspection: Coordinate field inspection.
- .2 Site Installation Tolerances: Install window mullions square and true with tolerance of plus or minus 1.5 mm maximum for units with diagonal measurement of 1800 mm maximum and plus or minus 3 mm maximum for units with diagonal measurement greater than 1800 mm.
- .3 Manufacturer's Services:
 - .1 Coordinate manufacturer's services with Section 01 45 00 - Quality Control.
 - .2 Submit to Consultant a written agreement from the manufacturer to perform the manufacturer's services.
 - .3 Schedule manufacturer's review of work procedures at stages listed:
 - 1. Product Application: 1 off site review.
 - 2. Fabrication and Handling: 1 review at authorized installers fabrication facilities.
 - 3. Installation: 3 site reviews at commencement of Work, 50% completion of Work and Upon completion of Work.

- .4 Submit manufacturer's written reports to Consultant describing:
 - .1 The scope of work requested.
 - .2 Date, time and location.
 - .3 Procedures performed.
 - .4 Observed or detected non-compliances or inconsistencies with manufacturers' recommended instructions.
 - .5 Limitations or disclaimers regarding the procedures performed.
 - .6 Obtain reports within seven days of review and submit immediately to Consultant.

3.7 CLEANING

- .1 Progress Cleaning: Perform cleanup as work progresses [in accordance with Section 01 74 00 - Cleaning and Waste Management].
 - .1 Remove sealant and caulking drippings as work progresses.
 - .2 Leave work area clean end of each day.
- .2 Final cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment [in accordance with Section 01 74 00 – Cleaning and Waste Management].
- .3 Waste Management:
 - .1 Co-ordinate recycling of waste materials.
 - .2 Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.
 - .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

- .1 Protect installed windows and components from damage during construction.
- .2 Repair damage to adjacent materials caused by aluminum window installation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

1. Rough Carpentry	Section 06 10 00
2. Hollow Metal Doors and Frames	Section 08 11 13
3. Gypsum Board	Section 09 29 00
4. Acoustic Ceilings	Section 09 51 00

1.2 REFERENCES

1. CSA S136	North American Specification for the Design of Cold-Formed Steel Structural Members
2. CAN/ULC-S101	Standard Methods of Fire Endurance Tests of Building Construction and Materials
3. AISI	North American Standard for Cold-Formed Steel Framing – Product Data
4. ASTM International	
.1 A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
.2 A641/A641M	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
.3 A792/A792M	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
.4 A1003	Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic coated for Cold-Formed Framing Members
.5 C645	Standard Specification for Nonstructural Steel Framing Members
.6 C754	Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
.7 C840	Standard Specification for Application and Finishing of Gypsum Board
.8 C841	Standard Specification for Installation of Interior Lathing and Furring
.9 C844	Standard Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster
.10 C1002	Standard Specification for Steel-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster bases to Wood Studs or Steel Studs
.11 ASTM E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
.12 ASTM E413	Classification for Rating Sound Insulation
.13 E488	Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
.14 E1190	Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
.5	Canadian Sheet Steel Building Institute (CSSBI):
.1	Lightweight Steel Framing Technical Bulletin Volume 7, Number 1, Maximum Height Tables for Interior Non-Loadbearing Partitions.

1.3 QUALITY ASSURANCE

- .1 Fire-Test-Response Characteristics:
 - .1 For fire-resistance-rated assemblies that incorporate non-loadbearing interior steel framing, provide materials and construction identical to those tested in assembly indicated according to CAN/ULS-S101.
 - .2 STC-Rated Assemblies:
 - .1 For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413.

1.4 DELIVERY AND STORAGE

- .1 Handle and store materials carefully to prevent damage.
- .2 Obtain approval of proposed locations for stockpiling material. Provide any necessary temporary covers, skids and the like.
- .3 Do not install damaged or deteriorated material but remove from Site.

1.5 RELATIONS WITH OTHER TRADES

- .1 Coordinate with other trades for the locations of items to be framed in and framed around.
- .2 Co-ordinate with mechanical and electrical Trades to ensure that all services are installed prior to application of wall board.
- .3 Coordinate with mechanical and electrical trades for locations of access panels. Install access doors and panels supplied by those trades.
- .4 Co-ordinate with forces installing insulation and vapour barrier in exterior soffits.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Metal framing shall be as manufactured by Bailey Metal Products or approved alternate; to ASTM C645.
- .2 Metal Studs and Track: minimum 0.455mm (18 mils) galvanized steel; depths as indicated on drawings, [41mm] [64mm] [92mm] [152mm].
- .3 Metal Furring Channels: minimum 0.455 (18 mils) sheet galvanized steel channel and accessories as manufactured by Bailey Metal Products, or approved alternate; to ASTM C645.

- .4 Cold Rolled Furring Channel: 20mm, x 12.7mm zinc coated channel weighing minimum 0.446 kg per m.
- .5 Cold Rolled Carrying Channel: 38mm x 15mm zinc coated channel weighing min 0.707 kg per m.
- .6 Hanger wire: minimum 3.77mm (9ga) galvanized steel wire.
- .7 Tie Wire: minimum 1.5mm (16 ga) galvanized soft annealed steel.
- .8 CGC Brand Screws (or approved equal) of type recommended by the board manufacturer.
- .9 Thermal Break: Permanent adhesive faced rubberized cork, 3 mm thick by width of stud on channel to be used between masonry in exterior wall and metal furring channels.
- .10 Ceiling Anchors: Self drilling tie wire anchors, Phillips "Red Head" T-32 or approved equal.

PART 3 - EXECUTION

3.1 GENERALS

- .1 Provide plumb, straight, level, rigid, and secure installation. Failing to achieve this result shall be cause for rejection and reinstallation of this work.
- .2 Where walls run parallel and under steel joists, the joists shall be framed both sides and enclosed with gypsum board to provide sound barrier between rooms.

3.2 CEILING SUSPENSION

- .1 Do not regard grillage system indicated on drawings as exact or complete. The Specification for metal framing contained in CGC Gypsum Construction Handbook and ASTM C840 shall govern installation conditions not covered by this Specification. The more stringent specifications shall apply.
- .2 Hangers:
 - .1 Install hangers for suspended wallboard ceilings to support the grillage independent of walls, columns, pipes, ducts and the like. Erect plumb and securely anchor to the structure. Submit details of proposed method to the Consultant for approval. If so requested, test hangers to prove that anchorage is adequate to support the proposed loading. Erect hangers plumb and securely anchor to structural steel or support channels fastened to structural steel (DO NOT FASTEN TO STEEL DECK).
 - .2 Space hangers at 1200mm maximum o.c. along the carrying channels and not more than 150mm from ends (or as required to conform with fire tested assemblies where applicable).
- .3 Carrying Channels:

09 22 00 – NON-STRUCTURAL METAL FRAMING

- .1 Space channels at 1200mm maximum o.c. (or as required to conform with fire tested assemblies where applicable).
- .2 Run channels transversely to structural framing members.
- .3 Where splices are necessary, lap members at least 200mm and wire each end with two laps; avoid clustering or lining up splices.
- .4 Attach to hangers by bending hanger under runner and securely wire in place with a saddle tie.
- .5 Provide 25mm clearance between channels and abutting walls and partitions.
- .4 Cross Furring
 - .1 Install drywall screw channels transversely across runner channels, joists or other supports.
 - .2 Space drywall screw channels at 600mm o.c. and not more than 150mm from perimeter walls. Provide 25mm clearance between channels and abutting walls and partitions. Use closer spacing if so noted on drawings.
 - .3 Secure drywall screw channels to each support with approved clip or attachment; splice joints by messing minimum 200mm and tying channels together with double strand 16 gauge tie wire.
 - .4 Level drywall screw channels to a maximum tolerance of 4mm over 3600mm.
 - .5 Drywall shall not be fixed directly to open web steel joists and the like. Provide cross furring as specified.
- .5 Openings
 - .1 Frame openings with suitable channels; check clearances with respective Trades. Provide support for edges of boards at all cut-outs and openings in ceilings.
 - .2 Provide all additional hangers and supports for fixtures as required.
 - .3 Provide additional hangers and framing for enclosure of radiant heating panels.
- .6 Bulkheads
 - .1 Fur out bulkheads in areas indicated and as required to conceal mechanical, electrical or other services in rooms where drywall finishes are scheduled, and elsewhere if called for on drawings.
 - .2 Use methods and materials as previously specified in this section.

3.3 STEEL STUD SYSTEM (PARTITION) INSTALLATION

- .1 Conform to the guidelines for metal framing contained in The Gypsum Construction Handbook, CSA A.82.31, and these specifications. The most stringent requirements shall apply.
- .2 Attach metal runners at floor and ceiling to structural elements with suitable fasteners located 50mm from each end and spaced 600 mm. o.c. with toggle or molly bolts spaced 400mm o.c.
- .3 Position studs vertically, engaging floor and ceiling runners, and spaced 400mm o.c., unless otherwise noted on drawings. When necessary, splice studs with 200mm nested lap and one positive attachment per stud flange. Place studs in direct contact with door frame jambs, abutting partitions, partition corners and existing construction elements.

- .4 Where studs are installed directly against exterior walls install rubberized cork stip between studs and wall surfaces to provide thermal break.
- .5 Anchor studs for shelf-walls and those adjacent to door and window frames, partition intersections and corners to ceiling and floor runner flanges with an approved crimping tool. Securely anchor studs to jamb and head anchor clips of door or borrowed-light frames by bolt or screw attachment. Over metal door and borrowed-light frames, place horizontally a cut-to-length section of runner, with a web-flange bent at each end, and secure with one positive attachment per flange. Position a cut-to-length stud (extending to ceiling runner) at vertical panel joints over door frame header.
- .6 Stiffen partitions exceeding 3m long or 2.7m high with 19mm. cold rolled channels. Fix horizontally and provide the number of rows necessary to ensure a rigid installation. Provide other partition reinforcing necessary to support wall hung components, cupboards, closets and the like. Use 2 studs at jambs of openings and corners.
- .7 Where horizontal runs of service lines are to be installed within the partition, erect studs with web openings aligned.
- .8 Provide reinforcing and necessary stiffeners to support hollow metal frames and screens. Reinforcing to be capable of supporting screens rigidly and solid without deflection.

3.4 CHASE WALL INSTALLATION

- .1 Align two parallel rows of floor and ceiling runners spaced apart as indicated. Attach to concrete slabs with concrete stub nails or power driven anchors 600 mm o.c. Attach to suspended ceilings with toggle or molly bolts 400mm o.c. Attach to wood framing with suitable fasteners 600mm o.c.
- .2 Align metal studs vertically in runners, 200mm o.c. with flanges in the same direction and with studs on opposite sides of chase directly across from each other. Anchor studs to floor and ceiling runner flanges with an approved metal crimping tool.
- .3 Cut cross bracing to be placed between rows of studs from gypsum panels, 400mm high by chase wall width. Space braces at quarter points not to exceed 600mm o.c. vertically and attach to stud webs with six 25mm screws 200mm o.c. maximum on each side.
- .4 Bracing with 64mm metal studs may be used in place of gypsum panels. Anchor web at each end of metal brace to stud web with two 10mm pan head screws. When chase wall studs are not opposite, install metal stud cross braces 400mm o.c. horizontally and securely anchor each end to a continuous horizontal 64mm runner screw-attached to chase wall studs with the cavity.
- .5 Adapt cross bracing as necessary to avoid interference with service.

3.5 WALL FURRING INSTALLATION

- .1 Direct Furring Channel Attachment - Attach metal furring channels, vertically or horizontally spaced 400mm o.c. to masonry or concrete surfaces with hammer-set or power-driven fasteners or concrete stub nails staggered 600mm o.c. on opposite flanges. Nest channels 200mm at splices and anchor with two fasteners in each wing. Where furring channel is installed directly to exterior wall, install thermal break strip between

furring channel and wall. For horizontally placed channels attach maximum 100mm from floor and ceiling.

- .2 Bracketed Furring Channel Attachment:
 - .1 Attach adjustable wall furring brackets with serrated edges up, 900mm o.c. horizontally, 1200mm o.c. vertically, within 100mm of columns or other abutting construction, within 150mm of floor and ceiling, and as required above and below openings. Use 50mm cut nails in mortar joints of brick or clay tile or concrete block, or in field of lightweight aggregate blocks; use 16mm concrete stub nails or power driven nails or other suitable fasteners in monolithic concrete. Place fastener in top hole of bracket.
 - .2 Lay cold-rolled channels horizontally with flanges down, on furring brackets, plumb with other channels, and tie with double strand 16 ga. or triple strand 18 ga. wire at each junction with cold rolled channel.
- .3 Free Standing Furring - In locations where wall furring is indicated as self-supporting, use steel studs and furring channels installed to provide a rigid frame to receive wall board.

3.6 CONSTRUCTION OF SUSPENDED AND FURRED CEILINGS

- .1 Apply gypsum panels of maximum practical length with long dimension at right angles to drywall furring channels. Position end joints over furring channel web and staggered in adjacent rows.
- .2 Fasten panels to drywall furring channels with screws spaced a maximum of 300mm o.c. in field of panels and along abutting ends and edges.
- .3 Provide framing and drywall finish in stairwells, where required to enclose underside of stairs and landings.
- .4 Where noted on plans, provide bulkheads with steel framing and drywall finish.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

1.	Rough Carpentry	Section 06 10 00
2.	Non-structural Metal Framing	Section 09 22 00
3.	Acoustic Ceilings	Section 09 51 00
4.	Painting and Coating	Section 09 90 00

1.2 REFERENCES

- .1 ASTM International:
 - 1. ASTM C1396 Standard Specification for Gypsum Board
 - 2. ASTM C840 Standard Specification for Application and Finishing of Gypsum board
 - 3. ASTM C1629 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fibre-Reinforced Cement Panels.
- .2 CAN/ULC-S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials
- .3 Gypsum Association:
 - .1 GA-214 Recommended Levels of Gypsum Board Finish
 - .2 GA-216 Application and Finishing of Gypsum Panel Products
- .4 The Gypsum Construction Handbook - CGC Inc.

1.3 DELIVERY AND STORAGE

- .1 Handle and store materials carefully to prevent damage. Materials must be delivered to site in their original, unopened packages.
- .2 Obtain approval of proposed locations for stockpiling material. Materials must be stored in an enclosed shelter providing protection from exposure to the elements. Provide any necessary temporary covers, skids and the like.
- .3 Store all panels flat.
- .4 Do not install damaged or deteriorated material but remove from Site.
- .5 Materials as delivered shall bear manufacturer's name, brand name of material and where applicable, ULC designation.

1.4 ENVIRONMENTAL CONDITIONS

- .1 Do not apply gypsum board or joint filler to surfaces that are damp or contain frost.

- .2 During gypsum panel application and joint finishing, temperatures within work areas shall be within the range 12 degrees C. to 25 degrees C.
- .3 Provide adequate ventilation to carry off excess moisture.

1.5 RELATIONS WITH OTHER TRADES

- .1 Co-ordinate with mechanical and electrical Trades to ensure that all services are installed prior to application of wall board.
- .2 Coordinate with mechanical and electrical trades for locations of access panels. Install access doors and panels supplied by those trades.
- .3 Co-ordinate with forces installing insulation and vapour barrier in exterior soffits.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 All materials to conform to ASTM C1396 unless specified otherwise. Except where noted otherwise, products listed herein are produced by Canadian Gypsum Company (CGC). Equivalent products from Georgia Pacific (GP) and Certainteed will be accepted, subject to acceptance of equivalency by the Consultant.
- .2 Gypsum panels:
 - .1 Typical panels to be 16mm thick abuse resistant and mould resistant, to ASTM C1629. Sheetrock Mold Tough Abuse Resistant Firecode Core gypsum panels or GP ToughRock Fireguard X Mold-Guard Abuse Resistant gypsum board.
 - .2 Panels in gypsum board ceilings at high ceilings may be 13mm thick mould resistant panels; CGC Sheetrock Mold Tough or GP ToughRock Mold-Guard.
- .3 Fire-Rated Gypsum panels at Ceilings:
 - .1 To ASTM C1629. Abuse resistant, mould resistant, Type X-Fire Rated
 - .2 CGC Sheetrock Mold Tough Abuse Resistant Firecode Core gypsum panels or GP ToughRock Fireguard X Mold-Guard Abuse-Resistant gypsum board.
 - .3 Minimum thickness to be 16mm.
- .4 Shaft Liner Panels:
 - .4 To ASTM-C442, fire resistant gypsum panel, square cut ends and edges, 600mm wide by practical length.
 - .5 to ULC tested assembly
 - .6 CGC shaftwall Liner Panels; 25mm
 - .7 CertainTeed Gypsum Canada Inc.: Pro ROC shaftliner 25mm thick.
 - .8 G-P Gypsum Corporation: GyProc Fireguard Shaft Liner Panels, 25mm thick.
- .5 Metal Studs and Channels: minimum 0.455mm (26 ga) galvanized steel as manufactured by Bailey Metal Products or approved alternate; to ASTM C645.

- .6 Metal Furring Channels: minimum 0.455 (26ga) sheet galvanized steel channel and accessories as manufactured by Bailey Metal Products, or approved alternate; to ASTM C645.
- .7 Cold Rolled Furring Channel: 20mm, x 12.7mm zinc coated channel weighing minimum 0.446 kg per m.
- .8 Cold Rolled Carrying Channel: 38mm x 15mm zinc coated channel weighing min 0.707 kg per m.
- .9 Cold Rolled Carrying Channel: 28 ga. galvanized steel with perforated flanges; one piece per location.
- .10 Control Joint: CGC No. 093.
- .11 Hanger wire: minimum 3.77mm (9ga) galvanized steel wire.
- .12 Tie Wire: minimum 1.5mm (16 ga) galvanized soft annealed steel.
- .13 Screws: CGC Brand Screws (or approved equal) of type recommended by the board manufacturer.
- .14 Thermal Break: Permanent adhesive faced rubberized cork, 3 mm thick by width of stud on channel to be used between masonry in exterior wall and metal furring channels.
- .15 Joint Treatment Material:
 - .1 Joint compound, topping compound, laminating compound; to ASTM C474 and C475.
 - .2 Use material recommended by board and tape manufacturer for the proposed use.
 - .3 CGC Sheetrock or Durabond Setting-Type, for use with CGC fibreglass drywall tape.
- .16 Reinforcing Tape:
 - .1 Paper or fibreglass mesh tape, as recommended by the panel manufacturer for the panel type.
- .17 Finish materials
 - .1 Over surface of glass mat faced boards, use level 5 finisher such as CGC Tuff Hide.
- .18 Acoustic sealant: Quietseal Pro as manufactured by Quietrock, or equivalent as manufactured by CGC, Tremco or Presstite Division of Interchemical Corporation for acoustic partitions.

- .19 Acoustic Insulation: AFB acoustic fire batt by Roxul or Thermafiber SAFB Sound Attenuation Fire Blankets (unfaced) from Owens Corning, to thickness shown on drawings, and as required to obtain required S.T.C. rating.
- .20 Ceiling Anchors: Self drilling tie wire anchors, Phillips "Red Head" T-32 or approved equal.
- .21 Drywall Reveals: Fry Reglet, reveal mouldings and "F" reveal mouldings, 13mm wide, with baked on finish, as follows:
 - .1 DRM-625-50 and DRM-50-50
 - .2 DRMF-625-50 and DRMF-50-50
 - .3 Aluminum alloy 6063 T5 with chemical conversion coating.
 - .4 Colour to be selected by the Consultant.
- .22 Access Panels: Refer to mechanical and electrical.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Provide plumb, straight, level, rigid, and secure installation. Failing to achieve this result shall be cause for rejection and reinstallation of this work.
- .2 Conform to The Gypsum Construction Handbook, ASTM C840, and these specifications. The most stringent requirements shall apply.
- .3 Where walls run parallel and under steel joists, the joists shall be enclosed both sides with gypsum board to provide sound barrier between rooms. Fill with minimum 100 mm acoustic batt insulation.
- .4 Install access panels supplied by mechanical and electrical contractors. Rigidly secure panel frames to furring or framing systems.

3.2 CEILING SUSPENSION

- .1 Do not regard grillage system indicated on drawings as exact or complete. The Specification for metal framing contained in CGC Gypsum Construction Handbook and ASTM C840 shall govern installation conditions not covered by this Specification. The more stringent specifications shall apply.
- .2 Hangers
 - .1 Install hangers for suspended wallboard ceilings to support the grillage independent of walls, columns, pipes, ducts and the like. Erect plumb and securely anchor to the structure. Submit details of proposed method to the Consultant for approval. If so requested, test hangers to prove that anchorage is adequate to support the proposed loading. Erect hangers plumb and securely

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- anchor to structural steel or support channels fastened to structural steel (DO NOT FASTEN TO STEEL DECK).
- .2 Space hangers at 1200mm maximum o.c. along the carrying channels and not more than 150mm from ends (or as required to conform with fire tested assemblies where applicable).
 - .3 Carrying Channels
 - .1 Space channels at 1200mm maximum o.c. (or as required to conform with fire tested assemblies where applicable).
 - .2 Run channels transversely to structural framing members.
 - .3 Where splices are necessary, lap members at least 200mm and wire each end with two laps; avoid clustering or lining up splices.
 - .4 Attach to hangers by bending hanger under runner and securely wire in place with a saddle tie.
 - .5 Provide 25mm clearance between channels and abutting walls and partitions.
 - .4 Cross Furring
 - .1 Install drywall screw channels transversely across runner channels, joists or other supports.
 - .2 Space drywall screw channels at 600mm o.c. and not more than 150mm from perimeter walls. Provide 25mm clearance between channels and abutting walls and partitions. Use closer spacing if so noted on drawings.
 - .3 Secure drywall screw channels to each support with approved clip or attachment; splice joints by messing minimum 200mm and tying channels together with double strand 16 gauge tie wire.
 - .4 Level drywall screw channels to a maximum tolerance of 4mm over 3600mm.
 - .5 Drywall shall not be fixed directly to open web steel joists and the like. Provide cross furring as specified.
 - .5 Opening
 - .1 Frame openings with suitable channels; check clearances with respective Trades. Provide support for edges of boards at all cut-outs and openings in ceilings.
 - .2 Provide all additional hangers and supports for fixtures as required.
 - .3 Provide additional hangers and framing for enclosure of radiant heating panels.
 - .6 Bulkheads

- .1 Furr out bulkheads in areas indicated and as required to conceal mechanical, electrical or other services in rooms where drywall finishes are scheduled, and elsewhere if called for on drawings.
- .2 Use methods and materials as previously specified in this section. Drywall panels at bulkheads shall be as specified for walls.

3.3 STEEL STUD SYSTEM (PARTITION) INSTALLATION

- .1 Conform to the guidelines for metal framing contained in The Gypsum Construction Handbook, CSA A.82.31, and these specifications. The most stringent requirements shall apply.
- .2 Attach metal runners at floor and ceiling to structural elements with suitable fasteners located 50mm from each end and spaced 600 mm. o.c. with toggle or molly bolts spaced 400mm o.c.
- .3 Position studs vertically, engaging floor and ceiling runners, and spaced 400mm o.c., unless otherwise noted on drawings. When necessary, splice studs with 200mm nested lap and one positive attachment per stud flange. Place studs in direct contact with door frame jambs, abutting partitions, partition corners and existing construction elements. Where studs are installed directly against exterior walls install rubberized cork stip between studs and wall surfaces to provide thermal break.
- .4 Anchor studs for shelf-walls and those adjacent to door and window frames, partition intersections and corners to ceiling and floor runner flanges with an approved crimping tool. Securely anchor studs to jamb and head anchor clips of door or borrowed-light frames by bolt or screw attachment. Over metal door and borrowed-light frames, place horizontally a cut-to-length section of runner, with a web-flange bent at each end, and secure with one positive attachment per flange. Position a cut-to-length stud (extending to ceiling runner) at vertical panel joints over door frame header.
- .5 Stiffen partitions exceeding 3m long or 2.7m high with 19mm. cold rolled channels. Fix horizontally and provide the number of rows necessary to ensure a rigid installation. Provide other partition reinforcing necessary to support wall hung components, cupboards, closets and the like. Use 2 studs at jambs of openings and corners.
- .6 Where horizontal runs of service lines are to be installed within the partition, erect studs with web openings aligned.
- .7 Provide reinforcing and necessary stiffeners to support hollow metal frames and screens. Reinforcing to be capable of supporting screens rigidly and solid without deflection.

3.4 CHASE WALL INSTALLATION

- .1 Align two parallel rows of floor and ceiling runners spaced apart as indicated. Attach to concrete slabs with concrete stub nails or power driven anchors 600 mm o.c. Attach to suspended ceilings with toggle or molly bolts 400mm o.c. Attach to wood framing with suitable fasteners 600mm o.c.

- .2 Align metal studs vertically in runners, 200mm o.c. with flanges in the same direction and with studs on opposite sides of chase directly across from each other. Anchor studs to floor and ceiling runner flanges with an approved metal crimping tool.
- .3 Cut cross bracing to be placed between rows of studs from gypsum panels, 400mm high by chase wall width. Space braces at quarter points not to exceed 600mm o.c. vertically and attach to stud webs with six 25mm screws 200mm o.c. maximum on each side.
- .4 Bracing with 64mm metal studs may be used in place of gypsum panels. Anchor web at each end of metal brace to stud web with two 10mm pan head screws. When chase wall studs are not opposite, install metal stud cross braces 400mm o.c. horizontally and securely anchor each end to a continuous horizontal 64mm runner screw-attached to chase wall studs with the cavity.
- .5 Adapt cross bracing as necessary to avoid interference with service.

3.5 WALL FURRING INSTALLATION

- .1 Direct Furring Channel Attachment - Attach metal furring channels, vertically or horizontally spaced 400mm o.c. to masonry or concrete surfaces with hammer-set or power-driven fasteners or concrete stub nails staggered 600mm o.c. on opposite flanges. Nest channels 200mm at splices and anchor with two fasteners in each wing. Where furring channel is installed directly to exterior wall, install thermal break strip between furring channel and wall. For horizontally placed channels attach maximum 100mm from floor and ceiling.
- .2 Bracketed Furring Channel Attachment
 - .1 Attach adjustable wall furring brackets with serrated edges up, 900mm o.c. horizontally, 1200mm o.c. vertically, within 100mm of columns or other abutting construction, within 150mm of floor and ceiling, and as required above and below openings. Use 50mm cut nails in mortar joints of brick or clay tile or concrete block, or in field of lightweight aggregate blocks; use 16mm concrete stub nails or power driven nails or other suitable fasteners in monolithic concrete. Place fastener in top hole of bracket.
 - .2 Lay cold-rolled channels horizontally with flanges down, on furring brackets, plumb with other channels, and tie with double strand 16 ga. or triple strand 18 ga. wire at each junction with cold rolled channel.
- .3 Free Standing Furring - In locations where wall furring is indicated as self-supporting, use steel studs and furring channels installed to provide a rigid frame to receive wall board.

3.6 APPLICATION OF GYPSUM BOARD

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.

09 29 00 – GYPSUM BOARD

- .2 Apply all gypsum board parallel to framing. Position all ends over studs. Use maximum practical lengths to minimize end joints. Fit ends and edges closely, but not forced together.
- .3 Stagger joints on opposite sides of partition.
- .4 Apply single, double or triple layers of gypsum board to metal furring as indicated using screw fasteners.
- .5 Maximum screw spacing for single-ply gypsum board and face ply of 2-ply gypsum board to be 300mm o.c.
- .6 Maximum spacing of screws for base-ply of 2-ply gypsum board over steel framing to be 300mm o.c. along edges of the gypsum board and 600mm o.c. into stud or furring channel in the field of the gypsum board.
- .7 Use cement board as backer board wherever tile is to be installed to walls of shower partitions.

3.7 ADHESIVE APPLICATION

- .1 Where gypsum board is called to be laminated to masonry walls, application shall conform to Gypsum Association Publication GA-216-2013, Section 11, "Adhesive Application of Gypsum Panel Products to Interior Masonry, Concrete, or Brick Walls".
- .2 Do taping and filling, as specified below, for paint finish.

3.8 CONSTRUCTION OF FIRE RATED CEILING ASSEMBLIES

- .1 Where fire rated construction is required, the thickness and number of layers of board shall be governed by rating required and material used in approved assemblies.
- .2 Provide 1 hour rated beam enclosures, where required, to ULC design.

3.9 CONSTRUCTION OF SUSPENDED AND FURRED CEILINGS

- .1 Apply gypsum panels of maximum practical length with long dimension at right angles to drywall furring channels. Position end joints over furring channel web and staggered in adjacent rows.
- .2 Closely fit together, ends and edges but not forced together.
- .3 Fasten panels to drywall furring channels with screws spaced a maximum of 300mm o.c. in field of panels and along abutting ends and edges.
- .4 Provide control joints in ceilings as noted but maximum 7500 mm o.c. each way or at change in direction.
- .5 Provide framing and drywall finish in stairwells, where required to enclose underside of stairs and landings.

- .6 Where noted on plans, provide bulkheads with steel framing and drywall finish.

3.10 WALL FURRING

- .1 Apply gypsum panels parallel to framing. Position all edges over drywall furring channels with joints staggered in successive courses.
- .2 Use maximum practical lengths to minimize end joints. Fit ends and edges closely, but not forced together.
- .3 Fasten panels to channels with screws spaced a maximum 300mm oc.

3.11 APPLICATION OF ACCESSORIES

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Joints shall be made tight, accurately aligned and rigidly secured.
- .2 Reinforce all vertical and horizontal exterior corners with cornerbead fastened with screws 200mm oc on both flanges along entire length of bead.
- .3 Where assembly terminates against masonry or other dissimilar material, apply ledge trim over panel edge and fasten with screws or staples spaced 300 mm. oc.
- .4 Power drive screws at least 9mm. from edges or ends of panel to provide uniform dimple 0.8mm deep.
- .5 Where recessed reglets are noted on drawings, built into drywall assembly to provide edges flush with drywall.

3.12 TAPING AND FILLING

- .1 Finish in accordance with GA-214, as follows:
 - .1 Exposed gypsum board to Level 5 finish, suitable for finish painting with semi-glass and gloss coatings. Use full skim coat of joint compound over entire surface to achieve smooth and uniform appearance.
 - .2 Concealed gypsum board to minimum Level 1 finish. Where a fire-resistance rating is required, finishing level must conform to ULC rated assembly design.
- .2 Finish face panel joints and internal angles with joint system consisting of self-adhering cross-fibre fibreglass joint tape and joint compound installed according to manufacturer's directions and feathered out into panel faces. Note: If self-adhering joint tape is not used, taping compound will be required.
- .3 Be sure drywall surface is dry and clean.
- .4 Center and apply CGC Fiberglass Drywall Tape directly over joint, pressing firmly to ensure even adherence to surface. Eliminate wrinkles by pressing entire length of tape with drywall knife. Avoid overlapping tape at intersections. Cut tape with drywall knife.

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- .5 Cover taped joint with a layer of setting-type joint compound, forcing compound through the tape with a drywall knife or trowel to completely fill and level the joint. Allow joint to dry, and sand lightly. Apply second coat of setting-type or drying-type joint compound, feathering approximately 50mm beyond first coat. Let dry and sand lightly as required.
 - .6 To finish inside corners, bend tape with to form a “U” shape. Apply tape along one side only. Press tape into corner for approximately 30mm, then apply the other side. Work downward, alternating sides in this manner until tape is pressed firmly in place. Apply setting-type joint compound as specified above, first on one side for the length of the corner and then repeating the process on the second side.
 - .7 Finish fastener heads, corner bead and trim as required with two to three coats of joint compound, feathered out onto panel faces and sanded to a smooth surface.
 - .8 Provide skim coat over entire face of boards to ensure smooth surface for painting.
 - .9 Fill screw head depressions to bring flush with adjacent surface of gypsum board so as to be invisible after painting is completed.
 - .10 Sand dried taping compound lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
 - .11 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.
 - .12 Painting shall be done in accordance with Section 09 90 00

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Gypsum Board	Section 09 29 00
.2	Mechanical Equipment	Division 20, 22
.3	Electrical Equipment	Division 26, 27, 28

1.2 CEILING SYSTEMS

- .1 This Specification includes the ceiling assembly systems listed below, noted in schedules and shown on reflected ceiling plans, including ceiling panels, suspension system and trim.
- .2 Ceiling systems shall be 610mm x 1220mm lay in exposed Tee system, non- rated.

1.3 REFERENCE STANDARDS

.1	ASTM C635	Specifications for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
.2	ASTM C636	Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
.3	CAN/CGSB 92.1	Sound Absorptive Prefabricated Acoustical Units

1.4 DESIGN

.1	N.R.C. Range:	Unless otherwise noted under description of ceiling system the N.R.C. Range shall be 60-65 (Table 1 of CAN/CGSB 92.1).
.2	Ceiling S.T.C.:	Unless otherwise noted under description of ceiling system the S.T.C. rating shall be 35 or better.
.3	Light Reflectance:	Unless otherwise noted under description of ceiling system, panels shall have a light reflectance co-efficient designation of L.R.1 (0.75 minimum). Table 3 of CAN/CGSB 92.1 refers.

1.5 SHOP DRAWINGS

- .1 Reflected ceiling plans indicate proposed layout but this shall not relieve Contractor of responsibility for co-ordination of the work and provision of Shop Drawings where field conditions call for variation from proposed layout.
- .2 Submit shop drawings accurately locate lighting fixtures, ventilating grilles, sprinkler heads, exit lights and other ceiling fittings.
- .3 Conform to Section 01 33 23 – Shop Drawings, Product Data and Samples.

3.6 SAMPLES

- .1 Upon award of the Contract submit duplicate 300mm by 300mm sample panels of each acoustical unit proposed for installation in the project. All panels subsequently used on the job shall match the approved sample.
- .2 Submit one representative model sample of each suspension system members for approval prior to commencement of installation.
- .3 Ceiling system sample shall show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes and acoustical unit installation.

3.7 DELIVERY AND STORAGE

- .1 Transport, handle and store material in manner to prevent warp, twist and damage to tile and board edges and surfaces in accordance with the manufacturer's recommendations.
- .2 Any warped and/or damaged boards, tile and trim shall be rejected and be replaced by new, straight, undamaged and acceptable materials at no cost to the Owner.
- .3 Store material in warm, dry place away from water and the elements. Protect against undue loading stresses and shock.
- .4 All packaged material shall be delivered in original manufacturers' wrappers and containers with labels and seals intact.

3.8 PROTECTION

- .1 Exercise care in the execution of work under this Section to prevent damage to finished surfaces and adjacent work, and mechanical and electrical installations.

3.9 EXTRA PANELS

- .1 Provide 2 full boxes of acoustic panels of each type specified for use in maintenance work. Obtain receipt from the Consultant or Owner's representative on site.
- .2 Do not use panels supplied to Owner for maintenance work to make good any damaged or removed tile required by Contract.
- .3 Clearly label all boxes and delivery and store the boxes as directed by the Owner.

3.10 SPECIAL CLEANING

- .1 Clean, repair or replace dirty, discoloured or defective units or exposed suspension members to Consultant's satisfaction.

3.11 ENVIRONMENT AND REGULATORY REQUIREMENTS

- .1 Commence installation after building enclosed and dust- generating activities completed.
- .2 Permit wet work to dry prior to commencement of installation.
- .3 Maintain uniform minimum temperature of 15 deg. C. and humidity of 20% to 40% prior to, during and after installation.
- .4 Comply with Ontario Hydro Electrical Inspection Bulletin No. 30-4-3 regarding support of luminaires in suspended ceilings. Submit to the Consultant a certificate confirming that the ceiling support grid provides support for lighting fixtures in accordance with Ontario Hydro requirements.
- .5 Deliver finish materials in unopened packaging provided by manufacturer.
- .6 Store materials in work area 48 hours prior to installation, in protected dry areas.

6.1 QUALITY ASSURANCE

- .1 Installer is to be experienced in performing work of this section and who has specialized in installation of work similar to that required for this project.
- .2 Installer is to have a minimum of five (5) years of experience in performing the work described.

6.2 WARRANTY

- .1 The Warranty stipulated in the General Conditions of the Contract shall be deemed to include the following definition in reference to Work specified in this Section. The following will be considered defects without being limited thereto:
 - .1 Failure of the suspended ceiling to remain water level.
 - .2 Lifting or sagging of tile and board between supports.
 - .3 Staining and discolouration of factory finishes.
 - .4 Development of corrosion of galvanized ferrous metal.
 - .5 Development of cracks, splits and other surface deterioration in acoustic panels.
 - .6 Failure of hanging wire anchorage.
- .2 The warranty period shall be two (2) years, commencing on the date of Substantial Performance of the Work.
- .3 Warranties shall be issued to the Owner within two (2) Working Days following the date of Substantial Performance of the Work.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Acoustic Ceiling Panels (ACT and ACT-N):
 - .1 Typical non-fire rated ceilings, to CAN/CGSB-92.1
 - .2 Type: Mineral composition acoustical units, sag resistant.
 - .3 Pattern: Non-directional fissured.
 - .4 Edge type: Square Lay-in.
 - .5 Colour: White.
 - .6 Thickness: 16mm minimum.
 - .7 Size: 610mm x 1220mm. Refer to architectural reflected ceiling plans for location and layout.
 - .8 Shape: Flat
 - .9 Flame spread rating of 25 or less.
 - .10 Smoke developed class of 50 or less.
 - .11 Acceptable Products:
 - .1 Armstrong World Industries Canada Ltd., Cortega No.823.
 - .2 Equivalents by CGC Interiors and CertainTeed Ceilings may be submitted for review but may not be considered or accepted.
- .2 Suspension:
 - .1 Acceptable Products, contingent on compatibility with specified ceiling tiles:
 - .1 Armstrong World Industries Canada Ltd.: Prelude ML Exposed Tee System.
 - .2 Equivalents as noted above under paragraph 1.11 by:
 - .1 CGC, Suspension system Donn "DX" 24mm wide faced T-bar.
 - .2 CertainTeed Ceilings: Classic Aluminum Capped Hook System.
 - .3 Chicago Metallic Corporation: Series 1200 Suspension System.
 - .2 Exposed interlocking tee grid system, formed out of cold rolled zinc-bond steel 0.54mm thick. Provide fire rated grid where fire ratings noted.
 - .3 Main Tees: 38mm x 25.4mm double web rectangular bulb top with capping plate in precoat baked-on white paint finish and incorporating holes for hangers and slots for connecting pieces, and capable of supporting 12.5 kg per 1200mm. for continuous spans and 6.5 kg per 1200mm span for single span without exceeding a deflection of 1/360 of the span.
 - .4 Standard Cross-Tees: 25.4 x 25.4mm double web, bulb top, capping plate in precoat white baked-on finish, capable of supporting 11.3 kg per 600mm span without exceeding a deflection of 1/360 of span, and with positive interlock with main tees.
 - .5 Structural Cross-Tees as main tees, but with crimped ends for lapping bottom flange of main tees and interlocking tack ends to engage slots in main tees.
 - .6 Accessories:
 - .1 Splice plate, clips, screws, etc. as required to complete the installation. All galvanized finish.
 - .7 Concealed flat spline: 0.71mm flat steel spline.
 - .8 Edge Trim:
 - .1 0.635mm zinc bonded, cold rolled steel mould.
 - .2 Trim shall be minimum 22mm x 22mm angles.
 - .3 Provide 50mm wide shadowline trim at perimeter of corridor ceilings.

- .9 Finish to tees and edge trim: flame resistant white baked enamel satin finish to match panel finish, 2 coats on exposed surfaces, 1 coat elsewhere.
- .10 Carrying Channels: 38mm x 19mm cold rolled galv. weighing 1.042 kg per metre.
- .11 Tie Wire: 1.6mm galvanized soft annealed steel
- .12 Hangers: 2.6mm galvanized steel wire.
- .13 Screws: Corrosion resistant, self-tapping Philips truss head, of length and gauge to suit installation.
- .14 Ceiling Hanger Pins (for fixing to metal): capacitor discharge ceiling hanger pins, by Continental Studwelding Ltd., or approved equivalent, of type approved by Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Employ mechanics skilled in this Trade and install work in strict accordance with the system manufacturer's printed directions to produce a first class, true finish, free from dropping, warpage, soiled or damaged tile.
- .2 Make provisions for thermal movement.
- .3 Install hanger inserts in a manner approved by Consultant.
- .4 Locate hangers directly over Main Tees and as close to intersections as possible. Secure hangers firmly to concrete inserts, steel joists and beams, bracing, etc. Do not install hangers to metal deck, provide separate grid off joists if required.
- .5 Erect ceiling grid plumb and square with accurately fitted locked-in joints in true alignment, secure and rigid and with provision for thermal movement. Water level ceiling to tolerance of 1mm in 1m and maximum deviation of 4mm. from mean level.
- .6 Frame around recesses fixtures, diffusers, grilles, and the like and provide heavier section hangers and supports as necessary to support same. Provide hanger within 150mm. of each fixture corner.
- .7 Consult with Electrical and Mechanical Trades for requirements and provide access to valves and switches.
- .8 Ensure that all hangers and carrying members are designed and spaced to support entire ceiling system including recessed lighting fixtures. Note, weight of fixtures is approximately 9-13.5 kg.
- .9 Install panels only after all mechanical and electrical equipment, conduits, piping, telephone distribution, etc. are in place.
- .10 Co-ordinate ceiling work to accommodate components of other sections, to be built into acoustical ceiling components, such as light fixtures, diffusers, speakers and sprinkler heads.
- .11 Neatly cut acoustical units to fit tightly around all building elements that penetrate ceiling.

3.2 INSTALLATION OF LAY-IN SUSPENSION SYSTEM

- .1 Install suspension system in accordance with ASTM-C636 except where specified otherwise. Install suspension system to manufacturer's instructions and certification organization's tested design requirements where referenced.
- .2 Generally hangers shall be spaced at not more than 1200mm o.c. directly above main runner tees, except at fixtures, where they shall be 600mm o.c. or closer as required to adequately support fixtures. Locate hangers as close as possible to tee junctions. Locate first hanger within 300mm of perimeter wall.
- .3 Install main tee runners continuous at 1200mm o.c. with interlocking structural cross-tees each side of fixtures at right angles to main tees. Install standard cross-tees generally at 90 degrees to main tees and as required to achieve pattern shown on reflected ceiling plans. Secure joints by web of tees; snaplock into place forming rigid connections. Main tees shall be as long as possible with butt ends joined by means of splice plates locked into webs.
- .4 Frame up around light fixtures, grilles, diffusers, speakers, openings, etc. as required.
- .5 Secure edge moldings to walls, bulkheads and other vertical surfaces at perimeter edges of acoustic ceilings. Note special moldings required.
- .6 Securely fix hangers to tees by bending ends 90 degrees at the correct height and inserting through holes in top of main tees, then wiring around open side at least 3 turns twisting ends together. Flats shall be bolted to tees. Secure to concrete inserts in similar manner.
- .7 Do not erect ceiling suspension system until work above ceiling has been inspected by the Building Inspector.
- .8 Do not secure hangers to fluted steel floor or roof deck. Secure hangers to overhead structure using attachment methods as required for particular structure and acceptable to the Consultant. Where structural spacing exceeds ceiling hanger spacing, provide double carrying channels nested and placed perpendicular to and on top of bottom flange of steel beams or on top of the lower chords of the open web steel joists, and secured to each joist with three loops of 1.2mm galvanized soft steel wire.
- .9 Where obstructions interfere with the placement of ceiling hangers, provide double carrying channels nested and hung from the structure above on both sides of the obstruction.
- .10 Provide isolation hangers at all hangers where indicated as required for specific ceiling assemblies.
- .11 Install hangers on main tees spaced at maximum 1200mm centres and within 150mm from ends of main tees and tee splices.
- .12 Lay out with border units not less than 50% of standard unit width and according to reflected ceiling plans.

