

**ST. PAUL'S CES
CHILD CARE ADDITION**

**100 JAMES A. MCCAGUE AVENUE, Alliston
TENDER NO. CP-0467**



**SIMCOE MUSKOKA CATHOLIC
DISTRICT SCHOOL BOARD**



Unit 100 –706 Euclid Avenue
Toronto, Ontario, Canada M6G 2T9
Tel: 416-591-6575 Fax: 416-591-1010

Project No.: 17034
Date: February 2018

Set No.:
Issued:

Specifications

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List of Drawings

<u>No.</u>	<u>Title</u>	<u>Date</u>	<u>Revision</u>
<u>Architectural Drawings</u> WK Lim Architect Inc. Unit 100-706 Euclid Avenue Toronto, Ontario M6G 2T9 Tel: (416) 591- 6575 Fax: (416)591- 1010			
SP1	Site Plan	November 2017	February 15, 2018
SP2	Key and Phasing Plan, Roof Plan, Legend, General Notes and Site Details	November 2017	February 15, 2018
SP3	Site Plan Details	November 2017	February 15, 2018
A1	Ground Floor Plan	November 2017	February 15, 2018
A2	Reflected Ceiling Plan	November 2017	February 15, 2018
A3	Exterior Elevations	November 2017	February 15, 2018
A4	Typical Wall Sections and Details	November 2017	February 15, 2018
A5	Typical Wall Sections and Details	November 2017	February 15, 2018
A6	Typical Wall Sections and Details	November 2017	February 15, 2018
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A9	Interior Elevations	November 2017	February 15, 2018

Structural Drawings

IRC Building Sciences Group
2121 Argentia Road
Toronto, Ontario
Tel: (905) 607-7244
Fax: (905) 607-7288

S01	Notes	November 2017	February 16, 2018
S02	Foundation Plan & Roof Framing Plan	November 2017	February 16, 2018
S03	Foundation Details	November 2017	February 16, 2018
S04	Framing Details	November 2017	February 16, 2018

Mechanical Drawings

Moon-Matz Ltd.
2902 South Sheridan Way, Suite 300
Oakville, Ontario
Tel: (905) 274-7556
Fax: (905) 274-5382

M-1	Legend, Symbols and Standard Details	November 2017	February 16, 2018
M-2	Equipment Schedules	November 2017	February 16, 2018
M-3	Equipment Schedules	November 2017	February 16, 2018
M-4	Piping Schematics	November 2017	February 16, 2018
M-5	HVAC Layout	November 2017	February 16, 2018
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M-10	Roof Plan Mechanical Layout	November 2017	February 16, 2018
M-11	Mechanical Room Plan Low and High Level Equipment and Piping Layouts	November 2017	February 16, 2018

Electrical Drawings

Moon-Matz Ltd.
2902 South Sheridan Way, Suite 300
Oakville, Ontario
Tel: (905) 274-7556
Fax: (905) 274-5382

E1	Electrical Site Plan, Legend and Notes	November 2017	February 15, 2018
E2	Power and Systems Plan	November 2017	February 15, 2018
E3	Lighting Plan	November 2017	February 15, 2018
E4	Electrical Details Sheet 1 of 2	November 2017	February 15, 2018
E5	Electrical Details Sheet 2 of 2	November 2017	February 15, 2018
E6	Electrical Lighting Control Panel and Panel Schedules	November 2017	February 15, 2018
E7	Electrical Details and Panel Schedule	November 2017	February 15, 2018

St. Paul's CES
Child Care Addition
100 James A. McCague Avenue
Alliston, Ontario
SMCDSB CP-0467/WKL 17034

List of Drawings

Section 00001

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December 2017

Site Servicing Drawings
Eaglebrooke Engineering Ltd.
1228 Gorham Street, Unit 15
Newmarket, Ontario
Tel: (905) 288-5353
Fax: (905) 657-5811

17260-SG-1 Site Grading Plan

December 2017 February 15, 2018

END OF SECTION



PROJECT NAME St. Paul's CES
Child Care Addition CP-0467
PROJECT ADDRESS 100 James A. McCague Ave
CITY Alliston, Ontario

PROJECT NO: 17034
SHEET: 1 of 1
DATE: DEC 2017

ROOM FINISH SCHEDULE

ROOM NO.	ROOM NAME	FLOOR FINISH	WALL BASE	WALL MATERIAL	WALL FINISH	CEILING MATERIAL	CEILING FINISH	CEILING HEIGHT	F.R.R.	REMARK
V02	EXISTING VESTIBULE	-	-	-	-	-	-	-	-	SAWCUT, DEMOLISH, REMOVE AND MAKE GOOD EXISTING CANOPY
101	CORRIDOR	PORCELAIN TILE	PORCELAIN TILE	CONC. BL	PAINT	AC TILE	-	2600	-	
102	CORRIDOR	PORCELAIN TILE	PORCELAIN TILE	CONC. BL	PAINT	AC TILE	-	2600	-	
103	CORRIDOR	PORCELAIN TILE	PORCELAIN TILE	CONC. BL	PAINT	AC TILE	-	2600	-	
111	VESTIBULE	PORCELAIN TILE	PORCELAIN TILE	CONC. BL	PAINT	GYP. BD	PAINT	2600	-	
112	VESTIBULE	PORCELAIN TILE	PORCELAIN TILE	CONC. BL	PAINT	GYP. BD	PAINT	2600	-	
121	PRE-SCHOOLERS	VCT	RUBBER	CONC. BL	PAINT	AC TILE	-	2700	-	
122	STORAGE	VCT	RUBBER	CONC. BL	PAINT	AC TILE	-	2700	-	
131	TODDLERS	VCT	RUBBER	CONC. BL	PAINT	AC TILE	-	2700	-	
132	STORAGE	VCT	RUBBER	CONC. BL	PAINT	AC TILE	-	2700	-	
141	INFANTS	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	AC TILE	-	2700	-	
142	WASHROOM	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	AC TILE	-	2700	-	
143	SLEEPING	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	AC TILE	-	2700	-	
144	STORAGE	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	AC TILE	-	2700	-	
161	CHILDCARE KITCHEN	VCT	RUBBER	CONC. BL	PAINT	AC TILE	-	2700	-	
162	STAFF	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	AC TILE	-	2700	-	
163	OFFICE	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	AC TILE	-	2700	-	
171	SHARED WASHROOM	VCT	RUBBER	CONC. BL	PAINT	AC TILE	-	2700	-	
172	SERVICE ROOM	VCT	RUBBER	CONC. BL	PAINT	-	-	-	-	
173	WASHROOM	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	AC TILE	-	2700	-	
174	CUSTODIAN	VCT	RUBBER	CONC. BL/ GYP. BD	PAINT/ PAINT	-	-	-	-	



PROJECT NAME St. Paul's CES
Child Care Addition CP-0467

PROJECT ADDRESS 100 James A. McCague Avenue
Alliston, Ontario

CITY

PROJECT NO: 17034

SHEET: 1 of 1

DATE: DEC 2017

DOOR AND FRAME SCHEDULE

DOOR NO.	SIZE	DOOR TYPE	DOOR MATERIAL	DOOR FINISH	DOOR GRILLE	GLAZING	FRAME TYPE	FRAME MATERIAL	FRAME FINISH	LABEL	REMARK
101	1000 X 2150 X 45	D	H.M.	PAINT	-	CERAMIC	1	P.S.	PAINT	45 MIN.	LEVERSET + PANIC DEVICE, CLOSER WITH STOP, KICKPLATE
102	2 - 1050 X 2150 X 45	E	ALUM.	-	-	LAM./TEMP.	6	ALUM.	-	-	LEVERSET + PANIC DEVICE, CLOSER WITH STOP, KICKPLATE, WEATHERSTRIPPING, SWEEP, THRESHOLD, REMOVABLE MULLION. SEE NOTE 1.
111	2 - 1050 X 2150 X 45	E	ALUM.	-	-	LAM./TEMP.	6	ALUM.	-	-	LEVERSET + PANIC DEVICE, CLOSER WITH STOP, MOTORIZED OPERATOR, ELEC.STRIKE, KICKPLATE, WEATHERSTRIPPING, SWEEP, THRESHOLD, REMOVABLE MULLION
111A	2 - 1050 X 2150 X 45	E	H.M.	PAINT	-	LAM.	6	P.S.	PAINT	-	LEVERSET + PANIC DEVICE, CLOSER WITH STOP, MOTORIZED OPERATOR, ELEC.STRIKE KICKPLATE, REMOVABLE MULLION
112	1000 X 2150 X 45	D	ALUM.	-	-	LAM./TEMP.	5	ALUM.	-	-	LEVERSET + PANIC DEVICE, CLOSER WITH STOP, MOTORIZED OPERATOR, ELEC.STRIKE, KICKPLATE, WEATHERSTRIPPING, SWEEP, THRESHOLD
112A	1000 X 2150 X 45	D	H.M.	PAINT	-	LAM.	5	P.S.	PAINT	-	LEVERSET + PANIC DEVICE, CLOSER WITH STOP, MOTORIZED OPERATOR, ELEC.STRIKE, KICKPLATE
121	950 X 2150 X 45	C	H.M.	PAINT	-	LAM.	2	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
122	950 X 2150 X 45	A	H.M.	PAINT	-	-	1	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
131	950 X 2150 X 45	C	H.M.	PAINT	-	LAM.	2	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
132	950 X 2150 X 45	A	H.M.	PAINT	-	-	1	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
141	950 X 2150 X 45	C	H.M.	PAINT	-	LAM.	2	P.S.	PAINT	-	LEVERSET, CLOSER WITH STOP, KICKPLATE
142	950 X 2150 X 45	A	H.M.	PAINT	-	LAM.	3	P.S.	PAINT	-	PRIVACY LEVERSET, OVERHEAD STOP, KICKPLATE
143	950 X 2150 X 45	A	H.M.	PAINT	-	LAM.	3 (D2)	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
144	950 X 2150 X 45	A	H.M.	PAINT	-	-	1	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
161	950 X 2150 X 45	A	H.M.	PAINT	-	-	1	P.S.	PAINT	45 MIN.	LEVERSET, CLOSER WITH STOP, KICKPLATE
162	950 X 2150 X 45	B	H.M.	PAINT	-	LAM.	1	P.S.	PAINT	-	LEVERSET, CLOSER WITH STOP, KICKPLATE
163	950 X 2150 X 45	B	H.M.	PAINT	-	LAM.	1	P.S.	PAINT	-	LEVERSET, CLOSER WITH STOP, KICKPLATE
171	950 X 2150 X 45	A	H.M.	PAINT	-	LAM.	4	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
171A	950 X 2150 X 45	A	H.M.	PAINT	-	LAM.	3 (D1)	P.S.	PAINT	-	LEVERSET, OVERHEAD STOP, KICKPLATE
172	950 X 2150 X 45	A	H.M.	PAINT	-	-	1	P.S.	PAINT	45 MIN.	LEVERSET, CLOSER WITH STOP, KICKPLATE
173	950 X 2150 X 45	A	H.M.	PAINT	-	-	1	P.S.	PAINT	45 MIN.	PRIVACY LEVERSET, CLOSER WITH STOP, KICKPLATE
174	950 X 2150 X 45	A	H.M.	PAINT	-	-	1	P.S.	PAINT	45 MIN.	LEVERSET, CLOSER WITH STOP, KICKPLATE
143W	2 - 725 X 1100	-	-	-	-	LAM.	7	P.S.	PAINT	-	PRESSED STEEL WINDOW FRAME AND GLASS ASSEMBLY.
163W	2 - 725 X 1300	-	-	-	-	LAM.	8	P.S.	PAINT	-	PRESSED STEEL WINDOW FRAME AND GLASS ASSEMBLY.
											NOTE 1: REMOVE, SALVAGE AND INSTALL EXISTING HARDWARE INCLUDING MOTORIZED OPERATOR, ELEC. STRIKE, CONTROLS AND CARD READER FROM EXISTING WEST EXIT DOOR

DOOR AND
FRAME
SCHEDULE

ST. PAUL'S CES
CHILD CARE ADDITION CP-0467
100 JAMES A. MCCAGUE AVENUE

PROJECT NO.: 17034

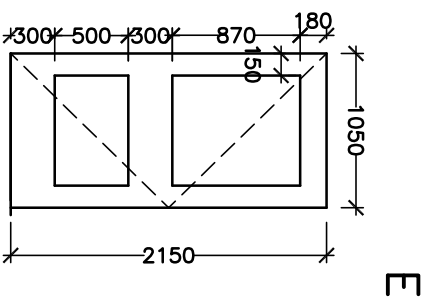
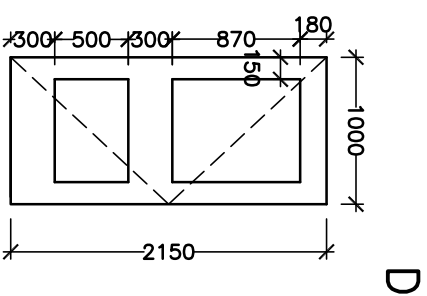
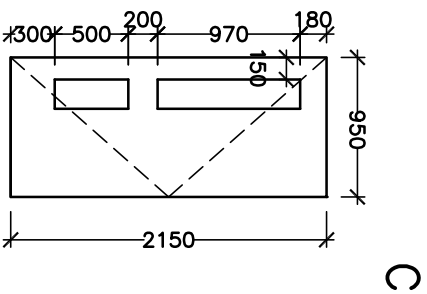
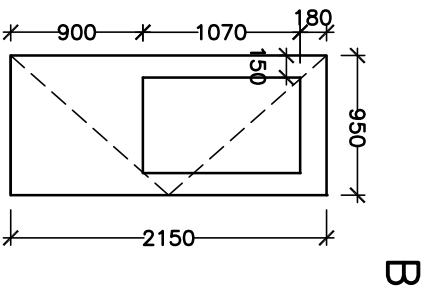
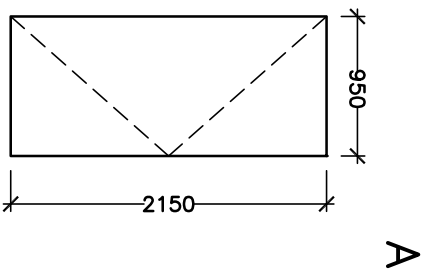
DATE: DECEMBER 2017,
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ALLISTON

ONTARIO

SHEET 1 OF 2

DOOR TYPES



DOOR AND FRAME SCHEDULE

ST. PAUL'S CES
CHILD CARE ADDITION CP-0467
100 JAMES A. MCCAGUE AVENUE

PROJECT NO.: 17034

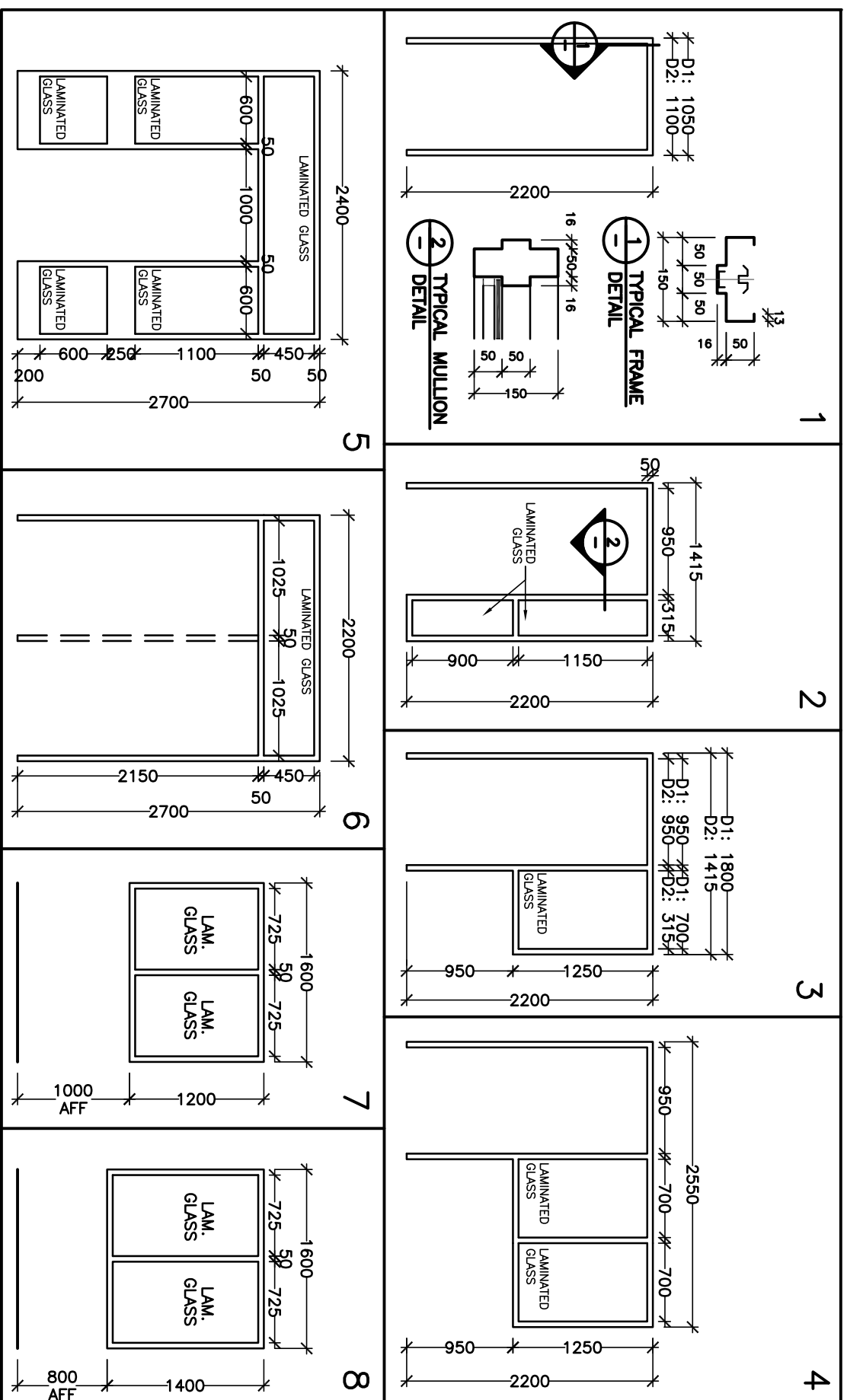
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ALLISTON

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SHEET 2 OF 2

FRAME TYPES



WINDOW SCHEDULE

ST. PAUL'S CES
CHILD CARE ADDITION CP-0467
100 JAMES A. MCCAGUE AVENUE

ALLISTON

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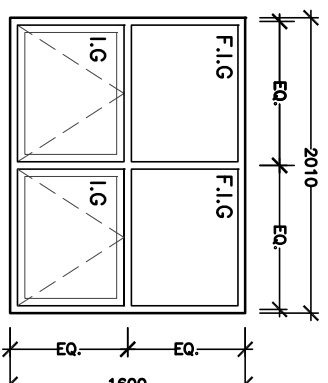
PROJECT NO.: 17034

DATE: DECEMBER 2017

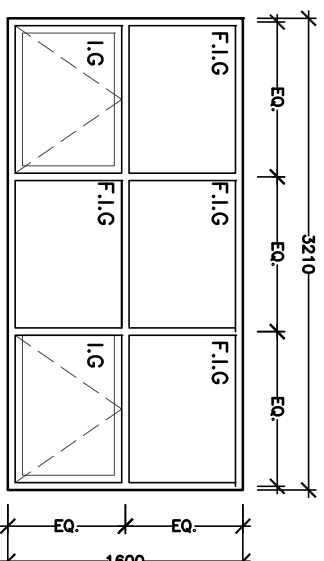
SHEET 1 OF 1

NOTE:

1. DIMENSIONS INDICATE APPROXIMATE ROUGH OPENING SIZES. VERIFY ON SITE.
2. FILL FRAME JOINT TO R.O. W/ COMPRESSIBLE FOAM INSULATION.
3. PROVIDE INTERIOR AND EXTERIOR PERIMETER CAULKING ON BACKER ROD.
4. PROVIDE CONTINUOUS SEAL AT JUNCTION TO AIR AND VAPOUR BARRIERS.
5. SEAL FRAME PERIMETER TO BUILDING ENVELOPE AIR/VAPOUR BARRIER WITH SELF-ADHESIVE SHEET MEMBRANE



WINDOW TYPE W1:
ALUMINUM THERMALLY BROKEN
SASH AND FRAME
PRE-FINISHED CLEAR ANODIZED
INSULATING GLASS
2 UPPER FIXED PANES
2 LOWER THPO AWNING SASHES
W/ FRAMED REMOVABLE INSECT SCREENS
W/ ROTARY GEAR FOLDING OR
LOW-PROFILE HANDLE OPERATOR
EXTRUDED ALUMINUM SILL ON DAMPROOF
COURSE MEMBRANE
SLOPED MIN. 5 DEG. WITH DRIP
AND JAMB DEFLECTORS



WINDOW TYPE W2:
ALUMINUM THERMALLY BROKEN
SASH AND FRAME
PRE-FINISHED CLEAR ANODIZED
INSULATING GLASS
3 UPPER FIXED PANES
1 LOWER CENTRE FIXED PANE
2 LOWER FLANKING THPO AWNING SASHES
W/ FRAMED REMOVABLE INSECT SCREENS
W/ ROTARY GEAR FOLDING OR
LOW-PROFILE HANDLE OPERATOR
EXTRUDED ALUMINUM SILL ON DAMPROOF
COURSE MEMBRANE
SLOPED MIN. 5 DEG. WITH DRIP
AND JAMB DEFLECTORS
REMOTE TELEFLEX OPERATOR
LOCATE CRANK HANDLE ON SITE AS
DETERMINED BY CONSULTANT
MAX 1100 AFF

PART 1 GENERAL

1.1 THE CONSULTANT (ARCHITECT)

WK Lim Architect Inc.
Unit 100-706 Euclid Avenue
Toronto, Ontario M6G 2T9
Tel: (416) 591-6575
Fax: (416) 591-1010

1.2 THE SUBCONSULTANTS

1. The Structural Engineer for this Project is:
IRC Building Sciences Group
2121 Argentia Road
Toronto, Ontario
Tel: (905) 607-7244
Fax: (905) 607-7288
2. The Mechanical/Electrical Consultant for this Project is:
Moon-Matz Ltd.
2902 South Sheridan Way, Suite 300
Oakville, Ontario
Tel: (905) 274-7556
Fax: (905) 274-5382
3. The Site Servicing Consultant for this Project is:
Eaglebrooke Engineering Ltd.
1228 Gorham Street, Unit 15
Newmarket, Ontario
Tel: (905) 288-5353
Fax: (905) 657-5811

END OF SECTION

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

Project: **St. Paul's CES**
Child Care Addition
100 James A. McCague Avenue, Alliston, Ontario

Tender Number: **CP-0467**
WKL Project Number: **17034**

BID FORM

NAME OF BIDDER _____

BID PRICE

The undersigned, having carefully examined the Bid Documents, having received, carefully examined and incorporated Addenda No. _____ to No. _____ inclusive, having visited and investigated the Place of the Work, and having examined all conditions, circumstances and limitations affecting the Work, offer to enter into a Contract with the Owner to perform the Work required by the Bid Documents for the price of

_____ CANADIAN DOLLARS (\$_____).

The price offered excludes all Harmonized Sales Tax (HST) but includes all other eligible taxes.

BID SECURITY

Attached to this Bid Form is a bid bond issued by

in the amount of \$ _____.

No other form of bid security is acceptable.

AGREEMENT TO BOND

Attached to this bid is a separate agreement to bond issued by

undertaking to provide the bonds required by the Bid Documents.

DECLARATIONS

The undersigned declare:

1. To perform the Work in compliance with the Contract Documents and attain Substantial Performance of the Work on or before August 10, 2018.
2. No person, firm or corporation other than the undersigned has any interest in this bid or in the proposed Contract for which this bid is made.
3. This bid is irrevocable and is open for acceptance by the Owner for a period of sixty (60) days from the date of submission.

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

Project: **St. Paul's CES**

Tender Number: **CP-0467**

Child Care Addition

100 James A. McCague Avenue, Alliston, Ontario

WKL Project Number: **17034**

BID FORM

PRE-QUALIFIED SUBCONTRACTORS

1. Where the Owner has pre-qualified one or more Subcontractors to perform or supply an item of the Work called for by the Contract, **bidders shall select only a pre-qualified Subcontractor** to perform or supply that item of Work. The names and bid prices (Harmonized Sales Tax (HST) excluded) of the Mechanical, Electrical, Masonry, Roofing, Millwork and Data Cabling Subcontractors included in my/our Bid Price are:

.1	Mechanical	_____	\$ _____
.2	Electrical	_____	\$ _____
.3	Masonry	_____	\$ _____
.4	Roofing	_____	\$ _____
.5	Millwork	_____	\$ _____
.6	Data Cabling	_____	\$ _____

DATE _____

SIGNATURE _____ (Bidder's Original Signature)

Name (Printed) _____

Title _____

END OF DOCUMENT

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

Project: **St. Paul's CES**

Tender Number: **CP-0467**

Child Care Addition

100 James A. McCague Avenue, Alliston, Ontario

WKL Project Number: **17034**

**BID FORM – APPENDIX “A”
LIST OF BIDDER KEY PERSONNEL AND SUBCONTRACTORS**

NAME OF BIDDER _____

The undersigned will be assigning the following Key Personnel in the positions indicated to perform the Work called for by the Contract and confirm their reliability and competency to carry out such Work in accordance with the Contract Documents.

The undersigned acknowledge that the Instructions to Bidders require that we list only one Key Person for each position described in this Appendix A.

POSITION

NAME

Project Manager

Site Superintendent

The undersigned propose to employ the following Subcontractors and/or Suppliers to perform an item of the Work called for by the Contract and confirm that all have been investigated to confirm their reliability and competency to carry out such Work in accordance with the Contract Documents.

The undersigned acknowledge that the Instructions to Bidders require that we list only one Subcontractor and/or Supplier for each item of the Work described in this Appendix A. The undersigned further acknowledge that where we have entered "own forces" to perform an item of the Work, it is our intention to use "own forces" for that purpose and confirm they are qualified and competent to perform the item of Work in accordance with the Contract Documents.

After bid submission, no substitution for a Subcontractor, Supplier or "own forces" will be permitted except as provided in the Contract.

ITEM OF WORK

SUBCONTRACTOR / SUPPLIER

Excavating, Backfilling and Rough
Grading

Asphalt Paving

Concrete Walks, Curbs and Gutters

Landscaping

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

Project: **St. Paul's CES**
Child Care Addition

100 James A. McCague Avenue, Alliston, Ontario

Tender Number: **CP-0467**

WKL Project Number: **17034**

BID FORM – APPENDIX “A”
LIST OF BIDDER KEY PERSONNEL AND SUBCONTRACTORS

Sodding	_____
Cast-in-place Concrete	_____
Precast Concrete Units	_____
Masonry (Manufacturer Brick)	_____
Masonry (Manufacturer Block)	_____
Architectural Concrete Block	_____
Glazed Block	_____
Structural Steel and Joists	_____
Steel Roof Deck	_____
Metal Fabrications	_____
Metal Railings	_____
Fireproofing	_____
Finish Carpentry	_____
Preformed Metal Siding	_____
Sealants	_____
Steel Doors and Frames (Manufacturer)	_____
Wood Doors (Manufacturer)	_____
Aluminum Windows and Doors	_____
Gypsum Board	_____
Porcelain Tile	_____
Ceramic Tile	_____
Acoustic Ceilings	_____

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

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BID FORM – APPENDIX “A”
LIST OF BIDDER KEY PERSONNEL AND SUBCONTRACTORS

Resilient Flooring	_____
Carpet	_____
Painting	_____
Chalkboards, Tackboards & Whiteboards (Manufacturer)	_____
Toilet Partitions	_____
Window Blinds	_____

This Appendix A is an integral part of these Bid Documents.

DATE _____

SIGNATURE _____ (Bidder's Original Signature)

Name (Printed) _____

Title _____

END OF DOCUMENT

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

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Child Care Addition

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**BID FORM – APPENDIX “B”
SEPARATE, ITEMIZED AND ALTERNATIVE PRICES**

NAME OF BIDDER _____

The undersigned offer the Separate Prices, Itemized Prices, Alternative Prices and Information Prices described below and agree that:

1. All prices submitted take into consideration and allow for changes and adjustments in other work as may be necessary to provide a finished and functional result, unless specifically indicated otherwise.
2. “Separate Prices” are for work that is not included in the bid price offered in the Bid Form but which the Owner may add for the amount quoted below. The undersigned agree that if no price is shown for work for which a Separate Price is required, it shall mean that the work is offered to the Owner at no increase in the bid price.
3. “Itemized Prices” are for Work that is included in the bid price offered in the Bid Form but which the Owner may delete for the amount quoted below. The undersigned agree that if no price is shown for Work for which an Itemized Price is required, it shall mean that the Work is to be deleted without a change in the bid price.
4. “Alternative Prices” are for work that is not included in the bid price offered in the Bid Form but which the Owner may substitute for Work which is included in the bid price, for the amount quoted below. The undersigned agree that if no price is shown for work for which an Alternative Price is required, it shall mean the substitute work is offered to the Owner at no change in the bid price.
5. “Information Prices” are for Work that is included in the bid price offered in the Bid Form but which the Owner may require for financial reporting purposes.
6. Without limiting its rights under the Instructions to Bidders, the Owner reserves the right to accept or reject any of the prices proposed under this Appendix B.
7. Prices listed hereunder do not include Harmonized Sales Tax (HST) but include all other eligible taxes.

SEPARATE PRICES

- 1 Reserved

ITEMIZED PRICES

- 1 Reserved

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**BID FORM – APPENDIX “B”
SEPARATE, ITEMIZED AND ALTERNATIVE PRICES**

ALTERNATIVE PRICES

1 Reserved \$ _____

INFORMATION PRICES

1 Reserved

This Appendix B is an integral part of the Bid Documents.

DATE _____

SIGNATURE _____ (Bidder's Original Signature)

Name (Printed) _____

Title _____

END OF DOCUMENT

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

Project: **St. Paul's CES**

Tender Number: **CP-0467**

Child Care Addition

100 James A. McCague Avenue, Alliston, Ontario

WKL Project Number: **17033**

INSTRUCTIONS TO BIDDERS

1. INTRODUCTION

- 1.1 Simcoe Muskoka Catholic District School Board (the "**Owner**") is soliciting Bids from pre-qualified general contractors to carry out the work described in the Bid Documents at St. Paul's CES: 100 James A. McCague Avenue, Alliston, Ontario (the "**Place of the Work**"). Bids must be submitted on Thursday, March 15, 2018 (the "**Closing Date**") and before the time specified in Article 13. Bids must be irrevocable for a period of ninety (90) days starting from the day after the Closing Date (the "**Irrevocability Period**").

2. THE BID CONTRACT

- 2.1 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 set out in paragraph 16.3 and substantially complies with the other requirements of the Bid Documents. 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.

3. DEFINITIONS

- 3.1 Capitalized terms not otherwise defined in this Article or elsewhere in these Instructions to Bidders shall have the meanings ascribed to them in the Definitions to the CCDC 2 – 2008 stipulated price contract, as amended by supplementary conditions.
- 3.2 "**Additional Information**" has the meaning set out in paragraph 15.
- 3.3 "**Bid**" means the Bid Form and all other documents submitted by a bidder in accordance with these Instructions to Bidders.
- 3.4 "**Bid Contract**" means the process contract described in paragraph 2.1 for the evaluation of Bids and the execution of the Contract, if any
- 3.5 "**Bid Documents**" has the meaning set out in paragraph 4.1.
- 3.6 "**Board**" means the Board of Trustees of the Simcoe Muskoka Catholic District School Board.
- 3.7 "**Closing Date**" has the meaning set out in paragraph 1.1.
- 3.8 "**Consultant**" means W.K. Lim Architect inc.
- 3.9 "**Data**" has the meaning set out in paragraph 5.1.
- 3.10 "**Irrevocability Period**" has the meaning set out in paragraph 1.1.
- 3.11 "**Local Time**" means the time measured by the Owner's clock at the location identified in paragraph 13.1.
- 3.12 "**Place of the Work**" has the meaning set out in paragraph 1.1.
- 3.13 "**Reports**" has the meaning set out in paragraph 5.1.

4. BID DOCUMENTS

- 4.1 The following are the Bid Documents:
- .1 Instructions to Bidders.
 - .2 Bid Form and Appendix A.

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

Project: **St. Paul's CES**

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INSTRUCTIONS TO BIDDERS

- .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 Addenda issued prior to the Closing Date.
- 4.2 Check Bid Documents for completeness upon receipt. Inform Consultant immediately should any documents be missing or incomplete and/or upon finding any discrepancies or omissions.
- 4.3 Complete sets of Bid Documents are available in electronic format from the Consultant. **A CD ROM disk is available for retrieval on the date and time as advised by the Consultant and may be available at the Bidders Briefing Meeting by making prior arrangements with the consultant.** Bid Documents shall be returned to Consultant within ten (10) days after the Closing Date. The consultant may transmit Bid documents via electronic means for the convenience of Bidders, however, each Bidder will be responsible for making arrangements with their own respective internet service provider to clear firewall restrictions and other security measures which may impede the transmission of Bid Documents. Transmission of Bid Documents via electronic means will not relieve each and any Bidder of the responsibility to verify and ensure that Bid Documents are received.

Electronic files of Tender Documents are made available for the convenience of Bidders for their information and use, and for specific distribution to only subtrades and suppliers for the sole purpose of submitting quotations for this Tender. Any other use or distribution is not authorized and will be an infraction under the Architects Act and subject to fines and remedies thereto. WK Lim Architect inc. assumes no responsibility or liability for the transmission of these documents including technical impediments or firewall limitations of the recipient. A CD ROM of these electronic files is available for retrieval at the office of the Consultant by making arrangements prior to retrieval. After notification of Tender results, and not later than 14 days after Tender Close, all electronic files of Tender Documents are to be deleted. This paragraph is to be attached and forwarded with all Bid Documents. Forwarding and use of the attached documents confers agreement and compliance by the Bidder to these directions and conditions.

- 4.4 The Bid Documents are made available only for the purpose of submitting Bids for the Project. Availability and/or use of the Bid Documents does not confer a licence or grant for any other purpose.

5. SITE INVESTIGATION

5.1 .1 Geo-Environmental and Geo-Technical 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 bound in this specification, titled as follows:

GEOTECHNICAL INVESTIGATION PROPOSED ADDITION ST. PAUL'S CATHOLIC ELEMENTARY SCHOOL 100 JAMES A. McCAGUE AVENUE, ALLISTON, ONTARIO FOR SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD, PML Ref 17BF054, November 2017, Peto MacCallum Ltd.

SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD

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INSTRUCTIONS TO BIDDERS

- .2 The Reports record properties of the soil and recommendations for the design of the Work. The recommendations indicated in the Reports are a requirement of the Contract.
 - .3 The Reports should not be considered a representation of the site conditions of the entire Place of the Work. Should site conditions, in the opinion of the Consultant and the geotechnical engineer, be found to vary substantially from the Reports, changes in the design and construction of the foundations will be made, with resulting credits or expenditures to the Owner
 - .4 Neither the Owner nor the Consultant guarantees the accuracy or completeness of the Reports, nor does either assume any responsibility for any interpretations or conclusions that bidders may make or draw from the Reports.
- 5.2 Each bidder is solely responsible, at its own cost and expense, to carry out its own independent research, 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.
- 5.3 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 Closing Date, and/or in connection with Work which is required and which is reasonably inferable from the Reports and/or Data as being necessary.

6. DESIGNATED SUBSTANCES

- 6.1 Without limiting the obligations of the bidders set out in Article 5, where the Place of the Work is within or part of an existing building, bidders should note they may encounter designated substances such as lead, mercury, silica, asbestos-containing material ("**ACM**"), benzene, arsenic, etc. If applicable, a list of designated substances present at the Place of the Work has been provided to all bidders and, if ACM is included in the list of designated substances, a report has also been provided indicating the condition and location of any ACM that may be present at the Place of the Work (collectively the "**OHSA Reports**"). Designated substance information prepared or obtained with respect to the Place of the Work (collectively the "**Data**") are bound in the specification and titled as follows:

PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY Simcoe Muskoka Catholic District School Board Childcare Addition Project St. Paul's Catholic School 100 James A. McCague Avenue, Alliston, Ontario, 702786-000, November 2017, Arcadis Canada Inc.

- 6.2 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 OHSA Reports or not, unless included in the Work required by the Bid Documents. Should a bidder determine, prior to the Closing Date, that the Work cannot be completed without handling, dealing with, disturbing or removing any designated substance identified in the OHSA Reports (and the Work does not otherwise require the bidder to handle, deal with, disturb and/or remove such substance), it shall immediately notify the Owner and the Consultant in writing so that, if necessary, instructions and/or clarifications may be issued in the form of an addendum.

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INSTRUCTIONS TO BIDDERS

- 6.3 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 a contract is awarded, and which confidentiality obligations shall survive termination of the bid process. Such information is not to be used for any purpose other than submitting a Bid.

7. PRE-QUALIFICATION

- 7.1 Bidders must be pre-qualified by the Owner or its representative prior to submitting a Bid. Bids received from general contract bidders who have not been pre-qualified prior to the submission of their Bid shall be returned unopened.

- 7.2 The following general contract bidders are pre-qualified to submit a Bid:

1. Everstrong Construction Ltd.
15 Brownridge Rd., Unit 4
Georgetown, ON
L7G 0C6
(905) 878-7295 fax (905) 878-7298
2. Garritano Bros Ltd.
881 Nelson St.
Oshawa, ON
L1H 5N7
(905) 576-8642 fax (905) 576-2582
3. Jasper Construction Corp.
344 North Rivermade Rd.
Concord, ON
L4K 3N2
(416) 736-9798 fax (416) 736-0236
4. JR Certus Construction Co. Ltd.
72 Hazelridge Court
Kleinburg, ON
L0J 1C0
(647) 494-0150 fax (647) 494-0155
5. Monteith Building Group Ltd.
31 Colborne St. E.
Orillia, ON
L3V 1T4
(705) 326-5533 fax (705) 326-1311
6. Percon Construction Inc.
20 Airview Rd.
Toronto, ON
M9W 4P2
(416) 744-9967 fax (416) 744-8863
7. Pre-Eng Contracting Ltd.

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INSTRUCTIONS TO BIDDERS

1 Applewood Cres.
Concord, ON
L4K 4K1
(905) 738-6866 fax (905) 738-4879

8. Struct-Con Construction Ltd.
2051 Williams Parkway East, Unit 14,
Brampton, Ontario,
L6S 5T3
(905) 791-5445 fax (905) 791-5380

9. Tambro Construction Ltd.
1 Taggart St., Unit 1
Guelph, ON
N1H 6H8
(519) 766-1234 fax (519) 766-4019

10. Torcom Construction Inc.
2 Sheppard Ave. E., Suite 930
North York, ON
M2N 5Y7
(416) 226-9337 fax (416) 226-2467

7.3 The following mechanical subcontractors are pre-qualified for the Project:

1. CEC Mechanical Ltd.
16188 Bathurst St.
King City, ON
L7B 1K9
(905) 713-3711 fax (905) 713-0734

2. Dependable Mechanical Systems Inc.
50 Four Valley Dr.
Concord, ON
L4K 4T9
(905) 660-9144 fax (905) 660-9145

3. HS St.Amant & Sons Inc.
39 Robert St. W.
Pennetanguishene, ON
L9M 1M5
(705) 549-7227 fax (705) 549-4308

4. JMR Electric Ltd.
301 Thames Road East,
Exeter, ON
N0M 1S3
(519) 235-1516 fax (519) 235-0507

5. Mapleridge Mechanical Contracting Inc.

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INSTRUCTIONS TO BIDDERS

939 Dillingham Rd.
Pickering, ON
L1W 1Z7
(905) 831-0524 fax (905) 831-1628

6. Quality Mechanical
1806 Casey Rd.
Belleville, ON
K8N 4Z6
(613) 969-7403 fax (613) 969-8809

7. Sexton's Mechanical Ltd.
566 Welham Rd.,
Barrie, ON
L4N 8Z7
(705) 728-4040 fax (705) 728-4046

8. SOAN Mechanical Ltd.
11 Bayview Court,
London, ON
N5W 5W4
(519) 455-1530 fax (519) 455-1104

9. Stellar Mechanical Inc.
15 Penn Dr.
Toronto, ON
M9A 2A6
(416) 748-8088 fax (416) 748-8288

10. Western Mechanical Electrical Millwright Services Ltd.
160 Brock Street,
Barrie, Ontario
L4N 2M4
(705) 737-1435 fax (705) 737-1765

7.4 The following electrical subcontractors are pre-qualified for the Project:

1. CEC Services Limited (Aurora)
16188 Bathurst St.
King City, ON
L7B 1K5
(905) 713-3711 fax (905) 713-0736

2. Dependable Mechanical Systems Inc.
50 Four Valley Dr.
Concord, ON
L4K 4T9
(905) 660-9144 fax (905) 660-9145

3. JMR Electric Ltd.

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INSTRUCTIONS TO BIDDERS

301 Thames Road East,
Exeter, ON
N0M 1S3
(519) 235-1516 fax (519) 235-0507

4. N. S. E. 2000 Inc.
261 Hughes Rd.
Orillia, ON
L3V 1M5
(705) 325-3738 fax (705) 325-3717
5. Wallwin Electric Services Ltd.
50 Innisfil St.
Barrie, ON
L4N 4K5
(705) 726-1859 fax (705) 727-7607

7.5 The following masonry subcontractors are pre-qualified for the Project:

1. Bernel Masonry Ltd.
131 Delta Park Blvd., Suite B
Brampton, ON
L6T 5M8
(905) 791-8818 fax (905) 791-8895
2. Neivex Masonry Inc.
291 Edgely Blvd., Unit 10
Concord, ON
L4K 3Z4
(905) 760-0200 fax (905) 760-0139
3. RedCap Masonry
31 Colborne St. E.
Orillia, ON
L3V 1T4
(705) 896-0580 fax (705) 329-0812

7.6 The following roofing subcontractors are pre-qualified for the Project:

1. Atlas – Apex Roofing Inc.
65 Disco Road,
Etobicoke, ON
M9W 1M2
(416) 421-6244 fax: (416) 421-1661
2. Blanchfield Roofing Company Limited
34 Venture Cres.
North Bay, ON
P1A 0E4
(705) 472-5973 fax: (705) 472-0343

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INSTRUCTIONS TO BIDDERS

3. Cordeiro Roofing Ltd.
343 Olivewood Road
Toronto, ON
M8Z 2Z6
(416) 234-9901 fax: (416) 234-9581
4. Nedlaw Roofing Ltd.
232B Woolwich St. S.
Breslau, ON
N0B 1M0
(519) 648-2218 fax: (519) 648-3508
5. Nortex Roofing Ltd.
66 Six Point Rd.
Toronto, ON
M8Z 2X2
(416) 236-6090 fax: (416) 236-6091
6. Proteck Roofing & Sheet Metal Inc.
34 Guided Court
Etobicoke, ON
M9V 4K6
(416) 630-2300 fax: (416) 630-2310
7. Provincial Industrial Roofing & Sheet Metal Company Limited
166 Bowes Road
Concord, ON
L4K 1J6
(905) 669-2569 fax: (905) 669-6118
8. Roque Roofing Inc.
3 Clark Ave.
Hamilton, ON
L8L 5J7
(905) 525-9689 fax: (905) 525-7844
9. Semple Gooder Roofing Corporation
1365 Martin Grove Road
Toronto, ON
M9W 4X7
(416) 743-5370 fax: (416) 743-4257
10. Trio Roofing Systems Inc.
243 Advance Blvd.
Barrington, ON
L6T 4J2
(905) 456-1688 fax: (905) 456-3440

7.7 The following millwork subcontractors are pre-qualified for the Project:

1. Baywood Interiors Ltd.

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INSTRUCTIONS TO BIDDERS

55 Hollinger Cres.
Kitchener, ON
N2K 2Y8
(519)748-9577 fax (519)748-6563

2. CCW Inc.
56 Rankin St.
Waterloo, ON
N2L 6AV
(519) 884-7918 fax (519) 886-0120
3. Gregus Millwork Ltd.
70684 Morrison Line, PO Box 52
Exeter, ON
N0M 1S6
(519) 235-0300 fax (519) 235-0337
4. Harris Corporate Interiors Inc.
4290 Bartlett Rd.
Beamsville, ON
L0R 1B1
(905) 563-6111 fax (905) 563-6122
5. Personal Touch Woodcrafters Ltd.
3375 North Service Rd., Unites D1-3
Burlington, ON
L7N 3G2
(905) 336-9885 fax (905) 336-2005
6. Second Generation Furnishings Inc.
329 Connie Cresc.
Concord, ON
L4K 5R2
(905) 738-1403 fax (905) 738-3780

7.8 The following data cabling subcontractors are pre-qualified for the Project:

1. ACP Communications Technologies Inc.
6-885 Main Street East
Milton, ON
L9T 5A7
(905) 876-4026 fax: (905) 876-4697
2. Fitzpatrick Electrical Contractor Inc.
41 Maple St.
Uxbridge, ON
L9P 1C8

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INSTRUCTIONS TO BIDDERS

(905) 686-1661 fax: (905) 686-4373

3. Helix IT Inc.
9 Ontario St, Unit #7
Orillia, ON
L3V 0T7
(705) 327-6564 fax: (705) 327-6541
4. Marcomm Integrated Business Solutions
100 Hanlan Rd., Unit 8
Vaughan, ON
L4L 4V8
(905) 695-1700 fax: (905) 695-1701
5. TBD Telecom By Design Inc.
99 Atlantic Ave., Suite 200
Toronto, ON
M6K 1X9
(416) 244-2525 fax: (416) 244-2525
6. Wallwin Voice & Data Ltd.
97 Vespra St.
Barrie, ON
L4N 4T5
(705) 725-9080 fax: (705) 725-9130

7.9 The following security subcontractors are pre-qualified for the Project:

1. Huronia Alarms
233 Midland Ave.
Midland, ON
L4R 3K1
(705) 526-9311 fax: (705) 527-4530

7.10 The following communications subcontractors are pre-qualified for the Project:

1. Barrie Communications
1114 Wesport Crescent
Mississauga, ON
L5T 1G1
(905) 564-7026 fax: (905) 564-0806

7.11 The Owner reserves the right to issue an addendum naming additional pre-qualified general contract bidders and additional pre-qualified subcontractors.

8. BIDDERS' QUESTIONS AND AMENDMENTS TO BID DOCUMENTS

8.1 Direct questions arising during the bidding period to W.K. Lim Architect inc. (the "**Consultant**") at the following e-mail address: wklim.architect@on.aibn.com. The Consultant is the sole contact for bidding on this Project and a Bid may be disqualified where contact is made with any person other than the Consultant.

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INSTRUCTIONS TO BIDDERS

- 8.2 All questions are to be in writing, and not less than eight (8) Working Days before the Closing Date so that if a response is warranted, the question and its answer will be set out in an addendum. In responding to questions, similar questions from different bidders may be answered only once, questions may be edited for purposes of clarity, and questions which, in the Consultant's opinion, are obscure, ambiguous or unclear may be ignored.
- 8.3 Neither the Owner nor the Consultant will be responsible for answers, instructions, clarifications or amendments communicated orally. Answers, instructions, clarifications or amendments which affect the Bid Documents may only be made by addendum.
- 8.4 Report all discrepancies, omissions, errors, departures from building by-laws, codes or good practice, and points considered to be ambiguous or conflicting to the Consultant in writing, and not less than eight (8) Working Days before the Closing Date so that, if deemed necessary, instructions, clarifications or amendments may be issued to all bidders by addendum.
- 8.5 Addenda issued during the bidding period shall become part of the Bid Documents and their receipt shall be acknowledged in the space provided on the Bid Form. A bidder's failure to do so shall result in its Bid being declared non-compliant.

9. MATERIALS SUBSTITUTION

- 9.1 Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents. Substitution of the named articles and or products will only be permitted when the bidder and or subcontractor and or supplier has submitted a written request to substitute from the manufacturer, product or system. The submission shall include data and information as necessary to demonstrate and verify equal performance. The Consultant will perform a review of the submission and at the sole discretion of the Consultant, will ascertain conformance of the submitted manufacturer, product or system with the Bid Documents and acknowledge acceptance of the proposed substitution by addendum only. Requests to substitute a manufacturer, product or system must be made not less than ten (10) Working Days before the Closing Date so that, if deemed necessary, acceptance of the substitution may be issued to all bidders by addendum.
- 9.2 When two or more of the products are named in the Bid Documents, any one of the products named will be acceptable. When requested by the Consultant, after the Bid Contract has been awarded, the bidder shall notify the Consultant of the name of the manufacturer, product or system included in the Bid. If due to availability or colour limitations, the Consultant has to request a change to one of the other named manufacturers, products or systems, this shall be completed without extra cost to the Bid Contract.
- 9.3 The Bid shall be based on the use of approved products only.

10. MANDATORY PRE-BID SITE MEETING

- 10.1 A mandatory pre-bid site meeting for all pre-qualified general contract bidders has been scheduled on March 1, 2018 at 10:00 am at the Place of Work. All pre-qualified general contract bidders must attend and will be required to sign the "Site Meeting Log" to confirm their attendance.
- 10.2 The Consultant will oversee the signing of the "Site Meeting Log" and once all in attendance have signed the log and the Consultant has called the meeting to order, pre-qualified general contract

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bidders who arrive after that time shall be considered late and will not be permitted to sign the "Site Meeting Log".

- 10.3 Only bids from pre-qualified general contract bidders who have signed the "Site Meeting Log" will be considered. All other bids shall be deemed non-compliant and will not receive further consideration.

11. BID SECURITY, PERFORMANCE SECURITY, AND INSURANCE

- 11.1 Each bid shall be accompanied by bid security in the following form:

.1 a bid bond in the amount of 10% of the Bid Price naming the Owner as obligee and issued by a surety licensed to conduct surety and insurance business in Canada. The bid bond shall remain valid for a period of sixty (60) days from the Submission Deadline.

- 11.2 The bid security is for the benefit of the Owner and stands as security that the bidder, if awarded the Contract, will execute the Contract and will deliver the specified performance security and evidence of insurance and all other documents required by these Instructions to Bidders or by the Contract. Where the bid security submitted is a certified cheque then:

.1 Upon execution of the Contract and the delivery of the evidence of insurance and other documents required by these Instructions to Bidders or by the Contract, the bid security will be retained by the Owner as performance security, securing the proper and timely performance of the Contract.

.2 The performance security will be returned to the bidder upon the successful completion of the Contract, subject to any claims which the Owner might have against such security.

- 11.3 Where the bid security submitted is a bid bond then:

.1 The bid shall be accompanied by an agreement to bond issued by the same surety company that provides the bid bond, undertaking to provide a fifty percent (50%) performance bond and a fifty percent (50%) labour and material payment bond, both to be delivered to the Owner if the bidder is awarded the Contract.

- 11.4 Bids not accompanied by the required bid security the required agreement to bond, will be declared non-compliant and rejected.

- 11.5 Include the costs of all bid security and performance security in the bid price.

- 11.6 Bids which do not include the required bid bond and agreement to bond shall be declared non-compliant and rejected.

- 11.7 The Contract requires the Contractor to provide the insurance coverage described in GC 11.1 of the Contract. In particular, where Products are specified to be provided by the Owner for incorporation into the Work, the full value of such Products, as stated in the Supplementary Conditions, shall be added to the Contract Price for the purpose of "broad form" property insurance coverage. Bidders are encouraged to carefully review the insurance coverage requirements of the Contract.

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12. INSTRUCTIONS FOR COMPLETING THE BID

12.1 Bid Form and Appendices.

- .1 Fill in all blank spaces on the Bid Form and Appendices in ink, or typewritten, providing all information requested, and ensure each is signed by an authorized person or persons. Submission of a Bid Form which does not bear an original signature will result in the Bid being declared non-compliant and rejected.
- .2 Use only the Bid Form and Appendices issued as part of the Bid Documents for the Project. If any or all pages of the Bid Form and/or Appendices are amended by addendum, only the amended pages shall be used to submit a Bid. Failure to comply with this paragraph shall result in the Bid being declared non-compliant and rejected.
- .3 A bidder's failure to provide all requested information on the Bid Form or to fill in all blank spaces shall result in the Bid being declared non-compliant and rejected. Submission of a Bid Form which is illegible or incomplete, or which contains modifications, erasures, changes, exceptions, additions, conditions, qualifications or uninitialled amendments, shall result in the Bid being declared non-compliant and rejected.
- .4 A bidder's failure to provide all requested information on the Appendices or to fill in all blank spaces may result in the Bid being rejected. Submission of an Appendix which is illegible or incomplete, or which contains modifications, erasures, changes, exceptions, additions, conditions, qualifications or uninitialled amendments, may result in the Bid being rejected.
- .5 Information provided by bidders on the Bid Form and on the Appendices may be amended prior to the Closing Date, provided corrections are initialled by an authorized representative of the bidder.
- .6 Bidders are not to submit any information or documents not specifically required by these Instructions to Bidders, and any such extraneous material will be not considered.

12.2 Prices.

- .1 Where the bid price or any other prices are provided in words and in numbers, the words shall govern in case of conflict or ambiguity between the words and numbers.
- .2 Where the Bid Form or Appendices require the bidder to provide a breakdown of the bid price, then, in the case of conflict or ambiguity between the bid price and the sum of the breakdown of the bid price, the bid price in the Bid Form shall govern over the sum of the breakdown of the bid price in the Appendices and shall be taken as the bidder's bid price.
- .3 Harmonized Sales Tax (HST) shall not be included in any prices submitted as part of a Bid. All other taxes shall be included.

12.3 Listing of Bidder Key Personnel and Subcontractors.

- .1 Where required by the Bid Documents, bidders shall indicate their Key Personnel for the project and submit a list of the Subcontractors and/or Suppliers proposed to perform or supply an item of the Work called for by the Contract by completing and submitting Appendix A – List of Bidder Key Personnel and Subcontractors. Failure to list Bidder Key Personnel where required, or the listing of more than one Key Person to perform in a position, may result in the Bid being rejected. Failure to reach mutual agreement on Key Personnel may result in the Bid being rejected. Failure to list Subcontractors and/or

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Suppliers where required, or the listing of more than one Subcontractor and/or Supplier to perform or supply an item of Work, may result in the Bid being rejected.

- .2 Where the Owner has pre-qualified one or more Subcontractors and/or Suppliers to perform or supply an item of the Work called for by the Contract, bidders shall select only a pre-qualified Subcontractor or Supplier to perform or supply that item of Work. Failure to do so may result in the Bid being rejected.
- .3 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.

- 12.4 Each Bid shall be irrevocable and shall remain open for acceptance by the Owner for the duration of the Irrevocability Period.

13. INSTRUCTIONS FOR SUBMITTING THE BID

- 13.1 Bidders shall submit two(2) envelopes as described below:

- .1 Envelope 1 - Submit one (1) completed original of:
 - .1 The Bid Form, together with the required bid bond and agreement to bond, in a sealed opaque envelope. Ensure that the outside of the envelope bears the bidder's return address, clearly labels the envelope as "BID PRICE" and includes a label clearly identifying the bidder, the Project, and the Project number. Submit the envelope to:

Reception Desk
Simcoe Muskoka Catholic District School Board
46 Alliance Boulevard,
Barrie, ON L4M 5K3

before 15:00:00 hours (3:00:00 p.m.) Local Time on the Closing Date. Upon receipt the envelope will be date and time stamped at the Reception Desk.
- .2 Envelope 2 - Submit one (1) completed original of:
 - .1 The Bid Form – Appendices in a sealed opaque envelope. Ensure that the outside of the envelope bears the bidder's return address, clearly labels the envelope as "BID PRICE - APPENDICES" and includes a label clearly identifying the bidder, the Project, and the Project number. Submit the envelope to:

Reception Desk
Simcoe Muskoka Catholic District School Board
46 Alliance Boulevard,
Barrie, ON L4M 5K3

before 16:00:00 hours (4:00:00 p.m.) Local Time on the Closing Date. Upon receipt the envelope will be date and time stamped at the Reception Desk.

- 13.2 In the event of a dispute over the time of submission, the time stamped by the Owner on the envelope shall govern.

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- 13.3 Bids submitted by any form of delivery other than as set out in this Article will not be accepted or considered. Bidders are solely responsible for the method and timing of delivery of their Bids.

14. BID OPENING

- 14.1 Only Bids received before the time stipulated in paragraph 13.1 will be opened and received for evaluation.

- 14.2 Bids are generally opened in public at the offices of the Owner following submission of Bids, however, the Owner reserves the right to open Bids in private.

15. ADDITIONAL INFORMATION

- 15.1 The Owner and/or Consultant may contact any one or more bidders to request additional information (collectively "**Additional Information**") including:

- .1 the submission of a trade by trade breakdown of the bid price;
- .2 the submission of a preliminary construction schedule showing Project milestones and critical schedule items; and/or
- .3 clarification or any other information,

without any obligation to contact any other bidder or bidders with the same or any requests for Additional Information. Requests for Additional Information shall not be construed as award of the Contract, acceptance of a Bid, or the rejection of a Bid.

- 15.2 Bidders shall respond to all requests for Additional Information within the time stipulated at the time of the request. Failure to do so may result in the Bid being rejected.

- 15.3 Information, prices, rates and documents submitted in response to a request for Additional Information shall form part of a bidder's Bid.

16. BID EVALUATION AND OWNER'S RIGHTS

- 16.1 The evaluation process will be conducted by the Consultant, who may obtain the assistance of the sub consultants and advisors as they may deem appropriate. However, and notwithstanding anything else contained in the Bid Documents, the award of the Contract, if any, may be subject to the approval of the Board, in its sole and unfettered discretion. Bidders shall have no claims whatsoever against the Owner or any member of the Board arising out of the Board's exercise of its authority, particularly in the event the Owner, in its sole and unfettered discretion, and for any or no reason, decides not to award the Contract.

- 16.2 Without limiting the generality of paragraph 16.6, Bids will be evaluated as follows:

- .1 Bids will first be evaluated based on the mandatory requirements set out in paragraph 16.3
- .2 Bids which comply with all of the mandatory requirements will be evaluated as described in paragraph 16.4 and considered for an award of the Contract.

- 16.3 Mandatory Requirements. Only bidders that submit Bids which the Consultant determines meet all of the mandatory requirements set out below on a "pass/fail" basis will be eligible to be considered for an award of the Contract:

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- .1 The Bid is complete and includes the Bid Form, the required Bid Bond and the Agreement to Bond.
 - .2 Bidder is pre-qualified.
 - .3 Subcontractors as per Article 7 are pre-qualified.
 - .4 Bidder attended the mandatory pre-bid meeting and signed the "Site Meeting Log".
- 16.4 Bids which meet all of the mandatory requirements will be evaluated by bid price.
- 16.5 Where there is a tie between two or more Bids and the Owner intends to award the Contract to one of the tied bidders, the tie will be broken using the submission date and time of the "BID PRICE" envelope based on the order in which the submissions were received.
- 16.6 The Owner may, in its sole discretion, and for any or no reason, reject the Bid with the lowest bid price, accept or reject the whole or any part of any Bid, reject all Bids, or cancel this bid process in whole or in part, and may then re-bid all or any part of the Work.
- 16.7 If only one Bid is received on time the Owner may:
- .1 take any action in accordance with paragraph 16.6; or
 - .2 notify the bidder that it is the only bidder and, upon being so advised, the bidder may:
 - (i) request the Owner to return its Bid unopened and the Owner agrees to do so; or
 - (ii) authorize the Owner, in writing, to open the Bid but, in such case, the bidder specifically agrees that the Owner is not required to award the Contract and may reject the Bid even if it meets all of the mandatory requirements set out in paragraph 16.3.
- 16.8 If all of the Bids fail at least one of the mandatory requirements set out in paragraph 16.3 the Owner, in its discretion, may:
- .1 evaluate one or more of the Bids using the criteria set out in paragraph 16.4 and may award a contract for the whole or any part of the Work to the bidder with the lowest Bid Price; and/or
 - .2 negotiate a contract for the whole or any part of the Work with any bidder.
- 17. AWARD OF THE CONTRACT, DOCUMENTS TO BE DELIVERED, AND EXECUTION OF THE CONTRACT**
- 17.1 If the Owner decides to award the Contract to a bidder, it will issue an award letter to the successful bidder.
- 17.2 Within five (5) 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;
 - .2 certified true copies of the insurance policies required by the Contract or certificates of insurance, at the option of the Owner; and
 - .3 a current WSIB clearance certificate.

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- 17.3 The successful bidder shall execute the Contract and shall deliver the executed original to the Owner within five (5) Working Days of receipt of the same.

18. BIDDER DEBRIEFING

- 18.1 If requested in writing to the Consultant and/or the Owner by an unsuccessful bidder, representative(s) of the Consultant and/or the Owner agree to meet with the interested party within sixty(60) days of award notice.