- .13 Ensure suspension system is coordinated with location of related components.
- .14 Install typical wall moulding to provide correct ceiling height.
- .15 Completed suspension system shall support super-imposed loads, such as lighting fixtures, diffusers, grilles, speakers and other ceiling mounted fixtures.
- .16 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150mm of each corner and at maximum 600mm around perimeter of fixture. Install an additional hanger immediately above each fastener for ceiling mounted curtain tracks.
- .17 Interlock cross member to main runner to provide rigid assembly. Ensure all main tee splices and cross tee end clips are fully engaged.
- .18 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .19 Finished ceiling system shall be square with adjoining walls and level within 6mm in 3000mm.

3.3 LAY-IN PANEL INSTALLATION

- .1 End panels shall not be less than half full size and installation in each area shall be symmetrical, with end tiles and abutting opposite vertical wall surface to be of the same width. Do all necessary cutting and fitting neatly and accurately to suit grid openings and accommodate fixtures, grilles, detectors, speakers and the like located on the ceiling panels.
- .2 Lay directionally patterned acoustic panels in one direction, parallel to the longest direction of the grid concerned.
- .3 Place panels between tees so that edges bear evenly on flanges.
- .4 Confirm with reflected ceiling plans.
- .5 Provide fire rated enclosures as required around light fixtures and mechanical equipment in fire rated ceilings, according to applicable ULC Design Criteria.
- .6 Where mechanical equipment is located above the ceiling, panels shall be suitably and inconspicuously marked by the use of small colour-coded stickers. Mechanical equipment to be located shall include valves, dampers, heat exchangers, heat pumps, VAV boxes, electrical disconnects, as applicable, and other such equipment not visible from below.

3.4 CLEANING

- .1 Upon completion, clean acoustic tile of all finger marks and other defacements.

09 51 00 – ACOUSTIC CEILINGS

- .2 Remove all accumulated rubbish and excess materials from the site.
- .3 Clean acoustic tile and replace any damaged tiles immediately before occupation of building by Owner.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Concrete Floor Finishing Section 03 35 00

1.2 SCOPE OF WORK

- .1 Resilient Sheet Flooring and Rubber Base.
- .2 Flooring Preparation and Flooring Accessories.

1.3 REFERENCE STANDARDS

- .1 ASTM Standards:
 - .1 F 141 Resilient Floor Coverings
 - .2 F 386 Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces
 - .3 F 511 Quality of Cut (Joint Tightness) of Resilient Floor Tile
 - .4 F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient
 - .5 F 1344 Flooring Specification for Rubber Floor Tile
 - .6 F 1861 Specification for Resilient Wall Base
 - .7 F 2055 Size and Squareness of Resilient Floor Tile by Dial Gage Method
 - .8 E 662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - .9 E 1907 Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
 - .10 F 970 Standard Test Method for Static Load Limit
 - .11 F2034 Standard Specification for Linoleum Sheet Floor Covering
- .12 CAN/ULC-S102.2 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies
- .13 RFCI:
 - .1 IP #1 Recommended Installation Practice for Homogeneous Sheet Flooring.
 - .2 Recommended Work Practices for Removal of Resilient Floor Coverings

1.4 SUBMITTALS AND SAMPLES

- .1 Submit samples as per Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Submit colour samples of flooring accessories for selection by the Consultant.
- .4 Submit 300mm x 300mm samples of resilient sheet flooring.

- .5 Submit samples of rubber floor base.
- .6 Submit product technical data sheets indicating material performance criteria, physical characteristics and requirements.
- .7 Submit manufacturer's written installation recommendations and requirements.
- .8 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

- .1 Provide extra materials of resilient tile flooring and base.
- .2 Provide one unopened box of flooring installed of each colour, pattern and type of flooring material required for this Project for maintenance use.
- .3 Provide one 3600mm length of each type and colour of resilient base required for this Project for maintenance use.
- .4 Extra materials shall be from same production run as installed materials.
- .5 Store where directed by the Owner.
- .6 Material to be in wrapped packages or fully labelled as to product and colour.

1.6 WARRANTY

- .1 Submit manufacturer's warranty warranting material and performance for a minimum period of five (5) years for all resilient products, following the date of Substantial Performance of the Work.
- .2 Installation Warranty: Submit the flooring contractor's installation warranty agreeing to repair or replace work which has failed as a result of defects in workmanship. Failure shall include, but not limited to, tearing, cracking, separation, deterioration or loosening from substrate, seam failure, ripples, bubbling or puckering.
- .3 Installation Warranty Period: Two (2) year limited warranty commencing on Date of Substantial Completion from flooring contractor.
- .4 Warranties shall be issued to the Owner within two (2) Working Days following the date of Substantial Performance of the Work.

4.7 QUALITY ASSURANCE

- .1 Installer is to be experienced in performing work of this section and who has specialized in installation of work similar to that required for this project.
- .2 Installer is to have a minimum of five (5) years of experience in performing the work described.

PART 2 – PRODUCTS

4.1 MATERIALS

- .1 Primers and Adhesives:
 - .1 Solvent-free white acrylic.
 - .2 Supply and install as recommended by manufacturers of resilient sheet flooring, vinyl composite flooring, and base.
 - .3 Rubber base adhesive: Mapei Ultrabond ECO 575 or equivalent.
 - .4 Adhesive must produce good and permanent waterproof bond between wall surfaces and cove base.
- .2 Transition strips at dissimilar materials:
 - .1 At transition between resilient flooring and porcelain tile: Schluter, Schiene Transition Strip in aluminum or brass alloy with lip of edge strip extending under and with shoulder finishing flush with top of resilient floor.
 - .2 At transition between resilient flooring and tile or terrazzo flooring: Tarkett, Johnsonite Rubber Reducer Transition Strip to floor type SSR-B. Colour to be confirmed at a later date by the Consultant.
- .3 Resilient Sheet Flooring (LIN or LIN-N):
 - .1 Sheet Linoleum Flooring to ASTM F2034.
 - .2 Slip Resistance: Tested in accordance with ASTM D2047; meeting or exceeding A.D.A recommendations of 0.6.
 - .3 Construction: Homogeneous sheet floor covering.
 - .4 Minimum Thickness and Wear Layer: 2.0mm.
 - .5 Net Fit Seams and Welding Rods: Provide for net fit seams and welding rods to match in colour to linoleum sheeting flooring.
 - .6 Acceptable Manufacturers and Products:
 - .1 Armstrong, Meditone and Medintech with Diamond 10 Technology.
 - .2 Tarkett, iQ Optima Homogeneous Sheet Flooring
 - .3 Consultant to pick any standard or premium colours from any of the acceptable products described above. A minimum of five (5) colours may be selected.
- .5 Resilient Base (RB or RB 100): to CAN/CSA-A126.5, Type 1, rubber.
 - .1 Manufacturer: Tarkett, Rubber Baseworks with toe/cove base.
 - .2 Minimum 1200mm length and 100mm high by 3mm thick, with grooved back.
 - .3 Colour: To be confirmed by the Consultant from the standard range.
- .6 Sub-floor Filler and Leveler: as recommended by flooring manufacturer for use with their Product.

- .7 Sealer: type recommended by flooring manufacturer, meeting the requirements of CAN/CGSB-25.20.
- .8 Floor Protection: heavy kraft paper laminated with non-staining adhesive to both sides of glass fibre reinforcing ply.

PART 3 - EXECUTION

3.1 INSPECTION AND TESTING

- .1 Check floor surfaces for evidence of carbonation, dusting, excessive moisture or other defects affecting bond of adhesive. Ascertain nature of curing and/or sealing compound used on concrete and its compatibility with flooring adhesive. Take all required remedial measures. Remove compounds if necessary to ensure that adhesive bonds to concrete.
- .2 Test concrete slab, using anhydrous calcium chloride test, in conformance with ASTM F1869. Do not proceed until moisture vapour emission rate is equal or less than 2.44kg/100m²/24hours (3lbs/1000sq.ft./24hours).
- .3 Confirm ph level of concrete is acceptable to manufacturers of adhesive and tile. Generally, ph level is to be 9 or less.
- .4 Perform bond testing to confirm compatibility between concrete slab and adhesives.
- .5 Provide test results to manufacturers of products proposed for use and obtain approval of conditions before commencing installation. If the test results exceed the limitations specified to not proceed until the problem is corrected and satisfactory test results are obtained.

3.2 INSTALLATION – GENERAL

- .1 Do not start installation of resilient flooring until all other trades have completed their work and just prior to completion of building.
- .2 Obtain approval from manufacturers for all adhesives, caulking, patching and levelling agents, and installation methods, before proceeding with the work of this section.
- .3 Ensure flooring materials are clean of any contaminants which would interfere with proper bonding.

3.3 PREPARATION

- .1 On concrete floors, level depressions and cracks with non-shrinking latex joint filler. Patching and levelling products must be compatible with adhesives; obtain approval from manufacturer of adhesive. Do not use products containing gypsum.
- .2 Report large cracks to Consultant. Do not proceed until remedied. Prime surface with approved primer.

- .3 Thoroughly clean concrete floors of any substances deleterious to bond of adhesive.
- .4 Close off areas where work is in progress to prevent deposit of dust or grit on slabs where flooring is being laid.
- .5 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .6 Clean floor thoroughly of any dirt, oil, grease and other material which may affect adhesive bonding and cause telegraphing. Apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler has cured and is dry.
- .7 Prime concrete to flooring manufacturer's printed instructions.

3.4 INSTALLATION - RESILIENT FLOORING

- .1 Material Installation:
 - .1 Measure the area to be installed and determine the direction in which the material will be installed and seam placement.
 - .2 Seams should be a minimum of 6" away from underlayment and concrete joints, saw cuts, etc. Cut the required length for the first sheet off of the roll, adding approximately 3" - 6" for extra trimming. Fit the first sheet along the main (long) wall and at the ends using standard fitting methods. Position the fitted sheet in place against the main wall. The factory edge must be trimmed in order to produce a clean edge suitable for seaming. Utilize a straight edge, utility knife and hooked blade knife may also be used. Position the straight edge approximately 1/2" - 3/4" from the factory edge and score the material using the utility knife along the straight edge.
 - .3 After scoring, complete the cut using a hooked blade knife following the score line. Hold the blade at a slight angle to the surface of the material so the seam edge will have a slight undercut. After trimming the seam edge, draw a pencil line on the substrate lengthwise along the trimmed edge. This line will serve as a spread line when applying the adhesive.
 - .4 Do not reverse the sheets. Install all sheets in the same direction.
 - .5 Immediately roll the flooring in all directions using a 100 lb. roller to ensure proper adhesive transfer. Additional rolling is required during adhesive setup to ensure that the material is flat and fully adhered. The use of a three-section wall roller or steel seam roller is required at walls, under toe kicks or anywhere the full weight of a 100 lb. roller cannot access or be applied.
 - .6 Adhesive Application: Follow manufacturer's instructions, using the manufacturer's recommended products.
 - .7 Seaming: Allsheet products shall be installed utilizing net fit seams. A properly executed net fit seam will have no gaps or fullness. If the material is cut too full, it will result in bubbled or peaked seams. Gaps will allow dirt or contaminants to accumulate. Cut the material at an angle so as to slightly undercut the material. This will compensate for any slight expansion that may occur. Roll the seam with a steel seam roller, making sure that the flooring material is placed into wet adhesive.
- .2 Installation Techniques:

09 65 00 – RESILIENT FLOORING

- .1 Where millwork and partitions and other items are indicated for installation on top of finished flooring, install flooring before these items are installed.
 - .2 Scribe, cut, fit flooring to butt tightly to vertical surfaces, permanent fixtures, including pipes, outlets, edgings, thresholds and nosings.
 - .3 Extend flooring into toe spaces, door reveals, closets, and similar openings.
 - .4 Install flooring on covers for telephone and electrical ducts, and similar items occurring within finish floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers.
 - .5 Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specification sections for expansion joint covers.
 - .6 Adhere resilient flooring to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed installation.
 - .7 Use adhesive applied to the substrate in compliance with the flooring manufacturer's recommendations, including those for proper spreading of the adhesive, adhesive missing and adhesive open and working times.
 - .8 Immediately roll the flooring in all directions using a 100 lb. roller to ensure proper adhesive transfer. Additional rolling is required during adhesive setup to ensure that the material is flat and fully adhered. The use of a three-section wall roller or steel seam roller is required at walls, under toe kicks or anywhere the full weight of a 100 lb. roller cannot access or be applied.
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- .3 Avoid all traffic for at least 12 hours and limit to light traffic for a period of 72 hours after the installation. Avoid cold or excessive heat, including direct sunlight during this 72 hour period.
 - .4 Protection: Protect installed product and finish surfaces from damage during construction. Remove and legally dispose of protective covering at time of Substantial Completion.
 - .5 72 hours after installation is completed, implement initial maintenance procedures, as per manufacturer's printed maintenance instructions.

3.5 APPLICATION - RUBBER BASE AND TRANSITION STRIPS

- .1 Fill cracks and level irregularities of surfaces to which base is to be applied with filler approved by adhesive manufacturer so as to provide solid backing over entire area behind base.
- .2 Cement cove base to vertical surfaces so that gaps do not occur behind base, so that front lip of base cove bears firmly and uniformly on floor surface, and so that good and permanent bond is produced between base and surface to which it is applied.
- .3 For right angled external corners use preformed matching cove corner units. Make end joints flush with gap.
- .4 At wall ends and openings where ends of preformed corners come close together or touch or overlap, cut each corner unit equally so that a neat, inconspicuous joint is formed in middle of wall end or opening or so that filled gap, if gap is necessary, is not less than 38mm wide and located in middle of wall or end of opening.

- .5 Resilient Transition Strips:
 - .1 Install specified resilient transition strips at junction with dissimilar floor materials and coordinate installation with trades installing these materials.
 - .2 Install resilient transition strips fully bonded to floors using manufacturer recommended adhesive.
 - .3 Where resilient flooring meets carpet flooring coordinate installation of transition strips with carpet installation.
 - .4 Install strips under doors at openings.

3.6 CLEANING AND PROTECTION

- .1 Remove surplus adhesive from face of material as work progresses.
- .2 Upon completion of work remove all markings and heel scuffs. Broom clean.
- .3 Prior to occupation by Owner, broom clean all resilient floors and remove all noticeable stains and marks. Remove all surface soil, debris, sand and grit by dust mopping, sweeping or vacuuming the floor.
- .4 All wet mopping will be done by the custodian staff.
- .5 Protect new floors from time of final set of adhesive until Project completion.
- .6 Prohibit traffic on floor for 72 hours after installation.
- .7 Protect floors by lapping joints of protection material a minimum of 150mm, sealing with non-asphaltic tape.
- .8 Remove excess adhesive from floor, base and wall surfaces without damage, as work progresses.
- .9 Clean and seal resilient base surface to flooring manufacturer's instructions immediately after installation.
- .10 Apply sealers and waxing as directed by the manufacturer.
- .11 Final cleaning is specified in Section 01 74 10 – Cleaning and Waste Management.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Concrete Unit Masonry	Section 04 22 00
.4	Rough Carpentry	Section 06 10 00
.5	Hollow Metal Doors and Frames	Section 08 11 13
.6	Gypsum Board System	Section 09 29 00
.7	Shop Priming Specified in various Sections of the Specification.	
.8	Factory applied paint coatings unless otherwise specified.	
.9	Mechanical	Division 20, 22
.10	Electrical	Division 26, 27, 28

1.2 SCOPE OF WORK

- .1 With exceptions specified above or specifically called for in other Sections of the Specification, all paintwork is included in the scope of this Section of the Specification. Colours will be specified at a later date by the Consultant.
- .2 In locations where Drawings do not call for paint or similar finish on walls and/or ceilings, the intent of this Specification is that items, new work and existing surfaces in areas affected by the Work of this project, including miscellaneous metal work, shall be painted.
- .3 Work includes moisture testing and surface preparation of substrates as required for acceptance of paint, including cleaning, small crack repair, patching, caulking, and making good surfaces, and specific pre-treatments, sealing, and priming of surfaces.
- .4 Check conditions of all existing surfaces to be repainted before commencing new work, including assessing the level of degradation of the surface, the type of coating existing, and the thickness of the existing coating. Perform adhesion tests on all existing coatings to be repainted to ensure that surfaces are sound and well adhered before applying new coatings. It is expected that the Contractor will have visually assessed the existing conditions during the pre-tender site visit, and no contract extras will be considered for addressing conditions which were readily apparent at that time.
- .5 Paint all new exterior surfaces which normally require painting, including hollow metal panels and associated existing frames and galvanized steel lintels, and gas lines.
- .6 Perform interior painting noted on drawings. Paint all new walls, ceilings, bulkheads, and all surfaces which normally receive a paint finish, whether noted on schedules, or not noted. Walls shall be completely painted around existing installed tackboards, whiteboards/markerboards and prior to installation of new millwork, etc.
- .7 All heating units, recessed convectors, grilles, pipes, access panels, hangers and miscellaneous exposed metal work (other than stainless steel, anodized aluminum and baked enamel) to be painted to match the surfaces on which they occur, unless otherwise directed by Consultant.

- .8 For special painted graphics, colour changes, accent stripes, etc. see drawings.
- .9 In all renovated areas, paint affected walls as specified for new construction. All other walls in the room are to be cleaned and painted with one coat. If more than one colour is used in the room, confirm colours with Consultant.
- .10 Paint exposed drywall and the like in locations where finish is not otherwise specified or noted. Do not paint such surfaces in mechanical shafts, unless specifically noted.
- .11 Paint all exposed structural steel and steel roof deck and mechanical ducts in finished areas.
- .12 Paint exposed structure and metal deck in all mechanical and storage rooms, except Water Meter and Electrical Rooms.
- .13 Paint pipes, conduit, ducts and related thermal insulation and all prime painted mechanical and electrical equipment and supports located in mechanical and electrical rooms and in all locations where Drawings call for paint or similar finish on walls and/or ceilings. Paint all mechanical equipment exposed on the roof. Exposed pipes shall be painted to Owner's Colour Coding/Piping schedule to suit use (i.e. hot water, etc.), included below.
- .14 Paint all gas piping, inside and out, whether exposed or concealed. Do not paint other pipe, conduit, ducts, insulation and the like where concealed above ceilings or in service shafts.
- .15 Make good paint finish on shop coated work where damaged.
- .16 Paint visible portions of steel shelf angles, lintels and structural steel.
- .17 Paint edges and all faces of metal doors.
- .18 Paint interior of ducts and diffusers visible from exterior on room side.
- .19 Painting, as referred to herein shall include paint, enamel, stain, varnish and other finishes herein specified and normally applied to the various materials by the painting Subcontractor.

1.3 REFERENCE STANDARDS

- .1 Do painting and finishing to CAN/CGSB-85-GP series standards including Appendix A and to material manufacturer's instructions and to The Master Painters Institute (MPI) Architectural Painting Specification Manual and Maintenance Repainting Manual, except where specifically specified otherwise. The most stringent standards shall apply.
- .2 All coatings must conform to Regulation SOR/2009-264, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations, and the VOC limits set therein.

- .3 All paints and coatings used must conform to Green Seal Standard GS-11 for paints and coatings based on performance requirements and reduced use of hazardous substances and reduced volatile organic compounds.

1.4 QUALIFICATIONS

- .1 The Painting Subcontractor must be a member in good standing of the Ontario Painting Contractors' Association and have a minimum of ten (10) years proven satisfactory experience.
- .2 Manufacturer's Qualifications: The paint Products of the Paint Manufacturer shall be as listed in Chapter 5 - Approved Products List of the MPI Manual.

1.5 INSPECTION

- .1 A cash allowance has been included for independent painting inspections. The cost of the painting inspection is to be paid from the Cash Allowance included in the Contract. Refer to Section 01 21 00 – Allowances.
- .2 Prior to commencing the work of this section the painting Subcontractor shall arrange for OPCA inspection in accordance with the requirements of the OPCA Quality Assurance Program.
- .3 Painting shall not commence until the inspection company has been notified and the Inspector makes the initial site visit.
- .4 Supply the Inspector with a schedule of materials intended for use on the job at the commencement of the painting.
- .5 The Inspector will issue Inspection Reports during the Project. On completion of the job, the final Inspection Report will be issued.

1.6 WORK ENVIRONMENT

- .1 Do not apply paint finish in areas where dust is being generated.
- .2 Maintain environmental conditions within limits recommended by manufacturer, for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.
- .3 Conform to requirements of MPI Architectural Specification Manual including recommendations for surface preparation.
- .4 Temperature: No painting shall be performed when surface and ambient temperatures are below 5°C. The minimum temperature for Latex paints shall be 10°C for both interior work and exterior work.

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- .5 Relative humidity shall not be higher than 85%.
 - .1 Moisture Content of Surfaces:
 - .2 Tests shall be by electronic moisture meter.
 - 1. Plaster and Gypsum Board and Cement Board: Maximum moisture content of 12%.
 - 2. Concrete and Concrete Masonry Units: Maximum moisture content of 12% for solvent type paint. Concrete and masonry walls must be installed at least 28 days and must be visually dry on both sides before painting commences.
 - 3. Wood: Maximum moisture content of 15%.
 - 4. Concrete Floors: Shall be tested for moisture by Acover patch test@.
 - .6 Lighting: Painting shall not proceed unless the permanent lighting is in place and operational or a minimum of 161 lm/m² lighting is provided on the surfaces to be painted.
 - .7 Ventilation: In areas where painting is proceeding provide adequate continuous ventilation and heating to maintain temperatures above 7°C for 24 hours before, during and 24 hours after paint application.
 - .8 Do not paint exterior work immediately following rain, frost or dew. Do not paint interior work where condensation has formed or is likely to form. Proceed only when proper environmental conditions are achieved.
 - .9 Avoid applying paint to surfaces when exposed to direct sunlight.

1.7 ACCEPTANCE OF WORK IN PLACE

- .1 Submit written confirmation of acceptance of existing conditions, to the Consultant, prior to commencing painting work. Painting may not commence without submission of this confirmation.
- .2 Receipt of this confirmation will be considered a prerequisite for certification of payment for this work.
- .3 Notify the Consultant, in writing, immediately if any existing condition is encountered that will prevent the attainment of satisfactory results in this work

1.8 REGULATORY REQUIREMENTS

- .1 Conform to requirements of applicable Volatile Organic Compound (VOC) concentration limits for Architectural Coatings Regulations.
- .2 Conform to the latest edition of Industrial Health and Safety Regulations issued by authorities having jurisdiction regarding site safety, including, but not limited to, ladders, scaffolding, and ventilation.

- .3 Conform to requirements of local authorities having jurisdiction regarding the storage, mixing, application, and disposal of all paint and related waste materials.
- .4 Notify the OPCA on award of contract and make application for assignment of an inspector using the appropriate forms.
- .5 Fully cooperate at all times with the requirements of the OPCA in the performance of their duties, including providing access and assistance as required to complete inspection work.

1.9 SUBMITTALS

- .1 Samples:
 - .1 Submit triplicate samples consisting of 300mm x 200mm panels of each type of paint finish specified.
 - .2 Panels shall be of same material as that on which sample coatings are to be applied in the field where possible.
 - .3 Identify each sample as to job, name of paint manufacturer, finish, colour, name and number, sheen and gloss units and name of Contractor.
 - .4 Retain one set of approved samples on site until completion of the Work.
- .2 Submit manufacturer's data sheets for each paint product, including:
 - .1 Product characteristics.
 - .2 Surface preparation instructions and recommendations Primer requirements and finish specifications.
 - .3 Storage and handling recommendations.
 - .4 Application methods.
 - .5 Cautions.
 - .6 VOC data.
 - .7 Complete Material Safety and Data Sheets (MSDS) for each product.
- .3 Submit written confirmation of acceptance of existing conditions, as specified above.

1.10 STORAGE AND HANDLING

- .1 Store paint and painter's materials in clean, dry locations approved by the Consultant. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- .2 All paint shall be in unopened containers, labelled with:
 - .1 manufacturer's name,
 - .2 product name, product type,
 - .3 instructions for surface preparation and product application,
 - .4 VOC content,
 - .5 environmental issues,
 - .6 batch date, and
 - .7 colour name and number.

- .3 Provide CO2 fire extinguisher minimum 9 kg capacity in paint storage area.
- .4 Dispose of materials in accordance with the requirements of authorities having jurisdiction.
- .5 Paint materials shall be delivered to the job site in original sealed and labeled containers bearing the manufacturer's name, type of paint, brand name, colour designation, and instructions for mixing and reducing, and application requirements.
- .6 Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion. Take appropriate precautions, including no smoking restrictions, where toxic and explosive solvents are used.

1.11 SIGNS

- .1 Provide legible signs throughout the Work reading "WET PAINT" in prominent positions during painting and while paint is drying.
- .2 Use 75mm high letters on white card or board.

1.12 TEMPORARY COVERS AND PROTECTION

- .1 Protect floors and other surfaces with temporary covers such as dust sheets, polyethelene film or tarpaulins. All to Consultant's approval.
- .2 Mask identification plates occurring on equipment, switch boxes, and fire rating labels, etc. which require painting.
- .3 Protect, remove and replace hardware, accessories, lighting fixtures, and similar items as required except primed for paint door closers which shall be painted. Light switches and electrical communication outlet plates to be removed and reinstalled on completion of painting.
- .4 Keep oily rags, waste and other similar combustible materials in closed metal containers; take every precaution to avoid spontaneous combustion, remove waste and combustible materials daily.
- .5 Clean surfaces soiled by spillage of paint, paint spattering and the like. If such cleaning operations damage the surface, repair and replace damaged work at no cost to the Owner.

1.13 RETOUCHING

- .1 Do all retouching, etc. to ensure that the building may be handed over to the Owner in perfect condition, free of spatter, finger prints, rust, watermarks, scratches, blemishes of other disfiguration.

- .2 After fully decorating and retouching a room or other area, notify Consultant. After inspection and final approval by Consultant post sign 'DECORATING COMPLETE - NO ADMITTANCE WITHOUT PERMISSION'.

1.14 TEST AREAS

- .1 In areas to be repainted, test existing coatings for adhesion before applying new coatings, in accordance with the recommended practices in the MPI Repainting Specification Manual. Check for loose paint using a scraper and check for adhesion by cutting through the coatings and performing duct tape tests, or other acceptable means of testing adhesion. Once adequate adhesion is confirmed, apply a test section of the proposed new coating, allow to dry, and perform adhesion tests in area of new coating to confirm compatibility with existing coatings before proceeding with repainting work. Perform tests in all areas and on all surface types to ensure positive repainting results. Advise Consultant of any areas in which existing or new coatings fail adhesion tests. Do not proceed with the work until a recommended course of action is agreed upon by all parties. Commencement of work will signify acceptance of existing conditions.
- .2 In areas of new construction, A room or area in the building will be designated by the Consultant as a test area to establish standard of workmanship, texture, gloss and coverage.
- .3 Prior to any painting being started, request a meeting on Site between Consultant, Contractor, and Subcontractor and Inspector to review conditions, surfaces, anticipated problems and to clarify quality of workmanship acceptable to Consultant.
- .4 Apply finishes to each type of surface within room with correct material, coats, colour, texture and degree of gloss in sample area and have same approved prior to providing Work of this Section.
- .5 Retain test area until after completion of Work. Test area to be minimum standard for the Work.
- .6 Failure to comply with the above will be cause for Consultant to request all Work previously painted to be repainted.

1.15 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove and dispose of excess material and waste resulting from the work of this Section.
- .2 All excess materials and empty containers shall be removed from the site and disposed of or recycled in accordance with local regulations.
- .3 Obtain information regarding applicable Provincial and local government regulations for disposal of paint, stain, wood preservative finishes, and related thinners and solvents.
- .4 All waste materials shall be separated and recycled. Collect waste paint by type and provide for delivery to recycling or collection facility. Materials that cannot be reused shall be treated as hazardous waste and disposed of in an appropriate manner.

- .5 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .6 Cleaning and Disposal Procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
 - .2 Retain cleaners, thinners, solvents, and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Ensure empty paint cans are dry prior to disposal or recycling.
 - .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
 - .7 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.16 MAINTENANCE MATERIALS

- .1 Provide one sealed can, one litre capacity, of each product in each colour used in the Work for Owner's use in maintenance Work.
- .2 Container to be new fully labelled with manufacturer's name, type of paint, and colour.
- .3 Maintenance material shall be of the same run as the installed material.

1.17 WARRANTY/GUARANTEE

- .1 Provide a warranty, valid for three (3) years from date of Substantial Performance, or from date of completion of Work if work is not complete at date of Substantial Performance, will be required.
- .2 Subcontractor's shall warrant that the work has been performed in accordance with the standards and requirements of the MPI Architectural Painting Specification Manual, most recent edition.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Paint and finishing materials - highest grade, first line quality, low VOC products provided by any of the following manufacturers:
 - .1 Benjamin Moore & Co.
 - .2 The Sherwin-Williams Company
 - .3 Dulux Paints/PPG Canada
 - .4 Para Paints.
- .2 Paints, enamels, fillers, primers, varnishes and stains - ready mixed products of one of the manufacturers listed. Substitutes will not be allowed.
- .3 Thinners, cleaners - type and brand recommended by the paint manufacturer, or Inspector.
- .4 Only products manufactured by paint manufacturer stated at time of submission of samples will be allowed on Site unless other materials specifically specified herein. No painting to be performed until paint manufacturer identified and acceptance received from the Consultant and Inspector.
- .5 Deliver materials to Site in original unbroken containers bearing brand and maker's name. The presence of any unauthorized material or containers for such, on Site shall be of sufficient cause for rejection of ALL paint materials on Site at that time, and all previous painted work repainted with proper material.

2.2 COLOUR SCHEDULE

- .1 Consultant will provide detailed colour schedule at a later date. Conform to schedule including patterns, colours, and locations for all finishes.
- .2 A minimum of ten (10) paint colours may be selected by the Consultant.
- .3 In each room, the Consultant may select one wall where an accent colour may be applied.
- .4 Refer to room finishing notes for detailed application instructions.

2.3 FINISHING SYSTEMS

- .1 Interior Work:
 - .1 Gypsum Board:
 - .1 Walls (typical): INT 9.2M Institutional Low Odour/ Low VOC, semi-gloss finish, 1 coat Primer; MPI #149, Finish: 2 coats MPI #147.

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- .2 Walls (corridors, service rooms): INT 9.2F Epoxy-Modified Latex (over latex primer sealer), Semi-Gloss finish. Acceptable paint: Sherwin-Williams, Pro Industrial Zero VOC Waterborne Catalyzed Epoxy or Equivalent.
 - .3 Ceilings (typical): 2 coats of one of the following:
2 coat Dulux Lifemaster Interior Acrylic Ceiling Flat # 59170 Zero VOC or equal by one of the approved manufacturers.
 - .4 Ceiling (corridors, mechanical, electrical, custodian and washrooms): INT 9.2F Epoxy-Modified Latex (over latex primer sealer), Flat Finish. Acceptable paint: Sherwin-Williams, Pro Industrial Zero VOC Waterborne Catalyzed Epoxy or Equivalent.
 - .5 All drywall, whether requiring finish painting or not, must receive prime coat.
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- .2 Concrete Block, paint (typical):
 - .1 INT 4.2E (modified), Institutional Low Odour/ Low VOC, semi-gloss finish, 4 coat system.
 - .2 2 coats latex blockfiller; MPI #4.
 - .3 2 coats finish; MPI #147.
 - .4 Provide gloss finish, MPI #148, where noted as “gloss” in Room Finish Schedule.
 - .3 Concrete Block, glaze and wet areas:
 - .1 INT 4.2J (modified), Epoxy-modified Latex Finish, 4 coat system
 - .2 2 coats latex blockfiller; MPI #4
 - .3 2 Coats epoxy-modified latex finish; MPI #115
 - .4 Provide in all corridors, custodian room, mechanical room and washrooms, and where noted as “glazed” in Room Finish Schedule.
 - .5 Acceptable Paint: Sherwin-Williams, Pro Industrial Zero VOC Waterborne Catalyzed Epoxy or Equivalent.
 - .4 Cast in Place Concrete walls, ceilings:
 - .1 INT 3.1M Institutional Low Odour/ Low VOC, semi-gloss finish.
 - .2 1 coat MPI #149.
 - .3 2 coats MPI #147.
 - .5 Woodwork (Opaque Finish):
 - .1 INT 6.4T Institutional Low Odour/ Low VOC, semi-gloss finish.
 - .2 1 coat latex primer MPI #39.
 - .3 2 coats institutional low VOC latex finish; MPI #147.
 - .6 Stain Finish:
 - .1 LEED Complaint Stain.
 - .2 Coats Varnish, Water Based, clear gloss; MPI #130.
 - .7 Ferrous Metal:
 - .1 INT 5.1S Institutional Low Odour/ Low VOC, semi-gloss finish.
 - .2 1 coat MPI #107.

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- .3 2 coats MPI #147.
 - .8 Shop Primed Ferrous Metal:
 - .1 INT 5.1S Institutional Low Odour/ Low VOC, semi-gloss finish.
 - .2 Confirm type of shop primer used with structural steel supplier.
 - .3 Confirm compatibility of all coatings with manufacturers.
 - .4 Touch up prime coat where damaged, with compatible primer, type MPI#107.
 - .5 2 coats interior latex, MPI #147
 - .9 Galvanized Metal:
 - .1 Includes all hollow metal doors, frames and screens and pipe rails.
 - .2 INT 5.3N Institutional Low Odour/ Low VOC, semi-gloss finish
 - .3 1 coat galvanized Primer MPI #134
 - .4 2 coats Acrylic Semi-Gloss MPI #147
 - .10 Insulation on Pipes & Ducts:
 - .1 INT 6.8F Institutional Low Odour/ Low VOC, semi-gloss finish
 - .2 1 coat Primer MPI #17
 - .3 2 coats Acrylic Semi-Gloss MPI #147
 - .11 Mechanical Equipment:
 - .1 Institutional Low Odour/ Low VOC, semi-gloss finish
 - .2 As specified for metal types.
 - .12 Piping, Conduit & Ductwork (uncoated):
 - .1 INT 5.3N Institutional Low Odour/ Low VOC, semi-gloss finish
 - .2 1 coat galvanized Primer MPI #134
 - .3 2 coats Acrylic Semi-Gloss MPI #147
 - .13 Surfaces behind grilles, within 30mm of grille:
 - .1 INT 5.3N Institutional Low Odour/ Low VOC, flat finish
 - .2 1 coat galvanized Primer MPI #134
 - .3 2 Coats Acrylic Flat, Black; MPI #143
 - .14 Concrete Floors:
 - .1 1 Coat Water-Borne Epoxy (diluted 10-20% with water) MPI #115
 - .2 2 Coats Water-Borne Epoxy MPI #115
 - .3 VOC emissions of coating not to exceed 200 g/l.
 - .15 Zinc-Coated Metal:
 - .1 INT 5.3M with Epoxy-Modified Latex (over water based galvanized primer), Semi-gloss Finish.
 - .2 Acceptable Paint: Sherwin-Williams, Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, or Equivalent.
 - .16 Exposed Steel Floor and Roof Deck and Steel Floor and Roof Structure:
 - .1 INT 5.1CC, Waterborne Dry Fall (over galvanized steel or quick dry shop primer, Flat Finish.

- .17 High Temperature Pipe and Fittings: INT 5.2A Heat Resistant Enamel, Semi-gloss Finish.
- .18 NOTE: Use heat resistant paint where required.
- .2 Exterior Work:
 - .1 To MPI Manual Chapter 2.
 - .2 Painted Wood: EXT 6.3L Latex (over latex primer), Semi-Gloss Finish.
 - .3 Stained Wood: EXT 6.3N Satin, Semi-transparent, Water Based.
 - .4 Soffit Sheathing: EXT 9.1A Latex, Flat Finish.
 - .5 Ferrous Metal: EXT 5.1F Epoxy (over epoxy primer and high build epoxy) Finish.
 - .6 Zinc-Coated Metal: EXT 5.3C Epoxy (over epoxy primer) Finish.
- .3 Paint systems are to be of premium grade.
- .4 Use low odour, zero VOC products.

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES

- .1 Prepare surfaces in accordance with the following standards and to MPI Architectural Specification Manual Chapters 2 and 3; the most stringent requirements shall apply. Preparation of surfaces must be reviewed with painting inspector. Prepared surfaces must be inspected before application of prime coat.
 - .1 Prepare wood surfaces to CGSB 85-GP-IM. Use CAN/CGSB 1.126 vinyl sealer over knots and resinous areas. Use CGSB 1-GP -103M wood paste filler for nail holes. Tint filler to match.
 - .2 Touch up damaged spots of shop paint primer on steel with CAN/CGSB 1.40M to CGSB 85-GP-14M.
 - .3 Prepare galvanized steel and zinc coated surfaces to CGSB 85-GP-16M. This includes wiped coated steel surfaces.
 - .4 Prepare masonry and concrete surfaces to CGSB 85-GP-31M.
 - .5 Prepare wallboard surfaces to CGSB 85-GP-33M. Fill minor cracks with plaster patching compound for stained woodwork.
 - .6 Prepare concrete floors to CGSB 85-GP-32M.
 - .7 Prepare copper piping and accessories to CGSB 85-GP-20M.
 - .8 Apply prime coat on wood scheduled for paint finish before installation.

- .9 Back prime wood scheduled for transparent finish. Do not prime surfaces scheduled for transparent finish.
- .10 Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mould, mildew, mortar, efflorescence, and sealers from existing surfaces to assure sound bonding to tightly adhering old paint.
- .11 Scape peeling paint off existing masonry surfaces and apply a compatible masonry sealer, approved for use by the paint manufacturer, before applying new coatings.
- .12 Glossy surfaces must be clean and dull before repainting. Wash with abrasive cleanser, or, wash thoroughly and dull by sanding.
- .13 Spot prime any existing bare areas with an appropriate primer.
- .14 Check for compatibility between existing and new coatings by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow surface to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required.
- .15 NOTE: ABOVE NOTED SURFACES MAY NOT ALL BE APPLICABLE TO THIS PROJECT.

3.2 APPLICATION

- .1 Apply coatings in accordance with manufacturer's printed instructions.
- .2 Use suitable, clean equipment in good condition.
- .3 Maintain dust-free suitable conditions on the surfaces free from machine, tool or sandpaper marks, insects, grease, or any other condition liable to impair finished work to prevent production or good results.
- .4 At all hollow metal doors and frames, prime coat must be inspected and signed off by painting inspector before painting work may proceed.
- .5 Apply evenly, uniform in sheen, colour and texture, free from brush or roller marks, well brushed or rolled in and free of crawls, runs, join marks or other defects.
- .6 Permit paint to dry between coats. Touch up uneven spots after applying first coat. Tint various coats of multiple coat work in light shades of the final colour selected, to distinguish between coats.
- .7 Give Consultant and Inspector due notice and sufficient opportunity (minimum 48 hours) to inspect each coat. Do not proceed with subsequent coat until preceding coat approved. Consultant reserves the right to order complete retreatment if this condition is not observed.

- .8 Painting coats are intended to cover surfaces perfectly; if in painter's opinion, formula specified is inadequate to provide a first class finished surface, report to the Consultant and have formulas rectified before commencing work. Surfaces imperfectly covered shall receive additional coats at no additional cost. Provide additional coat where ever dark colours are used.
- .9 Use paint unadulterated. Use same brand of paint for primer, intermediate and finish coats. Factory mix all paints.
- .10 Paint finish shall be applied by roller except in the case of wood trim, door frames, base board and similar work of small surface area which shall be painted by brush. Do not use roller for applying finish other than paint.
- .11 Spray painting will not be permitted unless specifically approved in writing by the Consultant in each instance. Consultant may withdraw approval at any time and prohibit spray painting for reasons such as carelessness, poor masking or protection measures, drifting paint fog, disturbance to other Trades, or failure to obtain a dense, even, opaque finish. Spray painting shall be full double coat, i.e. at least two passes for each coat. Do not use spray or roller on wood or metal surfaces, brush only unless approved in writing by Consultant.
- .12 Paint entire surfaces, including areas where millwork or other items are to be installed.
- .13 Finish edges of doors with paint or stain treatment as required to match face of door. Seal hidden edges of wood doors with one coat of shellac and one coat gloss varnish or two coats paint. Repaint tops and edges of wood doors after fitting.
- .14 Even up stained woodwork in colour as required by nature of wood and as directed by Consultant. Apply same finish on trim, fitments cupboards and other protecting ledges as on surrounding work, disregard sight lines.
- .15 Carefully hand smooth and sandpaper wood between coats (including priming). Apply one coat sealer before applying first coat paint filler to knots or sap blemishes on wood surfaces to receive paint or stain finish.
- .16 After first coat, fill nail holes, splits and scratches, using putty coloured to match finish.
- .17 Remove rust, oil, grease and loose shop paint from metal work by brushing or with wire brushes and make good shop coat before proceeding with final finish. Feather out edges to make touch up patches inconspicuous.
- .18 Clean castings with wire brush before application of first paint coat.
- .19 Do not etch galvanized metal. Use zinc rich primer. This includes metal door frames and the like with wiped zinc coating.
- .20 Note that primer is required on all hollow metal doors, frames and screens. Three coat system is required. Sand between all coats.

- .21 Remove form oil or parting compounds from concrete surfaces. Use Xylol or approved compound.
- .22 Paint interior of pipe spaces, ducts, etc. visible through grilles or through linear metal ceilings in black matt finish.
- .23 Conform with Consultant's colour schedule and exactly match approved samples.
- .24 Mechanical and Electrical Pipes, Ducts and Conduits:
 - .1 Commence Work when piping installation is complete in the area concerned.
 - .2 Do not paint plated or other prefinished surfaces, unless otherwise noted.
 - .3 Paint conduit in same colour as background paint.
 - .4 Apply formulae specified even though surface prime painted at shop prior to delivery. Touch up shop priming where damaged.
 - .5 Use heat resistant epoxy paint on pipes and surfaces where operating surface temperature exceeds 65 degrees C.
 - .6 Paint exposed pipes and ducts and their supports and related items in colours to suit colour coding included below; confirm with Consultant. Refer to Mechanical Division 20 for further instructions.

3.3 COLOUR CODING OF PIPING

- .1 The following is a preliminary list of painting requirements for piping. All colours are to be confirmed by the Owner prior to commencing this work.

FUNCTION	COLOUR	WHERE EXPOSED	WHERE CONCEALED	DIRECTION INDICATION
Natural Gas	Yellow	Solid	Solid	-
Stand Pipe System	Red	Solid	Solid	-
Heating Water Supply	Dark Green	Solid	12" Band Every 20'	At minimum of every 20', Direction Arrow 9" Long, 1" wide
Heating Water Return	Pale Green	Solid	12" Band Every 20'	
Chilled Water Supply	Orange	Solid	Solid	
Chilled Water Return	Orange	Solid	Solid	
Cooling Water To Tower	Buff	Solid	Solid	
Cooling Water From Tower	Buff	Solid	Solid	

Domestic Hot Water	Dark Blue	Solid	Band Every 20'	At minimum of every 20', Direction Arrow 9" Long, 1" wide
Domestic Cold Water	Pale Blue	Solid	Band Every 20'	

3.4 REPAIRS

- .1 Cracks occurring in walls or ceilings requiring patching during "Warranty Period" shall be repainted in such a way that the patch is not visible at a distance of 1m.
- .2 If patch painting is not acceptable, repaint entire wall, or ceiling.

END OF SECTION

Division 20 Common Requirements for Mechanical

20 00 01	Mechanical Specification Index
	Common Contract Requirements for Mechanical
20 02 51	Mechanical Contract Requirements
	Common Work Results for Mechanical
20 05 11	Mechanical Work Requirements
20 05 31	Expansion Fittings and Loops
20 05 32	Thermometers and Pressure Gauges
20 05 34	Bases, Hangers and Supports
20 05 49	Vibration Control Measures
20 05 53	Identification of Mechanical Services
	Testing, Adjusting, and Balancing
20 06 11	Testing, Adjusting, and Balancing (TAB) of Mechanical Systems

Division 21 Fire Suppression

	Fire-Suppression Sprinkler Systems
21 13 13	Wet Pipe Fire Suppression

Division 23 Heating, Ventilating, and Air Conditioning (HVAC)

	HVAC Insulation
23 07 13	Duct Insulation
23 07 19	HVAC Piping Insulation
	Hydronic Piping and Pumps
23 21 13	Hydronic Piping (Welded)
23 21 14	Hydronic Piping (Rolled Groove)
23 21 23	Pumps Hydronic
	Refrigerant Piping
23 23 13	Refrigerant Piping and Specialties
	HVAC Water Treatment
23 25 13	Water Treatment for Closed-Loop Hydronic Systems
	HVAC Ducts and Casings
23 31 13	Metal Ducts
	Air Duct Accessories
23 33 13	Duct Accessories
23 33 13.13	Volume-Control Dampers
23 33 18	Operating Dampers
23 33 46	Flexible Ducts
23 33 53	Duct Liners

HVAC Fans

23 34 23 Packaged Exhausters

Air Outlets and Inlets

23 37 13 Diffusers, Registers, and Grilles

23 37 23 Louvres and Vents for Intake and Exhaust

Air-To-Air Energy Recovery Equipment

23 72 18 Fixed Plate Air-to-Air Heat Recovery Ventilators (Residential)

Decentralized Unitary HVAC Equipment

23 81 26 Split System Air Conditioning

Convection Heating and Cooling Units

23 82 23A Hydronic Unit Ventilators – Vertical Floor Mount – Pretender

23 82 23B Hydronic Unit Ventilators – Vertical Ducted

23 82 29 Radiators, Convectors, and Cabinet Heaters

Division 25 Integrated Automation

Building Control System

25 05 11 Variable Frequency Drives

25 40 11 Building Control System

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

- .1 This section covers items common to all sections of Mechanical Division.
- .2 Conform to Division 1 General Conditions.
- .3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.
- .4 Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

1.2 INTENT

- .1 Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for mechanical work.
- .2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.
- .3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.
- .4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.
- .5 Where used, word “provide” shall mean supply and install as each is described above.

1.3 REGULATIONS, PERMITS AND FEES

- .1 All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes and by-laws in force in the area of the project.
- .2 Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.
- .3 In the event that changes or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor’s expense.
- .4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.
- .5 Submit a copy of all final certificates in the maintenance manuals.

1.4 DRAWINGS

- .1 Mechanical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of piping, conduits and ducts to accommodate structural conditions. Location of pipes, ducts, conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.
- .2 As work progresses and before installing piping, ductwork, heating units, registers, diffusers, fixtures and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fittings.
- .3 Mechanical Drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.
- .4 Install piping and ductwork to clear structural members and any fireproofing. Locate mechanical work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.
- .5 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.
- .6 Locate all mechanical and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.
- .7 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.
- .8 Relocate equipment and/or material installed but not co-ordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.
- .9 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.5 INTERFERENCE AND CO-ORDINATION DRAWINGS

- .1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.
- .2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are co-ordinated.

- .3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.
- .4 Upon consultant's request submit copies of interference drawings to consultant.
- .5 Due to the nature of the building and the complexity of the building systems provide the following:
 - .1 Interference drawings, showing coordination of architectural, structural, mechanical and electrical systems for the consultant's review prior to fabrication.
 - .2 Detailed layout drawings, clearly showing fasteners and hangers.
- .6 Provide CAD drawings (minimum release AutoCAD 2007) in addition to hard copies.

1.6 QUALITY ASSURANCE

- .1 Perform work in accordance with applicable provisions of local Plumbing Code, Gas Ordinances, and adoptions thereof for all mechanical systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
- .2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

1.7 ALTERNATES AND SUBSTITUTIONS

- .1 Throughout Mechanical Division are lists of "Alternate and equal Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment.
- .2 Each bidder may elect to use "Alternate or equal Equipment" manufacturers from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price" in which case contractor will complete the Supplementary Tender Form.
- .3 It is responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" nor "equal" specified product unit is proposed and does not fit space allotted in Consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for "alternate" or "equal" equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.
- .4 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

1.8 EXAMINATION

- .1 Site Inspection
 - .1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.
 - .2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- .2 Drawings:
 - .1 Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
 - .2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, Mechanical, and Fire Protection Drawings.
 - .3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- .3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.9 SEQUENCING SCHEDULING AND COORDINATION

- .1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.
- .2 Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in Mechanical Division caused by neglect to do so shall be made at no cost to Owner.
- .3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

- .4 Furnish and install inserts and supports required by Mechanical Division unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Mechanical Division.
- .5 Be responsible for required excavation, backfilling, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
 - .1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
 - .2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
 - .3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .6 Adjust locations of pipes, ducts, equipment, fixtures, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.
 - .1 Make offsets, transitions, and changes in direction of pipes, ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
 - .2 Furnish and install traps, air vents, sanitary vents, pull boxes, etc, as required to effect these offsets, transitions, and changes in direction.
- .7 Slots and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.10 CONTRACT BREAKDOWN

- .1 Provide breakdown of contract exclusive of HST to acceptance of consultants prior to first draw submission.
- .2 Provide labour and material cost for each item.
- .3 Breakdown shall indicate total contract amount.

- .4 Contract breakdown shall be as follows as a minimum.
 - Mobilization and shop drawings (max. \$2000.00)
 - Demolition
 - Unit ventilators
 - Split a/c systems
 - Condensing units
 - Heating piping
 - Radiant heater revisions
 - Piping Insulation
 - Ductwork
 - Duct Insulation
 - Grilles & Diffusers
 - Fire Stopping
 - Exhaust fans
 - Testing Adjusting and Balancing
 - HVAC system commissioning
 - Mechanical contractor closeout requirements (min. of 3% but not less than \$5,000.00)
- .5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.

1.11 SHOP DRAWINGS AND PRODUCT DATA

- .1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 30 days after award of Contract.
- .2 Provide a complete list of shop drawings to be submitted prior to first submission.
- .3 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.
- .4 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.
- .5 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.
- .6 **Submit all shop drawings for the project as a package. Partial submittals will not be accepted.**
- .7 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or his Engineer shall not supersede Contract Documents.

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- .8 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.
 - .9 Check work described by catalog data with Contract Documents for deviations and errors.
 - .10 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances. e.g. access door swing spaces.
 - .11 Shop drawings and product data shall be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify as to current model production.
 - .5 Certification of compliance to applicable codes.
 - .12 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.
 - .13 Shop drawings shall be submitted electronically as per the following directions:
 - .1 Electronic Submissions:
 - .1 Electronically submitted shop drawings shall be prepared as follows:
 - .1 Use latest software to generate PDF files of submission sheets.
 - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.
 - .3 PDF format shall be of sufficient resolution to clearly show the finest detail.
 - .4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
 - .5 Submissions shall contain multiple files according to section names as they appear in Specification.
 - .6 File names shall include consultant project number and description of shop drawing section submitted.
 - .7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.
 - .8 On the shop drawing use an "electronic mark" to indicate what is being provided.

- .9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**
- .2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.
- .3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating “1 of 2” and “2 of 2” in email subject line for the case of two messages.
- .4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.
- .5 On site provide one copy of the “reviewed” shop drawings in a binder as noted above.
- .6 Contractor to print **3** copies of “reviewed” shop drawings and compile into maintenance manuals.

1.12 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for incorporation into manual as in submittals' requirements.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.
- .3 Operation data to include:
 - .1 Control schematics for each system including environmental controls.
 - .2 Description of each system and its controls.
 - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for each system and each component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .8 Spare parts equipment list.
 - .9 Manufacturers standard or extended warranty information.
- .4 Maintenance data shall include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.

- .5 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified elsewhere.
 - .4 Testing, adjusting and balancing reports as specified in Testing, Adjusting and Balancing Section.
- .6 Miscellaneous data to include:
 - .1 Letter of contractors warranty and guarantee.
 - .2 Index sheet.
 - .3 Tabbed format for each section.
 - .4 Manufacturers approved shop drawings.
 - .5 Spare parts list and source.
 - .6 List of Manufacturers and suppliers address for each piece of equipment.
- .7 Approvals:
 - .1 Submit 1 copy of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant.
 - .2 Make changes as required and re-submit as directed by Consultant.
 - .3 Provide three (3) copies of final operation maintenance manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one USB stick is to be provided containing both the approved manual and Record drawings.
- .8 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.13 AS-BUILT DRAWINGS

- .1 Site records:
 - .1 Contractor shall provide 2 sets of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection at all times.

- .2 As-Built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .3 TAB to be performed using as-built drawings.
 - .1 Submit hard copy to Consultant for approval. When returned, make corrections as directed.
 - .2 Once approved, submit completed reproducible paper as-built drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.

1.14 WARRANTIES

- .1 In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
- .2 The contractor shall provide all regular equipment service including any parts (as recommended by the manufacturer) for the warranty period.
 - .1 HVAC unit
 - .2 Pumps
 - .3 All equipment filter changes (4 times per year).
 - .4 Miscellaneous fans and heaters.
- .3 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.
- .4 Warranty period shall start from date of substantial completion and shall be 2 years. Warranty shall include parts and labour.

1.15 SUBSTANTIAL PERFORMANCE

- .1 Complete the following to the satisfaction of the consultant prior to request for submission of substantial performance.
 - .1 Record Drawings.
 - .2 Maintenance Manuals
 - .3 System Start up
 - .4 TAB Reports
 - .5 HVAC System Commissioning
 - .6 Instructions to Owners

- .7 Final Certificates (required prior to consultant's release of conformance letter).
 - .1 NFPA-13 Contractors Material and Test Certificate (sprinkler)
 - .2 Sprinkler Design Engineers' Letter
 - .3 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)
 - .4 Mandatory TSSA Gas Pressure Test (CSA B149.1).

1.16 OCCUPANCY REQUIREMENTS

- .1 The contractor shall provide the following documentation to the consultant prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:
 - .1 Final Certificates (required prior to consultant's release of conformance letter).
 - .1 FPA-13 Contractors Material and Test Certificate (sprinkler)
 - .2 Sprinkler Design Engineers' Letter
 - .3 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)
 - .4 Mandatory TSSA Gas Pressure Test (CSA B149.1).

1.17 REVISION TO CONTRACT

- .1 Provide the following:
 - .1 Itemized list of material with associated costs.
 - .2 Labour rate and itemized list of labour for each item.
 - .3 Copy of manufacturers/suppliers invoice if requested.

1.18 DELIVERY STORAGE & HANDLING

- .1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials.
- .2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

1.19 ASBESTOS

- .1 **If asbestos is suspected or identified cease all work in the immediate area in accordance with OHSA and notify consultant.**
- .2 **Each contractor and on-site employee of the contractor shall have "asbestos awareness training".**
- .3 The Contractor shall ensure that employees who may come into contact with asbestos due to the nature of the work that they perform, have received training that enables them to recognize asbestos and that enables them to react in accordance with the Occupational Health and Safety Act and regulations thereto should contact with asbestos occur during the course of their work.

- .4 It is the responsibility of the contractor to review the asbestos book in the building prior to starting any work.**
- .5 Existing occupied buildings (depending upon their age) may contain asbestos in thermal insulating materials and some manufactured products, such as vinyl asbestos floor tile. Any insulating materials, on pipes, fittings, boilers, tanks, ductwork, etc. may contain asbestos and shall not be disturbed.**
- .6 A survey of each building documenting the location and condition of asbestos-containing materials is available for your mandatory review prior to commencing any work on premises.**

1.20 TSSA INSPECTION

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.**
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.**

1.21 CONFINED SPACES

- .1 Certain areas of the building may be defined as a “Confined Space”. Any personnel working in these areas must have confined space training, appropriate equipment and undertake all work in conformance with appropriate codes and standards.**
- .2 Refer to building documentation for any spaces deemed “Confined Space”.**

1.22 ENERGY EFFICIENCY

- .1 The mechanical systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.**
- .2 All equipment, products, and installations must conform to the Codes and Standards.**

END OF SECTION

Part 1 General

1.1 TESTS

- .1 Give 48 hours written notice of date for tests.
- .2 Insulate or conceal work only after testing and approval by Consultant.
- .3 Conduct tests in presence of Consultant.
- .4 Bear costs including retesting and making good.
- .5 Piping:
 - .1 General: maintain test pressure without loss for 4 h unless otherwise specified.
 - .2 Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
 - .3 Test natural gas systems to CSA-B149.1-00, TSSA requirements and requirements of authorities having jurisdiction.
 - .4 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.
 - .5 Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 860 kPa (124.8 psi), whichever is greater.
 - .6 Test fire systems in accordance with authorities having jurisdiction and as specified elsewhere.
- .6 Equipment: test as specified in relevant sections.
- .7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.2 SYSTEM START UP

- .1 Provide adjusting, testing and start-up of all equipment prior to testing and balancing (TAB) specified elsewhere.
- .2 Provide consultant with written notice verifying all equipment operation and installation is complete.
- .3 Start-up shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.
- .4 Simulate system start up and shut down and verify operation of each piece of equipment.
- .5 Arrange with all parties and provide 72 hours notice for start-up procedure.
- .6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

1.3 COMMISSIONING

- .1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.
- .2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to consultant and Owner/Owner's Representative.
- .3 The Commissioning Process is detailed in ASHRAE Guideline 1-1996 HVAC Commissioning Process. The commissioning plan may be modified to reflect the actual construction schedule and design.
- .4 Provide a pre-functional test of all HVAC mechanical system and sub-system elements, including control devices, shall be checked for the following:
 - .1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.
 - .2 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.
 - .3 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.
 - .4 Controls calibration to be completed in accordance with the specification.
 - .5 The TAB shall be done in accordance with the specifications.
- .5 A functional performance testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests, and test the systems through all possible modes of operation.
- .6 Reports:
 - .1 The contractor shall be responsible for recording, documenting, and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.
 - .2 All data must be recorded as soon as possible during the course of the inspection and testing.
 - .3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.
 - .4 All test instruments shall be documented for valid calibration.
 - .5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Engineer and the owner's representative prior to the start of the testing.
 - .6 Include all commissioning documentation in the maintenance manuals.

- .7 Mechanical System Execution:
- .1 Operate equipment and systems shall be tested in the presence of the owner's representative and the consultant to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.
 - .2 Notify the consultant, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.
 - .3 Testing shall be conducted under specified design operating conditions as recommended or approved by the consultant.
 - .4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.
 - .5 All special testing materials and equipment shall be provided by the appropriate contractor.
 - .6 Provide three copies of all test reports and records to the consultant.
- .8 The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems, including:
- | | |
|----------------------------|---|
| Equipment Checklist | System Checklist |
| Unit Ventilators | Pumps |
| Condensing Units | ERV and DX Split AC System |
| DX Split AC Unit | Unit Ventilators with EF/Gravity Vent interlock |
| ERV | |
| Exhaust Fans | |
| Dampers | |
| Pumps | |
| Controllers/Valves/Dampers | |
| Relays/Sensors/Transducers | |

1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Mechanical contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.
- .3 Where specified elsewhere in Mechanical Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.
- .4 Use operation and maintenance manual, record drawings, audio visual aids, etc. as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

- .6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

1.5 TRIAL USAGE

- .1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 HVAC.
 - .2 Exhaust air.
 - .3 Unit Ventilator.

1.6 DEFICIENCIES

- .1 During the course of construction, the consultants will monitor construction and provide written reports of work progress, discussions, and instruction to correct work.
- .2 Instruction to correct work shall be done within the work period before the next review.
- .3 The contractor shall not conceal any work until inspected.
- .4 The contractor shall expedite 100% complete rough-in work and have inspected prior to concealing services and equipment especially above ceiling.
- .5 Upon completion of the project the consultant will do a final review. Upon receiving the final inspection report, the contractor must correct and sign back the inspection report indicating the deficiencies are completed. A re-inspection will only be done once consultant receives this in writing.

1.7 EQUIPMENT INSTALLATIONS

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to floor drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.8 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

- .3 Install mechanical equipment at following heights unless indicated otherwise.

- .1 Thermostats: Barrier Free (operable) 1200 mm (47.25")
Non Barrier Free 1500 mm (59")

Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

1.9 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other divisions.

1.10 PROTECTION OF OPENINGS

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.11 ELECTRICAL

- .1 Electrical work to conform to Electrical Division including the following:
 - .1 Supplier and installer responsibility and related mechanical responsibility is indicated in Equipment Schedule on mechanical and/or electrical drawings
 - .2 Control wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division. Refer to Electrical Division for quality of materials and workmanship.
 - .3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.12 MOTORS

- .1 Provide high efficiency motors for mechanical equipment as specified.
- .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .3 Motors under 373 W, (1/2 hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, voltage as indicated.
- .4 Motors 373 W, (1/2 hp) and larger: EEMAC Class B, Totally Enclosed Fan Cooled (TEFC) induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

1.13 GUARDS

- .1 Provide guards for unprotected devices.

- .2 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm (16 gauge) thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 20 mm (3/4") mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

1.14 PIPING AND EQUIPMENT SUPPORTS

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Mechanical Division.
- .2 Piping and equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.
- .3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete specified elsewhere.
- .4 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

1.15 ROOF MOUNTED PIPE SUPPORT

- .1 Provide zero penetration pipe support on roof where indicated.
- .2 Base shall be made of high density polypropylene with UV protection. Maximum loading shall be 50 lb/sq.ft.
- .3 Frames shall be galvanized. All fastenings, rods, nuts, washers, hangers, etc. shall be stainless steel.
- .4 Provide shop drawings as specified. Install to manufacturers recommendations.
- .5 Acceptable material:
 - Portable pipe hanger
 - Bigfoot systems
 - Miro rooftop supports
 - Trikon Systems

1.16 SLEEVES

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.
- .2 Schedule 40 steel pipe.

- .3 Sleeves with annular fin continuously welded at midpoint:
 - .1 Through foundation walls.
 - .2 Where sleeve extends above finished floor.
 - .3 Through fire rated walls and floors.
- .4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.
- .6 Fill voids around pipes:
 - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
 - .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with lime plaster or other easily removable filler.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.
- .7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

1.17 FIRE STOPPING

- .1 All walls between classroom and corridor, or classroom and any other room are to be considered 1 hr fire separation for fire-stopping purposes.
- .2 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.
- .3 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.
- .4 Do not use cementitious or rigid seals around penetrations for pipe, ductwork, or other mechanical items.
- .5 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.
- .6 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.
- .7 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.
- .8 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide "fire wrap" blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.

- .9 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.
- .10 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.
- .11 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.
- .12 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.
- .13 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.
- .14 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.
- .15 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.
- .16 Acceptable Manufacturer:
Minnesota Mining and Manufacturing
- .17 Acceptable Alternate Manufacturers to approval of local authority:
Fryslieve Industries Inc.
General Electric Pensil Firestop Systems
International Protective Coatings Corp.
Rectorseal Corporation (Metacaulk)
Proset Systems
3M
AD Systems
Hilti
- .18 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

1.18 ESCUTCHEONS

- .1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.
- .2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.
- .3 Outside diameter to cover opening or sleeve.
- .4 Inside diameter to fit around finished pipe.

1.19 PAINTING

- .1 Refer to Section Interior Painting and specified elsewhere.
- .2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

- .3 Apply two coats of paint to exposed piping service in mechanical room, base colour as specified in Mechanical Identification Section.
- .4 Prime and touch up marred finished paintwork to match original.
- .5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.20 SPARE PARTS

- .1 Furnish spare parts in accordance with general requirements and as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
 - .4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide list of equipment in maintenance manuals indicating corresponding spare parts required. List of spare parts to be signed off by receiving personnel.

1.21 SPECIAL TOOLS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Maintenance Materials Special Tools and Spare Parts.

1.22 DIELECTRIC COUPLINGS

- .1 General:
 - .1 To be compatible with and to suit pressure rating of piping system.
 - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes NPS 50 mm (2") and under: isolating unions.
- .3 Pipes NPS 65 mm (2 1/2") and over: isolating flanges.

1.23 DRAIN VALVES

- .1 Locate at low points and at section isolating valves unless otherwise specified.
- .2 Minimum NPS 20 mm (3/4") unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.
- .3 Drain valves on potable water systems shall be complete with vacuum breaker.

1.24 REPAIRS, CUTTING, AND RESTORATION

- .1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
- .2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

1.25 EXISTING SYSTEMS

.1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.

.2 Be responsible for damage to existing plant by this work.

1.26 CLEANING

.1 Clean interior and exterior of all systems including strainers.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.27 DISCONNECTION AND REMOVAL

.1 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.

.2 Cap and conceal all redundant and obsolete connections.

.3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.

.4 Store equipment to be retained by owner on site where directed by consultant.

1.28 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.29 DEMOLITION

.1 The general requirements are indicated on the drawings and on the outline specification in Division 1.

.2 The general execution of the demolition is to be carried out in a clean and efficient manner.

.3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.

.4 All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.

.5 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.

.6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

- .7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.
- .8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.
- .10 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site which the owner does not retain.
- .11 Maintain equipment to be retained by owner on site where directed by consultant.
- .12 Demolition of all parts of the work must be completed within the confines of the work area and in such a way as the dust produced and risk to injury of will not adversely affect the building users.
- .13 Demolition shall take place within areas isolated from all other areas with appropriate hoarding, scaffolding, netting, fencing or other means of security between building users and the work.
- .14 Co-ordinate making safe electrical devices, capping plumbing and removal of fixtures prior to commencement of demolition.
- .15 All piping and equipment to be removed and/or abandoned shall be drained prior to capping and/or abandoning. Disposal of all liquids shall be to the approval of authority of having jurisdiction and/or provincial regulations.
- .16 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

1.30 EXISTING CONCRETE SLAB X-RAY/SCANNING

- .1 This contractor shall retain the services of a qualified company to provide and X-Ray and/or scan of the existing buried services in wall and/or floors prior to starting any work in the affected area.
- .2 Failure to locate existing piping, conduit rebar etc., shall not relieve this contractor of repair of same prior to installing his service.
- .3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

1.31 TSSA INSPECTION

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American Society for Testing and Materials
 - .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate for each item as applicable:
 - .1 Manufacturer, model number, line contents, pressure and temperature rating.
 - .2 Movement handled; axial, lateral, angular and the amounts of each.
 - .3 Nominal size and dimensions including details of construction and assembly.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit maintenance data in accordance with general requirements.
- .2 Data to include:
 - .1 Servicing requirements, including any special requirements, stuffing box packing, lubrication and recommended procedures.

Part 2 Products

2.1 FLEXIBLE CONNECTION

- .1 Application: to suit motion.
- .2 Minimum length in accordance with manufacturer's recommendations to suit offset.
- .3 Inner hose: stainless steel corrugated.
- .4 Braided wire mesh stainless steel outer jacket.
- .5 Diameter and type of end connection: as indicated.
- .6 Operating conditions:
 - .1 Working pressure: 1034 kPa (150 psi).
 - .2 Working temperature: 250°C (482°F).
 - .3 To match system requirements.

2.2 ANCHORS AND GUIDES

- .1 Anchors:
 - .1 Provide as indicated.
- .2 Alignment guides:
 - .1 Provide as indicated.
 - .2 To accommodate specified thickness of insulation.
 - .3 Vapour barriers, jackets to remain uninterrupted.

2.3 EXPANSION COMPENSATORS (EXP)

- .1 Packless guided construction complete with multi ply stainless steel bellows.
- .2 Operating temperature (750°F).
- .3 Provide model H3 for steel pipe and model HB for copper pipe.
- .4 Material to match piping system.
- .5 Acceptable materials:
Senior Flexonics

Part 3 Execution

3.1 INSTALLATION

- .1 Install expansion joints with cold setting, as indicated as instructed by Consultant. Make record of cold settings.
- .2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
- .3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

3.2 APPLICATION

- .1 Provide on all vibration isolated equipment.
- .2 Provide where requested by equipment manufacturers installation manuals.
- .3 Install in accordance with manufacturer's recommendations.
- .4 Provide expansion compensators (exp.) on radiation heating element exceeding 3.6 M (12' – 0") in length. Provide one expansion compensators on each length of return piping in cabinet.

3.3 THERMAL EXPANSION

- .1 Provide in long runs of heating mains exceeding 100 ft. in length.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.
- .3 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
- .4 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Submit manufacturer's product data for following items:
 - .1 Thermometers.
 - .2 Pressure gauges.
 - .3 Stop clocks.
 - .4 Syphons.
 - .5 Wells.

Part 2 Products

2.1 GENERAL

- .1 Design point to be at mid point of scale or range.
- .2 Ranges: suitable for application.

2.2 DIRECT READING THERMOMETERS

- .1 Industrial, variable angle type, liquid filled, 225 mm (9") scale length: to CAN/CGSB 14.4.
 - .1 Acceptable materials:
 - .1 Terice
 - .2 Winters 91T
 - .3 Wiess

2.3 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass or stainless steel.

2.4 PRESSURE GAUGES

- .1 115 mm (4 1/2"), dial type: to ANSI/ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.
 - .1 Acceptable materials:
 - .1 Winters
 - .2 Trerice
 - .3 Wiess
 - .2 Provide:
 - .1 Siphon for steam service.
 - .2 Snubber for pulsating operation.
 - .3 Diaphragm assembly for corrosive service.
 - .4 Gasketed pressure relief back with solid front.
 - .5 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

- .1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

- .1 Install in wells on all piping. Provide heat conductive material inside well.
- .2 Install in locations as indicated and on inlet and outlet of:
 - .1 Water heating and cooling coils.
 - .2 In other locations indicated.
- .3 Install wells as indicated only for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

- .1 Install in following locations:
 - .1 Suction and discharge of pumps.
 - .2 Upstream and downstream of PRV's.
 - .3 Upstream and downstream of control valves.
 - .4 Inlet and outlet of coils.
 - .5 In other locations as indicated.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

- .1 Install engraved lamicoid nameplates as specified in elsewhere identifying medium.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Submit shop drawings and product data for following items:
 - .1 All bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: to ANSI & ULC requirements
 - .2 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.
 - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 10 mm (3/8") UL listed
 - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.
- .3 Upper attachment structural: Suspension from upper flange of I-Beam.
 - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
 - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.
- .4 Upper attachment to concrete.
 - .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are not considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.
- .5 Shop and field-fabricated assemblies.
 - .1 Trapeze hanger assemblies: ASME B31.1.
 - .2 Steel brackets: ASME B31.1.
- .6 Hanger rods: threaded rod material to MSS SP-58.
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.

- .7 Pipe attachments: material to MSS SP-58.
 - .1 Attachments for steel piping: carbon steel.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for all piping.
 - .4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.
- .8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m² (13.12 lbs/ft²) density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m (10') span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm (12") long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

2.5 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.7 ROOF MOUNTED EQUIPMENT

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated.
- .2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.

2.8 OTHER EQUIPMENT SUPPORTS

- .1 From structural grade steel meeting requirements of structural steel section specified herein.
- .2 Submit structural calculations with shop drawings.

2.9 MANUFACTURER

- .1 Acceptable materials:
 - .1 Grinnell
 - .2 Anvil
 - .3 Myatt
 - .4 Taylor

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to be to industry standards.
 - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 HANGER SPACING

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').
- .4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

- .5 **Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.**

- .6 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

- .7 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

3.3 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Do "NOT" support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

3.4 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.
- .2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.

- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Provide separate shop drawings for each isolated system complete with performance and product data.

Part 2 Products

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation to be as indicated.
- .2 To be of the same manufacturer for all isolation.
- .3 Acceptable materials:
Korfund
Vibro-Acoustics
Vibron

2.2 ELASTOMERIC PADS

- .1 Type EP1 - neoprene waffle or ribbed; 10 mm (3/8") minimum thick; 50 durometer; maximum loading 350 kPa (50.8 psi).
- .2 Type EP2 - rubber waffle or ribbed; 10 mm (3/8") minimum thick; 30 durometer natural rubber; maximum loading 415 kPa (60.2 psi).
- .3 Type EP3 - neoprene-steel-neoprene; 10 mm (3/8") minimum thick neoprene bonded to 1.5 mm (16 gauge) steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa (50.8 psi).
- .4 Type EP4 - rubber-steel-rubber; 10 mm (3/8") minimum thick rubber bonded to 1.5 mm (16 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa (60.2 psi).
- .5 Acceptable materials:
Korfund
IAC Acoustics
Vibro-Acoustics
Vibron

2.3 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of [60]; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

Acceptable materials:

Vibro-Acoustics

Korfund

IAC Acoustics

Vibron

2.4 SPRINGS

- .1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0.
- .3 Cadmium plate for all installations.
- .4 Colour code springs.

2.5 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; leveling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg (2100 lbs) maximum.
- .6 Performance: as indicated.
- .7 Acceptable materials:
 - Korfund
 - IAC Acoustics
 - Vibron
 - Vibro-Acoustics

2.6 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, molded with rod isolation bushing, which passes through hanger box.

- .3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.
- .4 Performance as indicated.
- .5 Acceptable materials:
 - Vibron
 - IAC Acoustics
 - Korfund
 - Vibro-Acoustics

Part 3 Execution

3.1 INSTALLATION

- .1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:
 - .1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.
 - .2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.2 SITE VISIT

- .1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.
- .2 Provide Consultant with notice 24 h in advance of visit.
- .3 Make adjustments and corrections in accordance with written report.

3.3 TESTING

- .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.
- .2 Vibration measurements shall be taken for equipment-listed below:
- .3 Provide Consultant with notice 48 h in advance of commencement of tests.

- .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.
- .5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 Canadian Standards Association (CSA).
 - .1 Natural Gas and Propane Installation Code CSA B149.1.
- .4 National Fire Protection Association
 - .1 NFPA 13, Installation of Sprinkler Systems.
 - .2 NFPA 14, Standpipe and Systems.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with General Requirements.
- .2 Product data to include paint colour chips, all other products specified in this section.

1.3 PRODUCT LITERATURE

- .1 Submit product literature in accordance with General Requirements.
- .2 Product literature to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

- .2 Construction:
 - .1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

- .3 Sizes:

- .1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")

- .2 Use maximum of 25 letters/numbers per line.

- .4 Locations:

- .1 Terminal cabinets, control panels: Use size #5.
 - .2 Equipment in Mechanical Rooms: Use size #9.
 - .3 Roof top equipment: use size #9.
 - .4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES

- .1 Colours:

- .1 Black letters, yellow background.

- .2 Construction:

- .1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.

- .3 Locations:

- .1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

2.4 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Consultant.

- .4 Upon completion of this project all references to room names and numbering shall be to the Owner's requirements which may or may not be the numbering system used on the drawings. Each contractor shall verify the proper numbering scheme to be used prior to project completion.
- .5 All equipment shall be identified in sequence from the existing equipment and "NOT" duplicate numbering of equipment.

2.5 PIPING SYSTEMS GOVERNED BY CODE

- .1 Identification:
 - .1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.
 - .2 Sprinklers: To NFPA 13.
 - .3 Standpipe and hose systems: To NFPA 14.

2.6 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .3 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.
 - .2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.
 - .3 Use double-headed arrows where flow is reversible.
- .4 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).

.6 Colours and Legends:

- .1 Where not listed, obtain direction from Consultant.
- .2 Colours for legends, arrows: To following table:
- | | | |
|--------------------|---------|---------|
| Background colour: | Legend: | Arrows: |
| Yellow | White | Black |
| Green | White | Black |
| Red | White | Black |

.7 Pictograms:

- .1 **Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.**

.8 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR	
	MARKING	LEGEND
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Condensate	Green	CONDENSATE
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID

2.7 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.8 VALVES, CONTROLLERS

- .1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.
- .3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

2.9 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

- .3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

2.10 LANGUAGE

- .1 Identification to be in English.

Part 3 Execution

3.1 TIMING

- .1 Provide identification only after all painting specified has been completed.

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection
 - .1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.

1.2 QUALIFICATIONS OF TAB AGENCIES

- .1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:
 - .1 Air Audit Inc.
110 Turnbull Court, Unit 11
Cambridge, Ontario
N1T 1K6
(519) 740-0871
 - .2 Air Velocities Control Ltd.
100 Premium Way
Mississauga, Ontario
L5B 1A2
(905) 279-4433
 - .3 Flowset Balancing Ltd.
431 Willis Dr.
Oakville, Ontario
L6L 4V6
(416) 410-9793
 - .4 Air Adjustments & Balancing Inc.
P.O. Box 176,
Schomberg, Ontario
L0G 1T0
(416) 254-3004

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average (95% design) and low (75% of design) loads using actual or simulated loads. TAB contractor to perform equipment evaluation upon start up and once during each season in the first year of operation.

- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions. Confirm all equipment interlocks and functions of associated systems.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and temperatures. Refer to BAS for system operating functions.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 DYNAMIC BALANCING

- .1 This project includes dynamic balancing for the hydronic system. Additional details for dynamic system balancing are provided on drawings.

1.6 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems. Co-ordinate with other trades to ensure all systems are interlocked as indicated elsewhere prior to TAB.

1.7 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.
- .4 During construction indicate all tolerances of piping, ductwork etc conforms to specifications.

1.8 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in the Mechanical Division.

1.9 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.10 START OF TAB

- .1 Notify Consultant in writing 3 days prior to start of TAB.
- .2 Start TAB only when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weather-stripping, sealing, caulking.
 - .3 All pressure, leakage, other tests specified elsewhere in the Mechanical Division.
 - .4 All provisions for TAB installed and operational.
 - .5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 All outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.
 - .7 Control valves are properly piped.
 - .8 Coils and radiation are properly piped.
 - .9 BAS in operation.

1.11 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 10%, minus 5%.
 - .2 Hydronic systems: plus or minus 10%.

1.12 ACCURACY TOLERANCES

- .1 Measured values to be accurate to within plus or minus 2% of actual values.

1.13 INSTRUMENTS

- .1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.14 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
 - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.16 TAB REPORT

- .1 Format to be in accordance with NEBB, AABC, or SMACNA.
- .2 TAB report to show all results in SI or imperial units as indicated on plans and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit copy of TAB Report to consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.17 VERIFICATION

- .1 All reported results subject to verification by Consultant.
- .2 Provide manpower and instrumentation to verify up to 30% of all reported results.
- .3 Number and location of verified results to be at discretion of Consultant.
- .4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.18 SETTINGS

- .1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.
- .2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.19 COMPLETION OF TAB

- .1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.20 AIR SYSTEMS

- .1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:
 - .1 Air handling systems and equipment
 - .2 Duct testing to SMACNA standards.
- .3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.
- .4 Quality assurance: Perform TAB under direction of qualified supervisor.
- .5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.
 - .2 At each controller, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

1.21 HYDRONIC SYSTEMS

- .1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.
- .2 Standard: TAB to be the most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .3 Do TAB of all systems, equipment, components, controls specified in Mechanical Division including but not limited to hydronic equipment testing.
- .4 Qualifications: personnel performing TAB to be current member in good standing of NEBB.
- .5 Quality assurance: perform TAB under direction of qualified supervisor.
- .6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power voltage, noise, vibration.

- .7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of each heat exchanger (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.
 - .2 At each controller, controlled device.
- .8 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of each primary and secondary loop (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water).

1.22 DUCT LEAKAGE TESTING

- .1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 NFPA 13 latest edition, Installation of Sprinkler Systems.
- .3 Ontario Fire Code.
- .4 Ontario Building Code.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements in accordance with NFPA 13, working plans and design requirements.
- .2 Shop drawings shall be approved by authority having jurisdiction prior to submission
- .3 Submit to consultant for general review and information only.
- .4 Submitted drawings shall be reproducible. Do not submit marked up prints.

1.3 SAMPLES

- .1 Submit samples in accordance with general requirements.
- .2 Submit samples of following:
 - .1 Each type of sprinkler head.
 - .2 Signs.

1.4 ENGINEERING DESIGN CRITERIA

- .1 Design system in accordance with Ontario Fire Marshall, local authority having jurisdiction, owner's underwriters as required, and NFPA 13, NFPA 20, and NFPA 45 using following parameters:
 - .1 To suit occupancy as indicated.
 - .2 Pipe size and layout: Hydraulic design.
 - .3 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with NFPA 13. Indicate location and flow on shop drawings.
 - .4 System zoning as indicated in accordance with NFPA 13.
 - .5 Provide complete drawings and calculations stamped by a qualified professional engineer registered in the Province of Ontario.
 - .6 Professional Engineer shall provide on site review and certification for local building code review.
- .2 System shall be approved by Ontario Fire Marshall, local authority, and owner's underwriter prior to shop drawing submission.

1.5 COMMISSIONING & INTEGRATED TESTING OF FIRE PROTECTION & LIFE SAFETY SYSTEMS

- .1 Sprinkler contractor to perform services with the Fire Commissioning Agent (FCA) to meet their requirements for administration, verification, and final sign-off.
- .2 The Fire Commissioning Agent (FCA) is being retained by the electrical contractor, however; this contractor's work to satisfy the FCA requirements shall be included in the tender price.
- .3 The sprinkler contractor at a minimum must include for:
 - .1 Providing FCA all documentation of design and shop drawings.
 - .2 Provide documents for sequence of operation and maintenance of system.
 - .3 Movement of all valves and accessories to confirm Alarm/Supervisory/Trouble at the fire panel.
 - .4 Create flow at all initiating devices to verify detection at the fire panel.
 - .5 Testing and operation of any fire pumps.
 - .6 Other items that may be requested by the FCA.
 - .7 Re-commissioning of any items that may have failed.
 - .8 Putting the system back into proper operation after tests are completed.
- .4 All work to be performed in accordance with NFPA 3 2010 Edition. Special consideration to be given to Figure A3.3.16 (b) for Sequence of Operation Form required to be completed in conjunction with the FCA and submitted to the consultant's prior to occupancy.
- .5 The work to be performed by this contractor is also described in NFPA 3 table A.5.1.1 as labelled "Construction Stage" and "Occupancy Stage".

1.6 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

1.7 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with general requirements.
- .2 Provide spare sprinklers and tools as required by NFPA 13.

1.8 QUALIFICATIONS

- .1 Contractor to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project.

1.9 PERMITS AND FEES

- .1 Obtain and pay for all permits, fees, and inspections as required by authority having jurisdiction.

1.10 EQUIPMENT

- .1 ULC listed and labeled.

1.11 STORAGE

- .1 Store in original packaging with manufacturers' labels and seals intact.
- .2 Store in dry secure location.
- .3 Damaged material and/or equipment shall be replaced.

Part 2 Products

2.1 PIPE, FITTINGS, AND VALVES

- .1 Pipe and Fittings:
 - .1 25 mm (1"): Schedule 40 steel pipe with screwed fittings.
 - .2 32 mm (1¼") to 50 mm (2"):
 - .1 Schedule 40 steel pipe with screwed fittings or,
 - .2 Schedule 10 steel pipe with roll grooved fittings.
 - .3 65 mm (2½") and larger: Schedule 10 steel pipe with roll grooved fittings.
- .2 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed ends, OS&Y gate.
 - .3 NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve.
 - .4 Swing check valves.
 - .5 Ball drip.
- .3 Pipe hangers:
 - .1 ULC listed for fire protection services.
- .4 End switches:
 - .1 Provide on all isolating valves.
 - .2 Coordinate voltage and location with fire alarm contractor.
- .5 Flow switches:
 - .1 Provide where indicated and required.
 - .2 Coordinate voltage and location with fire alarm contractor.

2.2 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Indicate type and location of sprinkler heads on drawings. Co-ordinate sprinkler heads location with other trades.
- .3 Locate sprinkler heads in acoustic tile ceiling in centre of tile.
- .4 Provide sprinkler heads as indicated.
- .5 Provide sprinkler heads under all equipment/ductwork over 1200 mm wide.

2.3 SUPERVISORY SWITCHES

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves:
 - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Flow switch type:
 - .1 With normally open and normally closed contacts and supervisory capability.
- .4 Pressure alarm switch:
 - .1 With normally open and normally closed contacts and supervisory capability.

2.4 FIRE DEPARTMENT CONNECTION (IF APPLICABLE)

- .1 To NFPA 13 and ULC listed, siamese type, location as indicated. Thread specifications to be compatible with local fire department.
- .2 Polished chrome plated recessed with identifying sign cast on plate. Threaded metal caps and chains.

2.5 PRESSURE GAUGES

- .1 ULC listed
- .2 Shall have maximum limit of not less than twice normal working pressure at point where installed.

2.6 SIGNS

- .1 Signs for control drain and test valves: to NFPA 13.
- .2 Provide exterior signage for Fire Department connection. Location of signage and text shall be to the approval of the local authority having jurisdiction.

2.7 SPARE PARTS CABINET

- .1 For storage of maintenance materials, spare sprinkler heads and special tools.
- .2 Include all types and temperature ratings of sprinkler heads installed.
- .3 Construct to sprinkler head manufacturers standard.
- .4 Install where directed on site or next to alarm valve.

2.8 DOUBLE CHECK VALVE ASSEMBLY (IF APPLICABLE)

- .1 The double check backflow preventer shall be ASSE 1015 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM.
- .2 The checks shall be accessible for maintenance without removing the device from the line.

- .3 Complete with supervisory switches for connection and monitoring by the fire alarm.
- .4 Install to manufacturer's requirements and not higher than 1200 mm (4'-0") AFF.
- .5 Acceptable materials:
 - .1 Watts 709 2½" - 10"
 - .2 Wilkins 950 2" - 10", 350 4" - 6"
 - .3 Conbraco 40-100 Series

2.9 INSPECTORS TEST CONNECTIONS

- .1 Provide where indicated and to requirements of local authority.
- .2 Discharge to building exterior to acceptance of consultant.
- .3 Provide suitable signage to satisfaction of authority having jurisdiction and consultant.

2.10 DOCUMENTATION

- .1 Prepare documentation as indicated.
- .2 Provide documentation based on tender documents. Coordinate sprinkler drawings with all trades.
- .3 Provide one hard copy and one electronic copy of As Built drawings acceptable to consultant prior to final payment.

Part 3 Execution

3.1 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and FC 403.
- .2 Install excess pressure pump across alarm valve in accordance with manufacturer's instructions.
- .3 Pipe a bypass complete with indicating valve, between Fire department connection and sprinkler main downstream of DCVA. Bypass shall be sized to allow flow test of system demand as per NFPA 13 forward flow test thru the backflow preventor.
- .4 Testing to be witnessed by authority having jurisdiction.
- .5 Space hangers and support of sprinkler piping in accordance with N.F.P.A. regulations.
- .6 Hydrostatically test systems at 350kPa in excess of normal working pressure, but not less than 1.4 MPA for two hours without loss under supervision of authority having jurisdiction and NFPA requirements.
- .7 Provide hydraulic pump, temporary connections and labour required for tests.
- .8 Protect exposed work, in accordance with 'Painting' section.
- .9 Do not cover or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction.
- .10 Adjust equipment to satisfaction of authority having jurisdiction and consultant.

- .11 Protect equipment during painting. Replace damaged and painted components.
- .12 Co-ordinate the sprinkler piping and equipment with that of other trades on the job. Mains and branches shall be run so as not to interfere with building's structure, mechanical, or electrical installations. Branch piping above ceilings is to run in joist space or minimum 300 mm above ceiling. Provide drops at head locations only. All exposed piping to run in joist space.
- .13 Guarantee that the systems and equipment be installed in accordance with all Local and Provincial by-laws and the rules and regulations of the Insurance Underwriters and the Building Code of Ontario.
- .14 Provide a flow test for each system on the remote inspectors test connection using methods approved by the local fire department and local water commission. Report the test results in writing to the consultant.

3.2 WATER FLOW TEST

- .1 Provide a flow test to approval of local fire department and local water commission at nearest fire hydrant adjacent to building to determine water flow rate and pressure. Provide written test results with shop drawing submission.
- .2 Provide a forward flow test thru the bypass to prove system demand can be provided thru the backflow preventer.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
 - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 CAN/ULC-S702, Mineral Fiber Thermal Insulation for Buildings.
 - .3 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.
 - .4 CGSB 51-GP-52Ma-[89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM).
 - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations.
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have expertise and be trained in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52 Ma.
 - .3 Maximum "k" factor: to ASTM C553.
- .4 Manufacturers:
 - .1 All materials must be supplied by the same manufacturer.