19. DISPUTES

- 19.1 In the event of a dispute arising in connection with this bid process including, without limitation, a dispute concerning the existence of the Bid Contract or a breach of the Bid Contract, or a dispute as to whether the Bid of any bidder was submitted on time or whether a Bid is compliant, the parties to the dispute agree:

- .1 to use their best efforts to resolve the dispute through amicable and good faith negotiations for a period of at least ten (10) days, having such written and oral communications and meetings as appropriate;
- .2 if a dispute is not resolved through negotiations any party may, at any time prior to the dispute being referred to arbitration in accordance with paragraph 19.1.3, request that a mediator be retained to assist in resolving the dispute. In the event a request for mediation is made, the parties shall, within five (5) business days, make reasonable attempts to agree on a mediator and shall mediate the dispute;
- .3 if the dispute is not resolved within thirty (30) days of a request for the appointment of a mediator, the Owner, in its unqualified subjective discretion, may refer the dispute to confidential binding arbitration before a single arbitrator with knowledge of procurement/bidding law and practice at Toronto, Ontario pursuant to the *Arbitration Act, 1991* (Ontario), as amended. In the event that the Owner refers the dispute to arbitration, each bidder agrees that it is bound to arbitrate such dispute with the Owner. Unless the Owner shall refer such dispute to arbitration, there shall be no arbitration of such dispute.

- 19.2 The Owner may give notice of a dispute to one or more or all of the bidders, each of whom shall be a party to and shall be entitled to participate in the negotiation, mediation and/or arbitration, as the case may be and, in the case of arbitration, each of whom shall be bound by the arbitrator's award, whether or not they participated in the arbitration.

- 19.3 In the event the Owner refers a dispute to arbitration, the parties to the arbitration shall exchange brief statements of their respective positions on the dispute, together with the relevant documents, and submit to an arbitration hearing which shall last no longer than two days, subject to the discretion of the arbitrator to increase such time. The parties further agree that there shall be no appeal from the arbitrator's award.

- 19.4 This Article is not intended to form part of any "bid contract" that may come into being between a bidder and any prospective Subcontractor or Supplier of that bidder.

20. LIMIT OF LIABILITY

- 20.1 The liability of a bidder to the Owner for loss and damage arising out of the bidder's breach of the Bid Contract shall be limited to the lesser of the actual loss suffered by the Owner and the amount of the bid bond to be submitted as part of the Bid.

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20.2 The liability of the Owner to any bidder for loss and damage arising in tort or for the breach by the Owner of the Bid Contract shall be limited to the reasonable cost to the bidder of preparing its Bid.

21. COMPLIANCE WITH OWNER POLICIES AND THE EDUCATION ACT, AND PROHIBITION ON LOBBYING

21.1 Bidders are instructed to familiarize themselves with Owner policies and procedures related to purchasing. Bidders may view the Owner's purchasing policy at: <http://www.smcdsb.on.ca>. By submitting a Bid each bidder represents that it has complied with the Owner's policies and procedures.

21.2 Bidders are instructed to familiarize themselves with section 217 of the *Education Act*, as amended, respecting the employment of employees of the Ministry of Education or the Owner in connection with this bid process. By submitting a Bid each bidder represents that it has complied with section 217 of the *Education Act*, as amended.

21.3 Bidders and/or any representatives employed or retained by them are strictly prohibited: (1) from communicating with any members of the Board and any employees of the Owner in relation to this bid process, and (2) 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. Failure of any bidder to comply with this paragraph may result in the disqualification of the bidder and the rejection of its Bid.

22. PUBLIC STATEMENTS, CONFIDENTIALITY, AND MFIPPA

22.1 Bidders shall not publish, issue or make any statements or news release, electronic or otherwise, concerning their or any other Bid, the bid process, the evaluation of the Bids, the award of the Contract, or cancellation of the 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.

22.2 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.

22.3 By submitting a Bid, bidders acknowledge that the contents of their Bids will be disclosed, on a confidential basis, to the Board and the Owner's staff, agents and advisors. The Owner will use reasonable efforts to protect pricing, commercial terms, and other sensitive and confidential information provided by the bidders (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 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.

22.4 Information provided in the Bids may be presented at public meetings of the Simcoe Muskoka Catholic District School Board and may be divulged 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 Owner and the Consultant from any liability for the same.



**GEOTECHNICAL INVESTIGATION
PROPOSED ADDITION
ST. PAUL'S CATHOLIC ELEMENTARY SCHOOL
100 JAMES A. McCAGUE AVENUE
ALLISTON, ONTARIO
FOR
SIMCOE MUSKOKA CATHOLIC DISTRICT SCHOOL BOARD**

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PML Ref.: 17BF054
Report: 1
November 2017

November 14, 2017

PML Ref.: 17BF054
Report: 1

Mr. Allen Morrison
Simcoe Muskoka Catholic District School Board
46 Alliance Boulevard
Barrie, Ontario
L4M 5K3

Dear Mr. Morrison

**Geotechnical Investigation
Proposed Addition
St. Paul's Catholic Elementary School
100 James A. McCague Avenue
Alliston, Ontario**

We are pleased to present the results of the geotechnical investigation recently completed for the addition proposed at the above referred site. Authorization for this assignment is provided in Purchase Order No. 72467, dated October 11, 2017.

An addition with new asphalt apron is planned to the west end of the existing school building as shown on the appended drawing. The addition will be single storey, approximately 20 by 25 m in plan, with finished floor level matching the existing at elevation 223.85.

The purpose of the investigation was to determine the subsurface conditions in the area of the proposed addition, and based on this information, provide comments and geotechnical engineering recommendations pertinent to the design and construction of the proposed addition. Geoenvironmental assessment was also carried out and chemical testing results will be reported under separate cover, when we receive the results.

The comments and recommendations provided in this report are applicable only to the proposed works as addressed in the report. Any changes in proposed plan will require review by Peto MacCallum Ltd. (PML) to assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.



BACKGROUND

The existing school facility was constructed in 2009. Prior to construction, PML completed a geotechnical investigation, PML Ref.: 09BF005, Report 1 Revised, dated April 13, 2017, comprising 44 boreholes distributed over the entire property. The boreholes essentially revealed old fill (1.4 to 2.9 m thick), over native sand and silt deposits. The old fill was removed and site excavated soils were used to construct engineered fill under the building and all paved areas.

PML carried out geotechnical field reviews and testing during the site development in 2009, PML Ref.: 09BM086, which included inspection of old fill removal, subgrade approval and engineered fill placement. Compaction standard of 100% Standard Proctor maximum dry density (SPMDD) under the building, and 95% SPMDD elsewhere, were achieved.

The proposed addition is located mostly within the presently paved area to the south of the school. The northwest portion of the proposed addition and new asphalt apron are located in the existing playing field.

INVESTIGATION PROCEDURES

The field work for this investigation consisted of Boreholes 1 to 4 drilled to 10.1 m depth on November 7 and 8, 2017. Borehole locations are shown on Drawing 1, appended.

Co-ordination of clearances of underground utilities was provided by PML.

The boreholes were advanced using continuous flight solid stem augers, powered by a rubber-tire D-90 drill rig supplied and operated by a specialist drilling contractor working under the full time supervision of a member of PML's engineering staff.

Representative samples of the overburden in the boreholes were recovered at frequent depth intervals for identification purposes using a conventional split spoon sampler. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the substrata. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as



the samples were retrieved, and measurement of water in the open boreholes upon completion, if any.

Boreholes were backfilled in accordance with O.Reg. 903. Boreholes through paved areas were capped with cold mix asphalt.

The locations of the boreholes were established in the field by PML based on a plan provided by the Client, and cognizant of underground utilities. Ground surface elevations of the boreholes were established relative to a Temporary Bench Mark (TBM 1), as shown on Drawing 1 and described as follows:

TBM: Top of Finished Floor of Existing School at West Entrance
 Elevation 223.85 (metric, geodetic)

All recovered soil samples were returned to our laboratory for moisture content determinations and detailed examination to confirm field classification.

SUBSURFACE CONDITIONS

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including soil classifications, inferred stratigraphy, Standard Penetration N values, ground water observations and the results of laboratory moisture content determinations.

Due to the soil sampling procedures and limited sample size, the depth demarcation on the borehole logs must be viewed as “transitional” zones between layers, and cannot be construed as exact geological boundaries between layers.

The stratigraphy revealed in the boreholes comprised pavement or topsoil, over fill, over a native sandy silt layer followed by a sand deposit, with a silty clay unit at depth.

Topsoil, 200 to 700 mm thick, was found at surface in Boreholes 1 and 2 located in the playing field. Boreholes 3 and 4 were drilled through the existing 520 to 600 mm thick pavement structure.



Below the topsoil or pavement structure, a 1.7 to 2.2 m thick layer of fill was encountered, which extended down to 2.4 to 2.7 m below existing grade. The fill consisted of silty sand with pockets of sandy silt. Standard Penetration N values ranged between 14 and 55, indicating compact to very dense relative density. The fill was moist with moisture contents mostly in the 8 to 12% range.

The fill was penetrated at 2.4 to 2.7 m depth, revealing an underlying sandy silt unit. This unit was 1.3 to 1.6 m thick, extending down to a depth of about 4.0 m. The unit was compact to dense, and moist (typical moisture contents of 15 to 20%).

A sand deposit was encountered under the sandy silt unit at 4.0 m depth, extending down to 8.5 to 9.7 m below grade. The sand was loose to dense and wet (moisture contents of 15 to 22%).

Below the sand deposit, a stiff hard layer of silty clay was contacted to the full depth of the boreholes.

Ground water was first observed during drilling (first water strike) at 4.0 to 4.3 m depth. Upon completion of drilling, water was noted near 3.7 to 4.6 m depth in three of the four boreholes. These observations, in conjunction with the moisture content profile, suggest the ground water table is in the underlying sand deposit at around 4.0 m depth. The ground water table is subject to seasonal fluctuations and rainfall trends.



GEOTECHNICAL ENGINEERING CONSIDERATIONS

Footings

The boreholes have found silty sand fill overlying native sandy silt and sand deposits. The fill was compact to very dense based on Standard Penetration N values, which is consistent with the engineered fill placed under the existing building and paved areas during the original construction of the facility in 2009.

The proposed addition floor will match the existing building floor at elevation 223.85. Exterior footings would be founded at about elevation 222.4 with interior footings at about elevation 223.3.

It is considered that the proposed addition can be supported on strip and spread footings found on the existing engineered fill, where a bearing capacity at Serviceability Limit State (SLS) of 100 kPa, and factored bearing capacity at Ultimate Limit State (ULS) of 150 kPa are recommended for design. Settlement should not exceed 25 mm with differential settlement of 75% of this value.

It is noted that the northwest portion of the proposed addition extends beyond the existing pavement and may extend beyond the limits of the engineered fill constructed in 2009. In this regard, geotechnical review during construction is necessary to approve the founding subgrade and/or to identify unsuitable conditions that may warrant a reduced bearing capacity or remediation by sub-excavation and replacement with engineered fill.

New footings butting existing footings shall be founded at the same level.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent.

A perimeter foundation drain system shall be installed comprising weeping tiles surrounded by clear stone and fully wrapped in filter cloth, leading to a frost free outlet. Backfill shall be free draining granular, capped with an impervious clay layer of pavement.



Based on the soil profile revealed in the boreholes, Site Classification D is applicable for Seismic Site Responses as set out in Table 4.1.8.4.A Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site, there is a low potential for liquefaction.

Floor Slab-on-Grade

Floor slab-on-grade would be feasible in existing paved areas, underlain by existing granulars and engineered fill from the 2009 construction.

Subgrade preparation should include stripping of topsoil. Following rough grading, the exposed subgrade shall be proofrolled under supervision by PML. Any unsuitable soil identified during this process shall be removed and replaced with engineered fill comprising select soil compacted to minimum 95% SPMDD, subject to approval by the geotechnical engineer. Any fill needed to raise the grade under the floor should also be constructed as engineered fill. The engineered fill should consist of select inorganic site soil at a moisture content suitable for compaction, or imported Select Subgrade Material (SSM) or Granular B Type I.

A minimum 200 mm thick base layer of crushed stone (nominal 20 mm size) is recommended as a moisture barrier directly beneath the floor slab. Where a vapour sensitive floor finish is to be used then the use of polyethylene sheeting or similar means should be incorporated as a vapour barrier. An underfloor drainage system is not considered necessary.

The floor slab should be nominally reinforced to minimize the effects of potential differential settlement.

Exterior grades should be established to promote surface drainage away from the building.

Pavement Design and Construction

The new asphalt apron and play area are located in the existing green field. Following removal of topsoil and rough grading, the exposed subgrade shall be proofrolled to minimum 95% Standard Proctor maximum dry density, under geotechnical review by PML. Unsuitable/unstable zones identified during this process should be removed and replaced with compacted select material.



The following is recommended for light duty asphalt areas:

Asphalt Concrete	90 mm
Granular A Base	150 mm
Granular B Base	300 mm

Imported material for the granular base and subbase should conform to OPSS gradation specification for Granular A and Granular B, and should be compacted to 100% SPMDD. Asphaltic concrete should be compacted in accordance with OPSS 310.

For the pavement to function properly, it is essential that provisions be made for water to drain out of it and not collect in the base material. Crowning of the subgrade and final surface to promote drainage away from the structure is recommended.

Excavation and Ground Water Control

Excavation shall be carried out in accordance with Type 3 Soil requirements of the Ontario Health and Safety Act, requiring side slopes to be inclined at no steeper than 1H:1V from the base of the excavation.

Seepage, if encountered, should be relatively minor and manageable by conventional sump pumping.

Geotechnical Review and Construction Inspection and Testing

It is recommended that the grading and foundation drawings be submitted for review by PML to ensure that the recommendations contained in this report are applicable, and are properly interpreted and implemented.

Earthworks operations shall be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures and verify specified compaction standards are achieved throughout. Prior to placement of structural concrete for footings, the founding surface must be inspected to verify the design bearing capacity is available.



CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.



Geoffrey R. White, P.Eng.
Associate
Manager, Geotechnical and Geoenvironmental Services



Turney Lee-Bun, P.Eng.
Vice President

GRW/TLB:tc

Enclosure(s):
List of Abbreviations
Log of Borehole Nos. 1 to 4
Drawing 1 – Borehole Location Plan

LIST OF ABBREVIATIONS



PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

<u>CONSISTENCY</u>	<u>N (blows/0.3 m)</u>	<u>c (kPa)</u>	<u>DENSENESS</u>	<u>N (blows/0.3 m)</u>
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		
WTPL	Wetter Than Plastic Limit			
APL	About Plastic Limit			
DTPL	Drier Than Plastic Limit			

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core
	PH	Sample Advanced Hydraulically	
	PM	Sample Advanced Manually	

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

LOG OF BOREHOLE NO. 1

17T 590359E 4890748N

1 of 1

PROJECT Proposed Addition - St. Paul's Catholic Elementary School

LOCATION 100 James A. McCague Avenue, Alliston, Ontario

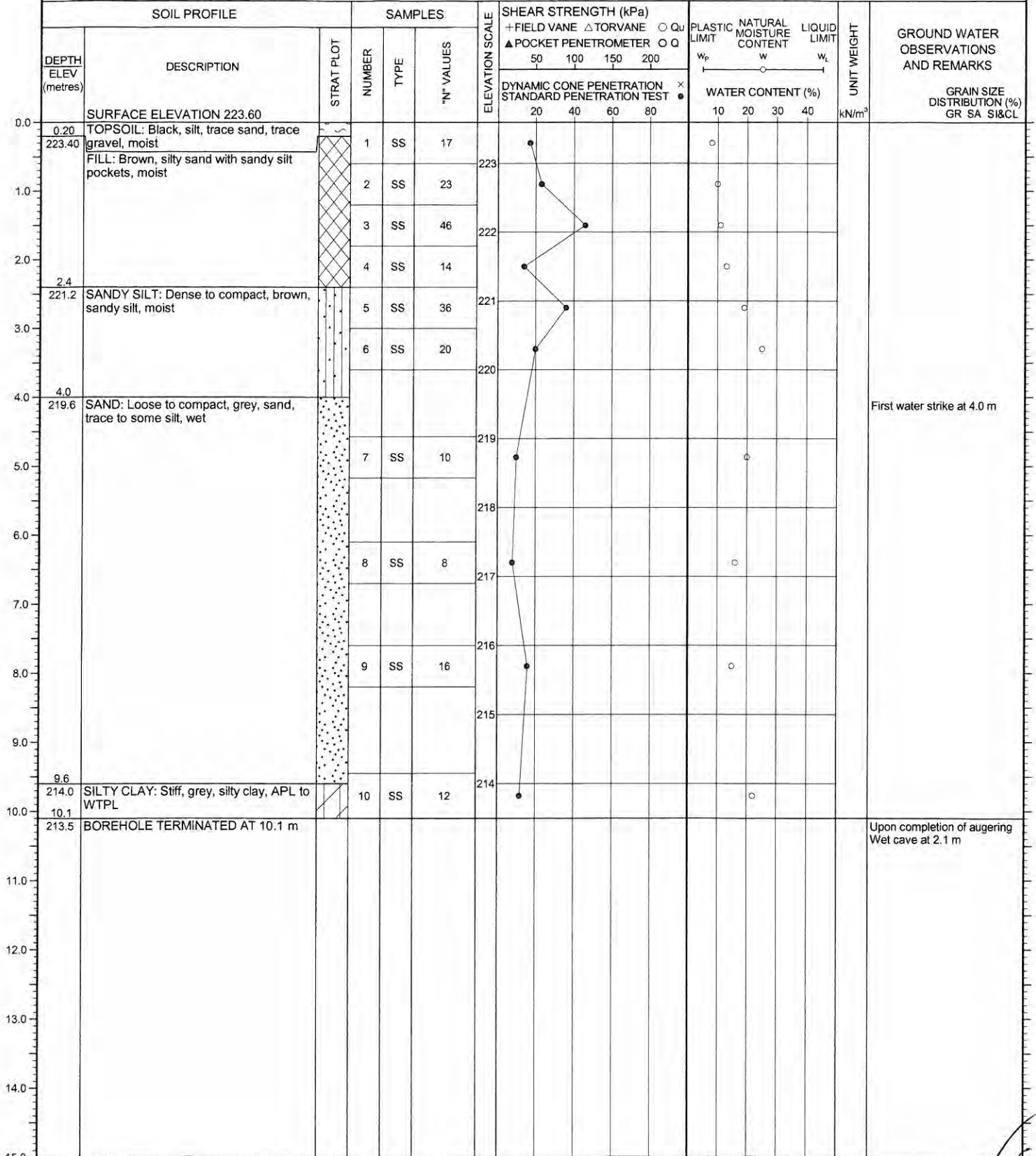
BORING METHOD Continuous Flight Solid Stem Augers

PML REF. 17BF054

BORING DATE November 7, 2017

ENGINEER GW

TECHNICIAN AT



NOTES

LOG OF BOREHOLE NO. 2

17T 590373E 4890713N

1 of 1

PROJECT Proposed Addition - St. Paul's Catholic Elementary School

LOCATION 100 James A. McCague Avenue, Alliston, Ontario

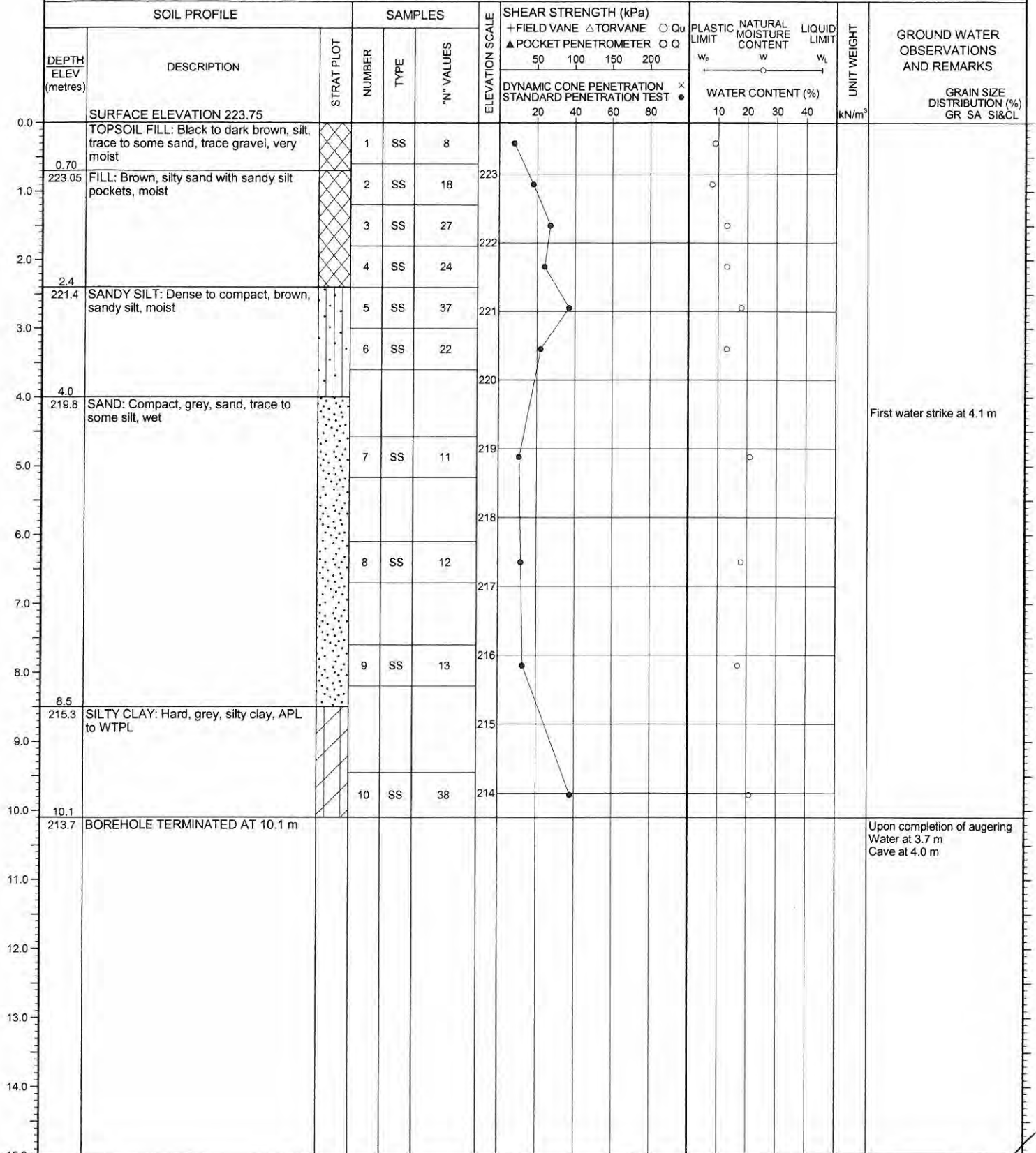
BORING METHOD Continuous Flight Solid Stem Augers

PML REF. 17BF054

BORING DATE November 7, 2017

ENGINEER GW

TECHNICIAN AT



NOTES

LOG OF BOREHOLE NO. 3

1 of 1

17T 590394E 4890728N

PROJECT Proposed Addition - St. Paul's Catholic Elementary School

PML REF. 17BF054

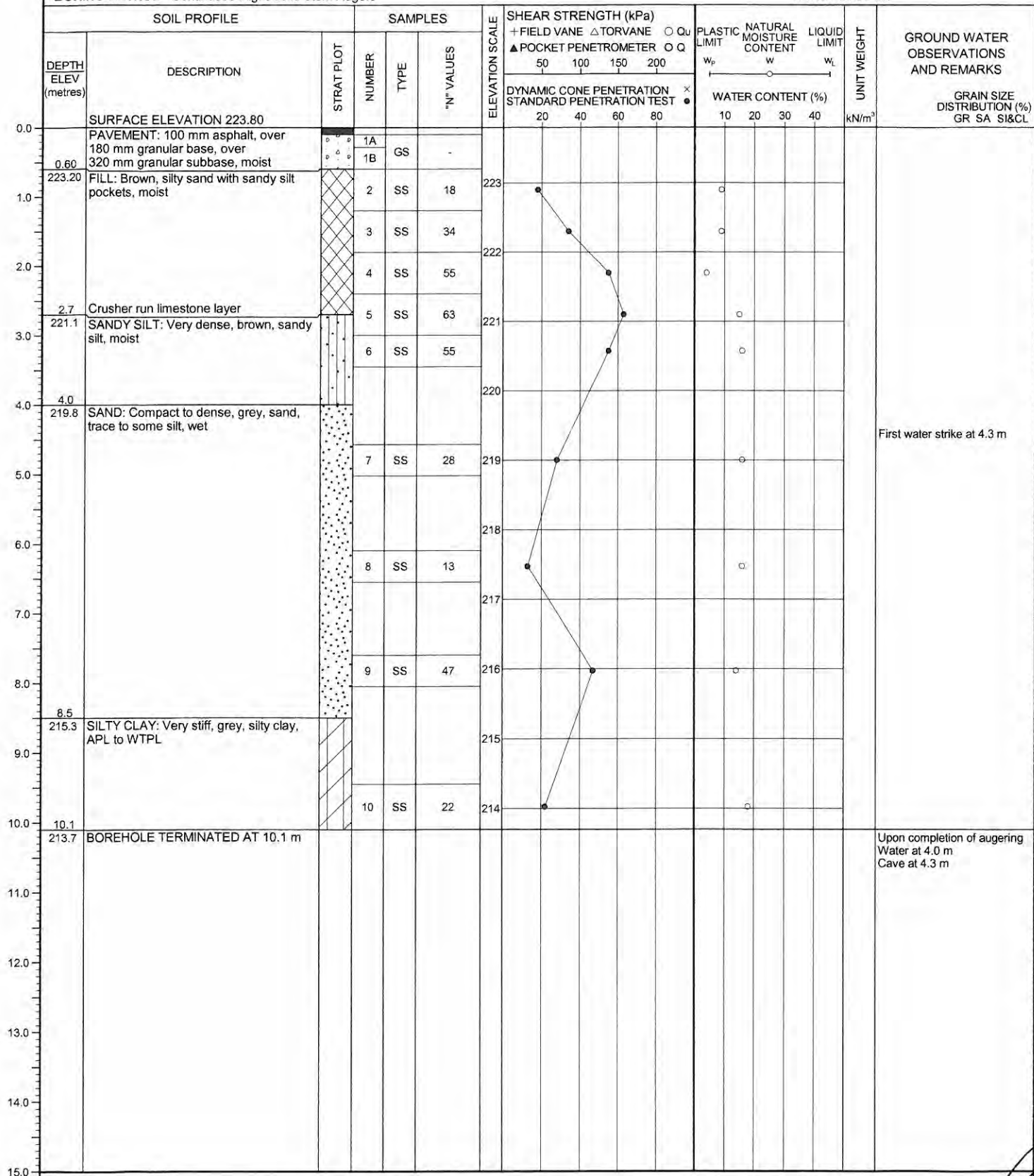
LOCATION 100 James A. McCague Avenue, Alliston, Ontario

BORING DATE November 8, 2017

ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN AT



NOTES

LOG OF BOREHOLE NO. 4

1 of 1

17T 590373E 4890712N

PROJECT Proposed Addition - St. Paul's Catholic Elementary School

PML REF. 17BF054

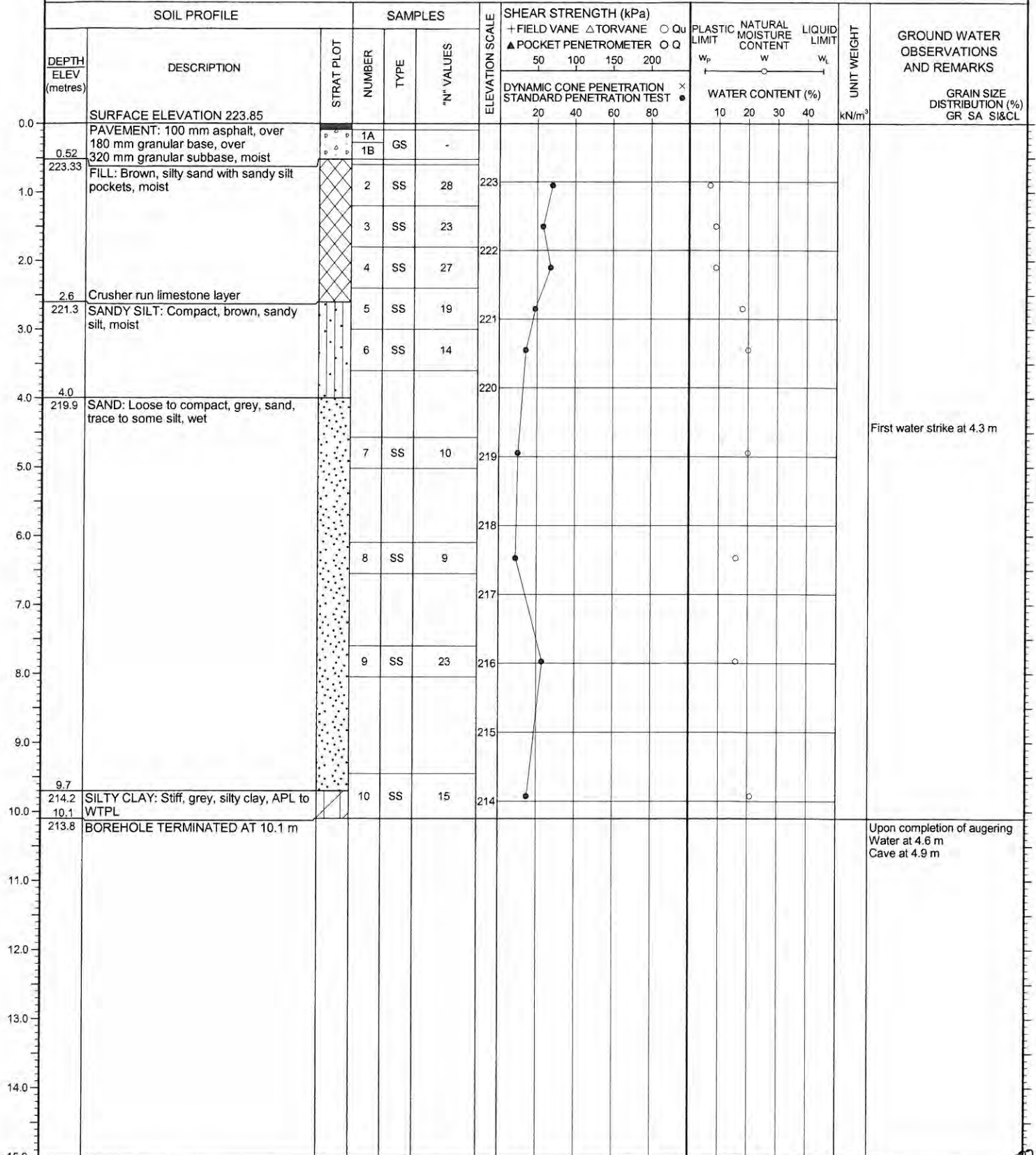
LOCATION 100 James A. McCague Avenue, Alliston, Ontario

BORING DATE November 8, 2017

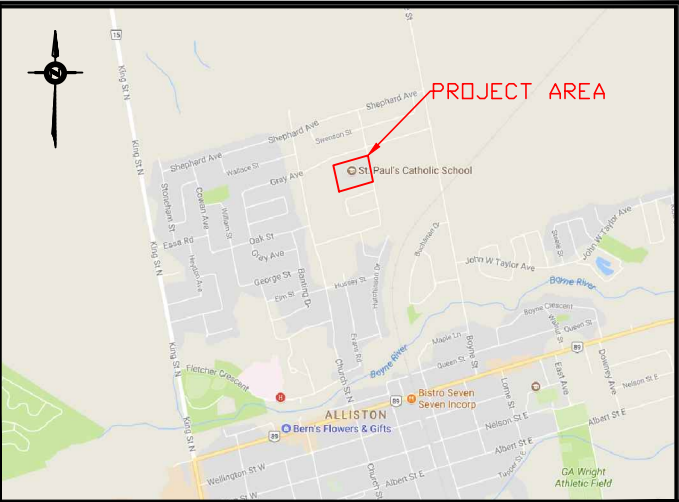
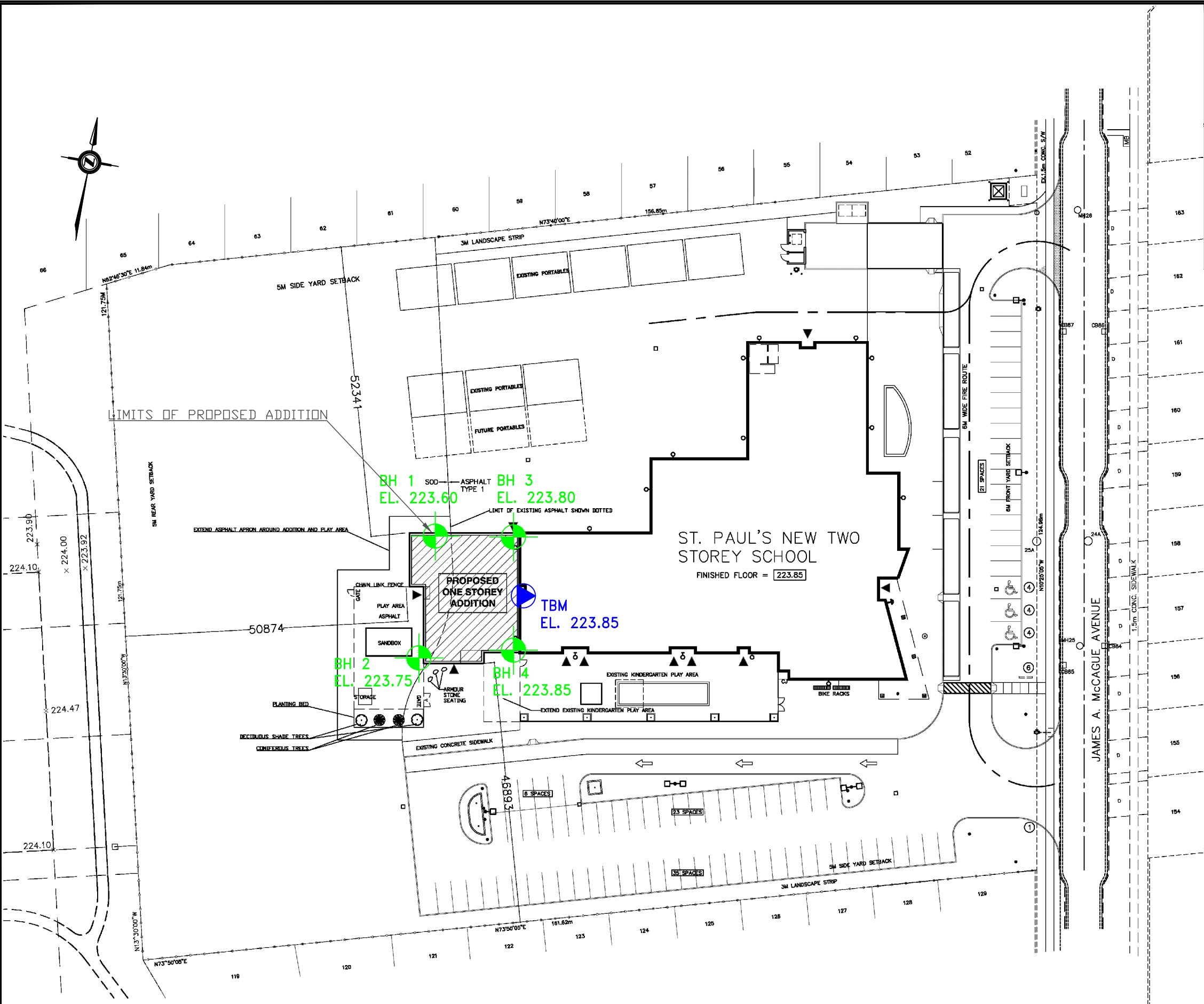
ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN AT



NOTES



KEY PLAN
ORILLIA, ONTARIO

- LEGEND:
- BH 1 BOREHOLE 1
EL. 223.60 SURFACE ELEVATION
 - TBM TEMPORARY BENCHMARK (TBM)
EL. 223.85 TOP OF FINISHED FLOOR OF
EXISTING SCHOOL AT WEST ENTRANCE
ELEVATION 223.85 (METRIC, GEODETIC)

REFERENCE:
BASE PLAN PROVIDED BY CLIENT.
KEY PLAN PRODUCED USING GOOGLE MAPS,
NOVEMBER, 2017.



BOREHOLE LOCATION PLAN

PROPOSED ADDITION
ST. PAUL'S CATHOLIC ELEMENTARY SCHOOL
ALLISTON, ONTARIO



DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GW	NOV. 2017	AS SHOWN	17BF054	1
APPROVED	GW				

PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY

Simcoe Muskoka Catholic District School Board
Childcare Addition Project
St. Paul's Catholic School
100 James A. McCague Avenue, Alliston, Ontario

November 13, 2017

702786-000

PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY –
SMCDSB CHILDCARE ADDITION PROJECT, ST. PAUL'S CATHOLIC SCHOOL, ALLISTON



Kelly Smith, B.Sc.

Senior Project Manager

Hazardous Materials and Industrial Hygiene Group

**PROJECT-SPECIFIC
DESIGNATED
SUBSTANCES AND
HAZARDOUS
MATERIALS SURVEY**

SMCDSB Childcare Addition Project
St. Paul's Catholic School

Prepared for:

Mr. Craig Elliot, M.A.A.T.O

Capital Project Manager

Simcoe Muskoka Catholic District School
Board

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Fax 905 882 8962

Our Ref.:

702786-000

Date:

November 13, 2017

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EXECUTIVE SUMMARY

Arcadis Canada Inc. (Arcadis) was retained by the Simcoe Muskoka Catholic District School Board (Board) to conduct a project-specific designated substances and hazardous materials survey in designated study areas of St. Paul's Catholic School, located at 100 James A. McCague Avenue in Alliston, Ontario

It is our understanding that the designated substances and hazardous materials survey is required to ensure that all materials of concern are handled in accordance with applicable regulatory requirements prior to the proposed Childcare Addition Project. The extent of the designated study areas is based on information provided by the Board. The survey was therefore limited to only the materials that may be affected by the proposed Childcare Addition Project.

It is also our understanding that the corridor ceiling space may also be affected by the proposed Childcare Addition Project to allow for the installation and tie-ins of mechanical and electrical services, therefore this area was also included as part of the designated study areas.

No asbestos-containing materials were found to be present that may be impacted by the proposed Childcare Addition Project.

Lead was not detected (i.e., less than the limit of detection of 90 mg/kg) in the sample of beige wall paint collected in the designated study areas.

Lead may be present in lead pipe, in the solder on the seals of bell joints of any cast iron drainpipe.

The Ministry of Labour *Guideline – Lead on Construction Projects*, dated April 2011, provides guidance in the measures and procedures that should be followed when handling lead containing materials during construction projects.

In addition, the *EACO Lead Abatement Guidelines, 2014 — Edition 1*, Environmental Abatement Council of Ontario, also provides guidance and recommended work practices.

Materials observed in the designated study areas which should be considered to contain silica included drywall wall, drywall joint compound, ceiling tiles, ceramic tile grout, mortar beds associated with ceramic tiles, concrete, mortar and cement block walls.

The Ministry of Labour *Guideline, Silica on Construction Projects*, dated April 2011, provides guidance in controlling exposure to silica dust during construction activities.

Fluorescent lights were observed throughout the buildings during the course of our site inspections. Light ballasts, such as those associated with the T8 type of fluorescent lights observed in the buildings, are usually an electronic-type which do not contain PCBs, however, this should be confirmed by an electrician at the time of dismantling of the lights.

PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY –
SMCDSB CHILDCARE ADDITION PROJECT, ST. PAUL'S CATHOLIC SCHOOL, ALLISTON

During the course of our site investigation, fluorescent lights were identified in the designated study areas. Mercury should be assumed to be present as a gas in all fluorescent light tubes.

No other designated substances (vinyl chloride, acrylonitrile, benzene, isocyanates, arsenic ethylene oxide and coke oven emissions) or hazardous materials (ODS, PCBs, mould,) were observed to be present in the designated study areas in a form that would represent an exposure concern.

1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by the Simcoe Muskoka Catholic District School Board (Board) to conduct a project-specific designated substances and hazardous materials survey in designated study areas of St. Paul's Catholic School, located at 100 James A. McCague Avenue in Alliston, Ontario

The information in this report is to be provided to all bidders on a project in accordance with the requirements of the *Occupational Health and Safety Act*.

It is our understanding that the designated substances and hazardous materials survey is required to ensure that all materials of concern are handled in accordance with applicable regulatory requirements prior to the proposed Childcare Addition Project. The extent of the designated study areas is based on information provided by the Board. The survey was therefore limited to only the materials that may be affected by the proposed Childcare Addition Project.

It is also our understanding that the corridor ceiling space may also be affected by the proposed Childcare Addition Project to allow for the installation and tie-ins of mechanical and electrical services, therefore this area was also included as part of the designated study areas.

Floor plans provided by the Board of the proposed Childcare Addition Project are provided in Appendix A.

The survey was undertaken to report on the presence or suspected presence of readily observable designated substances and hazardous materials.

1.1 Scope of Work

The scope of work for our investigation included:

- investigation for the presence of designated substances and hazardous materials used in building construction materials;
- obtaining representative bulk samples of materials suspected of containing asbestos, and one paint chip sample suspected of containing lead;
- laboratory analyses of bulk samples for asbestos content;
- laboratory analysis of paint chip samples for lead content; and
- preparation of a report outlining the findings of the investigation.

Mr. Dwyane Kellyman of Arcadis visited the site on November 1, 2017 to conduct the designated substances and hazardous materials survey.

2 REGULATORY DISCUSSION AND METHODOLOGY

Occupational Health and Safety Act (OHSA)

The *Occupational Health and Safety Act* (OHSA) sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include, but are not limited to:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)];
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)];
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)]; and
- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

In addition, Section 30 of the OHSA deals with the presence of designated substances on construction projects. Compliance with the OHSA and its regulations requires action to be taken where there is a designated substance hazard on a construction project.

Section 30 of the OHSA requires the owner of a project to determine if designated substances are present on a project and, if so, to inform all potential contractors as part of the bidding process. Contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project.

Regulation for Construction Projects, O.Reg. 213/91

The *Regulation for Construction Projects*, O.Reg. 213/91, applies to all construction projects. The following sections of the regulation would apply to situations where there is the potential for workers to be exposed to designated substances:

- | | | |
|------------|-----|---|
| Section 14 | (5) | A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project. |
| Section 21 | (1) | A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed. |
| | (2) | A worker's employer shall require the worker to comply with subsection (1). |

PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY –
SMCDSB CHILDCARE ADDITION PROJECT, ST. PAUL'S CATHOLIC SCHOOL, ALLISTON

- (3) A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.
- Section 30 Workers who handle or use substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.
- Section 46 (1) A project shall be adequately ventilated by natural or mechanical means,
- (a) if a worker may be injured by inhaling a noxious...dust or fume;
- (2) If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.
- Section 59 If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

Regulation for Designated Substances (O.Reg. 490/09)

The *Designated Substance Regulation* (O.Reg. 490/09) specifies occupational exposure limits (OELs) for designated substances and requires an assessment and a control program to ensure compliance with these OELs.

Although, O.Reg. 490/09 and the OELs do not apply to an employer on a construction project, or to their workers at the project, employers still have a responsibility to protect the health of their workers and to comply with the OHSA and other applicable regulations. Section 25(2)(h) of the OHSA requires that employers take "every precaution reasonable in the circumstances for the protection of a worker".

Other regulatory requirements (and guidelines) which apply to control of exposure to designated substances and hazardous materials are referenced in the sections below.

2.1 Asbestos

Asbestos has been widely used in buildings, both in friable applications (materials which can be crumbled, pulverized or powdered by hand pressure, when dry) such as pipe and tank insulation, sprayed-on fireproofing and acoustic texture material and in non-friable manufactured products such as floor tile, gaskets, cement board and so on. The use of asbestos in friable applications was curtailed around the mid-1970s and, as such, most buildings constructed prior to about 1975 contain some form of friable construction material with an asbestos content. The use of asbestos in certain non-friable materials continued beyond the mid-1970s.

Control of exposure to asbestos is governed in Ontario by Regulation 278/05 – *Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations*. Disposal of asbestos waste (friable and non-friable materials) is governed by Ontario Regulation 278/05 and by Ontario Regulation 347, *Waste Management – General*. O.Reg. 278/05 classifies asbestos work operations into three types (Type 1, 2 and 3), as shown in Table C-1 in Appendix C, and specifies procedures to be followed in conducting asbestos abatement work.

2.2 Lead

Lead is a heavy metal that can be found in construction materials such as paints, coatings, mortar, concrete, pipes, solder, packings, sheet metal, caulking, glazed ceramic products and cable splices. Lead has been used historically in exterior and interior paints.

The *Surface Coating Materials Regulations* made under the *Hazardous Products Act* (SOR/2005-109) sets a maximum concentration of total lead of 90 mg/kg (0.009 percent or 90 parts per million) for surface coating materials, including paints, effective 21 October 2010. This criterion level applies to the sale and importation of new surface coating materials.

The *National Plumbing Code* allowed lead as an acceptable material for pipes until 1975 and in solder until 1986.

The Ministry of Labour *Guideline, Lead on Construction Projects*, dated April 2011, provides guidance in the measures and procedures that should be followed when handling lead containing materials during construction projects. In the guideline, lead-containing construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of lead, as shown in Appendix B, Table C-2. Any operation that may expose a worker to lead that is not a Type 1, Type 2, or Type 3b operation, is classified as a Type 3a operation.

2.3 Mercury

Mercury has been used in electrical equipment such as alkaline batteries, fluorescent light bulbs (lamps), high intensity discharge (HID) lights (mercury vapour, high pressure sodium and metal halide), “silent switches” and in instruments such as thermometers, manometers and barometers, pressure gauges, float and level switches and flow meters. Mercury-containing lamps, the bulk of which are 1.22 m (four foot) fluorescent lamps contain between 7 and 40 mg of mercury each. Mercury compounds have also been used historically as additives in latex paint to protect the paint from mildew and bacteria during production and storage.

Intentional addition of mercury to Canadian-produced consumer paints for interior use was prohibited in 1991. Mercury may have remained in paints after 1991, however, as a result of impurities in the paint ingredients or cross-contamination due to other manufacturing processes. The *Surface Coating Materials*

Regulations made under the *Hazardous Products Act* set a maximum total mercury concentration of 10 mg/kg (0.001 percent) for surface coating materials (including paint). This criterion level applies to the sale and importation of new surface coating materials.

Mercury-containing thermostats and silent light switches are mercury tilt switches which are small tubes with electrical contacts at one end of the tube. A mercury tilt switch is usually present when no switch is visible. Mercury switches often have the word “TOP” stamped on the upper end of the switch, which is visible after removing the cover plate. If mercury switches are to be removed, the entire switch should be removed and placed into a suitable container for storage and disposal.

Waste light tubes generated during renovations or building demolition and waste mercury from equipment must either be recycled or disposed of in accordance with the requirements of Ont. Reg. 347 - *Waste Management, General*.

Waste mercury in amounts less than 5 kg (per month) are exempt from the generator registration requirements prescribed by O.Reg. 347 – *Waste Management – General*. Waste mercury from mercury switches or gauges should, however, be properly collected and shipped to a recycling facility or disposed of as a hazardous waste. Removal of mercury-containing equipment (e.g., switches, gauges, controls, etc.) should be carried out in a manner which prevents spillage and exposure to workers.

2.4 Silica

Silica exists in several forms of which crystalline silica is of most concern with respect to potential worker exposures. Quartz is the most abundant type of crystalline silica. Some commonly used construction materials containing silica include brick, refractory brick, concrete, concrete block, cement, mortar, rock and stone, sand, fill dirt, topsoil and asphalt containing rock or stone.

The Ministry of Labour *Guideline, Silica on Construction Projects*, dated April 2011, provides guidance in controlling exposure to silica dust during construction activities. In the guideline, silica-containing construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of respirable crystalline silica in the form of cristobalite, tridymite, quartz and tripoli as shown in Appendix C, Table C-3.

2.5 Vinyl Chloride

Vinyl chloride vapours may be released from polyvinyl chloride (PVC) products in the event of heating or as a result of decomposition during fire. PVC is used in numerous materials that may be found in building construction, including, for example, piping, conduits, siding, window and door frames, plastics, garden hoses, flooring and wire and cable protection.

2.6 Acrylonitrile

Acrylonitrile is used to produce nitrile-butadiene rubber, acrylonitrile-butadiene-styrene (ABS) polymers and styrene-acrylonitrile (SAN) polymers. Products made with ABS resins which may be found in buildings include telephones, bottles, packaging, refrigerator door liners, plastic pipe, building panels and shower stalls. Acrylonitrile can be released into the air by combustion of products containing ABS.

2.7 Other Designated Substances

Isocyanates are a class of chemicals used in the manufacture of certain types of plastics, foams, coatings and other products. Isocyanate-based building construction materials may include rigid foam products such as foam-core panels and spray-on insulation and paints, coatings, sealants and adhesives. Isocyanates may be inhaled if they are present in the air in the form of a vapour, a mist or a dust.

Benzene is a clear, highly flammable liquid used mainly in the manufacture of other chemicals. The commercial use of benzene as a solvent has practically been eliminated, however it continues to be used as a solvent and reactant in laboratories.

Arsenic is a heavy metal used historically in pesticides and herbicides. The primary use in building construction materials was its use in the wood preservative chromated copper arsenate (CCA). CCA was used to pressure treat lumber since the 1940's. Pressure-treated wood containing CCA is no longer being produced for use in most residential settings.

Ethylene oxide is a colourless gas at room temperature. It has been used primarily for the manufacture of other chemicals, as a fumigant and fungicide and for sterilization of hospital equipment.

Coke oven emissions are airborne contaminants emitted from coke ovens and are not a potential hazard associated with building construction materials.

2.8 Polychlorinated Biphenyls (PCBs)

The management of equipment classified as waste and containing Polychlorinated Biphenyls (PCBs) at concentrations of 50 parts per million (mg/kg) or greater is regulated by Ontario Regulation 362, *Waste Management – PCBs*. Under this regulation, PCB waste is defined as any waste material containing PCBs in concentrations of 50 mg/kg or greater. Any equipment containing PCBs at or greater than this level, such as transformers, switchgear, light ballasts and capacitors, which is removed from service due to age, failure or as a result of decommissioning, is considered to constitute a PCB waste. Although current federal legislation (effective 1 July 1980) has prohibited the manufacture and sale of new equipment containing PCBs since that time, continued operation of equipment supplied prior to this date and containing PCBs is still permitted. Handling, storage and disposition of such equipment is, however,

PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY –
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tightly regulated and must be managed in accordance with provincial and federal government requirements as soon as it is taken out of service or becomes unserviceable.

In most institutional, commercial facilities and in smaller industrial facilities, the primary source of equipment potentially containing PCBs is fluorescent and High-Intensity Discharge (H.I.D.) light ballasts. Small transformers may also be present. In larger industrial facilities, larger transformers and switch gear containing, or potentially containing, PCBs may also be present.

PCBs were also commonly added to industrial paints from the 1940s to the late 1970s. PCBs were added directly to the paint mixture to act as a fungicide, to increase durability and flexibility, to improve resistance to fires and to increase moisture resistance. The use of PCBs in new products was banned in Canada in the 1970s. PCB amended paints were used in specialty industrial/institutional applications prior to the 1970s including government buildings and equipment such as industrial plants, radar sites, ships as well as non-government rail cars, ships, grain bins, automobiles and appliances.

Removal of in-service equipment containing PCBs, such as fluorescent light ballasts, capacitors and transformers, is subject to the requirements of the federal *PCB Regulations* (discussed below).

The *PCB Regulations*, which came into force on 5 September 2008, were made under the *Canadian Environmental Protection Act, 1999* (CEPA 1999) with the objective of addressing the risks posed by the use, storage and release to the environment of PCBs, and to accelerate their destruction. The *PCB Regulations* set different end-of-use deadlines for equipment containing PCBs at various concentration levels.

The Regulations Amending the PCB Regulations and Repealing the Federal Mobile PCB Treatment and Destruction Regulations were published on 23 April 2014, in the Canada Gazette, Part II, and came into force on 1 January 2015. The most notable part of the amendments is the addition of an end-of-use deadline date of 31 December 2025 for specific electrical equipment located at electrical generation, transmission and distribution facilities.

When the PCB materials are classified as waste, jurisdiction falls under the Ontario Ministry of the Environment and Climate Change (MOECC) and O.Reg. 362. All remedial and PCB management work must be carried out under the terms of a Director's Instruction issued by an MOECC District Office (for quantities of PCB fluid greater than 50 litres). The PCB waste stream, regardless of quantity, must be registered with the MOECC, in accordance with O.Reg. 347, *General - Waste Management*. O.Reg. 362 applies to any equipment containing greater than 1 kg of PCBs.

2.9 Ozone-Depleting Substances (ODS) and Other Halocarbons

Ontario Regulation 463/10 – *Ozone Depleting Substances and Other Halocarbons*, applies to the use, handling and disposal of Class 1 ozone-depleting substances, including various chlorofluorocarbons (CFCs), halons and other halocarbons, Class 2 ozone-depleting substances, including various hydrochlorofluorocarbons (HCFCs) and halocarbons, and other halocarbons, including fluorocarbons (FCs) and hydrofluorocarbons (CFCs). The most significant requirements for handling of Ozone-Depleting Substances (ODS) and other Halocarbons, which include, for example, refrigerants used in refrigeration equipment and chillers, include the following:

- certification is required for all persons testing, repairing, filling or emptying equipment containing ODS and other halocarbons;
- the discharge of a Class 1 ODS or anything that contains a Class 1 ODS to the natural environment or within a building is prohibited;
- the making, use of, selling of or transferring of a Class 1 ODS is restricted to certain conditions;
- the discharge of a solvent or sterilant that contains a Class 2 ODS is prohibited;
- the making, use of, selling of or transferring of a solvent or sterilant that contains a Class 2 ODS is restricted to certain conditions;
- fire extinguishing equipment that contains a halon may be discharged to fight fires, except fires for firefighting training purposes;
- portable fire extinguishing equipment that contains a halon may be used or stored if the extinguisher was sold for use for the first time before 1 January 1996;
- records of the servicing and repair of equipment containing ODS and other halocarbons must be prepared and maintained by the owner of the equipment; and
- equipment no longer containing ODS and other halocarbons must be posted with a notice completed by a certified person.

Ontario Regulation 347, *General – Waste Management*, has also been amended to provide for more strict control of CFCs. The requirements under the amended regulation apply primarily to the keeping of records for the receipt or recycling of CFC waste.

2.10 Mould

Moulds are forms of fungi that are found everywhere both indoors and outdoors all year round. Outdoors, moulds live in the soil, on plants and on dead and decaying matter. More than 1000 different kinds of indoor moulds have been found in buildings. Moulds spread and reproduce by making spores, which are all small and light-weight, able to travel through air, capable of resisting dry, adverse environmental conditions, and hence capable of surviving a long time. Moulds need moisture and nutrients to grow and their growth is stimulated by warm, damp and humid conditions.

Control of exposure to mould is required under Section 25(2)(h) of the Ontario *Occupational Health and Safety Act*, which states that employers shall take every precaution reasonable in the circumstances for the protection of workers. Recommended work practices are outlined in the following documents:

- *Mould Guidelines for the Canadian Construction Industry*. Standard Construction Document CCA 82 2004. Canadian Construction Association.
- *Mould Abatement Guidelines*. Environmental Abatement Council of Ontario. Edition 3. 2015.

3 RESULTS AND DISCUSSION

3.1 Asbestos

During the course of our site investigation, representative bulk samples of material were collected by Arcadis staff. The samples were forwarded to EMSL Canada Inc. for asbestos analyses. Results of bulk sample analysis for asbestos content are provided in Table 3.1. The laboratory report is provided in Appendix B.

Table 3.1. Summary of Results of Analyses of Bulk Samples for Asbestos Content

Sample No.	Sample Location	Sample Description	Asbestos Content
1A	Room 108	2'x4' Ceiling tile – pinhole random fissure	None Detected
1B	Corridor outside Room 108	2'x4' Ceiling tile – pinhole random fissure	None Detected
1C	Room 108	2'x4' Ceiling tile – pinhole random fissure	None Detected
2A	Stair 1 Vestibule	Caulking on door frame	None Detected (PLM) None Detected (TEM)
2B	Room 108	Caulking on window frame	None Detected
2C	Stair 1 Vestibule	Caulking on door frame	None Detected
3A	Stair 1 Vestibule	Concrete block mortar	None Detected
3B	Room 108	Concrete block mortar	None Detected
3C	Stair 1 Vestibule	Concrete block mortar	None Detected
4A	Stair 1 Vestibule	Drywall joint compound	None Detected
4B	Stair 1 Vestibule	Drywall joint compound	None Detected
4C	Stair 1 Vestibule	Drywall joint compound	None Detected
5A	Exterior	Exterior brick mortar	None Detected
5B	Exterior	Exterior brick mortar	None Detected
5C	Exterior	Exterior brick mortar	None Detected

Determination of the locations of asbestos-containing material was made based on the results of bulk sample analysis, visual observations and physical characteristics of the applications as well as our knowledge of the uses of asbestos in building materials.

Based on visual observations and results of laboratory analyses of samples collected by Arcadis Canada Inc., no asbestos-containing materials were found to be present in the designated study areas that may be impacted by the Proposed Childcare Addition Project.

Asbestos may be present in materials which were not sampled during the course of the asbestos survey carried out by Arcadis, including, but not limited to, areas outside the designated study areas.

PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY –
SMCDSB CHILDCARE ADDITION PROJECT, ST. PAUL'S CATHOLIC SCHOOL, ALLISTON

Confirmatory testing of any such materials could be undertaken as the need arises (i.e., at the time of renovations, modifications or demolition) or the materials can be assumed to contain asbestos based on findings in adjacent areas.

If any materials which may contain asbestos and which were not tested during the course of the designated substances and hazardous materials survey are discovered during any construction activities, the work shall not proceed until such time as the required notifications have been made and an appropriate course of action is determined.

3.2 Lead

During the course of our site investigation, one paint chip sample was collected by Arcadis staff. The sample was forwarded to EMSL Canada Inc. for lead analysis. Result of the bulk sample analysis for lead content is provided in Table 3.2. The laboratory report is provided in Appendix B.

The predominant paint that may be affected by the renovation project was collected.

Table 3.2. Summary of Result of Analysis of Paint Chip for Lead Content

Sample No.	Sample Location	Sample Description	Lead Content
P-1	Stair 1/Vestibule	Beige paint on concrete block	<90 mg/kg

NOTE:

< = less than.

mg/kg = milligrams lead per kilogram paint.

1 mg/kg - 1 part per million (ppm).

Lead was not detected (i.e., less than the limit of detection of 90 mg/kg) in the sample of beige paint collected in the designated study areas.

Lead may be present in lead pipe, in the solder on the seals of bell joints of any cast iron drainpipe.

The Ministry of Labour *Guideline – Lead on Construction Projects*, dated April 2011, provides guidance in the measures and procedures that should be followed when handling lead containing materials during construction projects. In the guideline, lead-containing construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of lead, as shown in Appendix C, Table C-2. Any operation that may expose a worker to lead that is not a Type 1, Type 2, or Type 3b operation, is classified as a Type 3a operation.

In addition, the *EACO Lead Abatement Guidelines, 2014 — Edition 1*, Environmental Abatement Council of Ontario, also provides guidance and recommended work practices.

3.3 Mercury

During the course of our site investigation, fluorescent lights were identified in the designated study areas. Mercury should be assumed to be present as a gas in all fluorescent light tubes. The fluorescent light tubes should be recycled for mercury, if the lights are removed. No mercury-containing thermostats were observed in the designated study areas.

Proper procedures for removing and handling mercury-containing fluorescent light tubes typically involve:

- ensuring that electrical power to light fixtures has been disconnected and locked out;
- taking all necessary precautions to ensure that fluorescent lamp tubes are removed in a manner that prevents breakage; and
- transporting fluorescent lamp tubes to a licensed processing location for separation and recovery of mercury.

3.4 Silica

Materials observed in the designated study areas which should be considered to contain silica included drywall wall, drywall joint compound, ceiling tiles, ceramic tile grout, mortar beds associated with ceramic tiles, concrete, mortar and cement block walls.

Silica can also be assumed to be present in any gravel ballast on roofs and will also be found in asphalt roofing materials if rock or stone are present in the asphalt.

The Ministry of Labour Guideline, Silica on Construction Projects, April 2011, provides guidance in controlling exposure to silica dust during construction activities. In the guideline, silica-containing construction operations are classified into three groups - Type 1 (low risk), Type 2 (medium risk) and Type 3 (high risk) based on presumed airborne concentrations of silica, as shown in Appendix C, Table C-3.

Additional precautionary measures should also be implemented for certain types of materials (e.g., plaster and texture coat materials, including non-asbestos applications, concrete block, etc.). For minor disturbances such as drilling, a HEPA-filtered attachment should be used. For removal of more than a minor amount of material, enclosures should be constructed for dust control and separation of the work area from adjacent areas.

3.5 Other Designated Substances

No other designated substances (benzene, isocyanates, arsenic, ethylene oxide and coke oven emissions) were observed to be present in the designated study area and none would be expected to be encountered in any building materials in a form that would represent an exposure concern.

3.6 Polychlorinated Biphenyls (PCBs)

Fluorescent lights were observed in the designated study areas during the course of our site investigation. Light ballasts, such as those associated with the type of fluorescent lights (T8s) observed in the designated study areas, are usually an electronic-type which do not contain PCBs, however, this would be confirmed by an electrician at the time of dismantling of the lights.