- .2 Acceptable Materials:
 - .1 Johns Manville
 - .2 Fibreglass Canada
 - .3 Knauf
 - .4 Manson
 - .5 Roxul

2.3 JACKETS

- .1 Canvas:
 - .1 220 g/m² (0.0451 lb/ft²) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
 - .2 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 g/m² (0.0451 lb/ft²) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.
- .6 Contact adhesive: quick-setting Duro Dyne 1A-22 or equal.
- .7 Canvas adhesive: washable.
- .8 Tie wire: 1.5 mm (16 gauge) stainless steel.
- .9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation
- .10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers in accordance with general requirements.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.
- .6 Provide rigid insulation for exposed ductwork.

3.3 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thickness' conform to following table:

Application	Type	Thickness
Rectangular supply air ducts	C-1	25 mm (1")
Supply, return and exhaust ducts exposed (visible) in space being served	none	
Outdoor air intake ductwork and plenums	C-1	50 mm (2")
Exhaust plenums dampers and louvres	C-1	25 mm (1")
Interior acoustically lined ducts	none	
Last 1.5m of Exhaust duct	C-1	25 mm (1")

- .2 Exposed round ducts 600 mm (24") and larger, smaller sizes where subject to abuse:
 - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

- .3 Finishes: Conform to following table:

Application	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed	Canvas	Canvas

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
 - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
 - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have expertise and be trained in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52 Ma.
 - .3 Maximum "k" factor: to ASTM C553.
- .4 Type A-3: Flexible unicellular tubular elastomer.
 - .1 Insulation to ASTM C553 with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52 Ma.
 - .3 Maximum "k" factor: to ASTM C553.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

- .5 Materials:
 - .1 All materials must be supplied by the same manufacturer.
 - .2 Acceptable Materials:
 - Fibreglass Canada
 - Knauf
 - Manson
 - Pittsburg Corning

2.3 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 **Tie wire: 1.5mm (16 gauge) diameter stainless steel.**
- .5 **Bands: Stainless steel, 20 mm (3/4") wide, 0.5 mm (26 gauge) thick.**

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 To ASTM C553.
 - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m² (0.062 lb/ft²).

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: white.
 - .3 Minimum service temperatures: -20°C (-4°F).
 - .4 Maximum service temperature: 65°C (150°F).
 - .5 Moisture vapour transmission: 0.02 perm.

- .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
- .2 Aluminum:
 - .1 To ASTM B 209M.
 - .2 Thickness: 0.50 mm (26 gauge) sheet.
 - .3 Finish: Smooth.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.
 - .5 Fittings: 0.50 mm (26 gauge) thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 20 mm (3/4") wide, 0.50 mm (26 gauge) thick at 300 mm (12") spacing.

2.9 CAULKING FOR JACKETS

- .1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers' instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
- .2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: As per adjacent insulation.

3.4 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 Install insulator and jackets to applicable TIAC codes.
- .3 Insulate ends of capped piping with type and thickness indicated for capped service.
- .4 Thickness of insulation to be as listed in following table.
 - .1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Condensate	A-1	40 (1½")	40 (1½")	50 (2")	50 (2")	50 (2")
Hot Water Heating	A-1	40 (1½")	50 (2")	50 (2")	50 (2")	50 (2")
Refrigerant piping	A-3	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")

- .5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Concealed indoors	N/A	PVC
Exterior refrigerant piping	Aluminum	Aluminum

- .6 Connection: To appropriate TIAC code.
- .7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 HVAC Water Treatment Section.

1.2 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian Standards Association (CSA).
 - .1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- .3 American National Standards Institute (ANSI).
 - .1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
 - .2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
- .4 American Society for Testing and Materials (ASTM).
 - .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM A536, Specification for Ductile Iron Castings.
 - .4 ASTM B61, Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .5 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate on manufacturers catalogue literature the following:
 - .1 Piping
 - .2 Valves
 - .3 Accessories

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
 - .1 NPS 150 mm (6") and smaller: Schedule 40.
- .2 Final connection to copper heating elements.
 - .1 Type "L" copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

2.2 PIPE JOINTS

- .1 NPS 50 mm (2") and under: screwed fittings with pulverized lead paste.
- .2 NPS 65 mm (2½") and over: welding fittings and flanges to CSA W47.1.
- .3 Flanges: plain or raised face, slip-on.
- .4 Flange gaskets: suitable for hydronic heating up to 110°C (220°F).
- .5 Pipe thread: taper.
- .6 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ANSI/ASME B16.1, Class 125.
 - .2 Steel: to ANSI/ASME B16.5.
- .3 Butt-welding fittings: steel, to ANSI/ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M and ANSI/ASME B16.3.

2.4 VALVES MANUFACTURERS

- .1 All valves shall be of commercial grade and of same manufacturer.
- .2 Acceptable Manufacturers:
 - .1 Newman Hattersley Canada Ltd.
 - .2 Jenkins/Crane
 - .3 Milwaukee
 - .4 Toyo
 - .5 Kitz

2.5 VALVES

- .1 Connections:
 - .1 NPS 50 mm (2") and smaller: screwed ends.
 - .2 NPS 65 mm (2 ½") and larger: flanged ends.

-
- .2 Gate valves: Application: Isolating equipment, control valves, pipelines:
 - .1 NPS 50 mm (2") and under:
 - .1 Mechanical Rooms: Class 125, rising stem, solid wedge disc. Jenkins 810J.
 - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc. Jenkins 310J.
 - .2 NPS 65 mm (2 1/2") and over:
 - .1 Mechanical Rooms:
 - .1 Rising stem, solid wedge disc, bronze trim. Jenkins 454J.
 - .1 Operators: handwheel.
 - .2 Non-rising stem, solid wedge disc, bronze trim. Jenkins 452J.
 - .1 Operators: handwheel.
 - .3 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
 - .1 NPS 65 mm (2 1/2") and over: Flanged ends. Jenkins FIG 2232 ELJ.
 - .4 Globe valves: Application: Throttling, flow control, emergency bypass:
 - .1 NPS 50 mm (2") and under:
 - .1 With PTFE disc, as specified. Jenkins 106BJ. Bronze.
 - .2 NPS 65 mm (2 1/2") and over:
 - .1 With solid bronze disc, bronze trim, cast iron body. Jenkins 2342.
 - .5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.
 - .6 Swing check valves:
 - .1 NPS 50 mm (2") and under:
 - .1 Class 150, swing, with PTFE disc, as specified. Bronze. Jenkins 4475TJ.
 - .2 NPS 65 mm (2 1/2") and over:
 - .1 Flanged or Grooved ends, Bronze trim, Cast Iron: Gate, Globe, Check. Jenkins 587J.
 - .7 Ball valves:
 - .1 NPS 80 mm (3") and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
 - .3 Connections:
 - .1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .2 NPS 65 mm (2½") and over flanged ends.
 - .4 Stem: stainless steel tamperproof ball drive.
 - .5 Ball and seat: replaceable stainless steel solid ball and teflon seats.
 - .6 Operator: removable lever handle.
 - .7 Extended handles on chilled water valves.

- .8 Full port.
- .9 Jenkins 201SJ.

2.6 BALANCING VALVES

- .1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.
- .2 Size 65 mm (2 1/2") to larger: Cast iron body, raised flange connections, glove style with brass plug.
- .3 Differential pressure readout ports with internal EPT inserts and check valves, 6 mm (1/4")NPT tapped drain/purge ports, memory stop and calibrated nameplate.
- .4 Acceptable materials:
 - .1 Tour & Anderson (match Victaulic pipe section)

2.7 AUTOMATIC AIR VENT

- .1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kpa (125 psi) working pressure.
- .2 Float: solid material suitable for 115°C (240°F) working temperature.
- .3 Plastic vents are not acceptable.
- .4 Acceptable materials:
 - .1 Maid-O-Mist No. 67
 - .2 Spirax Sarco

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 Installation shall be by a licensed pipe fitter.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .4 Slope piping in direction of drainage and for positive venting.
- .5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .8 Assemble piping using fittings manufactured to ANSI standards.

- .9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

3.2 VALVE INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install butterfly valves on chilled water and condenser water lines only.
- .3 Install gate or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .4 Install globe valves for balancing and in by-pass around control valves as indicated.
- .5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .6 Provide swing check valves in horizontal lines as indicated.
- .7 Install chain operators on valves NPS 65 mm (2 1/2") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.

3.3 AIR VENTS

- .1 Install at high points of systems.
- .2 Install ball valve on automatic air vent inlet.
- .3 Extend vent lines in Mechanical Room with screwdriver stop at 1.8 m AFF.

3.4 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated and as follows:
 - .1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc).
 - .2 On return side of all water or glycol cooling coils.
 - .3 On return side of all reverse return piping loops and/or branch circuits.
- .2 Install to manufacturers requirements.
- .3 Valve size shall be one trade size smaller than piping.
- .4 Refer to Testing Adjusting and Balancing Section for applicable procedures.

3.5 FILLING OF SYSTEM

- .1 Refill system with clean water adding water treatment as specified.
- .2 Co-ordinate filling of system with HVAC water treatment contractor.
- .3 Drain and vent all new and existing piping, radiation, etc for a complete operable system.

3.6 TESTING

- .1 Test system in accordance with Mechanical General Requirements Section.
- .2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair any leaking joints, fittings or valves.

3.7 FLUSHING AND CLEANING

- .1 Procedure:
 - .1 Flushing and cleaning should only take place after successful piping pressure testing.
 - .2 Terminal device (reheat coils, heat pumps, perimeter radiation, etc.), air handling unit coils and their associated control and balancing valves should be bypassed during the preliminary flushing and cleaning process.
 - .3 Instruments such as flow meters, flow metering valves and orifice plates should only be installed after flushing and cleaning.
- .2 Timing:
 - .1 The overall construction schedule identifies piping flushing and cleaning with realistic time allotments.
 - .2 The mechanical contractor is required to provide a detailed report outlining the processes and procedures for flushing and cleaning per piping system at least 4 to 6 weeks in advance of work.
 - .3 As a minimum, at least one piping flushing and cleaning procedure shall be witnessed, by the consultant and/or commissioning agent.
- .3 The mechanical contractor shall to utilize a qualified water treatment specialist to supervise the flushing and cleaning process and provide the certified water analysis report certifying that the piping systems are clean.
- .4 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.
- .5 Flush and clean new piping system in presence of Consultant.
- .6 Flush after pressure test for a minimum of 4 hrs.
- .7 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.
- .8 Thoroughly flush all new mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.
- .9 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.
- .10 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.
- .11 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

- .12 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .13 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.
- .14 Repeat system drain and flush as often as necessary to have a clean system.
- .15 Disposal of cleaning solutions to be approved by authority having jurisdiction.
- .16 Isolate new piping system from existing system as required for system cleaning.
- .17 After hydronic system is cleaned, refill with clean water and chemical as per chemical supplier treatment.**

3.8 EXISTING SYSTEM DRAINAGE

- .1 Drain existing hot hydronic system as required to facilitate system renovations.
- .2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute (ANSI).
 - .1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
 - .2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
 - .3 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
 - .4 ANSI/ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
 - .5 ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM A536, Specification for Ductile Iron Castings.
 - .4 ASTM B61, Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 SCOPE

- .1 Rolled Grooved piping is permitted in boiler room only. No rolled grooved piping shall be installed outside of central boiler room.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate on manufacturers' catalogue literature the following:
 - .1 Piping
 - .2 Valves
 - .3 Accessories

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

- .1 Victaulic.
- .2 No alternates.

2.2 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
 - .1 NPS 40 mm (1½") to 150 mm (6"): Schedule 40.
- .2 Final connection to copper heating elements.
 - .1 Type "L" copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

2.3 PIPE JOINTS

- .1 NPS 32 mm (1¼") and under: screwed fittings with pulverized lead paste (see 23 21 13).
- .2 Rolled grooved with Grade E (EPDM) gaskets.

2.4 FITTINGS

- .1 Rolled grooved fittings:
 - .1 Couplings shall be Victaulic Style 07 Zero-Flex with angled bolt pad design and must be installed with Grade E (EPDM) gaskets.
- .2 Flanges: Victaulic Style 741.
- .3 Hole Cut Products and Branch Connections:
 - Victaulic Style 920 Mech. Tee
 - Victaulic Style 923 Vic-Let Outlet
 - Victaulic Style 924 Vic-O-Well Thermometer Outlet

2.5 VALVES

- .1 Connections:
 - .1 NPS 40 mm (1½") and larger: rolled grooved ends.
- .2 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
 - .1 NPS 40 mm (1½") to 300 mm (12"): Victaulic Vic 300
- .3 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.

- .4 Check valves:
 - .1 NPS 50 mm (2") and under:
 - .1 Class 150, swing, with PFTE disc, as specified.
Bronze. Jenkins 4475TJ.
- .5 Ball valves:
 - .1 NPS 80 mm (3") and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
 - .3 Connections:
 - .1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .2 NPS 65 mm (2½") and over flanged or grooved ends.
 - .4 Stem: stainless steel tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel solid ball and teflon seats.
 - .7 Operator: removable lever handle.
 - .8 Extended handles on chilled water valves.
 - .9 Full port.
 - .10 Jenkins 201SJ.
- .6 Strainers:
 - .1 Wye Strainer: NPS 50 mm (2") and over: Victaulic 732 Wye Type Vic-Strainer.

2.6 **BALANCING VALVES**

- .1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.
- .2 Size 65 mm (2 1/2") to larger: Victaulic Tour Anderson Series 789.
- .3 Differential pressure readout ports with internal EPT inserts and check valves, 6 mm (¼")NPT tapped drain/purge ports, memory stop and calibrated nameplate.
- .4 Acceptable materials:
 - .1 Tour & Anderson
 - .2 No alternates.

2.7 **AUTOMATIC AIR VENT**

- .1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kPa (125 psi) working pressure.
- .2 Float: solid material suitable for 115°C (240°F) working temperature.
- .3 Acceptable materials:
 - .1 Honeywell EA122 series with integral shutoff
 - .2 Spirax Sarco

2.8 EXPANSION JOINTS AND FLEXIBLE CONNECTIONS

- .1 Application: to suit motion.
- .2 Minimum length in accordance with manufacturers recommendations to suit offset.
- .3 Victaulic Style 150 Mover slip-type expansion joint. The expansion joint shall be installed with Style 07 Zero-Flex couplings.

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 Installation shall be by a licensed pipe fitter.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .4 Slope piping in direction of drainage and for positive venting.
- .5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .8 Assemble piping using fittings manufactured to ANSI standards.
- .9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

3.2 PIPE END PREPARATION

- .1 Outside diameter of grooved pipe shall not vary more than the tolerance approved. For IPS pipe, the maximum allowable tolerance from square cut ends is 0.030" for ¾" through 3½", 0.045" for 4" through 6"; and 0.060" for sizes 8" O.D. and above; measured from true square line. Any internal or external weld bead or seams in the groove area must be ground smooth and flush. The end of the pipe internally must be cleaned of any material that might interfere with or damage the internal roll.
- .2 Pipe surface shall be free from indentations and projections from the end of the pipe to the groove, to provide a leak tight seat for the gasket. All loose paint, scale, dirt, chips, grease and rust must be removed. It is the recommendations of Victaulic that the pipe be square cut. Beveled pipe may be used provided the wall thickness is standard wall (ANSI B36.10) or less and the bevel meets ANSI B16.25.
- .3 Bottom of the groove must be free of loose dirt, chips, rust and scale that may interfere with proper coupling assembly.

- .4 Groove dimensions shall conform to standard roll groove specifications as published by Victaulic.
- .5 Pipe shall be grooved using Victaulic roll grooving system with track enhanced grooving rolls.

3.3 “ZERO-FLEX” COUPLING INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Apply a thin coat of Victaulic Lubricant to gasket lips and outside of gasket.
- .3 Place gasket over pipe end, being sure lip does not overhang pipe end.
- .4 Align and bring two pipe ends together and slide gasket into position centered between the grooves on each pipe. No portion of the gasket shall extend into the groove on either pipe.
- .5 Loosely assemble all segments leaving one nut and bolt off to allow for “swing-over” feature.
- .6 With one nut and one bolt removed, use “swing-over” feature to position housings over gasket and into position into the grooves on both pipes.
- .7 Remaining bolt shall be inserted. Bolt track head must engage into housing recess.
- .8 Nuts shall be tightened alternately and equally and must maintain metal-to-metal contact at the angle bolt-pads. Tighten securely to assure a rigid joint. Torque to manufacturer’s recommendation.

3.4 “REDUCING” COUPLING INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Gasket must be thoroughly lubricated.
- .3 Place large opening of the gasket over the larger pipe ends until the Assembly Washer touches the pipe end.
- .4 Align the pipe centerlines and insert the smaller pipe end in the gasket. Assembly washer provided by Victaulic shall be used.
- .5 Coupling housings shall be positioned over the gasket into the groove on each pipe.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equal until housing bolt pads are firmly together – metal-to-metal.

3.5 “OUTLET” COUPLING INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.

- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Gasket must be thoroughly lubricated.
- .3 Gasket shall be placed on one pipe end so the lips on one side cover the area between the pipe end and the groove. The gasket must not overlap the groove. The pipe ends shall be d to touch the reinforcement ribs inside the gasket.
- .4 Bring mating pipe or fitting into position and insert into gasket. The gasket shall not overlap the groove, but fully cover the pipe end.
- .5 Housings shall be placed over the gasket and the housing keys must engage into the grooves. Ample lubricant shall be applied to the gasket outlet neck and the upper housing interior.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equally until housing bolt pads are firmly together – metal-to-metal.

3.6 VICTAULIC “FLANGE ADAPTOR” INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade.
- .3 Victaulic Flange adaptor shall be opened fully and hinged flange shall be placed around the grooved pipe end with the circular key section locating into the groove.
- .4 Standard bolt shall inserted through the mating holes of the Vic-Flange adaptor to secure firmly in the groove.
- .5 Gasket shall be fully lubricated and pressed into the cavity between the pipe O.D. and flange recess.
- .6 Standard flange bolt shall be place in the hinge hole (opposite the lock bolt) and the bolt assembly shall be directed to mate with the adjoining flange. Remaining flange bolts shall be added and tightened evenly until faces contact firmly.
- .7 Where Vic-Flange adaptors do not mate to a hard smooth surface, Victaulic Flange Washers must be used.

3.7 MECHANICAL-T OUTLET INSTALLATION

- .1 Holes must be drilled.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade.
- .3 In preparation for assembly, one nut and bolt shall be removed from the housing. The other nut and bolt shall be loosened until it is flush with the nut and bolt. Remove the tape and lift the gasket from the mechanical-T outlet.
- .4 Victaulic lubricant shall be applied to all surfaces of the gasket and the gasket shall be properly repositioned into the housing using alignment tabs.

- .5 When assembling the coupling, the lower housing shall be rotated 90 degrees away from the upper housing. Place the upper, or outlet section on to the face of the pipe in line with the outlet hole. The lower section shall then be rotated around the pipe to close the two halves. The locating collar must be in the outlet hole.
- .6 Insert bolt and apply nut. Oval neck must engage in recess of the housing.
- .7 Nuts shall be tightened alternately and equally until the housing is in complete surface contact in the gasket pocket area and the assembly is rigid. **Nuts must be tightened to 30 ft. (S/921) and 50 ft. (S/920 and 929)** with even gaps between the bolt pads.
- .8 Where mechanical-T are used as transition pieces between two runs, they must be assembled onto the runs before the branch connections are made.

3.8 VIC-LET STRAPLESS OUTLET & VIC-O-WELL STRAPLESS THERMOMETER & PRESSURE GAUGE INSTALLATION

- .1 Holes must be drilled.
- .2 Do not use for branch piping connections where size may not be available. Use first available size and reducer.
- .3 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Victaulic lubricant shall be applied to exposed gasket sealing lip.
- .4 Vic-Let outlet toe shall align with pipe. Tilt toe into the hole and drop into the pipe. The Vic-Let outlet must be positioned with the heel inside the pipe.
- .5 Collar shall be held in position while nut is being hand tightened. Nut shall then be wrench tightened until collar deforms to contact pipe all around. Maintain collar/gasket alignment to prevent gasket pinching. Do not exceed 200 ft.lbs. Vic-Let outlet shall not be reused after initial installation.

3.9 ROUST-A-BOUT PLAIN END PIPE COUPLING INSTALLATION

- .1 Pipe shall be marked 1" from the end.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Apply a thin coat of Victaulic Lubricant to gasket lips and outside of gasket.
- .3 Place gasket over pipe end, being sure lip does not overhang pipe end.
- .4 The pipe shall be butt and held in position while slide the gasket back into position. The gasket must be centered between the marks.
- .5 Housings shall be placed over the gasket.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equally to standard torque specifications as published by Victaulic. Segments must be assembled with equal gaps between the bolt pads.

3.10 VALVE INSTALLATION

- .1 Install valves in upright position with stem above horizontal.
- .2 Install butterfly valves on chilled water and condenser water lines only.
- .3 Install butterfly or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .4 Install globe valves for balancing and in by-pass around control valves as indicated.
- .5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .6 Provide swing check valves in horizontal lines as indicated.
- .7 Install chain operators on valves NPS 65 mm (2 1/2") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.
- .8 Provide ball valves for glycol service.

3.11 AIR VENTS

- .1 Install at high points of systems.
- .2 Install isolating ball valve on automatic air vent inlet.

3.12 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated.
 - .1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc).
 - .2 On return side of all reverse return piping loops and/or branch circuits.
- .2 Install to manufacturers requirements.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.
- .4 Refer to Testing Adjusting and Balancing Section for applicable procedures.

3.13 FLUSHING AND CLEANING

- .1 Refer to Water Treatment Section 23 25 13.

3.14 FILLING OF SYSTEM

- .1 Refill system with clean water adding water treatment as specified.

3.15 TESTING

- .1 Test system in accordance with Mechanical General Requirements Section.
- .2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair any leaking joints, fittings or valves.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with General Requirements.
- .2 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.
- .3 Submit product data of pump curves for review showing point of operation.
- .4 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 SINGLE SUCTION CENTRIFUGAL PUMP

- .1 General: bronze fitted all iron pump complete with motor.
- .2 Base: common fabricated steel with drip rim and tapping for drain connection.
- .3 Volute: cast iron radially split, end suction, flanged suction and discharge, with drain plug and vent cock, suction and discharge pressure gauge tapings.
- .4 Impeller: bronze type, keyed drive with locking nut or screw.
- .5 Shaft: stainless steel with two point support,
- .6 Seal assembly: mechanical seal, oil lubricated.
- .7 Coupling: flexible self-aligning complete with guard.
- .8 Motor: EEMAC Class B, squirrel cage induction, continuous duty, drip proof, ball bearing, TEFC, maximum temperature rise 50°C (90°F) as indicated.
- .9 Inlet suction guide with strainers and triple duty valve.
- .10 Capacity: as indicated.
- .11 Design pressure: 1200 kPa (175 psi).
- .12 Acceptable material:
 - .1 Armstrong 4380
 - .2 Bell & Gossett
 - .3 Grundfos
 - .4 Taco

2.2 TRIPLE DUTY VALVES

- .1 Body: Cast iron with flanged connections. Straight pattern combination shut off, non slam check and calibrated balance valve.
- .2 Brass seat, bronze disk with EPDM seat insert.
- .3 Brass stem, stainless steel spring, teflon-graphite packing.
- .4 Brass readout valve.
- .5 Acceptable material:
 - .1 To match pump supplier.
 - .2 Size shall match system piping. Size shall be larger than pump outlet diameter.

2.3 SUCTION DIFFUSER

- .1 Body: cast iron with flanged connections.
- .2 Strainer: with built-in, disposable 1.19 mm (3/64") mesh, low pressure drop screen and NPS 25 mm (1") blowdown connection.
- .3 Permanent magnet particle trap.
- .4 Full length straightening vanes.
- .5 Pressure gauge tappings.
- .6 Adjustable support leg.
- .7 Acceptable Material:
 - .1 To match pump supplier.

Part 3 Execution

3.1 INSTALLATION

- .1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible suction discharge in vertical alignment.
- .2 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.
- .3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- .4 Pipe drain tapping to floor drain complete with isolating valve.
- .5 Install volute venting pet cock in accessible location.
- .6 Check rotation prior to start-up.
- .7 Install pressure gauge with plug cocks on inlet and outlet on pump.

3.2 TRIPLE DUTY VALVES

- .1 Valves shall be straight pattern.
- .2 Provide 4x pipe diameter spool piece between pump discharge and triple duty valve.
- .3 Leave valves open for T.A.B to set.
- .4 Valve size shall match system size. Valve size shall be larger than pump outlet diameter.

3.3 SUCTION DIFFUSER

- .1 Body: cast iron with flanged connections.
- .2 Strainer: with built-in, disposable 1.19 mm (3/64") mesh, low pressure drop screen and NPS 25 mm (1") blowdown connection complete with valve and hose end.
- .3 Permanent magnet particle trap.
- .4 Full length straightening vanes.
- .5 Pressure gauge tapings.
- .6 Adjustable support leg.
- .7 Remove construction screen from inlet suction guide after system cleaned and before balancing.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.22, Wrought Copper Alloy and Copper Alloy Solder - Joint Pressure Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
- .3 ANSI/ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings.
- .4 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .5 ANSI/ASME B31.5, Refrigeration Piping and Heating Transfer Components.
- .6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 413.5 mPa (60,000 psi) Tensile Strength.
- .7 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .8 CSA B52, Mechanical Refrigeration Code.
- .9 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

Part 2 Products

2.1 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Hard copper: to ASTM B280, type ACR-B.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa (300 psi) and temperature 121°C (250°F).
- .2 Brazed:
 - .1 Fittings: wrought copper to ANSI/ASME B16.22.
 - .2 Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
- .3 Flanged:
 - .1 Bronze or brass, to ANSI/ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A307, heavy series.
- .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ANSI/ASME 16.26.

2.3 PIPE SLEEVES

- .1 Hard copper or steel, sized to provide 6 mm (1/4") clearance all around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

- .1 22 mm (7/8") and under: Class 500, 3.5 MPa (500 psi), globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.
- .2 Over 22 mm (7/8"): Class 375, 2.5 MPa (375 psi), globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moistureproof seal for below freezing applications, brazed connections.

2.5 FILTER-DRIER

- .1 On lines 20 mm (3/4") outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
- .2 On lines smaller than 20 mm (3/4") outside diameter, filter-drier shall be sealed type using flared copper fittings.
- .3 Size shall be full line size.
- .4 Approved manufacturers:
 - .1 Mueller
 - .2 Parker
 - .3 Sporlan
 - .4 Virginia

2.6 SIGHT GLASS

- .1 Combination moisture and liquid indicator with protection cap.
- .2 Sight glass shall be full line size.
- .3 Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.
- .4 Approved manufacturers:
 - .1 Mueller
 - .2 Henry
 - .3 Parker
 - .4 Superior

2.7 SUCTION LINE TRAP

- .1 Manufactured standard one-piece traps.

2.8 EXPANSION VALVES

- .1 For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
- .2 Size valves to provide full rated capacity of cooling coil served. Co-ordinate selection with evaporator coil and condensing unit.
- .3 Approved manufacturers:
 - .1 Henry
 - .2 Mueller
 - .3 Parker
 - .4 Sporlan

2.9 FLEXIBLE CONNECTORS

- .1 Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
- .2 Approved manufacturers:
 - Anaconda “Vibration Eliminators” by Anamet
 - Vibration Absorber Model VAF by Packless Industries
 - Vibration Absorbers by Superior Valve Co
 - Style “BF” Spring-flex freon connectors by Vibration Mountings.

2.10 ROOF FLASHING

- .1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

2.11 PIPING SUPPORT ASSEMBLY

- .1 All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A1011/A1011M, A653/A653M.
- .2 All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A575, A36/A36M or A635/A635M.
- .3 Electro galvanized crush clamps with shoulder bolt and molded thermoplastic cushion, size to suit pipe.
- .4 Acceptable materials:
 - .1 Unistrut
 - .2 Or equal

Part 3 Execution

3.1 GENERAL

- .1 Hard copper to be used. Throughout the project, the use of annealed copper shall not be used without approval of the consultant.

- .2 Install in accordance with CSA B52, EPS 1/RA/2 and ANSI/ASME B31.5.
- .3 Connect to equipment with isolating valves and unions.
- .4 Provide space for servicing, disassembly and removal of equipment and components all as recommended by manufacturer.
- .5 Protect all openings in piping against entry of foreign material.
- .6 Provide all necessary equipment including thermal expansion valve, sight glass, solenoid valve, filter dryer, etc., for a complete installed system. Pipe system as per manufacturer's recommendation and requirements.
- .7 Provide number of refrigerant circuits and appropriate corresponding piping as per manufacturer's recommendations and requirements.

3.2 BRAZING PROCEDURES

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

- .1 General:
 - .1 Hard drawn copper tubing: do not bend. Minimize use of fittings.
 - .2 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .3 Provide trap at base of risers greater than 2.4m (8') high and at each 7.6m (25'-0") thereafter.
 - .4 Provide inverted deep trap at top of each riser.
 - .5 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified above.
 - .2 Small riser: size for 5.1 m/s (1000 ft/min) at minimum load. Connect upstream of traps on large riser.

3.4 PRESSURE AND LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa (290 psi) and 1 MPa (145 psi) on high and low sides respectively.
- .3 Test Procedure: Build pressure up to 35 kPa (5 psi) with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.5 DEHYDRATION AND CHARGING

- .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13°C (55°F) for at least 12 h before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use 2-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa (0.02" WC) absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate all system components containing gases other than correct refrigerant or having lost holding charge as follows:
 - .1 Twice to 14 Pa (0.056" WC) absolute and hold for 4 h.
 - .2 Break vacuum with refrigerant to 14 kPa (0.056" WC).
 - .3 Final to 5 Pa (0.02" WC) absolute and hold for at least 12 h.
 - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
 - .5 Submit all test results to Consultant.
- .7 Charging:
 - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
 - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
 - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
 - .1 Make all checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report all measurements to Consultant.

3.6 INSTRUCTIONS

- .1 Post instructions in frame with glass cover in accordance with Operation and Maintenance Manual Section and CSA B52.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Plumbing Specialties and Accessories.
- .2 Hydronic Systems – Steel.

1.2 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American Society of Mechanical Engineers (ASME).
- .3 ANSI/ASME Boiler and Pressure Vessel Code, Section VI.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit operation and maintenance data for incorporation into manual specified in general requirements
- .2 Include following:
 - .1 Log sheets as recommended by manufacturer.
 - .2 Test reports.

Part 2 Products

2.1 MANUFACTURER

- .1 Equipment, chemicals, service by one supplier.
- .2 Acceptable manufacturer:
 - .1 Aquarian Chemicals 905-825-3711
 - .2 No alternates.

2.2 SHIPPING/ FEEDING CHEMICAL CONTAINERS

- .1 High density moulded polyethylene, with liquid level graduations, cover.
- .2 Agitators: as required by manufacturer.

2.3 CONDUCTIVITY CONTROLLER

- .1 Fully transistorized, suitable for wall or flush panel mounting, linear over full measuring range of 0-5000 micro omhs.
- .2 Insensitive to phase angle shifts, capable of operating on 95-130 Volts without affecting accuracy, power, bleedoff status lights.

2.4 CONDUCTIVITY PROBES

- .1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

2.5 WATER TREATMENT FOR HYDRONIC SYSTEMS

- .1 Micron filter for each pot feeder:
 - .1 Capacity 2% of pump recirculating rate at operating pressure.
 - .2 Six (6) sets of filter cartridges for each type, size of micron filter.
- .2 Balancing valve set for 2% pump capacity.

2.6 CHEMICALS

- .1 Provide 1 year's supply.

2.7 TEST EQUIPMENT

- .1 Provide one set of test equipment for each system to verify performance.
- .2 Complete with carrying case, reagents for chemicals, all specialized or supplementary equipment.

2.8 CLEANING CHEMICALS

- .1 Provide as required to make system clean.
- .2 Cleaner chemical: compatible and of the same manufacturer of the water treatment supplier.

2.9 RECORD MANAGEMENT

- .1 Provide cards and card holder mounted on wall adjacent to each pot feeder.

Part 3 Execution

3.1 INSTALLATION

- .1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 CHEMICAL FEED PIPING

- .1 Install crosses at all changes in direction. Install plugs in all unused connections.

3.3 WATER TREATMENT SERVICES

- .1 After entire new and existing system is cleaned as specified elsewhere, provide monthly water treatment monitoring and consulting services for period of one year after system start-up. Provide written report to consultant after each visit. Service to include:
 - .1 Initial water analysis and treatment recommendations.
 - .2 System start-up assistance.
 - .3 On site system testing and recording of treated hydronic system.
 - .4 Operating staff training.
 - .5 Visit plant every 7 days during first month of operation and as required until system stabilizes, and advise consultant in writing on treatment system performance.
 - .6 Provide monthly visits with reports after system has stabilized to the satisfaction of the owner.
 - .7 Provide necessary monthly recording charts and log sheets for one year operation.
 - .8 Provide necessary laboratory and technical assistance.
 - .9 Instructions and advice to operating staff to be clear, concise and in writing.

3.4 START-UP

- .1 Start up water treatment systems in accordance with manufacturer's instructions.

3.5 SYSTEM COMMISSIONING AND TRAINING

- .1 Commissioning and training shall be provided by installing water treatment sub-contractor and water treatment supplier.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After start-up and before TAB of connected systems.
- .3 Pre-commissioning Inspections:
 - .1 Verify:
 - .1 Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.
 - .2 Suitability of log book.
 - .3 Currency and accuracy of initial water analysis.
 - .4 Required quality of treated water.
- .4 Commissioning procedures - applicable to all Water Treatment Systems:
 - .1 Establish, adjust as necessary and record all automatic controls and chemical feed rates.
 - .2 Monitor performance continuously during commissioning of all connected systems and until acceptance of project.
 - .3 Establish test intervals, regeneration intervals.

- .4 Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
- .5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.
- .6 Visit project at monthly intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).
- .7 Advise Engineer in writing on all matters regarding installed water treatment systems.
- .5 Training:
 - .1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.
 - .2 Train O&M personnel in softener regeneration procedures.
- .6 Certificates:
 - .1 Upon completion, furnish certificates confirming satisfactory installation and performance.
- .7 Commissioning Reports:
 - .1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Consultant.
- .8 Commissioning activities during Warranty Period:
 - .1 Check out water treatment systems on regular basis and submit written report to Consultant.

3.6 CLEANING OF MECHANICAL SYSTEM

- .1 Coordinate cleaning of mechanical systems with mechanical contractor.
- .2 Provide copy of recommended cleaning procedures and chemicals for approval by Consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 SMACNA HVAC Duct Leakage Test Manual.
- .4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .7 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section general requirements.
- .2 Indicate following:
 - .1 Sealants
 - .2 Tape
 - .3 Proprietary Joints
 - .4 Fittings

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 DUCTWORK

- .1 Galvanized Steel:
 - .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness:

Size Type	Class A Gauge	Class B Gauge	Class C Gauge
Square and Rectangular			
Up to 600 mm (24")	22	24	24
625 mm to 1000 mm (25" to 40")	20	22	24
1025 mm to 1800 mm (41" to 72")	18	20	22
1825 mm to 2400 mm (73" to 96")	16	18	20
2450 mm and over (97")	16	16	16
Round and Oval			
Up to 300 mm (12")	24	24	24
325 mm to 600 mm (13" to 24")	22	24	24
625 mm to 900 mm (25" to 36")	20	22	24
925 mm to 1200 mm (37" to 48")	18	20	22
1225 mm (49") and over	18	18	20

2.2 DUCT CONSTRUCTION

.1 Round and oval:

- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm (36"): slip type with tape and sealants.
- .3 Transverse joints over 900 mm (36"): Ductmate or Exanno Nexus Duct System.

.2 Square and rectangular:

- .1 Ducts: to SMACNA.
- .2 Transverse joints, longest side:
up to and including 750 mm (30"): SMACNA proprietary duct joints.

.3 Ducts with sides over 750 mm (30") to 1200 mm (48"), transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA "E" or "G" Type connection). Weld all corners.

- .1 Acceptable materials:
 - .1 Ductmate Canada Ltd.
 - .2 Nexus, Exanno Corp.
 - .3 WDCI

.4 Ducts 1200 mm (48") and larger, Ductmate/35, Nexus, or WDCI (heavy) (SMACNA "J" Type connection). Weld all corners.

- .1 Acceptable materials:
 - .1 Ductmate Canada Ltd.
 - .2 Nexus, Exanno Corp.
 - .3 WDCI.

2.3 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius and or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
 - .2 Round:
 - .1 In exposed areas one-piece smooth radius, 1.5 times diameter.
 - .2 In concealed areas 3-piece adjustable, 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm (16"): with double thickness turning vanes.
 - .2 Over 400 mm (16"): with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with 45° entry on branch.
 - .2 Round main and branch: enter main duct at 45° with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
- .5 Diffuser connection to main:
 - .1 90° round spin in collars with balancing damper and locking quadrant.
- .6 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .7 Offsets:
 - .1 Full short radiused elbows.
- .8 Obstruction deflectors: maintain full cross-sectional area.

2.4 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa (" w.c.)	SMACNA Seal Class
2500 (10")	A
1500 (6")	A
1000 (4")	A
750 (3")	A
500 (2")	B
250 (1")	B
125 (0.5")	C

- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
- .3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

2.5 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).
 - .1 Acceptable materials:
 - .1 Duro Dyne S-2
 - .2 Foster

2.6 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.
 - .1 Acceptable material:
 - .1 Duro Dyne FT-2

2.7 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.8 FIRESTOPPING

- .1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.
- .3 All ductwork passing through partition walls shall be firestopped.

2.9 HANGERS AND SUPPORTS

- .1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
>750 to 1050 (>30 to 42)	40 x 40 x 3 (1½ x 1½ x 1/8)	6 (1/4)
>1050 to 1500 (>42 to 60)	40 x 40 x 3 (1½ x 1½ x 1/8)	10 (3/8)
>1500 to 2100 (>60 x 84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8)
>2100 to 2400 (>84 x 96)	50 x 50 x 5 (2 x 2 x 1/8)	10 (3/8)
>2400 (96) and over	50 x 50 x 6 (2 x 2 x ¼)	10 (3/8)

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .1 Acceptable material:
 - .1 Myatt fig. 485
 - .2 For steel joist: manufactured joist clamp or steel plate washer.
 - .1 Acceptable material:
 - .1 Grinnell fig. 61 or 60
 - .3 For steel beams: manufactured beam clamps:
 - .1 Acceptable material:
 - .1 Grinnell Fig. 60

Part 3 Execution

3.1 GENERAL

- .1 The following systems shall conform to these requirements:

System	Class	Material
HVAC Supply and Return	B	Galvanized steel
General Exhaust	B	Galvanized steel
Ventilation Plenum	B	Galvanized steel
Exhaust Plenum	B	Galvanized steel
Individual Exhaust	C	Galvanized steel

- .2 Do work in accordance with ASHRAE and SMACNA.
- .3 Do not break continuity of insulation vapour barrier with hangers or rods.
- .4 Support risers in accordance with ASHRAE and SMACNA.
- .5 Install breakaway joints in ductwork on each side of fire separation.
- .6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.

- .3 Hanger spacing: in accordance with ASHRAE, SMACNA and as follows:

Duct Size	Spacing
mm (")	mm (")
to 1500 (60")	3000 (120")
over 1500 (60")	2500 (100")

- .4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

3.3 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.4 LEAKAGE TESTS

- .1 Co-ordinate leakage testing with TAB contractor. TAB contractor will be responsible for all duct testing.
.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.
.3 Leakage tests to be done in sections.
.4 Trial leakage tests to be performed as instructed to demonstrate workmanship.
.5 Install no additional ductwork until trial test has been passed.
.6 Test section to be minimum of 15 m (50'-0") long with not less than 3 branch takeoffs and two 90° elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.
.7 Complete test before insulation or concealment.
.8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.
.9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

3.5 CLEANING

- .1 Keep ducts clear from dust and debris
.2 Keep duct liner clean from dust, debris, and moisture.
.3 At completion of project vacuum ducts if dirt or dust is present.
.4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection.
.5 Ensure all systems are clean prior to start up.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

2.3 ACCESS DOORS IN DUCTS

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (25 gauge) thick complete with sheet metal angle frame.

- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.
- .3 Gaskets: neoprene
- .4 Hardware:
 - .1 Up to 300 mm (12"): 2 sash locks
 - .2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.
 - .3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.
 - .4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.
 - .5 Hold open devices.
- .5 Acceptable materials:
 - Nailor
 - E. H. Price
 - Titus

2.4 TURNING VANES

- .1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.
- .2 Acceptable materials:
 - Duro Dyne
 - Ductmate

2.5 INSTRUMENT TEST PORTS

- .1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable material:
 - Duro Dyne IP1 or IP2
 - Duct mate

2.6 SPIN-IN COLLAR

- .1 Construction: galvanized straight or conical spin-in collar complete with spin-in bead and crimped collar connection.
- .2 Provide balancing damper where indicated.
- .3 Acceptable materials:
 - .1 Ecco Manufacturing
 - .2 Flex Master

Part 3 Execution

3.1 INSTALLATION

- .1 Flexible connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans. (Unless internally isolated)
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100 mm (4").
 - .3 Minimum distance between metal parts when system in operation: 75 mm (3").
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on each side of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access doors and viewing panels:
 - .1 Size:
 - .1 600 mm x 600 mm (24" x 24") for person size entry.
 - .2 600 mm x 1000 mm (24" x 40") for servicing entry.
 - .3 300 mm x 300 mm (12" x 12") for viewing.
 - .4 As indicated.
 - .2 Location:
 - .1 At fire and smoke dampers.
 - .2 At control dampers.
 - .3 At devices requiring maintenance.
 - .4 At locations required by code.
 - .5 At inlet and outlet of reheat coils.
 - .6 Elsewhere as indicated.
 - .7 Inlet and outlet of duct mounted coils.
- .3 Instrument test ports.
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments
 - .3 Install insulation port extensions as required.

- .4 Locations.
 - .1 For traverse readings:
 - .1 At ducted inlets to roof and wall exhausters.
 - .2 At inlets and outlets of other fan systems.
 - .3 At main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Consultant.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .4 Turning vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.
 - .2 Install on supply ducts only.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements
- .2 Indicate the following: performance data.

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

- .1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

- .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").
- .3 Shaft extension to accommodate insulation thickness and locking quadrant.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

- .3 Maximum blade height:
 - .1 50 mm (2") up to 375 mm (15") high duct.
 - .2 100 mm (4") max 400 mm (16") high duct and over.
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Shaft extension to accommodate insulation thickness and locking quadrants.**
- .8 Acceptable materials:
 - .1 Duro Dyne
 - .2 National Controlled Air (NCA)
 - .3 Nailor
 - .4 T.A. Morrison
 - .5 Tamco
 - .6 Ruskin
 - .7 Ventex/Alumavent
 - .8 United Enertech

2.5 LOCKING QUADRANTS

- .1 6 mm (1/4") dial regulator with square bearing shaft.
 - .1 18 gauge oval frame, cadmium plated, clearly shows damper position.
 - .2 18 gauge formed handle for easy adjustment.
 - .3 Bolt and wing nut lock damper securely.
 - .4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.
- .2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.
 - .1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.
 - .2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.
 - .3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.
 - .4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.
 - .5 Screw holes for mechanically fastening to ductwork.
- .3 High pressure system locking quadrant:
 - .1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.
 - .2 Handle design for easy recognition of damper position.

- .3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.
- .4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.
- .5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.
- .4 Acceptable manufacturers:
Duro Dyne
Ductmate

Part 3 Execution

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
 - .1 Single blade dampers up to 200 mm (8").
 - .2 Multi-blade dampers over 200 mm (8").
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Leave all dampers in open position for T.A.B.
- .7 Fasten locking quadrants to ductwork and shaft.
- .8 Place locking quadrants on standoffs where ductwork insulated.
- .9 Lock down quadrant arm in the open position.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section applies to operating dampers not specified in Controls Section.

1.2 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Performance data.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

1.5 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

Part 2 Products

2.1 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as indicated.
- .2 Acceptable materials:
 - T.A. Morrison
 - Tamco Series 7000
 - Ruskin
 - Nailor
 - National Controlled Air (NCA)
 - Henderson Industrial
 - Ventex/Alumavent

Part 3 Execution

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Duct Accessories Section.
- .5 Insulated dampers on all outside air intake and exhaust damper.
- .6 Non-insulated dampers on all interior motorized dampers not exposed to outside air.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
- .3 UL 181, Factory Made Air Ducts and Air Connectors.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .6 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC –INSULATED

- .1 Spiral wound flexible aluminum with factory applied, 25 mm (1") thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, Class 1 duct material.

- .2 Performance:
 - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
 - .1 Flexmaster T/L – VT
 - .2 Ductmate

2.3 METALLIC – UNINSULATED

- .1 Spiral wound flexible aluminum, Class 1 duct material.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
 - .1 Flexmaster T/L
 - .2 Ductmate

Part 3 Execution

3.1 DUCT INSTALLATION

- .1 Install in accordance with: SMACNA.
- .2 Maximum length of flexible duct: 1.8 m (6' 0").
- .3 Minimum length of acoustical ductwork; 1.5 m (5' 0") with minimum of 1 bend.
- .4 Provide support at centre of flexible duct with 25 mm (1") wide galvanized hanger.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.

Part 2 Products

2.1 DUCT LINER

- .1 General:
 - .1 Rigid fibrous glass duct liner: air stream side faced with mat facing.
 - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
 - .3 Acceptable material:
 - .1 Johns Manville, Permacote Linacoustic R-300
 - .2 Owen Corning
- .2 Rigid:
 - .1 Use on flat surfaces.
 - .2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
 - .3 Density: 36 kg/m² (7.4 lb/ft²).
 - .4 Thermal resistance to be minimum 750 mm (30") C/W for 25 mm (1") thickness 1150 mm (45") C/W for 40 mm (1½") thickness when tested in accordance with ASTM C177, at 24°C (75°F) mean temperature.

2.2 ADHESIVE

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).
- .3 Acceptable material:
 - .1 Duro Dyne 1A-22
 - .2 Ductmate

2.3 FASTENERS

- .1 Weld pins 2.0 mm (14 gauge) diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1¼") square.
- .2 Acceptable material:
 - .1 Duro Dyne
 - .2 Ductmate

2.4 JOINT TAPE

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.
- .2 Acceptable materials:
 - .1 Duro Dyne FT2
 - .2 Ductmate

2.5 SEALER

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68°C (-90°F) to 93°C (200°F).
- .3 Acceptable materials:
 - .1 Duro Dyne 1A-94
 - .2 Ductmate

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.
- .4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

3.2 DUCT LINER

- .1 Install in accordance with manufacturer's recommendations, and as follows:
 - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
 - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.
- .2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.
- .3 Store foam liners away from sunlight.

3.3 JOINTS

- .1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply 2 coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Consultant.
- .3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 AMCA 99, Standards Handbook.
- .3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.
- .5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Product data to include fan curves and sound rating data.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

Part 2 Products

2.1 FANS GENERAL

- .1 Capacity: flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

- .5 Bearings: sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.
- .6 Acceptable materials:
 - .1 Penn-Barry
 - .2 Greenheck
 - .3 Cook
 - .4 Jenco (S & P)/Jenn
 - .5 Carnes
 - .6 Acme
 - .7 Zonex
 - .8 Twin-City
 - .9 Reversomatic
 - .10 Fantech
 - .11 Aerovent
- .7 Provide factory mounted speed control for all direct drive motors.

2.2 EXISTING EXHAUST AIR FANS

- .1 Refurbish existing exhaust air fans as follows:
 - .1 Replace motor as indicated with VFD compatible ECM motor.
 - .2 Vacuum entire unit interior.
 - .3 Lubricate all bearings.
 - .4 Replace fan belt(s).
 - .5 Rebalance to capacity indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide flexible duct connection at roofline.
- .3 Provide backdraft damper at building exterior penetration.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.2 MAINTENANCE MATERIALS

- .1 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

1.3 MANUFACTURED ITEMS

- .1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

1.4 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified.
 - .3 Concealed fasteners.
- .3 Concealed operators.
- .4 Colour and Finish: standard as directed by Consultant.

.5 Acceptable materials:

- .1 Krueger
- .2 E.H. Price
- .3 Nailor
- .4 Titus
- .5 Carnes
- .6 Seiho
- .7 Metalaire

2.2 SUPPLY GRILLES AND REGISTERS

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.
- .2 Type, size, and capacity: as indicated.

2.3 RETURN AND EXHAUST GRILLES

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets and fire stop flap where indicated.
- .2 Type, size, and capacity: as indicated.

2.4 DIFFUSERS

- .1 General: volume control dampers with flow straightening devices and blank-off quadrants, as indicated and gaskets and fire stop flap and fire blanket where indicated.
- .2 Type, size, and capacity: as indicated.

2.5 OPEN MESH SCREEN

- .1 15 mm x 15 mm (½" x ½") open mesh screen fastened on 25 mm (1") border, screw fasten.
- .2 On all open ends of ductwork and where indicated.
- .3 Size: To match ductwork size.

2.6 DOOR GRILLES

- .1 Heavy duty steel construction, sight proof, complete with flat border both sides, screwed fastening. Finish by Consultant.
- .2 Install door grille in door.
- .3 Fire-rated.
- .4 Acceptable manufacturer:
 - .1 Krueger 600A.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.
- .5 Clean grilles upon completion.
- .6 Paint ductwork beyond grilles, matte black where visible.
- .7 Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
 - .4 Colour and finish.

1.3 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 TEST REPORTS

- .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

Part 2 Products

2.1 GOOSENECK HOODS

- .1 Thickness: to ASHRAE and SMACNA.
- .2 Fabrication: to ASHRAE and SMACNA.
- .3 Joints: to ASHRAE and SMACNA and or proprietary manufactured duct joint.
 - .1 Acceptable material:
 - Ductmate Canada
 - Exanno Nexus
- .4 Supports: as indicated.
- .5 Complete with integral birdscreen of 2.7 mm (12 gauge) diameter aluminum wire. Use 15 mm (1/2") mesh on exhaust 20 mm (3/4") mesh on intake.
- .6 Vertical or Horizontal backdraft dampers as required.
- .7 Prefabricated roof curb through roof complete with insulation and counter flashing.

2.2 FIXED LOUVRES – ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").
- .4 Frame, head, sill and jamb: 50 mm (2") deep, **50 mm (2") blade centers**, one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm (60") maximum centres.
- .6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 15 mm (1/2") exhaust 20 mm (3/4") intake mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: Kynar 500
Colour: to Consultant's approval.
- .9 Acceptable materials:
United Enertech FL-D-2 series
Greenheck
Construction Specialties
E.H. Price
Krueger
Ruskin
Ventmaster
Ventex
- .10 Nailor

Part 3 Execution

3.1 INSTALLATION

- .1 In accordance with manufacturers and SMACNA recommendations.
- .2 Reinforce and brace air vents, intakes and goosenecks as indicated.
- .3 Anchor securely into opening.
- .4 Seal with caulking all around to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers.
- .3 AMCA Standard 210, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating
- .4 ANSI/UL 1995, Heating and Cooling Equipment
- .5 CAN/CSA C22.2 No 236, Heating and Cooling Equipment

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Indicate following: performance.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with general requirements.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 MANUFACTURED ITEMS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

Part 2 Products

2.1 GENERAL

- .1 Comply with ASHRAE.

2.2 ENERGY RECOVERY VENTILATOR (RESIDENTIAL CAPACITY)

- .1 Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel with baked on enamel finish.
- .2 Heat transfer surfaces: polymerized paper.
- .3 Cross contamination: not permitted.

- .4 Removable or hinged access panels.
- .5 Supply and exhaust fans; two ECM motors thermally protected with insulation type B. Motor suitable for 120/1/60.
- .6 Overall size: 599 cm x 624 cm x 380 cm (23 9/16" x 24 9/16" x 14 15/16").
- .7 Accessories:
 - .1 Defrost cycle and controls.
 - .2 Washable filters. (Merv 7)
 - .3 Mixed air section.
 - .4 Free Cooling Economizer Mode
 - .5 Programmable ERV controller in Living Space.
 - .6 Local 20/40/60 min timers (one in each WR).
- .8 Performance characteristics: as indicated.
- .9 Acceptable materials:
 - .1 Aldes
 - .2 Greenheck
 - .3 Ruskin
 - .4 Cook

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of adjacent ductwork with flexible connections.
- .3 Install access doors in accordance with Sections for access to coils and dampers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM C553, Mineral Fiber Blanket, Thermal Insulation for Commercial and Industrial Applications.
- .3 CSA B52, Mechanical Refrigeration Code.
- .4 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general conditions.
- .2 Indicate major components and accessories including sound power levels of units.
- .3 Type of refrigerant used.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in general conditions.

1.4 WARRANTY

- .1 Contractor hereby warrants refrigeration compressors for 5 years.

Part 2 Products

2.1 GENERAL

- .1 System type:
 - .1 Air flow arrangement: horizontal
 - .2 Cooling: direct expansion
 - .3 Condensing: air cooled

2.2 OUTDOOR CONDENSING UNITS (CU-19)

- .1 General: Factory-assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, refrigerant holding charge, and special features required prior to field start-up. Unit shall be rated in accordance with ARI Standard and be CSA approved.

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- .2 Unit Cabinet:
 - .1 Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.
 - .2 A heavy gage roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging.
 - .3 Fans:
 - .1 Condenser fans shall be direct driven, propeller-type, discharging air horizontally.
 - .2 Fan blades shall be balanced.
 - .3 Condenser fan discharge openings shall be equipped with PVC coated steel wire safety guards.
 - .4 Condenser fan and motor shaft shall be corrosion resistant.
 - .4 Compressor:
 - .1 Compressor shall be mounted on vibration isolators.
 - .2 Compressors shall include overload protection.
 - .5 Condenser Coil:
 - .1 Condenser coil shall be air-cooled and circuited for integral subcooler.
 - .2 Coil shall be constructed of aluminum fins (copper fins optional) mechanically bonded to internally grooved seamless copper tubes which are then cleaned, dehydrated, and sealed.
 - .6 Refrigeration Components:
 - .1 Refrigeration circuit components shall include liquid line service valve, suction line service valve, liquid filter drier, a full charge of compressor oil, and a holding charge of refrigerant.
 - .7 Controls and Safeties:
 - .1 Minimum control functions shall include:
 - .1 Control wire terminal blocks.
 - .2 Five-minute recycle protection to prevent compressor short-cycling.
 - .3 Compressor lockout on auto-reset safety until reset from thermostat.
 - .2 Minimum Safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:
 - .1 High discharge pressure cutout.
 - .2 Loss-of-charge cutout.
 - .8 Electrical Requirements:
 - .1 As indicated on drawing schedule.
 - .2 Unit electrical power shall be single-point connection.
 - .3 Unit control circuit shall contain a 24-v transformer for unit control.
 - .9 Capacity: As indicated on drawing schedule.

- .10 Provide the following:
 - .1 Hail Guard Package.
 - .2 Winter Start Package.
- .11 Acceptable materials:
 - .1 Daikin FDMQ09
 - .2 LG
 - .3 Mitsubishi

2.3 CONCEALED CEILING DUCTED UNIT

- .1 Designed for ceiling concealed installation and shall be supplied with a horizontal discharge air connection. A return air thermistor shall be mounted inside the return air opening.
- .2 Units shall have a maximum height of 7-7/8" and be designed to fit in tight ceiling plenums.
- .3 Standard filter shall be mold resistant, washable.
- .4 Units shall be provided with a drain pump kit suitable for 18 to 23 inches of lift. Pump shall be located below the coil in the condensate pan with a built in safety alarm.
- .5 Cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation. Medium static units shall have a sound pressure range of 41 dB(A) to 45 dB(A). FXDQ units sound pressure level shall range from 29 dB(A) to 32 dB(A) at low speed and 33 dB(A) to 36 dB(A) at high speed 5 feet below the suction grille.
- .6 The fan shall be a direct-drive Sirocco type fan, with a statically and dynamically balanced impeller, with high and low fan speeds settings.
- .7 Electrical Requirements: As indicated on drawing schedules.
- .8 Capacity: As indicated on drawing schedules.
- .9 Acceptable materials:
 - .1 Daikin RX09
 - .2 LG
 - .3 Mitsubishi

2.4 REFRIGERANT

- .1 Holding charge of refrigerant applied at factory.

Part 3 Execution

3.1 GENERAL

- .1 Install as indicated, to manufacturers' recommendations.
- .2 Manufacturer to certify installation.

- .3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.
- .4 Provide concrete pad complete with 100 mm x 100 mm x 20 mm (4" x 4" x 3/4") neoprene type vibration isolation.

3.2 EQUIPMENT

- .1 Preparation and Start-Up
 - .1 Provide services of manufacturer's authorized factory trained mechanic to set and adjust equipment for operation as specified.
 - .2 Provide results in operation and maintenance manuals

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Conform to general provisions for mechanical division in General Requirements section.

1.2 SUBMITTAL

- .1 Submit shop drawings and product data in accordance with general requirements,
- .2 Indicate the following: complete specifications, wiring diagrams (showing all interconnections); weight; performance details.
- .3 Provide data for inclusion in the Operating and Maintenance manuals in accordance with general requirements,

1.3 1.3 SHOP DRAWING SUBMISSION/UNIT DELIVERY REQUIREMENTS

- .1 **Shop drawings shall be submitted to the Consultant within two (2) weeks of Award of Contract.**
- .2 **Shop drawings shall be reviewed/returned by the Consultant within one (1) week of submission.**
- .3 **Contractor to order equipment from manufacturer immediately upon returned/approved shop drawings.**
- .4 **This Contractor shall co-ordinate with the manufacturer to ensure unit ventilator equipment is delivered to site (for installation) by July 17, 2022. Include in tender price for premium costs associated with manufacturer's rush/accelerated delivery.**

Part 2 Products

2.1 VERTICAL NON-DUCTED UNIT VENTILATOR

- .1 Exterior cabinet panels shall be constructed of heavy gauge steel. Units shall be constructed such that testing and trouble-shooting can be accomplished in the end pockets of the unit without affecting the normal airflow pattern through the unit.
- .2 Floor mounted units shall have an integral pipe tunnel for convenient crossover of piping or electrical wiring in accordance with local and National Electric Codes (NEC). The front surface shall consist of three separate, removable panels. Control compartment must be accessible without removing the entire front panel. Unit discharge grille shall be welded continuous bar type with round edged steel bars placed for a 10° vertical deflection. Adjustable side deflection vanes shall be located beneath the continuous bar grille for easy adjustment by maintenance personnel. A 6 mm (1/4") painted galvanized mesh screen shall be furnished and located beneath the discharge grille. Unit top surface shall be supplied with a textured paint surface that resists scuffing and hides fingerprints.

Overall unit depth shall be 550 mm (21 7/8").

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- .3 Motors shall be direct drive electronically commutated motors (ECM) and be mounted on rubber isolation. Blowers shall be designed specifically for unit ventilator operation. ECM motors shall be programmed to meet the scheduled airflow at the specified external static pressure with additional speed taps for manual adjustment on site during balancing. Motors shall consist of a brushless, permanently lubricated ball bearing construction for maintenance free operation.
- .4 Hydronic coils are to be constructed with copper tubes and mechanically bonded aluminum corrugated plate fins. Water coils shall be furnished with a threaded drain plug at the lowest point. A manual air vent shall be provided at the high point of the coil on all floor mounted units. An auto air vent shall be provided at the high point of the coil on all ceiling mounted units. Direct expansion coils (DX) - all DX coils must be supplied with a factory installed thermal expansion valve. The expansion valve must be sized for the manufacturer's matching remote condensing unit.
- .5 Air Cooled Condensing Units - The unit ventilator manufacturer shall provide remote air cooled condensing units where indicated on plans. The outdoor unit shall be factory precharged and shall be design matched to the indoor unit.
- The installing contractor shall provide and install between indoor and outdoor unit the interconnecting refrigerant tubing of the size recommended by the unit manufacturer. The installing contractor shall evacuate the indoor coil and interconnection tubing and charge the system in accordance with manufacturer's instructions.
- Condensing unit shall have corrosion resistant cabinet, with hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection, copper tube aluminum fin condenser coil, direct drive propeller fan with permanently lubricated ball bearing single phase motor with internal overload protection.
- .1 Acceptable manufacturers:
- Daikin
Trane
Engineered Air
- .6 Microprocessor-based control for each unit ventilator that must be adaptable to future network system. This control must be pre-engineered, preprogrammed and pretested and shall be factory installed before shipment. The microprocessor-based control shall monitor room conditions and automatically adjust unit operations to maintain these requirements. The control sequence shall be on the basis of ASHRAE Cycle II. The manufacturer shall provide this DDC controller in each unit ventilator.
- .7 Separate room air and outdoor air dampers. The room air damper shall be constructed of aluminum and shall be counterbalanced against back pressure. Outdoor air damper shall be two-piece double wall construction with 15 mm (1/2") thick, 1.5 lb. density fiberglass insulation sandwiched between welded 1.0 mm (20 Ga.) galvanized steel blades for rigidity and to inhibit corrosion. Dampers shall be fitted with blended mohair seals along all the sealing edges. Damper bearings shall be made of nylon or other material which does not require lubrication.
- .8 Integral factory installed face and bypass damper. The face and bypass damper shall be constructed of aluminum and have a dead air space to minimize pickup in the bypass

position. The long sealing edges of the damper shall be fitted with silicone rubber impregnated glass cloth seals with blended mohair seals on the ends for long life and positive sealing.

- .9 Drain pan constructed of stainless steel and shall be insulated. A drain outlet shall be provided on both ends of the pan with one outlet capped. The drain hand of connection shall be easily field-reversed by relocating the cap to the opposite end.
- .10 Filters shall be MERV 13.
- .11 External wall louver will be separately supplied.
- .12 Unit manufacturer shall provide a decorative exterior aluminum wall grille constructed of heavy gauge aluminum with rectangular holes to match louver blade spacing to maximize the air opening. Grille to be secured to wall louver/ exterior wall. The grille finish shall match the louver above.
- .13 All internal line voltage wiring shall be by the unit manufacturer.
 - .1 A suitably rated unfused disconnect switch shall be factory installed within the unit.
- .14 Control Components
 - .1 Provide terminal strip (“digital-ready”) for standard electric/mechanical controls per Energy Controls.
- .15 Unit capacity: As indicated.
- .16 Acceptable manufacturers:
 - Daikin
 - Trane
 - Engineered Air

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer’s instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Protection: Provide finished cabinet units with protective covers during balance of construction.
- .4 Unit Ventilators: Locate as indicated, level and shim units, and anchor to structure. Coordinate with existing wall louver and radiation cabinet. Adjust existing adjacent surfaces as required for a complete finished installation.
- .5 Hydronic Units: Install with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
- .6 Connect drain pan to condensate drain.

- .7 Provide refrigerant piping, refrigerant accessories and refrigerant from condensing unit to DX coil.
- .8 The mechanical contractor shall charge the refrigeration system after installation and ensure that the cooling system is operating correctly.

3.2 START UP AND INSTRUCTION

- .1 Unit Manufacturer shall provide start up and instruction to the owner and the installer.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Conform to general provisions for mechanical division in General Requirements section.

1.2 SUBMITTAL

- .1 Submit shop drawings and product data in accordance with general requirements,
- .2 Indicate the following: complete specifications, wiring diagrams (showing all interconnections); weight; performance details.
- .3 Provide data for inclusion in the Operating and Maintenance manuals in accordance with general requirements,

Part 2 Products

2.1 VERTICAL DUCTED UNIT VENTILATOR

- .1 Main cabinet shall be 14 gauge corrosion resistant steel, braced and reinforced for rigidity. The finish shall be baked enamel, in the manufacturer's standard color/ color as per the consultant's instruction. The cabinet shall be fully lined with 1" [1/2"] glassfiber, coated on the air side.

The unit shall have an upflow configuration unless noted otherwise.

Upflow units shall have air openings suitable for direct discharge via double-deflection grilles / discharge into high-level duct.
- .2 Color-matched raised base, of height to suit the floor to ceiling dimension, so that the top of the unit penetrates the ceiling tile.
- .3 Color-matched top extension for the cabinet, of size to suit the ceiling height.
- .4 Top Acoustical Plenum shall be provided. Plenum to be 20" high top freeblow plenum. Plenum constructed of 14 gauge metal and color matched using a powder coat finish and 1" thick glassfiber insulation. An internal perforated cone and sound baffles shall be installed for sound abatement. The plenum shall be equipped with double deflection supply air grilles color matched to the cabinet.
- .5 The supply air fan shall be a direct double width, double inlet, centrifugal forward curve fan with an electrically commutated motor (ECM) mounted on rubber isolation grommets. Blowers shall be designed specifically for unit ventilator operation. ECM motors shall be programmed to meet the scheduled airflow at the specified external static pressure with additional speed taps for manual adjustment on site during balancing. Motors shall consist of a brushless, permanently lubricated ball bearing construction for maintenance free operation.

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- .6 Hot water coil shall have ½" copper tube of minimum wall thickness 0.016" and shall have aluminum fins. The coil supply and return headers shall be ¾" copper pipe, stubbed for sweat connection. The coil shall be factory pressure tested at not less than 350 p.s.i. A automatic air vent shall be factory installed and ball valves fitted / shipped loose for field installation. The coil capacity shall be as shown in the schedule.
 - .7 Direct Expansion coil shall have 3/8" copper tube and aluminum fins. The liquid line connection shall be 3/8" O.D. and the suction line ¾" O.D. The field connections shall be brazed. The coil capacity shall be as shown in the schedule. A suitable drain pan shall be provided. Pipe condensate to exterior wall grille.
 - .8 A capacity matched thermal expansion valve shall be factory installed at the evaporator coil. The refrigerant that shall be used in the system will be R410a. High and low pressure switches (auto reset low-pressure and manual reset high pressure) as well as a moisture indicated sight glass and service ports shall be factory installed. A suitable matched condensing coil shall be provided.
 - .9 Unit shall be provided with a two stage scroll compressor equipped with a crankcase heater, low ambient cut out, low and high pressure controls. The system shall be factory charged with R410A refrigerant. The compressor shall be mounted in such a way to have double vibration isolation from the unit structure.
 - .10 Outdoor and return air dampers shall be opposed blade type with airfoil section aluminum extruded blades. The dampers shall have neoprene blade tip and jamb seals. Leakage shall not exceed 4 c.f.m. per sq. ft. at 3" W.G. differential pressure, as determined by a recognized testing laboratory. Unit manufacturer to supply a modulating spring return damper actuator for proportional damper control.
 - .11 Economizer Operation: The unit shall have the capacity for 100% outdoor air when outdoor conditions allow.
 - .12 Filters shall be MERV 13
 - .13 Unit manufacturer shall provide an external wall louvre for the outdoor air intake. The louvre shall be of heavy gauge aluminum with 45 deg. Blades. The blade profile shall be designed to prevent water penetration. The louvre shall have ½" birdscreen attached to the inner face and shall have a minimum free area of 1.1 sq. ft. The finish on the louver shall be a custom color as selected by the consultant.
 - .14 Unit manufacturer shall provide a wall sleeve and shall be custom sized to suit the wall depth. The wall sleeve shall include air flow separators to prevent mixing of fresh air, condenser air intake and condenser air exhaust.
 - .15 All internal line voltage wiring shall be by the unit manufacturer.
 - .1 A suitably rated unfused disconnect switch shall be factory installed within the unit.
 - .16 Control items shall be furnished by the unit manufacturer and shall function as described in the Controls Specification.

- .1 Control items to be factory installed may include:
 - .1 DDC Controller
 - .2 Supply Air Temperature sensor
 - .3 Mixed Air Temperature sensor
 - .4 Supply Air Fan current sensor
 - .5 Enthalpy control for economizer operation
- .2 Controls shall be BACNet and communicate on the BAS system.
- .3 Controls shall be sequenced as per ASHRAE Cycle II or Cycle III to meet owner requirements.
- .17 Accessories
 - .1 Face and bypass heating coil
 - .2 Rear pipe chase panel
 - .3 Wall Louvre (Maximum 1000 mm total width)
- .18 Unit selection and Capacity: As indicated on schedule on drawings.
- .19 Acceptable Manufacturers:
 - .1 Airedale
 - .2 Engineered Air
 - .3 ChangeAir

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Protection: Provide finished cabinet units with protective covers during balance of construction.
- .4 Unit Ventilators: Locate as indicated, level and shim units, and anchor to structure. Coordinate with existing wall louvre and radiation cabinet. Adjust existing adjacent surfaces as required for a complete finished installation.
- .5 Hydronic Units: Install with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
- .6 Connect drain pan to condensate drain.
- .7 Provide refrigerant piping, refrigerant accessories and refrigerant from condensing unit to DX coil.
- .8 The mechanical contractor shall charge the refrigeration system after installation and ensure that the cooling system is operating correctly.

3.2 START UP AND INSTRUCTION

- .1 Unit Manufacturer shall provide start up and instruction to the owner and the installer.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate:
 - .1 Equipment, capacity, piping, and connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
 - .3 Special enclosures.
- .3 Primer coat to be off white.
- .4 All hydronic heating shall be by a single manufacturer.

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 DAMPERS

- .1 Factory built, internal damper, complete with operator, at enclosure air outlet grille for each convection type heating unit not thermostatically controlled. Refer to schedules on drawings.

2.2 CAPACITY

- .1 As indicated.

2.3 BASEBOARD RADIATION

- .1 Heating elements: NPS 20 mm (3/4") copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins, one tube end belled.
- .2 Enclosure: minimum 1.0 mm (20 gauge) thick steel with 1.0 mm (20 gauge) thick back and top of one piece construction. Front panel removable. Run wall to wall unless otherwise indicated. Provide panel corners joiner pieces end caps. Assemble with stainless steel oval head sheetmetal screws. Finish to be factory applied baked on enamel.
- .3 Element brackets: 1.2 mm (18 gauge) thick galvanized steel to support front panel and element cradle. Space brackets 900 mm (36") centres maximum.
- .4 Provide for noiseless expansion of all components.

- .5 Acceptable materials:
 - .1 Engineered Air
 - .2 Slant Fin
 - .3 Sigma

2.4 CABINET CONVECTORS

- .1 Heating element: seamless copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins and cast iron headers, steel side plates and supports.
- .2 Cabinet: type as indicated, 1.6 mm (16 gauge) thick steel back and ends, manual damper, exposed corners rounded, secured removable front panel, braced and reinforced for stiffness. Provide stamped grill in sloping top, open bottom. Provide damper and operator and access doors for valves. Finish cabinet with factory applied baked primer coat.
- .3 Catalogue rating: certified IBR ratings.
- .4 Capacity: as indicated.
- .5 Acceptable materials:
 - .1 Engineered Air C-1W
 - .2 Slant Fin
 - .3 Sigma

2.5 CABINET UNIT HEATERS (H-1)

- .1 Cabinet: surface or recessed installation as indicated, 1.6 mm (16 gauge) thick steel with rounded exposed corners and edges, removable panels, glass fiber insulation and integral air outlet and inlet, Arrangement 4
- .2 Finish with factory applied primer coat.
- .3 Coils: aluminum fins mechanically bonded to copper tubes. Hydrostatically tested to 1 MPa (145 psi).
- .4 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.
- .5 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .6 Filters: removable permanent washable type.
- .7 Capacity and orientation as indicated.
- .8 Control:
 - .1 3 speed switch with integral overloads in cabinet.
 - .2 Low limit aquastat strapped on to hot water heating supply set to prevent fan operating below 27°C (81°F).

- .3 Control thermostat: electric, rated to suit cabinet heater, with setpoint locking device and concealed adjustment.
 - .1 Remote thermostat and locking guard cover on downflow units.
 - .2 Integral thermostat with access door on upflow units.
 - .3 Remote thermostat and guard by BAS contractor.
- .9 Acceptable materials:
 - .1 Engineered Air CUH Series
 - .2 Slant Fin
 - .3 Sigma
 - .4 Dunham-Bush

2.6 EXISTING WALL FIN AND CABINET RADIATION (H-EX)

- .1 Remove existing grilles, vacuum existing fin and components.
- .2 Replace damaged components including but not limited to hangers, wall mounting brackets.
- .3 Replace existing grilles (toe and top grille) as required. Provide new filler pieces etc., to match existing cabinet.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install in accordance with piping layout and reviewed shop drawings.
- .3 Provide for pipe movement during normal operation.
- .4 Maintain sufficient clearance to permit performance of service maintenance.
- .5 Check final location with Consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Consultant's directive.
- .6 Valves
 - .1 Install valves with stems upright or horizontal unless approved otherwise.
 - .2 Install isolating gate valves on inlet and balancing valves on outlet of each unit.
- .7 Venting:
 - .1 Install screwdriver vent on cabinet convactor, terminating flush with surface of cabinet.
 - .2 Install standard air vent with cock on continuous finned tube radiation.
- .8 Clean finned tubes and comb straight.
- .9 Install flexible expansion compensators as indicated.
- .10 Mount wall mounted convectors at 200 mm (8") above finish floor.

- .11 Mount wall mounted radiation at 200 mm (8") above finish floor unless otherwise indicated.
- .12 **Thermostats on outside walls: mount on insulated backplates.**
- .13 On units fed from below floor provide factory manufactured piping shrouds on the exposed piping between base of the radiation cabinet and finished floor. Shroud shall be manufactured by the radiation manufacturer. Shroud shall match finish of the radiation cabinet.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section is to read in conjunction with the General Requirements of the Mechanical and Electrical trades.

1.2 REFERENCES

- .1 Tested to ANSI/UL Standard 508.
- .2 UL-508 certified for the building and assembly.
- .3 CSA or C-UL stickers shall be applied to both the VFD and option panels.
- .4 Manufacturers shall be ISO 9001 certified facilities.

1.3 SUBMITTALS

- .1 Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalogue information.
- .2 The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.
- .3 Harmonic filtering. The manufacturer shall, with the aid of the buyer's electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will meet the IEEE standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer–utility interface or primary side of the main distribution transformer.

1.4 WARRANTY

- .1 The VFD shall be warranted by the manufacturer for a period of five (5) years from date of substantial completion. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Danfoss Graham.
- .2 ABB.
- .3 AC Tech.

2.2 GENERAL

- .1 The VFD shall convert incoming fixed frequency AC power into a variable frequency and voltage for controlling the speed of AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
- .2 With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFD's utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- .3 Include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
- .4 Provide DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFD's without DC link reactors shall provide a minimum 5% impedance line reactor.
- .5 Full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
- .6 Provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
- .7 An automatic energy optimization selection feature shall be provided in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
- .8 Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
- .9 An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
- .10 Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFD's not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

- .11 VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
- .12 VFD's operating 600/3/60 motors not designed to meet Nema MG1 Part 31 should include Output dv/dt (LC) Reactors.

2.3 PROTECTIVE FEATURES

- .1 VFD shall be provided with an integral disconnect and Integral Fast Blow Semi-Conductor fuses sized as specified by ULC. Fuses shall be Bussman JJS type or equivalent.
- .2 A minimum of Class 20 I2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.
- .3 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over-voltage, under-voltage, VFD over-temperature and motor over-temperature. The VFD shall display all faults in plain English. Codes are not acceptable.
- .4 Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal.
- .5 The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
- .6 To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Motors shall have inverter rated insulation (1600V).
- .7 VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
- .8 VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
- .9 VFD shall catch a rotating motor operating forward or reverse up to full speed.
- .10 VFD shall be rated for 100,000 amp interrupting capacity (AIC).
- .11 VFD shall have externally mounted EMI electromagnetic suppressor to limit the EMI and RFI output from the VFD. VFD to be mounted in an all metal cabinet to limit radiated RFI.
- .12 VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
- .13 VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt VFD's, and 701V AC on 575 volt VFD's.
- .14 For remote VFD installations, provide an output filter (load side reactor) at each VFD to protect the equipment motor. Coordinate installation with equipment manufacturer.

2.4 INTERFACE FEATURES

- .1 Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.
- .2 The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
- .3 The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
- .4 Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.
- .5 The keypads for all sizes of VFD's shall be identical and interchangeable.
- .6 To set up multiple VFD's, it shall be possible to upload all set-up parameters to the VFD's keypad, place that keypad on all other VFD's in turn and download the set-up parameters to each VFD. To facilitate setting up VFD's of various sizes, it shall be possible to download from the keypad only size independent parameters.
- .7 Display shall be programmable to display in 9 languages including English, Spanish and French.
- .8 The display shall have four lines, with 20 characters on three lines and eight large characters on one line.
- .9 A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
- .10 A quick set-up menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
- .11 The VFD shall include a standard RS-485 communications port for connection to a Johnson Controls N2 and Siemens FLN serial communication system. The connection shall be software selectable and addressable by the user. The option for Lonworks and BacNet communication must also be available.
- .12 As a minimum, the following points shall be controlled and/or accessible:
VFD Start/Stop, Speed reference, Fault diagnostics, and Meter points as follows;
Motor power in HP, Motor power in kW, Motor kW-hr, Motor current, Motor voltage, Hours run, Feedback signal #1, Feedback signal #2, DC link voltage, Thermal load on motor, and Thermal load on VFD, Heat sink temperature.
- .13 Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the VFD.
- .14 Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
- .15 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

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- .16 Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFD's unable to show these four displays simultaneously shall provide panel meters.
 - .17 Sleep mode shall be provided to automatically stop the VFD when its speed drops below set "sleep" level for a specified time. The VFD shall automatically restart when the speed command exceeds the set "wake" level.
 - .18 The sleep mode shall be functional in both follower mode and PID mode.
 - .19 Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
 - .20 The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.
 - .21 The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (oF) for a cooling tower application.
 - .22 VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
 - .23 If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD's heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
 - .24 The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
 - .25 The VFD shall store in memory the last 10 faults and related operational data.
 - .26 Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
 - .27 Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
 - .28 Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
 - .29 Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

- .30 Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

2.5 ADJUSTMENTS

- .1 VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
- .2 Sixteen preset speeds shall be provided.
- .3 Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
- .4 Four current limit settings shall be provided.
- .5 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under-voltage, over-voltage, current limit and inverter overload.
- .6 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
- .7 An automatic “on delay” may be selected from 0 to 120 seconds.

2.6 SERVICE CONDITIONS

- .1 Unit shall operate in ambient temperature of -10 to 40°C (14 to 104°F).
- .2 Unit shall operate in 0 to 95% relative humidity, non-condensing.
- .3 Operate in elevation up to 3,300 feet without derating.
- .4 Maximum AC line voltage variation, -10 to +10% of nominal with full output.
- .5 No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

2.7 FACTORY TESTING

- .1 To ensure quality and minimize infantile failures at the jobsite, the manufacturer shall test the complete VFD. The VFD shall operate a dynamometer at full load and speed and shall be cycled during the test.
- .2 All optional features shall be functionally tested at the factory for proper operation.

2.8 BYPASS SWITCH

- .1 Bypass Controller - Automatic transfer to line power via contactors. When in the “Drive” mode, the bypass contactor is open and the drive output contactor is closed. In the “Bypass” position, the drive output contactor is open, and the bypass contactor is closed via Start/stop command. Start/stop via customer supplied maintained contact shall be Dry type 115V compatible and shall function in both the “Drive” and “Bypass” modes. The design shall include single-phase protection in both the VFD and bypass modes.

Part 3 Execution

3.1 START-UP SERVICE

- .1 The manufacturer shall provide start-up and commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

3.2 EXAMINATION

- .1 Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

3.3 INSTALLATION

- .1 Install to manufacturer's recommendations.
- .2 Install to the requirements of the local Hydro codes. Obtain hydro permits and pay all fees.
- .3 Install in an accessible location and proper service height from floor.
- .4 Install in clean, dry, and conditioned environment.
- .5 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.
- .6 Wiring of devices to be to the standards of Electrical Division.
- .7 Provide one manufacturer of VFD's throughout the project.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Conform to General Conditions for Mechanical Trades.
- .2 Related Work Specified Elsewhere.
 - .1 General Conditions for Mechanical Trades
 - .2 Heating, Ventilation & Air Conditioning
 - .3 Heating, Ventilation & Air Conditioning Equipment
 - .4 Electrical

1.2 SCOPE OF WORK

- .1 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall be an extension of the existing system and shall control/monitor HVAC equipment and systems as specified in this section. The work shall include but is not limited to the following:
 - .1 Refer to drawings and specification for complete scope.
 - .2 Control for unit ventilators (heating, cooling, free cooling, outdoor air ventilation).
 - .3 Control for modified radiators and other modified hydronic heating elements.
 - .4 Control of motorized relief air dampers for classrooms and all rooms with new non-ducted unit ventilators. Interlock to free-cooling mode for all unit ventilators.
 - .5 Control of two existing exhaust fans. Exhaust fans will be provided with new multi-speed VFDs. Multispeed VFDs are to ramp up and down based on outdoor outdoor air damper positions in associated spaces and rooms.
 - .6 Control for ERV, duct heater, and fan coil system (second floor).
 - .7 Control for hydronic system pump. Remove central temperature modulating three-way valve system. Provide new variable speed VFD system with remote differential pressure (DP) sensor.
 - .8 Replacement of some pneumatic temperature controls with new digital controls.

1.3 DESCRIPTION OF SYSTEM

- .1 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall control/monitor HVAC and plumbing equipment and systems as specified in this section. The work shall include but is not limited to the following:
 - .1 All necessary hardware, software, control panels, control wiring, field devices, installation, documentation and owner training as specified.

- .2 The installed system shall incorporate electronic and digital control devices to perform the control sequences and monitoring outlined herein. Specific control sequence requirements are as detailed elsewhere in this Section of the specification.
- .3 Control and monitoring of the equipment and systems shown on the drawings (refer also to 'Sequence of Operation' for additional details).
- .4 Control valves shall be supplied by this Trade but installed in the piping system by the Mechanical Trade complete with transitions and unions as required.
- .5 Testing, debugging, calibrating, adjustment, programming and confirmation of total system operation.
- .6 Electrical power for controls items from local electrical panel. Coordinate with electrician. All work to be done in accordance with electrical division.

1.4 MANUFACTURER AND INSTALLING CONTRACTOR

- .1 The temperature control manufacturer shall be Tour Andover (TAC).
- .2 All controls to supplied, installed and wired by Energy Controls (phone 519-893-2638).
- .3 Any new building must be a seamless extension of the current Energy Management and Building Control System.
 - .1 The existing TAC Vista software is, and shall continue to be, the only head-end BAS server for the entire School Board.
 - .2 The head-end server contains the secure Energy Management Settings (i.e. Master Setpoints & Schedules) that are sent to all schools in real-time. The control system must be an extension of the head-end server and be able to be managed exclusively through the Vista head-end server.
 - .3 Monitoring of all school board control systems are done in real-time and must be presented at the exclusive Vista head-end server as first-priority data.
 - .4 The Vista head-end server has all the required controller databases and software to be able to centrally maintain and modify network configuration and controller software for the entire School Board. The Vista head-end server is the only system that can access the LacNet programming variables inside the controllers for real-time configuration of setpoint and time scheduling parameters.
 - .5 The graphics and controller database must be presented inside the Vista head-end server in its native format in order to preserve the real-time speed, integrity and multi-site administration of the entire system.

1.5 QUALITY ASSURANCE

- .1 The system components shall be listed by Underwriters Laboratories Inc. and Canadian Standards Association.
- .2 The system control products shall be stored and handled according to manufacturer' recommendations.
- .3 The work shall be performed by skilled technicians all of whom shall be properly trained and qualified for this work.

1.6 SUBMITTALS

- .1 Prior to the installation of any equipment, the Contractor shall provide the Consultant with shop drawings and specifications for all devices and equipment used for the complete system installation. Shop drawings shall include the following:
 - .1 Identified schematic control diagrams for all systems, each diagram indicating or referencing input / output connection points, control components, component catalogue numbers, operation sequence, interlocking and RPU's to which they are connected.
 - .2 Complete network schematic indicating all programmable controllers and data connections.
 - .3 Detailed listing of inputs and outputs of each programmable controller.
 - .4 Control damper schedule indicating damper size, required torque and blade type.
 - .5 Technical data sheets / manufacturer application manuals of each system component.
- .2 Upon completion of the installation and prior to acceptance and Owner training, the Contractor shall furnish the Consultant with three copies of installation and operation manuals for the system. Each manual shall include:
 - .1 Record drawings, including plan layout indicating major device locations and wiring diagrams as finally installed.
 - .2 All shop drawings, incorporating all required revisions to reflect as-built conditions.
 - .3 The Contractor shall also keep one copy of backup programs for the system archived in a software storage vault at their business location.

Part 2 Products

2.1 GENERAL

- .1 The control system shall be a Tour Andover (TAC) Xenta building automation system (BAS).
- .2 The system shall integrate the operation of intelligent building management controllers distributed into the network.
- .3 The DDC System shall be generally comprised of the following devices to achieve the control functions described in this section:
 - .1 Input/output programmable controllers.
 - .2 Control relays.
 - .3 Control dampers and valves.
 - .4 Sensors, actuators and other input/output devices.
- .4 Controllers shall execute the application programs, calculations, and commands to provide the control function specified for that unit. Each controller shall include its own

-
- micro-computer controller, power supply, input/output modules, termination modules and real time clock.
- .5 Controllers shall be capable of full control functionality and alarm reporting independently or as a part of the DDC network.
 - .6 The system shall be stored in flash ram so no batteries are required.
 - .7 Each control device shall be modular and expandable to provide additional inputs and outputs and control functionality for that device.
 - .8 Each controller shall be able to transfer and receive data via the network for performance of control functions.
 - .9 The system shall be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.
 - .10 The complete system shall be capable of communication over a LonWorks network.
 - .11 The controllers shall monitor the status of all overrides and include this information in logs and summaries to inform the operator that automatic control has been inhibited.
 - .12 Controllers shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment and provide both local and remote annunciation of any component failures.
 - .13 Controllers shall activate an orderly shutdown of their operation in the event of loss of normal electrical power. Non-volatile memory shall be incorporated for all controller configuration data. The controllers shall automatically resume full operation without manual intervention.
 - .14 The controllers shall have sufficient memory to support their own operating system and data bases including:
 - .1 control processes
 - .2 energy management applications
 - .3 alarm management
 - .4 trend data
 - .5 operator input/output
 - .6 remote communications
 - .7 manual override monitoring
 - .15 Controllers shall incorporate the following software features:
 - .1 Energy management:
 - .1 Time of Day Scheduling
 - .2 Calendar Based Scheduling
 - .3 Holiday Scheduling
 - .4 Optimal Start and Stop
 - .5 Demand Limiting
 - .6 Heating/Cooling Interlock
 - .2 Alarm Management:

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- .1 Alarm Management shall be provided to monitor, buffer and direct alarm reports to operator devices and memory files. The controllers shall perform alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost.
 - .2 All alarm or point change report shall include the points English language description and the time and date of occurrence.
 - .3 The user shall be able to define the specific reaction for each point, the priority level (3 in total) and ability to inhibit alarm reporting for each point.
 - .4 The user shall be able to define conditions under which point changes need to be acknowledged by an operator and logged for analysis at a later date.
 - .5 The user shall be able to print, display or store a unique 60 character alarm message to more fully describe the alarm condition or direct operator response. The message shall be customizable to describe each individual alarm.
 - .6 In web access applications only critical alarms shall initiate a call to a remote operator device, otherwise call activity shall be minimized by time stamping and saving reports until a manual request is received or until the buffer space (minimum 50 alarms) is full.
- .3 Trend Logs:
- .1 Controllers shall provide an automatic roll-over trend log, which stores records up to an operator-selected number at an operator-selected sampling rate and then overwrites the oldest record with each new record.
 - .2 Sample intervals shall be from 1 minute to 24 hours.
 - .3 Provide graphical and tabular displays.
- .4 Runtime Totalization:
- .1 The controllers shall automatically accumulate and store runtime hours for binary points with a sampling resolution of 1 minute. The user shall have the ability to define a warning limit to trigger maintenance or user-defined messages.
- .5 Custom Programming:
- .1 The controllers shall permit user defined custom control processes based on:
 - .1 any system measured data or status
 - .2 any calculated data
 - .3 any results from other processes
 - .4 Boolean logic
 - .2 The custom processes may be triggered by:
 - .1 Time-of-day
 - .2 calendar date

.3 events (point alarm etc.)