No other equipment potentially containing Polychlorinated Biphenyls (PCBs) were observed in the designated study areas during the course of the site investigations.

3.7 Ozone-Depleting Substances (ODS) and Other Halocarbons

No equipment potentially containing ODS was identified in the designated study areas during the course of the site investigation that may be affected by the proposed Childcare Addition Project.

3.8 Mould

The investigation for mould included a visual inspection of readily-accessible surfaces throughout the designated study areas to determine if any mould was evident. No readily-evident mould was observed in the designated study areas during the course of the site investigation.

4 USE AND LIMITATIONS OF THIS PROJECT-SPECIFIC DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY REPORT

This report, prepared for the Simcoe Muskoka Catholic District School Board, does not provide certification or warranty, expressed or implied, that the investigation conducted by Arcadis Canada Inc. identified all designated substances (as defined in the Ontario *Occupational Health and Safety Act*) in the designated study area at the subject site. The work undertaken by Arcadis Canada Inc. was directed to provide information on the presence of designated substances in building construction materials based on visual inspection of readily accessible areas in the designated study areas of the building and on the results of laboratory analysis of a limited number of bulk samples of material for asbestos and paint samples for lead content.

The material in this report reflects Arcadis Canada Inc.'s best judgment in light of the information available at the time of the investigation, which was performed on November 1, 2017.

This report is not intended to be used as a scope of work or technical specification for remediation of designated substances or hazardous materials.

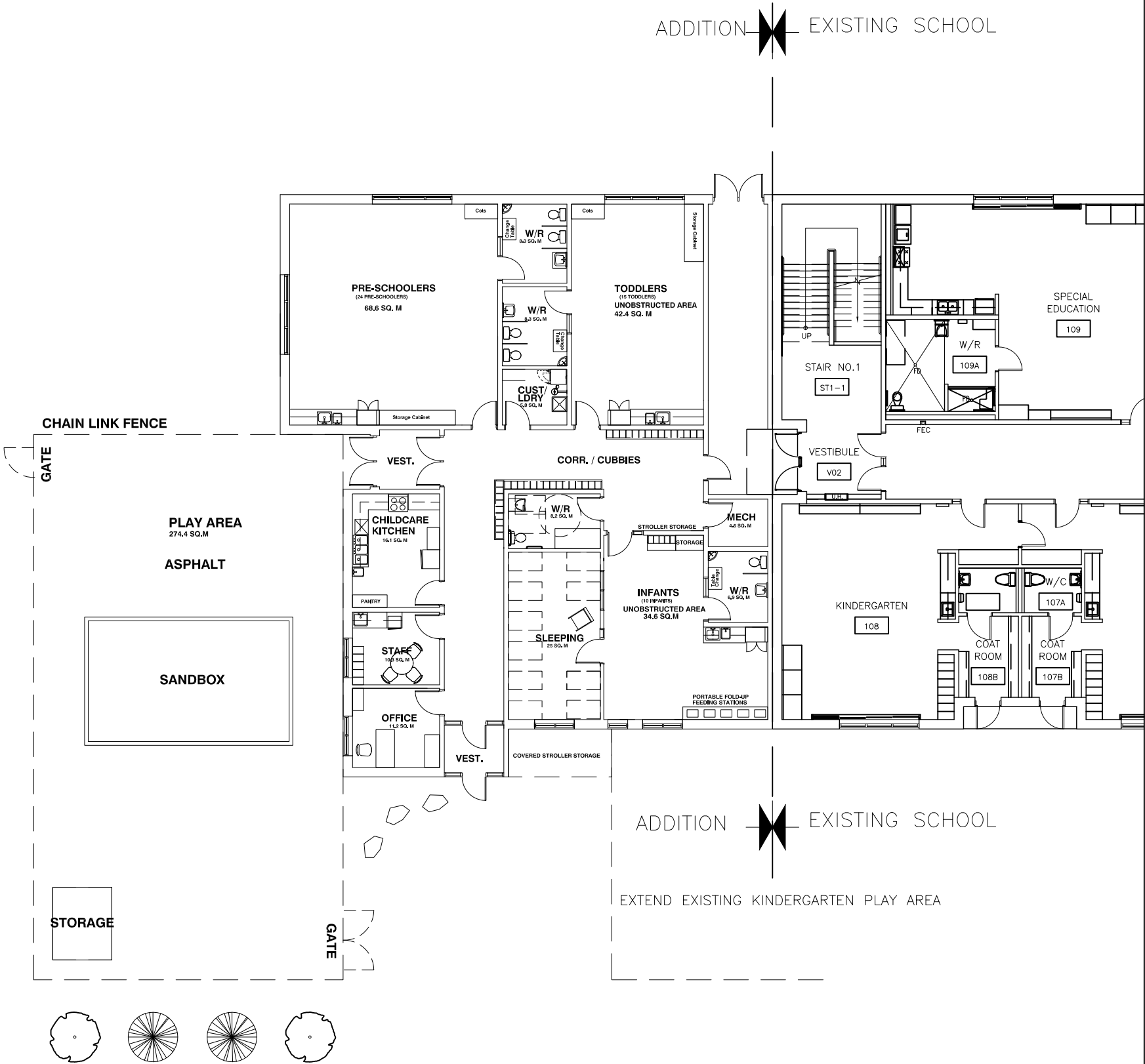
This report was prepared by Arcadis Canada Inc. for the Simcoe Muskoka Catholic District School Board. Any use which any other party makes of the report, or reliance on, or decisions to be based on it, is the responsibility of such parties.

APPENDIX A

Floor Plan



	REQUIRED	PROPOSED
NET PROGRAM AREA:		
PRE-SCHOOLERS 2.8 PER CHILD NUMBER OF CHILDREN: 24	67.2 m²	68.6 m²
TODDLERS 2.8 PER CHILD NUMBER OF CHILDREN: 15 34.5 m²	42 m²	42.4 m²
INFANTS 2.8 PER CHILD NUMBER OF CHILDREN: 10 28 m²	28 m²	34.6 m²
GROSS FLOOR AREA :		
EXISTING SCHOOL GFA	4185 m²	4185 m²
PROPOSED 3 ROOM CENTER ADDITION	418 m²	408 m²
CORRIDORS AND VESTIBULES		91.5 m² 22.4%
LOT COVERAGE	40%(MAX)	4593 m² 22.4%
PLAY AREA: 5.6 PER CHILD NUMBER OF CHILDREN: 49 274.4 m²	274.4 m²	274.4 m²
PARKING REQUIREMENTS:		
1.5 PARKING SPACES PER CLASSROOM OR TEACHING AREA, PLUS 1 PARKING SPACE PER EVERY 10.0 m² OF GROSS FLOOR AREA IN THE AUDITORIUM/GYMNASIUM	66	85 (EXISTING PARKING SPACES)
EXISTING: NUMBER OF CLASSROOMS: 22 AUDITORIUM/GYMNASIUM AREA:275 m²		
ADDITION: NUMBER OF CLASSROOMS: 3 AUDITORIUM/GYMNASIUM AREA: 0		



ST. PAUL CES – CCEY ADDITION
GROUND FLOOR PLAN

APPENDIX B

Laboratory Reports





EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 551712326
Customer ID: 55DCSL97
Customer PO: 702786-000
Project ID:

Attn: Dwayne Kellyman
ARCADIS Canada Inc.
121 Granton Drive
Unit 12
Richmond Hill, ON L4B 3N4
Proj: 702786-000/ St. Paul CES

Phone: (905) 882-5984
Fax: (905) 882-8962
Collected:
Received: 11/06/2017
Analyzed: 11/10/2017

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 1A

Lab Sample ID: 551712326-0001

Sample Description: Room 108/2'x4' Ceiling tile – pinhole random fissure

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	75%	25%	None Detected	

Client Sample ID: 1B

Lab Sample ID: 551712326-0002

Sample Description: Corridor outside Room 108/2'x4' Ceiling tile – pinhole random fissure

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	75%	25%	None Detected	

Client Sample ID: 1C

Lab Sample ID: 551712326-0003

Sample Description: Room 108/2'x4' Ceiling tile – pinhole random fissure

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	80%	20%	None Detected	

Client Sample ID: 2A

Lab Sample ID: 551712326-0004

Sample Description: Stair 1 Vestibule/Caulking on door frame

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	11/10/2017	Gray	0.0%	100%	None Detected	
TEM Grav. Reduction	11/10/2017	Gray	0.0%	100%	None Detected	

Client Sample ID: 2B

Lab Sample ID: 551712326-0005

Sample Description: Room 108/Caulking on window frame

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	0%	100%	None Detected	

Client Sample ID: 2C

Lab Sample ID: 551712326-0006

Sample Description: Stair 1 Vestibule/Caulking on door frame

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	0%	100%	None Detected	

Client Sample ID: 3A

Lab Sample ID: 551712326-0007

Sample Description: Stair 1 Vestibule/Concrete block mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	0%	100%	None Detected	



EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 551712326
Customer ID: 55DCSL97
Customer PO: 702786-000
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 3B **Lab Sample ID:** 551712326-0008
Sample Description: Room 108/Concrete block mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	0%	100%	None Detected	

Client Sample ID: 3C **Lab Sample ID:** 551712326-0009
Sample Description: Stair 1 Vestibule/Concrete block mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	White	0%	100%	None Detected	

Client Sample ID: 4A **Lab Sample ID:** 551712326-0010
Sample Description: Stair 1 Vestibule/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	White	0%	100%	None Detected	

Client Sample ID: 4B **Lab Sample ID:** 551712326-0011
Sample Description: Stair 1 Vestibule/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	White	0%	100%	None Detected	

Client Sample ID: 4C **Lab Sample ID:** 551712326-0012
Sample Description: Stair 1 Vestibule/Drywall joint compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	White	0%	100%	None Detected	

Client Sample ID: 5A **Lab Sample ID:** 551712326-0013
Sample Description: Exterior/Exterior brick mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	0%	100%	None Detected	

Client Sample ID: 5B **Lab Sample ID:** 551712326-0014
Sample Description: Exterior/Exterior brick mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	0%	100%	None Detected	

Client Sample ID: 5C **Lab Sample ID:** 551712326-0015
Sample Description: Exterior/Exterior brick mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/10/2017	Gray	0%	100%	None Detected	



EMSL Canada Inc.

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EMSL Canada Order 551712326
Customer ID: 55DCSL97
Customer PO: 702786-000
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Anne Balayboa PLM (4)
Jon Delos Santos PLM Grav. Reduction (1)
TEM Grav. Reduction (1)
Natalie D'Amico PLM (10)

Reviewed and approved by:

Matthew Davis
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 11/10/2017 21:03:20

**EMSL Canada Inc.**

2756 Slough Street, Mississauga, ON L4T 1G3

Phone/Fax: 289-997-4602 / (289) 997-4607

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EMSL Canada Or 551712336

CustomerID: 55DCSL97

CustomerPO: 702786

ProjectID:

Attn: **Dwayne Kellyman**
ARCADIS Canada Inc.
121 Granton Drive
Unit 12
Richmond Hill, ON L4B 3N4

Phone: (905) 882-5984
Fax: (905) 882-8962
Received: 11/07/17 9:00 AM
Collected:

Project: **702786-St Paul C.S****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)***

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
P-1	551712336-0001	11/8/2017		<90 mg/Kg
Site: Beige Paint on concrete block				

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 11/13/2017 08:02:39

APPENDIX C

Summary of Asbestos, Lead and Silica Work Classifications



TABLE C-1
SUMMARY OF CLASSIFICATION OF
TYPE 1, 2 AND 3 OPERATIONS
(Ont. Reg. 278/05)

TYPE 1 OPERATIONS

- removing less than 7.5 m² asbestos-containing ceiling tiles;
- removing non-friable asbestos-containing material other than ceiling tiles, if the material is removed without being broken, cut, drilled, abraded, ground, sanded or vibrated;
- breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the material is wetted and the work is done only using non-powered, hand-held tools; and
- removing less than 1 m² of drywall in which asbestos-containing joint compounds have been used.

TYPE 2 OPERATIONS

- removing all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling;
- removal of one square metre or less of friable asbestos-containing material;
- enclosing friable asbestos-containing material;
- applying tape or a sealant or other covering to asbestos-containing pipe or boiler insulation;
- removing 7.5 m² or more asbestos-containing ceiling tiles (if removed without being broken, cut, drilled, abraded, ground, sanded or vibrated);
- breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the material is not wetted and the work is done only using non-powered, hand-held tools;
- removal of one square metre or more of drywall in which asbestos-containing joint compounds have been used;
- breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the work is done using power tools that are attached to dust-collecting devices equipped with HEPA filters;
- cleaning or removing filters used in air-handling equipment in a building that has asbestos-containing sprayed fireproofing.

TABLE C-1 (Continued)
SUMMARY OF CLASSIFICATION OF
TYPE 1, 2 AND 3 OPERATIONS
(Ont. Reg. 278/05)

TYPE 3 OPERATIONS

- removal of more than one square metre of friable asbestos-containing material;
- spray application of a sealant to friable asbestos-containing material;
- cleaning or removing air-handling equipment, including rigid ducting but not including filters, in a building that has sprayed asbestos-containing fireproofing;
- repairing or demolishing a kiln, metallurgical furnace or similar structure that is made in part of asbestos-containing refractory materials;
- breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing materials, if the work is done using power tools that are not attached to dust-collecting devices equipped with HEPA filters.

TABLE C-2
SUMMARY OF CLASSIFICATION OF
LEAD-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE – LEAD ON CONSTRUCTION PROJECTS, APRIL 2011

Type 1 Operations	Type 2 Operations		Type 3 Operations	
	Type 2a	Type 2b	Type 3a	Type 3b
<0.05 mg/m ³	>0.05 to 0.50 mg/m ³	>0.50 to 1.25 mg/m ³	>1.25 to 2.50 mg/m ³	>2.50 mg/m ³

Note: The classification of Type 1, 2 and 3 operations is based on presumed airborne concentrations of lead, as shown above.

TYPE 1 OPERATIONS

- application of lead-containing coatings with a brush or roller;
- removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap;
- removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter;
- installation or removal of lead-containing sheet metal;
- installation or removal of lead-containing packing, babbitt or similar material;
- removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping or sanding;
- soldering.

TYPE 2 OPERATIONS

Type 2a Operations

- welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise it will be considered a Type 3a operation;
- removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools;
- manual demolition of lead-painted plaster walls or building components by striking a wall with a sledgehammer or similar tool.

Type 2b Operations

- spray application of lead-containing coatings.

TABLE C-2 (Continued)
SUMMARY OF CLASSIFICATION OF
LEAD-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE – LEAD ON CONSTRUCTION PROJECTS, APRIL 2011

TYPE 3 OPERATIONS

Type 3a Operations

- welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space;
- burning of a surface containing lead;
- dry removal of lead-containing mortar using an electric or pneumatic cutting device;
- removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter;
- removal or repair of a ventilation system used for controlling lead exposure;
- demolition or cleanup of a facility where lead-containing products were manufactured;
- an operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation

Type 3b Operations

- abrasive blasting of lead-containing coatings or materials;
- removal of lead-containing dust using an air mist extraction system.

TABLE C-3
SUMMARY OF CLASSIFICATION OF SILICA-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE, SILICA ON CONSTRUCTION PROJECTS, APRIL 2011

	Type 1 Operations	Type 2 Operations	Type 3 Operations
Cristobalite and Tridymite	>0.05 to 0.50 mg/m ³	>0.50 to 2.50 mg/m ³	>2.5 mg/m ³
Quartz and Tripoli	>0.10 to 1.0 mg/m ³	>1.0 to 5.0 mg/m ³	>5.0 mg/m ³

Note: The classification of silica-containing construction tasks is based on presumed concentrations of respirable crystalline silica, as shown above.

TYPE 1 OPERATIONS

- The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction.
- Milling of asphalt from concrete highway pavement.
- Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica).
- Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica.
- Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling.
- Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.

TYPE 2 OPERATIONS

- Removal of silica containing refractory materials with a jackhammer.
- The drilling of holes in concrete or rock that is part of a tunnelling or road construction.
- The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials.
- The use of a power tool to remove silica containing materials.
- Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation).
- Tuckpoint and surface grinding.
- Dry mortar removal with an electric or pneumatic cutting device.
- Dry method dust cleanup from abrasive blasting operations.
- The use of compressed air outdoors for removing silica dust.
- Entry into area where abrasive blasting is being carried out for more than 15 minutes.

TABLE C-3 (Continued)
SUMMARY OF CLASSIFICATION OF SILICA-CONTAINING CONSTRUCTION TASKS
MOL GUIDELINE, SILICA ON CONSTRUCTION PROJECTS, APRIL 2011

TYPE 3 OPERATIONS

- Abrasive blasting with an abrasive that contains ≥ 1 per cent silica.
- Abrasive blasting of a material that contains ≥ 1 per cent silica.

Arcadis Canada Inc.

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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 is hereby made part of these *Contract Documents*, with the following amendments, additions and modifications:

AGREEMENT BETWEEN OWNER AND CONTRACTOR

ARTICLE A-3 – CONTRACT DOCUMENTS

3.1 Add the following to the list of *Contract Documents* in paragraph 3.1:

- Amendments to CCDC 2 – 2008
- *Drawings*
- *Specifications*
- Performance Bond
- Labour and Material Payment Bond

ARTICLE A-5 – PAYMENT

5.1.3 Amend paragraph 5.1.3, in the first line, by deleting the words "...the issuance of the..." and replacing them with "...receipt of the *Consultant's*..."

5.3.1 Delete paragraph 5.3.1 in its entirety and replace it with the following:

Interest

.1 Should either party fail to make payments as they become due under the terms of the Contract or in an award by arbitration or court, interest shall also become due and payable on such unpaid amounts at 0% above the prime rate. Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by the Bank of Canada for prime business loans, as it may change from time to time.

ARTICLE A-9 – CONFLICT OF INTEREST

Add new Article A-9 – Conflict of Interest:

- 9.1 The *Contractor*, all of the *Subcontractors* and *Suppliers* 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 *Owner*) with the provision of the *Work* pursuant to the *Contract*. The *Contractor* acknowledges and agrees that a conflict of interest, as described in this Article A-9, includes, but is not limited to, the use of *Confidential Information* where the *Owner* has not specifically authorized such use.
- 9.2 The *Contractor* shall disclose to the *Owner*, 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 *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*.
- 9.3 The *Contractor* covenants and agrees that it will not hire or retain the services of any employee or previous employee of the *Owner* where to do so constitutes a breach by such employee or previous employee of the *Owner's* conflict of interest policy, as it may be amended from time to time, until after completion of the *Work* under the *Contract*.
- 9.4 It is of the essence of the *Contract* that the *Owner* shall not have direct or indirect liability to any *Subcontractor* or *Supplier*, and that the *Owner* relies on the maintenance of an arm's-length relationship between the *Contractor* and its *Subcontractors* and *Suppliers*. Consistent with this fundamental term of the *Contract*, the *Contractor* will not enter into any agreement or understanding with any *Subcontractor* or *Supplier*, 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 *Owner*, directly or through the *Contractor*, where such claim is, in whole or in part, in respect of a disputed claim by the *Subcontractor* or *Supplier* against the *Contractor*, where the payment to the *Subcontractor* or *Supplier* by the *Contractor* is agreed to be conditional or contingent on the ability to recover those amounts or a portion thereof from the

Owner, failing which the *Contractor* shall be saved harmless from all or a portion of those claims. The *Contractor* acknowledges that any such agreement would undermine the required arm's-length relationship and constitute a conflict of interest. For greater certainty, the *Contractor* shall only be entitled to advance claims against the *Owner* for amounts pertaining to *Subcontractor* or *Supplier* claims where the *Contractor* has actually paid or unconditionally acknowledged liability for those claims or where those claims are the subject of litigation or binding arbitration between the *Subcontractor* or *Supplier* and the *Contractor* 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, SUSPEND THE WORK OR TERMINATE THE CONTRACT, a breach of this Article by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract*, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity.

DEFINITIONS

Add the following new definitions:

27. Confidential Information

Confidential Information means all the information or material of the *Owner* 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 *Contractor* at any time, but *Confidential Information* shall not include information that:

- 1) is or becomes generally available to the public without fault or breach on the part of the *Contractor*, including without limitation breach of any duty of confidentiality owed by the *Contractor* to the *Owner* or to any third party, but only after that information becomes generally available to the public;
- 2) the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* from a third party who had the right to transfer or disclose it to the *Contractor* free of any obligation of confidence;
- 3) the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor* at the time of disclosure, free of any obligation of confidence; or
- 4) is independently developed by the *Contractor* without use of any *Confidential Information*.

28. Construction Schedule

Construction Schedule means the schedule for the performance of the *Work* provided by the *Contractor* pursuant to GC 3.5, including any amendments to the *Construction Schedule* made pursuant to the *Contract Documents*.

29. Force Majeure

Force Majeure means any cause, beyond the *Contractor's* control, other than bankruptcy or insolvency, which prevents the performance by the *Contractor* of any of its obligations under the *Contract* and the event of *Force Majeure* was not caused by the *Contractor's* default or active commission or omission and could not be avoided or mitigated by the exercise of reasonable effort or foresight by the *Contractor*. *Force Majeure* includes *Labour Disputes*, fire, unusual delay by common carriers or unavoidable casualties, civil disturbance, 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, or acts of God.

30. Install

Install means install and connect. *Install* has this meaning whether or not the first letter is capitalized.

31. Labour Dispute

Labour Dispute 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 *Work*.

32. Overhead

Overhead 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 *Place of the Work*; all requirements of Division 1, including but not limited to submittals, warranty, quality control, insurance and bonding; calculations, testing and inspections; meals and accommodations; and, tools, expendables and clean-up costs.

33. Request for Information/RFI

Request for Information or *RFI* means written documentation sent by the *Contractor* to the *Owner* or to the *Owner's* representative or the *Consultant* requesting written clarification(s) and/or interpretation(s) of the *Drawings* and/or *Specifications*, *Contract* requirements and/or other pertinent information required to complete the *Work* of the *Contract* without applying for a change or changes to the *Work*.

4. Amend Definition 4 by adding the following to the end of the Definition:

For the purposes of the *Contract*, the terms “*Consultant*”, “*Architect*” and “*Engineer*” shall be considered synonymous.

16. Amend Definition 16 by adding the following to the end of the Definition:

Provide has this meaning whether or not the first letter is capitalized.

GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

- 1.0 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.

GC 1.1 CONTRACT DOCUMENTS

1.1.6 Add the following to the end of paragraph 1.1.6:

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

- 1.1.7 Amend paragraph 1.1.7.1 by adding “Amendments to CCDC 2 – 2008” before “the Agreement between the Owner and the Contractor” and deleting the reference to “Supplementary Conditions”.

Add new paragraphs 1.1.7.5, 1.1.7.6, 1.1.7.7, 1.1.7.8, 1.1.7.9 and 1.1.7.10 as follows:

- .5 noted materials and annotations on the *Drawings* shall govern over the graphic representation of the *Drawings*.
- .6 finishes in the room finish schedules shall govern over those shown on the *Drawings*.
- .7 Schedules of Division 01 – General Requirements of the *Specifications* shall form part of and be read in conjunction with the technical specification section as listed in the table of contents of the *Specifications*.
- .8 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 *Consultant* or its sub-*Consultants* are to remain with each of the applicable drawing disciplines.
- .9 fixturing drawings provided by the *Owner* shall have precedence over architectural drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts.
- .10 should reference standards contained in the *Specifications* conflict with the *Specifications*, the *Specifications* shall govern. Should reference standards and *Specifications* conflict with each other or if certain requirements of the *Specifications* conflict with other requirements of the *Specifications*, the more stringent requirements shall govern.

1.1.8 Delete paragraph 1.1.8 in its entirety and substitute as follows:

The *Consultant*, on behalf of the *Owner* shall provide the *Contractor* without charge, twelve (12) copies of the *Contract Documents*, exclusive of those required by jurisdictional authorities and the executed *Contract Documents*. Additional copies can be purchased by the *Contractor* at the *Consultant's* cost of reproduction, handling and sales tax.

1.1.11 Add new paragraph 1.1.11 as follows:

The *Contract Documents* shall be signed in triplicate (3) by the *Owner* and the *Contractor*, and each of the *Contractor*, the *Owner* and the *Consultant* shall retain one set of signed and sealed (if required by the governing law of the *Contract*) *Contract Documents*.

GC 1.3 RIGHTS AND REMEDIES

1.3.2 Delete the word “No” from the beginning of paragraph 1.3.2 and substitute 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...”

GC 1.4 ASSIGNMENT

Delete paragraph 1.4.1 in its entirety and replace with the following:

- 1.4.1 The *Contractor* shall not assign the *Contract*, or any portion thereof, without the prior written consent of the *Owner*, which consent may be unreasonably withheld. The *Owner* shall be entitled to assign the *Contract* to a corporation, partnership or other entity (the “Assignee”). Upon the assumption by the Assignee of the *Owner's* obligations under the *Contract*, the *Owner* shall be released from its obligations under the *Contract*.

GC 1.5 EXAMINATION OF DOCUMENTS AND SITE

Add new GC 1.5 – EXAMINATION OF DOCUMENTS AND SITE as follows:

- 1.5.1 The *Contractor* declares and represents that in tendering for the *Work*, and in entering into a *Contract* with the *Owner* for the performance of the *Work*, it has either investigated for itself the character of the *Work* to be done and all local conditions, including the location of any utility which can be determined from the records or other information available at the offices of any person, partnership, corporation, including a municipal corporation and any board or commission thereof having jurisdiction or control over the utility that might affect its tender or its acceptance of the *Work*, or that, not having so investigated, the *Contractor* has assumed and does hereby assume all risk of conditions now existing or arising in the

course of the *Work* which might or could make the *Work*, 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 *Contract* signed.

- 1.5.2 The *Contractor* also declares that in tendering for the *Work* and in entering into this *Contract*, the *Contractor* did not and does not rely upon information furnished by the *Owner* or any of its agents or servants respecting the nature or confirmation of the ground at the site of the *Work*, or the location, character, quality or quantity of the materials to be removed or to be employed in the construction of *Work*, or the character of the construction machinery and equipment or facilities needed to perform the *Work*, or the general and local performance of the work under the *Contract* and expressly waives and releases the *Owner* from all claims with respect to the said information with respect to the *Work*.

GC 1.6 TIME IS OF THE ESSENCE OF THE CONTRACT

Add new GC 1.6 - TIME IS OF THE ESSENCE OF THE CONTRACT as follows:

- 1.6.1 All time limits stated in the *Contract Documents* are of the essence of the *Contract*.

GC 2.2 ROLE OF THE CONSULTANT

- 2.2.7 Delete the words "Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER" .

- 2.2.13 Amend paragraph 2.2.13 by the addition of the following to the end of that paragraph:

If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or in the *Contract Time*, it shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction*, provide the *Consultant* 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 *Supplemental Instruction* by the *Contractor*, without any adjustment in the *Contract Price* or *Contract Time*.

- 2.2.19 Add new paragraph 2.2.1.9 as follows:

The *Consultant* or the *Owner*, acting reasonably, may from time to time require the *Contractor* to remove from the *Project* any personnel of the *Contractor*, including project managers, superintendents or *Subcontractors*. Such persons shall be replaced by the *Contractor* in a timely fashion to the satisfaction of the *Consultant* or the *Owner*, as the case may be, at no cost to the *Owner*.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

- 2.3.2 Amend paragraph 2.3.2 by adding the words "and *Owner*" after the words "*Consultant*" in the second and third lines.

- 2.3.3 Delete paragraph 2.3.3 in its entirety and replace it with the following:

The *Contractor* shall furnish promptly two copies to the *Consultant* and one copy to the *Owner* of all certificates and inspection reports relating to the *Work*.

- 2.3.4 Insert the word "review" after the word "inspections" in the first line of paragraph 2.3.4.

- 2.3.5 In the first line after "*Consultant*", add "or the *Owner*".

- 2.3.8 Add a new paragraph 2.3.8 as follows:

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

GC 2.4 DEFECTIVE WORK

- 2.4.1 Amend GC 2.4.1 by inserting “, the *Owner* and/or its agent” in the first sentence following “rejected by the *Consultant*”.

Add new paragraphs 2.4.1.1 and 2.4.1.2:

- 2.4.1.1 The *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective work and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*.
- 2.4.1.2 The *Contractor* shall prioritize the correction of any defective work, which, in the sole discretion of the *Owner*, adversely affects the day to day operations of the *Owner* or which, in the sole discretion of the *Consultant*, adversely affects the progress of the *Work*.
- 2.4.2 Delete paragraph 2.4.2 in its entirety and replace it with the following:

The *Contractor* shall promptly pay the *Owner* for costs incurred by the *Owner*, the *Owner's* own forces or the *Owner's* other contractors, for work destroyed or damaged or any alterations necessitated by the *Contractor's* removal, replacement or re-execution of defective work. The *Owner* may request that the *Contractor* rectify any such deficiencies to other contractors' work, at the *Contractor's* expense.

Add new paragraph 2.4.4 as follows:

- 2.4.4 Neither acceptance of the *Work* by the *Consultant* or the *Owner*, nor any failure by the *Consultant* or the *Owner* to identify, observe or warn of defective *Work* or any deficiency in the *Work* shall relieve the *Contractor* from the sole responsibility for rectifying such defect or deficiency at the *Contractor's* sole cost, even where such failure to identify, observe or warn is negligent.

GC 3.1 CONTROL OF THE WORK

- 3.1.3 Add a new paragraph 3.1.3 as follows:

Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceedings with any part of the affected *Work*.

- 3.1.4 Add a new paragraph 3.1.4 as follows:

Notwithstanding the provisions of paragraphs 3.1.1 and 3.1.2, the *Owner* 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 *Contractor* to fulfill its contractual obligations.

GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

- 3.2.2.1 Delete paragraph 3.2.2.1 in its entirety.
- 3.2.2.2 Delete paragraph 3.2.2.2 in its entirety.
- 3.2.2.3 Delete paragraph 3.2.2.3 in its entirety.
- 3.2.2.4 Delete paragraph 3.2.2.4 in its entirety.

3.2.3.2 Delete paragraph 3.2.3.2 and replace it with the following:

Co-ordinate and schedule the activities and work of other contractors and *Owner's* own forces with the *Work* of the *Contractor* and connect as specified or shown in the *Contract Documents*.

3.2.3.4 Add new paragraph 3.2.3.4 as follows:

Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner's* 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 *Place of the Work*, including all of the responsibilities of the "constructor", pursuant to the *Occupational Health and Safety Act* (Ontario)..

GC 3.3 TEMPORARY WORK

3.3.2 In paragraph 3.3.2, in the second line after the words "where required by law", insert "or the *Consultant*".

GC 3.4 DOCUMENT REVIEW

3.4.1 Delete paragraph 3.4.1 in its entirety and substitute new paragraph 3.4.1:

The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency, or omission the *Contractor* may discover. Such review by the *Contractor* shall be undertaken with the standard of care described in paragraph 3.14.1 of the *Contract*. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. Provided it has exercised the degree of care and skill described in this paragraph 3.4.1, the *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered through the exercise of the required standard of care.

3.4.2 Add new paragraph 3.4.2. as follows:

If, at any time, the *Contractor* finds errors, inconsistencies, or omissions in the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, including laying out of the *Work*, the *Contractor* shall immediately notify the *Consultant*, and request instructions, a *Supplemental Instruction*, *Change Order*, or *Change Directive*, as the case may require, and the *Contractor* shall not proceed with the work affected until the *Contractor* has received such instructions, a *Supplemental Instruction*, *Change Order* or *Change Directive*. Neither the *Owner* nor the *Consultant* will be responsible for the consequences of any action of the *Contractor* based on oral instructions.

3.4.3 Add new paragraphs 3.4.3 and 3.4.4 as follows:

Errors, inconsistencies and/or omissions in the *Drawings* and/or *Specifications* which do not allow completion of the *Work* of the *Contract* shall be brought to the *Consultant's* attention prior to the execution of the *Contract* by means of an *RFI*.

3.4.4 Notwithstanding the foregoing, errors, inconsistencies, discrepancies and/or omissions shall not include lack of reference on the *Drawings* or in the *Specifications* to labour and/or *Products* that are required or normally recognized within respective trade practices as being necessary for the complete execution of the *Work*. The *Contractor* shall not use subsequent *RFIs*, issued during execution of the *Work* to establish a change and/or changes in the *Work* pursuant to Part 6 – CHANGES IN THE WORK.

GC 3.5 CONSTRUCTION SCHEDULE

3.5.1 Delete paragraph 3.5.1 in its entirety and replace with the following:

The *Contractor* shall:

.1 within five (5) calendar days of receiving written confirmation of the award of the *Contract*, prepare and submit to the *Owner* and the *Consultant* for their review and acceptance, a construction schedule in the format indicated below that indicates the timing of the activities of the *Work* and provides sufficient detail of the critical events and their inter-

relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time* and in accordance with the *Contract Documents*. Such schedule is to include a delivery schedule for *Products* whose delivery is critical to the schedule for the *Work* or are required by the *Contract* to be included in a *Products* delivery schedule. The *Contractor* shall employ construction scheduling software, being the latest version of "Microsoft Project", that permits the progress of the *Work* to be monitored in relation to the critical path established in the schedule. The *Contractor* shall provide the schedule and any successor or revised schedules in both electronic format and hard copy. Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline construction schedule; and,

.2 provide the expertise and resources, such resources including manpower and equipment, as are necessary to maintain progress under the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE; and,

.3 monitor the progress of the *Work* on a weekly basis relative to the baseline construction schedule, or any revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, update and submit to the *Consultant* and *Owner* the electronic and hard copy schedule on a monthly basis, at a minimum, or as required by the *Consultant* and advise the *Consultant* and the *Owner* weekly in writing of any variation from the baseline or slippage in the schedule; and,

.4 provide overtime work without change to the *Contract Price* if such work is deemed necessary to meet the schedule; and,

.5 ensure that the *Contract Price* shall include all costs required to phase or stage the *Work*.

3.5.2 Add new paragraph 3.5.2 as follows:

If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to subparagraph 3.5.1.3, the *Contractor* shall, either at the request of the *Owner* or the *Consultant*, or following giving notice pursuant to subparagraph 3.5.1.3, take appropriate steps to cause the actual progress of the *Work* to conform to the schedule or minimize the resulting delay. Within five (5) calendar days of the request by the *Owner* or the *Consultant* or the notice being given pursuant to subparagraph 3.5.1.3, the *Contractor* shall produce and present to the *Owner* and the *Consultant* a plan demonstrating how the *Contractor* will achieve the recovery of the last accepted schedule.

3.5.3 The *Contractor* is responsible for performing the *Work* within the *Contract Time*. Any schedule submissions revised from the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, during construction are not deemed to be approved extensions to the *Contract Time*. All extensions to the *Contract Time* must be made in accordance with the *Contract Documents*.

GC 3.6 SUPERVISION

Delete paragraph 3.6.1 in its entirety and replace with the following:

3.6.1 The *Contractor* shall employ a competent full-time superintendent, acceptable to the *Owner* and *Consultant*, who shall be in full time attendance at the *Place of Work* while the *Work* is being performed. The superintendent shall not be changed by the *Contractor* without valid reason which shall be provided in writing and shall not be changed without prior consultation with and agreement by the *Owner* and the *Consultant*. The *Contractor* shall replace the superintendent within 7 *Working Days* of the *Owner's* written notification, if the superintendent's performance is not acceptable to the *Owner*. The *Contractor* shall provide the *Owner* and the *Consultant* 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.

Delete paragraph 3.6.2 in its entirety and replace with the following:

3.6.2 The superintendent, and any project manager appointed by the *Contractor*, shall represent the *Contractor* at the *Place of Work* and shall have full authority to act on written instructions given by the *Consultant* and/or the *Owner*. Instructions given to the superintendent or the project manager shall be deemed to have been given to the *Contractor* and both the superintendent and any project manager shall have full authority to act on behalf of the *Contractor* and bind the *Contractor* in matters related to the *Contract*.

3.6.3 Add new paragraph 3.6.3 , 3.6.4, 3.6.5 and 3.6.6 as follows:

The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s). Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement, which is approved by the *Owner*.

3.6.4 The supervisory staff assigned to the *Project* shall also be fully competent to implement efficiently all requirements for scheduling, coordination, field engineering, reviews, inspections and submittals defined in the *Specifications*, and have minimum 5 years documented "Superintendent/Project Management" experience.

3.6.5 The *Consultant and Owner* shall reserve the right to review the record of experience and credentials of supervisory staff assigned to the *Project* prior to commencement of the *Work*.

3.6.6 A superintendent assigned to the *Work* 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 *Project* to the sole satisfaction of the *Owner*.

GC 3.7 SUBCONTRACTORS AND SUPPLIERS

3.7.1.1 In paragraph 3.7.1.1 add to the end of the second line "including any warranties and service agreements which extend beyond the term of the *Contract*."

3.7.1.2 In subparagraph 3.7.1.2 after the words "the *Contract Documents*" insert the words "including any required surety bonding".

Delete paragraph 3.7.2. in its entirety and replace with the following:

3.7.2 Substitution of any *Subcontractor* and/or *Suppliers* after submission of the *Contractor's* bid will not be accepted unless a valid reason is given in writing to and approved by the *Owner*, whose approval may be arbitrarily withheld. The reason for substitution must be provided to the *Owner* and to the original *Subcontractor* and/or *Supplier* and the *Subcontractor* and/or *Supplier* shall be given the opportunity to reply to the *Contractor* and *Owner*. The *Contractor* shall be fully aware of the capability of each *Subcontractor* and/or *Supplier* included in its bid, including but not limited to technical ability, financial stability and ability to maintain the proposed construction schedule.

3.7.4 Change the word "shall" to "may" in the second line.

Add new paragraphs 3.7.7 and 3.7.8 as follows:

3.7.7 Where provided in the *Contract*, the *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any contract procured by the *Owner* for *Work* or services required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*, and upon such assignment, the *Owner* shall have no further liability to any party for such contract.

3.7.8 The *Contractor* covenants that each subcontract or supply contract which the *Contractor* enters into for the purpose of performing the *Work* shall expressly provide for the assignment thereof to the *Owner* (at the option of the *Owner*) and the assumption by the *Owner* of the obligations of the *Contractor* thereunder, upon the termination of the *Contract* and upon written notice by the *Owner* to the other parties to such subcontracts or supply contracts, without the imposition of further terms or conditions; provided, however, that until the *Owner* has given such notice, nothing herein contained shall be deemed to create any contractual or other liability upon the *Owner* for the performance of obligations under such subcontracts or supply contracts and the *Contractor* shall be fully responsible for all of its obligations and liabilities (if any) under such subcontracts and supply contracts.

GC 3.8 LABOUR AND PRODUCTS

3.8.2 Delete paragraph 3.8.2 and substitute with the following:

Products provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, provincial and

municipal building codes, fire safety standards, and all governmental authorities and regulatory agencies having jurisdiction at the *Place of the Work*, unless otherwise specified. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*. *Products* brought on to the *Place of the Work* by the *Contractor* shall be deemed to be the property of the *Owner*, but the *Owner* shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever. The said *Products* shall be at the sole risk of the *Contractor*. Workmanship shall be, in every respect, first class and the *Work* shall be performed in accordance with the best modern industry practice.

- 3.8.3 Amend paragraph 3.8.3 by adding the words, "... , agents, *Subcontractors* and *Suppliers*..." after the word "employees" in the first line.

Add new paragraphs 3.8.4, 3.8.5, 3.8.6, 3.8.7, 3.8.8, 3.8.9 and 3.8.10 as follows:

- 3.8.4 Upon receipt of a written notice from the *Consultant*, the *Contractor* shall immediately dismiss, from the *Place of the Work*, tradesmen and labourers whose *Work* is unsatisfactory to the *Consultant* or who are considered by the *Consultant* to be unskilled or otherwise objectionable.
- 3.8.5 The *Contractor* shall cooperate with the *Owner* and its representatives and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the *Work* at the *Place of the Work*, including cooperation to attempt to avoid *Work* stoppages, trade union jurisdictional disputes and other *Labour Disputes*. Any costs arising from labour disputes shall be at the sole expense of the *Contractor*.
- 3.8.7 The cost for overtime required beyond the normal *Working Day* to complete individual construction operations of a continuous nature, such as pouring or finishing of concrete or similar work, or *Work* that the *Contractor* elects to perform at overtime rates without the *Owner* requesting it, shall not be chargeable to the *Owner*.
- 3.8.8. All manufactured *Products* which are identified by their proprietary names or by part or catalogue number in the *Specifications* shall be used by the *Contractor*. No substitutes for such specified *Products* shall be used without the written approval of the *Owner* and the *Consultant*. Substitutes will only be considered by the *Consultant* when submitted in sufficient time to permit proper review and investigation. When requesting approval for the use of substitutes, the *Contractor* shall include in its submission any proposed change in the *Contract Price*. The *Contractor* shall use all proprietary *Products* in strict accordance with the manufacturer's directions. Where there is a choice of proprietary *Products* specified for one use, the *Contractor* may select any one of the *Products* so specified for this use.
- 3.3.9 No consideration will be given to claims by the *Contractor* of unsuitability or unavailability of any *Products*, nor to the *Contractor's* unwillingness to use, or to produce first class work with, any *Products*, or to provide the specified warranties or guarantees.
- 3.8.10 Materials, appliances, equipment and other *Products* are sometimes specified by reference to brand names, proprietary names, trademarks or symbols. In such cases, the name of a manufacturer, distributor, *Supplier* or dealer is sometimes given to assist the *Contractor* to find a source *Supplier*. This shall not relieve the *Contractor* from its responsibility from finding its own source of supply even if the source names no longer supplies the *Product* specified. If the *Contractor* is unable to obtain the specified *Product*, the *Contractor* shall supply a substitute product equal to or better than the specified *Product*, as approved by the *Consultant* with no extra compensation. Should the *Contractor* be unable to obtain a substitute *Product* equal to or superior to the specified *Product* and the *Owner* accepts a different *Product*, the *Contract Price* shall be adjusted accordingly, as approved by the *Consultant*.

GC 3.9 DOCUMENTS AT THE SITE

- 3.9.1 Delete paragraph 3.9.1 in its entirety and substitute the following:

The *Contractor* shall keep one copy of the current *Contract Documents*, *Supplemental Instructions*, contemplated *Change Orders*, *Change Orders*, *Change Directives*, cash allowance disbursement authorizations, reviewed *Shop Drawings*, submittals, reports and records of meeting at the *Place of the Work*, in good order and available to the *Owner* and *Consultant*.

GC 3.10 SHOP DRAWINGS

3.10.1 Delete paragraph 3.10.1 in its entirety and replace with the following:

The *Contractor* shall provide shop drawings as described in the *Contract Documents* and as the *Consultant* may reasonably request

3.10.9 Delete paragraph 3.10.9 in its entirety and substitute the following:

At the time of providing *Shop Drawings*, the *Contractor* shall advise the *Consultant* in writing of any deviations in *Shop Drawings* from the requirements of the *Contract Documents*. The *Consultant* 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.

Add new paragraphs 3.10.13, 3.10.14, 3.10.15, 3.10.16, 3.10.17 and 3.10.18 as follows:

3.10.13 Reviewed *Shop Drawings* shall not authorize a change in the *Contract Price* and/or the *Contract Time*.

3.10.14 The *Contractor* shall prepare a *Shop Drawings* schedule acceptable to the *Owner* and the *Consultant* prior to the first application for payment. A draft of the proposed *Shop Drawings* schedule shall be submitted by the *Contractor* to the *Consultant* and the *Owner* for approval. The draft *Shop Drawings* schedule shall clearly indicate the phasing of *Shop Drawings* submissions. The *Contractor* shall periodically re-submit the *Shop Drawings* schedule to correspond to changes in the construction schedule.

3.10.15 Except where the parties have agreed to a different *Shop Drawings* schedule pursuant to paragraph 3.10.3, the *Contractor* shall comply with the requirements for *Shop Drawings* submissions stated in the *Specifications*.

3.10.16 The *Contractor* shall not use the term "by others" on *Shop Drawings* or other submittals. The related trade, *Subcontractor* or *Supplier* shall be stated.

3.10.17 Certain *Specifications* sections require the *Shop Drawings* to bear the seal and signature of a professional engineer. Such professional engineer must be registered in the jurisdiction of the *Place of the Work* and shall have expertise in the area of practice reflected in the *Shop Drawings*.

3.10.18 The *Consultant* will review and return *Shop Drawings* and submittals in accordance with the schedule agreed upon in paragraph 3.10.3, The *Contractor* shall allow the *Consultant* a minimum of 14 days to review *Shop Drawings* from the date of receipt. If resubmission of *Shop Drawings* is required, a further 14 day period is required for the *Consultant's* review.

GC 3.11 USE OF THE WORK

3.11.1 In the second line between the words "permits and "or" add", by direction of the *Owner* or *Consultant*.

3.11.3 Add new paragraph 3.11.3 as follows:

The *Owner* shall have the right to enter or occupy the *Work* in whole or in part for the purpose of placing fittings and equipment, or for other use before *Substantial Performance of the Work*, if, in the opinion of the *Consultant*, such entry and occupation does not prevent or substantially interfere with the *Contractor* in the performance of the *Contract* within the *Contract Time*. Such entry or occupation shall neither be considered as acceptance of the *Work*, nor in any way relieve the *Contractor* from its responsibility to complete the *Contract*.

GC 3.12 CUTTING AND REMEDIAL WORK

Add new paragraphs 3.12.5 and 3.12.6 as follows:

3.12.5 Unless specifically stated otherwise in the *Specifications*, the *Contractor* shall do all cutting and making good necessary for the proper installation and performance of the *Work*.

- 3.12.6 To avoid unnecessary cutting, the *Contractor* shall lay out its work and advise the *Subcontractors*, when necessary, where to leave holes for installation of pipes and other work.

GC 3.13 CLEAN UP

- 3.13.1 At the end of the paragraph 3.13.1, add the following:

Remove accumulated waste and debris at least once a week as a minimum or as required by the nature of the *Work*.

- 3.13.2 In paragraph 3.13.2, in the fourth line add the word “materials” between the word “tools” and the words “*Construction Equipment*”.

- 3.13.3 In paragraph 3.13.3, in the first and second lines add the word “materials” between the word “tools” and the words “*Construction Equipment*”.

Add new paragraphs 3.13.4, 3.13.5, 3.13.6 and 3.13.7 as follows:

- 3.13.4 In the event that the *Contractor* fails to remove waste and debris as provided in this GC 3.13, then the *Owner* or the *Consultant* may give the *Contractor* twenty-four (24) hours written notice to meet its obligations respecting clean up. Should the *Contractor* fail to meet its obligations pursuant to this GC 3.13 within the twenty-four (24) hour period next following delivery of the notice, the *Owner* may remove such waste and debris and deduct from payments otherwise due to the *Contractor*, the *Owner's* costs for such clean up, including a reasonable mark-up for administration costs.
- 3.13.5 The *Contractor* shall clean up garbage during and after construction, and maintain the site in a neat and orderly condition on a daily basis. Prior to leaving the site at the end of construction, the *Contractor* shall make good all damage to the building and its components caused by the performance of the *Work* or by any *Subcontractor* or *Supplier*. The *Contractor* shall leave the site in a clean and finished state; remove all equipment and materials; remove all paint, stains, labels, dirt, etc. from the *Work*; and touch up all damaged painted areas.
- 3.13.6 Without limitation to or waiver of the *Owner's* other rights and remedies, the *Owner* shall have the right to back charge to the *Contractor* the cost of damage to the site caused by transportation in and out of the site by the *Contractor*, *Subcontractors* or *Suppliers*, if not repaired before final payment.
- 3.13.7 The *Contractor* shall dispose of debris at location and in a manner acceptable to the *Owner*, and authorities having jurisdiction in the area of the *Work* and the disposal area, and cover containers with tarpaulins tied in place to prevent scattering of debris on site and during transport.

GC 3.14 CONTRACTOR STANDARD OF CARE

Add a new General Condition 3.14 – CONTRACTOR STANDARD OF CARE as follows:

- 3.14.1 In performing its services and obligations under the *Contract*, the *Contractor* 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 *Contractor* acknowledges and agrees that throughout the *Contract*, the performance of the *Contractor's* obligations, duties and responsibilities shall be judged against this standard. The *Contractor* shall exercise the same standard of care, skill and diligence in respect of any *Products*, personnel or procedures which it may recommend to the *Owner*.
- 3.14.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:
- .1 the personnel it assigns to the *Project* are appropriately experienced;
 - .2 it has a sufficient staff of qualified and competent personnel to replace any of its appointed representatives, subject to the *Owner's* 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 *Contractor* to perform its work under the *Contract*.

GC 3.15 OCCUPANCY OF THE WORK

- 3.15.1 The *Owner* reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the *Project* even though the *Work* may not be substantially performed, provided that such taking possession and use will not interfere, in any material way, with the progress of the *Work*. The taking of possession or use of any such portion of the *Project* shall not be deemed to be the *Owner's* acknowledgement or acceptance of the *Work* or the *Project*, nor shall it relieve the *Contractor* of any of its obligations under the *Contract*.
- 3.15.2 Whether the *Project* contemplates *Work* by way of renovations in buildings which will be in use or be occupied during the course of the *Work* or where the *Project* involves *Work* that is adjacent to a structure which is in use or is occupied, the *Contractor*, without in any way limiting its responsibilities under the *Contract*, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise 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.

GC 4.1 CASH ALLOWANCES

- 4.1.1 Delete the second sentence in paragraph 4.1.1
- 4.1.4 Delete paragraph 4.1.4 in its entirety and substitute the following:

Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the *Consultant's* direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents*.

- 4.1.5 Delete paragraph 4.1.5 in its entirety and substitute the following:

The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount.

Add new paragraphs 4.1.8 and 4.1.9 as follows:

- 4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, for competitive bids for portions of the *Work*, which are to be paid for from cash allowances.
- 4.1.9 Cash allowances cover the net cost to the *Contractor* of services, *Products*, *Construction Equipment*, freight, unloading, handling, storage, installation, provincial sales tax, and other authorized expenses incurred in performing any *Work* stipulated under the cash allowances but does not include any *Value Added Taxes* payable by the *Owner* and the *Contractor*.

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

- 5.1.1 Delete paragraph 5.1.1 in its entirety.
- 5.1.2 Delete paragraph 5.1.2 in its entirety.

GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

Delete paragraph 5.2.2 in its entirety and substitute the following:

- 5.2.2 Applications for payment shall be dated the last day of each payment period, which is the last day of the month or an alternative day of the month agreed in writing by the parties. The amount claimed shall be for the value, proportionate to

the amount of the *Contract*, or work performed and *Products* delivered and incorporated into the *Work* at that date. 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.

Each application for payment, except the first, shall include a statutory declaration, in the CCDC 9A – 2001 form, up to the date of the application for payment, in a form approved by the Consultant. Each application for payment (including the first), shall also include:

.1 A certificate, issued by an agency or firm providing workers' compensation insurance to the *Contractor*, verifying that coverage is in force at the time of making the application for payment, and that coverage will remain in force for at least sixty (60) days thereafter.

.2 A declaration by the *Contractor*, in a form approved by the *Consultant*, verifying that the performance of the *Work* is in compliance with all applicable regulatory requirements respecting environmental protection, first safety, public safety and occupational health and safety.

.3 A pre-approved schedule of values, supplied by the *Contractor*, for Divisions 1 through 14 of the *Work*, aggregating the total amount of the *Contract Price*.

.4 A separate pre-approved schedule of values, supplied by each *Subcontractor*, for each of Division 15, 16, and 17 of the *Work*, aggregating the total amount of the *Contract Price*.

.5 Invoices to support all claims against the cash allowance.

.6 An acceptable construction schedule pursuant to GC 3.5.

5.2.3 Amend paragraph 5.2.3 by adding the following to the end of that paragraph:

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

5.2.7 Delete existing paragraph 5.2.7:

Add new paragraphs 5.2.7, and 5.2.8 as follows:

5.2.7 The *Contractor* shall prepare and maintain current as-built drawings which shall consist of the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing changes to the *Drawings* and *Specifications*, which current as-built drawings shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Consultant* shall retain a reasonable amount for the value of the as-built drawings not presented for review.

5.2.8 Prior to each application for payment, the *Contractor* and the *Consultant* shall jointly review the progress of the *Work*.

GC 5.3 PROGRESS PAYMENT

5.3.1.2 In the first sentence amend as follows: After the words "issue to the *Owner*" delete "and copy to the *Contractor*". After the words "after the receipt of the" add "complete".

5.3.1.3 Delete subparagraph 5.3.1.3 in its entirety and substitute as follows:

the *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT no later than 30 calendar days after the date of a complete certificate of payment is issued by the *Consultant*

Add new paragraphs 5.3.2 and 5.3.3 as follows:

5.3.2 If the *Contractor* fails to provide all documentation as required by GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT, the *Contractor* or *Owner* shall be entitled to return the application for progress payment to the *Contractor* for

completion. The 10 day review period by the *Consultant* and 30 day payment period by the *Owner* will commence upon receipt of a complete application for progress payment.

- 5.3.3 Payment will be mailed to the *Contractor*. The payment date shall be the date the cheque is mailed. Delay resulting from mail shall not be used in calculating payment date.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

- 5.4.2 Delete paragraph 5.4.2 in its entirety and substitute the following:

The *Consultant* will review the *Work* to verify the validity of the application and shall promptly, and in any event, no later than 30 calendar days after receipt of the *Contractor's* complete deficiency list and application, the *Consultant* shall:

.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 is defined in GC 5.10 – DEFICIENCY HOLDBACK. The final deficiency list complete with values is to be included with the *Consultant's* draft verification and shall be reviewed with the *Owner* prior to 5.4.2.2.

.2 having completed 5.4.2.1, the *Consultant* shall:

.1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or

.2 state the date of *Substantial Performance of the Work* in a certificate and issue a copy of that certificate to each the *Owner* and the *Contractor*.

- 5.4.3 Delete paragraph 5.4.3 in its entirety and substitute the following:

Following the issuance of the certificate of *Substantial Performance of the Work*, the following shall apply to completing the *Work*:

.1 *Contractor* is to complete the *Work* within sixty (60) calendar days.

.2 No payments will be processed between *Substantial Performance of the Work* and the completion of the *Work*.

.3 The *Owner* reserves the right to contract out any or all unfinished *Work* if it has not been completed within sixty (60) days of *Substantial Performance of the Work* without prejudice to any other right or remedy and without affecting the warranty period. The cost of completing the *Work* shall be deducted from the *Contract Price*.

Add new paragraphs 5.4.4, 5.4.5 and 5.4.6:

- 5.4.4 Within the time prescribed by the construction/builder's lien legislation in force at the *Place of the Work*, or where there is no legislation or no time prescribed, within a reasonable time of receiving a copy of the certificate of *Substantial Performance of the Work* signed by the *Consultant*, the *Contractor* shall take whatever steps are required to publish or post a signed copy of the certificate, as is required by such legislation. If the *Contractor* fails to comply with this provision, the *Owner* may take the required steps pursuant to the legislation and charge the *Contractor* for any costs so incurred.

- 5.4.5 Prior to submitting its written application for *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* all:

- .1 guarantees;
- .2 warranties;
- .3 certificates;
- .4 final testing and balancing reports;
- .5 distribution system diagrams;
- .6 spare parts;
- .7 maintenance manuals;
- .8 samples;
- .9 reports and correspondence from authorities having jurisdiction in the *Place of the Work*;
- .10 shop drawings;
- .11 inspection certificates;
- .12 marked-up record or as-built drawings from the construction trailer.

and other materials or documentation required to be submitted under the *Contract*, together with written proof acceptable to the *Owner* and the *Consultant* that the *Work* has been substantially performed in conformance with the requirements of municipal, governmental, and utility authorities having jurisdiction in the *Place of the Work*. The *Consultant* shall refuse to certify *Substantial Performance of the Work* if the submittals referred to in this paragraph 5.4.5 are not provided by the *Contractor*.

- 5.4.6 The *Contractor* shall submit full and complete digital record or as-built drawings to the *Consultant* within forty-five (45) days of the issuance of the certificate of *Substantial Performance of the Work* and the *Owner* shall be at liberty to withhold, from amounts otherwise payable to the *Contractor*, an amount not to exceed one (1) percent of the *Contract Price* as security for the obligation of the *Contractor* to deliver such digital record or as built drawings.

GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

- 5.5.1.1. Add to end of sentence “, and the application by the *Contractor* shall be accompanied by:

- .1 a certificate, issued by an agency or firm providing workers' compensation insurance to the *Contractor*, verifying that coverage is in force at the time of making application for payment, and that coverage will remain in force for at least sixty (60) days thereafter; and,
- .2 a declaration by the *Contractor*, in a form approved by the *Consultant*, verifying performance of the *Work* in compliance with all applicable regulatory requirements respecting environmental protection, fire safety, public safety and occupational health and safety.

Add new subparagraph 5.5.1.3 as follows

- 5.5.1.3 submit a statement that no written notices of liens have been received by it

- 5.5.2 Amend paragraph 5.5.2 by adding the following sentence to the end of that paragraph:

A reserve fund may be retained by the *Owner* to secure the correction of deficiencies and/or warranty claims. Included in the reserve fund would be all *Consultant* and *Owner* costs related to the correction of deficiencies and/or warranty claims.

- 5.5.3 Delete paragraph 5.5.3 in its entirety.

- 5.5.5 Delete paragraph 5.5.5 in its entirety.

GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

Delete GC 5.6 in its entirety.

GC 5.7 FINAL PAYMENT

- 5.7.1 Delete paragraph 5.7.1 in its entirety and substitute as follows:

When the *Contractor* considers that the *Work* is completed, as defined in the lien legislation applicable to the *Place of the Work* or if such definition does not exist, in accordance with other applicable legislation, industry practice or provisions which may be agreed to between the parties, the *Contractor* shall submit an application for final payment. The *Contractor's* application for final payment shall be accompanied by any documents or materials not yet delivered pursuant to paragraph 5.4.5, together with complete and final as-built drawings and:

- .1 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;
- .2 a Statutory Declaration CCDC 9A-2001;

.3 the evidence of workers' compensation compliance required by GC 10.4.1.

The *Work* shall be deemed not to be completed until all of the aforementioned documents have been delivered, and the *Owner* may withhold payment in respect of the delivery of any documents in an amount determined by the *Consultant* in accordance with the provisions of GC 5.8 - WITHHOLDING OF PAYMENT.

5.7.2 Delete from the first line of paragraph 5.7.2 the words, "calendar days" and substitute the words "*Working Days*".

5.7.4 Delete from the second line of paragraph 5.7.4 the words, " 5 calendar days after the issuance" and substitute the words "30 calendar days after receipt of".

GC 5.8 WITHHOLDING OF PAYMENT

Delete paragraph 5.8.1 and replace with the following:

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

GC 5.10 DEFICIENCY HOLDBACK

Add a new General Condition 5.10 as follows:

5.10.1 Notwithstanding any provisions contained in the *Contract Documents* concerning certification and release of monies to the *Contractor*, the *Owner* reserves the right to establish a deficiency holdback, at the time of the review for *Substantial Performance*, based on a 200% dollar value of the deficiencies listed by the *Consultant*. The value of work outstanding for the calculation of *Substantial Performance of the Work* under the *Construction Lien Act* (Ontario) shall utilize this 200% dollar value. No individual deficiency will be valued at less than two hundred dollars (\$200.00). The *Owner* shall retain the entire deficiency holdback amount until completion of all of the deficiencies listed by the *Consultant* to the satisfaction of the *Consultant*.

GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

Add 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 *Contractor* agrees that changes resulting from construction coordination, including but not limited to, site surface conditions, site coordination, and *Subcontractor and Supplier* coordination are included in the *Contract Price* and the *Contractor* shall be precluded from making any claim for a change in the *Contract Price* as a result of such changes.

6.1.4 Labour costs shall be actual, prevailing rates at the *Place of the Work* paid to workers, plus statutory charges on labour including WSIB, unemployment insurance, Canada pension, vacation pay, hospitalization and medical insurance. The *Contractor* shall provide these rates, when requested by the *Consultant*, for review and/or agreement.

6.1.5 Quotations for changes to the *Work* shall be accompanied by itemized breakdowns together with detailed, substantiating quotations or cost vouchers from *Subcontractors* and *Suppliers*, submitted in a format acceptable to the *Consultant* and including any costs associated with extensions in *Contract Time*.

6.1.6 When both additions and deletions covering related *Work* or substitutions are involved in a change to the *Work*, payment, including *Overhead* and profit, shall be calculated on the basis of the net difference, if any, with respect to that change in the *Work*.

- 6.1.7 No extension to the *Contract Time* shall be granted for changes in the *Work* unless the *Contractor* can clearly demonstrate that such changes significantly alter the overall construction schedule submitted at the commencement of the *Work*. Extensions of *Contract Time* and all associated costs, if approved pursuant to GC 3.4.2, are to be included in the relevant *Change Order*.
- 6.1.8 When a change in the *Work* is proposed or required, the *Contractor* shall within 10 calendar days submit to the *Consultant* for review a claim for a change in *Contract Price* and/or *Contract Time*. Should 10 calendar days be insufficient to prepare the submission, the *Contractor* shall within 5 calendar days, advise the *Consultant* in writing of the proposed date of submission of the claim. Claims submitted after the dates prescribed herein will not be considered.