- .16 The control strategy for each control loop shall be performed by software within the controller. The sequence of events required for each control loop is described for each system in the control sequence.
- .17 Outdoor air temperature indication shall be available at each controller as an integral part of the control strategies for that controller. Should the network transmission of the common outdoor air temperature (or any other common value) fail, then each controller shall use the last good value received.
- .18 Controls and Requirements for VVT Systems
 - .1 Where VVT controls are specified, units are to operate as part of a Variable Volume/Variable Temperature System complete with all necessary controls including zone dampers, temperature sensors, static pressure sensor probes and bypass damper.

2.2 NETWORK ARCHITECTURE

- .1 The controllers on the local network shall communicate via a two wire LonTalk TP/FT-10 network.

2.3 CONTROL PANELS

- .1 Control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have a hinged door with locking latch or bolt-on cover plate. All cabinet locks shall be common keyed. Cabinets shall be finished with two coats of paint.

2.4 TEMPERATURE SENSORS

- .1 Provide thermistor temperature sensors, not requiring transmitters, to measure temperature.
- .2 Accuracy shall be +/-0.2°C from 0 to 70°C.
- .3 Temperature sensors shall be Greystone EC200 series.
- .4 Space sensors in occupied areas shall be type AE having an integral push button for unoccupied override and an integral slider to adjust set point (LED display not required).
- .5 In corridors and where noted on the drawings, provide stainless steel plate type sensors (push button override and LED display not required), type AS.
- .6 Duct temperature sensors shall be type B having a stainless steel probe length to suit application and ABS enclosure. Duct averaging temperature sensors shall be type FD having an element length to suit application, copper probe and ABS enclosure.
- .7 Immersion temperature sensors shall be type C having a ¼" OD stainless steel probe, 4" long and ABS enclosure. Immersion sensors shall be complete with thermowells. Thermal conductive compound shall be added inside the thermowell to provide optimum thermal transfer from the fluid to sensor. Stainless steel thermowells shall be used for steel pipe and brass thermowells shall be used in copper pipe.

2.5 CARBON DIOXIDE SENSORS

- .1 Sensors shall Greystone CDD series having the following features:
 - .1 0-2000 ppm factory default detection range, field adjustable.
 - .2 Non-dispersive infrared sensing element with self-calibration algorithm.
 - .3 Guaranteed 5 year calibration interval.
 - .4 Powered by either AC or DC source.
 - .5 Accuracy: within 50 ppm or 3% of reading (whichever is greater).
 - .6 Operating humidity range: 0-95% RH.
 - .7 Operating temperature range: 0 to 50°C or greater.
 - .8 Stability: less than 2% full scale in 15 years
 - .9 Response time: less than 2 minutes for 90% step change.
- .2 Duct mounted sensors shall be complete with ABS enclosure complete with sampling tube.
- .3 Space mounted sensors shall be executive space type without LCD display.

2.6 MOTORIZED CONTROL DAMPERS

- .1 Control dampers shall be the parallel or opposed blade type as below or as scheduled on drawings.
 - .1 Outdoor and/or return air mixing dampers and face and bypass (F & BP) dampers shall be parallel blade, arranged to direct air-streams toward each other.
 - .2 Other modulating dampers shall be the opposed blade type.
 - .3 Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
- .2 Damper frames shall be 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.
- .3 Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades are to be suitable for medium velocity performance (10 m/s [2000 fpm]). Blades shall be not less than 16 gauge.
- .4 Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze or better.
- .5 All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 50 L/s m² (10 cfm per ft²) at 1000 Pa (4 in. w.g.) differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s (1500 fpm).
- .6 Individual damper sections shall not be larger than 125 cm x 150 cm (48 in. x 60 in.). Provide a minimum of one damper actuator per section.
- .7 Modulating dampers shall provide a linear flow characteristic where possible.
- .8 Dampers shall have exposed linkages.

2.7 WATER CONTROL VALVES

- .1 Heating and cooling control valves shall be Belimo CCV series characterized ball valves, complete with chrome plated brass trim and NPT female pipe connections. Radiation valves shall be complete with non-spring return modulating actuators. Control valves for coils heating a portion of outdoor air shall have spring return modulating actuators.
- .2 Control valves shall be sized to provide approximately one half the circuit branch pressure drop to obtain good modulation control but they shall be no smaller than two pipe sizes less than the pipe they are installed in.

2.8 DIFFERENTIAL PRESSURE SENSORS

- .1 Differential pressure sensors shall be provided for liquid or air differential pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e.: water or air, and to withstand a minimum of two times the maximum pressure of the highest pressure range.
- .2 Each sensor shall be provided with an industry standard, 0 to 10 Vdc output signal mounted at the sensor. The transmitter and sensor shall have a combined accuracy and repeatability of 1.0% of the differential pressure range. A pushbutton zero adjustment shall be provided.

2.9 FREEZESTATS

- .1 Freezestats shall be complete with a vapour filled 20 foot bulb and 4 foot capillary. Wire freezestats to shut down the respective fans should temperature over any 12 in. of sensor length drop below the adjustable setpoint (2°C). Freezestats shall have manual reset.

Part 3 Execution

3.1 INSTALLATION

- .1 Installation
 - .1 All controllers and components in the system and on the network shall be installed according to manufacturer recommendations, general installation standards for digital controls and in accordance with the approved shop drawings.
 - .2 Locate room sensors in the locations shown on the mechanical drawings. All sensors shall be mounted at barrier free height (3'-11" (1175 mm) above finished floor).
 - .3 Provide serial data communication ports in the rooftop units where noted on the drawings, or at least one on each roof level, for operator interface. Also provide communication ports in the Custodian Office. Note that these shall be in addition to the associated rooftop unit controller with its built-in network port.
 - .4 All programmable controllers, web access components, relays and other control components shall be located within control panels. Control Panels shall be wall mounted and shall be located within suspended ceiling spaces or other locations approved by the Consultant.

- .5 The Electrical Contractor will provide hand-off-auto switches in all starters controlled by the BAS.
- .2 Wall mount carbon dioxide sensor shall be mounted next to the room temperature sensor for all rooms with unit ventilator.
- .3 All carbon dioxide levels which are measured by the carbon dioxide sensors shall be made available to the Owner in the form of trend logs. Record readings at 10 minute intervals and keep them for at least 30 days.
- .4 Freeze-stats shall be installed so that their sensing element runs horizontally across the coil face (not diagonally) with no more than 12" vertical drops at the outside coil frame. The full face of the coil shall be covered with no horizontal runs being more than 12" apart. The top and bottom horizontal run shall be within 6" of the coil frame. If more than one freezestat is required they shall be wired in series in order to detect a low temperature in portion of the coil. The sensing elements shall be firmly secured in place to avoid vibration without added air restriction.

3.2 SYSTEM START-UP AND ACCEPTANCE

- .1 Upon completion of installation, test, adjust and calibrate controls provided under this Section.
- .2 On system completion, a demonstration of complete system operation shall be made to the Owner's authorized representative and Consultant.
- .3 The Consultant shall verify through the Owners representatives that the entire system is complete and operating to the satisfaction of the Owner before final acceptance is approved.

3.3 TRAINING

- .1 The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:
- .2 Provide 4 hours of training for Owner's operating personnel. Training shall include:
 - .1 Explanation of drawings, operations and maintenance manuals
 - .2 Explanation of web access program
 - .3 Explanation of adjustment procedures
 - .4 Trend Analysis

3.4 WARRANTY

- .1 Equipment, material and software shall be unconditionally guaranteed for a period of two years form the date of substantial completion.
- .2 Provide warranty service at no cost to the Owner for the warranty period, which shall include but not be limited to the following:
 - .1 Emergency repair service on regular working hour basis.

- .2 Replacing defective parts and components as required.
- .3 System software support.

3.5 IDENTIFICATION

- .1 Provide system identification and provide nameplates identifying the following (nameplates shall be keyed to the wiring diagrams):
 - .1 Duct mounted sensors.
 - .2 Control panels (identify as to equipment / systems controlled). Each panel shall include an as-built drawing showing all the connected control points.

3.6 TESTING AND BALANCING

- .1 During the system testing and balancing by the Testing and Balancing Agency, demonstrate the operation of all controls. During balancing procedures, set controls to a fixed mode (bypass damper locked fully closed and all zone dampers locked fully open) to prevent any changes during the balancing procedure.

3.7 ELECTRICAL WIRING

- .1 All wiring shall be installed to the standards specified in the Electrical Division.
- .2 Use Echelon recommended orange jacket cable for all network wiring.
- .3 Run all wiring in EMT conduit where exposed, where running within concrete block walls and where required by the Ontario Electrical Code. Plenum rated cable shall be used in return air ceiling plenums.
- .4 Control relays necessary for BAS operation shall be provided by the Temperature Control Contractor but all contactors and their power supplies handling power wiring to the equipment shall be by the Electrical Contractor.

Part 4 Sequence of Operation

4.1 GENERAL

- .1 All setpoints shall be adjustable.
- .2 Outdoor air temperature shall be broadcasted to all controllers.
- .3 Heating mode: Heating is enabled between October 15 and April 15 or if the outdoor air temperature is below 10°C. This heating mode is used in all controllers for the building.
- .4 Cooling Mode: Mechanical cooling is enabled if the outdoor air temperature is above 18°C.
- .5 Free Cooling Mode: Free cooling is enabled if space temperature exceeds setpoint and outdoor air temperature is below 18°C. Modulate outdoor air damper position to maintain space temperature setpoint. Relief air dampers in relief air outlets are to open during free cooling mode. Modulate central exhaust systems serving classrooms based on outdoor air damper position of associated unit ventilators.

- .6 Carbon Dioxide Damper Override: In any air handling system with a return air or room air carbon dioxide sensor, it shall override the minimum position of the outdoor air damper during occupied mode. It shall override the minimum outdoor air damper between 0 and 40% as the carbon dioxide varies between 1000 and 1200 ppm. All limit controls shall take priority to maintain safe supply air temperatures. An alarm shall be generated if the carbon dioxide level is higher than 1700 ppm or lower than 200 ppm. Modulate central exhaust systems serving classrooms based on outdoor air damper position of associated unit ventilators.
- .7 Occupancy mode shall be determined by a weekly schedule with an annual holiday schedule. Each system shall have this schedule but there shall be provision for operating under a general (to the building) schedule as well. An adjustable parameter shall be available to select the local or general schedule for each system.
- .8 Lead/lag: Devices designed for lead lag operation shall operate in automatic lead/lag mode to equalize run time. If the lead unit fails the lag shall automatically start and an alarm shall be generated. The lead unit shall be advanced through the series of devices in sequence every Tuesday at noon.

4.2 EQUIPMENT SERVICES

- .1 Graphical sequence of operations will be provided by BAS contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Submit shop drawings and product data for following items:
 - .1 All bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: to ANSI & ULC requirements
 - .2 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.
 - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 10 mm (3/8") UL listed
 - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.
- .3 Upper attachment structural: Suspension from upper flange of I-Beam.
 - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
 - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.
- .4 Upper attachment to concrete.
 - .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are not considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.
- .5 Shop and field-fabricated assemblies.
 - .1 Trapeze hanger assemblies: ASME B31.1.
 - .2 Steel brackets: ASME B31.1.
- .6 Hanger rods: threaded rod material to MSS SP-58.
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.

- .7 Pipe attachments: material to MSS SP-58.
 - .1 Attachments for steel piping: carbon steel.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for all piping.
 - .4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.
- .8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m² (13.12 lbs/ft²) density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m (10') span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm (12") long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

2.5 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.7 ROOF MOUNTED EQUIPMENT

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated.
- .2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.

2.8 OTHER EQUIPMENT SUPPORTS

- .1 From structural grade steel meeting requirements of structural steel section specified herein.
- .2 Submit structural calculations with shop drawings.

2.9 MANUFACTURER

- .1 Acceptable materials:
 - .1 Grinnell
 - .2 Anvil
 - .3 Myatt
 - .4 Taylor

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to be to industry standards.
 - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 HANGER SPACING

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').
- .4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

- .5 **Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.**

- .6 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

- .7 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

3.3 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Do "NOT" support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

3.4 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.
- .2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.

- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Provide separate shop drawings for each isolated system complete with performance and product data.

Part 2 Products

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation to be as indicated.
- .2 To be of the same manufacturer for all isolation.
- .3 Acceptable materials:
 Korfund
 Vibro-Acoustics
 Vibron

2.2 ELASTOMERIC PADS

- .1 Type EP1 - neoprene waffle or ribbed; 10 mm (3/8") minimum thick; 50 durometer; maximum loading 350 kPa (50.8 psi).
- .2 Type EP2 - rubber waffle or ribbed; 10 mm (3/8") minimum thick; 30 durometer natural rubber; maximum loading 415 kPa (60.2 psi).
- .3 Type EP3 - neoprene-steel-neoprene; 10 mm (3/8") minimum thick neoprene bonded to 1.5 mm (16 gauge) steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa (50.8 psi).
- .4 Type EP4 - rubber-steel-rubber; 10 mm (3/8") minimum thick rubber bonded to 1.5 mm (16 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa (60.2 psi).
- .5 Acceptable materials:
 Korfund
 IAC Acoustics
 Vibro-Acoustics
 Vibron

2.3 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of [60]; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

Acceptable materials:

Vibro-Acoustics

Korfund

IAC Acoustics

Vibron

2.4 SPRINGS

- .1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0.
- .3 Cadmium plate for all installations.
- .4 Colour code springs.

2.5 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; leveling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg (2100 lbs) maximum.
- .6 Performance: as indicated.
- .7 Acceptable materials:
Korfund
IAC Acoustics
Vibron
Vibro-Acoustics

2.6 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, molded with rod isolation bushing, which passes through hanger box.

- .3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.
- .4 Performance as indicated.
- .5 Acceptable materials:
 - Vibron
 - IAC Acoustics
 - Korfund
 - Vibro-Acoustics

Part 3 Execution

3.1 INSTALLATION

- .1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:
 - .1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.
 - .2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.2 SITE VISIT

- .1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.
- .2 Provide Consultant with notice 24 h in advance of visit.
- .3 Make adjustments and corrections in accordance with written report.

3.3 TESTING

- .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.
- .2 Vibration measurements shall be taken for equipment-listed below:
- .3 Provide Consultant with notice 48 h in advance of commencement of tests.

- .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.
- .5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 Canadian Standards Association (CSA).
 - .1 Natural Gas and Propane Installation Code CSA B149.1.
- .4 National Fire Protection Association
 - .1 NFPA 13, Installation of Sprinkler Systems.
 - .2 NFPA 14, Standpipe and Systems.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with General Requirements.
- .2 Product data to include paint colour chips, all other products specified in this section.

1.3 PRODUCT LITERATURE

- .1 Submit product literature in accordance with General Requirements.
- .2 Product literature to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

- .2 Construction:
 - .1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

- .3 Sizes:

- .1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")

- .2 Use maximum of 25 letters/numbers per line.

- .4 Locations:

- .1 Terminal cabinets, control panels: Use size #5.
 - .2 Equipment in Mechanical Rooms: Use size #9.
 - .3 Roof top equipment: use size #9.
 - .4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES

- .1 Colours:

- .1 Black letters, yellow background.

- .2 Construction:

- .1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.

- .3 Locations:

- .1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

2.4 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Consultant.

- .4 Upon completion of this project all references to room names and numbering shall be to the Owner's requirements which may or may not be the numbering system used on the drawings. Each contractor shall verify the proper numbering scheme to be used prior to project completion.
- .5 All equipment shall be identified in sequence from the existing equipment and "NOT" duplicate numbering of equipment.

2.5 PIPING SYSTEMS GOVERNED BY CODE

- .1 Identification:
 - .1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.
 - .2 Sprinklers: To NFPA 13.
 - .3 Standpipe and hose systems: To NFPA 14.

2.6 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .3 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.
 - .2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.
 - .3 Use double-headed arrows where flow is reversible.
- .4 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).

.6 Colours and Legends:

- .1 Where not listed, obtain direction from Consultant.
- .2 Colours for legends, arrows: To following table:

Background colour:	Legend:	Arrows:
Yellow	White	Black
Green	White	Black
Red	White	Black

.7 Pictograms:

- .1 **Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.**

.8 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR	
	MARKING	LEGEND
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Condensate	Green	CONDENSATE
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID

2.7 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.8 VALVES, CONTROLLERS

- .1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.
- .3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

2.9 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

- .3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

2.10 LANGUAGE

- .1 Identification to be in English.

Part 3 Execution

3.1 TIMING

- .1 Provide identification only after all painting specified has been completed.

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection
 - .1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.

1.2 QUALIFICATIONS OF TAB AGENCIES

- .1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:
 - .1 Air Audit Inc.
110 Turnbull Court, Unit 11
Cambridge, Ontario
N1T 1K6
(519) 740-0871
 - .2 Air Velocities Control Ltd.
100 Premium Way
Mississauga, Ontario
L5B 1A2
(905) 279-4433
 - .3 Flowset Balancing Ltd.
431 Willis Dr.
Oakville, Ontario
L6L 4V6
(416) 410-9793
 - .4 Air Adjustments & Balancing Inc.
P.O. Box 176,
Schomberg, Ontario
L0G 1T0
(416) 254-3004

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average (95% design) and low (75% of design) loads using actual or simulated loads. TAB contractor to perform equipment evaluation upon start up and once during each season in the first year of operation.

- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions. Confirm all equipment interlocks and functions of associated systems.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and temperatures. Refer to BAS for system operating functions.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 DYNAMIC BALANCING

- .1 This project includes dynamic balancing for the hydronic system. Additional details for dynamic system balancing are provided on drawings.

1.6 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems. Co-ordinate with other trades to ensure all systems are interlocked as indicated elsewhere prior to TAB.

1.7 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.
- .4 During construction indicate all tolerances of piping, ductwork etc conforms to specifications.

1.8 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in the Mechanical Division.

1.9 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.10 START OF TAB

- .1 Notify Consultant in writing 3 days prior to start of TAB.
- .2 Start TAB only when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weather-stripping, sealing, caulking.
 - .3 All pressure, leakage, other tests specified elsewhere in the Mechanical Division.
 - .4 All provisions for TAB installed and operational.
 - .5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 All outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.
 - .7 Control valves are properly piped.
 - .8 Coils and radiation are properly piped.
 - .9 BAS in operation.

1.11 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 10%, minus 5%.
 - .2 Hydronic systems: plus or minus 10%.

1.12 ACCURACY TOLERANCES

- .1 Measured values to be accurate to within plus or minus 2% of actual values.

1.13 INSTRUMENTS

- .1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.14 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
 - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.16 TAB REPORT

- .1 Format to be in accordance with NEBB, AABC, or SMACNA.
- .2 TAB report to show all results in SI or imperial units as indicated on plans and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit copy of TAB Report to consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.17 VERIFICATION

- .1 All reported results subject to verification by Consultant.
- .2 Provide manpower and instrumentation to verify up to 30% of all reported results.
- .3 Number and location of verified results to be at discretion of Consultant.
- .4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.18 SETTINGS

- .1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.
- .2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.19 COMPLETION OF TAB

- .1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.20 AIR SYSTEMS

- .1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:
 - .1 Air handling systems and equipment
 - .2 Duct testing to SMACNA standards.
- .3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.
- .4 Quality assurance: Perform TAB under direction of qualified supervisor.
- .5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.
 - .2 At each controller, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

1.21 HYDRONIC SYSTEMS

- .1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.
- .2 Standard: TAB to be the most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .3 Do TAB of all systems, equipment, components, controls specified in Mechanical Division including but not limited to hydronic equipment testing.
- .4 Qualifications: personnel performing TAB to be current member in good standing of NEBB.
- .5 Quality assurance: perform TAB under direction of qualified supervisor.
- .6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power voltage, noise, vibration.

- .7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of each heat exchanger (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.
 - .2 At each controller, controlled device.
- .8 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of each primary and secondary loop (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water).

1.22 DUCT LEAKAGE TESTING

- .1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 NFPA 13 latest edition, Installation of Sprinkler Systems.
- .3 Ontario Fire Code.
- .4 Ontario Building Code.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements in accordance with NFPA 13, working plans and design requirements.
- .2 Shop drawings shall be approved by authority having jurisdiction prior to submission
- .3 Submit to consultant for general review and information only.
- .4 Submitted drawings shall be reproducible. Do not submit marked up prints.

1.3 SAMPLES

- .1 Submit samples in accordance with general requirements.
- .2 Submit samples of following:
 - .1 Each type of sprinkler head.
 - .2 Signs.

1.4 ENGINEERING DESIGN CRITERIA

- .1 Design system in accordance with Ontario Fire Marshall, local authority having jurisdiction, owner's underwriters as required, and NFPA 13, NFPA 20, and NFPA 45 using following parameters:
 - .1 To suit occupancy as indicated.
 - .2 Pipe size and layout: Hydraulic design.
 - .3 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with NFPA 13. Indicate location and flow on shop drawings.
 - .4 System zoning as indicated in accordance with NFPA 13.
 - .5 Provide complete drawings and calculations stamped by a qualified professional engineer registered in the Province of Ontario.
 - .6 Professional Engineer shall provide on site review and certification for local building code review.
- .2 System shall be approved by Ontario Fire Marshall, local authority, and owner's underwriter prior to shop drawing submission.

1.5 COMMISSIONING & INTEGRATED TESTING OF FIRE PROTECTION & LIFE SAFETY SYSTEMS

- .1 Sprinkler contractor to perform services with the Fire Commissioning Agent (FCA) to meet their requirements for administration, verification, and final sign-off.
- .2 The Fire Commissioning Agent (FCA) is being retained by the electrical contractor, however; this contractor's work to satisfy the FCA requirements shall be included in the tender price.
- .3 The sprinkler contractor at a minimum must include for:
 - .1 Providing FCA all documentation of design and shop drawings.
 - .2 Provide documents for sequence of operation and maintenance of system.
 - .3 Movement of all valves and accessories to confirm Alarm/Supervisory/Trouble at the fire panel.
 - .4 Create flow at all initiating devices to verify detection at the fire panel.
 - .5 Testing and operation of any fire pumps.
 - .6 Other items that may be requested by the FCA.
 - .7 Re-commissioning of any items that may have failed.
 - .8 Putting the system back into proper operation after tests are completed.
- .4 All work to be performed in accordance with NFPA 3 2010 Edition. Special consideration to be given to Figure A3.3.16 (b) for Sequence of Operation Form required to be completed in conjunction with the FCA and submitted to the consultant's prior to occupancy.
- .5 The work to be performed by this contractor is also described in NFPA 3 table A.5.1.1 as labelled "Construction Stage" and "Occupancy Stage".

1.6 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

1.7 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with general requirements.
- .2 Provide spare sprinklers and tools as required by NFPA 13.

1.8 QUALIFICATIONS

- .1 Contractor to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project.

1.9 PERMITS AND FEES

- .1 Obtain and pay for all permits, fees, and inspections as required by authority having jurisdiction.

1.10 EQUIPMENT

- .1 ULC listed and labeled.

1.11 STORAGE

- .1 Store in original packaging with manufacturers' labels and seals intact.
- .2 Store in dry secure location.
- .3 Damaged material and/or equipment shall be replaced.

Part 2 Products

2.1 PIPE, FITTINGS, AND VALVES

- .1 Pipe and Fittings:
 - .1 25 mm (1"): Schedule 40 steel pipe with screwed fittings.
 - .2 32 mm (1¼") to 50 mm (2"):
 - .1 Schedule 40 steel pipe with screwed fittings or,
 - .2 Schedule 10 steel pipe with roll grooved fittings.
 - .3 65 mm (2½") and larger: Schedule 10 steel pipe with roll grooved fittings.
- .2 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed ends, OS&Y gate.
 - .3 NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve.
 - .4 Swing check valves.
 - .5 Ball drip.
- .3 Pipe hangers:
 - .1 ULC listed for fire protection services.
- .4 End switches:
 - .1 Provide on all isolating valves.
 - .2 Coordinate voltage and location with fire alarm contractor.
- .5 Flow switches:
 - .1 Provide where indicated and required.
 - .2 Coordinate voltage and location with fire alarm contractor.

2.2 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Indicate type and location of sprinkler heads on drawings. Co-ordinate sprinkler heads location with other trades.
- .3 Locate sprinkler heads in acoustic tile ceiling in centre of tile.
- .4 Provide sprinkler heads as indicated.
- .5 Provide sprinkler heads under all equipment/ductwork over 1200 mm wide.

2.3 SUPERVISORY SWITCHES

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves:
 - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Flow switch type:
 - .1 With normally open and normally closed contacts and supervisory capability.
- .4 Pressure alarm switch:
 - .1 With normally open and normally closed contacts and supervisory capability.

2.4 FIRE DEPARTMENT CONNECTION (IF APPLICABLE)

- .1 To NFPA 13 and ULC listed, siamese type, location as indicated. Thread specifications to be compatible with local fire department.
- .2 Polished chrome plated recessed with identifying sign cast on plate. Threaded metal caps and chains.

2.5 PRESSURE GAUGES

- .1 ULC listed
- .2 Shall have maximum limit of not less than twice normal working pressure at point where installed.

2.6 SIGNS

- .1 Signs for control drain and test valves: to NFPA 13.
- .2 Provide exterior signage for Fire Department connection. Location of signage and text shall be to the approval of the local authority having jurisdiction.

2.7 SPARE PARTS CABINET

- .1 For storage of maintenance materials, spare sprinkler heads and special tools.
- .2 Include all types and temperature ratings of sprinkler heads installed.
- .3 Construct to sprinkler head manufacturers standard.
- .4 Install where directed on site or next to alarm valve.

2.8 DOUBLE CHECK VALVE ASSEMBLY (IF APPLICABLE)

- .1 The double check backflow preventer shall be ASSE 1015 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM.
- .2 The checks shall be accessible for maintenance without removing the device from the line.

- .3 Complete with supervisory switches for connection and monitoring by the fire alarm.
- .4 Install to manufacturer's requirements and not higher than 1200 mm (4'-0") AFF.
- .5 Acceptable materials:
 - .1 Watts 709 2½" - 10"
 - .2 Wilkins 950 2" - 10", 350 4" - 6"
 - .3 Conbraco 40-100 Series

2.9 INSPECTORS TEST CONNECTIONS

- .1 Provide where indicated and to requirements of local authority.
- .2 Discharge to building exterior to acceptance of consultant.
- .3 Provide suitable signage to satisfaction of authority having jurisdiction and consultant.

2.10 DOCUMENTATION

- .1 Prepare documentation as indicated.
- .2 Provide documentation based on tender documents. Coordinate sprinkler drawings with all trades.
- .3 Provide one hard copy and one electronic copy of As Built drawings acceptable to consultant prior to final payment.

Part 3 Execution

3.1 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and FC 403.
- .2 Install excess pressure pump across alarm valve in accordance with manufacturer's instructions.
- .3 Pipe a bypass complete with indicating valve, between Fire department connection and sprinkler main downstream of DCVA. Bypass shall be sized to allow flow test of system demand as per NFPA 13 forward flow test thru the backflow preventor.
- .4 Testing to be witnessed by authority having jurisdiction.
- .5 Space hangers and support of sprinkler piping in accordance with N.F.P.A. regulations.
- .6 Hydrostatically test systems at 350kPa in excess of normal working pressure, but not less than 1.4 MPA for two hours without loss under supervision of authority having jurisdiction and NFPA requirements.
- .7 Provide hydraulic pump, temporary connections and labour required for tests.
- .8 Protect exposed work, in accordance with 'Painting' section.
- .9 Do not cover or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction.
- .10 Adjust equipment to satisfaction of authority having jurisdiction and consultant.

- .11 Protect equipment during painting. Replace damaged and painted components.
- .12 Co-ordinate the sprinkler piping and equipment with that of other trades on the job. Mains and branches shall be run so as not to interfere with building's structure, mechanical, or electrical installations. Branch piping above ceilings is to run in joist space or minimum 300 mm above ceiling. Provide drops at head locations only. All exposed piping to run in joist space.
- .13 Guarantee that the systems and equipment be installed in accordance with all Local and Provincial by-laws and the rules and regulations of the Insurance Underwriters and the Building Code of Ontario.
- .14 Provide a flow test for each system on the remote inspectors test connection using methods approved by the local fire department and local water commission. Report the test results in writing to the consultant.

3.2 WATER FLOW TEST

- .1 Provide a flow test to approval of local fire department and local water commission at nearest fire hydrant adjacent to building to determine water flow rate and pressure. Provide written test results with shop drawing submission.
- .2 Provide a forward flow test thru the bypass to prove system demand can be provided thru the backflow preventer.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
 - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 CAN/ULC-S702, Mineral Fiber Thermal Insulation for Buildings.
 - .3 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.
 - .4 CGSB 51-GP-52Ma-[89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM).
 - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations.
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have expertise and be trained in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52 Ma.
 - .3 Maximum "k" factor: to ASTM C553.
- .4 Manufacturers:
 - .1 All materials must be supplied by the same manufacturer.

- .2 Acceptable Materials:
 - .1 Johns Manville
 - .2 Fibreglass Canada
 - .3 Knauf
 - .4 Manson
 - .5 Roxul

2.3 JACKETS

- .1 Canvas:
 - .1 220 g/m² (0.0451 lb/ft²) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
 - .2 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 g/m² (0.0451 lb/ft²) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.
- .6 Contact adhesive: quick-setting Duro Dyne 1A-22 or equal.
- .7 Canvas adhesive: washable.
- .8 Tie wire: 1.5 mm (16 gauge) stainless steel.
- .9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation
- .10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers in accordance with general requirements.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.
- .6 Provide rigid insulation for exposed ductwork.

3.3 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thickness' conform to following table:

Application	Type	Thickness
Rectangular supply air ducts	C-1	25 mm (1")
Supply, return and exhaust ducts exposed (visible) in space being served	none	
Outdoor air intake ductwork and plenums	C-1	50 mm (2")
Exhaust plenums dampers and louvres	C-1	25 mm (1")
Interior acoustically lined ducts	none	
Last 1.5m of Exhaust duct	C-1	25 mm (1")

- .2 Exposed round ducts 600 mm (24") and larger, smaller sizes where subject to abuse:
 - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

- .3 Finishes: Conform to following table:

Application	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed	Canvas	Canvas

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
 - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
 - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have expertise and be trained in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52 Ma.
 - .3 Maximum "k" factor: to ASTM C553.
- .4 Type A-3: Flexible unicellular tubular elastomer.
 - .1 Insulation to ASTM C553 with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52 Ma.
 - .3 Maximum "k" factor: to ASTM C553.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

- .5 Materials:
 - .1 All materials must be supplied by the same manufacturer.
 - .2 Acceptable Materials:
 - Fibreglass Canada
 - Knauf
 - Manson
 - Pittsburg Corning

2.3 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 **Tie wire: 1.5mm (16 gauge) diameter stainless steel.**
- .5 **Bands: Stainless steel, 20 mm (3/4") wide, 0.5 mm (26 gauge) thick.**

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 To ASTM C553.
 - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m² (0.062 lb/ft²).

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: white.
 - .3 Minimum service temperatures: -20°C (-4°F).
 - .4 Maximum service temperature: 65°C (150°F).
 - .5 Moisture vapour transmission: 0.02 perm.

- .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
- .2 Aluminum:
 - .1 To ASTM B 209M.
 - .2 Thickness: 0.50 mm (26 gauge) sheet.
 - .3 Finish: Smooth.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.
 - .5 Fittings: 0.50 mm (26 gauge) thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 20 mm (3/4") wide, 0.50 mm (26 gauge) thick at 300 mm (12") spacing.

2.9 CAULKING FOR JACKETS

- .1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers' instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
- .2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: As per adjacent insulation.

3.4 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 Install insulator and jackets to applicable TIAC codes.
- .3 Insulate ends of capped piping with type and thickness indicated for capped service.
- .4 Thickness of insulation to be as listed in following table.
 - .1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Condensate	A-1	40 (1½")	40 (1½")	50 (2")	50 (2")	50 (2")
Hot Water Heating	A-1	40 (1½")	50 (2")	50 (2")	50 (2")	50 (2")
Refrigerant piping	A-3	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")

- .5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Concealed indoors	N/A	PVC
Exterior refrigerant piping	Aluminum	Aluminum

- .6 Connection: To appropriate TIAC code.
- .7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 HVAC Water Treatment Section.

1.2 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian Standards Association (CSA).
 - .1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- .3 American National Standards Institute (ANSI).
 - .1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
 - .2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
- .4 American Society for Testing and Materials (ASTM).
 - .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM A536, Specification for Ductile Iron Castings.
 - .4 ASTM B61, Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .5 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate on manufacturers catalogue literature the following:
 - .1 Piping
 - .2 Valves
 - .3 Accessories

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
 - .1 NPS 150 mm (6") and smaller: Schedule 40.
- .2 Final connection to copper heating elements.
 - .1 Type "L" copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

2.2 PIPE JOINTS

- .1 NPS 50 mm (2") and under: screwed fittings with pulverized lead paste.
- .2 NPS 65 mm (2½") and over: welding fittings and flanges to CSA W47.1.
- .3 Flanges: plain or raised face, slip-on.
- .4 Flange gaskets: suitable for hydronic heating up to 110°C (220°F).
- .5 Pipe thread: taper.
- .6 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ANSI/ASME B16.1, Class 125.
 - .2 Steel: to ANSI/ASME B16.5.
- .3 Butt-welding fittings: steel, to ANSI/ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M and ANSI/ASME B16.3.

2.4 VALVES MANUFACTURERS

- .1 All valves shall be of commercial grade and of same manufacturer.
- .2 Acceptable Manufacturers:
 - .1 Newman Hattersley Canada Ltd.
 - .2 Jenkins/Crane
 - .3 Milwaukee
 - .4 Toyo
 - .5 Kitz

2.5 VALVES

- .1 Connections:
 - .1 NPS 50 mm (2") and smaller: screwed ends.
 - .2 NPS 65 mm (2 ½") and larger: flanged ends.

- .2 Gate valves: Application: Isolating equipment, control valves, pipelines:
 - .1 NPS 50 mm (2") and under:
 - .1 Mechanical Rooms: Class 125, rising stem, solid wedge disc. Jenkins 810J.
 - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc. Jenkins 310J.
 - .2 NPS 65 mm (2 1/2") and over:
 - .1 Mechanical Rooms:
 - .1 Rising stem, solid wedge disc, bronze trim. Jenkins 454J.
 - .1 Operators: handwheel.
 - .2 Non-rising stem, solid wedge disc, bronze trim. Jenkins 452J.
 - .1 Operators: handwheel.
- .3 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
 - .1 NPS 65 mm (2 1/2") and over: Flanged ends. Jenkins FIG 2232 ELJ.
- .4 Globe valves: Application: Throttling, flow control, emergency bypass:
 - .1 NPS 50 mm (2") and under:
 - .1 With PTFE disc, as specified. Jenkins 106BJ. Bronze.
 - .2 NPS 65 mm (2 1/2") and over:
 - .1 With solid bronze disc, bronze trim, cast iron body. Jenkins 2342.
- .5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.
- .6 Swing check valves:
 - .1 NPS 50 mm (2") and under:
 - .1 Class 150, swing, with PTFE disc, as specified. Bronze. Jenkins 4475TJ.
 - .2 NPS 65 mm (2 1/2") and over:
 - .1 Flanged or Grooved ends, Bronze trim, Cast Iron: Gate, Globe, Check. Jenkins 587J.
- .7 Ball valves:
 - .1 NPS 80 mm (3") and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
 - .3 Connections:
 - .1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .2 NPS 65 mm (2½") and over flanged ends.
 - .4 Stem: stainless steel tamperproof ball drive.
 - .5 Ball and seat: replaceable stainless steel solid ball and teflon seats.
 - .6 Operator: removable lever handle.
 - .7 Extended handles on chilled water valves.

- .8 Full port.
- .9 Jenkins 201SJ.

2.6 BALANCING VALVES

- .1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.
- .2 Size 65 mm (2 1/2") to larger: Cast iron body, raised flange connections, glove style with brass plug.
- .3 Differential pressure readout ports with internal EPT inserts and check valves, 6 mm (1/4")NPT tapped drain/purge ports, memory stop and calibrated nameplate.
- .4 Acceptable materials:
 - .1 Tour & Anderson (match Victaulic pipe section)

2.7 AUTOMATIC AIR VENT

- .1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kpa (125 psi) working pressure.
- .2 Float: solid material suitable for 115°C (240°F) working temperature.
- .3 Plastic vents are not acceptable.
- .4 Acceptable materials:
 - .1 Maid-O-Mist No. 67
 - .2 Spirax Sarco

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 Installation shall be by a licensed pipe fitter.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .4 Slope piping in direction of drainage and for positive venting.
- .5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .8 Assemble piping using fittings manufactured to ANSI standards.

- .9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

3.2 VALVE INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install butterfly valves on chilled water and condenser water lines only.
- .3 Install gate or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .4 Install globe valves for balancing and in by-pass around control valves as indicated.
- .5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .6 Provide swing check valves in horizontal lines as indicated.
- .7 Install chain operators on valves NPS 65 mm (2 1/2") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.

3.3 AIR VENTS

- .1 Install at high points of systems.
- .2 Install ball valve on automatic air vent inlet.
- .3 Extend vent lines in Mechanical Room with screwdriver stop at 1.8 m AFF.

3.4 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated and as follows:
 - .1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc).
 - .2 On return side of all water or glycol cooling coils.
 - .3 On return side of all reverse return piping loops and/or branch circuits.
- .2 Install to manufacturers requirements.
- .3 Valve size shall be one trade size smaller than piping.
- .4 Refer to Testing Adjusting and Balancing Section for applicable procedures.

3.5 FILLING OF SYSTEM

- .1 Refill system with clean water adding water treatment as specified.
- .2 Co-ordinate filling of system with HVAC water treatment contractor.
- .3 Drain and vent all new and existing piping, radiation, etc for a complete operable system.

3.6 TESTING

- .1 Test system in accordance with Mechanical General Requirements Section.
- .2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair any leaking joints, fittings or valves.

3.7 FLUSHING AND CLEANING

- .1 Procedure:
 - .1 Flushing and cleaning should only take place after successful piping pressure testing.
 - .2 Terminal device (reheat coils, heat pumps, perimeter radiation, etc.), air handling unit coils and their associated control and balancing valves should be bypassed during the preliminary flushing and cleaning process.
 - .3 Instruments such as flow meters, flow metering valves and orifice plates should only be installed after flushing and cleaning.
- .2 Timing:
 - .1 The overall construction schedule identifies piping flushing and cleaning with realistic time allotments.
 - .2 The mechanical contractor is required to provide a detailed report outlining the processes and procedures for flushing and cleaning per piping system at least 4 to 6 weeks in advance of work.
 - .3 As a minimum, at least one piping flushing and cleaning procedure shall be witnessed, by the consultant and/or commissioning agent.
- .3 The mechanical contractor shall to utilize a qualified water treatment specialist to supervise the flushing and cleaning process and provide the certified water analysis report certifying that the piping systems are clean.
- .4 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.
- .5 Flush and clean new piping system in presence of Consultant.
- .6 Flush after pressure test for a minimum of 4 hrs.
- .7 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.
- .8 Thoroughly flush all new mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.
- .9 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.
- .10 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.
- .11 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

- .12 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .13 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.
- .14 Repeat system drain and flush as often as necessary to have a clean system.
- .15 Disposal of cleaning solutions to be approved by authority having jurisdiction.
- .16 Isolate new piping system from existing system as required for system cleaning.
- .17 After hydronic system is cleaned, refill with clean water and chemical as per chemical supplier treatment.**

3.8 EXISTING SYSTEM DRAINAGE

- .1 Drain existing hot hydronic system as required to facilitate system renovations.
- .2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute (ANSI).
 - .1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
 - .2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
 - .3 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
 - .4 ANSI/ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
 - .5 ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM A536, Specification for Ductile Iron Castings.
 - .4 ASTM B61, Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 SCOPE

- .1 Rolled Grooved piping is permitted in boiler room only. No rolled grooved piping shall be installed outside of central boiler room.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate on manufacturers' catalogue literature the following:
 - .1 Piping
 - .2 Valves
 - .3 Accessories

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

- .1 Victaulic.
- .2 No alternates.

2.2 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
 - .1 NPS 40 mm (1½") to 150 mm (6"): Schedule 40.
- .2 Final connection to copper heating elements.
 - .1 Type "L" copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

2.3 PIPE JOINTS

- .1 NPS 32 mm (1¼") and under: screwed fittings with pulverized lead paste (see 23 21 13).
- .2 Rolled grooved with Grade E (EPDM) gaskets.

2.4 FITTINGS

- .1 Rolled grooved fittings:
 - .1 Couplings shall be Victaulic Style 07 Zero-Flex with angled bolt pad design and must be installed with Grade E (EPDM) gaskets.
- .2 Flanges: Victaulic Style 741.
- .3 Hole Cut Products and Branch Connections:
 - Victaulic Style 920 Mech. Tee
 - Victaulic Style 923 Vic-Let Outlet
 - Victaulic Style 924 Vic-O-Well Thermometer Outlet

2.5 VALVES

- .1 Connections:
 - .1 NPS 40 mm (1½") and larger: rolled grooved ends.
- .2 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
 - .1 NPS 40 mm (1½") to 300 mm (12"): Victaulic Vic 300
- .3 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.

- .4 Check valves:
 - .1 NPS 50 mm (2") and under:
 - .1 Class 150, swing, with PFTE disc, as specified.
Bronze. Jenkins 4475TJ.
- .5 Ball valves:
 - .1 NPS 80 mm (3") and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
 - .3 Connections:
 - .1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .2 NPS 65 mm (2½") and over flanged or grooved ends.
 - .4 Stem: stainless steel tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel solid ball and teflon seats.
 - .7 Operator: removable lever handle.
 - .8 Extended handles on chilled water valves.
 - .9 Full port.
 - .10 Jenkins 201SJ.
- .6 Strainers:
 - .1 Wye Strainer: NPS 50 mm (2") and over: Victaulic 732 Wye Type Vic-Strainer.

2.6 **BALANCING VALVES**

- .1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.
- .2 Size 65 mm (2 1/2") to larger: Victaulic Tour Anderson Series 789.
- .3 Differential pressure readout ports with internal EPT inserts and check valves, 6 mm (¼")NPT tapped drain/purge ports, memory stop and calibrated nameplate.
- .4 Acceptable materials:
 - .1 Tour & Anderson
 - .2 No alternates.

2.7 **AUTOMATIC AIR VENT**

- .1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kPa (125 psi) working pressure.
- .2 Float: solid material suitable for 115°C (240°F) working temperature.
- .3 Acceptable materials:
 - .1 Honeywell EA122 series with integral shutoff
 - .2 Spirax Sarco

2.8 EXPANSION JOINTS AND FLEXIBLE CONNECTIONS

- .1 Application: to suit motion.
- .2 Minimum length in accordance with manufacturers recommendations to suit offset.
- .3 Victaulic Style 150 Mover slip-type expansion joint. The expansion joint shall be installed with Style 07 Zero-Flex couplings.

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 Installation shall be by a licensed pipe fitter.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .4 Slope piping in direction of drainage and for positive venting.
- .5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .8 Assemble piping using fittings manufactured to ANSI standards.
- .9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

3.2 PIPE END PREPARATION

- .1 Outside diameter of grooved pipe shall not vary more than the tolerance approved. For IPS pipe, the maximum allowable tolerance from square cut ends is 0.030" for ¾" through 3½", 0.045" for 4" through 6"; and 0.060" for sizes 8" O.D. and above; measured from true square line. Any internal or external weld bead or seams in the groove area must be ground smooth and flush. The end of the pipe internally must be cleaned of any material that might interfere with or damage the internal roll.
- .2 Pipe surface shall be free from indentations and projections from the end of the pipe to the groove, to provide a leak tight seat for the gasket. All loose paint, scale, dirt, chips, grease and rust must be removed. It is the recommendations of Victaulic that the pipe be square cut. Beveled pipe may be used provided the wall thickness is standard wall (ANSI B36.10) or less and the bevel meets ANSI B16.25.
- .3 Bottom of the groove must be free of loose dirt, chips, rust and scale that may interfere with proper coupling assembly.

- .4 Groove dimensions shall conform to standard roll groove specifications as published by Victaulic.
- .5 Pipe shall be grooved using Victaulic roll grooving system with track enhanced grooving rolls.

3.3 “ZERO-FLEX” COUPLING INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Apply a thin coat of Victaulic Lubricant to gasket lips and outside of gasket.
- .3 Place gasket over pipe end, being sure lip does not overhang pipe end.
- .4 Align and bring two pipe ends together and slide gasket into position centered between the grooves on each pipe. No portion of the gasket shall extend into the groove on either pipe.
- .5 Loosely assemble all segments leaving one nut and bolt off to allow for “swing-over” feature.
- .6 With one nut and one bolt removed, use “swing-over” feature to position housings over gasket and into position into the grooves on both pipes.
- .7 Remaining bolt shall be inserted. Bolt track head must engage into housing recess.
- .8 Nuts shall be tightened alternately and equally and must maintain metal-to-metal contact at the angle bolt-pads. Tighten securely to assure a rigid joint. Torque to manufacturer’s recommendation.

3.4 “REDUCING” COUPLING INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Gasket must be thoroughly lubricated.
- .3 Place large opening of the gasket over the larger pipe ends until the Assembly Washer touches the pipe end.
- .4 Align the pipe centerlines and insert the smaller pipe end in the gasket. Assembly washer provided by Victaulic shall be used.
- .5 Coupling housings shall be positioned over the gasket into the groove on each pipe.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equal until housing bolt pads are firmly together – metal-to-metal.

3.5 “OUTLET” COUPLING INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.

- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Gasket must be thoroughly lubricated.
- .3 Gasket shall be placed on one pipe end so the lips on one side cover the area between the pipe end and the groove. The gasket must not overlap the groove. The pipe ends shall be d to touch the reinforcement ribs inside the gasket.
- .4 Bring mating pipe or fitting into position and insert into gasket. The gasket shall not overlap the groove, but fully cover the pipe end.
- .5 Housings shall be placed over the gasket and the housing keys must engage into the grooves. Ample lubricant shall be applied to the gasket outlet neck and the upper housing interior.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equally until housing bolt pads are firmly together – metal-to-metal.

3.6 VICTAULIC “FLANGE ADAPTOR” INSTALLATION

- .1 Pipe must be free from indentation, projections, or roll marks on exterior from the end to the groove, to assure a leak tight seat for the gasket.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade.
- .3 Victaulic Flange adaptor shall be opened fully and hinged flange shall be placed around the grooved pipe end with the circular key section locating into the groove.
- .4 Standard bolt shall inserted through the mating holes of the Vic-Flange adaptor to secure firmly in the groove.
- .5 Gasket shall be fully lubricated and pressed into the cavity between the pipe O.D. and flange recess.
- .6 Standard flange bolt shall be place in the hinge hole (opposite the lock bolt) and the bolt assembly shall be directed to mate with the adjoining flange. Remaining flange bolts shall be added and tightened evenly until faces contact firmly.
- .7 Where Vic-Flange adaptors do not mate to a hard smooth surface, Victaulic Flange Washers must be used.

3.7 MECHANICAL-T OUTLET INSTALLATION

- .1 Holes must be drilled.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade.
- .3 In preparation for assembly, one nut and bolt shall be removed from the housing. The other nut and bolt shall be loosened until it is flush with the nut and bolt. Remove the tape and lift the gasket from the mechanical-T outlet.
- .4 Victaulic lubricant shall be applied to all surfaces of the gasket and the gasket shall be properly repositioned into the housing using alignment tabs.

- .5 When assembling the coupling, the lower housing shall be rotated 90 degrees away from the upper housing. Place the upper, or outlet section on to the face of the pipe in line with the outlet hole. The lower section shall then be rotated around the pipe to close the two halves. The locating collar must be in the outlet hole.
- .6 Insert bolt and apply nut. Oval neck must engage in recess of the housing.
- .7 Nuts shall be tightened alternately and equally until the housing is in complete surface contact in the gasket pocket area and the assembly is rigid. **Nuts must be tightened to 30 ft. (S/921) and 50 ft. (S/920 and 929)** with even gaps between the bolt pads.
- .8 Where mechanical-T are used as transition pieces between two runs, they must be assembled onto the runs before the branch connections are made.

3.8 VIC-LET STRAPLESS OUTLET & VIC-O-WELL STRAPLESS THERMOMETER & PRESSURE GAUGE INSTALLATION

- .1 Holes must be drilled.
- .2 Do not use for branch piping connections where size may not be available. Use first available size and reducer.
- .3 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Victaulic lubricant shall be applied to exposed gasket sealing lip.
- .4 Vic-Let outlet toe shall align with pipe. Tilt toe into the hole and drop into the pipe. The Vic-Let outlet must be positioned with the heel inside the pipe.
- .5 Collar shall be held in position while nut is being hand tightened. Nut shall then be wrench tightened until collar deforms to contact pipe all around. Maintain collar/gasket alignment to prevent gasket pinching. Do not exceed 200 ft.lbs. Vic-Let outlet shall not be reused after initial installation.

3.9 ROUST-A-BOUT PLAIN END PIPE COUPLING INSTALLATION

- .1 Pipe shall be marked 1" from the end.
- .2 Gasket supplied must be checked to be certain it is suited for intended service. Colour code identifies gasket grade. Apply a thin coat of Victaulic Lubricant to gasket lips and outside of gasket.
- .3 Place gasket over pipe end, being sure lip does not overhang pipe end.
- .4 The pipe shall be butt and held in position while slide the gasket back into position. The gasket must be centered between the marks.
- .5 Housings shall be placed over the gasket.
- .6 Insert bolts and apply nuts.
- .7 Nuts must be tightened alternately and equally to standard torque specifications as published by Victaulic. Segments must be assembled with equal gaps between the bolt pads.

3.10 VALVE INSTALLATION

- .1 Install valves in upright position with stem above horizontal.
- .2 Install butterfly valves on chilled water and condenser water lines only.
- .3 Install butterfly or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .4 Install globe valves for balancing and in by-pass around control valves as indicated.
- .5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .6 Provide swing check valves in horizontal lines as indicated.
- .7 Install chain operators on valves NPS 65 mm (2 1/2") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.
- .8 Provide ball valves for glycol service.

3.11 AIR VENTS

- .1 Install at high points of systems.
- .2 Install isolating ball valve on automatic air vent inlet.

3.12 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated.
 - .1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc).
 - .2 On return side of all reverse return piping loops and/or branch circuits.
- .2 Install to manufacturers requirements.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.
- .4 Refer to Testing Adjusting and Balancing Section for applicable procedures.

3.13 FLUSHING AND CLEANING

- .1 Refer to Water Treatment Section 23 25 13.

3.14 FILLING OF SYSTEM

- .1 Refill system with clean water adding water treatment as specified.

3.15 TESTING

- .1 Test system in accordance with Mechanical General Requirements Section.
- .2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair any leaking joints, fittings or valves.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with General Requirements.
- .2 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.
- .3 Submit product data of pump curves for review showing point of operation.
- .4 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 SINGLE SUCTION CENTRIFUGAL PUMP

- .1 General: bronze fitted all iron pump complete with motor.
- .2 Base: common fabricated steel with drip rim and tapping for drain connection.
- .3 Volute: cast iron radially split, end suction, flanged suction and discharge, with drain plug and vent cock, suction and discharge pressure gauge tapings.
- .4 Impeller: bronze type, keyed drive with locking nut or screw.
- .5 Shaft: stainless steel with two point support,
- .6 Seal assembly: mechanical seal, oil lubricated.
- .7 Coupling: flexible self-aligning complete with guard.
- .8 Motor: EEMAC Class B, squirrel cage induction, continuous duty, drip proof, ball bearing, TEFC, maximum temperature rise 50°C (90°F) as indicated.
- .9 Inlet suction guide with strainers and triple duty valve.
- .10 Capacity: as indicated.
- .11 Design pressure: 1200 kPa (175 psi).
- .12 Acceptable material:
 - .1 Armstrong 4380
 - .2 Bell & Gossett
 - .3 Grundfos
 - .4 Taco

2.2 TRIPLE DUTY VALVES

- .1 Body: Cast iron with flanged connections. Straight pattern combination shut off, non slam check and calibrated balance valve.
- .2 Brass seat, bronze disk with EPDM seat insert.
- .3 Brass stem, stainless steel spring, teflon-graphite packing.
- .4 Brass readout valve.
- .5 Acceptable material:
 - .1 To match pump supplier.
 - .2 Size shall match system piping. Size shall be larger than pump outlet diameter.

2.3 SUCTION DIFFUSER

- .1 Body: cast iron with flanged connections.
- .2 Strainer: with built-in, disposable 1.19 mm (3/64") mesh, low pressure drop screen and NPS 25 mm (1") blowdown connection.
- .3 Permanent magnet particle trap.
- .4 Full length straightening vanes.
- .5 Pressure gauge tappings.
- .6 Adjustable support leg.
- .7 Acceptable Material:
 - .1 To match pump supplier.

Part 3 Execution

3.1 INSTALLATION

- .1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible suction discharge in vertical alignment.
- .2 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.
- .3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- .4 Pipe drain tapping to floor drain complete with isolating valve.
- .5 Install volute venting pet cock in accessible location.
- .6 Check rotation prior to start-up.
- .7 Install pressure gauge with plug cocks on inlet and outlet on pump.

3.2 TRIPLE DUTY VALVES

- .1 Valves shall be straight pattern.
- .2 Provide 4x pipe diameter spool piece between pump discharge and triple duty valve.
- .3 Leave valves open for T.A.B to set.
- .4 Valve size shall match system size. Valve size shall be larger than pump outlet diameter.

3.3 SUCTION DIFFUSER

- .1 Body: cast iron with flanged connections.
- .2 Strainer: with built-in, disposable 1.19 mm (3/64") mesh, low pressure drop screen and NPS 25 mm (1") blowdown connection complete with valve and hose end.
- .3 Permanent magnet particle trap.
- .4 Full length straightening vanes.
- .5 Pressure gauge tapings.
- .6 Adjustable support leg.
- .7 Remove construction screen from inlet suction guide after system cleaned and before balancing.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.22, Wrought Copper Alloy and Copper Alloy Solder - Joint Pressure Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
- .3 ANSI/ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings.
- .4 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .5 ANSI/ASME B31.5, Refrigeration Piping and Heating Transfer Components.
- .6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 413.5 mPa (60,000 psi) Tensile Strength.
- .7 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .8 CSA B52, Mechanical Refrigeration Code.
- .9 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

Part 2 Products

2.1 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Hard copper: to ASTM B280, type ACR-B.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa (300 psi) and temperature 121°C (250°F).
- .2 Brazed:
 - .1 Fittings: wrought copper to ANSI/ASME B16.22.
 - .2 Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
- .3 Flanged:
 - .1 Bronze or brass, to ANSI/ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A307, heavy series.
- .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ANSI/ASME 16.26.

2.3 PIPE SLEEVES

- .1 Hard copper or steel, sized to provide 6 mm (1/4") clearance all around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

- .1 22 mm (7/8") and under: Class 500, 3.5 MPa (500 psi), globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.
- .2 Over 22 mm (7/8"): Class 375, 2.5 MPa (375 psi), globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moistureproof seal for below freezing applications, brazed connections.

2.5 FILTER-DRIER

- .1 On lines 20 mm (3/4") outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
- .2 On lines smaller than 20 mm (3/4") outside diameter, filter-drier shall be sealed type using flared copper fittings.
- .3 Size shall be full line size.
- .4 Approved manufacturers:
 - .1 Mueller
 - .2 Parker
 - .3 Sporlan
 - .4 Virginia

2.6 SIGHT GLASS

- .1 Combination moisture and liquid indicator with protection cap.
- .2 Sight glass shall be full line size.
- .3 Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.
- .4 Approved manufacturers:
 - .1 Mueller
 - .2 Henry
 - .3 Parker
 - .4 Superior

2.7 SUCTION LINE TRAP

- .1 Manufactured standard one-piece traps.

2.8 EXPANSION VALVES

- .1 For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
- .2 Size valves to provide full rated capacity of cooling coil served. Co-ordinate selection with evaporator coil and condensing unit.
- .3 Approved manufacturers:
 - .1 Henry
 - .2 Mueller
 - .3 Parker
 - .4 Sporlan

2.9 FLEXIBLE CONNECTORS

- .1 Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
- .2 Approved manufacturers:
 - Anaconda “Vibration Eliminators” by Anamet
 - Vibration Absorber Model VAF by Packless Industries
 - Vibration Absorbers by Superior Valve Co
 - Style “BF” Spring-flex freon connectors by Vibration Mountings.

2.10 ROOF FLASHING

- .1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

2.11 PIPING SUPPORT ASSEMBLY

- .1 All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A1011/A1011M, A653/A653M.
- .2 All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A575, A36/A36M or A635/A635M.
- .3 Electro galvanized crush clamps with shoulder bolt and molded thermoplastic cushion, size to suit pipe.
- .4 Acceptable materials:
 - .1 Unistrut
 - .2 Or equal

Part 3 Execution

3.1 GENERAL

- .1 Hard copper to be used. Throughout the project, the use of annealed copper shall not be used without approval of the consultant.

- .2 Install in accordance with CSA B52, EPS 1/RA/2 and ANSI/ASME B31.5.
- .3 Connect to equipment with isolating valves and unions.
- .4 Provide space for servicing, disassembly and removal of equipment and components all as recommended by manufacturer.
- .5 Protect all openings in piping against entry of foreign material.
- .6 Provide all necessary equipment including thermal expansion valve, sight glass, solenoid valve, filter dryer, etc., for a complete installed system. Pipe system as per manufacturer's recommendation and requirements.
- .7 Provide number of refrigerant circuits and appropriate corresponding piping as per manufacturer's recommendations and requirements.

3.2 BRAZING PROCEDURES

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

- .1 General:
 - .1 Hard drawn copper tubing: do not bend. Minimize use of fittings.
 - .2 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .3 Provide trap at base of risers greater than 2.4m (8') high and at each 7.6m (25'-0") thereafter.
 - .4 Provide inverted deep trap at top of each riser.
 - .5 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified above.
 - .2 Small riser: size for 5.1 m/s (1000 ft/min) at minimum load. Connect upstream of traps on large riser.

3.4 PRESSURE AND LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa (290 psi) and 1 MPa (145 psi) on high and low sides respectively.
- .3 Test Procedure: Build pressure up to 35 kPa (5 psi) with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.5 DEHYDRATION AND CHARGING

- .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13°C (55°F) for at least 12 h before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use 2-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa (0.02" WC) absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate all system components containing gases other than correct refrigerant or having lost holding charge as follows:
 - .1 Twice to 14 Pa (0.056" WC) absolute and hold for 4 h.
 - .2 Break vacuum with refrigerant to 14 kPa (0.056" WC).
 - .3 Final to 5 Pa (0.02" WC) absolute and hold for at least 12 h.
 - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
 - .5 Submit all test results to Consultant.
- .7 Charging:
 - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
 - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
 - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
 - .1 Make all checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report all measurements to Consultant.

3.6 INSTRUCTIONS

- .1 Post instructions in frame with glass cover in accordance with Operation and Maintenance Manual Section and CSA B52.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Plumbing Specialties and Accessories.
- .2 Hydronic Systems – Steel.

1.2 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American Society of Mechanical Engineers (ASME).
- .3 ANSI/ASME Boiler and Pressure Vessel Code, Section VI.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit operation and maintenance data for incorporation into manual specified in general requirements
- .2 Include following:
 - .1 Log sheets as recommended by manufacturer.
 - .2 Test reports.

Part 2 Products

2.1 MANUFACTURER

- .1 Equipment, chemicals, service by one supplier.
- .2 Acceptable manufacturer:
 - .1 Aquarian Chemicals 905-825-3711
 - .2 No alternates.

2.2 SHIPPING/ FEEDING CHEMICAL CONTAINERS

- .1 High density moulded polyethylene, with liquid level graduations, cover.
- .2 Agitators: as required by manufacturer.

2.3 CONDUCTIVITY CONTROLLER

- .1 Fully transistorized, suitable for wall or flush panel mounting, linear over full measuring range of 0-5000 micro omhs.
- .2 Insensitive to phase angle shifts, capable of operating on 95-130 Volts without affecting accuracy, power, bleedoff status lights.

2.4 CONDUCTIVITY PROBES

- .1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

2.5 WATER TREATMENT FOR HYDRONIC SYSTEMS

- .1 Micron filter for each pot feeder:
 - .1 Capacity 2% of pump recirculating rate at operating pressure.
 - .2 Six (6) sets of filter cartridges for each type, size of micron filter.
- .2 Balancing valve set for 2% pump capacity.

2.6 CHEMICALS

- .1 Provide 1 year's supply.

2.7 TEST EQUIPMENT

- .1 Provide one set of test equipment for each system to verify performance.
- .2 Complete with carrying case, reagents for chemicals, all specialized or supplementary equipment.

2.8 CLEANING CHEMICALS

- .1 Provide as required to make system clean.
- .2 Cleaner chemical: compatible and of the same manufacturer of the water treatment supplier.

2.9 RECORD MANAGEMENT

- .1 Provide cards and card holder mounted on wall adjacent to each pot feeder.

Part 3 Execution

3.1 INSTALLATION

- .1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 CHEMICAL FEED PIPING

- .1 Install crosses at all changes in direction. Install plugs in all unused connections.

3.3 WATER TREATMENT SERVICES

- .1 After entire new and existing system is cleaned as specified elsewhere, provide monthly water treatment monitoring and consulting services for period of one year after system start-up. Provide written report to consultant after each visit. Service to include:
 - .1 Initial water analysis and treatment recommendations.
 - .2 System start-up assistance.
 - .3 On site system testing and recording of treated hydronic system.
 - .4 Operating staff training.
 - .5 Visit plant every 7 days during first month of operation and as required until system stabilizes, and advise consultant in writing on treatment system performance.
 - .6 Provide monthly visits with reports after system has stabilized to the satisfaction of the owner.
 - .7 Provide necessary monthly recording charts and log sheets for one year operation.
 - .8 Provide necessary laboratory and technical assistance.
 - .9 Instructions and advice to operating staff to be clear, concise and in writing.

3.4 START-UP

- .1 Start up water treatment systems in accordance with manufacturer's instructions.

3.5 SYSTEM COMMISSIONING AND TRAINING

- .1 Commissioning and training shall be provided by installing water treatment sub-contractor and water treatment supplier.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After start-up and before TAB of connected systems.
- .3 Pre-commissioning Inspections:
 - .1 Verify:
 - .1 Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.
 - .2 Suitability of log book.
 - .3 Currency and accuracy of initial water analysis.
 - .4 Required quality of treated water.
- .4 Commissioning procedures - applicable to all Water Treatment Systems:
 - .1 Establish, adjust as necessary and record all automatic controls and chemical feed rates.
 - .2 Monitor performance continuously during commissioning of all connected systems and until acceptance of project.
 - .3 Establish test intervals, regeneration intervals.

- .4 Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
- .5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.
- .6 Visit project at monthly intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).
- .7 Advise Engineer in writing on all matters regarding installed water treatment systems.
- .5 Training:
 - .1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.
 - .2 Train O&M personnel in softener regeneration procedures.
- .6 Certificates:
 - .1 Upon completion, furnish certificates confirming satisfactory installation and performance.
- .7 Commissioning Reports:
 - .1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Consultant.
- .8 Commissioning activities during Warranty Period:
 - .1 Check out water treatment systems on regular basis and submit written report to Consultant.

3.6 CLEANING OF MECHANICAL SYSTEM

- .1 Coordinate cleaning of mechanical systems with mechanical contractor.
- .2 Provide copy of recommended cleaning procedures and chemicals for approval by Consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 SMACNA HVAC Duct Leakage Test Manual.
- .4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .7 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section general requirements.
- .2 Indicate following:
 - .1 Sealants
 - .2 Tape
 - .3 Proprietary Joints
 - .4 Fittings

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 DUCTWORK

- .1 Galvanized Steel:
 - .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness:

Size Type	Class A Gauge	Class B Gauge	Class C Gauge
Square and Rectangular			
Up to 600 mm (24")	22	24	24
625 mm to 1000 mm (25" to 40")	20	22	24
1025 mm to 1800 mm (41" to 72")	18	20	22
1825 mm to 2400 mm (73" to 96")	16	18	20
2450 mm and over (97")	16	16	16
Round and Oval			
Up to 300 mm (12")	24	24	24
325 mm to 600 mm (13" to 24")	22	24	24
625 mm to 900 mm (25" to 36")	20	22	24
925 mm to 1200 mm (37" to 48")	18	20	22
1225 mm (49") and over	18	18	20

2.2 DUCT CONSTRUCTION

.1 Round and oval:

- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm (36"): slip type with tape and sealants.
- .3 Transverse joints over 900 mm (36"): Ductmate or Exanno Nexus Duct System.

.2 Square and rectangular:

- .1 Ducts: to SMACNA.
- .2 Transverse joints, longest side:
up to and including 750 mm (30"): SMACNA proprietary duct joints.

.3 Ducts with sides over 750 mm (30") to 1200 mm (48"), transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA "E" or "G" Type connection). Weld all corners.

- .1 Acceptable materials:
 - .1 Ductmate Canada Ltd.
 - .2 Nexus, Exanno Corp.
 - .3 WDCI

.4 Ducts 1200 mm (48") and larger, Ductmate/35, Nexus, or WDCI (heavy) (SMACNA "J" Type connection). Weld all corners.

- .1 Acceptable materials:
 - .1 Ductmate Canada Ltd.
 - .2 Nexus, Exanno Corp.
 - .3 WDCI.

2.3 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius and or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
 - .2 Round:
 - .1 In exposed areas one-piece smooth radius, 1.5 times diameter.
 - .2 In concealed areas 3-piece adjustable, 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm (16"): with double thickness turning vanes.
 - .2 Over 400 mm (16"): with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with 45° entry on branch.
 - .2 Round main and branch: enter main duct at 45° with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
- .5 Diffuser connection to main:
 - .1 90° round spin in collars with balancing damper and locking quadrant.
- .6 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .7 Offsets:
 - .1 Full short radiused elbows.
- .8 Obstruction deflectors: maintain full cross-sectional area.

2.4 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa (" w.c.)	SMACNA Seal Class
2500 (10")	A
1500 (6")	A
1000 (4")	A
750 (3")	A
500 (2")	B
250 (1")	B
125 (0.5")	C

- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
- .3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

2.5 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).
 - .1 Acceptable materials:
 - .1 Duro Dyne S-2
 - .2 Foster

2.6 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.
 - .1 Acceptable material:
 - .1 Duro Dyne FT-2

2.7 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.8 FIRESTOPPING

- .1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.
- .3 All ductwork passing through partition walls shall be firestopped.

2.9 HANGERS AND SUPPORTS

- .1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
>750 to 1050 (>30 to 42)	40 x 40 x 3 (1½ x 1½ x 1/8)	6 (1/4)
>1050 to 1500 (>42 to 60)	40 x 40 x 3 (1½ x 1½ x 1/8)	10 (3/8)
>1500 to 2100 (>60 x 84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8)
>2100 to 2400 (>84 x 96)	50 x 50 x 5 (2 x 2 x 1/8)	10 (3/8)
>2400 (96) and over	50 x 50 x 6 (2 x 2 x ¼)	10 (3/8)

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .1 Acceptable material:
 - .1 Myatt fig. 485
 - .2 For steel joist: manufactured joist clamp or steel plate washer.
 - .1 Acceptable material:
 - .1 Grinnell fig. 61 or 60
 - .3 For steel beams: manufactured beam clamps:
 - .1 Acceptable material:
 - .1 Grinnell Fig. 60

Part 3 Execution

3.1 GENERAL

- .1 The following systems shall conform to these requirements:

System	Class	Material
HVAC Supply and Return	B	Galvanized steel
General Exhaust	B	Galvanized steel
Ventilation Plenum	B	Galvanized steel
Exhaust Plenum	B	Galvanized steel
Individual Exhaust	C	Galvanized steel

- .2 Do work in accordance with ASHRAE and SMACNA.
- .3 Do not break continuity of insulation vapour barrier with hangers or rods.
- .4 Support risers in accordance with ASHRAE and SMACNA.
- .5 Install breakaway joints in ductwork on each side of fire separation.
- .6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.

- .3 Hanger spacing: in accordance with ASHRAE, SMACNA and as follows:

Duct Size	Spacing
mm (")	mm (")
to 1500 (60")	3000 (120")
over 1500 (60")	2500 (100")

- .4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

3.3 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.4 LEAKAGE TESTS

- .1 Co-ordinate leakage testing with TAB contractor. TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Leakage tests to be done in sections.
- .4 Trial leakage tests to be performed as instructed to demonstrate workmanship.
- .5 Install no additional ductwork until trial test has been passed.
- .6 Test section to be minimum of 15 m (50'-0") long with not less than 3 branch takeoffs and two 90° elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.
- .7 Complete test before insulation or concealment.
- .8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.
- .9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

3.5 CLEANING

- .1 Keep ducts clear from dust and debris
- .2 Keep duct liner clean from dust, debris, and moisture.
- .3 At completion of project vacuum ducts if dirt or dust is present.
- .4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection.
- .5 Ensure all systems are clean prior to start up.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

2.3 ACCESS DOORS IN DUCTS

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (25 gauge) thick complete with sheet metal angle frame.

- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.
- .3 Gaskets: neoprene
- .4 Hardware:
 - .1 Up to 300 mm (12"): 2 sash locks
 - .2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.
 - .3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.
 - .4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.
 - .5 Hold open devices.
- .5 Acceptable materials:
 - Nailor
 - E. H. Price
 - Titus

2.4 TURNING VANES

- .1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.
- .2 Acceptable materials:
 - Duro Dyne
 - Ductmate

2.5 INSTRUMENT TEST PORTS

- .1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable material:
 - Duro Dyne IP1 or IP2
 - Duct mate

2.6 SPIN-IN COLLAR

- .1 Construction: galvanized straight or conical spin-in collar complete with spin-in bead and crimped collar connection.
- .2 Provide balancing damper where indicated.
- .3 Acceptable materials:
 - .1 Ecco Manufacturing
 - .2 Flex Master

Part 3 Execution

3.1 INSTALLATION

- .1 Flexible connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans. (Unless internally isolated)
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100 mm (4").
 - .3 Minimum distance between metal parts when system in operation: 75 mm (3").
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on each side of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access doors and viewing panels:
 - .1 Size:
 - .1 600 mm x 600 mm (24" x 24") for person size entry.
 - .2 600 mm x 1000 mm (24" x 40") for servicing entry.
 - .3 300 mm x 300 mm (12" x 12") for viewing.
 - .4 As indicated.
 - .2 Location:
 - .1 At fire and smoke dampers.
 - .2 At control dampers.
 - .3 At devices requiring maintenance.
 - .4 At locations required by code.
 - .5 At inlet and outlet of reheat coils.
 - .6 Elsewhere as indicated.
 - .7 Inlet and outlet of duct mounted coils.
- .3 Instrument test ports.
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments
 - .3 Install insulation port extensions as required.

- .4 Locations.
 - .1 For traverse readings:
 - .1 At ducted inlets to roof and wall exhausters.
 - .2 At inlets and outlets of other fan systems.
 - .3 At main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Consultant.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .4 Turning vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.
 - .2 Install on supply ducts only.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements
- .2 Indicate the following: performance data.

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

- .1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

- .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").
- .3 Shaft extension to accommodate insulation thickness and locking quadrant.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

- .3 Maximum blade height:
 - .1 50 mm (2") up to 375 mm (15") high duct.
 - .2 100 mm (4") max 400 mm (16") high duct and over.
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Shaft extension to accommodate insulation thickness and locking quadrants.**
- .8 Acceptable materials:
 - .1 Duro Dyne
 - .2 National Controlled Air (NCA)
 - .3 Nailor
 - .4 T.A. Morrison
 - .5 Tamco
 - .6 Ruskin
 - .7 Ventex/Alumavent
 - .8 United Enertech

2.5 LOCKING QUADRANTS

- .1 6 mm (1/4") dial regulator with square bearing shaft.
 - .1 18 gauge oval frame, cadmium plated, clearly shows damper position.
 - .2 18 gauge formed handle for easy adjustment.
 - .3 Bolt and wing nut lock damper securely.
 - .4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.
- .2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.
 - .1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.
 - .2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.
 - .3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.
 - .4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.
 - .5 Screw holes for mechanically fastening to ductwork.
- .3 High pressure system locking quadrant:
 - .1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.
 - .2 Handle design for easy recognition of damper position.

- .3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.
- .4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.
- .5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.
- .4 Acceptable manufacturers:
Duro Dyne
Ductmate

Part 3 Execution

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
 - .1 Single blade dampers up to 200 mm (8").
 - .2 Multi-blade dampers over 200 mm (8").
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Leave all dampers in open position for T.A.B.
- .7 Fasten locking quadrants to ductwork and shaft.
- .8 Place locking quadrants on standoffs where ductwork insulated.
- .9 Lock down quadrant arm in the open position.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section applies to operating dampers not specified in Controls Section.

1.2 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Performance data.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

1.5 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

Part 2 Products

2.1 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as indicated.
- .2 Acceptable materials:
 - T.A. Morrison
 - Tamco Series 7000
 - Ruskin
 - Nailor
 - National Controlled Air (NCA)
 - Henderson Industrial
 - Ventex/Alumavent

Part 3 Execution

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Duct Accessories Section.
- .5 Insulated dampers on all outside air intake and exhaust damper.
- .6 Non-insulated dampers on all interior motorized dampers not exposed to outside air.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
- .3 UL 181, Factory Made Air Ducts and Air Connectors.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .6 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC –INSULATED

- .1 Spiral wound flexible aluminum with factory applied, 25 mm (1") thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, Class 1 duct material.

- .2 Performance:
 - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
 - .1 Flexmaster T/L – VT
 - .2 Ductmate

2.3 METALLIC – UNINSULATED

- .1 Spiral wound flexible aluminum, Class 1 duct material.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
 - .1 Flexmaster T/L
 - .2 Ductmate

Part 3 Execution

3.1 DUCT INSTALLATION

- .1 Install in accordance with: SMACNA.
- .2 Maximum length of flexible duct: 1.8 m (6' 0").
- .3 Minimum length of acoustical ductwork; 1.5 m (5' 0") with minimum of 1 bend.
- .4 Provide support at centre of flexible duct with 25 mm (1") wide galvanized hanger.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.

Part 2 Products

2.1 DUCT LINER

- .1 General:
 - .1 Rigid fibrous glass duct liner: air stream side faced with mat facing.
 - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
 - .3 Acceptable material:
 - .1 Johns Manville, Permacote Linacoustic R-300
 - .2 Owen Corning
- .2 Rigid:
 - .1 Use on flat surfaces.
 - .2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
 - .3 Density: 36 kg/m² (7.4 lb/ft²).
 - .4 Thermal resistance to be minimum 750 mm (30") C/W for 25 mm (1") thickness 1150 mm (45") C/W for 40 mm (1½") thickness when tested in accordance with ASTM C177, at 24°C (75°F) mean temperature.

2.2 ADHESIVE

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).
- .3 Acceptable material:
 - .1 Duro Dyne 1A-22
 - .2 Ductmate

2.3 FASTENERS

- .1 Weld pins 2.0 mm (14 gauge) diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1¼") square.
- .2 Acceptable material:
 - .1 Duro Dyne
 - .2 Ductmate

2.4 JOINT TAPE

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.
- .2 Acceptable materials:
 - .1 Duro Dyne FT2
 - .2 Ductmate

2.5 SEALER

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68°C (-90°F) to 93°C (200°F).
- .3 Acceptable materials:
 - .1 Duro Dyne 1A-94
 - .2 Ductmate

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.
- .4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

3.2 DUCT LINER

- .1 Install in accordance with manufacturer's recommendations, and as follows:
 - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
 - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.
- .2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.
- .3 Store foam liners away from sunlight.

3.3 JOINTS

- .1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply 2 coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Consultant.
- .3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 AMCA 99, Standards Handbook.
- .3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.
- .5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Product data to include fan curves and sound rating data.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

Part 2 Products

2.1 FANS GENERAL

- .1 Capacity: flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

- .5 Bearings: sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.
- .6 Acceptable materials:
 - .1 Penn-Barry
 - .2 Greenheck
 - .3 Cook
 - .4 Jenco (S & P)/Jenn
 - .5 Carnes
 - .6 Acme
 - .7 Zonex
 - .8 Twin-City
 - .9 Reversomatic
 - .10 Fantech
 - .11 Aerovent
- .7 Provide factory mounted speed control for all direct drive motors.

2.2 EXISTING EXHAUST AIR FANS

- .1 Refurbish existing exhaust air fans as follows:
 - .1 Replace motor as indicated with VFD compatible ECM motor.
 - .2 Vacuum entire unit interior.
 - .3 Lubricate all bearings.
 - .4 Replace fan belt(s).
 - .5 Rebalance to capacity indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide flexible duct connection at roofline.
- .3 Provide backdraft damper at building exterior penetration.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.2 MAINTENANCE MATERIALS

- .1 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

1.3 MANUFACTURED ITEMS

- .1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

1.4 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified.
 - .3 Concealed fasteners.
- .3 Concealed operators.
- .4 Colour and Finish: standard as directed by Consultant.

.5 Acceptable materials:

- .1 Krueger
- .2 E.H. Price
- .3 Nailor
- .4 Titus
- .5 Carnes
- .6 Seiho
- .7 Metalaire

2.2 SUPPLY GRILLES AND REGISTERS

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.
- .2 Type, size, and capacity: as indicated.

2.3 RETURN AND EXHAUST GRILLES

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets and fire stop flap where indicated.
- .2 Type, size, and capacity: as indicated.

2.4 DIFFUSERS

- .1 General: volume control dampers with flow straightening devices and blank-off quadrants, as indicated and gaskets and fire stop flap and fire blanket where indicated.
- .2 Type, size, and capacity: as indicated.

2.5 OPEN MESH SCREEN

- .1 15 mm x 15 mm (½" x ½") open mesh screen fastened on 25 mm (1") border, screw fasten.
- .2 On all open ends of ductwork and where indicated.
- .3 Size: To match ductwork size.

2.6 DOOR GRILLES

- .1 Heavy duty steel construction, sight proof, complete with flat border both sides, screwed fastening. Finish by Consultant.
- .2 Install door grille in door.
- .3 Fire-rated.
- .4 Acceptable manufacturer:
 - .1 Krueger 600A.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.
- .5 Clean grilles upon completion.
- .6 Paint ductwork beyond grilles, matte black where visible.
- .7 Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
 - .4 Colour and finish.

1.3 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 TEST REPORTS

- .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

Part 2 Products

2.1 GOOSENECK HOODS

- .1 Thickness: to ASHRAE and SMACNA.
- .2 Fabrication: to ASHRAE and SMACNA.
- .3 Joints: to ASHRAE and SMACNA and or proprietary manufactured duct joint.
 - .1 Acceptable material:
 - Ductmate Canada
 - Exanno Nexus
- .4 Supports: as indicated.
- .5 Complete with integral birdscreen of 2.7 mm (12 gauge) diameter aluminum wire. Use 15 mm (1/2") mesh on exhaust 20 mm (3/4") mesh on intake.
- .6 Vertical or Horizontal backdraft dampers as required.
- .7 Prefabricated roof curb through roof complete with insulation and counter flashing.

2.2 FIXED LOUVRES – ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").
- .4 Frame, head, sill and jamb: 50 mm (2") deep, **50 mm (2") blade centers**, one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm (60") maximum centres.
- .6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 15 mm (1/2") exhaust 20 mm (3/4") intake mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: Kynar 500
Colour: to Consultant's approval.
- .9 Acceptable materials:
United Enertech FL-D-2 series
Greenheck
Construction Specialties
E.H. Price
Krueger
Ruskin
Ventmaster
Ventex
- .10 Nailor

Part 3 Execution

3.1 INSTALLATION

- .1 In accordance with manufacturers and SMACNA recommendations.
- .2 Reinforce and brace air vents, intakes and goosenecks as indicated.
- .3 Anchor securely into opening.
- .4 Seal with caulking all around to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers.
- .3 AMCA Standard 210, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating
- .4 ANSI/UL 1995, Heating and Cooling Equipment
- .5 CAN/CSA C22.2 No 236, Heating and Cooling Equipment

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Indicate following: performance.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with general requirements.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 MANUFACTURED ITEMS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

Part 2 Products

2.1 GENERAL

- .1 Comply with ASHRAE.

2.2 ENERGY RECOVERY VENTILATOR (RESIDENTIAL CAPACITY)

- .1 Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel with baked on enamel finish.
- .2 Heat transfer surfaces: polymerized paper.
- .3 Cross contamination: not permitted.

- .4 Removable or hinged access panels.
- .5 Supply and exhaust fans; two ECM motors thermally protected with insulation type B. Motor suitable for 120/1/60.
- .6 Overall size: 599 cm x 624 cm x 380 cm (23 9/16" x 24 9/16" x 14 15/16").
- .7 Accessories:
 - .1 Defrost cycle and controls.
 - .2 Washable filters. (Merv 7)
 - .3 Mixed air section.
 - .4 Free Cooling Economizer Mode
 - .5 Programmable ERV controller in Living Space.
 - .6 Local 20/40/60 min timers (one in each WR).
- .8 Performance characteristics: as indicated.
- .9 Acceptable materials:
 - .1 Aldes
 - .2 Greenheck
 - .3 Ruskin
 - .4 Cook

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of adjacent ductwork with flexible connections.
- .3 Install access doors in accordance with Sections for access to coils and dampers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM C553, Mineral Fiber Blanket, Thermal Insulation for Commercial and Industrial Applications.
- .3 CSA B52, Mechanical Refrigeration Code.
- .4 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with general conditions.
- .2 Indicate major components and accessories including sound power levels of units.
- .3 Type of refrigerant used.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in general conditions.

1.4 WARRANTY

- .1 Contractor hereby warrants refrigeration compressors for 5 years.

Part 2 Products

2.1 GENERAL

- .1 System type:
 - .1 Air flow arrangement: horizontal
 - .2 Cooling: direct expansion
 - .3 Condensing: air cooled

2.2 OUTDOOR CONDENSING UNITS (CU-19)

- .1 General: Factory-assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, refrigerant holding charge, and special features required prior to field start-up. Unit shall be rated in accordance with ARI Standard and be CSA approved.

- .2 Unit Cabinet:
 - .1 Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.
 - .2 A heavy gage roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging.
- .3 Fans:
 - .1 Condenser fans shall be direct driven, propeller-type, discharging air horizontally.
 - .2 Fan blades shall be balanced.
 - .3 Condenser fan discharge openings shall be equipped with PVC coated steel wire safety guards.
 - .4 Condenser fan and motor shaft shall be corrosion resistant.
- .4 Compressor:
 - .1 Compressor shall be mounted on vibration isolators.
 - .2 Compressors shall include overload protection.
- .5 Condenser Coil:
 - .1 Condenser coil shall be air-cooled and circuited for integral subcooler.
 - .2 Coil shall be constructed of aluminum fins (copper fins optional) mechanically bonded to internally grooved seamless copper tubes which are then cleaned, dehydrated, and sealed.
- .6 Refrigeration Components:
 - .1 Refrigeration circuit components shall include liquid line service valve, suction line service valve, liquid filter drier, a full charge of compressor oil, and a holding charge of refrigerant.
- .7 Controls and Safeties:
 - .1 Minimum control functions shall include:
 - .1 Control wire terminal blocks.
 - .2 Five-minute recycle protection to prevent compressor short-cycling.
 - .3 Compressor lockout on auto-reset safety until reset from thermostat.
 - .2 Minimum Safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:
 - .1 High discharge pressure cutout.
 - .2 Loss-of-charge cutout.
- .8 Electrical Requirements:
 - .1 As indicated on drawing schedule.
 - .2 Unit electrical power shall be single-point connection.
 - .3 Unit control circuit shall contain a 24-v transformer for unit control.
- .9 Capacity: As indicated on drawing schedule.

- .10 Provide the following:
 - .1 Hail Guard Package.
 - .2 Winter Start Package.
- .11 Acceptable materials:
 - .1 Daikin FDMQ09
 - .2 LG
 - .3 Mitsubishi

2.3 CONCEALED CEILING DUCTED UNIT

- .1 Designed for ceiling concealed installation and shall be supplied with a horizontal discharge air connection. A return air thermistor shall be mounted inside the return air opening.
- .2 Units shall have a maximum height of 7-7/8" and be designed to fit in tight ceiling plenums.
- .3 Standard filter shall be mold resistant, washable.
- .4 Units shall be provided with a drain pump kit suitable for 18 to 23 inches of lift. Pump shall be located below the coil in the condensate pan with a built in safety alarm.
- .5 Cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation. Medium static units shall have a sound pressure range of 41 dB(A) to 45 dB(A). FXDQ units sound pressure level shall range from 29 dB(A) to 32 dB(A) at low speed and 33 dB(A) to 36 dB(A) at high speed 5 feet below the suction grille.
- .6 The fan shall be a direct-drive Sirocco type fan, with a statically and dynamically balanced impeller, with high and low fan speeds settings.
- .7 Electrical Requirements: As indicated on drawing schedules.
- .8 Capacity: As indicated on drawing schedules.
- .9 Acceptable materials:
 - .1 Daikin RX09
 - .2 LG
 - .3 Mitsubishi

2.4 REFRIGERANT

- .1 Holding charge of refrigerant applied at factory.

Part 3 Execution

3.1 GENERAL

- .1 Install as indicated, to manufacturers' recommendations.
- .2 Manufacturer to certify installation.

- .3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.
- .4 Provide concrete pad complete with 100 mm x 100 mm x 20 mm (4" x 4" x 3/4") neoprene type vibration isolation.

3.2 EQUIPMENT

- .1 Preparation and Start-Up
 - .1 Provide services of manufacturer's authorized factory trained mechanic to set and adjust equipment for operation as specified.
 - .2 Provide results in operation and maintenance manuals

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Conform to general provisions for mechanical division in General Requirements section.

1.2 SUBMITTAL

- .1 Submit shop drawings and product data in accordance with general requirements,
- .2 Indicate the following: complete specifications, wiring diagrams (showing all interconnections); weight; performance details.
- .3 Provide data for inclusion in the Operating and Maintenance manuals in accordance with general requirements,

1.3 1.3 SHOP DRAWING SUBMISSION/UNIT DELIVERY REQUIREMENTS

- .1 **Shop drawings shall be submitted to the Consultant within two (2) weeks of Award of Contract.**
- .2 **Shop drawings shall be reviewed/returned by the Consultant within one (1) week of submission.**
- .3 **Contractor to order equipment from manufacturer immediately upon returned/approved shop drawings.**
- .4 **This Contractor shall co-ordinate with the manufacturer to ensure unit ventilator equipment is delivered to site (for installation) by July 17, 2022. Include in tender price for premium costs associated with manufacturer's rush/accelerated delivery.**

Part 2 Products

2.1 VERTICAL NON-DUCTED UNIT VENTILATOR

- .1 Exterior cabinet panels shall be constructed of heavy gauge steel. Units shall be constructed such that testing and trouble-shooting can be accomplished in the end pockets of the unit without affecting the normal airflow pattern through the unit.
- .2 Floor mounted units shall have an integral pipe tunnel for convenient crossover of piping or electrical wiring in accordance with local and National Electric Codes (NEC). The front surface shall consist of three separate, removable panels. Control compartment must be accessible without removing the entire front panel. Unit discharge grille shall be welded continuous bar type with round edged steel bars placed for a 10° vertical deflection. Adjustable side deflection vanes shall be located beneath the continuous bar grille for easy adjustment by maintenance personnel. A 6 mm (1/4") painted galvanized mesh screen shall be furnished and located beneath the discharge grille. Unit top surface shall be supplied with a textured paint surface that resists scuffing and hides fingerprints.