GC 6.2 CHANGE ORDER

- 6.2.1 Add after the last sentence in the paragraph:

The adjustment in the *Contract Time* and the *Contract Price* shall include an adjustment, if any, for delay or for the impact that the change in the *Work* has on the *Work* of the *Contractor*, and once such adjustment is made, the *Contractor* shall be precluded from making any further claims for delay or impact with respect to the change in the *Work*.

Add new paragraph 6.2.3 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 *Consultant*.
- .1 by estimate and acceptance of a lump sum;
 - .2 by negotiated unit prices which include the *Contractor's Overhead* and profit, or;
 - .3 by the actual cost to the *Owner*, 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 for *Change Orders* with a value of \$0 to \$15,000 the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 10% and the total *Contractor* mark-up including *Overhead* and profit shall be 5%.
 - .2 For *Change Orders* in excess of \$15,000, the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 5% and the total *Contractor* mark-up including *Overhead* and profit shall be 3%.

Add new paragraph 6.2.4 as follows:

- 6.2.4 All quotations will 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 *Subcontractor* quotations submitted listing items 1 to 4 above and item 6 below.
 - .6 mark-up

Add new paragraph 6.2.5 as follows:

- 6.2.5 The *Owner* and the *Consultant* will not be responsible for delays to the *Work* resulting from late, incomplete or inadequately broken down valuations submitted by the *Contractor*.

GC 6.3 CHANGE DIRECTIVE

6.3.6.1 Amend paragraph 6.3.6.1 by deleting the final period and adding as follows:

.1 Ten percent (10%) for profit plus five percent (5%) for overhead on work by the *Contractor's* own forces up to the value of \$15,000 and five percent (5%) for profit plus three percent (3%) for *Overhead* on work by the *Contractor's* own forces in excess of \$15,000 and,

.2 Ten percent (10%) fee on amounts paid to *Subcontractors* or *Suppliers* 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 *Subcontractor's* or *Supplier's* price has been approved by the *Owner*, the *Subcontractor* or *Supplier* shall be entitled to its actual net cost as determined in accordance with paragraph 6.3.7, plus ten percent (10%) for profit and five percent (5%) for *Overhead* on such actual net cost for changes in the *Work*, 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 *Work* in excess of \$15,000.

6.3.6.2 Delete paragraph 6.3.6.2 and replace it with the following:

If a change in the *Work* results in a net decrease in the *Contract Price* in excess of \$15,000 the amount of the credit shall be the net cost, with deduction for *Overhead* and profit. If a change in the *Work* results in a net decrease in the *Contract Price* of \$15,000 or less, the amount of the credit shall be the net cost, without deduction for *Overhead* or profit.

6.3.7.1 In subparagraph 6.3.7.1 insert "while directly engaged in the work attributable to the change" after the words "in the direct employ of the *Contractor*".

6.3.7 At the end of paragraph 6.3.7 add the following:

All other costs attributable to the change in the *Work* including the costs of all administrative or supervisory personnel are included in *Overhead* and profit calculated in accordance with the provisions of paragraph 6.1.5 of GC6.1 – OWNER'S RIGHT TO MAKE CHANGES.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

6.4.1 Delete paragraph 6.4.1 and replace with the following:

6.4.1.1 Prior to the submission of the bid on which the *Contract* was awarded, the *Contractor* confirms that it carefully investigated the *Place of the Work* 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.

6.4.1.2 The *Contractor* is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the *Work* which could make the work more expensive or more difficult to perform than was contemplated at the time the *Contract* was executed. No claim by the *Contractor* will be considered by the *Owner* or the *Consultant* in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*.

6.4.2 Amend paragraph 6.4.2 by adding a new first sentence as follows:

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

Amend the existing second sentence of paragraph 6.4.2 in the second line, following the word "materially" by adding the words "or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1,"

6.4.3 Delete paragraph 6.4.3 in its entirety and substitute the following:

If the *Consultant* makes a finding pursuant to paragraph 6.4.2 that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* shall report in writing the reasons for this finding to the *Owner* and the *Contractor*.

Add new paragraph 6.4.5 as follows:

6.4.5 No claims for additional compensation or for an extension of *Contract Time* shall be allowed if the *Contractor* fails to give *Notice in Writing* to the *Owner* or *Consultant*, as required by paragraph 6.4.2.

GC 6.5 DELAYS

6.5.1 Delete the words after the word "for" in the fourth line of paragraph 6.5.1, and add the words "...reasonable direct costs 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)."

6.5.2 Delete the words after the word "for" in the fourth line of paragraph 6.5.2, and add the words "...reasonable direct costs 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)."

6.5.3 Delete paragraph 6.5.3 in its entirety and replace with the following:

If the *Contractor* is delayed in the performance of the *Work* by *Force Majeure*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from the actions of the *Owner*.

Delete paragraph 6.5.4 in its entirety and replace with the following:

6.5.4 No extension or compensation shall be made for delay or impact on the *Work* unless notice in writing of a claim is given to the *Consultant* not later than ten (10) *Working Days* after the commencement of the delays or impact on the *Work*, provided however, that, in the case of a continuing cause of delay or impact on the *Work*, only one notice of claim shall be necessary.

Add new paragraphs 6.5.6, 6.5.7 and 6.5.8 as follows:

6.5.6 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone directly or indirectly employed or engaged by the *Contractor*, or by any cause within the *Contractor's* control, then the *Contract Time* may be extended for such reasonable time as the *Owner* may decide in consultation with the *Consultant* and the *Contractor*. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including, but not limited to, the cost of all additional services required by the *Owner* from the *Consultant* or any sub-consultants, project managers, or others employed or engaged by the *Owner*, and in particular, the costs of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein, as the same may be extended through the provision of these General Conditions, and any later or actual date of *Substantial Performance of the Work* achieved by the *Contractor*.

6.5.7 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS or GC 9.4 – CONSTRUCTION SAFETY, the *Owner* or *Consultant* may, by notice in writing, direct the *Contractor* to stop the *Work* where the *Owner* or *Consultant* determines that there is an imminent risk to the safety of persons or property at the *Place of the Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contract Time* or the reimbursement of the *Contractor's* costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.

6.5.8 No claim for delay shall be made and the *Contract Time* shall not be extended due to climatic conditions or arising from the *Contractor's* efforts to maintain the *Contract* schedule.

GC 6.6 CLAIMS FOR A CHANGE IN THE CONTRACT PRICE

Delete GC 6.6 in its entirety.

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

Revise the heading to read "**OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT**"

Delete paragraph 7.1.2 and replace with the following:

- 7.1.2 If the *Contractor* should neglect to prosecute the *Work* properly, fails or neglects to maintain the latest schedule provided pursuant to GC 3.5, or otherwise fails to comply with the requirements of the *Contract*, and if the *Consultant* has given a written statement to the *Contractor* that sufficient cause exists to justify such action, the *Owner* may notify the *Contractor*, in writing, that the *Contractor* is in default of the *Contractor's* contractual obligations and instruct the *Contractor* to correct the default in the five (5) *Working Days* immediately following the receipt of such notice.

Add a new subparagraph 7.1.3.4 as follows:

- 7.1.3.4 An "acceptable schedule" as referred to in subparagraph 7.1.3.2. means a schedule approved by the *Consultant* and the *Owner* wherein the default can be corrected within the balance of the *Contract Time* and shall not cause delay to any other aspect of the *Work* or the work of other contractors, and in no event shall it be deemed to give a right to extend the *Contract Time*.

- 7.1.4.1 Delete sentence and replace with the following:

Correct such default and deduct the cost, including *Owner's* expenses, thereof from any payment then or thereafter due the *Contractor*.

- 7.1.5.3 In subparagraph 7.1.5.3 delete the words: "however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference;"

Delete paragraph 7.1.6 in its entirety and add 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 Contract set out herein, the *Owner* may terminate this *Contract* at any time for any other reason and without cause upon giving the *Contractor* fifteen (15) *Working Days Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*, but in no event shall the *Contractor* be entitled to be compensated for any loss of profit on unperformed portions of the *Work*, or indirect, special, or consequential damages incurred.
- 7.1.7 The *Owner* may suspend *Work* under this *Contract* at any time for any reason and without cause upon giving the *Contractor Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* 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 *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the suspension of the *Work*, but in no event shall the *Contractor* 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 *Contract* 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 *Contract* or a suspension of the *Work* under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK, OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall use its best commercial efforts to mitigate the financial consequences to the *Owner* arising out of the termination or suspension, as the case may be.
- 7.1.9 Upon the resumption of the *Work* following a suspension under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* will endeavour to minimize the delay and financial consequences arising out of the suspension.
- 7.1.10 The *Contractor's* obligations under the *Contract* as to quality, correction, and warranty of the *Work* performed by the *Contractor* up to the time of termination or suspension shall continue after such termination of the *Contract* or suspension of the *Work*.

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

- 7.2.2 Delete paragraph 7.2.2 in its entirety.
- 7.2.3.1 Delete subparagraph 7.2.3.1 in its entirety.
- 7.2.3.2 Delete subparagraph 7.2.3.2 in its entirety
- 7.2.3.3 Delete subparagraph 7.2.3.3 in its entirety.
- 7.2.3.4 In subparagraph 7.2.3.4, delete the words "except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER".

Renumber paragraph 7.2.5 as paragraph 7.2.6. Add a new paragraph 7.2.5 as follows:

- 7.2.5 If the default cannot be corrected within the 5 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it:
- .1 commences correction of the default within the specified time;
 - .2 provides the *Contractor* with an acceptable schedule for such correction; and,
 - .3 completes the correction in accordance with such schedule.

Delete paragraph 7.2.6 entirely and replace with the following:

- 7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination, as determined by the *Consultant*. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization and losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any recovery for any special, indirect or consequential losses, including loss of profit.

Add new paragraphs 7.2.7, 7.2.8 and 7.2.9 as follows

- 7.2.7 The *Contractor* shall not be entitled to give notice of the *Owner's* default or terminate the *Contract* in the event the *Owner* withholds certificates or payment or both in accordance with the *Contract* because of:
- (a) the *Contractor's* failure to pay all legitimate claims promptly, or

- (b) the failure of the *Contractor* to discharge construction liens which are registered against the title to the *Place of the Work*.

7.2.8 The *Contractor's* obligations under the *Contract* as to quality, correction and warranty of the *Work* performed by the *Contractor* up to the effective date of termination shall continue in force and shall survive termination by the *Contractor* in accordance with paragraph 7.2.4.

7.2.9 If the *Contractor* suspends the *Work* or terminates the *Contract* as provided for in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall ensure the site and the *Work* are left in a safe, secure condition as required by authorities having jurisdiction at the *Place of the Work* and the *Contract Documents*.

GC 8.1 AUTHORITY OF THE CONSULTANT

8.1.2 Amend paragraph 8.1.2 by deleting "paragraph 8.1.3 and"

8.1.3 Delete entire paragraph

GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION

8.2.1 Amend paragraph 8.2.1 by changing part of the second line from "shall appoint a *Project Mediator*" to "may appoint a *Project Mediator*, except that such an appointment shall only be made if both the *Owner* and the *Contractor* agree."

8.2.4 Amend paragraph 8.2.4 by changing part of the second line from "the parties shall request the *Project Mediator*" to "and subject to paragraph 8.2.1 the parties may request the *Project Mediator*".

Delete paragraphs 8.2.6, 8.2.7 and 8.2.8 in their entirety.

Add 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 *Contractor* and the *Owner* agree. If the *Contractor* and the *Owner* agree to resolve the dispute by arbitration, the arbitration shall be conducted in the jurisdiction of the *Place of the Work*.

GC 9.1 PROTECTION OF WORK AND PROPERTY

Delete subparagraph 9.1.1.1 in its entirety and substitute the following:

9.1.1.1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in paragraph 3.14.1;

Delete paragraph 9.1.2 in its entirety and substitute as follows:

9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground or hidden utilities and structures indicated in or inferable from the *Contract Documents*, or that are inferable from an inspection of the *Place of the Work* exercising the degree of care and skill described in paragraph 3.14.1.

Add 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 *Contractor* 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 *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. Where, however, there is danger to life, the environment, or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger.

GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

Add a new subparagraph 9.2.5.5 as follows:

9.2.5.5 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.

9.2.6 Add 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 *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others,...

9.2.8 Add 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 *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others,...

Add new paragraphs 9.2.10 and 9.2.11 as follows:

9.2.10 The *Contractor*, *Subcontractors* and *Suppliers* shall not bring on to the *Place of the Work* any toxic or hazardous substances and materials except as required in order to perform the *Work*. 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 *Place of the Work*.

9.2.11 The *Contractor* shall indemnify and hold harmless the *Owner*, its parent, subsidiaries and affiliates, the *Consultant* and their respective partners, officers, directors, agents and employees from and against any and all liabilities, costs, expenses, and claims resulting from bodily injury, including death, and damage to property of any person, corporation or other body politic, that arises from the use by the *Contractor*, *Subcontractors* and *Suppliers* of any toxic or hazardous substances or materials at the *Place of the Work*.

GC 9.4 CONSTRUCTION SAFETY

Delete paragraph 9.4.1 in its entirety and substitute as follows:

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

Add new paragraphs 9.4.2 to 9.4.10 as follows:

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

- .1 the evidence of workers' compensation compliance required by GC 10.4.1;
- .2 copies of the *Contractor's* insurance policies having application to the *Project* or certificates of insurance, at the option of the *Owner*;
- .3 documentation setting out the *Contractor's* in-house safety programs;

- .4 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 *Place of the Work*.
- 9.4.3 The *Contractor* shall indemnify and save harmless the *Owner*, 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 *Contractor* under the occupational health and safety legislation in force at the *Place of the Work* including the payment of legal fees and disbursements on a substantial indemnity basis.
- 9.4.4 The *Owner* 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 *Contractor* with respect to occupational health and safety and related matters.
- 9.4.5 If the *Owner* is of the reasonable opinion that the *Contractor* has not taken such precautions as are necessary to ensure compliance with the requirements of paragraph 9.4.1, the *Owner* may take any remedial measures which it deems necessary, including stopping the performance of all or any portion of the *Work*, and the *Owner* may use its employees, the *Contractor*, any *Subcontractor* or any other contractors to perform such remedial measures.
- 9.4.6 The *Contractor* shall file any notices or any similar document required pursuant to the *Contract* or the safety regulations in force at the *Place of the Work*. This duty of the *Contractor* will be considered to be included in the *Work* and no separate payment therefore will be made to the *Contractor*.
- 9.4.7 Unless otherwise provided in the *Contract Documents*, the *Contractor* shall develop, maintain and supervise for the duration of the *Work* 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 *Owner* and any workers' compensation or occupational health and safety statutes or regulations in force at the *Place of the Work*.
- 9.4.8 The *Contractor* shall provide a copy of the safety program described in paragraph 9.4.7 hereof to the *Consultant* for delivery to the *Owner* prior to the commencement of the *Work*, and shall, ensure, as far as it is reasonably practical to do so, that every employer and worker performing work in respect of the *Project* complies with such program.
- 9.4.9 The *Contractor* 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 *Place of the Work*, 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 *Contractor* shall promptly report in writing to the *Owner* and the *Consultant* all accidents of any sort arising out of or in connection with the performance of the *Work*, 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 *Contractor* to the *Owner* and the *Consultant* by telephone or messenger in addition to any reporting required under the applicable safety regulations.

GC 9.5 MOULD

Delete subparagraph 9.5.3.3 and replace with the following:

- 9.5.3.3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the *Owner*. If, in the opinion of the *Consultant*, the *Contractor* has been delayed in performing the *Work* and/or has incurred additional costs under paragraph 9.5.1.2, the *Owner* shall reimburse the *Contractor* for the reasonable costs incurred as a result of the delay and as a result of taking those steps, and

GC 10.1 TAXES AND DUTIES

- 10.1.2 Amend paragraph 10.1.2 by adding the following sentence to the end of the paragraph:

For greater certainty, the *Contractor* shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the *Owner* shall not be entitled to any credit relating to mark-up for overhead or profit on any decrease in such taxes. The *Contractor* shall provide a detailed breakdown of additional taxes if requested by the *Owner* in a form satisfactory to the *Owner*.

Add new paragraph 10.1.3 as follows:

- 10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist with the application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

- 10.2.5 Amend paragraph 10.2.5 by addition the words "Subject to paragraph 3.4" at the beginning of the paragraph. Add the following to the end of the second sentence:

...and no further *Work* on the affected components of the *Contract* shall proceed until these directives have been obtained by the *Contractor* from the *Consultant*.

- 10.2.6 Amend paragraph 10.2.6 by adding the following sentence to the end of the paragraph:

In the event the *Owner* suffers loss or damage as a result of the *Contractor's* failure to comply with paragraph 10.2.5 and notwithstanding any limitations described in paragraph 12.1.1, the *Contractor* agrees to indemnify and to hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions suits or proceedings resulting from such failure by the *Contractor*.

Add new paragraph 10.2.8 as follows:

- 10.2.8 The *Contractor* shall furnish all certificates that are required or given by the appropriate governmental authorities as evidence that the *Work* as installed conforms with the laws and regulations of authorities having jurisdiction, including certificates of compliance for the *Owner's* occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the *Work*, in the event that such governmental authorities furnish such certificates.

GC 10.4 WORKERS' COMPENSATION

- 10.4.1 Delete paragraph 10.4.1 and replace with the following:

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

GC 11.1 INSURANCE

Delete entirety of general condition and CCDC 41 and replace with the following:

- 11.1** Without restricting the generality of GC 12 – INDEMNIFICATION, the *Contractor* 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 *Work* until the expiration of the warranty periods set out in the *Contract Documents*. Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* 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 amending endorsements.

.1 General Liability Insurance

General liability insurance shall be in the name of the *Contractor*, with the *Owner* and the *Consultant* named as additional insureds, with limits of not less than \$5,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property, including loss of use thereof, for itself and each of its employees, *Subcontractors* and/or agents. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent replacement, 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 *Substantial Performance of the Work*, as set out in the certificate of *Substantial Performance of the Work*, on an ongoing basis for a period of 6 years following *Substantial Performance of the Work*. Where the *Contractor* maintains a single, blanket policy, the addition of the *Owner* and the *Consultant* is limited to liability arising out of the *Project* and all operations necessary or incidental thereto. The policy shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation and of change or amendment 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 *owned* or leased by the *Contractor*, and endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation, change or amendment restricting coverage. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.

.3 Aircraft and Watercraft Liability Insurance [NTD: This can come out if N/A]

Where determined necessary by the *Contractor*, 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 *Work*, including use of additional 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 *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage.

.4 Property and Boiler and Machinery Insurance

(1) Builder's Risk property insurance shall be in the name of the *Contractor* with the *Owner* and the *Consultant* named as additional 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 *Work*, whether owned by the *Contractor* or the owner or owned by others, so long as the property forms part of the *Work*. 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 replacement provided that the IBC Form 4042 shall include the latest addition 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 *Contractor*, with the *Owner* and the *Consultant* named as additional insureds, for not less than the replacement value of the boilers, pressure vessels and other insurable objects forming part of the *Work*. 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 *Work*.

(4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. The *Contractor* shall act on behalf of the *Owner* 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 *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of the *Contract Time*, relative to the extent of the loss or damage, as determined by the *Owner*, in its sole discretion.

(5) The *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount at which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. In addition, the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor's* interest in the restoration of the *Work*.

(6) In the case of loss or damage to the *Work* arising from the work of other contractors, or the *Owner's* own forces, the *Owner*, in accordance with the *Owner's* obligations under paragraph 3.2.2.4 of GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, shall pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* 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 *Contractor* for the performance of the *Work*, excluding boiler insurance, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance of his equipment, the *Owner* agrees to waive the equipment insurance requirement.

11.1.2 The *Contractor* shall be responsible for deductible amounts under the policies except where such amounts may be excluded from the *Contractor's* 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 *Work* is substantially less than the *Contract Price*, the *Owner* may reduce the amount of insurance required to waive the course of construction insurance requirement.

11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and provide evidence of same to the *Contractor*. The *Contractor* shall pay the costs thereof to the *Owner* on demand, or the *Owner* may deduct the amount that is due or may become due to the *Contractor*.

11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*.

GC 11.2 CONTRACT SECURITY

11.2.2 Delete paragraph after the word "provided" and replace with the following:

Such bonds shall be issued by a duly licensed surety company, which has been approved by the *Owner*, authorized to transact a business of suretyship in the province or territory of the *Place of the Work* and shall be maintained in good

standing until the fulfillment of the *Contract*, including all warranty and maintenance periods set out in the *Contract Documents*.

Add 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 *Contractor's* obligations in the *Contract Document* and, wherever a performance bond is provided with language which conflicts with this intention, it shall be deemed to be amended to comply. The *Contractor* represents and warrants to the *Owner* that it has provided its surety with a copy of the *Contract Documents* prior to the issuance of such bonds.

GC 12.1 INDEMNIFICATION

Delete General Condition 12.1 – INDEMNIFICATION in its entirety and substitute as follows:

- 12.1.1 The *Contractor* shall indemnify and hold harmless the *Owner*, its parent, subsidiaries and affiliates, the *Consultant* and their respective partners, trustees, officers, directors, agents and employees 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 *Owner* 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 *Contractor*, its employees, agents, *Subcontractors*, *Suppliers* 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 *Work*, the *Owner's* property or equipment, the *Contractor's* property or equipment or equipment or property adjacent to the *Place of the Work* or death or injury to the *Contractor's* personnel).
- 12.1.2 The provisions of GC 12.1 - INDEMNIFICATION shall survive the termination of the *Contract*, 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 *Work* shall constitute a waiver or release of any of the provisions of GC 12.1.

GC 12.2 WAIVER OF CLAIMS

- 12.2.1 In the fourth line, add the words "claims for delay pursuant to GC 6.5 DELAYS" after the word "limitation". Add the words "(collectively "Claims")" after "*Substantial Performance of the Work*" in the sixth line.
- 12.2.1.1 Change the word "claims" to "Claims" and change the word "claim" to "Claim".
- 12.2.1.2 Change the word "claims" to "Claims".
- 12.2.1.3 Delete paragraph in its entirety.
- 12.2.1.4 Change the word "claims" to "Claims".
- 12.2.2 Change the words "in paragraphs 12.2.1.2 and 12.2.1.3" to "in paragraph 12.2.1.2". Change the word "claims" to "Claims" in both instances and change the word "claim" to "Claim".
- 12.2.3 Delete paragraph in its entirety.
- 12.2.4 Delete paragraph in its entirety.
- 12.2.5 Delete paragraph in its entirety.
- 12.2.6 Change the word "claim" to "Claim" in all instances in the paragraph.
- 12.2.7 Change "The party" to "The *Contractor*". Change the word "claim" to "Claim" in all instances in the paragraph.
- 12.2.8 Change "under paragraphs 12.2.1 or 12.2.3" to "under paragraph 12.2.1". Change both instances of the words "the party" to "the *Contractor*". Change the word "claim" to "Claim" in all instances in the paragraph.

12.2.9 Delete paragraph 12.2.9 in its entirety.

12.2.10 Delete paragraph 12.2.10 in its entirety.

GC 12.3 WARRANTY

12.3.2 Delete from the first line of paragraph 12.3.2 the word, "The" and substitute the words "Subject to paragraph 3.4.1, the..."

Add new paragraphs 12.3.7 to 12.3.12 as follows:

12.3.7 Where required by the *Contract Documents*, the *Contractor* shall provide a maintenance bond as security for the performance of the *Contractor's* obligations as set out in GC 12.3 WARRANTY.

12.3.8 The *Contractor* shall provide fully and properly completed and signed copies of all warranties and guarantees required by the *Contract Documents*, containing:

- .1 the proper name of the *Owner*;
- .2 the proper name and address of the *Project*;
- .3 the date the warranty commences, which shall be at the "date of *Substantial Performance of the Work*" unless otherwise agreed upon by the *Consultant* in writing.
- .4 a clear definition of what is being warranted and/or guaranteed as required by the *Contract Documents*; and
- .5 the signature and seal (if required by the governing law of the *Contract*) of the company issuing the warranty, countersigned by the *Contractor*.

12.3.9 Should any *Work* 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 *Contractor* shall ensure that its *Subcontractors* are bound to the requirements of GC 12.3 – WARRANTY for the *Subcontractor's* portion of the *Work*.

12.3.11 The *Contractor* shall ensure that all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor*, *Supplier* or other person in connection with the *Work* are obtained and available for the direct benefit of the *Owner*. In the alternative, the *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor*, *Supplier* or other person in connection with the *Work* 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 *Owner* under the *Contract Documents*.

12.3.12 The *Contractor* shall commence or correct any deficiency within 2 Working Days after receiving a notice from the *Owner* or the *Consultant*, and shall complete the *Work* 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 *Owner* 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 *Contractor* fail to provide this emergency service within 8 hours of a request being made during the normal business hours of the *Contractor*, the *Owner* is authorized, notwithstanding GC 3.1, to carry out all necessary repairs or replacements at the *Contractor's* expense.

PART 13 OTHER PROVISIONS

Add new Part 13 OTHER PROVISIONS as follows:

GC 13.1 OWNERSHIP OF MATERIALS

13.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be

the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*.

GC 13.2 CONSTRUCTION LIENS

- 13.2.1 In the event that a claim for lien is registered against the *Project* by a *Subcontractor*, *Sub-subcontractor* or *Supplier*, and provided the *Owner* has paid all amounts properly owing under the *Contract*, the *Contractor* shall, at its own expense:
- .1 within 10 calendar days, ensure that any and all claims for lien and certificates of action are discharged, released, or vacated by the posting of security or otherwise; and
 - .2 in the case of written notices of lien, ensure that such notices are withdrawn, in writing.
- 13.2.2 In the event that the *Contractor* fails to conform with the requirements of paragraph 13.2.1, the *Owner* may fulfil those requirements without *Notice in Writing* to the *Contractor* and set off and deduct from any amount owing to the *Contractor*, all costs and associated expenses, including the costs of posting security and all legal fees and disbursements associated with discharging or vacating the claim for lien or certificate of action and defending the action. If there is no amount owing by the *Owner* to the *Contractor*, then the *Contractor* shall reimburse the *Owner* for all of the said costs and associated expenses.
- 13.2.3 Notwithstanding any other provision in the *Contract*, the *Consultant* shall not be obligated to issue a certificate and the *Owner* shall not be obligated to make payment to the *Contractor* if, at the time such certificate or payment was otherwise due:
- .1 a claim for lien has been registered against the *Project* lands, or
 - .2 if the *Owner* or mortgagee of the *Project* lands has received written notice of a lien.. or
 - .3 the *Owner* or *Consultant* reasonably believe that any party has purported to retain title to *Products* or materials in respect of which an application for payment has been made.
- 13.2.4 Without limiting the foregoing, the *Contractor* shall, if requested by the *Owner*, defend, indemnify and save the *Owner* harmless from the amount of all such claims and the costs of defending any and all actions commenced against the *Owner* pursuant to the construction/builder's lien legislation in force at the *Place of the Work*, including the legal costs of the *Owner*, unless the lien was a direct result of a breach of the *Contract* by the *Owner* or the non-payment by the *Owner* of a valid charge or claim under the *Contract*.
- 13.2.5 GC 13.2 – CONSTRUCTION LIENS does not apply to construction/builder's liens claimed by the *Contractor*.

END OF AMENDMENTS TO CCDC 2 - 2008

PART 1: GENERAL

1.1. GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions of the Contract CCDC 2,
 - .2 Section 00830, Supplementary Conditions CCDC 2,
 - .3 The Sections of Division 01.
- .2 These general requirements shall apply to every section of the work contained in these specifications, and shall apply to all contracts within this tender.
- .3 All tenders, quotes and proposals are subject to the Municipal Freedom of Information and Protection of Privacy Act and will be disclosed where the Board is required to do so for the purposes of complying with an Order of the Information and Privacy Commissioner.

1.2. CODES AND BYLAWS

- .1 2012 Ontario Building Code (Ont. Reg. 423/06) and By-laws of Municipality shall govern this work. Most stringent requirements indicated by above shall govern.
- .2 Where the by-law, code or official standard is quoted, it shall mean latest edition including all revisions or amendments in effect at time of submission of tenders.

PART 2: EXECUTION

2.1. SECURITY

- .1 Ensure that all construction areas are secured at all times and locked when no construction personnel are in attendance. Restrict access in construction areas to construction personnel only. Lock up construction tools when not in use.

2.2. SITE DIMENSIONS

- .1 Before proceeding with shop drawings, fabrication, or supply of each new part of the Work, examine installed parts of the Work and verify as-built site dimensions to coordinate previously built construction with pending construction.

2.3. SIGNS, ADVERTISING AND PUBLICATIONS

- .1 Do not erect or display devices, signs or advertisements of labour, materials or services provided to the Work unless authorized to do so, in writing, by the Owner. Signs relative to fire, danger and safety are exempted from this requirement.
- .2 Do not consent to advertising of the Work, of any kind, without the Owner's and the Consultant's written acceptance. Do not consent to mention of the Work in any advertising or articles in any publication relating to the Work without the acceptance of the copy and written permission from the Owner and the Consultant.

2.4. PARKING AND STORAGE

- .1 Parking is available to the contractor on site but shall be limited to the staging area indicated on the Drawings or as designated by the Architect or Owner only.
- .2 Adjacent Municipal property / roadways are not to be used for construction parking or materials storage.
- .3 Confine storage of materials and Contractors office to areas on Owner's property adjacent to the building and as indicated on the drawings.

2.5. PROCEDURE AND SUPPLY OF CRITICAL MATERIALS

- .1 Supply products in ample time to be installed into the Work together with templates, measurements and other information required for placement.

2.6. RESTRICTIONS

- .1 Restrict non-construction personnel from the construction site, except for Contractor-authorized visitors.

2.7. DAILY CONSTRUCTION CLEANING

- .1 At all times when the school is occupied by staff and/or students, the Contractor is to take extra care in the daily clean up of the site to ensure any possible hazards have been removed.
- .2 **Clean and tidy the Work areas daily.** Keep dust and dirt to a level acceptable to the Owner.
- .3 Remove rubbish and surplus materials promptly and dispose of in a legal manner. Do not allow scrap piles to accumulate.
- .4 Provide garbage bins for the disposal and removal of garbage.
- .5 Provide complete cleaning of each area of the building as construction activities are completed.

2.8. PERMITS

- .1 The Owner will pay for the building permit.
- .2 The contractor is responsible for obtaining the permit and notifying the authorities having jurisdiction for reviews throughout the project.
- .3 The contractor is responsible for obtaining all other permits.

2.9. SAFETY

- .1 Conform to and enforce strict compliance with Occupational Health & Safety Act, latest revised edition, including amendment call "Workplace Hazardous Materials Information Systems (WHMIS)" and including amendment called Bill 208 requiring creation of health and safety representatives/committee.
- .2 The Contractor shall observe all health and safety requirements including the following procedures, methods and responsibilities:
 - .1 The Contractor will take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property from any harm during the course of the contract.
 - .2 All work procedures will be in accordance with board and legislated standards.
 - .3 All equipment shall be in safe operating condition and appropriate to the task.
 - .4 The Contractor shall ensure that only competent personnel are permitted to work on site. The Owner will throughout the term of the contract also remove from the site any persons not observing or complying with safety requirements.
 - .5 The Contractor shall provide competent personnel to implement their safety program and ensure that the Owner's standards and those of the Ontario Health and Safety Act are being complied with.
 - .6 The Consultant will monitor every week to ensure that safety requirements are met and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the contract to be cancelled and the Contractor or subcontractors removed from the site.
 - .7 The Contractor will report to the Owner, Consultant and jurisdictional authorities any accident or incident involving Contractor, Board or public personnel and/or property arising from the Contractor's execution of the work.
 - .8 The Contractor shall ensure that every "controlled product" used at the work site shall meet the labelling requirements and have an updated corresponding material safety data sheet as per the Workplace Hazardous Materials Information System legislation. The

Contractor shall ensure that all the material safety data sheets are available at the work site.

.9 **Designated Substances and Asbestos:**

- .1 If the Contractor locates asbestos containing materials or a designated substance during the project then the Contractor shall cease work and seal the area and immediately contact the Consultant and School Board personnel.
- .2 The Contractor shall comply with all regulations relating to asbestos. The removal and disposal of asbestos shall be in accordance with the Ministry of Environment and Energy Regulation 347 and Ontario Ministry of Labour Occupational and Safety Act 838.

END OF SECTION

1. Work Site Location

- 1.1 Hours of operations for the construction in unoccupied areas may occur during the regular work week hours with the following exception, odor based construction activities such as but not limited to; painting, flooring adhesion, epoxy flooring, solvent based cleaning, sanitization etc shall be limited to Fridays from 4pm to Saturday at 12 midnight. (This allows for a 36 hour time period for off gassing.)
- 1.2 Operations of the Contractor in occupied areas may only occur from 4pm to 7am Monday to Friday and 4pm Friday to 7am Monday unless otherwise approved by the Facilities Services Dept.
- 1.3 Work during school business hours must be approved by the appropriate Board Authority and the School Principal / designate. All construction and maintenance activities shall be confined to the areas under construction. Fire exits shall be maintained at all times and physical barriers will be used to isolate the construction work from school and Board Office staff and students.
- 1.4 The contractor must co-operate and co-ordinate all construction activities, which may interfere with the school, with the school Principal / designate. All excessive noise related construction activities that would affect the occupants abilities to properly concentrate on school and work related activities is to be limited to 4pm to 8am daily.
- 1.5 It is the responsibility of the Contractor to clearly demark the work site borders and areas not to be used by usual occupants of the building or grounds. The Contractor must at all times erect and maintain adequate fencing or barriers around all excavations, pits, and in other places of danger.
- 1.6 The Contractor must be responsible for all sub-trades, including payment of the same, necessary to produce a complete installation.
- 1.7 Power and water may be available from the site where approved, but these facilities shall not be altered for the Contractor's use.
- 1.8 The Contractor shall obtain approval from the Facilities Services Dept. for location of temporary buildings, temporary office, storage sheds and workshops as required by the work throughout the period of construction. The contractor must remove temporary buildings upon completion of the work and restore the property to the condition as found on commencement of the work.
- 1.9 The Contractor and their employee(s) must be aware of the location of the building's Health & Safety Board containing the following information: Designated Substance Reports, MSDS Sheets and general Health & Safety information. The contractor must provide a First Aid Kit and the name of the Safety Representative and stretcher for use by contractor employees.

- 1.10 The Contractor must not use school property as an office, for the purpose of hiring staff or conducting business or personal affairs on any project.

2. Communication

- 2.1 The Site Supervisor and Principal / designate shall have communication meetings at the start of each day for the purpose to review the construction activities planned for that day.
- 2.2 The Facilities Services Dept. will follow-up with the Principal / designate regularly to review the communication between the Site Supervisor and the Principal / designate and to review construction activities.
- 2.3 The Principal / designate will communicate work activities to the school staff and students as required.
- 2.4 The Principal / designate is the single point of contact for reporting of Health and Safety incidences from staff. Upon receipt of notification of an incidence the Principal / designate shall perform an investigation with the School Health & Safety Representative. Following the investigation, the Principal / designate and the Health and Safety Representative will decide either to evacuate or relocate staff and students from the area of concern. Following this, the Principal / designate will report the findings to the contractor's site supervisor and the Facilities Services Dept. If the belief is that there is an immediate danger to the Health and Safety of staff and students the Principal / designate may direct the contractor's site supervisor to terminate construction activities until such time that all parties believe the workplace is safe. The reporting structure to the Board is as follows, the Principal / designate shall report directly to the Facilities Services Dept. who will in turn report the incidence to the Board's Health and Safety Officer. If the Facilities Services Dept. is not reachable the Principal / designate is to contact the Assistant to the Controller of Plant at extension 351. From this point the Facilities Services Dept. will be notified of the incidence.

3. School Use of Facilities

- 3.1 The school regular hours of operations are from 7am to 4pm Monday to Friday.
- 3.2 The school is encouraged to hold off any after hours use of facilities adjacent to the area of work until completion of the construction contract. That said it is understood that the school needs to continue to provide activities beyond the regular school day and thus after hours school use of facilities in the building will be permitted from Monday to Thursday. The school must be aware and accept that after hours use may be interrupted by construction activities.
- 3.3 The Principal / designate will communicate after hours use of facilities activities to the Contractor's site supervisor at the communication meetings described in 2.1 of Communication. It is anticipated that the Contractor will co-operate with the school to make the facilities available and safe for the use of extra curricular activities such as sports tournaments, school dances, school productions etc.

3.4 Staff are encouraged to work from home for after hours work until completion of the construction contract.

3.5 External Groups are not permitted to use the facilities after hours until completion of the construction contract.

4. Operation of Vehicles On Board Property

4.1 Prior written approval must be obtained from the School Principal / designate when bringing vehicles on to board property during schools hours. Trucks and all other vehicles shall proceed with caution with a maximum 10 k/ph on school property. All trucks must be equipped with automatic back-up alarms. If a back-up alarm is not available than a Flag person must be provided.

4.2 Trades persons vehicles must be parked in designated parking areas with signage to indicate "Contractor Parking Only". All trades personnel are to back their vehicles into the spaces.

5. Tools and Equipment

5.1 The Contractor's equipment/tools must be in safe working condition, including required guards on tools and equipment and grounding devices. Operating manuals and maintenance records shall be available on request for all powered equipment.

6. Material Storage

6.1 Contractor material and equipment must be stored in a safe manner in designated materials storage areas. These areas shall be protected at minimum with snow fencing sufficiently secured by metal posts.

6.2 Oxygen and acetylene cylinders must be chained in the vertical position or be secured on a welding cart designed for this purpose. If not on a cart, the cylinder regulator must be removed and the cylinder cap on. Full and empty tanks are to be stored in separate fenced areas and signage provided to indicate their presence.

6.3 Propane tanks that are not in use must not to be stored in school buildings. Propane cylinders shall not be changed indoors. Workers using propane must have Technical Standards Safety Authority (T.S.S.A.) Certification and provide proof to the Board upon request.

6.4 Open cans of varsol, thinners and other volatile products are not permitted in the building. For storage and dispensing restrictions refer to Item 8. "Flammable Liquids".

6.5 Paint cans must be sealed when not in use and stored in construction areas.

7. Natural Gas Piping

7.1 All work related to natural gas systems must be completed by a licensed gas fitter. This work may not occur while the building is occupied.

8. Flammable Liquids

- 8.1 Flammable liquids must be stored in appropriate ULC approved metal safety containers with a flame arrestor and spring-loaded cap. The contractor is responsible for the provision of proper storage containers and/or steel cabinet designed for that purpose. One day's supply of flammable liquid may be used without a steel flammable storage cabinet. However, dispensing containers for flammable liquids must be as described above and containers and dispensing equipment must be bonded and grounded. Dispensing must be done using mechanical ventilation or be done outdoors. Equipment and dispensing methods must confirm to CSA B376-M1980 and Ontario Regulation 213/851.

9. Controlled Products (WHMIS)

- 9.1 All controlled products must be WHMIS labeled before being brought onto Board property. Material Safety Data Sheets for all controlled products must be available on site. The contractors are responsible for training their employees in the safe use and handling of all controlled products and proof of training must be provided as part of the Pre-Qualification.

10. Safety Equipment

- 10.1 The contractors are responsible to ensure that all employees wear safety equipment, as required, to work in a safe manner. Contractors must ensure that their employees are trained in the use of this equipment.

11. Fire Safety

- 11.1 The contractor is responsible for providing fire extinguishers in the repair / renovation / construction areas and for ensuring that employees are trained in the use of extinguishers.
- 11.2 The following persons contact numbers shall be added to the school's Fire Plan – Emergency Contacts list; the contractor's Site Supervisor and the contractor's emergency line.

12. Cigarettes, Alcohol and Illegal Drugs

- 12.1 Smoking is not permitted on Board property. Consuming alcohol or illegal drugs on Board property is strictly prohibited. Persons appearing to be under the influence of alcohol or illegal drugs will be asked to leave the work site. The contractor must ensure that employees asked to leave are provided transportation home.

13. Housekeeping

- 13.1 Contractors must keep work site areas clean and tidy. Nails in lumber must be removed. Materials must be laid down and piled safely and garbage must be placed in proper waste containers.

- 13.2 The contractor must survey the site at the end of each day and remove any garbage that has not been removed as described in 13.1.

14. Ladders, Scaffolds, Swing Stages, Vertical Man-Lifts

- 14.1 The contractors are responsible for training their employees in inspecting, erecting, and using scaffolds, ladders, swing stages and vertical man-lifts. Ladders must extend 3 feet beyond the upper support. Ladders must be held by a worker on the ground or tied off if over 10 feet high. Formal training must be given to workers on the proper use of scaffolds, swing stages and vertical man-lifts if used on the job. Equipment operating manuals and the required Professional Engineering documents must be available on site and produced upon request.

15. Asbestos

- 15.1 Prior to commencement of any work affecting the structure of the building, the Contractor shall review the asbestos report for the building (available through the Facilities Services Dept.) The Contractor shall evaluate the potential presence of asbestos in the specific work zone. If asbestos is present, the Facilities Services Dept. shall be notified immediately, and no work is to proceed until any materials containing asbestos have been dealt with in accordance with the Board's Asbestos Management Program. The Board will establish the asbestos removal contractor as the need may arise. All work must be in compliance with the Board's Asbestos Management Program.

16. Permits and Regulations

- 16.1 The Contractor shall obtain any required permits and conform to any existing applicable codes, such as the Canadian Standards Association, Underwriter's Laboratories of Canada, Ontario Fire Code, Ontario Building Code, Ontario Electrical Code, Ministry of Labour, and all local Bylaws and any other applicable regulatory requirements.
- 16.2 The Contractor shall record all electrical work performed on a daily basis.

17. Injuries

- 17.1 Each Contractor or sub-contractor is responsible for responding to, providing treatment and transporting to medical services their injured employees. Response must include first aid to the injured person, hospital aid, securing the site and notification as required under the *Occupational Health and Safety Act*. Emergency Response Plans should be in place for all emergencies and pull stations used to clear the building if required. Someone on site must be certified in Standard Care First Aid. The School Principal / designate or the Facilities Services Dept. shall be notified of any emergency or worker injury.

18. Supervision and Responsibility

- 18.1 The Contractor shall supervise and direct the work of all persons engaged in the work, including sub-contractors and those who supply materials and the contractor will be fully responsible for full compliance with the terms of the contract by all such persons. All

construction shall be performed as specified and in a manner conforming to the best trade practices.

19. Defective Material and Workmanship

- 19.1 The Contractor shall promptly remove from the building all used materials and materials condemned by the Board, as failing to conform to the contract, whether incorporated in the work or not.

20. Cutting, Patching, Digging and Fitting

- 20.1 The Contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit to it, receive or be received by work of other contractors, shown upon or reasonably implied by the contract documents and he shall make good after them.. Any costs or expenses caused by poorly coordinated or ill-timed work shall be borne by the party responsible therefore.
- 20.2 The Contractor shall not endanger any existing work or building by cutting, digging or otherwise.
- 20.3 Any work requiring the use of welders, torches etc. requires a Hot Work Permit issued by the Board's Plant Services Dept. This permit shall be co-ordinated through the Facilities Services Dept.

21. Ventilation

- 21.1 Contractor to ensure that HVAC systems are run in occupied mode 24hrs per day 7 days a week until completion of the construction contract. Contractor to make all necessary arrangements for running of the HVAC systems through the Facilities Services Dept.
- 21.2 Filter changes to the HVAC systems must be increased in frequency to bi-weekly changes until the work of the contract is complete.
- 21.3 The Board will provide the filter changes in 21.2 to occupied areas of the building. The contractor is responsible for the filter changes in 21.2 in all unoccupied areas.

22. Dust Control

- 22.1 The contractor shall provide appropriate polyethylene plastic curtains between new construction and corridors to prevent dust penetration and provide doormats and take other appropriate precautions in these rooms to prevent dirt being tracked into the school. These areas must be sealed tight with tape or other suitable material to provide a dust and vapor tight enclosure.
- 22.2 Fresh air returns from construction areas shall be sealed tight or temporary filter system provided while dust causing work is being performed.
- 22.3 The contractor shall provide suitable dust control for all exterior construction activities.

22.4 Dust control measures must be used when sweeping of floors in construction areas.

23. Signage

23.1 Signage shall be provided by the contractor on the occupied side of every door and entry into construction areas. Signage shall indicate "Construction Zone – Authorized Personnel Access Only" or similar wording.

23.2 Construction signage shall also be provided by the contractor for any exterior site work activities. The signage shall indicate "Construction Zone – Authorized Personnel Access Only" or similar wording.

23.3 In addition to items 23.1 and 23.2, the contractor shall also provide for and maintain all required construction signage by the Ministry of Labour.

24. Bussing and Transportation Routes

24.1 No construction activity may occur during student drop-off and pick-up times. The Site supervisor shall obtain the bussing schedule from the school Principal / designate.

24.2 All fire and emergency access routes shall be maintained free and clear of any obstructions 24hrs per day 7 days a week. These access routes shall also be maintained and accessible to allow for snow removal by Board retained snow removal contractors.

24.3 The school is responsible for ensuring that the routes (described in 24.2) are clear is limited to ensuring that they are kept clear of staff, student, visitor and school delivery vehicles.

24.4 The Board shall arrange for normal snow clearing of the parking areas and the fire and emergency access routes. The Contractor is responsible for controlling dust mud build-up of these routes.

25. Security

25.1 The building must be left in a safe and secure condition at the end of every day. The Contractor is responsible for arming the building at the end of each day if school staff are not present.

25.2 The Contractor shall be solely responsible for loss or damage of his/her tools, equipment or any materials on Board property.

25.3 The Contractor shall ensure the work zone is clearly delineated with appropriate barricades to prevent unauthorized access.

25.4 The Contractor shall key all door cylinders in door entries to construction areas with a construction key different than that of any keying dedicated to the building. One key shall be provided to the following Board personnel; Principal / designate, Vice-Principal / designate, the Facilities Services Dept. and the Custodian-in-Charge. Duplication of the

-
- construction keys is not permitted by Board personnel unless consent is provided jointly by the contractor and the Facilities Services Dept.
- 25.5 All doors and entries into construction zones shall remain locked at all times to prevent unauthorized entry into these spaces.
- 25.6 The Principal / designate, Vice-Principal / designate and Custodian in Charge shall access construction areas for emergency purposes only. The Facilities Services Dept. is entitled access to these areas to perform site review and inspection activities.
- 25.7 Access to all construction areas shall be made directly from the exterior only unless it is agreed to with the Principal / designate / designate and/or the Facilities Services Dept. that access is required through the occupied spaces.
- 26. Washrooms/Toilets**
- 26.1 The Contractor shall provide and maintain in a sanitary condition, washrooms and toilets for the use of all persons at the work site, and upon completion of the work, remove it and contents, and leave its site in a neat, clean and sanitary condition. Workers shall use designated washrooms as designated by their employer.
- 26.2 School washrooms/toilets are not to be used by any trades persons.
- 27. Safe Excavation/Drilling Practices**
- 27.1 Prior to work commencing the Contractor shall adhere to the following the procedures;
- 27.1.1 Obtain ground locates of the following utilities, but not limited to, water, electrical, gas, Bell, fiber optics, ground source heating lines. Locates are to be physically identified on the ground with paint or flags and the Contractor shall obtain a certificate by the Locate Contractor with a sketch map identifying these locates. A copy of such is to be provided to the School Board and it is obligatory that the Facilities Services Dept. review the site to confirm the presence of the paint identification markings, flags etc. prior to the work commencing.
- 27.1.2 The Locate/certificate shall not go beyond the expiry date. In the event that the certificate expires the contractor shall obtain new locates and follow the procedures described in 27.1.1
- 27.1.3 The contractor shall provide minimum 48hrs notice of the work activities to the Facilities Services Dept. and the contractor shall provide a schedule of the work.
- 27.1.4 The Contractor shall be knowledgeable of all Safe Digging regulations for each Utility Company.

END OF SECTION

PART 1: GENERAL

1.1. GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions of the Contract CCDC 2,
 - .2 Section 00830, Supplementary Conditions CCDC 2,
 - .3 The Sections of Division 01.
- .2 Contractor to be responsible for the co-ordination and execution of each cash allowance item of work as for all other aspects of the work.
- .3 For each cash allowance item and when requested by the Consultant, provide the following services and/or information:
 - .1 Assist the Consultant to determine qualified suppliers,
 - .2 Obtain proposals from suppliers. A minimum of three quotations are to be obtained unless otherwise indicated.
 - .3 Make appropriate recommendations for the consideration of the Consultant.
 - .4 Notify the Consultant of any effect anticipated by selection of products or supplier under consideration regarding contract schedule and cost.
 - .5 On notification of selection by Consultant, enter into purchase agreement with designated supplier.
- .4 Expend portions of the cash allowance only on Consultant's written instructions.
- .5 The value of Cash Allowances covers the net cost to the Contractor of all aspects of the work related to the cash allowance items and other work as directed by the Consultant, unless otherwise indicated in the documents.
- .6 The Contract Price, and not the Cash Allowance, includes the Contractor's overhead and profit in connection with the cash allowance.
- .7 The Contract Price will be adjusted by written order to provide for an excess or deficit to the Cash Allowance. In the case of an excess, the Contractor shall be allowed an amount for overhead and profit as set out in the Documents.
- .8 Progress payments on account of work authorized under the cash allowance shall be included in the Consultant's monthly certificate for payment.
- .9 A schedule shall be prepared by the Contractor for the approval of the Consultant to show when items called for under Cash Allowance must be authorized by the Consultant so that progress of the Work will not be delayed.

1.2. CASH ALLOWANCE ITEMS

- .1 The total value of the Cash Allowance shall include, but not be limited to, the following items of work:
 - .1 Roof Anchors - \$8,830.00
 - .1 Ankor Engineering Systems Ltd. is the approved supplier and installer.
 - .2 Supply and Install Hardware - \$19,200.00
 - .1 Upper Canada Specialty Hardware is the approved supplier and installer.

1.3. TOTAL VALUE OF CASH ALLOWANCE

.1 Include in the Base Bid the following Total per Section 00200 Instructions to Bidders:

Total: **\$28,030.00**

END OF SECTION

1 Section Includes

- .1 Shop drawings and product data
- .2 Samples
- .3 Certificates and transcripts

2 Related Sections

- .1 Section 01310 - Construction Schedule: Submissions of schedules
- .2 Section 01400 - Quality Control: Submission of test and mix design mill tests.
- .3 Section 01601 - Material and Equipment: Submission of manufacturer's instructions.
- .4 Section 01655 - Systems Demonstration: Submission of system and equipment documents.

3 Administrative

- .1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .2 Work affected by the submittal shall not proceed until review is complete.
 - .3 Review submittals prior to submission to the 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 the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and shall be considered rejected.
 - .4 Verify field measurements and affected adjacent Work are coordinated.
 - .5 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
 - .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
 - .7 Keep one reviewed copy of each submission on site.
-

4 Shop Drawings and Product Data

- .1 Refer to GC 40.
- .2 Submit six (6) copies of product data sheets or brochures for requirements requested in specification Sections and as the Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.
- .3 If upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, the transparency will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, shall be performed before fabrication and installation of Work may proceed.

5 Samples

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

6 Certificates and Transcripts

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

PART 1 GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions of the Contract CCDC 2,
 - .2 Section 00830, Supplementary Conditions CCDC 2,
 - .3 The Sections of Division 01.

1.2 SHOP DRAWING SCHEDULE

- .1 Submit a shop drawing schedule, in accordance with GC 34.4, which allows for a minimum of 14 days for the consultant to review the shop drawings, from the date of receipt, to the date of postage with a courier. If the consultant requires resubmission of the shop drawings allow for an additional 14 days for review.
- .2 Re-submit the schedule monthly w/ application for progress payment to correspond to changes in the Construction schedule. Maintain the Consultants 14-day review period in the schedule re-submissions.

1.3 FABRICATION

- .1 Do not fabricate until shop drawings are indicated as "REVIEWED" or "REVIEWED AS NOTED".

1.4 CONSULTANT'S SHOP DRAWING REVIEW

- .1 The consultant's review of shop drawings is for the sole purpose of ascertaining conformance with the general design concept.
- .2 The consultant's review does not provide approval of the items. This remains the Contractor's responsibility.
- .3 Among other things, the Contractor remains responsible for:
 - .1 Detail design inherent in the shop drawings
 - .2 Errors and omissions in the shop drawings
 - .3 Meeting all requirements of the Contract Documents
 - .4 Confirmed and correlated site dimensions
 - .5 Information that pertains solely to fabrication processes, techniques of construction and installation.
 - .6 Co-ordination of the work of all trades

1.5 SHOP DRAWING REQUIREMENTS

- .1 Drawings are to be drafted professionally in a neat, legible manner.
- .2 Indicate the following information at a minimum as applicable:
 - .1 Plans, sections and details
 - .2 Verified site dimensions
 - .3 Materials thicknesses and finishes
 - .4 Methods of setting and sealing
 - .5 Methods of securing, fastening and anchoring including field connections.
- .3 Do not make product substitutions on shop drawings without the consultant's written acceptance in accordance with the product substitution proposal process. Replace unaccepted product substitutions and complete the Work in accordance with the Contract Documents.
- .4 Determine which shop drawings the Department of Buildings of the Municipality will require for its

approval and submit two final copies of each shop drawing to the Department of Buildings.

1.6 SHOP DRAWING PROCEDURES

- .1 Execute the following prior to submitting all shop drawings to the consultant:
 - .1 Review, check and mark-up the shop drawings with your comments and revisions.
 - .2 Stamp each shop drawing.
 - .3 Fill-in the contractor's review date and signature of the contractor's reviewer.
- .2 Shop drawings which do not conform to the above criteria will be automatically returned without review and any resulting delays will be the contractor's responsibility.
- .3 Submit the following for the consultant's reviewer:
 - .1 1 original of each stamped shop drawing to be returned to the Contractor and 4 prints of each stamped shop drawing which will not be returned to the contractor.
 - .2 If catalogue cuts are acceptable to the consultant, submit 4 copies of catalogue cuts for review. Only one set will be returned to the Contractor.
- .4 Do not resubmit shop drawings indicated as "REVIEWED" or "REVIEWED AS NOTED". Contractor is responsible to make copies of reviewed drawings as required for their own use, for distribution to Subcontractors, suppliers, etc., for submission to Building Department (if requested) and for submission to Owner in Manuals at Project close-out.
- .5 Re-submit shop drawings indicated as "REVISE AND RESUBMIT" with the required changes and comments addressed. Insert the letter "R" after the shop drawing number on resubmitted shop drawings, re-date and re-sign. Identify revisions from earlier submissions graphically on the revised shop drawings.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions of the Contract CCDC 2,
 - .2 Section 00830, Supplementary Conditions CCDC 2,
 - .3 The Sections of Division 01.

1.2 PROJECT QUALITY ASSURANCE PROCESS

- .1 The Owner's Plant Services "Project Quality Assurance Process" must be incorporated into the Contractor's administration process. The Contractor is expected to provide manpower as necessary and to cooperate fully with the Owner and Consultant as required to implement the process. The document is attached following this section.
- .2 Refer to the following for process details:
 - .1 Quality Assurance Review
 - .1 Quality Assurance Team from the Owner will be conducting a detailed review of the building and its systems to forward on to the Consultants and Contractor for incorporation into the deficiency list where appropriate as work has been defined under the scope of work of the Contract;
 - .2 The Consultant to produce a consolidate list of deficiencies to the Contractor for correction.
 - .2 Equipment Start-up
 - .1 Schedule Equipment Start-up with Quality Assurance Team representatives, General Contractor, related sub-contractor and manufacturer's representatives.
 - .2 Document time, date, people in attendance and results of start-up.
 - .3 Keep copies of manufacturer's start-up report.
 - .3 Equipment Demonstrations:
 - .1 Schedule demonstrations with Capital Staff, Quality Assurance Team, Custodial Staff, Consultants, General Contractor, specific sub-contractors and manufacturer's representatives in attendance.
 - .2 Record time, date, people in attendance and any issue that may have developed as a result of the demonstration.

1.3 OAC MEETINGS

- .1 Purpose: to review policy and the status of money and the schedule.
- .2 Period: monthly at a mutual acceptable time.
- .3 Attendees:
 - .1 Owner
 - .2 Consultant
 - .3 Contractor
- .4 Chair: the Consultant
- .5 Party responsible for record and distribution of minutes of the meetings to each participant within five working days: the Consultant
 - .1 Minutes shall record decisions, comments, instructions required and a report on the schedule

1.4 SITE COORDINATION AND PROGRESS MEETINGS

- .1 Purpose: to identify and resolve construction coordination items.

- .2 Period: every second week on a mutually acceptable schedule
- .3 Attendees:
 - .1 Contractor's project manager and site supervisor
 - .1 Subcontractors
 - .2 Owner
 - .3 the Consultant
 - .1 Sub-consultants
- .4 Chair: Consultant
- .5 Party responsible for record and distribution of minutes of the meetings to each participant (Contractor responsible for distribution to Subcontractors) within five working days: Consultant
 - .1 Minutes shall record decisions, comments, instructions required and a report on the schedule
- .6 Submit the record of progress reports at site coordination and progress meetings
- .7 Present the as built Contract Documents at site meetings

1.5 SCHEDULE OF THE WORK

- .1 Submit the following schedules:
 - .1 Construction Progress Schedule
 - .2 Submittal Schedule for Shop Drawings and Product Data
 - .3 Submittal Schedule for Samples
- .2 Format:
 - .1 Prepare a detailed bar chart construction in the form of a computerized chart (i.e. Microsoft Project)
 - .1 Provide a separate bar for each trade or operation.
 - .2 Provide a horizontal time scale identifying the first work day of each week.
 - .3 Format for listings: the List of Contents of this Specification.
 - .4 Mechanical and Electrical trades to be identified by tasks and phases.
- .3 Submission:
 - .1 Submit initial schedules within 5 days of award of Contract.
 - .2 Update and resubmit the schedule on a monthly basis, at a minimum, or as required by the Consultant and advise the Consultant and the Owner weekly in writing of any variation from the baseline or slippage in the schedule.
 - .3 **Submit revised progress schedule with each application for payment.**
- .4 Construction Progress Schedule:
 - .1 Provide schedule with activities itemized to enable the Contractor and the consultant to monitor the progress of the Work.
 - .2 Identify those items which are critical to the orderly progress of the Work.
 - .3 Identify target achievement dates for the following as a minimum:
 - .1 Testing of all building systems and operations.
 - .2 Substantial Completion.
 - .3 Completion of all deficiencies.

1.6 PROGRESS PAYMENT SCHEDULE

- .1 Prior to commencement of the Work, submit a detailed Progress Payment Schedule to the Consultant for review.
- .2 Submit progress payment schedule with values applied against the following:
 - .1 Mobilization and start-up
 - .2 General overhead expenses
 - .3 Each cash allowance
 - .4 Each Section of the specification (Divisions 2-16)
 - .5 \$5,000 for architectural as-built documents & manuals
 - .6 \$5,000 each for mechanical and electrical as-built documents & manuals
- .3 With each Progress Billing Breakdown submit statutory declarations, WSIB certificate of clearance, current construction schedule.

1.7 PERSONNEL

- .1 Appoint a senior member of staff, with full authority to commit the Contractor to methods and schedules for construction, to participate actively in the administration and maintenance of the detailed construction schedule. Provide the necessary information on progress of the Work to enable a status report to be produced every two weeks.
- .2 A senior member of staff must be available on a 24hr /day 7 day/week basis to respond to emergency situations occurring as a result of construction. Provide contact names and telephone numbers of personnel responsible for this function.

1.8 PROGRESS REPORTS AND CONSTRUCTION RECORDS

- .1 Maintain a permanent written record of the progress of the Work at the Place of the Work, open to inspection by the Consultant.
 - .1 Record the dates of commencement and completion of the different Subcontractor's part of the Work.
 - .2 Record the following on each report:
 - .1 Dates of construction
 - .2 Division of the Work upon which each group is engaged.