Overall unit depth shall be 550 mm (21 7/8").

-
- .3 Motors shall be direct drive electronically commutated motors (ECM) and be mounted on rubber isolation. Blowers shall be designed specifically for unit ventilator operation. ECM motors shall be programmed to meet the scheduled airflow at the specified external static pressure with additional speed taps for manual adjustment on site during balancing. Motors shall consist of a brushless, permanently lubricated ball bearing construction for maintenance free operation.
- .4 Hydronic coils are to be constructed with copper tubes and mechanically bonded aluminum corrugated plate fins. Water coils shall be furnished with a threaded drain plug at the lowest point. A manual air vent shall be provided at the high point of the coil on all floor mounted units. An auto air vent shall be provided at the high point of the coil on all ceiling mounted units. Direct expansion coils (DX) - all DX coils must be supplied with a factory installed thermal expansion valve. The expansion valve must be sized for the manufacturer's matching remote condensing unit.
- .5 Air Cooled Condensing Units - The unit ventilator manufacturer shall provide remote air cooled condensing units where indicated on plans. The outdoor unit shall be factory precharged and shall be design matched to the indoor unit.
- The installing contractor shall provide and install between indoor and outdoor unit the interconnecting refrigerant tubing of the size recommended by the unit manufacturer. The installing contractor shall evacuate the indoor coil and interconnection tubing and charge the system in accordance with manufacturer's instructions.
- Condensing unit shall have corrosion resistant cabinet, with hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection, copper tube aluminum fin condenser coil, direct drive propeller fan with permanently lubricated ball bearing single phase motor with internal overload protection.
- .1 Acceptable manufacturers:
- Daikin
Trane
Engineered Air
- .6 Microprocessor-based control for each unit ventilator that must be adaptable to future network system. This control must be pre-engineered, preprogrammed and pretested and shall be factory installed before shipment. The microprocessor-based control shall monitor room conditions and automatically adjust unit operations to maintain these requirements. The control sequence shall be on the basis of ASHRAE Cycle II. The manufacturer shall provide this DDC controller in each unit ventilator.
- .7 Separate room air and outdoor air dampers. The room air damper shall be constructed of aluminum and shall be counterbalanced against back pressure. Outdoor air damper shall be two-piece double wall construction with 15 mm (1/2") thick, 1.5 lb. density fiberglass insulation sandwiched between welded 1.0 mm (20 Ga.) galvanized steel blades for rigidity and to inhibit corrosion. Dampers shall be fitted with blended mohair seals along all the sealing edges. Damper bearings shall be made of nylon or other material which does not require lubrication.
- .8 Integral factory installed face and bypass damper. The face and bypass damper shall be constructed of aluminum and have a dead air space to minimize pickup in the bypass

position. The long sealing edges of the damper shall be fitted with silicone rubber impregnated glass cloth seals with blended mohair seals on the ends for long life and positive sealing.

- .9 Drain pan constructed of stainless steel and shall be insulated. A drain outlet shall be provided on both ends of the pan with one outlet capped. The drain hand of connection shall be easily field-reversed by relocating the cap to the opposite end.
- .10 Filters shall be MERV 13.
- .11 External wall louver will be separately supplied.
- .12 Unit manufacturer shall provide a decorative exterior aluminum wall grille constructed of heavy gauge aluminum with rectangular holes to match louver blade spacing to maximize the air opening. Grille to be secured to wall louver/ exterior wall. The grille finish shall match the louver above.
- .13 All internal line voltage wiring shall be by the unit manufacturer.
 - .1 A suitably rated unfused disconnect switch shall be factory installed within the unit.
- .14 Control Components
 - .1 Provide terminal strip (“digital-ready”) for standard electric/mechanical controls per Energy Controls.
- .15 Unit capacity: As indicated.
- .16 Acceptable manufacturers:
 - Daikin
 - Trane
 - Engineered Air

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer’s instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Protection: Provide finished cabinet units with protective covers during balance of construction.
- .4 Unit Ventilators: Locate as indicated, level and shim units, and anchor to structure. Coordinate with existing wall louver and radiation cabinet. Adjust existing adjacent surfaces as required for a complete finished installation.
- .5 Hydronic Units: Install with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
- .6 Connect drain pan to condensate drain.

- .7 Provide refrigerant piping, refrigerant accessories and refrigerant from condensing unit to DX coil.
- .8 The mechanical contractor shall charge the refrigeration system after installation and ensure that the cooling system is operating correctly.

3.2 START UP AND INSTRUCTION

- .1 Unit Manufacturer shall provide start up and instruction to the owner and the installer.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Conform to general provisions for mechanical division in General Requirements section.

1.2 SUBMITTAL

- .1 Submit shop drawings and product data in accordance with general requirements,
- .2 Indicate the following: complete specifications, wiring diagrams (showing all interconnections); weight; performance details.
- .3 Provide data for inclusion in the Operating and Maintenance manuals in accordance with general requirements,

Part 2 Products

2.1 VERTICAL DUCTED UNIT VENTILATOR

- .1 Main cabinet shall be 14 gauge corrosion resistant steel, braced and reinforced for rigidity. The finish shall be baked enamel, in the manufacturer's standard color/ color as per the consultant's instruction. The cabinet shall be fully lined with 1" [1/2"] glassfiber, coated on the air side.

The unit shall have an upflow configuration unless noted otherwise.

Upflow units shall have air openings suitable for direct discharge via double-deflection grilles / discharge into high-level duct.

- .2 Color-matched raised base, of height to suit the floor to ceiling dimension, so that the top of the unit penetrates the ceiling tile.
- .3 Color-matched top extension for the cabinet, of size to suit the ceiling height.
- .4 Top Acoustical Plenum shall be provided. Plenum to be 20" high top freeblow plenum. Plenum constructed of 14 gauge metal and color matched using a powder coat finish and 1" thick glassfiber insulation. An internal perforated cone and sound baffles shall be installed for sound abatement. The plenum shall be equipped with double deflection supply air grilles color matched to the cabinet.
- .5 The supply air fan shall be a direct double width, double inlet, centrifugal forward curve fan with an electrically commutated motor (ECM) mounted on rubber isolation grommets. Blowers shall be designed specifically for unit ventilator operation. ECM motors shall be programmed to meet the scheduled airflow at the specified external static pressure with additional speed taps for manual adjustment on site during balancing. Motors shall consist of a brushless, permanently lubricated ball bearing construction for maintenance free operation.

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- .6 Hot water coil shall have ½" copper tube of minimum wall thickness 0.016" and shall have aluminum fins. The coil supply and return headers shall be ¾" copper pipe, stubbed for sweat connection. The coil shall be factory pressure tested at not less than 350 p.s.i. A automatic air vent shall be factory installed and ball valves fitted / shipped loose for field installation. The coil capacity shall be as shown in the schedule.
 - .7 Direct Expansion coil shall have 3/8" copper tube and aluminum fins. The liquid line connection shall be 3/8" O.D. and the suction line ¾" O.D. The field connections shall be brazed. The coil capacity shall be as shown in the schedule. A suitable drain pan shall be provided. Pipe condensate to exterior wall grille.
 - .8 A capacity matched thermal expansion valve shall be factory installed at the evaporator coil. The refrigerant that shall be used in the system will be R410a. High and low pressure switches (auto reset low-pressure and manual reset high pressure) as well as a moisture indicated sight glass and service ports shall be factory installed. A suitable matched condensing coil shall be provided.
 - .9 Unit shall be provided with a two stage scroll compressor equipped with a crankcase heater, low ambient cut out, low and high pressure controls. The system shall be factory charged with R410A refrigerant. The compressor shall be mounted in such a way to have double vibration isolation from the unit structure.
 - .10 Outdoor and return air dampers shall be opposed blade type with airfoil section aluminum extruded blades. The dampers shall have neoprene blade tip and jamb seals. Leakage shall not exceed 4 c.f.m. per sq. ft. at 3" W.G. differential pressure, as determined by a recognized testing laboratory. Unit manufacturer to supply a modulating spring return damper actuator for proportional damper control.
 - .11 Economizer Operation: The unit shall have the capacity for 100% outdoor air when outdoor conditions allow.
 - .12 Filters shall be MERV 13
 - .13 Unit manufacturer shall provide an external wall louvre for the outdoor air intake. The louvre shall be of heavy gauge aluminum with 45 deg. Blades. The blade profile shall be designed to prevent water penetration. The louvre shall have ½" birdscreen attached to the inner face and shall have a minimum free area of 1.1 sq. ft. The finish on the louver shall be a custom color as selected by the consultant.
 - .14 Unit manufacturer shall provide a wall sleeve and shall be custom sized to suit the wall depth. The wall sleeve shall include air flow separators to prevent mixing of fresh air, condenser air intake and condenser air exhaust.
 - .15 All internal line voltage wiring shall be by the unit manufacturer.
 - .1 A suitably rated unfused disconnect switch shall be factory installed within the unit.
 - .16 Control items shall be furnished by the unit manufacturer and shall function as described in the Controls Specification.

- .1 Control items to be factory installed may include:
 - .1 DDC Controller
 - .2 Supply Air Temperature sensor
 - .3 Mixed Air Temperature sensor
 - .4 Supply Air Fan current sensor
 - .5 Enthalpy control for economizer operation
- .2 Controls shall be BACNet and communicate on the BAS system.
- .3 Controls shall be sequenced as per ASHRAE Cycle II or Cycle III to meet owner requirements.
- .17 Accessories
 - .1 Face and bypass heating coil
 - .2 Rear pipe chase panel
 - .3 Wall Louvre (Maximum 1000 mm total width)
- .18 Unit selection and Capacity: As indicated on schedule on drawings.
- .19 Acceptable Manufacturers:
 - .1 Airedale
 - .2 Engineered Air
 - .3 ChangeAir

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Protection: Provide finished cabinet units with protective covers during balance of construction.
- .4 Unit Ventilators: Locate as indicated, level and shim units, and anchor to structure. Coordinate with existing wall louvre and radiation cabinet. Adjust existing adjacent surfaces as required for a complete finished installation.
- .5 Hydronic Units: Install with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
- .6 Connect drain pan to condensate drain.
- .7 Provide refrigerant piping, refrigerant accessories and refrigerant from condensing unit to DX coil.
- .8 The mechanical contractor shall charge the refrigeration system after installation and ensure that the cooling system is operating correctly.

3.2 START UP AND INSTRUCTION

- .1 Unit Manufacturer shall provide start up and instruction to the owner and the installer.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate:
 - .1 Equipment, capacity, piping, and connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
 - .3 Special enclosures.
- .3 Primer coat to be off white.
- .4 All hydronic heating shall be by a single manufacturer.

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 DAMPERS

- .1 Factory built, internal damper, complete with operator, at enclosure air outlet grille for each convection type heating unit not thermostatically controlled. Refer to schedules on drawings.

2.2 CAPACITY

- .1 As indicated.

2.3 BASEBOARD RADIATION

- .1 Heating elements: NPS 20 mm (3/4") copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins, one tube end belled.
- .2 Enclosure: minimum 1.0 mm (20 gauge) thick steel with 1.0 mm (20 gauge) thick back and top of one piece construction. Front panel removable. Run wall to wall unless otherwise indicated. Provide panel corners joiner pieces end caps. Assemble with stainless steel oval head sheetmetal screws. Finish to be factory applied baked on enamel.
- .3 Element brackets: 1.2 mm (18 gauge) thick galvanized steel to support front panel and element cradle. Space brackets 900 mm (36") centres maximum.
- .4 Provide for noiseless expansion of all components.

- .5 Acceptable materials:
 - .1 Engineered Air
 - .2 Slant Fin
 - .3 Sigma

2.4 CABINET CONVECTORS

- .1 Heating element: seamless copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins and cast iron headers, steel side plates and supports.
- .2 Cabinet: type as indicated, 1.6 mm (16 gauge) thick steel back and ends, manual damper, exposed corners rounded, secured removable front panel, braced and reinforced for stiffness. Provide stamped grill in sloping top, open bottom. Provide damper and operator and access doors for valves. Finish cabinet with factory applied baked primer coat.
- .3 Catalogue rating: certified IBR ratings.
- .4 Capacity: as indicated.
- .5 Acceptable materials:
 - .1 Engineered Air C-1W
 - .2 Slant Fin
 - .3 Sigma

2.5 CABINET UNIT HEATERS (H-1)

- .1 Cabinet: surface or recessed installation as indicated, 1.6 mm (16 gauge) thick steel with rounded exposed corners and edges, removable panels, glass fiber insulation and integral air outlet and inlet, Arrangement 4
- .2 Finish with factory applied primer coat.
- .3 Coils: aluminum fins mechanically bonded to copper tubes. Hydrostatically tested to 1 MPa (145 psi).
- .4 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.
- .5 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .6 Filters: removable permanent washable type.
- .7 Capacity and orientation as indicated.
- .8 Control:
 - .1 3 speed switch with integral overloads in cabinet.
 - .2 Low limit aquastat strapped on to hot water heating supply set to prevent fan operating below 27°C (81°F).

- .3 Control thermostat: electric, rated to suit cabinet heater, with setpoint locking device and concealed adjustment.
 - .1 Remote thermostat and locking guard cover on downflow units.
 - .2 Integral thermostat with access door on upflow units.
 - .3 Remote thermostat and guard by BAS contractor.
- .9 Acceptable materials:
 - .1 Engineered Air CUH Series
 - .2 Slant Fin
 - .3 Sigma
 - .4 Dunham-Bush

2.6 EXISTING WALL FIN AND CABINET RADIATION (H-EX)

- .1 Remove existing grilles, vacuum existing fin and components.
- .2 Replace damaged components including but not limited to hangers, wall mounting brackets.
- .3 Replace existing grilles (toe and top grille) as required. Provide new filler pieces etc., to match existing cabinet.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install in accordance with piping layout and reviewed shop drawings.
- .3 Provide for pipe movement during normal operation.
- .4 Maintain sufficient clearance to permit performance of service maintenance.
- .5 Check final location with Consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Consultant's directive.
- .6 Valves
 - .1 Install valves with stems upright or horizontal unless approved otherwise.
 - .2 Install isolating gate valves on inlet and balancing valves on outlet of each unit.
- .7 Venting:
 - .1 Install screwdriver vent on cabinet convactor, terminating flush with surface of cabinet.
 - .2 Install standard air vent with cock on continuous finned tube radiation.
- .8 Clean finned tubes and comb straight.
- .9 Install flexible expansion compensators as indicated.
- .10 Mount wall mounted convectors at 200 mm (8") above finish floor.

- .11 Mount wall mounted radiation at 200 mm (8") above finish floor unless otherwise indicated.
- .12 **Thermostats on outside walls: mount on insulated backplates.**
- .13 On units fed from below floor provide factory manufactured piping shrouds on the exposed piping between base of the radiation cabinet and finished floor. Shroud shall be manufactured by the radiation manufacturer. Shroud shall match finish of the radiation cabinet.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section is to read in conjunction with the General Requirements of the Mechanical and Electrical trades.

1.2 REFERENCES

- .1 Tested to ANSI/UL Standard 508.
- .2 UL-508 certified for the building and assembly.
- .3 CSA or C-UL stickers shall be applied to both the VFD and option panels.
- .4 Manufacturers shall be ISO 9001 certified facilities.

1.3 SUBMITTALS

- .1 Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalogue information.
- .2 The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.
- .3 Harmonic filtering. The manufacturer shall, with the aid of the buyer's electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will meet the IEEE standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer–utility interface or primary side of the main distribution transformer.

1.4 WARRANTY

- .1 The VFD shall be warranted by the manufacturer for a period of five (5) years from date of substantial completion. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Danfoss Graham.
- .2 ABB.
- .3 AC Tech.

2.2 GENERAL

- .1 The VFD shall convert incoming fixed frequency AC power into a variable frequency and voltage for controlling the speed of AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
- .2 With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFD's utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- .3 Include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
- .4 Provide DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFD's without DC link reactors shall provide a minimum 5% impedance line reactor.
- .5 Full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
- .6 Provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
- .7 An automatic energy optimization selection feature shall be provided in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
- .8 Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
- .9 An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
- .10 Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFD's not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

- .11 VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
- .12 VFD's operating 600/3/60 motors not designed to meet Nema MG1 Part 31 should include Output dv/dt (LC) Reactors.

2.3 PROTECTIVE FEATURES

- .1 VFD shall be provided with an integral disconnect and Integral Fast Blow Semi-Conductor fuses sized as specified by ULC. Fuses shall be Bussman JJS type or equivalent.
- .2 A minimum of Class 20 I2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.
- .3 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over-voltage, under-voltage, VFD over-temperature and motor over-temperature. The VFD shall display all faults in plain English. Codes are not acceptable.
- .4 Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal.
- .5 The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
- .6 To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Motors shall have inverter rated insulation (1600V).
- .7 VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
- .8 VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
- .9 VFD shall catch a rotating motor operating forward or reverse up to full speed.
- .10 VFD shall be rated for 100,000 amp interrupting capacity (AIC).
- .11 VFD shall have externally mounted EMI electromagnetic suppressor to limit the EMI and RFI output from the VFD. VFD to be mounted in an all metal cabinet to limit radiated RFI.
- .12 VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
- .13 VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt VFD's, and 701V AC on 575 volt VFD's.
- .14 For remote VFD installations, provide an output filter (load side reactor) at each VFD to protect the equipment motor. Coordinate installation with equipment manufacturer.

2.4 INTERFACE FEATURES

- .1 Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.
- .2 The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
- .3 The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
- .4 Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.
- .5 The keypads for all sizes of VFD's shall be identical and interchangeable.
- .6 To set up multiple VFD's, it shall be possible to upload all set-up parameters to the VFD's keypad, place that keypad on all other VFD's in turn and download the set-up parameters to each VFD. To facilitate setting up VFD's of various sizes, it shall be possible to download from the keypad only size independent parameters.
- .7 Display shall be programmable to display in 9 languages including English, Spanish and French.
- .8 The display shall have four lines, with 20 characters on three lines and eight large characters on one line.
- .9 A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
- .10 A quick set-up menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
- .11 The VFD shall include a standard RS-485 communications port for connection to a Johnson Controls N2 and Siemens FLN serial communication system. The connection shall be software selectable and addressable by the user. The option for Lonworks and BacNet communication must also be available.
- .12 As a minimum, the following points shall be controlled and/or accessible:
VFD Start/Stop, Speed reference, Fault diagnostics, and Meter points as follows;
Motor power in HP, Motor power in kW, Motor kW-hr, Motor current, Motor voltage, Hours run, Feedback signal #1, Feedback signal #2, DC link voltage, Thermal load on motor, and Thermal load on VFD, Heat sink temperature.
- .13 Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the VFD.
- .14 Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
- .15 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

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- .16 Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFD's unable to show these four displays simultaneously shall provide panel meters.
 - .17 Sleep mode shall be provided to automatically stop the VFD when its speed drops below set "sleep" level for a specified time. The VFD shall automatically restart when the speed command exceeds the set "wake" level.
 - .18 The sleep mode shall be functional in both follower mode and PID mode.
 - .19 Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
 - .20 The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.
 - .21 The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (oF) for a cooling tower application.
 - .22 VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
 - .23 If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD's heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
 - .24 The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
 - .25 The VFD shall store in memory the last 10 faults and related operational data.
 - .26 Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
 - .27 Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
 - .28 Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
 - .29 Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

- .30 Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

2.5 ADJUSTMENTS

- .1 VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
- .2 Sixteen preset speeds shall be provided.
- .3 Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
- .4 Four current limit settings shall be provided.
- .5 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under-voltage, over-voltage, current limit and inverter overload.
- .6 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
- .7 An automatic “on delay” may be selected from 0 to 120 seconds.

2.6 SERVICE CONDITIONS

- .1 Unit shall operate in ambient temperature of -10 to 40°C (14 to 104°F).
- .2 Unit shall operate in 0 to 95% relative humidity, non-condensing.
- .3 Operate in elevation up to 3,300 feet without derating.
- .4 Maximum AC line voltage variation, -10 to +10% of nominal with full output.
- .5 No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

2.7 FACTORY TESTING

- .1 To ensure quality and minimize infantile failures at the jobsite, the manufacturer shall test the complete VFD. The VFD shall operate a dynamometer at full load and speed and shall be cycled during the test.
- .2 All optional features shall be functionally tested at the factory for proper operation.

2.8 BYPASS SWITCH

- .1 Bypass Controller - Automatic transfer to line power via contactors. When in the “Drive” mode, the bypass contactor is open and the drive output contactor is closed. In the “Bypass” position, the drive output contactor is open, and the bypass contactor is closed via Start/stop command. Start/stop via customer supplied maintained contact shall be Dry type 115V compatible and shall function in both the “Drive” and “Bypass” modes. The design shall include single-phase protection in both the VFD and bypass modes.

Part 3 Execution

3.1 START-UP SERVICE

- .1 The manufacturer shall provide start-up and commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

3.2 EXAMINATION

- .1 Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

3.3 INSTALLATION

- .1 Install to manufacturer's recommendations.
- .2 Install to the requirements of the local Hydro codes. Obtain hydro permits and pay all fees.
- .3 Install in an accessible location and proper service height from floor.
- .4 Install in clean, dry, and conditioned environment.
- .5 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.
- .6 Wiring of devices to be to the standards of Electrical Division.
- .7 Provide one manufacturer of VFD's throughout the project.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Conform to General Conditions for Mechanical Trades.
- .2 Related Work Specified Elsewhere.
 - .1 General Conditions for Mechanical Trades
 - .2 Heating, Ventilation & Air Conditioning
 - .3 Heating, Ventilation & Air Conditioning Equipment
 - .4 Electrical

1.2 SCOPE OF WORK

- .1 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall be an extension of the existing system and shall control/monitor HVAC equipment and systems as specified in this section. The work shall include but is not limited to the following:
 - .1 Refer to drawings and specification for complete scope.
 - .2 Control for unit ventilators (heating, cooling, free cooling, outdoor air ventilation).
 - .3 Control for modified radiators and other modified hydronic heating elements.
 - .4 Control of motorized relief air dampers for classrooms and all rooms with new non-ducted unit ventilators. Interlock to free-cooling mode for all unit ventilators.
 - .5 Control of two existing exhaust fans. Exhaust fans will be provided with new multi-speed VFDs. Multispeed VFDs are to ramp up and down based on outdoor outdoor air damper positions in associated spaces and rooms.
 - .6 Control for ERV, duct heater, and fan coil system (second floor).
 - .7 Control for hydronic system pump. Remove central temperature modulating three-way valve system. Provide new variable speed VFD system with remote differential pressure (DP) sensor.
 - .8 Replacement of some pneumatic temperature controls with new digital controls.

1.3 DESCRIPTION OF SYSTEM

- .1 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall control/monitor HVAC and plumbing equipment and systems as specified in this section. The work shall include but is not limited to the following:
 - .1 All necessary hardware, software, control panels, control wiring, field devices, installation, documentation and owner training as specified.

- .2 The installed system shall incorporate electronic and digital control devices to perform the control sequences and monitoring outlined herein. Specific control sequence requirements are as detailed elsewhere in this Section of the specification.
- .3 Control and monitoring of the equipment and systems shown on the drawings (refer also to 'Sequence of Operation' for additional details).
- .4 Control valves shall be supplied by this Trade but installed in the piping system by the Mechanical Trade complete with transitions and unions as required.
- .5 Testing, debugging, calibrating, adjustment, programming and confirmation of total system operation.
- .6 Electrical power for controls items from local electrical panel. Coordinate with electrician. All work to be done in accordance with electrical division.

1.4 MANUFACTURER AND INSTALLING CONTRACTOR

- .1 The temperature control manufacturer shall be Tour Andover (TAC).
- .2 All controls to supplied, installed and wired by Energy Controls (phone 519-893-2638).
- .3 Any new building must be a seamless extension of the current Energy Management and Building Control System.
 - .1 The existing TAC Vista software is, and shall continue to be, the only head-end BAS server for the entire School Board.
 - .2 The head-end server contains the secure Energy Management Settings (i.e. Master Setpoints & Schedules) that are sent to all schools in real-time. The control system must be an extension of the head-end server and be able to be managed exclusively through the Vista head-end server.
 - .3 Monitoring of all school board control systems are done in real-time and must be presented at the exclusive Vista head-end server as first-priority data.
 - .4 The Vista head-end server has all the required controller databases and software to be able to centrally maintain and modify network configuration and controller software for the entire School Board. The Vista head-end server is the only system that can access the LacNet programming variables inside the controllers for real-time configuration of setpoint and time scheduling parameters.
 - .5 The graphics and controller database must be presented inside the Vista head-end server in its native format in order to preserve the real-time speed, integrity and multi-site administration of the entire system.

1.5 QUALITY ASSURANCE

- .1 The system components shall be listed by Underwriters Laboratories Inc. and Canadian Standards Association.
- .2 The system control products shall be stored and handled according to manufacturer' recommendations.
- .3 The work shall be performed by skilled technicians all of whom shall be properly trained and qualified for this work.

1.6 SUBMITTALS

- .1 Prior to the installation of any equipment, the Contractor shall provide the Consultant with shop drawings and specifications for all devices and equipment used for the complete system installation. Shop drawings shall include the following:
 - .1 Identified schematic control diagrams for all systems, each diagram indicating or referencing input / output connection points, control components, component catalogue numbers, operation sequence, interlocking and RPU's to which they are connected.
 - .2 Complete network schematic indicating all programmable controllers and data connections.
 - .3 Detailed listing of inputs and outputs of each programmable controller.
 - .4 Control damper schedule indicating damper size, required torque and blade type.
 - .5 Technical data sheets / manufacturer application manuals of each system component.
- .2 Upon completion of the installation and prior to acceptance and Owner training, the Contractor shall furnish the Consultant with three copies of installation and operation manuals for the system. Each manual shall include:
 - .1 Record drawings, including plan layout indicating major device locations and wiring diagrams as finally installed.
 - .2 All shop drawings, incorporating all required revisions to reflect as-built conditions.
 - .3 The Contractor shall also keep one copy of backup programs for the system archived in a software storage vault at their business location.

Part 2 Products

2.1 GENERAL

- .1 The control system shall be a Tour Andover (TAC) Xenta building automation system (BAS).
- .2 The system shall integrate the operation of intelligent building management controllers distributed into the network.
- .3 The DDC System shall be generally comprised of the following devices to achieve the control functions described in this section:
 - .1 Input/output programmable controllers.
 - .2 Control relays.
 - .3 Control dampers and valves.
 - .4 Sensors, actuators and other input/output devices.
- .4 Controllers shall execute the application programs, calculations, and commands to provide the control function specified for that unit. Each controller shall include its own

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- micro-computer controller, power supply, input/output modules, termination modules and real time clock.
- .5 Controllers shall be capable of full control functionality and alarm reporting independently or as a part of the DDC network.
 - .6 The system shall be stored in flash ram so no batteries are required.
 - .7 Each control device shall be modular and expandable to provide additional inputs and outputs and control functionality for that device.
 - .8 Each controller shall be able to transfer and receive data via the network for performance of control functions.
 - .9 The system shall be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.
 - .10 The complete system shall be capable of communication over a LonWorks network.
 - .11 The controllers shall monitor the status of all overrides and include this information in logs and summaries to inform the operator that automatic control has been inhibited.
 - .12 Controllers shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment and provide both local and remote annunciation of any component failures.
 - .13 Controllers shall activate an orderly shutdown of their operation in the event of loss of normal electrical power. Non-volatile memory shall be incorporated for all controller configuration data. The controllers shall automatically resume full operation without manual intervention.
 - .14 The controllers shall have sufficient memory to support their own operating system and data bases including:
 - .1 control processes
 - .2 energy management applications
 - .3 alarm management
 - .4 trend data
 - .5 operator input/output
 - .6 remote communications
 - .7 manual override monitoring
 - .15 Controllers shall incorporate the following software features:
 - .1 Energy management:
 - .1 Time of Day Scheduling
 - .2 Calendar Based Scheduling
 - .3 Holiday Scheduling
 - .4 Optimal Start and Stop
 - .5 Demand Limiting
 - .6 Heating/Cooling Interlock
 - .2 Alarm Management:

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- .1 Alarm Management shall be provided to monitor, buffer and direct alarm reports to operator devices and memory files. The controllers shall perform alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost.
 - .2 All alarm or point change report shall include the points English language description and the time and date of occurrence.
 - .3 The user shall be able to define the specific reaction for each point, the priority level (3 in total) and ability to inhibit alarm reporting for each point.
 - .4 The user shall be able to define conditions under which point changes need to be acknowledged by an operator and logged for analysis at a later date.
 - .5 The user shall be able to print, display or store a unique 60 character alarm message to more fully describe the alarm condition or direct operator response. The message shall be customizable to describe each individual alarm.
 - .6 In web access applications only critical alarms shall initiate a call to a remote operator device, otherwise call activity shall be minimized by time stamping and saving reports until a manual request is received or until the buffer space (minimum 50 alarms) is full.
- .3 Trend Logs:
- .1 Controllers shall provide an automatic roll-over trend log, which stores records up to an operator-selected number at an operator-selected sampling rate and then overwrites the oldest record with each new record.
 - .2 Sample intervals shall be from 1 minute to 24 hours.
 - .3 Provide graphical and tabular displays.
- .4 Runtime Totalization:
- .1 The controllers shall automatically accumulate and store runtime hours for binary points with a sampling resolution of 1 minute. The user shall have the ability to define a warning limit to trigger maintenance or user-defined messages.
- .5 Custom Programming:
- .1 The controllers shall permit user defined custom control processes based on:
 - .1 any system measured data or status
 - .2 any calculated data
 - .3 any results from other processes
 - .4 Boolean logic
 - .2 The custom processes may be triggered by:
 - .1 Time-of-day
 - .2 calendar date

.3 events (point alarm etc.)

- .16 The control strategy for each control loop shall be performed by software within the controller. The sequence of events required for each control loop is described for each system in the control sequence.
- .17 Outdoor air temperature indication shall be available at each controller as an integral part of the control strategies for that controller. Should the network transmission of the common outdoor air temperature (or any other common value) fail, then each controller shall use the last good value received.
- .18 Controls and Requirements for VVT Systems
 - .1 Where VVT controls are specified, units are to operate as part of a Variable Volume/Variable Temperature System complete with all necessary controls including zone dampers, temperature sensors, static pressure sensor probes and bypass damper.

2.2 NETWORK ARCHITECTURE

- .1 The controllers on the local network shall communicate via a two wire LonTalk TP/FT-10 network.

2.3 CONTROL PANELS

- .1 Control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have a hinged door with locking latch or bolt-on cover plate. All cabinet locks shall be common keyed. Cabinets shall be finished with two coats of paint.

2.4 TEMPERATURE SENSORS

- .1 Provide thermistor temperature sensors, not requiring transmitters, to measure temperature.
- .2 Accuracy shall be +/-0.2°C from 0 to 70°C.
- .3 Temperature sensors shall be Greystone EC200 series.
- .4 Space sensors in occupied areas shall be type AE having an integral push button for unoccupied override and an integral slider to adjust set point (LED display not required).
- .5 In corridors and where noted on the drawings, provide stainless steel plate type sensors (push button override and LED display not required), type AS.
- .6 Duct temperature sensors shall be type B having a stainless steel probe length to suit application and ABS enclosure. Duct averaging temperature sensors shall be type FD having an element length to suit application, copper probe and ABS enclosure.
- .7 Immersion temperature sensors shall be type C having a ¼" OD stainless steel probe, 4" long and ABS enclosure. Immersion sensors shall be complete with thermowells. Thermal conductive compound shall be added inside the thermowell to provide optimum thermal transfer from the fluid to sensor. Stainless steel thermowells shall be used for steel pipe and brass thermowells shall be used in copper pipe.

2.5 CARBON DIOXIDE SENSORS

- .1 Sensors shall Greystone CDD series having the following features:
 - .1 0-2000 ppm factory default detection range, field adjustable.
 - .2 Non-dispersive infrared sensing element with self-calibration algorithm.
 - .3 Guaranteed 5 year calibration interval.
 - .4 Powered by either AC or DC source.
 - .5 Accuracy: within 50 ppm or 3% of reading (whichever is greater).
 - .6 Operating humidity range: 0-95% RH.
 - .7 Operating temperature range: 0 to 50°C or greater.
 - .8 Stability: less than 2% full scale in 15 years
 - .9 Response time: less than 2 minutes for 90% step change.
- .2 Duct mounted sensors shall be complete with ABS enclosure complete with sampling tube.
- .3 Space mounted sensors shall be executive space type without LCD display.

2.6 MOTORIZED CONTROL DAMPERS

- .1 Control dampers shall be the parallel or opposed blade type as below or as scheduled on drawings.
 - .1 Outdoor and/or return air mixing dampers and face and bypass (F & BP) dampers shall be parallel blade, arranged to direct air-streams toward each other.
 - .2 Other modulating dampers shall be the opposed blade type.
 - .3 Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
- .2 Damper frames shall be 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.
- .3 Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades are to be suitable for medium velocity performance (10 m/s [2000 fpm]). Blades shall be not less than 16 gauge.
- .4 Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze or better.
- .5 All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 50 L/s m² (10 cfm per ft²) at 1000 Pa (4 in. w.g.) differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s (1500 fpm).
- .6 Individual damper sections shall not be larger than 125 cm x 150 cm (48 in. x 60 in.). Provide a minimum of one damper actuator per section.
- .7 Modulating dampers shall provide a linear flow characteristic where possible.
- .8 Dampers shall have exposed linkages.

2.7 WATER CONTROL VALVES

- .1 Heating and cooling control valves shall be Belimo CCV series characterized ball valves, complete with chrome plated brass trim and NPT female pipe connections. Radiation valves shall be complete with non-spring return modulating actuators. Control valves for coils heating a portion of outdoor air shall have spring return modulating actuators.
- .2 Control valves shall be sized to provide approximately one half the circuit branch pressure drop to obtain good modulation control but they shall be no smaller than two pipe sizes less than the pipe they are installed in.

2.8 DIFFERENTIAL PRESSURE SENSORS

- .1 Differential pressure sensors shall be provided for liquid or air differential pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e.: water or air, and to withstand a minimum of two times the maximum pressure of the highest pressure range.
- .2 Each sensor shall be provided with an industry standard, 0 to 10 Vdc output signal mounted at the sensor. The transmitter and sensor shall have a combined accuracy and repeatability of 1.0% of the differential pressure range. A pushbutton zero adjustment shall be provided.

2.9 FREEZESTATS

- .1 Freezestats shall be complete with a vapour filled 20 foot bulb and 4 foot capillary. Wire freezestats to shut down the respective fans should temperature over any 12 in. of sensor length drop below the adjustable setpoint (2°C). Freezestats shall have manual reset.

Part 3 Execution

3.1 INSTALLATION

- .1 Installation
 - .1 All controllers and components in the system and on the network shall be installed according to manufacturer recommendations, general installation standards for digital controls and in accordance with the approved shop drawings.
 - .2 Locate room sensors in the locations shown on the mechanical drawings. All sensors shall be mounted at barrier free height (3'-11" (1175 mm) above finished floor).
 - .3 Provide serial data communication ports in the rooftop units where noted on the drawings, or at least one on each roof level, for operator interface. Also provide communication ports in the Custodian Office. Note that these shall be in addition to the associated rooftop unit controller with its built-in network port.
 - .4 All programmable controllers, web access components, relays and other control components shall be located within control panels. Control Panels shall be wall mounted and shall be located within suspended ceiling spaces or other locations approved by the Consultant.

- .5 The Electrical Contractor will provide hand-off-auto switches in all starters controlled by the BAS.
- .2 Wall mount carbon dioxide sensor shall be mounted next to the room temperature sensor for all rooms with unit ventilator.
- .3 All carbon dioxide levels which are measured by the carbon dioxide sensors shall be made available to the Owner in the form of trend logs. Record readings at 10 minute intervals and keep them for at least 30 days.
- .4 Freeze-stats shall be installed so that their sensing element runs horizontally across the coil face (not diagonally) with no more than 12" vertical drops at the outside coil frame. The full face of the coil shall be covered with no horizontal runs being more than 12" apart. The top and bottom horizontal run shall be within 6" of the coil frame. If more than one freezestat is required they shall be wired in series in order to detect a low temperature in portion of the coil. The sensing elements shall be firmly secured in place to avoid vibration without added air restriction.

3.2 SYSTEM START-UP AND ACCEPTANCE

- .1 Upon completion of installation, test, adjust and calibrate controls provided under this Section.
- .2 On system completion, a demonstration of complete system operation shall be made to the Owner's authorized representative and Consultant.
- .3 The Consultant shall verify through the Owners representatives that the entire system is complete and operating to the satisfaction of the Owner before final acceptance is approved.

3.3 TRAINING

- .1 The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:
- .2 Provide 4 hours of training for Owner's operating personnel. Training shall include:
 - .1 Explanation of drawings, operations and maintenance manuals
 - .2 Explanation of web access program
 - .3 Explanation of adjustment procedures
 - .4 Trend Analysis

3.4 WARRANTY

- .1 Equipment, material and software shall be unconditionally guaranteed for a period of two years form the date of substantial completion.
- .2 Provide warranty service at no cost to the Owner for the warranty period, which shall include but not be limited to the following:
 - .1 Emergency repair service on regular working hour basis.

- .2 Replacing defective parts and components as required.
- .3 System software support.

3.5 IDENTIFICATION

- .1 Provide system identification and provide nameplates identifying the following (nameplates shall be keyed to the wiring diagrams):
 - .1 Duct mounted sensors.
 - .2 Control panels (identify as to equipment / systems controlled). Each panel shall include an as-built drawing showing all the connected control points.

3.6 TESTING AND BALANCING

- .1 During the system testing and balancing by the Testing and Balancing Agency, demonstrate the operation of all controls. During balancing procedures, set controls to a fixed mode (bypass damper locked fully closed and all zone dampers locked fully open) to prevent any changes during the balancing procedure.

3.7 ELECTRICAL WIRING

- .1 All wiring shall be installed to the standards specified in the Electrical Division.
- .2 Use Echelon recommended orange jacket cable for all network wiring.
- .3 Run all wiring in EMT conduit where exposed, where running within concrete block walls and where required by the Ontario Electrical Code. Plenum rated cable shall be used in return air ceiling plenums.
- .4 Control relays necessary for BAS operation shall be provided by the Temperature Control Contractor but all contactors and their power supplies handling power wiring to the equipment shall be by the Electrical Contractor.

Part 4 Sequence of Operation

4.1 GENERAL

- .1 All setpoints shall be adjustable.
- .2 Outdoor air temperature shall be broadcasted to all controllers.
- .3 Heating mode: Heating is enabled between October 15 and April 15 or if the outdoor air temperature is below 10°C. This heating mode is used in all controllers for the building.
- .4 Cooling Mode: Mechanical cooling is enabled if the outdoor air temperature is above 18°C.
- .5 Free Cooling Mode: Free cooling is enabled if space temperature exceeds setpoint and outdoor air temperature is below 18°C. Modulate outdoor air damper position to maintain space temperature setpoint. Relief air dampers in relief air outlets are to open during free cooling mode. Modulate central exhaust systems serving classrooms based on outdoor air damper position of associated unit ventilators.

- .6 Carbon Dioxide Damper Override: In any air handling system with a return air or room air carbon dioxide sensor, it shall override the minimum position of the outdoor air damper during occupied mode. It shall override the minimum outdoor air damper between 0 and 40% as the carbon dioxide varies between 1000 and 1200 ppm. All limit controls shall take priority to maintain safe supply air temperatures. An alarm shall be generated if the carbon dioxide level is higher than 1700 ppm or lower than 200 ppm. Modulate central exhaust systems serving classrooms based on outdoor air damper position of associated unit ventilators.
- .7 Occupancy mode shall be determined by a weekly schedule with an annual holiday schedule. Each system shall have this schedule but there shall be provision for operating under a general (to the building) schedule as well. An adjustable parameter shall be available to select the local or general schedule for each system.
- .8 Lead/lag: Devices designed for lead lag operation shall operate in automatic lead/lag mode to equalize run time. If the lead unit fails the lag shall automatically start and an alarm shall be generated. The lead unit shall be advanced through the series of devices in sequence every Tuesday at noon.

4.2 EQUIPMENT SERVICES

- .1 Graphical sequence of operations will be provided by BAS contractor.

END OF SECTION

7198-RW-22 - Tait St. Public School HVAC Renovations

Opening Date: February 8, 2022 1:00 PM

Closing Date: February 22, 2022 2:00 PM

Schedule of Prices

* Denotes a "MANDATORY" field

Do not enter \$0.00 dollars unless you are providing the line item at zero dollars to the Board.

Bid Price Form

Note: Cash Allowances included in BID PRICE.

Blackout Period Protocol is understood and will be adhered to.

HST is additional.

Line Item	Description	Unit of Measure	Quantity	Bid Price *	Total
1	Tait St Public School HVAC Renovations as per tender documents	Lump Sum	1		
Subtotal:					

Summary Table

Bid Form	Amount
Bid Price Form	
HST (13%)	\$ 0.00
Total Contract Amount:	

Specifications

Bidder's Contact Information

Provide contact information for the following employees for this project.

If any of the contacts are to change within the duration of the contract the Board must be immediately notified and pre-approve the change(s).

Title	Name *	E-mail *	Cell Phone Number *	
Project Manager				*
Site Supervisor				*

Documents

It is your responsibility to ensure the uploaded file(s) is/are not defective or corrupted and are able to be opened and viewed by the Owner. If the attached file(s) cannot be opened or viewed, your Bid Submission may be rejected.

COVID REPSONSE

Submit a work plan that outlines how the company plans to address COVID-19, including implementing workplace strategies

that include, but are not limited to, social distancing, personal hygiene recommendations, and other relevant recommendations made by the government of Ontario, the government of Canada, the local municipal government, and their respective ministries, agencies, and departments, in respect of the employees and other personnel of the successful bidder, their subcontractors and suppliers, as well as the employees and other personnel of the Board, the Board's Consultant, and the general public.

- WSIB * (mandatory)
- Covid Response * (mandatory)

BONDING UPLOAD SECTION

Refer to the Bonding Requirements Section of the Terms and Conditions.

- Digital Bid Bond & Agreement to Bond * (mandatory)

Addenda, Terms and Conditions

I/We have read and understand this Bid Solicitation document, and agree to perform the Work required in accordance with this Bid

Solicitation document, including all addenda, at the price(s) detailed in the Bid.

I/We confirm that:

1. The person named in this Bid is authorized to sign and electronically submit this Bid through the Bidding System.
2. I/We meet all mandatory requirements of the Bid Solicitation document.
3. The bid will remain open for a specified acceptance period after the Closing Time. The Board may, at any time within this period, accept the Bid whether or not any other Bid has previously been accepted.
4. All prices provided in the Bid will remain fixed and firm for the duration of the term of the agreement, unless specified otherwise.
5. All prices provided in my/our Bid are in Canadian funds and include all charges of every kind attributable to the Work. Harmonized Sales Tax will be extra and not shown, unless specified otherwise.
6. To the best of my/our knowledge and belief:
 - a) the information provided in the Bid is correct; and
 - b) the Bid is made without any comparison of figures or arrangement with any other individual, corporation or person submitting a Bid for the same Work and is in all respects fair and without collusion or fraud.
7. I/We comply with the all applicable Board policies, provincial, and federal laws, and are aware of the Board's "Principles of Business Conduct" and will comply.
8. I/We agree and understand that the recommendation to award the Work may be subject to the approval from the Board as well as availability of funds.
9. I/We agree to be bound by the terms and conditions of the Bid Solicitation document and submit this Bid on behalf of the Bidder.

☐ I have the authority to bind the Bidder.

The Bidder/Proponent is to declare any actual, potential or perceived conflict of interest that could arise from submitting the Bid/Proposal.

Do you have a potential conflict of interest?

☒ Yes ☐ No

The Bidder acknowledges and agrees that the addendum/addenda below form part of the Bid Solicitation Document.

Please check the box in the column "**I have reviewed this addendum**" below to acknowledge each of the addenda.

File Name	I have reviewed the below addendum and attachments (if applicable)	Pages
There have not been any addenda issued for this bid.		