1.9 AS-BUILT DOCUMENT MAINTENANCE

- .1 During the progress of the Work maintain the following, in the complete sets, at the Place of the Work:
 - .1 As built Contract Documents,
 - .2 Shop Drawings
- .2 Mark changes, revisions, deletions and additions to the Work clearly, neatly, accurately and promptly

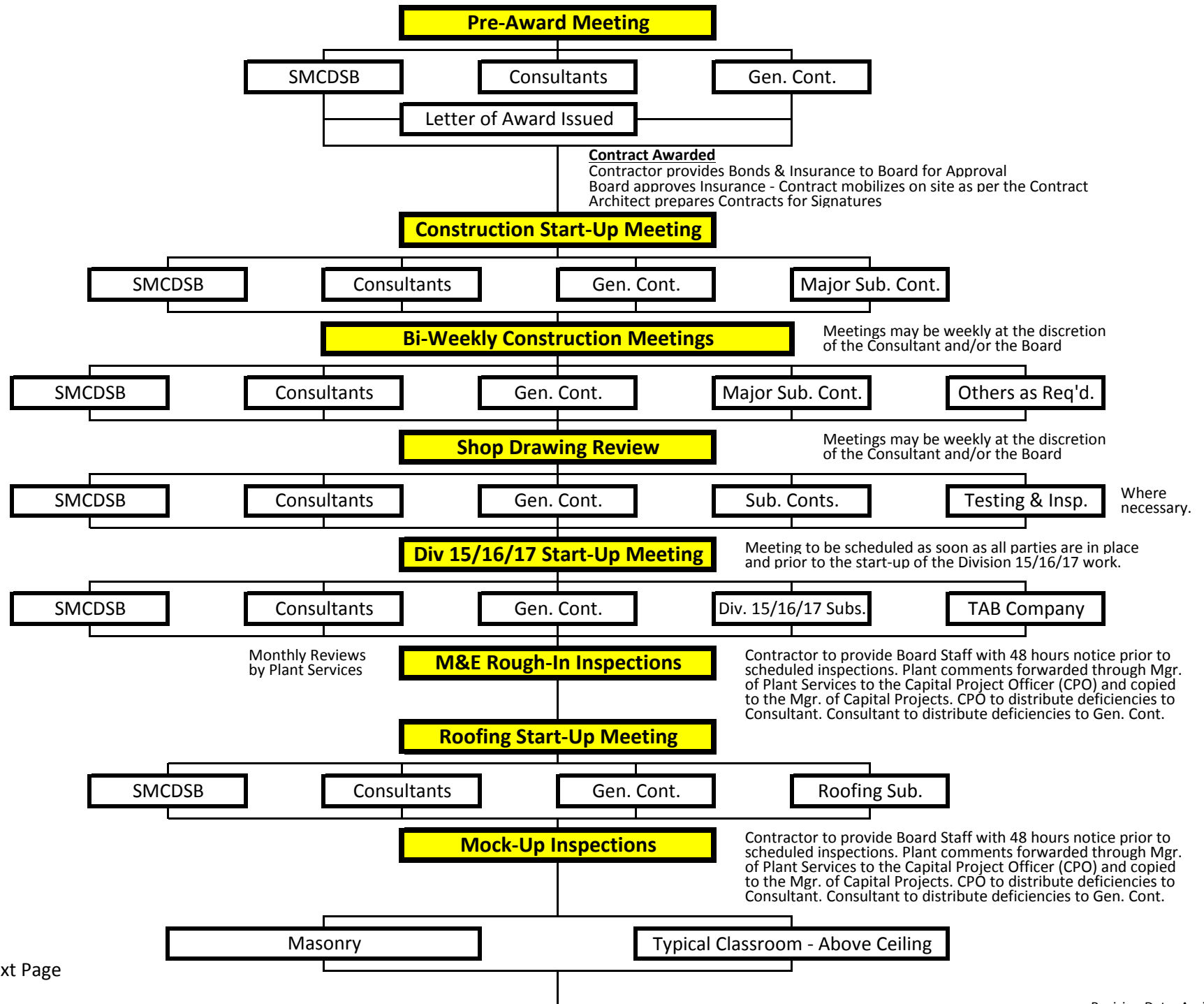
1.10 DEFICIENCIES

- .1 Correct deficiencies noted by the consultant, in accordance with the contract documents. The contractor will be deemed to have corrected all prior and subsequent typical deficiencies.
- .2 Do not proceed with the installation of the subsequent parts of the Work until deficiencies have been corrected.

END OF SECTION

Simcoe Muskoka Catholic District School Board

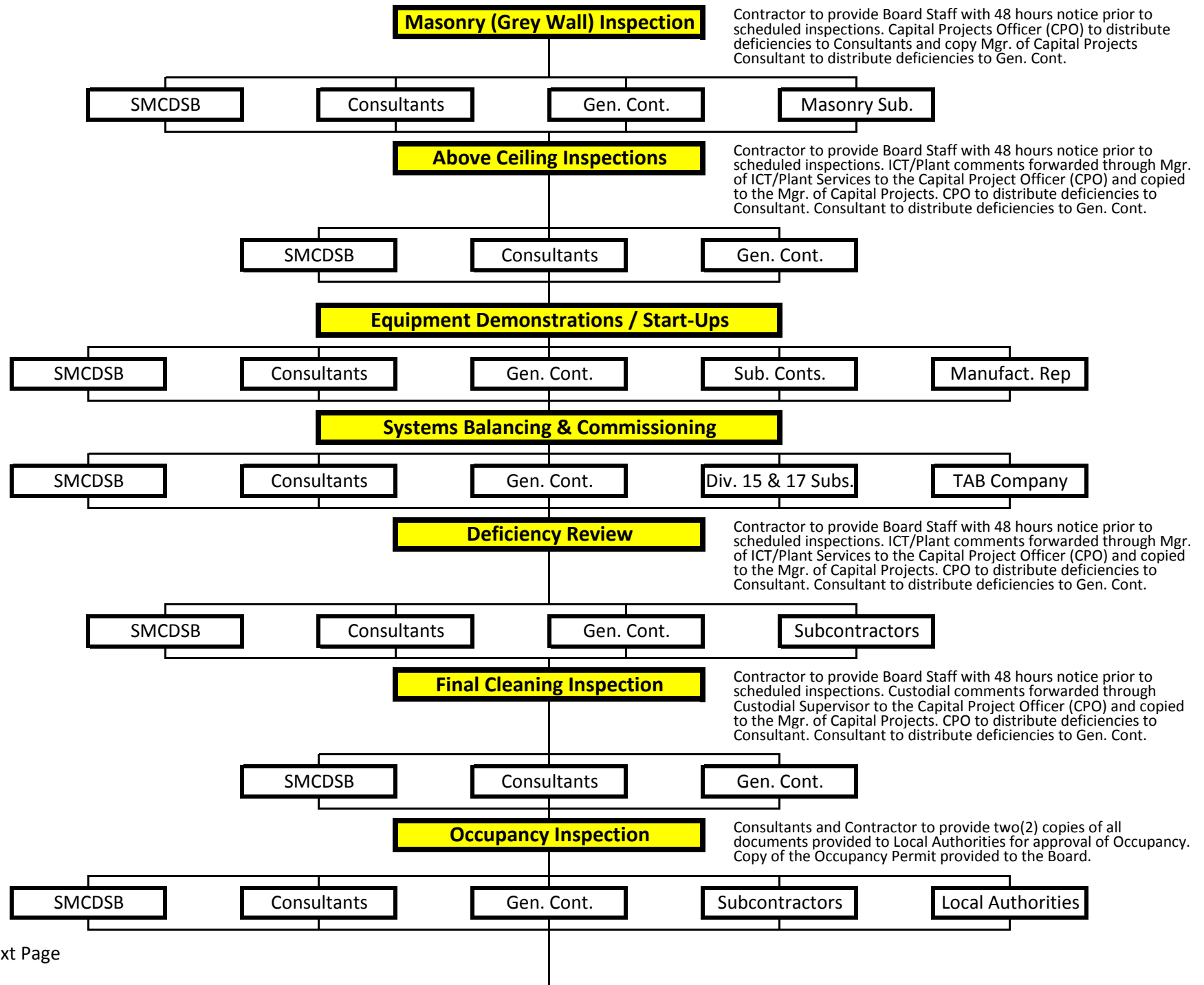
Plant Department - Quality Assurance Process (QAP) - Construction



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Simcoe Muskoka Catholic District School Board

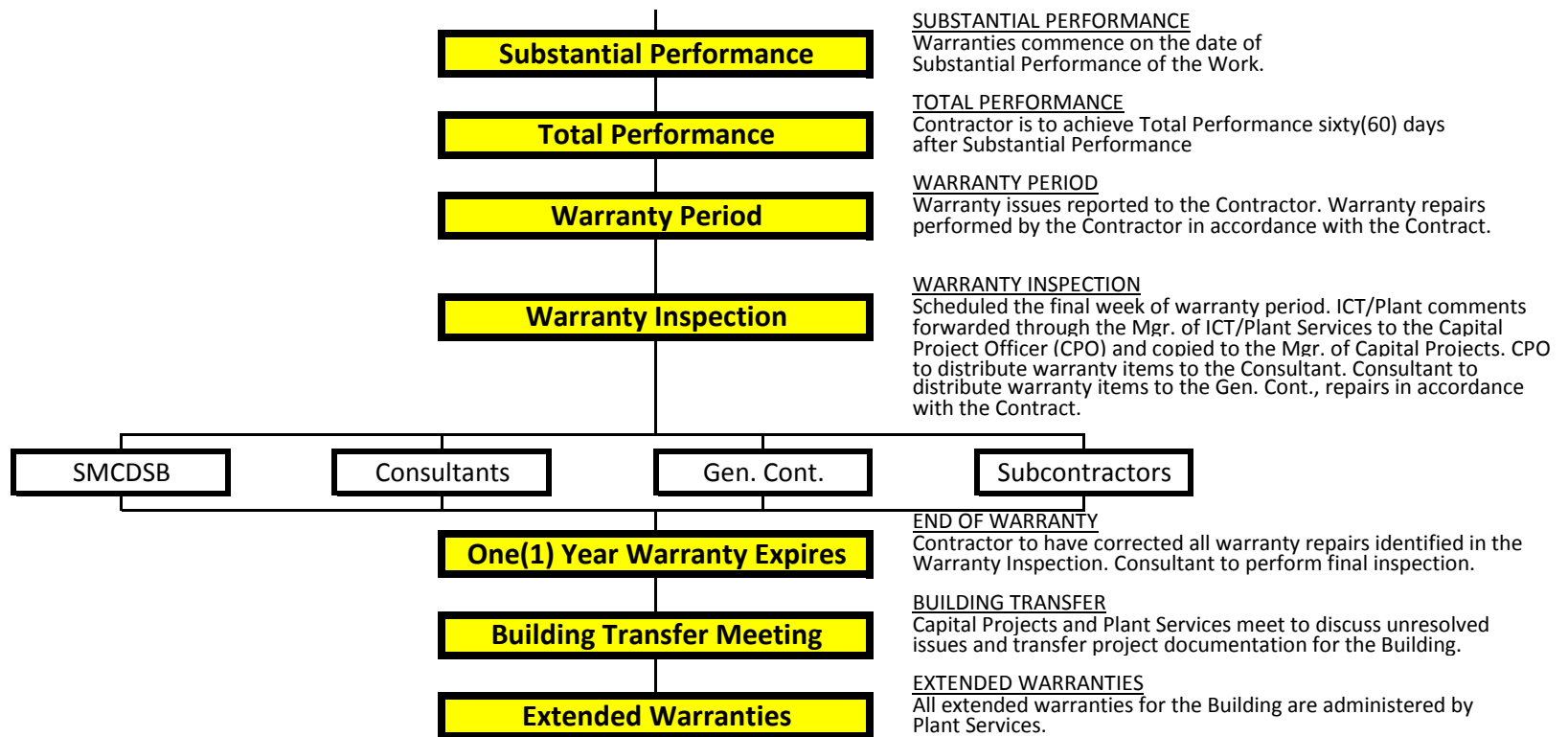
Plant Department - Quality Assurance Process (QAP) - Construction



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Simcoe Muskoka Catholic District School Board

Plant Department - Quality Assurance Process (QAP) - Construction



PART 1: GENERAL

1.1. GENERAL REQUIREMENTS:

- .1 The requirements specified in this Section apply to the independent inspection and testing specified under technical specifications Sections and / or as directed by Consultant.
- .2 Requirements specified in this Section do not apply to the following:
 - .1 Inspection and testing required by laws, ordinances, rules and regulations and orders of public authorities.
 - .2 Testing, adjustment and balancing of mechanical and electrical systems and equipment.
 - .3 Inspection and testing carried out exclusively for the Contractor's convenience.
 - .4 Tests specified in Division 2 to 16 inclusive, to be included in the Contract such as mill tests, certificates of compliance and testing to be carried out by the Contractor under direction of the Consultant
- .3 Failure by independent testing agency to detect defective work or materials shall not in any way prevent later rejection, when such defect is discovered, nor shall it obligate Consultant for final acceptance.
- .4 Independent inspection and testing specified in this Section is not meant to replace or supplement Contractor's own quality control nor relieve Contractor of his contractual obligation to meet requirements of Contract Documents.
- .5 Costs for independent inspection and testing, but not covering Contractor's related responsibilities specified hereinafter, are to be paid for directly by the Owner (N.I.C.).

1.2. DUTIES OF TESTING AGENCY :

- .1 Testing Agency is expected to do the following:
 - .1 Act on a professional and unprejudiced basis and carry out inspection and testing functions to establish compliance with requirements of Contract Documents.
 - .2 Check out work as it progresses and prepare reports stating results of tests and conditions of work and state in each report whether specimen tested conform to the requirements of the Contract Documents, specifically noting deviations.
 - .3 Distribute reports as follows:

.1	Consultant:	1 copy
.2	Subconsultants affected:	1 copy
.3	Contractor:	2 copies
.4	Building Department:	1 copy
.5	Owner:	1 copy
 - .4 Testing agency is not authorized to release or amend any requirements of Contract Documents, nor to approve or accept any portion of the work.

1.3. CONTRACTOR'S RESPONSIBILITIES:

- .1 Contractor shall be responsible for and pay the expense of all of the following:
 - .1 Notification of Consultant and testing agency minimum 48 hours in advance of operations to allow for assignment of personnel and scheduling of tests without causing a delay in work.
 - .2 Provide testing agency with access to work at all times.
 - .3 Supply material samples for testing.
 - .4 Supply casual labour and other incidental services required by testing agency.
 - .5 Provide facilities for the storage of samples.
 - .6 Where materials are specified to be tested, deliver representative samples in required quantity to designated testing laboratory.
 - .7 Make good work disturbed by independent testing and inspection
- .2 When initial inspection and testing indicates non-compliance with Contract Documents, any subsequent reinspection and testing occasioned by non-compliance shall be performed by same testing agency and cost thereof borne by Contractor.

END OF SECTION

PART 1:

1.1. CODES AND BYLAWS, REGULATIONS, ORDINANCES

- .1 2012 Ontario Building Code (Ont. Reg. 423/06), and By-laws of Municipality shall govern this work. Most stringent requirements indicated by above shall govern.
- .2 Where the by-law, code or official standard is quoted, it shall mean latest edition including all revisions or amendments in effect at time of submission of tenders.
- .3 Comply with requirements, regulations and ordinances of other authorities having jurisdiction.
- .4 Where it is necessary to carry out work outside property lines, such as side walks, paving, concrete curbs, service connections, comply with applicable requirements of municipal authorities having jurisdiction.

1.2. FIRE PROTECTION REQUIREMENTS

- .1 Refer to technical Sections of Specifications and Drawings for specific fire protection requirements.
- .2 Test methods used to determine fire hazard classification and fire endurance rating shall be as required by the Building Code.
- .3 Upon request, furnish Consultant with evidence of compliance with project fire protection requirements.
- .4 Materials and components used to construct fire rated assemblies and materials requiring fire hazard classification shall be listed and labeled, or otherwise approved, by fire rating authority. Labeled materials and their packaging shall bear fire rating authorities label showing product classification.
- .5 Fire rated door assemblies shall include doors, frame, anchors and hardware and shall bear label of fire rating authority showing opening classification and rating.
- .6 Materials having a fire rating classification shall be applied / installed in accordance with manufacturer's directions.
- .7 Fire rated assemblies shall be constructed in strict accordance with applicable assembly design report. Deviation will not be allowed.
- .8 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.
- .9 Fill and patch voids and gaps around openings and penetrations in and at perimeter of fire rated assemblies so as to maintain continuity and integrity of fire separation and smoke seal to the requirements of jurisdictional authorities.

1.3. WASTE MANAGEMENT

- .1 Conform to and enforce strict compliance with Occupational Health & Safety Act, latest revised comply with applicable requirements of the Ministry of Environment and Energy governing waste management.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions of the Contract CCDC 2,
 - .2 Section 00830, Supplementary Conditions CCDC 2,
 - .3 The Sections of Division 01.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Provide and maintain temporary utilities, facilities and controls in order to execute the work expeditiously.
- .2 Maintain temporary utilities, facilities and controls in a neat and tidy condition.
- .3 Remove from site all such work after use.

1.3 TEMPORARY UTILITIES

- .1 Temporary Electricity
 - .1 Existing power system may be utilized to provide a source of electricity for adequate temporary lighting, operation of power tools, and to ensure proper completion of the work. The Contractor is responsible for the provision of temporary power from the Owner's source.
 - .2 Provide and maintain any necessary additional temporary electrical systems to requirements of CSA C22.1-1990, Canadian Electrical Code, Part 1 – Temporary Wiring.
- .2 Temporary Heating, Cooling and Ventilating
 - .1 Upon approval of the Owner, the permanent heating system of the building, or portions thereof, may be used when available. Be responsible for repair of damage thereto.
 - .2 On completion of work, replace filters in permanent heating system and clean all ducts.
 - .3 Provide minimum one air change per hour for enclosed areas receiving architectural finishes.
 - .4 Prior to commencement of work using hazardous or volatile adhesives, coatings or substances, install adequate mechanical ventilation.
 - .5 Do not allow excessive build-up of moisture in building.
- .3 Temporary Lighting
 - .1 Provide and maintain temporary lighting throughout the work for emergency evacuation, safety, security and performance of the work.
 - .2 Permanent lighting may be used during construction only where available.
- .4 Temporary Telephone
 - .1 Provide and pay for temporary telephone service and fax machine on a separate line necessary for own use and use of Consultant during construction. Make available for all trades.
- .5 Temporary Water
 - .1 The existing building service may be utilized as a source of potable water for construction use. Provide any necessary temporary extension required for construction.

1.4 CONSTRUCTION FACILITIES

.1 Field Offices and Sheds

.1 The Contractor's offices and storage are to be located in trailers provided by the Contractor located at the Place of Work. Provide and maintain:

- .1 In a clean condition
- .2 Heated to a minimum of 20 degrees Celsius
- .3 Ventilated office with sufficient space for conducting OAC meetings (20 persons)
- .4 Superintendent office
- .5 Layout drawings

.2 Provide the following field office facilities:

- .1 Telephone services for Contractor's own use.
- .2 One facsimile machine compatible with the Consultant's fax machine.
- .3 One photocopy machine
- .4 "No Smoking" signs.

.3 Provide proper flammable and explosive materials storage.

.2 First Aid

- .1 Provide emergency and first aid equipment as prescribed by authorities having jurisdiction.
- .2 Mount emergency and first aid equipment in a prominent and easily accessible location with easily identifiable labels.
- .3 A minimum of one person trained in basic first aid shall be on site at all times. This person may perform other duties, but must be available immediately to render first aid when needed. Provide documentation confirming first aid training when requested by Consultant.

.3 Sanitary Facilities

- .1 Contractor to provide temporary sanitary facilities in sufficient number for all trades and maintain them in a sanitary condition.
- .2 Use of existing washroom facilities is not permitted.

1.5 CONSTRUCTION AIDS

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists and cranes shall be operated by qualified operator.
- .3 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs as required for the safe execution of the work.

1.6 VEHICULAR ACCESS AND PARKING

- .1 Provide for access of emergency vehicles at all times.
- .2 Parking will be permitted on site within the construction staging area designated on the Drawings and as directed by Consultant.

- .3 **Construction parking is not permitted on Municipal roadways.**
- 1.7 **TEMPORARY FIRE PROTECTION**
 - .1 Provide and maintain temporary access routes to exits, clear and visibly identified 24 hours a day.
- 1.8 **BARRIERS**
 - .1 Construction Hoarding (Site Perimetre):
 - .1 1800 mm high chain-link fencing complete with all required posts and rails.
 - .2 Provide lockable gates for access to site by workers and vehicles.
 - .3 Enclose perimeter of construction area.
 - .4 Temporary construction hoarding: "fast fence" purpose made units securely fastened and laterally braced.
 - .2 Protective Enclosures:
 - .1 Provide and maintain suitable warning signs as required by all applicable regulations and by-laws.
 - .3 Floor Protection:
 - .1 **Provide continuous layer 6 mil poly sheet and 13mm plywood over full extent of all wood gymnasium flooring throughout the course of the work where work occurs in the room where gymnasium flooring is located.**
 - .4 Dust Barriers:
 - .1 Provide dust tight screens or partitions to localize dust generating activities, and for the protection of workers, finished areas of work and the public.
 - .2 Maintain and relocate protection until such work is complete.
 - .5 Security Measures:
 - .1 Maintain security of construction site.
 - .2 Maintain security at all times during shut-downs due to strikes or lockouts.
 - .6 Interior Hoarding:
 - .1 Provide fire-rated, dust-tight, temporary enclosures (steel studs insulation and gypsum board) rated for minimum 1 hour as required to separate occupied areas from construction areas.
 - .2 Provide hollow metal doors and frames complete with lockable hardware and 45 minute rating, where required for access.
- 1.9 **PROTECTION**
 - .1 Work shall include necessary methods, materials, and construction to ensure that no damage or harm to existing building, the Work, materials, property and persons results from Work of this Contract.
 - .2 Protect adjacent private and public property: make good damage.
 - .3 Prevent spread of dust beyond the construction area by temporary hoarding; or by other means approved by the Architect.
 - .4 Protect finished surfaces of completed work and existing building from damage by restriction of access or by use of physical means suitable to the material and surface location. Where work must be performed over finished floors, provide heavy-duty floor protection with a minimum

thickness of 46 mils (1.17mm) with spill guard protection and vapour-cure technology to allow protected substrates and finishes to cure while being protected.

- .1 Acceptable manufacturer: Ram Board, 27460 Avenue Scott; Valencia, CA 91355; Tel: 855-848-8678; Fax: 818-848-0099; (info@ramboard.com); Web: www.ramboard.com Approved equal must match.
- .5 Weather Enclosure:
 - .1 Provide temporary, fire-rated (minimum 1 hour) weather-tight enclosures to unfinished door and window openings, tops of shafts and other openings in floors, and roofs.
 - .2 Provide weather-tight, vandal-proof, insulated (R12 minutes) enclosures between existing building and/ or finished new construction and areas of construction where the new construction is not weather tight and/ or heated.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions of the Contract CCDC 2,
 - .2 Section 00830, Supplementary Conditions CCDC 2,
 - .3 The Sections of Division 01.

1.2 WORKMANSHIP

- .1 All work performed on the Owner property shall be done by mechanics skilled in their respective trades. Where required by code or other by-laws and regulations, trades people shall be licensed in their trade. All workmanship shall be of the highest calibre in accordance with the best standard practice, unless special methods or performance standards are specified or given in writing by the Owner or Consultant.
- .2 Without affecting the requirements as outlined above, the work shall be carried to completion as expeditiously as possible.
- .3 Where not otherwise specified or shown, all work must conform to the local governing codes and by-laws and to the Ontario and National Building Codes. All codes, standards, regulations and by-laws shall be of the latest date or amendment prior to tender issue.
- .4 Any work not acceptable to the Owner or Consultant or local authorities shall be removed and replaced when and as directed by them. The cost of re-executing such work shall be borne by the Contractor.

1.3 SCHEDULING

- .1 The Contractor shall take all possible steps to minimize interference with school operations and schedule their work, etc., in such a manner as to accomplish this end.
- .2 Schools are normally open for a Contractor to perform work during weekdays. These hours should be confirmed with the Plant Services Department prior to completing any work schedule. Weekend work can be arranged where the Contractor is prepared to pay for custodial coverage at the applicable overtime rates.
- .3 The Contractor shall provide the Owner with a complete plan or layout of their work schedule prior to commencing any work on Owner property. All work scheduled shall be approved by the Plant Services Department.
- .4 The Contractor must report to the school office before proceeding elsewhere on Owner property.

1.4 CUTTING AND PATCHING

- .1 Cutting and patching is the responsibility of the trade requiring the opening.
- .2 Execute cutting neatly and carefully, no larger than necessary employing workers skilled in the erection of the part of the Work being cut.
- .3 Patch parts of the Work to match adjacent construction and finishes unless otherwise specified or indicated on Drawings.
 - .1 Provide patching products equal to existing finishes
 - .2 Join new work to existing in neat, accurate manner
 - .3 Provide soundproof interior junctions.
- .4 Prior to cutting and drilling through concrete, structural masonry and steel and load bearing members, including floors, ceilings, columns, beams and walls, obtain Consultant's written acceptance.
 - .1 Design and provide permanent and temporary reinforcement and supports, as directed by the Consultant.

- .5 Maintain fire separations and provide fire and smoke penetration sealants in conformance with Section 07270 in cut and patched parts of the Work.
- .6 Unless otherwise indicated, run piping, ducts and conduit in ceiling and furred spaces and bury conduit in walls.
- .7 Saw-cut floors, walls and ceilings accurately. Provide holes and openings no larger than necessary to minimize damage. Core drill circular holes in concrete. Accurately cut new openings for electrical outlets and other recessed items in walls.
- .8 After cutting and patching is complete, re-finish surfaces to minimum 100mm outside the patch perimeter. Match patch finish to existing adjacent surfaces to completely conceal the patch. Where surfaces are painted, **paint entire surface associated with cutting and patching to nearest break in wall surfaces such as inside and outside corners.**

1.5 MECHANICAL AND ELECTRICAL LOCATION DRAWINGS

- .1 Mechanical and electrical drawings indicate approximate locations diagrammatically. Prior to installation, request and obtain final location and arrangement drawings for mechanical and electrical items. Allow the Consultant to adjust final locations within 5'-0" radius from the diagrammatic position indicated, without change to the Contract Price.
- .2 Align and cluster devices and fitments neatly in accordance with specified mounting heights.

1.6 BUILT-IN ITEMS

- .1 Provide and coordinate the location of chases, slots and reglets including frames, sleeves, inserts, anchors, fasteners and bolts, forms and templates.

1.7 ANCHORS AND FASTENERS

- .1 Do not use materials subject to electrolytic action and corrosion where conditions will be liable to cause such action.

1.8 TRADEMARKS AND LABELS

- .1 Do not expose trademarks and labels, including applied labels in the finished Work. Remove visible trademarks and labels except those, which are essential to obtain identification of mechanical and electrical equipment for maintenance and replacement purposes and for mandatory fire ratings.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Package, crate and brace products to prevent damage during delivery, storage and handling.
- .2 Provide protection to finished surfaces to prevent damage during delivery, storage and handling.
- .3 Store packaged materials in original undamaged condition with manufacturer's labels and seals intact.
- .4 Handle and store materials in accordance with manufacturer's and supplier's recommendations in protected location.
- .5 Replace products damaged during delivery to the Place of the Work, storage, handling and installation.

1.10 CONCEALMENT OF SERVICES

- .1 Conceal pipes, service lines, wiring, conduit and ducts in purpose-built masonry chases in existing and new walls, behind furring or above ceilings except where they are specifically indicated as being exposed to view. Where no existing or new ceiling is provided, such items may be exposed at the ceiling level.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
- .1 The General Conditions of the Contract CCDC 2,
- .2 Section 00830, Supplementary Conditions CCDC 2,
- .3 The Sections of Division 01.
- .4 OAA/OGCA Take-over Procedures, OAA/OGCA Document No. 100.

1.2 ABOVE CEILING REVIEW

- .1 Prior to installation of gypsum board ceilings and placing of acoustical ceiling tiles (except tiles with sprinkler heads, detectors and other fixtures) advise Consultant that above ceiling work is complete and ready for review. Provide 48 hours notice of readiness to the Board. Provide 72 hours notice for any cancellation or changes; failure to do so may result in a back charge to the Contractor for costs of Owner's personnel.
- .2 Owner, Consultant and sub consultants will conduct above ceiling review and prepare list of deficiencies.
- .3 Contractor shall correct deficiencies and advise Consultant when all deficiencies have been corrected.
- .4 Gypsum board ceilings and acoustical ceiling tiles may not be installed before Consultant has verified that all above ceiling deficiencies have been corrected.

1.3 TAKE OVER PROCEDURE

- .1 Generally, at the completion of the Work arrange for, conduct and document final inspection, closeout and take-over in accordance with the process as described in the OAA/OGCA Document No. 100 "Take-over Procedures".
- .2 Contractor's Inspection: The Contractor and his Sub-Contractors shall conduct an inspection of the Work, and correct all deficiencies. **Contractor is to provide a written list of deficiencies to the Consultant.**
- .3 Consultant's Inspection: The Contractor shall notify the Consultant in writing of satisfactory completion of the "Contractor's Inspection" and request a "Consultant's Inspection" for Substantial Performance. The Architect, Consulting Engineers, the Contractor and the Owner shall be present for the "Consultant's Inspection". Consultant's Inspection for Substantial Performance will not be scheduled until above ceilings are 100% deficiency free.
- .4 Deficiencies: During the "Consultant's Inspection" a list of all deficiencies shall be drawn up by the Architect and his Consultants. The Contractor shall correct all deficiencies in a satisfactory manner. Deficient work will be valued at 150% of "normal" costs as determined by the Architect and an amount retained on that basis until all deficiencies have been corrected and accepted by the Consultant subsequent to Final Inspection.
- .5 When the Contractor is satisfied that all deficiencies noted by the Architect have been corrected, the Contractor shall request, in writing, a "Final Inspection". The final inspection team shall consist of the Owner, Architect, Contractor and Engineers if required.
- .6 Declaration of Completion: When it is mutually agreed by the Final Inspection team that the work is substantially completed, the Contractor shall issue, in writing, a declaration to the Owner that:
 - .1 "All work in respect to the Contract for (Name of Project) has been completed as of (day month year) and no further work is required except for repairs or replacements as are outlined within this declaration of completion".
- .7 Certificate of Substantial Completion: The Architect will state in writing, upon agreement with the above declaration, his approval of the inspected work, as "Substantially Complete".

- .8 Commencement of Lien and Guarantee Periods: The date of the publication of the Substantial Completion Certificate shall mean immediate commencement of the lien period as specified by Provincial lien laws and the commencement of Guarantee periods.

1.4 RECORD DRAWINGS AND SPECIFICATIONS

- .1 Upon completion of Work and ten (10) days prior to requesting Substantial Completion, arrange, pay for and submit two (2) sets of as-built record Drawings, and submit to the Consultant. Also provide one electronic copy of as-built drawings in Autocad R2009 format.
- .2 Submit Record Drawings conforming to the following requirements:
- .1 Each as-built deviation/change from the Contract Documents recorded including information, specifications, drawings, instructions and details contained in Site Instructions, Change Orders and Cash Allowance Authorizations. Reference only to SI, CO and CAA numbers is not acceptable.
 - .2 Changes professionally drafted and subject to the Consultant's acceptance.
 - .3 Changes located by outline clouding and referenced to title revisions column.
- .3 Submit one set of notated specifications indicating as built changes to the Contract Documents.
- .4 Refer to Divisions 15 and 16 for supplementary requirements.

1.5 MAINTENANCE AND OPERATING INSTRUCTIONS MANUAL

- .1 On completion of the Work and ten (10) days prior to requesting Substantial Completion, submit 3 sets of the maintenance and operating instructions manual to the Consultant. Include the following:
- .1 A complete set of reviewed shop drawings, folded to 8 ½" x 11" size and contained in heavy duty manila envelopes, numbered and labeled. Follow specification format with no more than one (1) Section per envelope.
 - .2 Data books and literature,
 - .3 Maintenance instructions specifying warnings of any maintenance practice that may damage or disfigure the specified products,
 - .4 Operational information on products, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information,
 - .5 Recommended maintenance products,
 - .6 Extended warranties.
- .2 Submit instructions in simple language so as to guide the Owner in the proper operation and maintenance of building components.
- .3 Organize contents into applicable categories of the Work numbered to match the Specification Section numbering system.
- .4 Bind the contents of the maintenance and operating instructions manual in three-ring, hard covered, vinyl jacketed binders and label the spine "MAINTENANCE AND OPERATING INSTRUCTIONS MANUAL" and include the following:
- .1 Title sheet, labeled "Operating and Maintenance Instructions" containing project name and completion dated.
 - .2 List of contents.
 - .3 List of names, addresses and phone numbers of installing Subcontractors and suppliers for future repair or maintenance.

- .4 Schedule of Finishes (as-built) listing paints, colours and fabrics provided.
- .5 Refer to Divisions 15 and 16 for supplementary requirements.
- 1.6 MISCELLANEOUS CLOSEOUT SUBMITTALS**
 - .1 In addition to Items 1.4 and 1.5, and ten (10) days prior to requesting Substantial Completion, submit the following to the Owner with a copy to the Consultant:
 - .1 Hydro certificates
 - .2 Fire Alarm verification report
 - .3 Testing, adjusting and balancing reports
 - .2 Refer to Section 00810, GC 5.8.2 regarding a reserve fund that will not be paid until all items in the Miscellaneous Close-out Submittals List have been provided to the Owner's satisfaction. Note that this reserve is in addition to the statutory holdback.
- 1.7 TOTAL PERFORMANCE**
 - .1 Final payment will not be considered until after the 45 day lien period is completed.
 - .2 Prior to requesting a final inspection do the following:
 - .1 Submit a final request for payment incorporating all approved changes to the Contract Price, including adjustments to the Cash Allowances listed in Section 01021.
 - .2 Ensure completion of all deficiencies, clean all areas, surfaces and components affected by the Work.
 - .3 Ensure that all services, equipment, apparatus are properly tested, adjusted, balanced and fully operational.
 - .4 Provide a written statement that items .2 and .3 above have been completed.
 - .3 After all deficiencies have been corrected, submit to the Consultant a written request for a final inspection containing a statement that deficiencies have been corrected and that the project is ready for final inspection. This inspection shall be carried out by the same parties involved in the Substantial Performance deficiency inspection.
 - .4 If all deficiencies have not been corrected in the opinion of the Consultant, a final deficiency list shall be prepared by the Contractor in the same manner as specified herein for the Substantial Performance deficiency inspection and the inspection procedure repeated until all items have been completed to the satisfaction of the Consultant.
 - .5 The Consultant will conduct one Total Performance inspection and a maximum one follow-up inspection. Subsequent inspections due to the Contractor's failure to complete the work shall be paid for by the Contractor at current OAA per diem rates. The Owner will deduct said expenses from the Contractor's payment.
 - .6 Failure of the Contractor to correct the listed deficiencies within the 45 day lien period will result in direct action being taken by the Owner to correct the deficiencies outside of the Contract.
 - .7 On the 45th day of the lien period final inspection shall be made to ascertain the Contractor's progress with deficiencies and to invoke the above clause should it be required.
- 1.8 FINAL CLEANING**
 - .1 Upon completion of the Work, prior to Substantial Performance or where Work is phased, upon completion of each phase, commence final cleaning of the area.
 - .2 Clean the Place of the Work thoroughly, free of rubbish and surplus material. Dispose of rubbish and debris. Vacate the Place of the Work in a clean and tidy condition satisfactory to the Consultant. **Note that final cleaning is intended to allow the Owner to occupy the Work without being required to do any further cleaning.**

- .3 Dismantle and remove the work of the Temporary Facilities Section from the Place of the Work.
- .4 Clean new and existing components within the Place of the Work including, without being limited to:
 - .1 Floors: sweep / vacuum, wash, wax, polish
 - .2 Walls: vacuum / dust / wet wash / dry wipe
 - .3 Ceilings: vacuum
 - .4 Window coverings: wet wash / wipe and vacuum
 - .5 Electrical switch gear: vacuum / wipe
 - .6 Windows, screens, mirrors, door glazing: dust, polish inside and outside
 - .7 Millwork: dust inside and out
 - .8 Hardware: dust and polish clean
 - .9 Mechanical and electrical fixtures and equipment: remove stains, dust dirt and paint spots
 - .10 Stainless steel, anodized aluminum, brass, bronze and other metals: dust and polish clean
- .5 Use manufacturers' recommended cleaning products for each product provided in the Work.
- .6 Remove stains, efflorescence, paint, plaster, labels, temporary coverings and protection, caulking compounds and dirt.
- .7 Touch up damaged painted areas to satisfaction of Consultant.
- .8 Dust, clean and polish metal and glass surfaces.
- .9 Apply 2 coats sealers and 4 coats wax, in separate applications, to vinyl tile floors in accordance with manufacturers' instructions. Baseboards are not to be waxed. When applying the floor wax there must be clearance of one inch +/-, within reasonable tolerance, from the baseboard and wall. Utilize Owner's preferred waxing products "TuffSeal" product # 3500-20 and "Crystal Floor Finish" Product #65338-20 distributed by Swish products) unless prior approval from Owner has been obtained in writing to utilize alternate products. Finished floors to be free from streaks and embedded dirt particles.
- .10 Provide final vacuuming of carpets. Ensure that carpets are free of stains, tears and / or other blemishes.
- .11 Replace heating, ventilation and air conditioning filters. Clean inside of ducts, blowers and coils and behind grilles, louvers and screens.
- .12 Ceramic or porcelain tile is to be scrubbed so that all dirt, debris, stains and marks are removed. **Grout is to be sealed.**
- .13 Maintain cleaning until Owner has taken possession of Work.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and conform to:
 - .1 The General Conditions of the Contract CCDC 2,
 - .2 Section 00830, Supplementary Conditions CCDC 2,
 - .3 The Sections of Division 01.

1.2 EXTENDED WARRANTIES AND GUARANTEES

- .1 The Contractor is the warrantor and the guarantor for the parts of the Work requiring extended warranties and guarantees. If subcontractors or suppliers have provided parts of the Work, submit their supporting warranties and guarantees in accordance with the requirements of this Section.
- .2 Extended warranties and guarantees include labour and materials for removal, repair and replacement of both products provided as part of the Work of the applicable Section and adjacent damaged products.
- .3 Extended warranty and guaranty durations (in years) are identified in each Section and are deemed to commence on the date of Substantial Performance of the Work.

1.3 SUPPORTING WARRANTIES AND GUARANTEES

- .1 Submit each supporting warranty and guaranty as follows:
 - .1 identifying the sub-contractor as warrantor/guarantor.
 - .2 issued in both the Contractor's and the Owner's name
 - .3 including labour and materials for removal, repair and replacement of products provided as part of the Work of the applicable Section and adjacent damaged products.
 - .4 for periods of years identified in each Section and commencing on the date of Substantial Performance of the Work.
- .2 Submit 3 bound sets of supporting warranties and guarantees, within 14 Days after Substantial Completion of the Work, as follows:
 - .1 bound in a three-ring, hard covered, vinyl-jacketed binder. Label the spine "WARRANTIES AND GUARANTEES" and include the following:
 - .2 Title sheet, labeled "Warranties and Guarantees" containing project name and completion date.
 - .3 List of contents
 - .4 List of names, addresses and phone numbers of installing Subcontractors and suppliers.

1.4 LIST OF EXTENDED WARRANTIES

- .1 The following list of extended warranties is shown here for convenience only. All must be supplied whether listed below or not. Refer to Divisions 2 to 16 inclusive for requirements.
 - .1 Cabinetwork 2 years
 - .2 Sealants 2 years
 - .3 Sealed Units 10 years
- .2 Refer to Divisions 22 through 28 for mechanical and electrical extended warranty requirements.

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Extended Warranties &
Guarantees

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END OF SECTION

PART 1 - GENERAL

1.1 Protection

- .1 Protect in accordance with Section 02223 - Excavating Trenching and Backfilling.
- .2 Protect existing items designated to remain and materials designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Consultant and at no cost to Owner.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION

3.1 Preparation

- .1 Inspect site and verify with Consultant items designated for removal and items to remain.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.
- .3 Notify utility companies before starting demolition.

3.2 Removal

- .1 Remove items as indicated.
 - .2 Do not disturb adjacent items designated to remain in place.
 - .3 In removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Consultant.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying granular materials.
 - .4 When removing reclaimed asphalt pavement (RAP) for subsequent incorporation into hot mix asphalt concrete paving, prevent contamination with base coarse aggregates.
 - .5 When removing pipes under existing or future pavement area, excavate at least 300 mm below pipe invert.
-

3.3 Salvage

- .1 Carefully dismantle items containing materials for salvage and stockpile salvaged materials at locations as indicated or as directed by Consultant.

3.4 Sealing

- .1 Seal pipe ends and walls of manholes or catch basins as indicated or as directed by Consultant. Securely plug to form watertight seal.

3.5 Disposal of Material

- .1 Dispose of materials not designated for salvage or re-use in work, off-site.

3.6 Backfill

- .1 Backfill in accordance with Section 02223 - Excavating Trenching and Backfilling.

3.7 Restoration

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Reinstall areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.

PART 1 - GENERAL

1.1 References

- .1 ASTM D 698-12, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m³).

1.2 Site Conditions

- .1 Known underground and surface utility lines and buried objects are as indicated on site plan. Investigate subsurface utilities and buried objects in the vicinity of the Work Area. Establish locations of utility lines prior to commencing work.
- .2 If other subsurface utility lines and buried objects are encountered, contact the Consultant for further instructions.

1.3 Protection

- .1 Protect existing fencing trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain. If damaged, restore to original or better condition unless specified otherwise.
- .2 Maintain access roads to prevent accumulation of mud on roads.

PART 2 - PRODUCTS

2.1 Materials

- .1 Fill material: in accordance with Section 31 23 01 - Excavating, Trenching and Backfilling.
 - .2 Use excavated or graded material existing on site as fill for grading work if approved by Consultant. Protect approved material from contamination.
-

PART 3 - EXECUTION

3.1 Stripping of Topsoil

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .2 Commence topsoil stripping of areas as directed by Consultant after area has been cleared of brush weeds and grasses and removed from site.
- .3 Strip topsoil to depths as directed by Consultant. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Consultant. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil off site.

3.2 Grading

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finish grades:
 - .1 150 mm for grassed areas.
 - .2 300 mm for flowerbeds.
 - .3 500 mm for shrub beds.
 - .4 500 mm for asphalt paving.
 - .5 300 mm for concrete paving, walks and precast paving units.
- .3 Slope rough grade away from building 1:50 minimum.
- .4 Grade ditches to depth required for maximum run-off.
- .5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .6 Compact filled and disturbed areas to corrected maximum dry density to ASTM D 698-12 as follows or as indicated in soils report:
 - .1 90% for general fill in areas with no structural requirements.
 - .2 100% Standard Proctor maximum dry density for fill under the building addition.
- .7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 Inspection and Testing

- .1 Inspection and testing of soil compaction will be carried out by Inspection and Testing Company appointed and paid by the Owner. Contractor to provide notifications and assistance required under Section 01 45 00 Quality Control.

3.4 Surplus Material

- .1 Refer to Section 31 23 01 for off-site haulage of excavated site soils.

PART 1 - GENERAL

1.1 References

- .1 Canadian Council of Ministers of the Environment (CCME).
 - .1 CCME EPC-LST-61E - March 1993 , Environmental Code of Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products.
 - .2 CCME EPC-LST-71E - August 1994 , Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products.
- .2 Canadian Federal Legislation
 - .1 Canadian Environmental Protection Act (CEPA), 1988.
 - .2 Canadian Environmental Assessment Act (CEAA), 1995.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992.
 - .4 Motor Vehicle Safety Act (MVSA), 1995.
- .3 Canadian Standards Association (CSA).
 - .1 CSA S350-M1980 (R1998) (R1998) M1980 , Code of Practice for Safety in Demolition of Structures.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 ULC ORD-C107.19-1992, Secondary Containment of Underground Piping for Flammable and Combustible Liquids.
 - .2 ULC ORD-C58.15-1992, Overfill Protection Devices for Flammable Liquid Storage Tanks.
 - .3 ULC ORD-C58.19-1992, Spill Containment Devices for Underground Flammable Liquid Storage Tanks.

1.2 Existing Conditions

- .1 Should material resembling spray or trowel applied asbestos or any other designated substance listed be encountered in the course of demolition, stop work, take preventative measures, and notify Consultant immediately. Do not proceed until written instructions have been received.
- .2 List of items to be salvaged for reuse:
 - .1 Reserved
- .3 Structures to be demolished to be based on their condition on date that tender is accepted.
 - .1 Remove, protect and store salvaged items as directed by Consultant . Salvage items as identified by Consultant . Deliver to Consultant as directed.

1.3 Demolition Drawings

- .1 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Ontario, Canada.

1.4 Protection

- .1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades parts of existing building to remain . Provide bracing, shoring and underpinning as required. Repair damage caused by demolition as directed by Consultant .
- .2 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures and then cease operations and notify Consultant .
- .3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- .4 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .5 Fires and burning of waste or materials is not permitted on site.
- .6 Do not bury waste or materials on site.
- .7 Do not dispose of waste or volatile materials such as: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.
- .8 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- .9 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
- .10 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .11 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .12 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

1.5 Regulatory Requirements

- .1 Ensure work is performed in compliance with CEPA, CEAA, TDGA, MVSA, and all applicable provincial regulations .

PART 2 - PRODUCTS

2.1 Equipment

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

PART 3 - EXECUTION

3.1 Preparation

- .1 Disconnect and re-route electrical and telephone service lines entering buildings to be demolished. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .2 Disconnect and cap designated mechanical services.
 - .1 Natural gas supply lines: remove in accordance with gas company requirements.
 - .2 Sewer and water lines: remove to property line.
 - .3 Other underground services: remove and dispose of as directed by Consultant.
- .3 Do not disrupt active or energized utilities traversing premises designated to remain undisturbed .

3.2 Safety Code

- .1 Do demolition work in accordance with safety codes and requirements of local municipality.

3.3 Demolition

- .1 Demolish parts of structure to permit construction of addition and as indicated.
 - .2 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
 - .3 At end of each day's work, leave work in safe and stable condition. Protect interiors of parts not to be demolished from exterior elements at all times .
 - .4 Demolish to minimize dusting. Keep materials wetted as directed by Consultant.
-

- .5 Remove structural framing.
- .6 Dispose of materials as directed by Consultant .
- .7 Removal from site.
 - .1 Remove stockpiled material as directed by Engineer Consultant , when it interferes with operations of project construction.
 - .2 Remove stockpiles of like materials by an alternate disposal option once collection of materials is complete.
 - .3 Contain all fibrous materials (e.g. Insulation) to minimize release of airborne fiber while being transported within facility.
- .8 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
- .9 Use natural lighting to work by wherever possible. Shut off all lighting except those required for security purposes at the end of each day.

PART 1 - GENERAL

1.1 Examination of Site

- .1 Refer to Instructions to Bidders Article 5, Site Investigation, included in this specification, for details regarding co-ordination of earthworks activities.
- .2 Recommendations in the Soil Report, PML Ref.: 17BF054, Report: 1, dated November 14, 2017 constitute part of the Tender Document. Interpretation of the factual data by the contractor for his purposes is solely the responsibility of the contractor Contractor shall examine site and ascertain for himself extent and nature of materials it may be necessary to remove or supply to reach or provide depth levels, and grades required by drawings and specifications.

1.2 References

- .1 American Society for Testing and Materials (ASTM)
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1 Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2 Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1 and A23.2, Concrete Materials and Methods of Concrete Construction.
- .4 Ministry of Transportation, Ontario (MTO)
 - .1 LS-601 Method of Test for Materials Finer than 75m Sieve in Mineral Aggregates by Wasing.
 - .2 LS-602 Method of Test for Sieve Analysis of Aggregates.
 - .3 LS-625 Guidelines for Sampling of Aggregate Materials.
 - .4 LS-631 Method of Test for Determination of Presence of Plastic Fines in Aggregates.
 - .5 Ontario Provincial Standard Sepcification (OPSS)
 - .1 OPSS MUNI 1004 Material Specifications for Aggregates - Miscellaneous
 - .2 OPSS 1010 Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material
- .5 References to standards and tests as noted refer to the most recent version and update of the reference.

1.3 Definitions

- .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m³.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan and frozen materials.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.4 Protection of Existing Features

- .1 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to commencing any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.
 - .3 Confirm locations of buried utilities by careful test excavations.
 - .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of Consultant before moving or otherwise disturbing utilities or structures.
 - .5 Advise utility company to remove or re-route existing lines in area of excavation. Pay costs for such work.
 - .6 Record location of maintained, re-routed and abandoned underground lines.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Consultant, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.
 - .2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

1.5 Shoring, Bracing and Underpinning

- .1 Comply with applicable local regulations to protect existing features.
- .2 Engage services of qualified professional engineer who is registered in Ontario to design and inspect shoring, bracing and underpinning required for work.
- .3 At least 2 weeks prior to commencing work, submit design and supporting data.
- .4 Design and supporting data submitted to bear the stamp and signature of qualified professional engineer registered in the Province of Ontario.
- .5 Professional engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where engineer is employee of contractor, in which case contractor shall submit proof that work by professional engineer is included in contractor's insurance coverage.

1.6 Samples

- .1 At least 4 weeks prior to commencing work, inform Consultant of proposed source(s) of fill materials and provide access for sampling by the Inspection and Testing Company.
- .2 Supply only those materials approved by the Inspection and Testing Company for use on the project.

PART2 - MATERIALS

1.7 Granular Materials

- .1 Granular A conforming to OPSS 1010 to be used as base course below pavement (and slab-on-grade, if specified).
- .2 Granular B conforming to OPSS 1010 to be used as subbase course below pavement and engineered fill below slab-on-grade.
- .3 Select Subgrade Material (SSM) conforming to OPSS 1010 to be used as backfill below pavement and engineered fill below slab-on-grade.
- .4 19 mm crushed rock conforming to OPSS 1004 to be used as granular base below slab-on-grade, if specified, and embedment for exterior foundation drainage.
- .5 Select Excavated Material: Excavated site soil, free of deleterious materials that is at a suitable moisture content to achieve the specified degree of compaction, for use as engineered fill and below paved areas below design subgrade elevation and/or as general fill, subject to geotechnical field review and approval.

PART 3 - EXECUTION

3.1 Site Preparation

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with Section 02222 Structure Demolition.

3.2 Stripping of Topsoil

- .1 Commence topsoil stripping of areas as directed by Consultant after area has been cleared of brush weeds and grasses and removed from site.
- .2 Strip topsoil to depths as directed by Consultant. Avoid mixing topsoil with subsoil.
- .3 Stockpile in locations as directed by Consultant. Stockpile height not to exceed 2 m.
- .4 Dispose of unused topsoil off site.

3.3 Stockpiling

- .1 Stockpile fill materials in areas designated by Consultant. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

3.4 Shoring, Bracing and Underpinning

- .1 Construct temporary works to depths, heights and locations as approved by Consultant.
- .2 During backfill operation:
 - .1 Unless otherwise as indicated or as directed by Consultant, remove shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
- .3 Upon completion of substructure construction:
 - .1 Remove shoring and bracing.
 - .2 Remove excess materials from site and restore water courses as indicated and as directed by Consultant.

3.5 Dewatering and Heave Prevention

- .1 Keep excavations free of water while work is in progress.
- .2 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.
- .5 Submit for Consultant's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.

- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

3.6 Excavation

- .1 Advise Consultant sufficiently in advance of excavation operations to enable original cross sections to be taken.
 - .2 Excavate to lines, grades, elevations and dimensions as indicated on drawings and in the soil report, whichever is deeper and wider as required to complete the work. Provide shoring and bracing as required to complete this work.
 - .3 Remove concrete masonry paving walks demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02222 Structure Demolition.
 - .4 Excavation must not interfere with normal 7 Vertical to 10 Horizontal angle from bottom of any footing.
 - .5 For trench excavation, unless otherwise authorized by Consultant in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
 - .6 Do not obstruct flow of surface drainage or natural watercourses.
 - .7 Inspection and Testing Company to approve base of excavation before backfilling.
 - .8 Where unacceptable bearing or other subsurface conditions are encountered, do not excavate beyond the design elevation or extent of contract or as indicated in the soil report without written authorization of the consultant. All additional excavation to proceed only as follows.
 - .1 Contractor to excavate to elevations noted.
 - .2 Contractor to arrange for Inspection and Testing Company to be present to document presence of unacceptable subsurface conditions and to confirm that additional excavation is required.
 - .3 Removal of all additional material to be removed and quantified by independent Inspection and Testing Company designated by Owner.
 - .4 Inspection and Testing Company to outline extent of required additional excavation and to confirm and document all new elevations and quantities of removal and replaced material.
 - .5 Inspection and Testing Company to verify all additional quantities as submitted by the contractor.
 - .6 All requests for extras to be submitted with Inspection and Testing Company verification documentation.
 - .9 Unauthorized over excavation to be corrected at no extra cost to Owner using imported granular materials as approved by the Inspection and Testing Company.
-

3.7 Fill Types and Compaction

- .1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698-12.
- .2 100% Standard Proctor maximum dry density for
 - .1 Granular A base course and Granular B subbase course below pavement and engineered fill below floor slab-on-grade.
 - .2 Granular A below concrete slabs, if specified.
 - .3 Select Excavated Soil and Select Subgrade Material for fill under paved areas, and engineered below building addition.
- .3 95% Standard Proctor maximum dry density for
 - .1 Service trench backfill to design subgrade elevation / underside of Granular B subbase.
 - .2 Backfill to the exterior side of perimeter walls.
- .4 90% Standard Proctor maximum dry density for general fill in areas with no structural requirements.
- .5 Asphalt: In accordance with OPSS 310 (Refer to Section 02513).

3.8 Excavation and Backfilling for Underground Services

- .1 Application:
 - .1 Excavate all existing materials, including rock, to extents, depths and limits as indicated on drawings for all site services. Maintain excavations large enough to permit placement, inspection, and testing of pipe work as required. Provide all shoring and bracing required to execute this work.
 - .2 Excavate to provide granular frost tapers for service trenches in accordance with OPSD 803.030 and OPSD 803.031.
 - .3 After excavation to the design grade and before placing pipes, contact the Inspection & Testing Company for inspection and approval of the trench base.
 - .4 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground. Backfill material to be free from debris, snow, ice and water.
 - .5 Place appropriate bedding materials around pipe work as indicated on drawings. Backfill remainder of trench with Select Subgrade Material. Select Excavated Soil may be used as backfill below a depth of 1 m below the pavement design subgrade elevation / below underside of Granular B subbase.
 - .6 Deposit and spread material in uniform layers not exceeding 200 mm loose measurement, in depth. Shape each layer to a smooth contour and compact to 95% Standard Proctor Density before placing succeeding layers.
 - .7 Supply compaction equipment suitable for achieving the specified degree of compaction.
 - .8 Co-ordinate work with Inspection & Testing Company to allow inspection and testing and approval of earthworks.
 - .9 Install insulation over storm sewer to extent shown on drawings. Do not cover until inspected and approved by Civil Consultant.

3.9 Backfilling

- .1 Vibratory compaction equipment: appropriate to achieve specified degree of compaction.
- .2 Do not proceed with backfilling operations until Consultant has inspected and approved installations.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 200 mm loose measurement up to grades indicated. Compact each layer to specified degree of compaction before placing succeeding layer.
- .6 Backfilling around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in- place concrete within 24 h after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed .6 m.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Consultant or:
 - .2 If approved by Consultant, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Consultant.

3.10 Restoration

- .1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects as directed by Consultant.
- .2 Replace topsoil.
- .3 Reinstate pavement and sidewalks and lawns to elevation which existed before excavation and blend to ensure smooth transition.
- .4 Clean and reinstate areas affected by work as directed by Consultant.

3.11 Quality Assurance

- .1 Materials and installation shall be subject to approval by independent Inspection and Testing Company appointed and paid by the Owner.

3.12 Off-Site Haulage of Excavated Site Soil

- .1 The soil Report included in the Tender Document (PML Ref: 17BF054, Report: 3, dated November 21, 2017) has identified the Site Condition Standards for the project site to be Table 2 with Residential / Parkland / Institutional land use, in accordance with Ontario Regulation 153/04, as amended. (O.Reg. 153/04, as amended)
- .2 Limited testing has identified that the site soils meet the Table 2 Residential / Parkland / Institutional Site Condition Standards and can be re-used on-site, subject to geotechnical requirements and approval by the Consultant.
- .3 Excess excavated soil shall be taken to a receiving site, where the receiving Site Condition Standards comply with any of the following O.Reg. 153/04, as amended, criteria
 - .1 Table 2, Any Land Use
 - .2 Table 3, Any Land Use
 - .3 Table 6, Any Land Use
 - .4 Table 7, Any Land Use
- .4 Excavated site soil shall not be hauled to a site where Table 1, Table 8 or Table 9 Site Condition Standards apply, or to a site where a Record of Site Condition (RSC) is being carried out as outlined in O.Reg.153/04, as amended.
- .5 The contractor is fully and solely responsible for all activities related to haulage of soil off-site, including, but not limited to:
 - .1 Conduct sampling and testing to verify the environmental quality of the actual soil to be removed off-site, and confirm applicable handling and disposal options.
 - .2 Disclose all available analytical results and environmental assessment reports to the receiving site owners/authorities and provide confirmation that they have agreed to receive the material.
 - .3 Satisfy all requirements of the receiving site, including any additional testing that the receiving site may require.
 - .4 Select a receiving site with Site Condition Standards that are compatible with the environmental quality of the soil originating from the source site.
 - .5 Supply all equipment suitable for handling and transporting the material, including licensed haulage contractors.
 - .6 Complete any and all manifest and documents that are necessary for this activity.
 - .7 Complying with all requirements of MOE, other regulating agencies and the receiving site authority.

PART 1 - GENERAL

1.1 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 698, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)
 - .2 ASTM D 6752, Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA A23.1/A23.2 Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .3 Ministry of Transportation, Ontario (MTO)
 - .1 LS-261, Preparation of Marshall Specimens
 - .2 LS-262, Bulk Relative Density of Compacted Bituminous Mixtures
 - .3 LS-263, Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
 - .4 LS-264, Theoretical Maximum Relative Density of Bituminous Pavement Mixtures
 - .5 LS-265, Percent Air Voids in Compacted Dense Bituminous Pavement Mixtures
 - .6 LS-282, Quantitative Extraction of Asphalt Cement and Analysis of Extracted Aggregate from Bituminous Paving Mixtures
- .4 Ontario Provincial Standards Specification(OPSS)
 - .1 OPSS.MUNI 310, Construction Specification for Hot Mix Asphalt
 - .2 OPSS 1003, Material Specification for Aggregates - Hot Mix Asphalt
 - .3 OPSS.MUNI 1101, Material Specification for Performance Graded Asphalt Cement
 - .4 OPSS.MUNI 1003, Material Specification for Emulsified Asphalt
 - .5 OPSS.MUNI 1103, Rev. Date: 11/2006, Material Specification for Aggregates - Hot Mix Asphalt

1.2 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 At least 4 weeks prior to commencing work inform Consultant of proposed source(s) of aggregates and provide access for sampling by the Inspection and Testing Company.
- .3 Supply only those materials approved by the Inspection and Testing Company for use on the Project.

1.3 Protection

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38°C. Do not permit stationary loads on pavement until 24 h after placement.
- .2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

1.4 Mix Design

- .1 Submit to the Consultant for approval, a minimum of 2 weeks prior to construction, current mix designs for concrete and asphalt verifying conformance to the OPSS requirements. No materials shall be delivered to the site until the mix designs have been approved.

PART 2 - MATERIALS

2.1 Granular Materials

- .1 Granular A conforming to OPSS 1010 to be used as base course below pavement and exterior concrete slabs, if specified.
- .2 B conforming to OPSS 1010 to be used as subbase course below pavement.

2.2 Asphaltic Concrete Pavement

- .1 The materials used in the production of Hot Mix Asphalt shall be according to OPSS 1150.
 - .2 Asphalt Cement - Performance Graded Asphalt Cement conforming to OPSS 1101.
 - .3 Tack Coat shall consist of SS-1 emulsified asphalt diluted within equal volume of water. The undiluted material shall be according to OPSS 1103.
 - .4 Aggregates to be used in the production of Hot Mix Asphalt shall meet the gradation requirements detailed in OPSS 1003.
-

PART 3 - EXECUTION

3.1 Subgrade Inspection

- .1 Install 100 mm diameter perforated subdrain with factory wrapped geosynthetic filter fabric at all storm manhole and catchbasin locations to extending out 1.5 m from all four sides. Subdrain installation to conform to OPSD 216.021 and OPSS 405.
- .2 Inspect existing subgrade materials over which new granulars and asphalt are to be placed to ensure that they are stable and compacted to 95% Standard Proctor maximum dry density as indicated under Section 02223. Report deficiencies to General Contractor for rectification prior to commencement of work.

3.2 Granular Sub-base and Granular Base

- .1 Place granular base and sub-base material on clean unfrozen surface, properly shaped and compacted and free from snow and ice and prepared in accordance with Article 3.1, Item 2.
- .2 Place granular base and sub-base to compacted thicknesses as indicated.
- .3 Place in layers not exceeding 200 mm loose thickness and compact to 100% Standard Proctor maximum dry density.
- .4 Finished granular base surface to be within 10 mm of specified grade, but not uniformly high or low.

3.3 Tack Coat

- .1 Emulsified asphalt:
 - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Consultant.
 - .2 Apply diluted asphalt emulsion at rate directed by Consultant but do not exceed 5 L/m².
 - .3 Apply to all existing pavement surfaces to receive new asphalt, vertical and horizontal.

3.4 Plant and Mixing Requirements

- .1 To OPSS 1150.

3.5 Equipment

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers, general: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers for parking lots and driveways:
 - .1 Minimum drum diameter: 750 mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of adequate size, speed and condition to ensure orderly and continuous operation.
- .5 Suitable hand tools.

3.6 Asphalt Concrete Paving

- .1 Obtain approval of granular base from Consultant before placing asphalt mix.
- .2 Place hot mix asphalt to extent shown on drawings.
- .3 Place asphalt mix only when granular base or previous pavement course is dry and air temperature is above 5°C.
- .4 Place asphalt concrete in compacted layers not exceeding 50 mm each lift.
- .5 Asphalt shall be delivered to site at a sufficient temperature to achieve a minimum of 120°C in the pavement mat after placement and prior to initial rolling.
- .6 Maximum 160°C mix temperature permitted at any time.
- .7 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .8 Roll until roller marks are eliminated. Compact asphaltic concrete to density not less than 92% of mixes' Maximum Relative Density in accordance with OPSS 310.
- .9 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .10 Moisten roller wheels with water to prevent mix adhesion. .
- .11 Compact mix with hot tampers or other equipment approved by Consultant, in areas inaccessible to roller.
- .12 Finish surface smooth, true to grade to within 6 mm and with no irregularities greater than 6 mm in 3 m.

3.7 Joints

- .1 Cut existing pavement to full depth in neat lines to provide full cross section against which new paving will be laid. Remove loose material. Should the existing pavement exceed 50 mm in thickness, a minimum 300 mm wide step joint should be constructed immediately adjacent to the new work to a minimum depth of 40 mm.
- .2 Paint exposed vertical edge of asphaltic joints, edges of drainage structures, curbs and similar items with tack coat prior to placing of fresh mix.
- .3 Overlap previously laid strip with spreader by 150 mm, plus or minus 50 mm.
- .4 Carefully place and compact hot asphaltic material against joints.

3.8 Asphaltic Curbs

- .1 Form asphaltic curbs by machine to profiles as indicated. Curve curbs uniformly.

3.9 Speed Bumps

- .1 Form speed-limiting bumps as indicated. Stop bumps 300 mm short of curb edge of driveway.

3.10 Paving Schedule

- .1 Specified granular and pavement thicknesses are as shown on drawings and no less than as follows below:
 - .1 40 mm HL 3 Surface
 - .2 50 mm HL 8 Binder
 - .3 150 mm Granular A
 - .4 300 mm Granular B Type I

3.11 Inspection and Testing

- .1 Inspection and testing of asphalt pavement will be carried out by Independent Inspection and Testing Company appointed and paid by Owner.

PART 1 - GENERAL

1.1 References

- .1 ASTM D 698, Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 2.49 kg Rammer and 304.8 mm Drop.

PART 2 - PRODUCTS

2.1 Materials

- .1 Concrete mixes and materials: to Section 03300 - Cast-in-Place Concrete.
- .2 Reinforcing steel: to Section 03200 - Concrete Reinforcement.
- .3 Joint filler Curing Compound: to Section 03300 - Cast-in-Place Concrete.
- .4 Granular base: as approved by Consultant .
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.

2.2 Pre-Cast Concrete Curbs

- .1 Pre-cast concrete curbs 2440mm long x 279mm wide x 152mm high chamfered at top corners 76mm x 76mm with 2 pinning holes set 300mm from ends centred on width. Air entrained 6%, smooth trowel finish. Submit shop drawings in accordance with Section 01300.

PART 3 - EXECUTION

3.1 Grade Preparation

- .1 Place fill in maximum 150 mm layers and compact to at least 95% of maximum density to ASTM D 698.

3.2 Granular Base

- .1 Obtain Consultant's approval of subgrade before placing granular base.
 - .2 Place granular base material to lines, widths, and depths as indicated.
 - .3 Compact granular base to 100% of maximum density to ASTM D 698.
-

3.3 Concrete

- .1 Obtain Consultant's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03300 - Cast-in-Place Concrete and as specified herein.
- .3 Round edges, including edges of joints, with 10 mm radius edging tool.
- .4 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line. Provide edging as indicated.
- .5 Provide minimum 6% air entrainment to all exterior concrete.

3.4 Pre-Cast Concrete Curbs

- .1 Set pre-cast concrete curbs as shown on drawings in accordance with manufacturer's specifications and as directed on site.

3.5 Tolerances

- .1 Finish surfaces to within 3 mm in 3 m as measured with straightedge placed on surface.

3.6 Expansion and Contraction Joints

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.
 - .2 Install expansion joints at intervals of 6 m.
 - .3 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
 - .4 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.
 - .5 Install joint filler in expansion joints in accordance with Section 03300 - Cast-in-Place Concrete.
 - .6 Seal expansion joints with sealant approved by Consultant.
-

3.7 Curing

- .1 Cure concrete by adding moisture to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound approved by Consultant.
- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film. Follow manufacturer's instructions.

3.8 Backfill

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material approved by Consultant. Compact and shape to required contours as indicated or as directed by Consultant.

3.9 Linseed Oil Treatment

- .1 After concrete has cured for specified curing time and when surface of concrete is dry, apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters.

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 02223 - Excavating, Trenching and Backfilling .

1.2 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .2 G401, Corrugated Steel Pipe Products.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-34.22, Asbestos-Cement Drain Pipe.
 - .2
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .4 Ontario Provincial Standard Specification (OPSS)

1.3 Site Conditions

- .1 Examine sub-surface investigation report which is bound into specification following Section 00225.
- .2 Known underground utility lines and buried objects are as indicated on plans.

PART 2 - PRODUCTS

2.1 Bedding and Surround Materials

- .1 19mm Clear Crushed Stone conforming to OPSS.MUNI 1004.
- .2 Flexible plastic tubing and fittings. Corrugated Perforated nominal inside diameter 150 mm.
- .3 Rigid plastic pipe and fittings: to CSA B182.1-96, size NPS 2 , complete with fittings.
- .4 Geotextile filter: Terrafix 270R or equal.
- .5 Glass fibre rigid board building insulation, 112 kg/m³ density, unfaced.
- .6 Prefabricated drainage system with long term flow capacity and compressive strength to suit application.

- .7 Cleanouts: as recommended by manufacturer .

2.2 Backfill Material

- .1 Type 2, in accordance with Section 02223 - Excavating, Trenching and Backfilling.

PART 3 - EXECUTION

3.1 Inspection

- .1 Ensure graded subgrade, sub-base, and base conforms with required drainage pattern before placing bedding material.
- .2 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Consultant .
- .3 Ensure foundation wall and dampproofing have been installed and approved by Consultant before placing bedding material.

3.2 Bedding Preparation

- .1 Cut trenches in subgrade base sub-base and place bedding material s in uniform layer s not exceeding 150 mm compacted thickness to depth of 300 mm minimum or to depth as indicated.
- .2 Shape bed true to grade and to provide continuous, uniform bearing surface for tubing.
- .3 Shape transverse depressions, as required, to suit joints.
- .4 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698-00a.
- .5 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.3 Pipe or Tubing Installation

- .1 Ensure tubing interior and coupling surfaces are clean before laying.
- .2 Lay perforated tubing level minimum to slope of 1:100. Face perforations and coupling slots downward.
- .3 Grade bedding to establish tubing slope.
- .4 Install end plugs at ends of collector drains to protect tubing ends from damage and ingress of foreign material.

- .5 Connect non-perforated tubing to storm sewer by appropriate adapters manufactured for this purpose.
- .6 Provide flush cleanouts where directed by Consultant .
- .7 Connect drainage system to building storm sewers, as indicated.

3.4 Pipe or Tubing Surround Material

- .1 Upon completion of tubing laying and after Consultant has inspected work in place, surround and cover tubing and install geotextile filter as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness, as indicated. Do not drop material within 1 m of tubing.
- .3 Place layers uniformly and simultaneously on each side of tubing.
- .4 Compact each layer from tubing invert to mid-height of tubing to at least 95% maximum density to ASTM D 698.
- .5 Compact each layer from mid-height of tubing to underside of backfill to at least 95% maximum density to ASTM D 698.

3.5 Backfill Material

- .1 Place backfill material above tubing surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D 698. In other areas, compact to at least 90% maximum density to ASTM D 698.

PART 1 - GENERAL

1.1 References

- .1 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thinner.
- .2 CGSB 1-GP-12c-68, Standard Paint Colours.
- .3 CGSB 1-GP-71, Method, of Testing Paints and Pigments.
- .4 CGSB 1-GP-74M, Paint, Traffic, Alkyd.
- .5 Water-borne traffic paint shall conform to OPSS 1716.

1.2 Samples

- .1 Submit samples in accordance with Section 01300.
- .2 Submit to Consultant following material sample quantities at least 4weeks prior to commencing work.
 - .1 Two 1L samples of each type of paint.
- .3 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

PART 2 - PRODUCTS

2.1 Materials

- .1 Paint:
 - .1 To CGSB 1-GP-74M, alkyd traffic paint.
 - .2 Colour: to CGSB 1-GP-12C, yellow 505-308.
 - .3 Upon request, Engineer Consultant will supply a qualified product list of paints applicable to work. Qualified paints may be used but Engineer Consultant reserves right to perform further tests.
- .2 Thinner: to CAN/CGSB-1.5-M91.

PART 3 - EXECUTION

3.1 Equipment Requirements

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.
- .2 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

3.2 Condition of Surfaces

- .1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.3 Application

- .1 Lay out pavement markings.
- .2 Unless otherwise approved by Consultant, apply paint only when air temperature is above 10°C, wind speed is less than 60km/h and no rain is forecast within next 4h.
- .3 Apply traffic paint evenly at rate of 3m² /L.
- .4 Do not thin paint unless approved by Consultant.
- .5 Symbols and letters to conform to dimensions indicated.
- .6 Paint lines to be of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.

3.4 Tolerance

- .1 Paint markings to be within plus or minus 12mm of dimensions indicated.
- .2 Remove incorrect markings as directed by and using methodology as directed by Consultant.

3.5 Protection of Completed Work

- .1 Protect pavement markings until dry.

PART 1 – General

1.1 Requirements

- .1 Installer shall have at least five (5) years proven experience in the industry and approved by product manufacturer
- .2 Submit 300mm x 300mm product samples in specific colour and specified thickness.
- .3 Rubberized asphalt safety surface will only be installed in specific colour and specified thickness.

PART 2– PRODUCTS

2.1 Material

- .1 Fortco Limited Playsafe or equal by Rubaroc or as approved by Consultant (Poured-in-Place) seamless play area surface consisting of recycled rubber tire granular combined together with polyurethane binder. Top Coat is UV-stable EPDM Rubber granules combined with polyurethane binder. All Materials are North American manufactured. Designed and installed by manufacturer to meet and surpass all current C.S.A. standards.
- .2 Tested in accordance to A.S.T.M. F-1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
- .3 Tested according to A.S.T.M F-1292 , C.S.A. and meeting CPSC standards for playground surfacing and providing a GMAX of less then 200 and a HIC of less then 1000.
- .4 CAN/CSA-Z614-07 Standards on Children's Playspaces and Equipment. A National standard of Canada.
- .5 Geotextile Terrafix 270R or equal as approved by Consultant.

2.2 Colours

- .1 Colour selected by Consultant from manufacturer's full colour range. UV-stable EPDM.

PART 3– EXECUTION

3.1 Installation – Base Preparation

- .1 Install on granular subbase with minimum slope of 2%. Verify suitability prior to installation.
- .2 Provide 100 mm minimum depth, compacted to a 95% proctor density with a maximum water percolation rate of 60 liters/M2/hour. Should the rate be less, a french drain must be installed to provide adequate water flow. Provide geotextile between the granular base and surface Terrafix 200R or equal.

3.2 Installation – Thickness of Poured-in-Place

- .3 First lift application: Thickness of the rubber safety surface 100mm min. (SBR rubber) meeting CSA and ASTM standards for safety surfacing.
- .4 Second lift to be applied at a minimum thickness of 5-8mm, using E.P.D.M. rubber granules ranging from 2.5mm to 3.5mm in size.
- .5 Polyurethane binder shall be mixed throughout the entire thickness.
- .6 Install bevel at the perimeter of the installation running from the thickness of the surface down to the base. The outside line of the bevel must be clear and follow the designed edge of the installation.

PART 1 - GENERAL

1.1 References

- .1 ASTM A 53/A 53M-02 53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A 90/A 90M-01 90M-01, Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- .3 ASTM A 121-99, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
- .4 ASTM A 525M-91b, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process.
- .5 ASTM A 585-97, Specification for Aluminum-Coated Steel Barbed Wire.
- .6 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.
- .7 CAN/CSA-G164-M92 (R1998) (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .8 CAN/CGSB-138.1-96, Fence, Chain Link, Fabric.
- .9 CAN/CGSB-138.2-96, Fence, Chain Link, Framework, Zinc-Coated, Steel.
- .10 CAN/CGSB-138.3-96, Fence, Chain Link - Installation.
- .11 CAN/CGSB-138.4-96, Fence, Chain Link, Gates.
- .12 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

PART 2 - PRODUCTS

2.1 Materials

- .1 Concrete mixes and materials: to Section 03300 - Cast-in-Place Concrete CAN/CSA-A23.1-00.
 - .1 Nominal coarse aggregate size: 20-5.
 - .2 Compressive strength: 20 MPa minimum at 28 days.
- .2 Chain-link fence fabric: to CAN/CGSB-138.1-96.
 - .1 Type 1, Class A, heavy style, 38mm x 38mm 6 ga. wire black vinyl coated.
 - .2 Height of fabric: 1.8 m, or as shown on drawings.
- .3 Posts, braces, top and bottom rails: to CAN/CGSB-138.2-96, galvanized steel pipe primed and painted 2 coats black. Dimensions as indicated.
- .4 Tie wire fasteners: to CAN/CGSB-138.1-96, Table vinyl coated.

- .5 Tension bar: to ASTM A 525M-91b, 5 x 20 mm minimum galvanized steel.
- .6 Gate frames: to ASTM A 53/A 53M-02 53M-02, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.
 - .1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.
 - .2 Fasten fence fabric to gate with twisted selvage at top.
 - .3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.
 - .4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.
- .7 Fittings and hardware: to CAN/CGSB-138.2-96, cast aluminum alloy, galvanized steel or malleable or ductile cast iron. Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail. Overhang tops to provide waterproof fit, to hold top rails. Turnbuckles to be drop forged.
- .8 Organic zinc rich coating: to CAN/CGSB-1.181-99.

2.2 Finishes

- .1 Galvanizing:
 - .1 For chain link fabric: to CAN/CGSB-138.1-96 Grade 2.
 - .2 For pipe: 550 g/m² minimum to ASTM A 90/A 90M-01 90M-01.
 - .3 For barbed wire: to ASTM A 121-99, Class 2 CAN/CGSB-138.2-96.
 - .4 For other fittings: to CAN/CSA-G164-M92 (R1998) (R1998).
- .2 Aluminum coating:
 - .1 For barbed wire: to ASTM A 585-97, Class 2.
- .3 Vinyl coating:
 - .1 0.045 mm dry film thickness minimum.

PART 3 - EXECUTION

3.1 Grading

- .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 Erection of Fence

- .1 Erect fence along lines as indicated and in accordance with CAN/CGSB-138.3-96.
- .2 Excavate post holes to dimensions indicated.
- .3 Space line posts 3 m apart, measured parallel to ground surface.
- .4 Space straining posts at equal intervals not exceeding 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.
- .5 Install additional straining posts at sharp changes in grade and where directed by Consultant.
- .6 Install corner post where change in alignment exceeds 10°.
- .7 Install end posts at end of fence and at buildings. Install gate posts on both sides of gate openings.
- .8 Place concrete in Sonotube forms or equal then embed posts into concrete to minimum 1200 mm depth. Extend concrete 50 mm above ground level and slope to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .9 Do not install fence fabric until concrete has cured a minimum of 5 days.
- .10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.
- .11 Install overhang tops and caps.
- .12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.
- .13 Install bottom rail between posts and fasten securely to posts.
- .14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Knuckled selvedge at bottom. Twisted selvedge at top.
- .15 Secure fabric to top rails, line posts and bottom rails with tie wires at 450 mm intervals. Give tie wires minimum two twists.
- .16 Install grounding rods as indicated.

3.3 Installation of Gates

- .1 Install gates in locations as indicated.
- .2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.
- .3 Determine position of centre gate rest for double gate. Cast gate rest in concrete as directed. Dome concrete above ground level to shed water.
- .4 Install gate stops where indicated.

3.4 Touch up

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas in accordance with Section 09911 - Painting. Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.5 Cleaning

- .1 Clean and trim areas disturbed by operations. Dispose of surplus material and replace damaged turf with sod as directed by Consultant.

PART 1 - GENERAL

- .1 Conform to Division 1. General Requirements and all documents referred to therein.

1.1 Related Work

- .1 Site Grading: Section 02210
- .2 Sodding: Section 02938

1.2 Source Quality Control

- .1 Advise Consultant of sources of topsoil to be utilized 7 days in advance of starting work.
- .2 Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.

PART 2 - PRODUCTS

2.1 Topsoil

- .1 Topsoil for seeded areas: mixture of mineral particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand and contain 2 to 10% organic matter by weight.
 - .2 Fertility: major soil nutrients present in following ratios:
 - .1 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .2 Phosphorus (P): 10 to 20 micrograms of phosphate per gram of topsoil.
 - .3 Potassium (K): 80 to 120 micrograms of potash per gram of topsoil.
 - .4 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
 - .3 Ph value: 6.5 to 8.0
 - .4 Contain no toxic elements or growth inhibiting materials.
 - .5 Free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .6 Consistence: friable when moist.

2.2 Soil Amendments

- .1 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
- .2 Sand: washed coarse silica sand, medium to coarse textured.
- .3 Limestone:
 - .1 Ground agricultural limestone containing minimum calcium carbonate equivalent of 85%.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .4 Fertilizer:
 - .1 Complete, commercial, with 35% soluble nitrogen.

PART 3 - EXECUTION

3.1 Stripping of Topsoil

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .2 Commence topsoil stripping after area has been cleared of brush, weeds and grasses and removed from site.
- .3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Consultant. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil off site.
- .6 Protect stockpiles from contamination and compaction.

3.2 Preparation of Existing Grade

- .1 Verify that grades are correct. If discrepancies occur, notify Consultant and do not commence work until instructed by Consultant.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.

- .4 Course cultivate entire area which is to receive topsoil to depth of 100 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 Placing and Spreading of Topsoil/Planting Soil

- .1 Place topsoil after Consultant has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil to following minimum depths after settlement and 80% compaction:
 - .1 150 mm for seeded areas
 - .2 150 mm for sodded areas
 - .3 300 mm for flower beds
 - .4 500 mm for shrub beds
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.4 Soil Amendments

- .1 For planting beds and turf: apply and thoroughly mix soil amendments and fertilizer into full specified depth of topsoil as recommended by the soil analysis testing report.

3.5 Finish Grading

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Consultant. Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 Acceptance

- .1 Consultant will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading. Approval of topsoil material subject to soil testing and analysis.
- .2 Testing of topsoil will be carried out by testing laboratory designated by Consultant. Soil sampling, testing and analysis to be in accordance with Provincial regulations and standards.

3.7 Restoration of Stockpile Sites

- .1 Restore stockpile sites acceptable to Consultant.

3.8 Surplus Material

- .1 Promptly as the work proceeds and upon completion, remove all surplus material from the building and site resulting from the foregoing work.

PART 1 - GENERAL

- .1 Conform to Division 1. General Requirements and all documents referred to therein.

1.1 Source Quality Control

- .1 Obtain approval from Consultant of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization.

1.2 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit:
 - .1 Sod for each type specified.
 - .2 Bio-degradable geotextile fabric.
 - .3 Geotextile jet blast control fabric.
- .3 Obtain approval of samples by Consultant.

1.3 Scheduling

- .1 Schedule sod laying to coincide with preparation of soil surface.
- .2 Schedule sod installation after frost has left ground and before June 15 or between August 15 and September 30.

1.4 Delivery and Storage

- .1 Schedule deliveries in order to keep storage at job site to minimum, without causing delays.
 - .2 Deliver, unload and store sod on pallets.
 - .3 Deliver sod to site within 24 hours of being lifted and lay sod within 36 hours of being lifted.
 - .4 Do not deliver small irregular or broken pieces of sod.
 - .5 During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.
 - .6 During dry weather, protect sod from drying and water sod as necessary to ensure its vitality and prevent drooping soil in handling. Dry sod will be rejected.
-

PART 2 - PRODUCTS

2.1 Materials

- .1 Number One Turfgrass Nursery Sod to match existing: Sod that has been especially sown and cultivated in nursery fields as turfgrass crop.
 - .1 Turfgrass Nursery Sod types:
 - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.
 - .2 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivar(s).
 - .3 Number One Named Cultivars: Nursery Sod grown from certified seed of licenced cultivar.
 - .2 Turfgrass Nursery Sod quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible when mown to height of 40 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 9 to 15 mm in thickness.
- .2 Field or Pasture Sod: sod that has not been grown as Turfgrass Nursery Sod crop.
 - .1 Fertilize prior to lifting in accordance with fertilizer program.
 - .2 Mow sod at height directed by Consultant within 36 h prior to lifting, and remove clippings.
- .3 Sod establishment support:
 - .1 Geotextile fabric: biodegradable.
 - .2 Wooden pegs: 17 x 18 x 250 mm.
 - .3 Geotextile jet blast control fabric: 50 mm square mesh, tensile strength sufficient to withstand jet blast loading. Staples: U-shape, 300 mm length.
- .4 Water:
 - .1 Supplied by Owner at designation source.
 - .2 Potable, free of impurities.
- .5 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

PART 3 - EXECUTION

3.1 Preparation

- .1 Verify that grades are correct and prepared in accordance with Section 02921 - Topsoil and Finish Grading. If discrepancies occur, notify Consultant and do not commence work until instructed by Consultant.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet or dry soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turfgrass Nursery Sod and plus or minus 15 mm for Field or Pasture Sod, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.
- .5 Cultivate fine grade approved by Consultant to 25 mm depth immediately prior to sodding.

3.2 Sod Placement

- .1 Lay sod within 36 h of being lifted. Sodding during dry summer period, at freezing temperatures or over frozen soil is NOT acceptable. —
- .2 Lay sod sections in rows, longitudinally, along contours of slopes, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Consultant. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.
- .4 Water immediately after sod placement to obtain moisture penetration through sod into top 100mm of topsoil.

3.3 Fertilizing Program

- .1 Fertilize during establishment and warranty periods to Industry standards.

3.4 Maintenance During Establishment Period

- .1 Perform following operations from time of installation until acceptance.
 - .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
-

- .3 Cut grass to 40 mm when it reaches height of 60 mm. Remove clippings which will smother grassed areas.
- .4 Clean-up any accidental contamination of surfaces by foreign objects instantly.
- .5 Maintain sodded areas weed free.
- .6 Fertilize areas in accordance with fertilizing program.

3.5 Acceptance

- .1 Turfgrass Nursery Sod areas will be accepted by Consultant provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots and without weeds.
 - .3 No surface soil is visible when grass has been cut to height of 40 mm.
 - .4 Sodded areas have been cut minimum 2 times, and within 24 h prior to acceptance.
 - .5 Fertilizing in accordance with fertilizer program has been carried out at least once.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

PART 1 - GENERAL

1.1 References

- .1 CSA A179-M76 Mortar and Grout for Unit Masonry.
- .2 A371-94 Masonry Construction for Buildings.

1.2 Source Quality Control

- .1 Submit laboratory test reports in accordance with Section 01300 - Submittals.
- .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 for units proposed for use.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit samples:
 - .1 Two of each type of masonry unit specified.
 - .2 One of each type of masonry accessory specified.
 - .3 One of each type of masonry reinforcement and tie proposed for use.
 - .4 As required for testing purposes.

1.4 Product 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.

1.5 Cold Weather Requirements

- .1 Supplement Clause 5.15.2 of A371-94 with following requirements:
 - .1 Maintain temperature of mortar between 5°C and 50°C until used.
-

1.6 Hot Weather Requirements

- .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

1.7 Protection

- .1 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.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 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 other sections.

PART 3 - EXECUTION

3.1 Workmanship

- .1 Do masonry work in accordance with A371-94 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.

3.2 Tolerances

- .1 Tolerances in notes to Clause 5.3 of A371-94 apply.

3.3 Exposed Masonry

- .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.
-

3.4 Jointing

- .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints where concave joints are indicated.
- .2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.
- .3 At all exposed horizontal masonry, strike mortar across exposed masonry to drain water and prevent accumulation of snow. Apply clear waterproof sealer.
- .4 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.

3.5 Cutting

- .1 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.
- .2 Make cuts straight, clean, and free from uneven edges.

3.6 Building-In

- .1 Build in items required to be built into masonry.
- .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

3.7 Wetting of Bricks

- .1 Except in cold weather, wet clay bricks having an initial rate of absorption exceeding 1 g/minute/1000 mm²: 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.
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3.8 Parging

- .1 Use parging mortar specified in Section 04100 - Mortar and Grout for Masonry.
- .2 Apply parging in uniform coating not less than 10 mm thick, where indicated.

3.9 Support of Loads

- .1 Use 25 MPa concrete to Section 03300 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.
- .2 Use grout to CSA A179-94(R1999) where grout is used in lieu of solid units.
- .3 Install building paper below voids to be filled with concrete grout; keep paper 25 mm back from faces of units.

3.10 Provision for Movement

- .1 Leave 3 mm space below shelf angles.
- .2 Leave 6 mm space or space as required to accommodate anticipated deflection between top of non-load bearing walls and partitions and structural elements. Do not use wedges. Pack joint with mineral wool batts, and caulk with fire stop material. Provide lateral support at 1200 o.c. as required, unless otherwise specified.
- .3 Build masonry to tie in with stabilizers, with provision for vertical movement.

3.11 Loose Steel Lintels

- .1 Install loose steel lintels. Centre over opening width.

3.12 Control Joints

- .1 Provide continuous control joints at 6.0 m o.c. maximum or as indicated.

3.13 Existing Work

- .1 Make good existing work. Use materials to match existing.

3.14 Recessed Devices

- .1 Recess wall mounted electrical devices in Gymnasium and any other wall mounted equipment which may be prone to damage. Recess concrete block face panel minimum 50mm, size to suit but not smaller than 200mm x 200mm. Provide
-

bullnose blocks at exposed vertical corners. Submit summary of equipment to be recessed and review with Consultant prior to commencement of work.

3.15 Testing

- .1 Inspection and testing will be carried out by Testing Laboratory designated by Consultant.
- .2 Cost of testing will be paid from cash allowance specified in Section 01021 - Allowances.

PART 1 - GENERAL

1.1 Related Work

- .1 Masonry procedures: Section 04050 Masonry Procedures

1.2 References

- .1 CSA A179-94(R1999) Mortar and Grout for Unit Masonry.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit two samples of coloured mortar.

PART 2 - PRODUCTS

2.1 Materials

- .1 Mortar and grout: CSA A179-94(R1999).
- .2 Lime Mortars:
 - .1 Portland cement type 10, in accordance with CAN/CSA-A5-93.
 - .2 Hydrated lime type 'S', in accordance with C207-91 (1992).
 - .3 Colouring pigments: pigments constituted of ground coloured natural aggregates or mettalic oxide pigments, colour as selected by consultant from manufacturer's available range. The ratio of colouring agent/density of cementitious material shall not exceed 10%.
 - .4 Do not use admixtures.
- .3 Water: potable, clean exempt from ice, oils, acids, alkalis, organic matter, sediments or any other harmful matter.
- .4 Sand: fine grain aggregates, grading in accordance with A179-94.
- .5 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
- .6 Colour: ground coloured natural aggregates or metallic oxide pigments to Consultants selection from manufacturer's standard range, one colour for each masonry type.
- .7 Provide materials in strict accordance with mortar and masonry manufacturers' specifications.

2.2 Material Source

- .1 Use same brands of materials and source of aggregate for entire project.

2.3 Mortar Types

- .1 Mortar for exterior masonry above grade:
 - .1 Loadbearing: Type S based on Property specifications.
 - .2 Non-loadbearing: Type S based on Property specifications.
 - .3 Parapet walls, chimneys, unprotected walls: Type S based on Proportion specifications.
- .2 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type M based on Property specifications.
- .3 Mortar for interior masonry:
 - .1 Loadbearing: Type S based on Property specifications.
 - .2 Non-loadbearing: Type N based on Property specifications.
- .4 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for calcium silicate brick and concrete brick: Type O based on Proportion specifications.
 - .2 Mortar for grouted reinforced masonry: Type S based on Proportion specifications.
 - .3 Mortar for pointing: Type O based on Proportion specifications.
 - .4 Mortar for glass block: 1 part white portland cement, 1 part hydrated lime, 6 parts white sand aggregate by volume.

2.4 Coloured Mortar

- .1 Coloured mortar: use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, or portland/lime to produce coloured mortar to match approved sample.
- .2 Use coloured mortar for brick, one colour for each brick type..

2.5 Grout

- .1 Grout: to CSA A179-94(R1999) Table 3.

2.6 Parging

- .1 Parging mortar: Type N to CSA A179-94(R1999).

2.7 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Genlime Group L.P.
 - .2 Rockwell Lime Company

PART 3 - EXECUTION

3.1 Mixing

- .1 Do masonry mortar and grout work in accordance with CSA A179-94(R1999) except where specified otherwise.
- .2 Mix grout to semi-fluid consistency.
- .3 Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
- .4 Use clean mixer for coloured mortar.
- .5 Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

3.2 Parging

- .1 Apply parging in uniform coating not less than 10mm thick, where indicated.

PART 1 - GENERAL

1.1 References

- .1 ASTM D 2240-02b Test Method for Rubber Property - Durometer Hardness.
- .2 A371-94 Masonry Construction for Buildings.

1.2 Samples

- .3 Submit samples in accordance with Section 1300.

PART 2 - PRODUCTS

2.1 Materials

- .1 Control joint filler: purpose-made elastomer 90 durometer hardness to ASTM D 2240-02b of size and shape indicated.
- .2 Nailing inserts: 0.6 mm thick purpose-made galvanized steel inserts for setting in mortar joints.
- .3 Masonry flashing:
 - .1 Membrane masonry flashing and through-wall dampproof course: Blue Skin TWF as manufactured by Bakor Inc. or Colphene 3000 as manufactured by Soprema Inc.
 - .2 Lap adhesive: recommended by manufacturer of flashing material.
- .4 Weep hole vents: purpose-made PVC designed to drain cavities to exterior, complete with insect screens and mortar guards.
- .5 Cavity spacers: purpose made to prevent accumulation of mortar droppings from obstructing cavity. Submit samples and technical information for review.

PART 3 - EXECUTION

3.1 Control Joints

- .1 Install continuous control joint fillers in control joints at locations indicated.

3.2 Weep Hole Vents

- .2 Install weep hole vents in vertical joints immediately over flashings, sills and at top of cavities, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm oc.

3.3 Nailing Inserts

- .3 Install nailing inserts in mortar joints at 400 mm oc each way, for attachment of wall strapping.

3.4 Masonry Flashing

- .4 Install flashings in masonry in accordance with A371-M94 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 double wythe walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:
 - .1 For masonry backing embed flashing 25 mm in joint.
 - .2 For concrete backing, insert flashing into reglets.
 - .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.
- .3 Lap joints 150 mm and seal with adhesive.
- .4 Lap and seal through-wall dampproof course flashings to air and vapour barrier membranes.
- .5 Lap and seal minimum 150 through-wall dampproof course flashings to adjacent roof flashing membranes. Extend with backing film intact surplus dampproof course membrane for this purpose.
- .6 Provide masonry flashing membrane where continuity of trowelled air/vapour barriers may be compromised.

3.5 Cavity Spacers

- .5 Provide in accordance with manufacturer's specifications cavity spacers minimum 150mm at bottom of cavities above throughwall dampproof courses/masonry flashings.

PART 1 - GENERAL

1.1 References

- .1 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.
- .2 A370-94, Connectors for Masonry.
- .3 A371-94, Masonry Construction for Buildings.
- .4 CSA G30.3-M1983 (R1998), Cold-Drawn Steel Wire for Concrete Reinforcement.
- .5 CSA G30.12-M1977, Billet-Steel Bars for Concrete Reinforcement.
- .6 CAN3-S304-M84 (R1997), Masonry Design for Buildings.
- .7 CSA W186-M1990 (R1998), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.2 Source Quality Control

- .1 Upon request, provide Consultant with 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.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01305.
 - .2 Shop drawings consist of bar bending details, lists and placing drawings.
 - .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.
-

PART 2 - PRODUCTS

2.1 Materials

- .1 Bar reinforcement: to A371-M94 and CSA G30.12.
- .2 Wire reinforcement: to A371-M94 and CSA G30.3-M1983 (R1998), truss type.
- .3 Connectors: to A370-M94 and CAN3-S304-M84 (R1997).
 - .1 Interior walls: corrosion resistant or non corroding connectors.
 - .2 Exterior walls: Adjustable hot-dipped galvanized DW130 as recommended by manufacturer for intended use.
- .4 Corrosion protection: to CAN3-S304-M84 (R1997), galvanized.

2.2 Fabrication

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1-00 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.
- .2 Fabricate connectors in accordance with A370-M94.
- .3 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of Consultant, weld reinforcement in accordance with CSA W186-M1990 (R1998).
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Dur-O-Wal
 - .2 Blok-Lok
 - .3 Fero

PART 3 - EXECUTION

3.1 Installation

- .1 Install masonry connectors and reinforcement in accordance with A370-M94, A371-M94 and CAN3-S304-M84 (R1997), unless indicated otherwise.
- .2 Prior to placing concrete mortar grout, obtain Consultant's approval of placement of reinforcement and connectors.
- .3 Do additional reinforcement of masonry as indicated.

3.2 Bonding and Tying

- .1 Bond walls of two or more wythes using metal connectors in accordance with NBC, CAN3-S304-M84 (R1997), A371-94 and as indicated.
- .2 Tie masonry veneer to backing in accordance with NBC, CAN3-S304-M84 (R1997) A371-94 and as indicated.

3.3 Reinforced Lintels and Bond Beams

- .1 Reinforce masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CAN3-S304-M84 (R1997).

3.4 Grouting

- .1 Grout masonry in accordance with CAN3-S304-M84 (R1997) and as indicated.

3.5 Metal Anchors

- .1 Do metal anchors as indicated.

3.6 Lateral Support and Anchorage

- .1 Do lateral support and anchorage in accordance with CAN3-S304-M84 (R1997) and as indicated.
-

3.7 Control Joints

- .1 Terminate reinforcement 25 mm short of each side of control joints unless otherwise indicated.

3.8 Field Bending

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

3.9 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.

PART 1 - GENERAL

1.1 Related Work

- .1 Masonry procedures: Section 04050 Masonry Procedures
- .2 Masonry mortar and grout Section 04100 for masonry: Mortar and Masonry Grout.
- .3 Masonry reinforcing and tying Section 04160: Masonry Anchorage and Reinforcing.

1.2 References

- .1 ASTM C 126-99 Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
- .2 CAN/CSA-A82.1-M87 (R1999) Burned Clay Brick (Solid Masonry Units Made From Clay or Shale).
- .3 CSA A82.3-M1978 (R1998) Calcium Silicate (Sand-Lime) Building Brick.
- .4 CSA CAN3-A82.8-M78 Hollow Clay Brick.
- .5 A165 Series-94 Series-M85 CSA Standards on Concrete Masonry Units.

PART 2 - PRODUCTS

2.1 Face Brick

- .1 Burned clay brick: to CAN/CSA-A82.1-M87 (R1999) all to match approved samples.
 - .1 Brick Type 1: Brampton Brick Wheatland Velour or equal as approved by Consultant. Metric Jumbo 90 x 290 x 90 mm. Submit samples.
 - .2 Brick Type 2: Brampton Brick Brown Velour or equal as approved by Consultant. Velour or equal as approved by Consultant. Metric Jumbo 90 x 290 x 90 mm. Submit samples.

2.2 Acceptable Manufacturers:

- .1 Products in accordance with this specification by only the following manufacturers will be accepted to achieve best match with existing as determined by the Consultant.
 - .1 Brampton
 - .2 Hanson
-

PART 3 - EXECUTION

3.1 Laying

- .1 Bond: stretcher, stack and soldier as indicated on drawings. Mitre soldier course at corners.
- .2 Coursing height: 200 mm for three bricks and three joints as indicated.
- .3 Jointing: concave and raked where exposed or where paint or similar thin finish coating is specified. Sloped to drain at projections revealing exposed horizontal surfaces.
- .4 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.
- .5 Sawcut and mitre soldier courses at corners.
- .6 Sawcut and mitre brick at corner angles exceeding 90 degrees.

3.2 Cleaning Unglazed Clay Masonry

- .1 Clean 10 m² area of wall designated by Consultant as directed below and leave for one week. 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 Technical Note No. 20 published by Brick Institute of America dated Sept./Oct. 1977.
 - .5 Test acid cleaning method on designated area of wall, followed by waiting period of at least one week, before proceeding with cleaning.
 - .6 Clean in strict accordance with manufacturer's specifications.

PART 1 - GENERAL

1.1 References

- .1 A165 Series-94 Series (CAN3-A165.1)-M85 CSA Standards on Concrete Masonry Units.

PART 2 - PRODUCTS

2.1 Materials

- .1 Standard concrete masonry units: to A165 Series-94 Series (CAN3-A165.1).
 - .1 Classification: H/15/A /M.
 - .2 Size: modular.
 - .3 Special shapes: provide bull- nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. At window openings, provide solid bull-nose sill blocks laid on side. Provide additional special shapes as indicated. Provide solid blocks at first course above foundation and as indicated on structural drawings.
 - .4 Colour: standard grey.
- .2 Prefaced concrete block units: to A165 Series-94 Series (CAN3-A165.3). Ledge.
 - .1 Classification of body of unit: S/15/A/M to CAN3-A165.1.
 - .2 Size: modular.
 - .3 Special shapes: provide special shapes indicated. Provide purpose made shapes for bullnose block, lintels and bond beams.
 - .4 Colour: to match existing ledge block selected from manufacturer's standard range.

2.2 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Permacon
 - .2 Brampton Brick
 - .3 Richvale York
 - .4 Shouldice

PART 3 - EXECUTION

3.1 Laying Concrete Masonry Units

- .1 Bond: running bond for interior units.
- .2 Coursing height: 200 mm for one block and one joint.
- .3 Jointing: concave where exposed or where paint or other finish coating is specified.

3.2 Laying Pre-faced Concrete Masonry Units

- .1 Bond: running.
 - .1 Coursing height: 200 mm for one block and one joint.
 - .2 Jointing: provide concave joints.
 - .3 Clean block faces using soft cloths before mortar hardens rake to 10 mm depth. After completion of block laying fill joints with pointing mortar then point to provide concave joints. Repeat cleaning of faces.

3.3 Concrete Masonry Lintels

- .1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
- .2 End bearing: not less than 200 mm as indicated on drawings.

3.4 Corridor Bullnose Blocks With Ceramic Tile Base

- .1 At exterior concrete block corners with ceramic tile base, at first course provide square block with upper corner ground to single facet at 45 degree chamfer at corner.

3.5 Cleaning

- .1 Allow mortar droppings on unglazed concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

PART 1 - GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA B111-1974 (R1998) (R1998) (R1998) (R1998) (R1998), Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-M92 (R1998) (R1998) (R1998) (R1998) (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O121-M1978 (R1998) (R1998) (R1998) (R1998) (R1998), Douglas Fir Plywood.
 - .4 CAN/CSA-O141-91 (R1999) (R1999) (R1999) (R1999) (R1999), Softwood Lumber.
 - .5 CSA O151-M1978 (R1998) (R1998) (R1998) (R1998) (R1998), Canadian Softwood Plywood.
 - .6 CAN/CSA-O325.0-92 (R1998) (R1998) (R1998) (R1998) (R1998), Construction Sheathing.
- .2 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 1991.

1.2 Quality Assurance

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

1.3 Waste Management and Disposal

- .1 Do not burn scrap at the project site.
- .2 Fold up metal banding, flatten, and place in designated area for recycling.

1.4 Source Quality

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

PART 2 - PRODUCTS

2.1 Lumber Material

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141-91 (R1999).
 - .2 NLGA Standard Grading Rules for Canadian Lumber, latest edition.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Glued end-jointed (finger-jointed) lumber is not acceptable.
- .4 Framing and board lumber: in accordance with NBC 1985 Subsection 9.3.2.
- .5 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.

2.2 Panel Standards

- .1 Panel standards: type, grade and thickness as indicated, in accordance with following standards:
 - .1 Douglas fir plywood (DFP): to CSA O121-M1978 (R1998), standard construction.
 - .2 Canadian softwood plywood (CSP): to CSA O151-M1978 (R1998), standard construction.
 - .3 Poplar plywood (PP): to CAN/CSA-O15-90 (R1999), standard construction.
 - .4 Interior mat-formed wood particleboard: to CAN3-0188.1.
 - .5 Waferboard: to CAN3-0188.2.
 - .6 Hardboard: to CAN/CGSB-11.3-M87.
 - .7 Insulating fiberboard sheathing: to CAN/CSA-A247-M86 (R1996).
 - .8 Glass fibre board sheathing: non- structural, rigid, faced, fiberglass, insulating exterior sheathing board.
 - .9 Poly-isocyanurate sheathing: to CGSB 51- GP-21M.
 - .10 Expanded polystyrene sheathing: to CAN/CGSB-51.20-M87.
 - .11 Gypsum sheathing: to CAN/CSA-A82.27-M91.

2.3 Panel Materials End Uses

- .1 Roof sheathing:
 - .1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, T&G square edge, 16 mm thick.
- .2 Exterior wall sheathing:
 - .1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, square edge, 16 mm thick.

2.4 Sheathing Paper

- .1 Exterior wall sheathing paper: to CAN/CGSB-51.32-M77 laminated type impregnated .

2.5 Dampproof Membrane

- .1 Polyethylene film: to CAN/CGSB-51.33-M89, Type 1, 0.15 mm thick.
- .2 Roll roofing: to CSA A123.2-M1979 (R2001), Type S.

2.6 Adhesives

- .1 Subflooring adhesive: to CAN/CGSB-71.26-M88, cartridge loaded.

2.7 Fasteners

- .1 Nails, spikes and staples: to CSA B111-1974 (R1998).
- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .4 Galvanizing: to CAN/CSA-G164-M92 (R1998), use galvanized fasteners for exterior work, interior highly humid areas, pressure- preservative, fire-retardant treated lumber.
- .5 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.
- .6 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, fibre, formed to prevent dishing. Bell or cup shapes not acceptable.

2.8 Wood Preservative

- .1 Surface-applied wood preservative: clear, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative. All lumber utilized at roof and exterior applications to be treated with wood preservative.
 - .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.
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- .3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

PART 3 - EXECUTION

3.1 Construction

- .1 Comply with requirements of the Ontario Building Code NBC 1985 Part 9 supplemented by following paragraphs.

3.2 Erection of Framing Members

- .1 Install members true to line, levels and elevations.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.
- .4 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 Erection

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

3.4 Defacement Marks

- .1 Install lumber and panel materials so that grade-marks and other defacing marks are not visible or are removed by sanding.

3.5 Wall Sheathing

- .1 Install wall sheathing in accordance with manufacturer's printed instructions.

3.6 Furring and Blocking

- .1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .2 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.

- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.7 Nailing Strips, Grounds and Rough Bucks

- .1 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

3.8 Cants, Curbs, Fascia Backing

- .1 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .2 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

3.9 Sleepers

- .1 Install sleepers as indicated.

3.10 Fasteners

- .1 Countersink bolts where necessary to provide clearance for other work.
- .2 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.11 Surface- Applied Wood Preservative

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

3.12 Electrical Equipment Backboard

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

PART 1 - GENERAL

1.1 Related Work

- .1 Laminated plastic Section 06240 work: Laminated plastic
- .2 Architectural Section 06400 woodwork: Architectural Woodwork
- .3 Supply of finishing Section 08710 hardware: Finish Hardware
- .4 Painting and Section 09900 finishing: Painting

1.2 References

- .1 CSA B111-1974 (R1998) (R1998) Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92 (R1998) (R1998) Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O115-M1982(R2001) Hardwood and Decorative Plywood.
- .4 CSA O121-M1978 (R1998) (R1998) Douglas Fir Plywood.
- .5 CAN/CSA-O141-91 (R1999) (R1999) Softwood Lumber.
- .6 CSA O151-M1978 (R1998) (R1998) Canadian Softwood Plywood.
- .7 CSA O153-M1980 (R1998) (R1998) Poplar Plywood.
- .8 CAN3-O188.1-M78 Interior Mat-Formed Wood Particleboard.
- .9 CAN4-S104-M80(R1985) Fire Tests of Door Assemblies.
- .10 CAN4-S105-M85(R1992) Fire Door Frames.
- .11 CAN/CGSB-11.3-M87 Hardboard.
- .12 ANSI A208.1-1999 Particleboard, Matformed Wood.
- .13 AWMAC Quality Standards for Architectural Woodwork 1991.
- .14 National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber 1987.
- .15 National Hardwood Lumber Association (NHLA) Rules for the Measurement and Inspection of Hardwood and Cypress January 1986.

1.3 Reference Standards

- .1 Do finish carpentry to Millwork Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) 1998, except where specified otherwise.

1.4 Requirements of Regulatory Agencies

- .1 Wood fire rated frames and panels: listed and labelled by an organization accredited by Standards Council of Canada in conformance with CAN4-S104-M80(R1985) and CAN4-S105-M85(R1992) for ratings specified or indicated.

1.5 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit duplicate samples: sample size 300 x 300 mm or 400 mm long unless specified otherwise.

1.6 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
- .3 Indicate all materials, thicknesses, finishes and hardware.

1.7 Product Delivery, Storage and Handling

- .1 Protect materials against dampness during and after delivery.
 - .2 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.
-

PART 2 - PRODUCTS

2.1 Lumber Material

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141-91 (R1999) (R1999).
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC premium grade, moisture content as specified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: moisture content 7% or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC premium grade, moisture content as specified.

2.2 Panel Materials

- .1 Douglas fir plywood (DFP): to CSA O121-M1978 (R1998) (R1998), standard construction.
- .2 Canadian softwood plywood (CSP): to CSA O151-M1978 (R1998) (R1998), standard construction.
- .3 Hardwood plywood: to CSA O115-M1982(R2001).
- .4 Poplar plywood (PP): to CSA O153-M1980 (R1998) (R1998), standard construction.
- .5 Interior mat-formed wood particleboard: to CAN3-0188.1.
- .6 Hardboard: to CAN/CGSB-11.3-M87.
- .7 Medium density fibreboard (MDF): to ANSI A208.2-1994, density 769 kg/m³.
- .8 Melamine overlaid panelboards:
 - .1 Melamine overlay, heat and pressure laminated with phenolic resin to thickness indicated mm thick particleboard core.
 - .2 Overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain (buff) balancing sheet.
 - .3 Furniture finish: matched wood grain pattern selected by Consultant.
 - .4 Edge finishing: matching melamine and polyester overlay edge strip with self-adhesive.

2.3 Fasteners

- .1 Nails and staples: to CSA B111-1974 (R1998) (R1998); galvanized to CAN/CSA-G164-M92 (R1998) for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .2 Wood screws: to CSA B35.4-72 electroplated steel, size and type to suit application.
- .3 Splines: metal.
- .4 Adhesive: as recommended by manufacturer.

2.4 Standing and Running Trim

- .1 Interior:
 - .1 Grade: Clear select.
 - .2 Solid stock: Maple species.
 - .3 Veneered stock: Maple veneer, clear select grade, quarter cut.

2.5 Shelving

- .1 Hardwood plywood:
 - .1 Thickness: 16mm.
 - .2 Number of plies: 5.
 - .3 Face veneer: Maple species, clear select grade, rotary cut.
 - .4 Back veneer: Maple species, clear select grade, rotary cut.
 - .5 Core: veneer.
 - .6 Bond: Type II.
 - .7 Sanding: regular sanding.
 - .8 Grain direction longitudinal.
- .2 Edge banding: provide 10mm thick solid matching wood strip on plywood edges 12 mm or thicker, exposed in final assembly. Strips same width as plywood .

PART 3 - EXECUTION

3.1 Workmanship

- .1 Do finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.
 - .2 Scribe and cut as required to fit abutting walls, and surfaces, to fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
 - .3 Form joints to conceal shrinkage.
-

3.2 Fastening

- .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
- .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
- .3 Set finishing nails to receive filler. Where screws are used to secure members countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
- .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

3.3 Standing and Running Trim

- .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
- .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
- .3 Make joints in baseboard, where necessary using a 45° scarfe type joint.
- .4 Install door and window trim in single lengths without splicing.

3.4 Shelving

- .1 Install shelving on adjustable shelf brackets with recessed steel pilasters.

PART 1 - GENERAL

1.1 References

- .1 CAN3-A172-M79 (R1999) (R1999) (R1999) (R1999) High Pressure, Paper Base, Decorative Laminates.
- .2 CSA O112.4-M1977 Polyvinyl Adhesives for Wood.
- .3 CSA O112.5-M1977 Urea Resin Adhesives for Wood (Room- and High-Temperature Curing).
- .4 CSA O112.7-M1977 Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).
- .5 CSA O121-M1978 (R1998) (R1998) (R1998) (R1998) Douglas Fir Plywood.
- .6 CSA O151-M1978 (R1998) (R1998) (R1998) (R1998) Canadian Softwood Plywood.
- .7 CSA O153-M1980 (R1998) (R1998) (R1998) (R1998) Poplar Plywood.
- .8 CAN3-O188.1-M78 Interior Mat-Formed Wood Particle Board.
- .9 CAN/CGSB-71.20-M88 Adhesive, Contact, Brushable.

1.2 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit duplicate samples of joints, edging, cutouts and postformed profiles.

1.3 Maintenance Data

- .1 Provide maintenance data for plastic laminate work for incorporation into manual specified in Section 01300 - Submittals.

1.4 Product Handling

- .1 Cover finished laminated plastic surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.
 - .2 Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22°C.
-

PART 2 - PRODUCTS

2.1 Materials

- .1 Laminated plastic for flatwork: to CAN3-A172-M79 (R1999), Grade General Purpose, Type 107, 1.27mm thick.
- .2 Laminated plastic for postforming work: to CAN3-A172-M79 (R1999), Grade PF, Type 350, 1.067mm thick, satin finish, printed pattern to match existing as selected by Consultant.
- .3 Laminated plastic backing sheet: supplied by same manufacturer as facing sheet; not less than 0.5 mm thick and same thickness and colour as face laminate. Sanded one side.
- .4 Laminated plastic liner sheet: supplied by same manufacturer as facing sheet, not less than 0.76 mm thick, white colour.
- .5 Plywood core: to CSA O121-M1978 (R1998) CSA O151-M1978 (R1998) CSA O153-M1980 solid two sides, 19 mm thick.
- .6 Laminated plastic adhesive: contact adhesive to CAN/CGSB-71.20-M88.
- .7 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
- .8 Sealant: in accordance with Section 07900 - Sealants, paragraph 2.1.4 , colour selected by Consultant.
- .9 Draw bolts and splines: as recommended by fabricator.
- .10 Colour Groupings:
 - .1 Plastic Laminate Colour "A"
 - .1 Countertop, splashes, valences, gables, consoles: Nevamar ARP Surface Verde Patina PT-5-1SM Supermatte Finish or as selected by Consultant.
 - .2 Casework Interior (behind doors): White, matte finish.

2.2 Shop Fabrication

- .1 Comply with CAN3-A172-M79 (R1999), Appendix 'A'.
- .2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.

- .5 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .6 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .7 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .8 Apply laminated plastic liner sheet to interior of cabinetry.

2.3 Acceptable Manufacturers:

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Arborite
 - .2 Formica
 - .3 Wilsonart
 - .4 Pionite
 - .5 Nevamar

PART 3 - EXECUTION

3.1 Installation

- .1 Install work plumb, true and square, neatly scribed to adjoining surfaces.
- .2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm oc, 75 mm from edge. Make flush hairline joints.
- .4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.
- .6 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where approved. Slightly bevel arrises. Cap exposed edges with anodized aluminum extrusions.
- .7 For site application, offset joints in plastic laminate facing from joints in core.

3.2 Protection

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

PART 1: GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Conform to all applicable sections of Division 1.

1.2 REFERENCES

- .1 Dimensions of lumber shall conform to dressed sizes specified in CAN/CSA-O141-91 unless actual dimensions are otherwise indicated or specified.
- .2 Dimensional references to lumber on Drawings and in Specifications are to nominal sizes unless actual dimensions are indicated. Such actual dimensions shall be dry size.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 35mm Wood Doors supplied by: Section 08210: Wood Doors

1.4 SUBMITTALS

- .1 Shop Drawings: Submit shop drawings for the work of this Section.

1.5 SAMPLES:

- .1 Submit samples of plastic laminate and melamine panels for approval and colour selection.

1.6 QUALITY ASSURANCE

- .1 Qualifications: Perform work of this Section only by a fabricator of recognized standing who has adequate plant, equipment, and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory fabrications similar to that specified during a period of at least five years.
- .2 Execute work of this Section in accordance with requirements of Quality Standards for Architectural Woodwork, Premium Grade, of the Architectural Woodwork Manufacturers Association of Canada except as specified otherwise.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Protect materials from damage during handling, delivery and storage.
- .2 Do not deliver wood materials to site until storage areas are completed, and conditions are such that no damage will occur to it while in storage and during installation.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Ensure that relative humidity in areas where work is stored and installed does not exceed 55%.

1.9 WARRANTY

- .1 Warranty to be minimum two years labour and materials from Date of Substantial Performance.

PART 2: PRODUCTS

2.1 MATERIALS

- .1 General:
 - .1 Work of Section shall include rough hardware required for its execution. Use non-

- corrosive hardware at exterior locations.
- .2 Moisture content of wood at time of installation shall be for interior locations at an average of 7%, with a permitted range of individual pieces of 5% to 9%; and for exterior locations at an average of 12%, with a permitted range in individual pieces of 10% to 15%.
- .3 Use only adhesives and fastenings that develop sufficient strength for intended use, are non-staining, and are unaffected by the environment to which exposed.
- .2 Wood:
 - .1 Shall be select grade suitable for intended use. Install select clear grade where surfaces are given a transparent finish and select sound grade where surfaces are painted.
 - .2 Softwood and Hardwood: Grade mark softwood and hardwood lumber by the appropriate association under authority of the National Lumber Grades Authority. Wood shall be select lumber, and clear where required to meet specified use and finish. Wood that is not exposed shall be of highest grade that satisfies fabrication, utility, and structural needs.
 - .1 Hardwood: Species selected by Consultant. Where no species is indicated, provide Birch, Clear Select.
 - .2 Softwood: Where no species is indicated, provide No. 1 White Pine.
- .3 Glass:
 - .1 3 mm Clear float glass to CAN/CGSB-12.3, glazing quality.
- .4 Plywood:
 - .1 Melamine Surfaced Particleboard: Panval melamine surfaced board with Surface Plus abrasion resistant finish by Uniboard Canada Inc., Toronto, Ontario; tel. 905-673-5743 or equal product by other manufacturer.
 - .2 Birch Veneer Core: hardwood plywood core, to CSA 0115-M1982, good two sides, with stain grade, **white Birch veneer** facing.
 - .3 Veneer Core: hardwood plywood core, to CSA 0115-M1982, good two sides.
 - .4 Particleboard: To meet Can3-0188.1, Grade H.
- .5 Medium Density Fibreboard (MDF):
 - .1 Ultra smooth both sides with uniform surface to core density.
- .6 Aluminium Channel (Gable Base):
 - .1 19x19x3mm aluminium channel cut to length to suit gable and secured to floor with tapcon screws.
- .7 Galvanized Square Wire Mesh:
 - .1 3x3 galvanized steel wire mesh, 1.6mm wire dia., 6.87mm opening, painted.
- .8 Edge-banding:
 - .1 PVC : 3mm thick equal to Woodtape by Canada Woodtape Inc. in maximum 3 colours to later selection by Architect. Adhesive as recommended by edging manufacturer.
 - .2 Wood : 3mm thick, solid wood edging, same birch species as adjacent face veneer.

- .9 Plastic Laminate:
- .1 CAN3-A 172-M79, Arborite Plus, Nevamar ARP , or equivalent by Formica and WilsonArt:
- .1 Decorative Sheet and Liner Sheet, Regular Grade (GP-R), 1.2mm for flat work.
- .2 Postforming Grade (PF-30), 0.76mm for postformed counter tops.
- .3 Backing Sheet, in same thickness as face sheet.
- .4 Surface Finish: Suede Finish.
- .5 Colour: Selected by Architect from manufacturer's complete range to match existing laminate in existing school. Submit samples in accordance with Section 01300.
- .10 35mm Plywood Core Closet Doors: supplied by Section 08210; wood doors, 35mm thick, face veneer and edge banding matching adjacent cabinet work.
- .11 Cabinet Hardware:
- .1 Shelf Supports: Knape and Vogt KV255 strips 2 per side and adjustable support clips Richelieu Hardware Cat. No. 2432G, 4 per shelf, screw fastened.
- .2 Hinges: Julius Blum concealed hinges 91-650170° opening, self closing. Provide manufacturer's recommended number of hinges to suit door size and thickness.
- .3 Butt Hinges: Provide in accordance with Section 08710.
- .4 Cabinet Multi-Point Locks: Richelieu or Hafele Espagnolette Locking System c/w locks, hooks, centre and end saddles, striker and bars as required for complete system, keying per Keying Schedule Section 08710.
- .5 Cabinet Locks: CCL 0737 pin tumbler, keying per Keying Schedule Section 08710.
- .6 Drawer Locks: CCL 0738 pin tumbler, keying per Keying Schedule Section 08710.
- .7 Closet Door Locks: by Section 08710.
- .8 Automatic Door Bolt: Richelieu LOCDL200 or LOCDL300 to suit.
- .9 Glass Locks: Knape & Vogt 965NP.
- .10 Sliding Glass Hardware: Knape & Vogt P992.
- .11 Pulls: GSH 302 x 100mm, CTC 7.5mm o.d. brushed stainless steel.
- .12 Drawer Slides: Knape and Vogt 8505.
- .13 Elbow Catch: Ives 2-A3 on all inactive doors of locked pairs.
- .14 Coat Hooks: Gallery Specialty Hardware 307x115 brushed s/s.
- .15 Coat Rod: Gallery Specialty Hardware 138-2, 32mm x 2mm wall thickness chrome plated.
- .16 Keyboard slides: Knape and Vogt 8100.
- .17 Adjustable counter circular grommet and wafer pin insert: K&V 58310 and 58312.
- .18 All cabinet hardware finish shall be chrome or nickel plated.

2.2 FABRICATION

- .1 General:
 - .1 Design and fabricate work of this Section for concealed anchorage and fastening.
 - .2 Assemble work in mill in units as large as possible. Provide in design for assembly at site to fit together.
 - .3 Make necessary cutouts to template information for services, fixtures, and trim in work of this Section as indicated on Drawings or specified in Divisions 15 or 16, or both.
 - .4 All exposed edges shall be edged with PVC, unless noted otherwise.
 - .5 Fine sand exposed wood surfaces level and smooth after fabrication, ready for painting.
- .2 Trim:
 - .1 Rout or groove backs of flat trim members.
 - .2 Kerf backs of wide flat members.
- .3 Fastening:
 - .1 Fasten work with nails generally, but use screws or special fasteners at critical joints where strain and excessive usage and shrinkage are anticipated, and where required by specified quality grade standards.
 - .2 Glue built-up work as well as nailing and screwing.
 - .3 Blind nail unless impossible.
 - .4 Set finishing nails below finished surfaces and fill to match surface. Countersink and plug surface screws with wood plugs of material to match surface.
- .4 Plastic Laminate Facing:
 - .1 For countertops apply plastic laminate to veneer core plywood, minimum 19 mm actual thickness, or as otherwise indicated on Drawings or specified herein.
 - .2 Bond plastic laminate to backing with urea resorcinol adhesive, or by methods of equal or better quality recommended by the plastic laminate manufacturer.
 - .3 Seal edges of cutouts with plastic laminate, or where concealed from view, by other methods that will prevent entry of moisture into core.
 - .4 Apply plastic laminate backing sheet to core on back side of panels faced with plastic laminate.
 - .5 Bond plastic laminate self-edges under pressure, and bevel and finish smooth finished, corners.
 - .6 Round edges of holes cut through plastic laminate and file them smooth.
 - .7 Make joints only when lengths of plastic laminate facing exceeds 3.65 m. Butt joints together, reinforce core with 6 mm hardwood blind splines and lock together with Tite Joint fasteners located at a maximum of 75 mm from edges.
- .5 Millwork and Casework Components:

- .1 Unless indicated otherwise on the drawings, casework type shall be flush overlay.
- .2 Unless indicated otherwise as PVC edging, all exposed edges shall be edged with solid wood.
- .3 Exposed parts except counter tops and doors:
 - .1 Core – Birch Veneer core plywood
 - .2 Finish – factory finish; stain and two part catalytic conversion varnish system
 - .3 Wood edge banding to apron and valences.
 - .4 Minimum thickness – 19 mm unless noted otherwise.
- .4 19mm doors:
 - .1 Core – Birch Veneer core plywood
 - .2 Finish – factory finish; stain and two part catalytic conversion varnish system
 - .3 Wood.
- .5 19mm doors with glass or wire mesh panels:
 - .1 Core – solid Birch hardwood
 - .2 Finish – factory finish; stain and two part catalytic conversion varnish system
- .6 Counter tops:
 - .1 Core – Birch Veneer core plywood
 - .2 Finish – P. Lam
 - .3 Splashbacks, splash returns & edges – P. Lam.
 - .4 Minimum thickness – 25mm.
- .7 Shelves
 - .1 Core – Birch veneer core plywood
 - .2 Finish – factory finish; stain and two part catalytic conversion varnish system
 - .3 Wood edge banding to all edges.
 - .4 Minimum thickness – 19 mm.
 - .5 Maximum unsupported length 900 mm.
 - .6 Mount on recessed pilaster strips and shelf clips screw fastened.
- .8 Window Stools
 - .1 Core – Birch Veneer core plywood
 - .2 Finish – P. Lam.
 - .3 Solid birch edge as detailed.
 - .4 Minimum thickness – 19 mm.

- .9 Control Panels
 - .1 Core – Birch Veneer core plywood
 - .2 Finish – P. Lam.
 - .3 P. Lam. edge banding to all edges.
 - .4 Minimum thickness – 19 mm.
 - .5 Co-ordinate with Div. 25, 26, and 27 for size and location of required cut-outs.
- .10 Unless indicated otherwise all free-standing gables to be mounted in aluminium channel base secured to floor.
- .11 Unless indicated otherwise, provide all casework with min. 6mm backs, melamine-faced.
- .12 Shop install all cabinet hardware.

2.3 FOLDING FEEDING STATION

- .1 Infants' Feeding Stations: Wood and thermoplastic pre-manufactured wall mounted high chairs with removable trays by JBCL inc. or approved equal. Colours as selected by Consultant. Submit shop drawings. Provide according to manufacturer's specifications and guidelines.

PART 3: EXECUTION

3.1 EXAMINATION

- .1 Before commencing installation, ensure that grounds, strapping, and other constructions and surfaces to which work is installed are satisfactory for fitting and adequate for securing of work.
- .2 Take site measurements of construction to which work of this Section must conform, and through which access must be made, before work is delivered to site.

3.2 INSTALLATION

- .1 General:
 - .1 Install work plumb, level, and straight, and fasten it securely to backing to support itself and anticipated superimposed loads.
 - .2 Build work into construction as indicated on Drawings or specified in other Sections of this Specification, or both.
- .2 Trim: Install in single lengths except where material limitation makes impossible. Stagger joints where they occur and locate over solid backing for fastening.
- .3 Cutting and Fitting:
 - .1 Cut mouldings with sharp true profiles.
 - .2 Cope trim and mouldings at interior comers and at returns.
 - .3 Mitre trim and mouldings at exterior corners. Glue and lock shop mitres that are over 100mm from heel to point.
 - .4 Scribe and join work accurately together, and to other work to fit tightly and with flat

smooth surfaces. Install trim or filler panels to close gaps.

.4 Fastening:

.1 Blind nail work where possible, use screws or special fastening devices at joints in critical locations.

.2 Set finishing nails below finished surfaces to receive putty.

3.3 ADJUSTING

.1 Adjust drawers and doors to operate smoothly and effortlessly and to close tightly against cabinet.

.2 Lubricate hardware in accordance with manufacturer's instructions.

3.4 PROTECTION

.1 Ensure that work of this Section is protected from damage and deterioration during installation, and otherwise until Project completion.

3.5 FINISH CARPENTRY SCHEDULE

.1 General: This schedule is not a complete listing of all finish carpentry items, but only those items which require specific description. Examine all Drawings to establish full extent of the work.

.1 Millwork and Casework: As specified herein and indicated on Drawings.

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 CAN/CGSB-51.33-M89 Vapour Barrier, Sheet, for Use in Building Construction.

PART 2 - PRODUCTS

2.1 Sheet Vapour Barrier

- .1 Polyethylene film: to CAN/CGSB-51.34-M86, 0.15 mm thick.

2.2 Accessories

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .2 Sealants: according to Section 07900.
- .3 Staples: minimum 6 mm leg.
- .4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

2.3 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Stego
 - .2 W R meadows
 - .3 Duchesne

2.4 Concrete Slab Vapour Barrier

- .1 Clear 15 mm thick Perminator 15 or equivalent.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Examine surfaces to receive membrane. Notify Consultant if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.
- .2 Ensure services are installed and inspected prior to installation of retarder.
- .3 Install sheet vapour barrier on warm side of exterior wall ceiling and floor assemblies prior to installation of gypsum board to form continuous barrier.
- .4 Use sheets of largest practical size to minimize joints.
- .5 Inspect sheets for continuity. Repair punctures and tears with sealing tape before work is concealed.
- .6 Prepare surfaces in accordance with manufacturer's instructions.
- .7 Install vapour retarder membrane in accordance with manufacturer's instructions and ASTM E 1643-98.

3.2 Exterior Surface Openings

- .1 Cut sheet vapour barrier to form openings and ensure material is lapped and sealed to frame.
- .2 Seal all penetrations (including pipes) with manufacturer's pipe boot.

3.3 Lap Joint Seals

- .1 Seal lap joints of sheet vapour barrier as follows:
 - .1 Unroll vapour retarder with longest dimension parallel with direction of pour.
 - .2 Attach first sheet to substrate.
 - .3 Overlap joints 152 mm (6") and seal with manufacturer's tape.
 - .4 Lap vapour retarder over footings and seal to foundation walls.

3.4 Electrical Boxes

- .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
 - .1 For panel-type vapour barriers, install moulded box vapour barrier.
 - .2 For sheet-type vapour barriers, install moulded box vapour barrier or wrap boxes with polyethylene film sheet providing minimum 300 mm perimeter lap flange.

3.5 Repairs

- .1 Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 152 mm (6") and taping all four sides.

3.6 Concrete Slab Vapour Barrier

- .1 Where indicated on the Drawings or called for in the Soils Report, place Perminator 15 or equivalent sheeting below concrete slab-on-grade.
- .2 Ensure minimum 200 mm (or as otherwise stated in Soils Report) or specified granular fill below vapour barrier and underside of slab.
- .3 Perminator 15 or equivalent sheets should be adequately lapped and continuously taped.
- .4 Take precautions that construction traffic and operations do not pierce the sheets.

PART 1 - GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA A101-M1983 Thermal Insulation, Mineral Fibre, for Buildings.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.20-M87 Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .2 CGSB 51-GP-21M Thermal Insulation, Urethane and Isocyanurate, Unfaced.
 - .3 CAN/CGSB-51.25-M87 Thermal Insulation, Phenolic, Faced.
 - .4 CAN/CGSB-51.26-M86 Thermal Insulation, Urethane and Isocyanurate, Boards, Faced.
 - .5 CAN/CGSB-51.38-92, Cellular Glass Thermal Insulation.
 - .6 CGSB 71-GP-24M Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .3 Canadian Gas Association (CGA)
 - .1 CAN/CGA-B149.1-M95 Gas Installation Code.
 - .2 CAN/CGA-B149.2-M95 Propane Installation Code.
- .4 American Society for Testing and Materials (ASTM)
 - .1 ASTM E 96-00e1 Test Methods for Water Vapor Transmission of Materials.

1.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300 for tapered insulation.

PART 2 - PRODUCTS

2.1 Insulation

- .1 Expanded polystyrene at masonry cavity walls: to CAN/CGSB-51.20-M87, shiplapped edges, thickness as indicated.
- .2 Expanded polystyrene for below grade applications: to CAN/CGSB-51.20-M87.
- .3 Expanded polystyrene for roof applications: to CGSB 51-GP-@0m.
- .4 Expanded polystyrene for cavity wall and metal cladding applications: to CAN/CGSB-51.20-M87.
- .5 Rigid Glass Fibre.

2.2 Adhesive

- .1 Use only adhesives as recommended by manufacturer of each type of rigid insulation board for use intended, applied in strict accordance with manufacturer's specifications. Co-ordinate with and ensure compatibility to air barrier and vapour retarder.
- .2 Foundation Perimeter: synthetic rubber base, solvent type, suitable for continuous application by trowel, fungi resistant, application temperature 12°C to 50°C, compatible with insulation.
- .3 Masonry Cavity Wall: air/vapour barrier type, suitable for continuous application by trowel, fungi resistant, application temperature 5°C minimum, permeance (3 mm wet film, to ASTM E 96-00e1 method E) 2.2 ng/(Pa.s.m^{25v}), compatible with insulation. Provide sheet membrane as required to adjacent dissimilar materials.

2.3 Accessories

- .1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

2.4 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Dow
 - .2 Owens-Corning

PART 3 - EXECUTION

3.1 Workmanship

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604-M91 type A chimneys and CAN/CGA-B149.1-M95 and CAN/CGA-B149.2-M95 type B and L vents.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.

- .7 Do not enclose insulation until it has been inspected and approved by Consultant.

3.2 Examination

- .1 Examine substrates and immediately inform Consultant in writing of defects.
- .2 Prior to commencement of work ensure:
 - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.3 Vapour Barrier Type Adhesive

- .1 Ensure substrate is sound, smooth and clean.
- .2 Apply vapour barrier type adhesive, to concrete exterior surfaces to provide continuous vapour barrier film.

3.4 Rigid Insulation Installation

- .1 Apply adhesive to polystyrene insulation board by notched trowel at rate in accordance with manufacturer's recommendations.
- .2 Apply type D adhesive to polystyrene insulation board by push box method, to thickness of 5 mm.
- .3 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.
- .4 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm polyethylene strip over expansion and control joints using compatible adhesive before application of insulation.

3.5 Perimeter Foundation Insulation

- .1 Interior application: extend boards 600mm horizontally beneath concrete slab and 600 mm vertically below bottom of finish floor slab, installed on inside face of perimeter foundation walls.

3.6 Cavity Wall Installation

- .1 Install polystyrene insulation boards on outer surface of inner wythe of wall cavity on bed of adhesive.
- .2 Provide continuous air/vapour barrier sheet membrane fully adhered to return surface of all openings. Lap membrane minimum 150mm to outside face of inner wythe of cavity wall.

- .3 Provide air/vapour barrier sheet membrane at top of all parapet walls, lapped to roof membrane flashing.
- .4 Provide insulation adhesive (air/vapour barrier) in strict accordance with manufacturer's specifications, lapped and sealed to sheet membrane.
- .5 Seal all penetrations through air barrier. Ensure integrity and continuity of air barrier. Utilize sheet membrane air/vapour barrier and sealants as required to ensure that air barrier is not interrupted.
- .6 Review air barrier installation on site with Consultant prior to commencing Work.

PART 1 - GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings.
 - .2 CSA B111-1974 (R1998) (R1998) (R1998), Wire Nails, Spikes and Staples.
- .2 Canadian Gas Association (CGA)
 - .1 CAN/CGA-B149.1-M95 Gas Installation Code.
 - .2 CAN/CGA-B149.2-M95, Propane Installation Code.

PART 2 - PRODUCTS

2.1 Insulation

- .1 Batt and blanket mineral fibre: to CSA A101-M1983, Type 1, thickness as indicated.
 - .1 Acceptable material: fibreglas batt insulation, unfaced.

2.2 Accessories

- .1 Insulation clips:
 - .1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111-1974 (R1998).
- .3 Staples: 12 mm minimum leg.
- .4 Tape: as recommended by manufacturer.

2.3 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Owens-Corning
 - .2 Roxul
 - .3 Knauf
 - .4 Ottawa Fibre

PART 3 - EXECUTION

3.1 Insulation Installation

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Do not compress insulation to fit into spaces.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604-M91 type A chimneys and CAN/CGA-B149.1-M95 and CAN/CGA-B149.2-M95 type B and L vents.
- .5 Do not enclose insulation until it has been inspected and approved by Consultant.

PART 1 - GENERAL

1.1 Related Work

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Divisions 15 and 16 respectively.

1.2 References

- .1 ULC-S115-M95, Standard Method of Fire Tests of Firestop Systems.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 Submittals.

1.4 Shop Drawings

- .1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.
- .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.
- .3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

PART 2 - PRODUCTS

1.5 Materials

- .1 Fire stopping and smoke seal systems: in accordance with ULC-S115-M95.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115-M95 and not to exceed opening sizes for which they are intended.
 - .2 Firestop system rating: to suit rating of penetrated assembly, minimum 1 hr.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115-M95 and listed in ULC Guide No. 40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with ULC-S115-M95 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

- .4 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

1.6 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 3M
 - .2 AD Fire Protection
 - .3 Hilti
 - .4 Nuco
 - .5 Tremco
 - .6 Rectorseal

PART 3 - EXECUTION

1.7 Preparation

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

1.8 Installation

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

1.9 Inspection

- .1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

1.10 Schedule

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

1.11 Clean Up

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

PART 1 - GENERAL

1.1 Section Includes

- .1 Materials and installation methods supplementing primary air seal materials and assemblies.
- .2 Air seal materials to bridge and seal openings and penetrations of window frames, door frames, eifs and curtain wall system.

1.2 References

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13-M87 M87 , Sealing Compound, One Component, Elastomeric Chemical Curing.
 - .2 CAN/CGSB-19.18-M87 M87 , Sealing Compound, One Component, Silicone Base Solvent Curing.
 - .3 CAN/CGSB-19.24-M90 M90 , Multi-Component, Chemical Curing Sealing Compound.
 - .4 CGSB 19-GP-14M 76 , Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .2 NBCC 1995; Part 5 - Environmental Separation
- .3 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.3 Submittals

- .1 Submit product data to requirements of Section 01300.
- .2 Product Data: Provide data on material characteristics, performance criteria, and limitations.
- .3 Manufacturer's Installation Instructions: Indicate preparation, installation requirements and techniques, product storage and handling criteria.

1.4 Quality Assurance

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation .
 - .2 Maintain one copy of documents on site.
-

1.5 Qualifications

- .1 Applicator: Company specializing in performing work of this section with minimum 5 years documented experience approved by materials' manufacturers .

1.6 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.

1.7 Coordination

- .1 Coordinate work of this section with all sections referencing this section.

PART 2 - PRODUCTS

2.1 Sheet Materials

- .1 Membrane laps to other components, soffits and fascia, and air/vapour barrier membrane at masonry cavity walls: Bakor BlueSkin SA or Sopraseal Stick 1100 as manufactured by Soprema Inc. or W.R. Grace Perm-A-Barrier.

2.2 Adhesives

- .1 Mastic Adhesive Type 1 : Compatible with sheet seal and substrate, thick mastic of uniform knife grade consistency.
- .2 Primer: Compatible with sheet seal and substrate, permanently non-curing as recommended by manufacturer.

2.3 Accessories

- .1 Adhesives, tapes and fasteners as recommended by manufacturers.
- .2 Ensure compatibility with all contacted components.

2.4 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
-

1. Bakor
2. IKO
3. Soprema
4. Tremco
5. W.R. Meadows

PART 3 - EXECUTION

3.1 Examination

- .1 Verify that surfaces and conditions are ready to accept the Work of this section.
- .2 Ensure all surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.
- .3 Report any unsatisfactory conditions to the Consultant in writing.
- .4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.

3.2 Preparation

- .1 Remove loose or foreign matter which might impair adhesion of materials.
- .2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Ensure all substrates are free of surface moisture prior to application of self-adhesive membrane and primer.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.3 Installation

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Apply sheet materials and sealant within recommended application temperature ranges. Consult manufacturer when sheet materials and/or sealant cannot be applied within these temperature ranges.

3.4 Protection of Work

- .1 Protect finished Work under provisions of Division 1.
- .2 Do not permit adjacent work to damage work of this section.

3.5 Schedules

- .1 Wall Air Seal Over Exterior Surface of Gypsum Sheathing: Place sheet seal over sheathing surfaces with adhesive. Seal with sealant.
- .2 Window Frame Perimeter: Lap sheet seal from wall air seal surface with 75 mm of full contact over firm bearing to window frame with 25 mm of full contact. Edge seal with sealant.
- .3 Wall and Roof Junction: Lap sheet seal from wall seal material with 150 mm of contact over firm bearing to roof air seal membrane with 100 mm of full contact. Seal with sealant.
- .4 Roof System Air Seal Over Steel Deck: Gypsum sheathing, taped joints, apply membrane air seal over sheathing surfaces with adhesive; edge seal membrane with sealant.
- .5 Masonry cavity wall: Lap sheet seal on firm substrate to ensure integrity of air/vapour barrier membrane at entire building envelope. Seal with mastic at all penetrations. Lap to through-wall flashing. Provide double membrane laps over through-wall membrane flashings over roof membrane flashings.

PART 1 - GENERAL

1.1 Conditions

- .1 All General Conditions of the Stipulated Price contract incorporated in Canadian Standard Construction Document CCDC2-2008 and Supplementary General Conditions included in this Specification shall form part of and govern all Sections of the specifications.
- .2 The Work associated with this section shall comply to all pertinent sections and articles in Document O - Contract and Bidding Requirements and Division 1 - General Requirements.

1.2 Scope

- .1 The work to be performed consists of furnishing all labour, materials, equipment and miscellaneous items necessary to carry out the complete installation of the composite (glass fibre reinforced concrete) panels for exterior soffits, including:
 - .1 Composite building panels
 - .2 Fastening system
 - .3 Closures and related trim
 - .4 Caulking and sealants
 - .5 Other related work as indicated on Drawings and Specifications.

1.4 Delivery And Storage Of Materials

- .1 All materials shall be delivered in their unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements. Damaged or deteriorated materials shall be removed from the premises.

1.5 Samples

- .1 Prior to commencing work on the exterior finish, prepare a 300mm x 300mm sample for review and approval.

1.6 Quality Assurance

- .1 Manufacture's Qualification: 20 year minimum experience in Manufacturing Glass Fibre Reinforced Concrete Panels.
 - .2 Execute the work of this section only by a Subcontractor meeting the following qualifications:
 - .1 Has adequate plant, equipment, and skilled workers to perform it expeditiously.
 - .2 Is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past 5 years.
 - .3 Is certified by the system manufacturer for installation of their system.
-

Submit written certification to Consultant prior to commencing the work of this section.

- .4 Panel cladding installation: shall be applied by applicator trained and approved by manufacturer for application of its products.
- .3 Provide a written guarantee covering the replacement of defective work for a period of one year from the expiry of the standard one year General Contractor's warranty.
- .4 The following will be deemed as defective work; leakage, failure to stay in place, undue cracking, chipping or adjacent deformations, panel deformation, buckling, spalling, deterioration of surface. Failure of 15 % of surface area of panels shall be deemed a total failure of the installation requiring complete re-application of the panels.

1.7 Shop Drawings

- .1 Building panel shop drawings shall be submitted to the Consultant for review. No work shall be fabricated before review of shop drawings by the Consultant. Submit shop drawings in accordance with SECTION 01305.
- .2 Indicate on the drawings all information required to fabricate and install components of the Section. This shall include product and material standards, dimensions, connection and jointing details, gauges, finishes, etc. ensure that plan and section details of interior and exterior corners, horizontal and vertical joints, soffits, cut-outs, misc. trim, fastening methods etc., are shown at a minimum 1:5 scale.

PART 2 - PRODUCTS

2.1 Panel System

- .1 The following specified products and materials form the complete building panel system required for this Project. Ensure that only compatible products and materials are used. Alternates may only be used if approved, in writing, by the Consultant.
- .2 Panels shall be exposed aggregate faced panels, and are to be face fastened. They shall consist of inorganic fibre with natural stone and cement.
- .3 Panels to have the following physical properties:
 - .1 Density: 2086 kg/m³
 - .2 Tensile Strength: ASTM D790, 22 MPa.
 - .3 Tensile modulus: ASTM D229, 600 N/mm²
 - .4 Flexural strength: ASTM D229, 50 MPa
 - .5 Flexural modulus: ASTM D790, 4137 N/mm²
 - .6 Edge Comp. strength: ASTM D790, 31 MPa
 - .7 Impact strength: ASTM D2794, 1371 Nmm/mm²
 - .8 Co-efficient of linear thermal expansion: ASTM D696, D696, 27 x 10⁻⁶
 - .9 Thermal conductivity: 0.7 W/m/°C.
 - .10 Water vapour transmission: ASTM E96, 4.38 ng.Pa-1s-1m-1
 - .11 Water absorption: ASTM D570, 4.5%

.12 Air Permeability: 1.46 ng.Pa-1s-1m-1

- .4 Panels shall be fabricated in the factory to ensure that they are the same size, consistent in colour and free from warps, cracks and other imperfections. The panels shall be Synstone, Series #1, Raised Aggregate with a nominal overall thickness of 8mm (5/16").
- .5 These panels shall be non-combustible when tested to ASTM E-136-81 (Also CAN4-S114M80)
- .6 Panels shall be glass fibre reinforced concrete Synstone panels as manufactured by Concrete Cladding Systems Ltd. 905-607-8304, supplied and installed as per the manufacturer's latest published data, and as noted on the Drawings and Specifications.
- .7 Panels are coloured through using synthetic iron oxide pigments, colour to be Pearl White.
- .8 The concrete panel has been designed for a wind load of 25 psf. Based on the recommendation of the Prestressed Concrete Institute (PSI), a factor of Safety of 4 to 6 should be used for GFRC materials. A safety factor of 4 has been used in this design calculation.

2.2 Structural Shapes

- .1 18 Gauge and 16 Gauge galvanized brake shapes conforms to ASTM A653
 - .1 Coating designation: Metric Z275-275grams/m² both sides. Imperial G90 - 90oz/ft² both sides
 - .2 Pre-painted brake shapes for light gauge trims galvanized substrate Z275/G90 with Perspectra series paint by Dofasco.
 - .3 Bug Trim 26 Gauge Galvalume.

2.3 Fasteners

- .1 Steel and woods studs, use #8-18 Rock-on wafer head self-drilling screws from Buildex, or equivalent products.
- .2 All screws should have sufficient corrosion resistance or be coated with Climaseal, or equivalent corrosion resistant products.
- .3 The distance between fasteners both vertically and horizontally should not be more than 18" C.O.C. and also not less than ½" from the panel's edge. Care should be taken that the head of the screw does not penetrate the panel surface. Note that the head of the screw must be colour matched to the panel.
- .4 A joint gap of not less than ¼" must be maintained between all panels. All joints should be filled with backing rod and caulking using a high quality sealant. Using specified sealant enables 3 point adhesion.

2.4 Sealants

- .1 Dow Corning 795 or CWS, one-part silicone, neutral-cure, architectural

sealant or Bondaflex Sil 295 NB or Sil 199PG, one-part silicone neutral cure, architectural sealant. Colour as selected by the Architect from the manufacturer's chart.

2.5 Soffit Vents:

- .1 Provide continuous 50 mm wide metal soffit vents with insect screen as recommended by manufacturer. Tru Vent hidden vent pre-finished aluminum soffit by Maple Leaf Millworks or approved equal. Submit shop drawings.

PART 3 - EXECUTION

3.1 General

- .1 All panels are to be installed level, true and plumb and in line as indicated on the drawings. Tolerances shall be within 2 mm. in 3 meters vertically and horizontally, and 3 mm. in 3 meters for the diagonal surface alignment.
- .2 Panels required to be stored shall be protected from dirt and damage. Keep panels covered at all times to protect from dirty rain water until on the project. Panels which are damaged in any way shall not be accepted or installed.
- .3 Pre-drill exterior panels with #8 oversize, countersunk holes.
- .4 Screws are to be located so that panels can be individually removed without removing adjacent materials such as flashing.
- .5 To maintain 1/4" gaps between panels use "Synstone Black Shims" prior to fastening. Remove before caulking.
- .6 It is recommended that only installers approved by Synstone International Ltd. be allowed to install this system.

3.2 Continuous Metal Soffit Vents

- .1 Provide vents at a minimum of 2" wide x full length between joists, and should be screened. Vents to be attached to min. 1"x 2" backing strips installed prior to panel application. Vent openings should be framed and located as per drawings.

3.3 Clean Up

- .1 Clean all panels periodically during the process of reaching substantial completion with approved methods in accordance with manufactures recommendations. Dust from cutting and drilling holes in panels must be removed immediately. Do not use wire brushes, metallic tools or abrasives .
- .2 Upon completion of panel installation, remove any excess sealant with solvent approved or recommended by the panel manufacturer. Power wash the complete installation to remove construction dirt. No routine maintenance is required with Synstone panels. If required, the panels may be cleaned with mild detergent and water or plain water.

PART 1 - GENERAL

1.1 Related Work

- .1 Prefabricated roof expansion joints: Section 07712
Prefabricated Roof Expansion Joints
- .2 Caulking: Section 07900 Joint Sealers
- .3 Roof drains: Section 15401 Plumbing Specialties and
Accessories

1.2 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 36- 95b , Specification for Gypsum Wallboard.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.5- M89 , Cutback Asphalt Plastic Cement.
 - .2 CGSB 37-GP-9Ma- 83 , Primer, Asphalt, Unfilled, for Asphalt Roofing,
Dampproofing and Waterproofing.
 - .3 CGSB 37-GP-15M- 76 , Application of Asphalt Primer for Asphalt Roofing,
Dampproofing and Waterproofing.
 - .4 CGSB 37-GP-19M- 76 , Cement, Plastic, Cutback Tar.
 - .5 CAN/CGSB-37.29- M89 , Rubber-Asphalt Sealing Compound.
 - .6 CGSB 37-GP-56M- 80 , Membrane, Modified, Bituminous, Prefabricated, and
Reinforced for Roofing.
 - .7 CAN/CGSB-51.20- M87 , Thermal Insulation, Polystyrene, Boards and Pipe
Covering.
 - .8 CAN/CGSB-51.26- M86 , Thermal Insulation, Urethane and Isocyanurate,
Boards, Faced.
 - .9 CAN/CGSB-51.31- M84 , Thermal Insulation, Mineral Fibre Board for Above
Roof Decks.
 - .10 CAN/CGSB-51.33- M89 , Vapour Barrier Sheet, Excluding Polyethylene, for
Use in Building Construction.
 - .11 CAN/CGSB-51.34- M86 , Vapour Barrier, Polyethylene Sheet for Use in
Building Construction.
 - .12 CAN/CGSB 51.38- 92 , Cellular Glass Thermal Insulation.
- .3 Canadian Standards Association (CSA)
 - .1 CSA A123.3- M19 92 , Asphalt or Tar Saturated Roofing Felt.
 - .2 CSA A123.4- M19 92 , Bitumen for Use in Construction of Built-Up Roof
Coverings and Dampproofing and Waterproofing Systems.
 - .3 CSA A231.1- 1972 , Precast Concrete Paving Slabs.
 - .4 CAN/CSA-A247- M86 , Insulating Fibreboard.
 - .5 CSA A284- 1976 Mineral Aggregate Thermal Roof Insulation.
 - .6 CSA O121- M1978 , Douglas Fir Plywood.
 - .7 CSA O151- M1978 , Canadian Softwood Plywood.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300.
- .2 Indicate flashing, control joints, tapered insulation details.
- .3 Provide layout for tapered insulation.

1.4 Storage and Handling

- .1 Provide and maintain dry, off-ground weatherproof storage.
- .2 Store rolls of felt and membrane in upright position. Store membrane rolls with selvage edge up.
- .3 Remove only in quantities required for same day use.
- .4 Place plywood runways over work to enable movement of material and other traffic.
- .5 Store sealants at +5°C minimum.
- .6 Store insulation protected from daylight and weather and deleterious materials.

1.5 Environmental Requirements

- .1 Do not install roofing when temperature remains below -18°C for torch application, or -10°C to manufacturers' recommendations for mop application.
- .2 Minimum temperature for solvent-based adhesive is -5°C.
- .3 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.6 Protection

- .1 Fire Extinguishers: maintain one cartridge operated type with hose and shut-off nozzle, ULC labeled for A, B and C class protection. Size s 1.14 2.25 4.5 9 and 14 kg or as indicated on roof per torch applicator, within 10 m of torch applicator.
- .2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.7 Warranty

- .1 Contractor hereby warrants that modified bituminous roofing and membrane flashings will stay in place and remain leakproof in accordance with General Conditions , but for twenty years.
-

1.8 Reference Standards

- .1 Do roofing work in accordance with applicable, standard in Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual except where specified otherwise.
- .2 Do priming for asphalt roofing in accordance with CGSB 37-GP-15M-76(R84).

1.9 Identification and Delivery

- .1 Indicate on containers or wrappings of materials:
 - .1 Manufacturer's name and brand.
 - .2 Compliance with applicable standard.
 - .3 Mass where applicable.
- .2 Deliver materials in original containers, sealed, with labels intact.
- .3 Deliver fasteners in boxes or kegs and keep in protective storage until used. Do not oil or grease fasteners.

1.10 Compatibility

- .1 Compatibility between components of roofing system is essential. Bituminous adhesives, insulation, felts, and surface coatings which are to be incorporated into system must be compatible with each other.
- .2 Provide written declaration that components of roofing system are compatible.

PART 2 - PRODUCTS

2.1 Materials

- .1 Sheathing Adhesive: Instafoam Products Inc. Insta-Stik.
- .2 Sheathing board: Georgia Pacific Dens-Deck to CSA A82.27-M1977, 12.7 mm thick thickness as indicated.
- .3 Saturated glass fibre roofing felts: to ASTM D2178-85a, Type IV.
- .4 Asphalt primer: to CGSB 37-GP-9Ma-83.
- .5 Asphalt : to CSA A123.4-M1979, Type 3.
- .6 Plastic cement: asphalt
- .7 Sealing compound: to CGSB 37-GP-29M-77, rubber asphalt type.

- .8 Insulation: Urethane (Isocyanurate).
 - .1 Faced: to CAN/CGSB-51.26-M86, Facing in accordance with manufacturer's specifications, flame spread classification: less than 500 unrated, thickness 2 1/2" unless otherwise noted on drawings. Maximum board size 4'x4'.
 - .1 Acceptable material: NRG Barriers E'nerg'y 2 Plus including tapered pre-cut crickets and mitres.
- .9 Protection Board: 12.7mm asphalt impregnated fibreboard conforming to CAN/CSA-A247-M86 with shiplapped edges.
- .10 Base Sheet and Base Sheet Flashing membrane: Modified Bitumen with sanded lower surface for mopping asphalt and a thermofusible ply upper surface to receive torched on granular cap sheet. Soprema Elastophene 180 PS.
- .11 Cap Sheet and Cap Sheet Flashing membrane: Granular top surface, thermo fusible poly bottom surface for torched application. Soprema Sopralene Flam 250 GR.
- .12 Cant strips: cut from 38 mm thick fibreboard material, 100 mm x 100 mm x 45° slope, to measure 140 mm on slope.
- .13 Accessories:
 - .1 Adhesive: listed by ULC under Roof Deck Construction Materials, Guide No. 360 R13 and as recommended by manufacturer of material being adhered and for use under climatic conditions to be encountered.
 - .2 Insulation joint tape: asphalt treated kraft paper, fiber reinforced, 100 to 150 mm wide, self adhering.
 - .3 Sealing compound: as req'd. by asphalt and felt manufacturer.
 - .4 Polyethylene back-up rope: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa, compatible with primers and sealants, oversized 30 to 50%.

PART 3 - EXECUTION

3.1 Plant and Equipment

- .1 Use only kettles equipped with thermometers or gauges in good working order.
- .2 Locate kettles in safe place outside of building or, if approved by Consultant, on noncombustible roof at location to avoid danger of igniting combustible material below. When locating kettles, give consideration to direction of prevailing winds, building fans and air handling units to minimize possibility of smoke and fumes entering surrounding occupied buildings. If wind direction causes smoke and fume problems, relocate kettles on daily basis when directed by Consultant.
- .3 Maintain continuous supervision while kettles are in operation and provide metal covers for kettles to smother flames in case of fire. Provide suitable fire extinguishers.

- .4 Maintain efficiency of kettles and equipment by frequent cleaning. Remove all carbonized bitumen.
- .5 Prior to start of work, demonstrate container capacities and spread rate of machines to Consultant.
- .6 Use only fibreglass roofing mops.
- .7 Do not leave used roofing mops unattended on roof; store away from building and combustible materials.

3.2 Protection

- .1 Cover walls and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of work.
- .3 Clean off drips and smears of bituminous material.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .5 Prevent traffic over completed roofing except where required by work above roof level. Comply with precautions deemed necessary by Consultant. Repair damage caused by non-compliance with Consultant's requirements.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.

3.3 Examination of Roof Decks

- .1 Examine roof decks and immediately inform Consultant in writing of defects.
- .2 Prior to commencement of work ensure:
 - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris.
 - .2 Curbs have been built.
 - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
 - .4 Plywood and lumber nailer plates have been installed to walls and parapets as indicated.

3.4 Preparation of Steel Deck (Channel Type)

- .1 Mechanically fasten sheathing board to steel deck with galvanized screws on top side of flutes spaced 400 o.c. max each way.
- .2 Place sheathing board with long axis of each sheet transverse to ribs, with end joints staggered and fully supported on ribs.

- .3 Do not use mechanical fasteners.

3.5 Roofing Asphalt

- .1 Apply roofing asphalt at plus or minus 15°C of EVT indicated on Bill of Lading.
- .2 Maintain asphalt in tanker at or below its FBT indicated.

3.6 Vapour Retarder Membrane

- .1 Adhere 2 plies of glassfibre felts to sheathing board and to each other by means of hot bitumen applied at coverage rate of 1.2 kg/m² per ply. Lap each sheet 480 mm.
- .2 Return vapour retarder membrane up side and over top of insulation at terminations and penetrations.

3.7 Insulation

- .1 Lay in regular pattern to facilitate taping of joints and to provide uniform insulation value over entire roof. Install pre-manufactured sloped insulation to pattern as required.
- .2 Mop insulation to felt vapour barrier with hot bitumen applied at coverage rate of 1 kg/m².
- .3 Butt boards together without gaps. Keep joints free of asphalt.
- .4 Apply tape over joints of top insulation layer and over joints between insulation and insulation stops. Ensure full and positive adhesion.
- .5 At end of each work period, mop felt membrane over exposed surfaces and edges of insulation and onto vapor barrier to render watertight. Remove this seal on resumption of work.

3.8 Protection Board

- .1 Mop protection board into top of insulation at rate of 1.2 kg/m² Type 3 asphalt.

3.9 Modified Bitumen Membrane: Application Method

- .1 Mop in base sheet to protection board by means of Type 3 hot asphalt applied at coverage rate of 1.2 kg/m²/per ply and in accordance with CRCA Specification SGI-1.
- .2 Torch cap sheet to base sheet in accordance with manufacturer's specifications.

3.10 Modified Bitumen Membrane Flashings: General

- .1 Apply membrane flashings at valleys, ridges, eaves, junctions of horizontal and vertical surfaces, roof drains, vents, and other roof mounted appurtenances.
- .2 Ensure surfaces are smooth, clean, dry.
- .3 Clean with solvent all metal in contact with bitumens such as flashings, caulking retainers and vents. Dry with clean rags, prime with asphalt primer and allow to dry before incorporating into roof system.
- .4 Prior to flashing, prime surfaces to receive bitumens, except felts, with asphalt primer at maximum rate of 0.37 L/m².

3.11 Flashing at Roof Edge

- .1 Cut roof membrane flush with top edge of cant strip.
- .2 Install 2 ply modified bituminous membrane similar to roofing membrane.
- .3 Extend up and over parapets, turn down outside face, securely nail to wood fascia at approximately 100 mm staggered centres and coat on face of cant.

3.12 Flashing at Vertical Surfaces

- .1 Cut roof membrane 100mm extended from top edge of cant strip.
- .2 Install 2 ply modified bitumen membrane flashing over cant and up vertical surface and lap under air barrier or through-wall flashing of wall assembly.

3.13 Other Flashings

- .1 Provide flashing in accordance with manufacturer's specifications and details and related details in accordance with latest edition of CRCA manual.

PART 1 - GENERAL

1.1 References

- .1 Aluminum Association
 - .1 Aluminum Sheet Metal Work in Building Construction- 1980.
 - .2 Designation System for Aluminum Finishes- 1980.
 - .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 167-99 94a , Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A 591/A 591M-98 591M-98 591M-98 591M-96 591M-96 591M-96 591M-96 591 M- 89(1994) , Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
 - .3 ASTM A 606-01 91a(1993) , Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .4 ASTM A 653/A 653M-02a 653M-02a 653M-02a 653 M- 95 , Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM A 792/A 792M-02 792M-02 792M-02 792M- 95 , Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .6 ASTM B 32-00e1 95b , Specification for Solder Metal.
 - .7 ASTM B 370-98 92 , Specification for Copper Sheet and Strip for Building Construction.
 - .8 ASTM D 523-89(1999) 89(1994) , Test Method for Specular Gloss.
 - .9 ASTM D 822-01 89 , Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon Arc Light and Water Exposure Apparatus.
 - .3 Canadian Roofing Contractors Association (CRCA).
 - .1 Roofing Specifications Manual.
 - .4 Canadian Standards Association (CSA)
 - .1 CSA A123.3-98 M1979 , Asphalt or Tar Saturated Roofing Felt.
 - .2 CSA PKG.A440-00 Series-98 Series-98 Series-98 Series-98 M90 , Windows.
 - .3 CSA B111-1974 (R1998) (R1998) (R1998) 1974 , Wire Nails, Spikes and Staples.
 - .5 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.5-M89 M89 , Cutback Asphalt Plastic Cement.
 - .2 CAN/CGSB-51.32-M77 M77 , Sheathing, Membrane, Breather Type.
 - .3 CAN/CGSB-93.1-M85 M85 , Sheet, Aluminum Alloy, Prefinished, Residential.
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1.2 Samples

- .1 Submit shop drawings in accordance with Section 01305.
- .2 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.

PART 2 - PRODUCTS

2.1 Prefinished Steel Sheet

- .1 Prefinished steel with factory applied silicone modified polyester.
 - .1 Class F2S.
 - .2 Premium colour selected by Consultant to match existing.
 - .3 Specular gloss: 30 units +/- 5 in accordance with ASTM D 523-89(1999).
 - .4 Coating thickness: not less than 25 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D 822-01 as follows:
 - .1 Outdoor exposure period 1000 hours.
 - .2 Humidity resistance exposure period 1000 hours.

2.2 Accessories

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5-M89.
- .3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3-98.
- .4 Sealants: according to Section 07 92 00. Ensure compatibility of materials.
- .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .6 Fasteners: of same material as sheet metal, to CSA B111-1974 (R1998) (R1998) (R1998), ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 Fabrication

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with Aluminum Association Aluminum Sheet Metal Work in Building Construction.
- .3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm. Miter and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 Metal Flashings

- .1 Form flashings, copings and fascias to profiles indicated of 22ga prefinished steel .

2.5 Pans

- .1 Form pans to receive roofing plastic from 22ga thick prefinished steel sheet metal with minimum 75 mm upstand above finished roof and 100 mm continuous flanges with no open corners. Rivet joints. Make pans minimum 50 mm wider than member passing through roof membrane.

2.6 Reglets and Cap Flashings

- .1 Form recessed reglets and metal cap flashing of 1 mm thick sheet metal to be built-in masonry work for base flashings as detailed and in accordance with CRCA FL series details. Provide slotted fixing holes and steel/plastic washer fasteners. Cover face and ends with plastic tape.

PART 3 - EXECUTION

3.1 Installation

- .1 Install sheet metal work in accordance with CRCA FL series details and as detailed.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips, as detailed.
- .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 into reglets and under cap flashing to form weathertight junction.
- .8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .9 Caulk flashing at reglet and cap flashing with sealant.
- .10 Install pans, where shown and as required around items projecting through roof membrane.

PART 1 - GENERAL

1.1 Summary

- .1 This Section specifies caulking and sealants not specified in other Sections.
- .2 Refer to other sections for other caulking and sealants.

1.2 References

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

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit duplicate samples of each type of material and colour. Colours to be as selected by Consultant from manufacturer's standard and premium colour range.
- .3 Submit manufacturer's data sheets for each type of sealant used.

1.4 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 and water.

1.5 Environmental and Safety Requirements

- .1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 For interior caulking work, ventilate areas as directed by Consultant.

1.6 Compatibility

- .1 Contractor together with manufacturer to recommend materials most appropriate for use intended and to assure compatibility of caulking materials with adjacent materials. Commencement of Work shall be deemed conformance with this Article.
- .2 Examine substrates prior to commencing work and report to Consultant deficiencies which may impede the work of this Section. Commencement of Work shall be deemed acceptance of substrate.

PART 2 - PRODUCTS

2.1 Sealant Materials

- .1 Sealants and caulking compounds must:
 - .1 meet or exceed all applicable governmental and industrial safety and performance standards; and
 - .2 be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the fisheries Act and the Canadian Environmental Protection Act (CEPA).
 - .2 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulfate.
 - .3 Sealant and caulking compounds must not contain a total of volatile organic compounds (VOCs) in excess of 5% by weight as calculated from records of the amounts of constituents used to make the product;
 - .4 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.
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- .5 Caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant shall not be used in air handling units.
- .6 When low toxicity caulks are not possible, confine usage to areas which offgas to the exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.
- .7 In the selection of the products and materials of this section preference will be given to those with the following characteristics: Water based, water soluble, water clean-up, non-flammable, Biodegradable , low Volatile Organic Compound (VOC) content, manufactured without compounds which contribute to ozone depletion in the upper atmosphere, manufactured without compounds which contribute to smog in the lower atmosphere, does not contain methylene chloride, does not contain chlorinated hydrocarbons.
- .8 The manufacturing process must adhere to Lifecycle Assessment Standards as per CSA Z760-94 LCA Standards .
- .9 Sealants acceptable for use on this project except CAN/CGSB-19.1-M87 and CAN/CGSB-19.18-M87 must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

2.2 Sealant Material Designations

- .1 Sealants for vertical and horizontal non-traffic bearing joints, to Table 1, CGSB 19-GP-23:
 - .1 Normal temperature range, dry conditions, movement range to 25%: CGSB 19-GP-9Ma+Amd- Oct-80, CAN/CGSB-19.13-M87, CAN/CGSB-19.18-M87, Can2-19.24-M80.
 - .2 Normal temperature range, wet conditions, movement range to 25%: CAN/CGSB-19.13-M87, Can2-19.24-M80.
 - .3 Low temperature range, dry conditions, movement range to 25%: CGSB 19-GP-9Ma+Amd- Oct-80, CAN/CGSB-19.13-M87, CAN/CGSB-19.18-M87, Can2-19.24-M80.
 - .4 Low temperature range, wet conditions, movement range to 25%: CAN/CGSB-19.13-M87, Can2-19.24-M80.
- .2 Sealants in interior applications subject to high humidity and dampness to be silicone type with integral fungicide.

2.3 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
 - .1 Round solid rod, Shore A hardness 70.

- .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .2 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.
 - .3 Ensure compatibility with sealants.

2.4 Sealant Selection

- .1 Use sealant as recommended by manufacturer for use intended. Submit sealant schedule to Consultant for review prior to commencement of work.

2.5 Joint Cleaner

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

2.6 Joint Cleaner

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - 1. Dow Corning
 - 2. General Electric
 - 3. Sonneborn
 - 4. Tremco

PART 3 - EXECUTION

3.1 Protection

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

3.2 Preparation of Joint Surfaces

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.

- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

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

3.4 Backup Material

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape.

3.5 Mixing

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

3.6 Application

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

- .3 Remove masking tape after initial set of sealant.

PART 1 - GENERAL

1.1 References

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A 653/A 653M-02a 653M-02a 653M-02a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B 29-92(1997), Specification for Pig Lead.
 - .3 ASTM B 749-97, Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
 - .3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .4 CGSB 51-GP-21M, Thermal Insulation, Urethane and Isocyanurate, Unfaced.
- .3 Canadian Standards Association (CSA).
 - .1 CSA A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings.
 - .2 CSA G40.21-98, Structural Quality Steels.
 - .3 CSA W59-M1989 (R2001), Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA).
 - .1 CSDFMA, Specifications for Commercial Steel Doors and Frames, 1990.
 - .2 CSDFMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA).
 - .1 ANSI/NFPA 80-1998, Fire Doors and Windows.
 - .2 ANSI/NFPA 252-1999, Door Assemblies, Fire Tests of.
- .6 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN4-S104-M80(R1985), Fire Tests of Door Assemblies.
 - .2 CAN4-S105-M85(R1992), Fire Door Frames.

1.2 Design Requirements

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

1.3 Requirements of Regulatory Agencies

- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104-M80(R1985) revised 1985 and CAN4-S105-M85(R1992) for ratings specified or indicated.
- .2 Install labelled steel fire rated doors and frames to ANSI/NFPA 80-1998 except where specified otherwise.

1.4 Warranty

- .1 Warranty to be minimum two years labour and materials from Date of Substantial Performance.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed louvred, arrangement of hardware and fire rating.
- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and finishes.

PART 2 - PRODUCTS

1.6 Materials

- .1 Hot dipped galvanized steel sheet: to ASTM A 653/A 653M-02a 653M-02a 653M-02a, ZF75, minimum base steel thickness in accordance with CSDFMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.21-98, Type 44W, coating designation to ASTM A 653/A 653M-02a 653M-02a 653M-02a, ZF75.
- .3 Composites: balance of core materials used in conjunction with lead: in accordance with manufacturers' proprietary design.

1.7 Door Core Materials

- .1 Stiffened: face sheets welded, uninsulated core.
 - .1 Polyurethane: to CGSB 51-GP-21M rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m³.
- .2 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250°C at 30 60minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104-M80(R1985), ASTM E

152-81a or ANSI/NFPA 252-1999, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

- .3 Thermal insulation material must:
 - .1 not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act;
 - .2 be manufactured using a process that uses chemical compounds with the minimum ozone depletion potential (ODP) available.
- .4 Board-type thermal insulation materials must:
 - .1 contain, when calculated on a 12-month rolling basis:
 - .1 over 35 % recycled material by weight of the finished product if made from glass fibre,
 - .2 over 45 % recycled material by weight of the finished product if made from mineral composition,
 - .3 over 10 % recycled material by weight of the finished product, if made from plastic.

1.8 Adhesives

- .1 Select Adhesives which:
 - .1 do not contain volatile organic compounds in excess of 5 % by weight as measured by EPA Method 24-24A, 40 C.F.R., Part 60, Appendix A (1991), Method 18,48 Federal Register 48, no. 202, October 18, 1983 Method 1400 NIOSH Manual of Analytical Methods, Volume 1, February 1984, Environmental Protection Agency Method 8240 GC/MS Method for Volatile Organics, September 1986, as demonstrated through calculation from records of the amounts of constituents used to make the product;
 - .2 are accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance;
 - .3 are accompanied by information describing proper disposal methods for containers.
- .2 Steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .3 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .4 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

1.9 Primers

- .1 Touch-up prime CAN/CGSB-1.181-99.

1.10 Accessories

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior and interior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma steel.
- .3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Door bottom seal.
- .5 Metallic paste filler: to manufacturer's standard.
- .6 Fire labels: metal riveted.
- .7 Sealant: in accordance with Section 07900.
- .8 Glazing: in accordance with Section 08800.
- .9 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws or dry glazing of snap-on type.
 - .2 Design exterior glazing stops to be tamperproof.

1.11 Frames Fabrication General

- .1 Fabricate frames in accordance with CSDFMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated and to suit wall conditions. Frame depths to cover masonry cavities where applicable. All exposed corner blocks are bullnosed. Generally, for 150 concrete block walls, throat size to cap block. For cavity walls, frame depth to be minimum 178mm with fasteners to suit anchorage into masonry veneer and back-up block.
- .3 Exterior frames: 1.6 mm welded thermally broken type construction.
- .4 Interior frames: 1.6 mm welded knocked-down type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Protect mortised cutouts with steel guard boxes except for gypsum board installations.
- .7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .8 Manufacturer's nameplates on frames and screens are not permitted.

- .9 Conceal fastenings except where exposed fastenings are indicated.
- .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .11 Insulate exterior frame components with polyurethane insulation.
- .12 Steel frames to exterior and interior openings 1200 mm or less in unsupported width 1.52 mm base thickness.
 - .1 Steel frames exterior and interior openings over 1200 mm in unsupported width 1.52 mm base thickness. Reinforce head with framed steel reinforcing channel for full width. Reinforce for all hardware.

1.12 Frame Anchorage

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm o.c. maximum.
- .5 At masonry cavity walls, use galvanized offset T-anchors set into concrete block wythe.

1.13 Frames: Welded Type

- .1 Welding in accordance with CSA W59-1989 (R2001).
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .7 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

1.14 Door Fabrication General

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: hollow steel construction. Interior doors: hollow steel construction.
- .3 Fabricate doors with longitudinal edges fully welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E 330-02.
- .5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .7 Reinforce doors where required, for surface mounted hardware.
- .8 Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .10 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104-M80(R1985), ASTM E 152-81a or ANSI/NFPA 252-1999 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .11 Manufacturer's nameplates on doors are not permitted.
- .12 Bevel lock and hinge edges 3mm in 50mm unless builder's hardware or door swing dictates otherwise.
- .13 Fabricate door faces without visible seams, free of scale, pitting, coil brakes, buckles and waves. Formed edges shall be true and straight with a minimum radius for the thickness of steel used.
- .14 Top and bottom of doors shall be provided with inverted, recessed, 16 ga. steel end channels, welded to each face sheet at 150mm o.c. minimum.

1.15 Hollow Steel Construction

- .1 Form each face sheet for exterior doors from 1.6 mm sheet steel.
- .2 Form each face sheet for interior doors from 1.2 sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with polyurethane core.
- .5 Fill voids between stiffeners of interior doors with temperature rise rated core.

1.16 Thermally Broken Doors and Frames

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

1.17 Acceptable Manufacturers

1. Products in accordance with this specification by only the following manufacturers will be accepted.
 1. Artek
 2. Baron
 3. Daybar
 4. Fleming

PART 3 - EXECUTION

1.18 Installation General

- .1 Install in accordance with National Fire Codes, Volume 4, produced by National Fire Protection Association (ANSI/NFPA 80-1998).
- .2 Install doors and frames to CSDFMA Installation Guide.

1.19 Door Installation

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08710 - Finish Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, top of carpet noncombustible sill and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

1.20 Frame Installation

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

1.21 Finish Repairs

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

1.22 Glazing

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

PART 1 - GENERAL

1.1 Related Work

- .1 Caulking of joints between Section 07900 frames and other building Sealants components:
- .2 Supply of finish Section 08710 hardware: Door Hardware
- .3 Wiring and conduit Division 16 for electronic hardware.

1.2 References

- .1 Aluminum Association Designation System for Aluminum Finishes-1980.
- .2 ASTM E 330-02 Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- .3 CSA G40.21-98 Structural Quality Steels.
- .4 CAN/CSA-G164-M92 (R1998) Hot Dip Galvanizing of Irregularly Shaped Articles.
- .5 CAN/CGSB-1.40-M89 Primer, Structural Steel, Oil Alkyd Type.
- .6 CAN/CGSB-12.1-M90 Tempered or Laminated Safety Glass.

1.3 Design Criteria

- .1 Design frames and doors in exterior walls to:
 - .1 Accommodate expansion and contraction within service temperature range of -35 to 35°C.
 - .2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E 330-02 under wind load of 1.2 kpa. Submit certificate of tests performed.

1.4 Samples

- .1 Submit samples in accordance with Section 01300.
 - .2 Submit one 300 x 300 mm corner sample of each type door and frame.
 - .3 Submit sample showing glazing detail, reinforcement, finish and location of manufacturer's nameplates.
 - .4 Frame sample to show glazing stop, door stop, jointing detail, finish, wall trim, and removable mullion.
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1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01305.
- .2 Indicate each type of door and frame, extrusion profiles, method of assembly, section and hardware reinforcement, locations of exposed fasteners, finishes and location of manufacturer's nameplates.
- .3 Submit detail drawings indicating connections, lateral bracing of system and anchorage to base building.
- .4 Submit catalogue details for each type of door and frame illustrating profiles, dimensions and methods of assembly.
- .5 Shop drawings to be signed and sealed by member of the Professional Engineers of Ontario (P.E.O.).

1.6 Maintenance Data

- .1 Provide operation and maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section 01730.

1.7 Protection

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

PART 2 - PRODUCTS

2.1 Materials

- .1 Aluminum extrusions: Aluminum Association alloy AA6063-T5 or T6 anodizing quality.
 - .2 Sheet aluminum: Aluminum Association alloy AA1100-H14 or AA5005-H32 or H34 anodizing quality.
 - .3 Steel reinforcement: to CSA G40.21-98, grade 300W.
 - .4 Fasteners: stainless steel.
 - .5 Door bumpers: black neoprene.
 - .6 Isolation coating: bituminous paint.
 - .7 Glass: laminated security glass to CAN/CGSB-12.1-M90, Type 1, Class A.
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- .8 Glazing materials: in accordance with Section 08800.
- .9 Sealants: in accordance with Section 07900 colour selected by Consultant.

2.2 Aluminum Doors

- .1 Aluminum doors to be wide stile type constructed of porthole extrusions minimum 50mm thick with minimum wall thickness of 3 mm. Alumicor Series 800A, Kawneer 500, Sherwood Windows Limited W-2000 wide-style or other approved equal. Provide doors to dimensions and configurations as shown on drawings.
- .2 Door stiles minimum nominal 89 mm wide or as shown on drawings.
- .3 Top rail minimum nominal 89 mm wide or as shown on drawings.
- .4 Bottom rail minimum nominal 300 mm wide or as shown on drawings and to match glazing sill extrusion.
- .5 Mid rail minimum nominal 200mm or as shown on drawings.
- .6 Reinforce mechanically-joined corners of doors to produce sturdy door unit.
- .7 Glazing stops: interlocking snap-in type for single dry glazing. Exterior stops: tamperproof type.
- .8 Hardware: Prepare doors for hardware specified in Section 08710.
- .9 Supply and install aluminum doors in thermally broken aluminum frames and screens.
- .10 Corner construction shall be butt joined with two hidden welds. At each corner, welds shall be of the inert gas process with maximum penetration and without heat discolouration on exposed surfaces.
- .11 Prepare for and install finishing hardware on aluminum doors. Provide cutouts, recesses, mortising required for finish and operating hardware. Coordinate with Section 08710.
- .12 Provide rails and transoms to sizes and profiles shown in these Specifications or as shown on drawings.
- .13 Make provision for concealed magnetic door switches as specified.

2.3 Aluminum Frames

- .1 Construct heavy duty frames of aluminum extrusions with minimum wall thickness of 3 mm.
 - .2 Framing System: complete framing system including dry glazing splines, removable horizontal member stops, connecting brackets, sloped framing and single glazing, door
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stops, fasteners, extruded aluminum adapters for single glazing, removable centre mullions, etc. for complete installation.

- .3 Prepare exterior frames for door jamb contacts and security wiring to Owner's requirements.
- .4 Supply and install aluminum doors in thermally broken aluminum frames and screens.
- .5 Prepare for and install finishing hardware on aluminum frames. Provide cutouts, recesses, mortising required for finish and operating hardware. Coordinate with supply by Section 08710.
- .6 Provide sidelights, rails and transoms to sizes and profiles shown in these Specifications or as shown on drawings.
- .7 Make provision for concealed magnetic door switches as specified.

2.4 Finishes

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Bronze or brown anodized to match existing. Verify on site.
- .2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.

2.5 Steel Finishes

- .1 Finish steel clips and reinforcing steel with steel primer to CAN/CGSB-1.40-M89 zinc coating to CAN/CSA-G164-M92 (R1998) (R1998) (R1998) (R1998).

2.6 Fabrication

- .1 Doors and framing to be by same manufacturer.
- .2 Fabricate doors and frames to profiles and maximum face sizes as shown.
- .3 Provide structural steel reinforcement as required.
- .4 Fit joints tightly and secure mechanically.
- .5 Conceal fastenings.

- .6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08710 - Finish Hardware.
- .7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

2.7 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Aerloc
 - .2 Sherwood
 - .3 Windspec

PART 3 - EXECUTION

3.1 Installation

- .1 Set frames plumb, square, level at correct elevation in alignment with adjacent work.
- .2 Anchor securely.
- .3 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .4 Adjust operable parts for correct function.
- .5 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

3.2 Glazing

- .1 Glaze aluminum doors and frames in accordance with Section 08800 - Glazing. All glazing in doors, sidelights and transoms to be insulated units, tempered glass exterior and laminated security glass at interior.

3.3 Caulking

- .1 Seal joints to provide weathertight seal at outside and air, vapour seal at inside.
- .2 Apply sealant in accordance with Section 07900 - Sealant. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
 - .1 Quality Standards for Architectural Woodwork 2009.
- .2 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN-4S104M-80(R1985), Fire Tests of Door Assemblies.
 - .2 CAN4-S105-M85(R1992) (R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104-1980(R1985).

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01300.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01300. Indicate VOC's:
 - .1 For caulking materials during application and curing
 - .2 For door materials and adhesives.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01305.
 - .2 Indicate door types and sizes, and core construction.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Storage and Protection:
 - .1 Protect doors from dampness and damage. Arrange for delivery after work causing abnormal humidity has been completed.
 - .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
 - .3 Protect doors from scratches, handling marks and other damage. Wrap doors.
 - .4 Store doors away from direct sunlight.
 - .2 Deliver all doors directly to site, complete with cut-outs ready for grilles and/or vision panels and protected as necessary to prevent damage or deterioration.
 - .3 Seal all edges with two coats of urethane sealer, in plant, prior to shipping.
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- .4 Store doors flat on a level surface in a dry, well ventilated area where relative humidity is from 50 to 55% at 21 degrees C (70 degrees F).
- .5 Cover doors to keep clean but allow for air circulation.
- .6 Doors are not to be subjected to sudden or abnormal changes of heat, dryness or humidity. Condition doors to average prevailing humidity conditions at installation area before hanging.
- .7 It is recommended the General Contractor use sets of construction doors during construction and install the finished product only when construction is nearing completion. Dented, twisted, cracked or otherwise damaged doors and frames will be rejected.
- .8 Doors damaged before or after installation are to be replaced prior to building occupancy.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Dispose of corrugated cardboard polystyrene plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.
- .3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.
- .4 Divert unused adhesive material from landfill to official hazardous material collections site approved by Consultant.
- .5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

1.6 Warranty

- .1 Provide a written warranty guaranteeing the wood doors from warp exceeding 3mm, showing core lines, splitting, delaminating or sagging in accordance with AWMAC Standards and general conditions for Lifetime following Substantial Performance of the project. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense to Owner.
- .2 Defects in doors shall include, but not be limited to surface blemishes, showing of core ghost lines, splitting, delamination, swelling, sagging, deterioration of core and twisting, warping, bowing or cupping in excess of 3 mm measured across face of door.
- .3 Warranty shall cover the cost of replacing any defective door including delivery, handling, fitting, installation, reinstallation of hardware, grilles and glass, finishing to match replaced door, removal of existing door and repair to adjacent surfaces and materials if damaged during replacement work.

PART 2 - PRODUCTS

2.1 WOOD FLUSH DOORS

- .1 Solid core: to CAN/CSA-O132.2.1.
 - .1 Construction:
 - .1 Solid particleboard core: stile and rail frame bonded to particleboard core with wood lock blocks, 5-ply solid core construction.
 - .2 Core: 449 kg/cu.m. to 512 kg/cu.m. (28-32 lbs/cu.f.) density solid particleboard or kiln dried low density soft wood blocks conforming to CAN3-0188.1-M78, Type II, Grade DC. For fire rated doors, provide core in accordance with fire test requirements.
 - .3 Crossband: Minimum 1.6mm (0.060" or 1/16" normal) thick hardwood veneer laminated to each face of core at doors requiring plastic laminate facing, fire treated.
 - .4 Stiles: 3 mm (1/8") thick veneer, longitudinally laminated by Minimum overall hot pressing with type 1 structural glue, (LVL), including a 22 mm (7/8") piece of hardwood, matched with faces, for a total width of 107 mm (4 3/16").
 - .5 Top & Bottom Rails: 3 mm (1/8") thick veneer, longitudinally laminated by hot pressing with type 1 structural glue, (LVL), or laminated strand lumber (LSL) for a total width of 85 mm (3 5/16").
 - .6 Glass Stops: premanufactured metal frames in accordance with the requirements of ANSI/NFPA 80-1998 for fire-rated doors, stainless steel screws.
 - .1 Premanufactured metal frame glazing stops to be installed on all plastic laminated wood doors requiring lites.
 - .2 Fire door light frames.
 - .3 Metal vision frame.
 - .4 Colour of frames to be custom as directed by Consultant.
 - .2 Face Panels:
 - .1 Plastic laminate facing: to CAN3-A1 72-M79, 1.6 mm thick General Purpose grade; patterns, colours, finishes selected by Consultant from manufacturer's complete range, including abstract patterns.
 - .3 Adhesive: Type II (water resistant) for interior doors.
 - .4 Fire Rated Doors:
 - .1 Fire-rated doors shall be at least equal in all respects to doors specified in item `1' above.
 - .2 Provide particular materials or increased thicknesses of materials as required for 20-minute and 45-minute fire-rated doors to meet requirements of testing or labelling authority.
 - .3 Fire-rated doors shall bear 20-minute or 45-minute ULC label called for in Door Schedules.
 - .5 Standard of Acceptance: Baillargeon Extreme 8520-ME 5 ply.

2.2 FABRICATION

- .1 General:
 - .1 Finish laminated plastic smooth and flush with stile edges of door and bevel at approximately 20 degrees.
 - .2 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
 - .3 Manufacture doors to meet specified requirements of CAN/CSA-O132.2 Series-90(R1998) Series-90(R1998) Series-90(R1998) Series-90(R1998) and CAN/CSA O132.2.1-90 for service in interior locations.
 - .4 All doors shall be solid core construction, 45 mm thick, unless indicated otherwise (eg. closet doors for millwork shall be 35mm thick).
 - .5 Incorporate solid wood blocking at locations where hinges, locksets closures, and similar hardware is installed and applied.
 - .6 Indicate top and hinge side on each door.
 - .7 Undercut or rebate bottom rails as indicated on the Door Schedule.
 - .8 Factory seal top, sides and bottom edges of doors with 2 coats of polyurethane varnish prior to shipping to site.
 - .9 Cut and prepare doors for louvres and glass and provide glazing stops and stickings.
- .2 Solid Core Door Construction: Construct solid core doors with facings as indicated each side.
- .3 Wood Fire Door Construction: Construct wood fire doors with facings as indicated each side, with mineral core, metal framed vision panels and fire rated blocking. Provide fire rated blocking full width of door at top and bottom of door and intermediate blocking. Provide Triple-ply stiles with Special Laminated Material (SLM), for greater screw holding power or equivalent. Provide metal glazing stops at glazed labelled doors and factory seal top and bottom edges of door.
- .4 Receive from finish hardware supplier, template sheets, standard mounting dimensions and if necessary, hardware jigs. Factory prepare and reinforce doors for site mounting of hardware as per Hardware Schedule requirements, including butt hinges, locksets, latch sets, closers and other scheduled hardware.

2.3 ACCEPTABLE MANUFACTURERS

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Bailargeon
 - .2 Door-Lam
 - .3 VT Industries

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Supply wood doors to Section 06200: Finish Carpentry for installation.
- .2 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series-90(R1998)Series-90(R1998)Series-90(R1998)Series-90(R1998)Series, Appendix A.
- .3 Install labelled fire rated doors to ANSI/NFPA 80-1998.
- .4 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series-90(R1998) Series-90(R1998) Series-90(R1998) Series-90(R1998) Series, Appendix A
- .5 Adjust hardware for correct function.

3.3 ADJUSTMENT

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking; clean doors and frames.
- .3 Clean glass and glazing materials with approved non-abrasive cleaner.
- .4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

PART 1 - GENERAL

1.1 Reference

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-M89, Primer, Structural Steel, Oil Alkyd Type.
 - .2 CAN/CGSB-79.1-M91, Insect Screens.
- .2 Canadian Standards Association (CSA)
 - .1 CSA PKG.A440-00, Windows.
 - .2 CAN/CSA-G164-M92 (R1998) (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-Z91-M90, Safety Code for Window Cleaning Operations.
 - .4 CSA Z760-94, Life Cycle Assessment.
 - .5 CAN/CSA ISO 14040- 97, Environmental Management - Life Cycle Cost Assessment - Principle and Framework.

1.2 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit one representative model of each window type.
- .3 Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.
- .4 Include 150 mm long samples of head, jamb, sill, meeting rail mullions to indicate profile.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01305.
- .2 Indicate materials and details in scale full size for head, jamb and sill, profiles of components, interior and exterior trim junction between combination units elevations of unit, anchorage details, location of isolation coating, blocking, glazing, description of related components and exposed finishes fasteners, and caulking. Indicate location of manufacturer's nameplates.

1.4 Test Reports

- .1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for:
 - .1 Windows
 - .2 Enamelled finish, weathering characteristics.
 - .3 Insect screens.
 - .4 Air tightness.
 - .5 Water tightness.

- .6 Wind load resistance.
- .7 Condensation resistance.
- .8 Safety drop - vertical sliding windows only.
- .9 Block operation - sliding windows only.
- .10 Sash strength and stiffness - Hinged.
- .11 Ease of operation - windows with operable lights.
- .12 Sash pull-off - vinyl windows.
- .13 Forced entry resistance.
- .14 Mullion deflection - combination and composite windows.

1.5 Maintenance Data

- .1 Provide operation and maintenance data for windows.

1.6 Affidavits

- .1 Submit manufacturer's name, catalogue and proof that the windows to be supplied meet all the standards specified herein.

1.7 Quality Assurance

- .1 Aluminum manufacturer shall be responsible for design and fabrication of all system components to ensure they meet loads imposed and allow for expansion/contraction of materials without failure of joint seals, visible distortion in glazing panels, or undue stress on fastening mechanisms.
- .2 Doors and windows shall be designed to meet or exceed air and water infiltration performance criteria of applicable standards and shall safely withstand local wind and snow loadings acting on plane of unit per latest codes.
- .3 Contractors Qualifications: Work of this trade shall be executed by a company with a minimum of ten years proven first class experience in this type of work having adequate equipment and skilled personnel to expedite completion of the work in an efficient and very best workmanlike manner.
- .4 Source Quality Control: Windows supplied under this specification shall have been tested by an independent testing agency indicating compliance with the performance requirements of A440 Series-98. This qualification shall be prerequisite for tendering.
- .5 Field Testing: Provide frames on site for inspection prior to their installation. Upon receiving approval of the frame install one in the presence of the Owner complete with glass, panels, operating units and all sealants.
- .6 Two windows will be selected by the Consultant at random and be tested as complete and installed assemblies after all windows have been installed including air barrier and perimeter sealants, according to ASTM 283.73 and ASTM E 547-00. Assemblies that do not conform to specified standards and tests under test conditions shall be resealed, and other units shall be installed in a manner that will avoid the leakage. Cost of this test will be borne by the Owner.

- .7 Should the installed windows fail this test, costs of subsequent tests of corrected installations will be borne by the Contractor.
- .8 Caulking work of this section shall be performed by skilled experienced personnel in strict accordance with methods and procedures outlined in Section 07900. Submit proof of such experience if requested by Consultant.

1.8 Performance Criteria

- .1 Operating vents must meet CSA PKG.A440-00, Air Tightness - A3 (leakage- 0.00 cfm/ft), Water Tightness - B5, Wind Load Resistance - C5, and Condensation Resistance Index (I) of 50.
- .2 Fixed framing must meet CSA PKG.A440-00, Air Tightness - Fixed (leakage - 0.004 cfm/ft), Water Tightness - B7, Wind Resistance - C4, and Condensation Resistance Index (I) of 58.
- .3 Wind Load Resistance: Windows must resist deflection greater than L/125 for sash and greater than L/175 for mullions when tested to CSA PKG.A440-00 Level C3.
- .4 Thermal Resistance: Window must have an "I" value of 50 as determined in accordance with CSA PKG.A440-00 in order to resist condensation at -18 deg. C (Toronto 2.5% January mean) at 35% Relative Humidity.
- .5 At the conclusion of these tests there shall be no glass breakage, permanent damage of fasteners, hardware parts, or any other damage causing the window to be inoperable. There shall be no permanent deformation of any frame or sash member in excess of 0.4% of its span.
- .6 No escape of moisture into the wall cavity due to the failure of the window installation will be tolerated.
- .7 Test results determined by the testing agent will be prima facie evidence relied upon by the Owner to determine compliance to these requirements. The bidder agrees to accept said determination and will not contest same.

1.9 Warranty

- .1 All work of this section shall be warranted against leaks, irregularities, faulty material, faulty workmanship or poor installation of same. Corrective work performed under warranty shall be to Consultant's approval and at no additional cost to Owner. Warranty shall be effective for period of two (2) years from date of Substantial Performance of entire project. Also submit following extended warranties:
 - .1 Ten (10) year warranty on all windows
 - .2 Ten (10) year warranty on all caulking
 - .3 Ten (10) year warranty on hermetically sealed units

PART 2 - PRODUCTS

2.1 Manufacturers

- .1 Frames, sidelights, transoms, screens and windows shall be as manufactured and assembled in plant and must be installed by the selected manufacturer. No exceptions will be permitted.
- .2 Manufacturers of aluminum windows having Product considered acceptable for use are:
 - .1 Aerloc
 - .2 Windspec
 - .3 Alwind Industries Ltd.
- .3 Unless noted otherwise, aluminum window profiles as described in this section are based on the products of Aerloc Industries Ltd. Similar profiles by Windspec or Sherwood will be acceptable but it is the responsibility of the Bidder to ensure that they meet the intent of the design noted on the tender drawings.

2.2 Materials

- .1 Aluminum frames, sash, frames for flyscreens, etc. shall be extruded from 6063-T5 alloy, shall be mechanically straightened and free from hammer marks, etc. Extrusions shall adhere closely to profile and dimension as detailed on manufacturer's drawings and shall be 2.6 mm thick, minimum.
- .2 Materials: to CSA PKG.A440-00.
- .3 All windows by same manufacturer.
- .4 All windows shall be fabricated to sizes shown and be Aerloc Industries 4200/2200-5" series finished and glazed as stated below, and which, when erected, shall provide completely watertight enclosures. All windows to be provided with fiberglass pressure plate.
- .5 All operable windows shown on elevations shall open out. Operable windows shall be Aerloc Industries 2200 Series projecting ventilators. As inserts to the fixed window framing Aerloc 4200 series frame complete with top-hung open-out vents at locations shown on drawings. Operable windows are to have roto-operator and claw handles, and fly screens fitted with tamperproof fasteners. Sash openings to be restricted to maximum 100 mm. Submit sample.
- .6 Glass:
 - .1 Float glass: to CAN/CGSB-12.3-M91, glazing quality.
 - .2 Tempered safety glass to CAN/CGSB-12.1-M90, Type 2, Class A of thickness indicated minimum 6mm.
 - .3 Laminated safety glass to CAN/CGSB-12.1-M90, Type 1, Class A minimum 6mm or thickness as indicated.
 - .4 Insulating glass units: to CAN/CGSB-12.8-M97, with outer pane of 6mm glass and inner pane of 6mm glass with 25 mm total thickness.

- .7 Thermal Break: Extruded virgin polyvinylchloride Thermo-Barrier. Conform to CSA PKG.A440-00.
- .8 Screens: at each operating unit to CAN/CGSB-79.1-M91 and CSA PKG.A440-00.
 - .1 Class: Heavy Duty with rigidly joined corners.
 - .2 Insect screening mesh: count 18 x 14 black fiberglass secured by continuous spline.
 - .3 Fasteners: tamper proof.
 - .4 Screen frames: colour to match window frames.
 - .5 Mount screen frames for interior replacement. Insect screens installed on the exterior shall be mechanically fastened to the window frame in a vandal-proof manner.
- .9 Weatherstripping: E.P.D.M. gaskets as shown on drawings.
- .10 Aluminum Sills/Expansion Covers: To be extruded aluminum shapes 2.6 mm minimum thick, reinforced, as shown on the drawings with cover plates and drip deflectors. Finish to match framing.
- .11 Aluminum Interior Stools and Trim: Column covers, trim and aluminum flashing, etc. to be 1.5 mm (.062") finish to match framing.
- .12 Aluminum Exterior Trim/Panning: Extruded aluminum allow 6063-T5 be 2.0 mm (.078") thick minimum, to match frame finish and colour.
- .13 Anchor Brackets: Extruded aluminum angles, 90mm x 140mm x 100mm long x 3mm thick, bitumastic painted.
- .14 Anchors: Non-magnetic, stain and corrosion resistant stainless steel to ASTM E-149. Exposed fasteners are not acceptable.
- .15 Exterior metal sills and aluminum facings: extruded aluminum of type and size to suit job conditions; minimum 3 mm thick, complete with joint covers, jamb drip deflectors, chairs, anchors and anchoring devices.
- .16 Isolation coating: alkali resistant bituminous paint.
- .17 Insulated Aluminum Panels: Panel Construction:
 - Exterior Composite Panel:
 - Duranar Finish
 - 1.5 mm Aluminum fully adhesive bonded
 - 19 mm Plywood
 - 50 mm Rigid Polyisocyanurate Insulation Board
 - 6 mm Pressed Board
 - 1.5 mm Aluminum fully adhesive bonded
 - Interior Composite Panel:
 - Duracron Finish
 - 1.2mm Aluminum
 - 3m Hardboard
 - 32mm Rigid Polyisocyanurate Insulation

All of the above components to be under heat and pressure with top quality permanently elastic neoprene contact adhesive. Submit sample of panel to Consultant for approval before fabrication.

2.3 Window Type and Classification

- .1 Types:
 - .1 Hopper Sash: Bottom Hinged Projecting In with insulating glass.
 - .2 Awning Sash: Top Hinged Projecting out with insulating glass.
 - .3 Fixed: with insulating glass.
 - .4 Screens: on ventilating portion of windows.
- .2 Classification rating: to CSA PKG.A440-00.
 - .1 Air leakage: A3
 - .2 Water leakage: B3
 - .3 Wind load resistance: C3
 - .4 Condensation resistance: Temperature Index, I D2
 - .5 Forced Entry: F2
 - .6 Insect Screens: S2
 - .7 Glazing: G2
- .3 Ventilator frames shall consist of inner and outer aluminum frame sections joined by means of an interlocking thermal barrier. Thermal barrier shall completely prevent metal to metal contact in any form. Vent corner shall be cut at 45 degrees, swaged with 3 heavy duty reinforcing angles per corner. Screwed corners on vents will not be permitted.

2.4 Fabrication

- .1 Fabricate in accordance with CSA PKG.A440-00 supplemented as follows:
- .2 Cope and butt join all joints in main frame and sash, neatly, in weathertight manner and secure by means of screws anchored into integral screw ports with stainless steel screws 8-#8 screws per corner.
- .3 Internally seal all sash corners at time of assembly with polyurethane caulking.
- .4 Deburr and make smooth all sharp milled edges and corners of sash and screen frames.
- .5 Framing shall consist of closed tubular aluminum sections reinforced as required and thermally broken. Open channel profiles are not acceptable.
- .6 Design coupling mullions to eliminate "seam joint" on weathered side while providing functional split to permit unit module construction and to provide for thermal expansion.
- .7 Make allowances for deflection of structure to ensure that structural loads are not transmitted to aluminium framing.

- .8 Provide mullion wall thicknesses, internal reinforcement and mullion extensions necessary to provide adequate strength, stiffness and connections that suit overall loads imposed on configurations indicated on drawings.
- .9 Provide all vertical and horizontal mullions, corner and column covers, trim, insulated bases and panels, accessories, fasteners, integral wood blocking, etc. necessary for total aluminium assemblies indicated on drawings. Unless otherwise shown, aluminium to be minimum 2 mm thick.
- .10 Provide sill members with minimum 5 deg. slope away from the frame. Fabricate extruded aluminium sills with profiles indicated and to suit wall condition. Provide drip deflectors at sill ends and at abutting vertical surfaces. Open ends of sills shall be fitted with neatly applied closure plates. Anchors shall be designed not to work loose after installation. Unless otherwise detailed, provide flush slip joint at intermediate sill joints.
- .11 Provide sill weep system which will facilitate drainage of water accumulating in sill area while preventing passage of air, dirt and insects to interior.
- .12 Fabricate and anchor both inner and outer frames using specified screw fasteners without violating the Thermo-Barrier. Exposed fasteners or the use of pop revets is not acceptable.
- .13 Fabricate entire window in a manner that will allow easy replacement of any defective, damaged or worn components, hardware or weatherstripping.
- .14 Thermo-Barrier: Provide completely metal to metal separation between the two main frame members. Do not use connecting screws, clips or other members or restrict in any manner the expansion and contraction of the individual separate frame member. Factory seal between Thermo-Barrier and frame around entire perimeter to ensure weathertight assembly.
- .15 Glazing: Provide sash frames which will permit glass replacement without the use of special tools.
- .16 Weatherstripping: Double weatherstrip window units at all sash perimeters. Conceal weatherstripping to prevent accumulation of foreign matter or matting due to cleaning, operation or handling which would reduce effectiveness or life of seal. Install all weatherstripping in specially extruded ports and secure to prevent shrinkage, movement or loss when removing sash for cleaning or glass replacement.
- .17 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
- .18 Face dimensions detailed are maximum permissible sizes.
- .19 Brace frames to maintain squareness and rigidity during shipment and installation.
- .20 Finish steel clips and reinforcement with shop coat primer to CAN/CGSB-1.40-M89.

2.5 Aluminum Finishes

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes - 1980.
 - .1 Clear anodized to match existing: AA-M10C21A41.

2.6 Isolation Coating

- .1 Isolate aluminum from following components, by means of isolation coating:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.7 Glazing

- .1 Glaze windows in accordance with CSA PKG.A440-00.
- .2 Refer to Section 08800 for products supplied and installed under this Section.

2.8 Hardware

- .1 Operable Venting Hardware: Each hinged vent to have extruded aluminum hinges with stainless steel pins, and two solid white bronze cam handles and two stainless steel friction side arms and two solid white metal allen key locks.
- .2 Provide special keyed opening device for windows normally locked.
- .3 Window latching devices:
 - .1 Submit samples to Consultant for approval.
 - .2 Where sash is located 1900mm or more above finished floor, provide roto operator to permit opening and closing from remote location 1200mm above finished floor. Teleflex or equal. Submit sample and shop drawings.

2.9 Air Barrier and Vapour Retarder

- .1 Equip window frames with site installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:
 - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
 - .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

2.10 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Aerloc
 - .2 Windspec
 - .3 Alwind Industries Ltd.

PART 3 - EXECUTION

3.1 Window Installation

- .1 Install in accordance with CSA PKG.A440-00 and manufacturer's instructions.
- .2 Prior to installation of face masonry, install anchor brackets in masonry cavity as required to back-up concrete block. Ensure continuity of air/vapour barrier and insulation.
- .3 Install windows and doors plumb, level and true relative to building structure. Do not exceed 3mm in 3050mm (1/8" in 10'-0") variation from plumb and level.
- .4 Fill void between exterior aluminum frame and window opening with single component polyurethane foam as detailed to form a complete air seal to wall vapour retarder.
- .5 Arrange components to prevent abrupt variation in colour.

3.2 Sill Installation

- .1 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Use one piece lengths at each location.
- .2 Cut sills to fit window opening.
- .3 Secure sills in place with anchoring devices located at ends joints of continuous sills and evenly spaced 600 mm oc in between.
- .4 Fasten expansion joint cover plates and drip deflectors with self tapping stainless steel screws.
- .5 Maintain 6 to 9 mm space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 to 6 mm space at each end.

3.3 Caulking

- .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
- .2 Foam Sealant: All voids between aluminium frames and masonry openings shall be completely filled with Polycel sealant.
- .3 Apply sealant in accordance with Section 07900 - Sealants. Conceal sealant within window units except where exposed use is permitted by Consultant.

3.4 Protection

- .1 Protect pre-finished surfaces of metal work with protective coatings or wrappings to remain in place until construction completion. Use materials recommended by finishers or manufacturers of metals to ensure that method is sufficiently protective, easily removed and harmless to finish.
- .2 Remove protection from metal glazing surfaces before installation of glass.
- .3 Maintain protection from time of installation to final cleanup in accordance with Section 01700.

PART 1 – GENERAL

1.1 WORK INCLUDED

- .1 Supply and install finish hardware.
- .2 It is intended that the following list of hardware will cover all finish hardware to complete the project. Omissions and discrepancies shall be brought to the Consultant's attention during the bidding period.

1.2 RELATED SECTIONS

- .1 06200 Carpentry
- .2 06400 Millwork
- .3 08111 Steel Doors and Frames
- .4 08120 Aluminum Doors and Frames
- .5 08210 Flush Wood Doors
- .6 Division 16 Electrical

1.3 PRODUCTS SUPPLIED BUT NOT INSTALLED IN THIS SECTION

- .1 Power supplies, compressor/control boxes, junction boxes installed by Division 16.

1.4 ALLOWANCES

- .1 Supply and installation of finish hardware as described in this section as listed in the hardware schedule is carried as a cash allowance under Section 01021. Cash allowance will also cover cost of specification, drawings, manufacturer training and manufacturer inspection of products specified in this section and is to be included in bids solicited for this work.

1.5 REFERENCES

- .1 Recommended locations for Architectural Hardware for Standard Steel Doors and Frames - Door and Hardware Institute
- .2 Recommended locations for Architectural Hardware for Flush Wood Doors – Door & Hardware Institute
- .3 NFPA 80-Standard for Fire Doors and Windows
- .4 Sequence Format for Hardware Schedule – Door & Hardware Institute
- .5 Key Systems and Nomenclature - Door & Hardware Institute
- .6 Abbreviations and Symbols used in Architectural Door and Hardware Schedules and Specifications – Door & Hardware Institute

1.6 SUBMITTALS

- .1 Updated Finish Hardware Schedule:
Prepare and submit within ten (10) days of a receipt of a purchase order, eight (8) complete detailed hardware schedules prepared in vertical format.
- .2 Product Data:
Provide in a three ring binder six (6) copies of product data sheets with the finish hardware schedule showing all items of hardware to be used on the project.
- .3 Samples:

When requested in writing, provide (to the Consultant's Office) one sample of each hardware item complete with fasteners, within twenty (20) calendar days of award of a purchase order. Samples to be clearly labeled with their hardware schedule designation and manufacturers' name and model number. Samples may be incorporated into the work.

- .4 Templates:
Furnish templates within ten (10) days after award of a purchase order.
- .5 Keying Schedule
Provide three (3) copies of keying schedule for review prepared and detailed in Reference 1.5.5. Refer to attached Owner keying schedule. Include all special keying notes and stamping instructions. Locks and cylinders are not to be ordered until the key schedule has been approved by the Consultant.
- .6 Wiring Diagrams
Furnish a written description of the functional use of all electrical hardware. Include door and frame elevations showing the location of each item of electrical hardware to be installed, including a diagram showing number and size of all conductors.
- .7 Operations and Maintenance Data
Prior to Substantial Completion, furnish to the owner, three (3) copies of an owner's operation and maintenance manuals in a three ring binder with the following information:
 - .1 Maintenance instructions for each hardware item
 - .2 Catalogue cut sheets and Product Specifications or each product
 - .3 Parts list for each product
 - .4 Copy of final "as-built" finish hardware schedule
 - .5 Copy of final keying schedule

1.7 **QUALITY ASSURANCE**

- .1 Review installation procedures with the hardware distributor's designated Installer(s). Hold instruction meetings with the installers prior to installation and subsequent review meetings during the installation period. Submit minutes of meetings to the Consultant.
- .2 Substitutes
Only approved products specified will be accepted. Make substitution request in accordance with Division 1. Include product data and indicate benefit to the project.
- .3 Supplier Qualifications
Successful hardware distributor to have a minimum of five (5) years experience in the door and hardware industry. The distributor to have on staff an Architectural Hardware Consultant (A.H.C.) who will be responsible for scheduling, detailing, ordering and co-ordination of the finishing hardware for this project. This individual shall be required for jobsite visits if so requested by the Consultant, Owner and or installer for any installation problems that may occur.
- .4 Pre-Installation Meeting for Hardware: Prior to installation of hardware, arrange a meeting between manufacturer, distributor, installers and related trades to review materials, procedures and coordinating related work. Provide mock-up of installed hardware for review by the Consultant at this meeting. Where Ingersoll Rand Security & Safety products are specified, products shall be furnished and installed by an authorized Ingersoll Rand Security & Safety distributor to insure quality compliance, service and warranty. All Ingersoll Rand products are to be included in the mock-up. An Architectural Hardware Consultant (A.H.C.) from Ingersoll Rand Security & Safety will assist the Consultant with the review of the mock-up. The approved mock-up is to set the standard of hardware installation for the remainder of the project.
- .5 Finish and security hardware, auto operators to be installed by an Ingersoll Rand Security & Safety distributor and systems Integrator; the distributor shall employ and use Ingersoll Rand trained and certified hardware, auto operator and security system installers.

1.8 **DELIVERY, STORAGE AND HANDLING**

- .1 Marking and Packaging
All cartons shall be marked with heading number, door number, and key-set symbol where applicable in original packaging provided by the manufacturer. Pack packaged hardware in suitable wrappings and

containers to protect it from damage during shipping and storage. Accessories, fastening devices and other loose items shall be enclosed with each applicable item of hardware.

.2 Delivery
Deliver hardware to related trades.

.3 Storage
Store in a clean, dry room with lockable man door and adequate shelving to permit organization so item numbers are readily visible.

1.9 WARRANTY

.1 Provide warranties by the accepted manufacturers:

Hardware Item	Length of Warranty
Mortise Hinges	Lifetime
Pivot Sets	2 yrs.
Locks	7 yrs.
Keypad Locks	1 yrs.
Exit Devices	3 yrs.
Door Closers -mechanical	10 yrs.
Door Operators - Electro mechanical	2 yrs.
Door Hold open Devices - Electro mechanical	2 yrs.
Overhead stops/holders	1 yr.
Floor/Wall stops	1 yr.
Electric Strikes/Key Switches/Power Supplies	1 yr.
Electromagnetic Lock Coils	Lifetime

1.10 MAINTENANCE

.1 Maintenance Service
After the building is occupied arrange an appointment with the Owner for instruction of proper use, servicing, adjusting and lubrication of hardware furnished. Submit to the Consultant a list of attendees and meeting date.

.2 Extra Materials
The following items to be transferred by the General Contractor to the Owner in proper manufacturers cartons once the job has been completed:

.1 Three (3) of each installation tool used for locks/passage/privacy, all type of door closers, and all exit devices.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Screws and Fasteners:

All screws shall be matching finish to their product and shall be manufacturer's standard.

.1 Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use. Factory furnished Fasteners shall be used to install all Hardware. Tech Screws or substitute fasteners are not acceptable and will be rejected.

.2 Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Consultant according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on wood doors shall be thru-bolted. All thresholds shall be fastened with machine screws and anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.

.3 Design of all fastenings shall harmonize with the hardware as to material and finish.

.2 Hardware Items: types and finishes as listed in the Hardware Schedule

.3 Product Level of Acceptance

Hinges

CH1	ELCH-951 ULC X 2128	C32D
CH2	CH-951 ULC X 2128	C32D
H1	CB1368 114 X 101	C26D
H2	CB1368 127 X114	C26D
H3	STS CB1399 114 X 101 NRP	C32D
H4	CB1379 114 X101	C26D
H5	STS CB1399 114 x 101	C32D

Butt Hinges: Acceptable products to match or exceed the Grades above from the following Manufacturer's; Ives 3CB1 & 3CB1 HW, Stanley CB179, CB191, CB168 & CB199 as per Specifications.

Continuous Hinges: Ives 700 Series & Markar FM300

Locksets & Cylinders

CYL1	20-001 X 31 X CMK GMK D145 EVEREST X Q11-949	626
CYL2	20-021 CMK GMK D145 EVEREST	626
L1	ND95PD RHO CMK GMK D145 EVEREST	626
L2	ND94PD RHO CMK GMK D145 EVEREST	626
L3	ND 40S RHO	626
LR1	A501-566	
L4	ND96PD RHO CMK GMK D145 EVEREST	626
L5	L460P CMK GMK D145 EVEREST	626
L6	MASTER PRO 6621 WO	626
L7	0298-628	
L8	21-002 CMK GMK D145 EVEREST	626
L9	L463P CMK GMK D145 EVEREST	626
L10	ND72PD RHO X N12-002 CMK GMK D145 EVEREST	626
CYL3	20-001 X 31 CMK GMK D145 EVEREST	626
CYL4	20-013 AR Cam CMK D145 Everest	626
L11	ND10S RHO	626
L12	AL70PD SAT CMK GMK D145 EVEREST	626
L13	Deadlatch THTL 4510L c 1 1/8" BS	628
L14	Faceplate TH-FLL-Flat	628
L15	Lever TH-4560-L	
K1	MASTER KEYS BB	
K2	KEY BLANKS UNCUT D145	
K3	EVEREST GRAND MASTER A	
K4	MASTER KEYS AA	
K5	EVEREST CHANGE KEYS AA1	
K6	EVEREST CHANGE KEYS A1	
K7	EXTRACTOR TOOL 35-057	
K8	SCHLAGE CONSTRUCTION MASTER KEYS	
K9	BITTING LIST 50-123	

Products to match the Grades above. No substitutions permitted for locksets and cylinders

Exit Devices

ED1	LXCD 35A-NL-OP X 388NL 48"	626
ED2	CD 35A-EO 48"	626
ED3	98L-F X 996L-R + V 48"	626
ED4	98EO	626
ED5	98L X 996L-R + V	626
ED6	SD XP98EO 98-ALK-RX 48"	626

Acceptable products to match or exceed the Grades above from the following Manufacturer's; Corbin Russwin ED4200 & Falcon 24 Series. Corbin Russwin ED5200 & Falcon 25 Series as per Specifications.

Auto Operator & Accessories

AO1	7100 PUSH SIDE MTD	628
A02	6R3	C32D
AO3	SA1	

Acceptable products to match or exceed the Grades above from the following Manufacturer's; Stanley Magic Force & LCN 4640 Series as per Specifications.

Door Closers

DC1	4040XP EDA TB X ST-3068	689
DC2	4040-18PA	689
DC3	4040-61	689
DC4	4041T STD TB	689
DC5	4041T X STD X ST-3182 TB	689
DC6	4040-18G	689
DC7	4041 REG X ST-1630 TB	689
DC8	4040-18TJ	689
DC9	4041 EDA ST-3068 TB	689
DC10	4041 REG TB	689
DC11	4041T X STD X DEL X ST-3182 TB	689
DC12	4041T X STD X DEL X TB	689
DC13	4041XP SCUSH ST-3068 TB	689

Acceptable products to match or exceed the Grades above from the following Manufacturer's; Norton 7500 & PR7500, Dorma 8900 & 8900PR Series as per Specifications.

Overhead Stops

OH1	105S TB	630
OH2	104S TB	630
OH3	453S TB	630
OH4	105H TB	630

Acceptable products to match or exceed the Grades above from the following Manufacturer's; Rixson 9, 1 & 2 Series. ABH 9000, 1000 & 4400 Series as per Specifications.

Flatwear

P1	GSH 1180-2 #4B MTG	C32D
P2	GSH 1180-2 X 1180-2 B TO B	C32D
P3	GSH 1180-2 TB	C32D
PP1	GSH 81A 101 X 406 (3M)	C32D
KP1	GSH 80A 150 X 960 (3M)	C32D
DS1	GSH 250B	C32D
KP2	GSH 80A 150 X 910 (3M)	C32D
DS2	GSH 209	C26D
HP1	GSH 2616H 101 X 406 (CUT FOR CYL)	C32D
HP2	GSH 2616H 101 X 406 (CUT FOR T/T)	C32D
KP3	GSH 80A 150 X 950 (3M)	C32D
P4	GSH 1180-2-SR X 229 T/B	C32D
S1	SIGN BY OTHERS	
KP4	GSH 80A 150 X 975 (3M)	C32A
HP3	GSH 2616H 101 X 406	C32D
P5	GSH 4209-2 TB	C32D
KP5	GSH 80A 150 X 900 (3M)	C32D
HP4	GSH 2616H 101 X 101 CUSTOM (CUT FOR CYL)	C32D

P6	GSH 165 X 1829mm O/A	C32D
PP2	GSH 85N 101 X 406 (CUT FOR CYL) (3M)	C32D
PP3	GSH 85N 101 X 406 (3M)	C32D
HP5	GSH 2616H 101 X 101 CUSTOM (CUT FOR T/T)	C32D
KP6	GSH 80A 150 X 1050 (3M)	C32D

Acceptable products to match or exceed the Grades above from the following Manufacturer's; Canadian Builders Hardware (CBH) & Standard Metal as per Specifications.

Weatherstrip/Door Sweeps/Thresholds

TH1	CT-45 X 1000	AL	
DSW1	W-24S X 1000	AL	
HS1	W-20N X 1000 (INSTALL PRIOR TO CLOSER)		AL
JS1	W-23 X 2150	AL	
TH2	CT-45 X 1900	AL	
HS2	W-20N X 1900 (INSTALL PRIOR TO CLOSER)		AL
DSW2	W-24S X 950	AL	
TH3	CT-45 X 950	AL	
HS3	W-20N X 950 (INSTALL PRIOR TO CLOSER)		AL
TH4	CT-10 X 1050	AL	
JS2	W-23 1-1050/2-2150	AL	
DSW3	W-245 X 1050	AL	

Thresholds-Pemko 154A, 253X3AFG & Hager 412S, 421S. Head Seals-Pemko 290APK & Hager 881SN. Jamb Seals-45041CNB & Hager 803S. Door Sweeps-Pemko 18100CNB & 801S.

Miscellaneous Items

ES1	6111 24 VDC FSE	630
PS1	PS902FA	
MAG1	SEM 7850 (TRI-VOLTAGE)	689
CDL1	CDL 457 X 305 MILL	
FB1	FB458 X 305	626
DPS1	DP2	626
INSTALL	LABOUR TO INSTALL HARWARE	
KC1	1204-A X 300 KEY CAPACITY	
MAG2	SEM 7810-517	689
5654	5654 X 2489	US28
Electric Strikes-Folger Adams 700 Series		
Power Supplies-Securitron BPS		

2.2 CYLINDERS, KEYING SYSTEMS AND KEY CONTROL

- .1 Meet with the Consultant and Owner to finalize keying requirements and obtain keying instructions in writing as outlined in Division 1. Interior locks and cylinders shall be furnished in a new Schlage masterkey system.
- .2 Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Owner's Representative prior to occupancy. The Owner will instruct the Contractor to void the operation of the construction keys.
- .3 Permanent cylinders to be keyed by factory, combined in sets or subsets, master keyed or grand master keyed, as directed by Owner. Permanent keys and cylinders shall be marked with the keyset symbol on all keyblanks for identification. These visual key control marks or codes will not include the actual key cuts.
- .4 .1 Keying Handover: Prior to handing keys to the Owner, the Contractor shall organize the keys as follows:
 - .1 For each set of keys attach a hard plastic tag capable of being labeled.

- .2 Each plastic tag is to have typewritten or computer generated labels indicating the relevant door number and room number.
- .2 An itemized transmittal is to accompany all keys to be handed over.
- .3 All keys complete with labeled tags are to be in the key cabinet. Provide complete cross-index system, place keys on markers and hooks in the cabinet as determined by the final key schedule. Provide one each key cabinet and hinged panel type cabinet for wall mounting as noted in detailed hardware schedule. Key cabinet is to be properly secured to a wall in a location to be determined by the Board.
- .5 Key Material: Provide manufacturer's standard embossed keys of nickel silver to ensure durability. Key Quantity: Furnish keys in the following quantities:
 - 10 each Temporary construction master keys.
 - 3 each Grand Master keys per grand master group.
 - 6 each Master keys per master group.
 - 3 each Change keys per cylinder or keyed alike group.
 - 3 each Extractor tools
 - 6 each weatherproof exterior grade padlocks keyed to MKAA

All keying requirements per Owner's Secondary and Elementary School Keying Schematics (attached at end of specification).

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Ensure that doors and frames are properly prepared and reinforced to receive finish hardware prior to installation.
- .2 Ensure that door frames and finished floor are sufficiently plumb and level to permit proper engagement and operation of hardware.
- .3 Submit in writing a list of deficiencies determined as part of inspection required in 3.1.1 and 3.1.2 to Consultant prior to installation of finished hardware.

3.2 INSTALLATION

- .1 All installation is to be executed by employees of the Hardware supplier with a minimum of five (5) years experience in the installation of finishing hardware. Provide verification of the installer's qualifications to the Consultant for approval. All installers are to attend review meetings with the hardware manufacturers, distributors and supplier. Installation by the General Contractor's own forces and sub-contracts for the installation, of finishing hardware is not permitted.
- .2 Install hardware at mounting heights as specified in the manufacturers templates or specific references in approved hardware schedule or approved elevation drawings.
- .3 Where mounting height is not otherwise specified, install hardware at mounting heights as indicated in 1.5.1, 1.5.2.
- .4 Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.
- .5 Ensure that all locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position. Handing is part of installation procedure.
- .6 Ensure that all exit devices are of the correct hand and adjust device cam for proper outside trim function prior to installation. Handing is part of installation procedure.
- .7 Follow all manufactures installation instructions. Adjustment is inclusive of spring power, closing speed, latching speed and back-check at the time of installation.

- .8 Delayed action door closers are to be adjusted to forty (40) second delay for handicapped accessibility and movement of materials. Time period to be approved by Owner.
- .9 Install head seal prior to installation of "PA"-parallel arm mounted door closers and push side mounted door stops/holders.
- .10 Counter sink through bolt of door pull under push plate during installation.
- .11 Mount all closers, automatic operators and hold-open devices with through bolts, as indicated in the finish hardware schedule.

3.3 FIELD QUALITY CONTROL

- .1 Perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.
- .2 Upon completion of finish hardware installation, the Consultant, manufacturer, hardware distributor, installer, and General Contractor shall do a thorough "walk through" of the project to determine that all finishing hardware are; 1) furnished and installed in compliance with the specification, 2) final installation, adjustment, and correct applications are acceptable to the owner. In the event the Consultant rejects any product or installation, the hardware distributor shall correct the condition at no expense to the Owner, until the Consultant gives final acceptance. The hardware distributor and the Contractor shall record and provide a list of all hardware deficiencies. The manufacturer shall re-inspect when notified as to the clearing of deficiencies. The hardware distributor and the general contractor shall certify in writing that all hardware items and their installation are in accord with requirements of specification. Final inspection must ensure all hardware items operate as per manufacturers requirements. Coordinate final inspections with the manufacturer's representatives as required to establish warranties. Submit report to the consultant and owner.

3.4 ADJUSTING AND CLEANING

- .1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.
- .2 All hardware to be left clean and free of disfigurements.
- .3 Instruct owner personnel in the proper operation, adjustment and maintenance of hardware.
- .4 Check all locked doors against approved keying schedule.

3.5 PROTECTION

- .1 Protect hardware from damage during construction period by removing and reinstalling or where necessary, using temporary hardware to maintain finish in new condition and maintain manufacturers warranty.

END

St. Paul's CES - Childcare Addition

Architect

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Submittal Date: **January 4, 2018**

**UPPER
CANADA
SPECIALTY
HARDWARE
LIMITED**

Upper Canada Specialty Hardware
7100 Warden Ave. Unit 1
Markham, Ontario, L3R8B5

St. Paul's CES - Childcare Addition

Submittal Date: January 4, 2018

Openings Schedule

Hardware Group	Qty	Opening Number(s)	Location 1	To/ From	Location 2	Hand	Nominal Width	Nominal Height	Door Thickness	Door Mat'l	Frame Mat'l	Label
001	1	101	CORRIDOR 102	FROM	CORRIDOR 101	LHR	1000	2150	45	HM	HM	3/4 HR
002	1	102	EXTERIOR	FROM	CORRIDOR 102	LHR/RHRA	1050, 1050	2150	50	AL	AL	-
003	1	111	EXTERIOR	FROM	CORRIDOR 102	LHR/RHRA	1050, 1050	2150	50	AL	AL	-
004	1	111A	VESTIBULE 111	FROM	CORRIDOR 101	LHR/RHRA	1050, 1050	2150	45	HM	HM	-
005	1	112	EXTERIOR	FROM	VESTIBULE 112	RHR	1000	2150	50	AL	AL	-
006	1	112A	VESTIBULE	FROM	CORRIDOR 103	RHR	1000	2150	45	HM	HM	-
007	1	121	CORRIDOR 101	TO	PRE-SCHOOLERS 121	RH	950	2150	45	HM	HM	-
007	1	131	CORRIDOR 101	TO	TODDLERS 131	LH	950	2150	45	HM	HM	-
008	1	122	PRE-SCHOOLERS 121	TO	STORAGE 122	LH	950	2150	45	HM	HM	-
008	1	132	TODDLERS 131	TO	STORAGE 132	LH	950	2150	45	HM	HM	-
009	1	141	CORRIDOR 101	TO	INFANTS 141	RH	950	2150	45	HM	HM	-
009	1	142	INFANTS 141	TO	W/R 142	LH	950	2150	45	HM	HM	-
011	1	143	INFANTS 141	TO	SLEEPING 143	RH	950	2150	45	HM	HM	-
012	1	144	INFANTS 141	TO	STORAGE 144	RH	950	2150	45	HM	HM	-
013	1	161	CORRIDOR 103	TO	KITCHEN 161	LH	950	2150	45	HM	HM	3/4 HR
014	1	162	CORRIDOR 103	TO	STAFF 162	RH	950	2150	45	HM	HM	0 HR
014	1	163	CORRIDOR 103	TO	OFFICE 1463	LH	950	2150	45	HM	HM	0 HR
015	1	171	PRE-SCHOOLERS 121	TO	SHARED W/R 171	RH	950	2150	45	HM	HM	-
015	1	171A	TODDLERS 131	TO	SHARED W/R 171	LH	950	2150	45	HM	HM	-
016	1	172	CORRIDOR 103	TO	ELECTRICAL ROOM 172	RH	950	2150	45	HM	HM	3/4 HR
016	1	174	CORRIDOR 103	TO	CUSTODIAN 174	LH	950	2150	45	HM	HM	3/4 HR
017	1	173	CORRIDOR 103	TO	UNIVERSAL W/R 173	LH	950	2150	45	HM	HM	3/4 HR
018	1	121TC	PRE-SCHOOLERS 121	FROM	TEACHER'S CLOSET	LHRA/RHRA	412, 412	2100	38	WD	WD	-
018	1	131TC	TODDLERS 131	FROM	TEACHER'S CLOSET	LHRA/RHRA	412, 412	2100	38	WD	WD	-
018	1	141TC	INFANTS 141	FROM	TEACHER'S CLOSET	LHRA/RHRA	412, 412	2100	38	WD	WD	-
019	1	MISC								-	-	



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Hardware Schedule

Heading #001

1 Single door 101, CORRIDOR 102 FROM CORRIDOR 101

LHR

1000 x 2150 x 45 - HM DR x HM FR - 3/4 HR

4	Standard Hinge	CB1901R 127 x 101 C26D (4 Hinges Per Leaf)	C26D
1	Cylinder	20-021 626 Everest D145 CMK MK	626
1	Exit Device	98-L-F C26D 996L-R C26D LHR 4' Bar 1000 x 2150 Door	C26D/C26D
1	Surface Closer	4040XP S CUSH AL TB (Push Side Mount)	AL
1	Kick Plate	GSH 80A C32D (200 x 960) TM	C32D

Heading #002

1 Pair of doors 102, EXTERIOR FROM CORRIDOR 102

LHR/RHRA

1050, 1050 x 2150 x 50 - AL DR x AL FR - -

ALL EXISTING HARDWARE TO BE RE-USED

NOTE:

REMOVE, SALVAGE AND INSTALL EXISTING HARDWARE, INCLUDING AUTO DOOR OPERATOR, ELECTRIC STRIKE AND CONTROLS FROM EXISTING WEST EXIT DOOR.

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Heading #003

1 Pair of doors 111, EXTERIOR FROM CORRIDOR 102

LHR/RHRA

1050, 1050 x 2150 x 50 - AL DR x AL FR - -

FIXED MULLION

8	Standard Hinge	STS-CB1961R 127 x 101 C32D NRP (4 Hinges Per Leaf)	C32D
1	Cylinder	20-021 626 Everest D145 CMK MK	626
1	Exit Device	35A-NL-OP C26D 388 C26D RHR 4' Bar 1050 x 2150 x 50mm Thick Door	C26D/C26D
1	Exit Device	35A-EO C26D LHR 4' Bar 1050 x 2150 x 50mm Thick Door	C26D
1	Electric Strike	9400-24V-630-LBM Fail Secure	630-LBM
1	Power Supply	BPS-24-1	
2	Door Pull	1180-2 C32D x #4B MTG	C32D
1	Auto Operator	4000 Series - Push Side Mount (RHR Leaf)	
2	Push Button	4R3	
2	Push Button Escutcheon	N4RS	
1	Relay	SA1	
1	Surface Closer	4040XP EDA AL TB (Push Side Mount)	AL
1	Mounting Plate	4040XP-18PA AL	AL
1	Blade Stop Spacer	4040XP-61 AL	AL
1	Overhead Door Stop	105S C32D (110 Degrees - RHR Leaf)	C32D
1	Wall Door Stop	GSH 250B C32D (LHR Leaf)	C32D
2	Threshold	CT-45 x 1050	
1	Weatherstrip	Weatherstrip - By Aluminum Door Supplier	
2	Door Sweep	W-24S-CA x 1050	CA
1	Opening Schematics	Opening Schematics By UC Access	

- 120V AND LOW VOLTAGE WIRING BY ELECTRICAL CONTRACTOR

- EXTERIOR PUSH BUTTON TO BE TIED INTO LBM OF ELECTRIC STRIKE. WHEN EXIT DEVICE IS UNDOGGED, OUTSIDE PUSH BUTTON TO BE DISABLED. INSIDE PUSH BUTTON ALWAYS ACTIVE.



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Heading #004

1 Pair of doors 111A, VESTIBULE 111 FROM CORRIDOR 101

LHR/RHRA

1050, 1050 x 2150 x 45 - HM DR x HM FR - -

NO MULLION REQUIRED. PUSH/PULL APPLICATION

8	Standard Hinge	CB1901R 127 x 101 C26D (4 Hinges Per Leaf)	C26D
2	Door Pull	1180-2 C32D x TB	C32D
2	Push Plate	GSH 81A C32D (101 x 406) TM	C32D
1	Auto Operator	7000 Series - Push Side Mount (RHR Leaf)	
2	Push Button	4R3	
2	Push Button Escutcheon	N4RS	
1	Relay	SA1	
1	Surface Closer	4040XP EDA AL TB (Push Side Mount)	AL
2	Overhead Door Stop	105S C32D (110 Degrees)	C32D
2	Kick Plate	GSH 80A C32D (200 x 1025) TM	C32D
1	Opening Schematics	Opening Schematics By UC Access	

- 120V AND LOW VOLTAGE WIRING BY ELECTRICAL CONTRACTOR

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Heading #005

1 Single door 112, EXTERIOR FROM VESTIBULE 112

RHR

1000 x 2150 x 50 - AL DR x AL FR - -

4	Standard Hinge	STS-CB1961R 127 x 101 C32D NRP (4 Hinges Per Leaf)	C32D
1	Cylinder	20-021 626 Everest D145 CMK MK	626
1	Exit Device	35A-NL-OP C26D 388 C26D RHR 4' Bar 1000 x 2150 x 50mm Thick Door	C26D/C26D
1	Electric Strike	9400-24V-630-LBM Fail Secure	630-LBM
1	Power Supply	BPS-24-1	
1	Door Pull	1180-2 C32D x #4B MTG	C32D
1	Auto Operator	4000 Series - Push Side Mount	
2	Push Button	4R3	
2	Push Button Escutcheon	N4RS	
1	Relay	SA1	
1	Overhead Door Stop	105S C32D (110 Degrees)	C32D
1	Threshold	CT-45 x 1000	
1	Weatherstrip	Weatherstrip - By Aluminum Door Supplier	
1	Door Sweep	W-24S-CA x 1000	CA
1	Opening Schematics	Opening Schematics By UC Access	

- 120V AND LOW VOLTAGE WIRING BY ELECTRICAL CONTRACTOR

- EXTERIOR PUSH BUTTON TO BE TIED INTO LBM OF ELECTRIC STRIKE. WHEN EXIT DEVICE IS UNDOGGED, OUTSIDE PUSH BUTTON TO BE DISABLED. INSIDE PUSH BUTTON ALWAYS ACTIVE.

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Heading #006

1 Single door 112A, VESTIBULE FROM CORRIDOR 103

RHR

1000 x 2150 x 45 - HM DR x HM FR - -

4	Standard Hinge	CB1901R 114 x 101 C26D (4 Hinges Per Leaf)	C26D
1	Door Pull	1180-2 C32D x TB	C32D
1	Push Plate	GSH 81A C32D (101 x 406) TM	C32D
1	Auto Operator	7000 Series - Push Side Mount (RHR Leaf)	
2	Push Button	4R3	
2	Push Button Escutcheon	N4RS	
1	Overhead Door Stop	105S C32D (110 Degrees)	C32D
1	Kick Plate	GSH 80A C32D (200 x 960) TM	C32D
1	Opening Schematics	Opening Schematics By UC Access	

- 120V AND LOW VOLTAGE WIRING BY ELECTRICAL CONTRACTOR

Heading #007

1 Single door 121, CORRIDOR 101 TO PRE-SCHOOLERS 121

RH

1 Single door 131, CORRIDOR 101 TO TODDLERS 131

LH

950 x 2150 x 45 - HM DR x HM FR - -

SAFE SCHOOL LOCK-DOUBLE KEYED

6	Standard Hinge	CB1901R 114 x 101 C26D	C26D
2	Dbl Cyl Classroom Lockset	ND95PD RHO 626 Everest D145 CMK MK	626
2	Overhead Door Stop	104S C32D (90 Degrees)	C32D
2	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D

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Heading #008

1 Single door 122, PRE-SCHOOLERS 121 TO STORAGE 122 LH
 1 Single door 132, TODDLERS 131 TO STORAGE 132 LH

950 x 2150 x 45 - HM DR x HM FR - -

6	Standard Hinge	CB1901R 114 x 101 C26D	C26D
2	Classroom Lockset	ND94PD RHO 626 Everest D145 CMK MK	626
2	Overhead Door Stop	104S C32D (90 Degrees)	C32D
2	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D

Heading #009

1 Single door 141, CORRIDOR 101 TO INFANTS 141 RH
 1 Single door 142, INFANTS 141 TO W/R 142 LH

950 x 2150 x 45 - HM DR x HM FR - -

SAFE SCHOOL LOCK-DOUBLE KEYED

6	Standard Hinge	CB1901R 114 x 101 C26D	C26D
2	Dbl Cyl Classroom Lockset	ND95PD RHO 626 Everest D145 CMK MK	626
2	Overhead Door Stop	104S C32D (95 Degrees)	C32D
2	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D

Heading #011

1 Single door 143, INFANTS 141 TO SLEEPING 143 RH

950 x 2150 x 45 - HM DR x HM FR - -

3	Standard Hinge	CB1901R 114 x 101 C26D	C26D
1	Passage Latchset	ND10S RHO 626	626
1	Overhead Door Stop	104S C32D (110 Degrees)	C32D
1	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D



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Heading #012

1 Single door 144, INFANTS 141 TO STORAGE 144

RH

950 x 2150 x 45 - HM DR x HM FR - -

3	Standard Hinge	CB1901R 114 x 101 C26D	C26D
1	Classroom Lockset	ND94PD RHO 626 Everest D145 CMK MK	626
1	Overhead Door Stop	104S C32D (110 Degrees)	C32D
1	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D

Heading #013

1 Single door 161, CORRIDOR 103 TO KITCHEN 161

LH

950 x 2150 x 45 - HM DR x HM FR - 3/4 HR

3	Standard Hinge	CB1901R 114 x 101 C26D	C26D
1	Classroom Lockset	ND94PD RHO 626 Everest D145 CMK MK	626
1	Surface Closer	4040XP REG AL x ST-1630 TB (Pull Side Mount)	AL
1	Mounting Plate	4040XP-18TJ AL	AL
1	Overhead Door Stop	104S C32D (90 Degrees)	C32D
1	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D

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Heading #014

1 Single door 162, CORRIDOR 103 TO STAFF 162 RH
 1 Single door 163, CORRIDOR 103 TO OFFICE 1463 LH

950 x 2150 x 45 - HM DR x HM FR - 0 HR

6	Standard Hinge	CB1901R 114 x 101 C26D	C26D
2	Classroom Lockset	ND94PD RHO 626 Everest D145 CMK MK	626
2	Surface Closer	4040XPT STD AL x ST-3182 TB (Pull Side Mount)	AL
2	Mounting Plate	4040XP-18G AL	AL
2	Overhead Door Stop	104S C32D (90 Degrees)	C32D
2	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D
2	Gasketing	W-21-BL x 5300	BL
2	Door Sweep	W-24S-CA x 950	CA

Heading #015

1 Single door 171, PRE-SCHOOLERS 121 TO SHARED W/R 171 RH
 1 Single door 171A, TODDLERS 131 TO SHARED W/R 171 LH

950 x 2150 x 45 - HM DR x HM FR - -

6	Standard Hinge	CB1901R 114 x 101 C26D	C26D
2	Passage Latchset	ND10S RHO 626	626
2	Overhead Door Stop	104S C32D (90 Degrees)	C32D
2	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D

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Heading #016

1 Single door 172, CORRIDOR 103 TO ELECTRICAL ROOM 172

RH

1 Single door 174, CORRIDOR 103 TO CUSTODIAN 174

LH

950 x 2150 x 45 - HM DR x HM FR - 3/4 HR

6	Standard Hinge	CB1901R 114 x 101 C26D	C26D
2	Storeroom Lockset	ND96PD RHO 626 Everest D145 CMK MK	626
2	Surface Closer	4040XP REG AL x ST-1630 TB (Pull Side Mount)	AL
2	Mounting Plate	4040XP-18TJ AL	AL
2	Overhead Door Stop	104S C32D (90 Degrees)	C32D
2	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D

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Heading #017

1 Single door 173, CORRIDOR 103 TO UNIVERSAL W/R 173

LH

950 x 2150 x 45 - HM DR x HM FR - 3/4 HR

3	Standard Hinge	CB1901R 114 x 101 C26D	C26D
1	Storeroom Lockset	ND96PD RHO 626 Everest D145 CMK MK	626
1	Electric Strike	1006CLB-24V-630-LBM (Fail Secure)	630-LBM
1	Power Supply	CX-PS13 V3	
1	Auto Operator	7000 Series - Push Side Mount	
2	Push Button	4R3	
2	Push Button Escutcheon	N4RS	
1	Washroom Control Kit	CX-WC13FM (Less Door Contact)	
1	Emergency Call Kit	CX-WEC10	
1	Overhead Door Stop	104S C32D (90 Degrees)	C32D
1	Kick Plate	GSH 80A C32D (200 x 910) TM	C32D
1	Opening Schematics	Opening Schematics By UC Access	

MODE OF OPERATION:

1. TO OPEN DOOR ACTIVATE THE DOOR BY THE EXTERIOR BARRIER FREE PUSH PLATE AND DOOR WILL SLOWLY POWER OPEN. TIME OUT AND SLOWLY CLOSE.
2. TO LOCK DOOR FOR PRIVACY ACTIVATE PUSH TO LOCK SWITCH, POWER WILL BE CUT TO EXTERIOR BARRIER PUSH PLATE CREATING PRIVACY.
3. ALSO ON ACTIVATION OF THE INTERIOR PUSH TO LOCK SWITCH (#2).
4. TO EXIT WASHROOM ACTIVATE INTERIOR BARRIER FREE PUSH PLATE AND THE DOOR WILL SLOWLY OPEN (#3).
5. MANUAL NON B/FREE.
6. IN NON FIRE RATED APPLICATION, IF THE WASHROOM IS VACANT THE DOOR CAN BE MANUALLY PUSHED OPEN AS THE ELECTRIC STRIKE WILL NOT ENGAGED.
7. IN A FIRE RATED APPLICATION A KEY WILL BE REQUIRED TO OPERATE THE DOOR MANUALLY (#1). THE KEY WILL UNLOCK THE STOREROOM FUNCTION LOCKSET AS THE ELECTRIC STRIKE MUST BE ENGAGED TO MEET THE FIRE CODE REQUIREMENT FOR SELF LATCHING.

NOTE:

- DO NOT USE DOOR CONTACT - UTILIZE LBM IN ELECTRIC STRIKE.
- 120V & LOW VOLTAGE WIRING BY ELECTRICAL CONTRACTOR.
- OCCUPIED & EMERG KIT TO BE INSTALLED TO CONTROL. THE PRIVACY OF THE OCCUPANT, IN CONJUNCTION WITH AUTO DOOR OPERATOR AS WELL AS PROVIDED EMERGENCY RESPONSE CAPABILITIES, INCLUDING ALARMS INSIDE & OUTSIDE OF WASHROOM.
- ELECTRIC STRIKE TO BE TIED INTO AUTOMATIC DOOR OPERATOR AS WELL AS BOTH INTERIOR ACTUATORS & EXTERIOR ACTUATOR.



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Heading #018

1 Pair of doors 121TC, PRE-SCHOOLERS 121 FROM TEACHER'S CLOSET
 1 Pair of doors 131TC, TODDLERS 131 FROM TEACHER'S CLOSET
 1 Pair of doors 141TC, INFANTS 141 FROM TEACHER'S CLOSET

LHRA/RHRA
 LHRA/RHRA
 LHRA/RHRA

412, 412 x 2100 x 38 - WD DR x WD FR - -

TEACHER'S CLOSET

12	Standard Hinge	Hinges - By Millwork Supplier	
6	Classroom Lockset	AL70PD SAT 626 Everest D145 CMK MK	626

- BALANCE OF HARDWARE BY MILLWORK SUPPLIER

Heading #019

1 Elevation MISC

___ x ___ x ___ - - DR x - FR

MISCELLANEOUS

50	Key Blanks	35-002 D Everest D145
4	Extractor Tool	35-057
6	Construction Master Key	Construction Master Key

PART 1 - GENERAL

1.1 References

- .1 ASTM E 330-02 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
 - .2 ASTM C 542-94(1999) Specification for Lock-Strip Gaskets.
 - .3 ASTM D 790-02 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .4 ASTM D 1003-00 Test Method for Haze and Luminous Transmittance of Plastics.
 - .5 ASTM D 1929-96(2001)e1e1e1e1 Test Method for Ignition Properties of Plastics.
 - .6 ASTM D 2240-02b Test Method for Rubber Property - Durometer Hardness.
 - .7 ASTM E 84-01 Test Method for Surface Burning Characteristics of Building Materials.
 - .8 ASTM F 1233-98 Test Method for Security Glazing Materials and Systems.
 - .9 CAN/CGSB-12.1-M90 Tempered or Laminated Safety Glass.
 - .10 CAN/CGSB-12.2-M91 Flat, Clear Sheet Glass.
 - .11 CAN/CGSB-12.3-M91 Flat, Clear Float Glass.
 - .12 CAN/CGSB-12.4-M91 Heat Absorbing Glass.
 - .13 CAN/CGSB-12.5-M86 Mirrors, Silvered.
 - .14 CAN/CGSB-12.8-M97 Insulating Glass Units.
 - .15 CAN/CGSB-12.10-M76 Glass, Light and Heat Reflecting.
 - .16 CAN/CGSB-12.11-M90 Wired Safety Glass.
 - .17 CAN/CGSB-12.12-M90 Plastic Safety Glazing.
 - .18 Flat Glass Manufacturers Association (FGMA) Glazing Manual.
 - .19 Laminators Safety Glass Association Standards Manual.
-

1.2 Performance Requirements

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a design pressure applicable to locale as measured in accordance with ASTM E 330-02.
- .3 Limit glass deflection to lesser of 1/200 or flexural limit of glass with full recovery of glazing materials.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.

1.4 Closeout Submittals

- .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01730 - Operation and Maintenance Manual.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300.
- .2 Shop drawings to be sealed and signed by a member of the PEO.

1.6 Quality Assurance

- .1 Perform work in accordance with FGMA Glazing Manual IGMAC and Laminators Safety Glass Association - Standards Manual for glazing installation methods.
- .2 Maintain one copy of each standard document on site.
- .3 Provide testing and analysis of glass under provisions of Section 01400.
- .4 Provide shop inspection and testing for glass.

1.7 Environmental Requirements

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

PART 2 - PRODUCTS

2.1 Glass Materials

- .1 Tempered safety glass to CAN/CGSB-12.1-M90, Type 2 , Class B, thickness to suit opening, or minimum 3/8" thick unless otherwise noted.
- .2 Mirrored glass: Solarcool Graylite or Mirropane E.P., or approved alternate, 1/4" thick. Coating on surface 3 of glazing units.
- .3 Float glass: to CAN/CGSB-12.3-M91, glazing quality.
- .4 Laminated safety glass to CAN/CGSB-12.1-M90, Type 1, Class A minimum 6mm or thickness as indicated.
- .5 Insulating glass units:
 - .1 CAN/CGSB-12.8-M97, with outer pane of 6 mm thick tempered safety glass and inner pane of 6 mm thick clear float glass with 25 mm total thickness, capillary tubes, Low E coating on #3 surface.
 - .2 At all glass in exterior doors and exterior sidelights, CAN/CGSB-12.8-M97, with outer pane of 6 mm thick tempered glass and inner pane of 6 mm thick laminated safety glass with 25 mm total thickness, capillary tubes.
 - .3 At all glass in interior doors and screens 6mm laminated glass.
- .6 Low emissivity (LOW E) glass, 6 mm thick minimum, or to suit intended use with coating on #3 surface of insulating glass units.
 - .1 Metallic coating: hard, pyrolytic.
- .7 Fire rated glass: glass material labelled by accredited testing organization recognized by authorities having jurisdiction. Firelite Plus 8mm non-wired ceramic glazing or equal by Keralite or equal as approved by Consultant.

2.2 Glazing and Sealing Compound Materials

- .1 Glazing compound:
 - .1 Oil base, to CAN/CGSB-19.6-M87, Type 1, black colour.
 - .2 Non-hardening, modified oil type to CAN/CGSB-19.2-M87, black colour.
- .2 Sealant compound: multi-component, chemical curing to CAN/CGSB-19.24-M90, type 2, class A, black colour.
- .3 Sealing and Bedding Compound, Acoustical: to CAN/CGSB-19.21-M87.
- .4 Putty Linseed Oil: to CAN/CGSB-19.1-M87.

2.3 Accessories

- .1 Glazing tape: pre-shimmed preformed butyl tape, 10-15 durometer hardness, paper release, black colour, to suit.
- .2 Setting blocks: neoprene, Shore "A" durometer hardness 80-90, 100 mm long x 6 mm high x width to suit glass thickness.
- .3 Spacer shims: neoprene, Shore "A" durometer hardness 80, 75 mm long x 2.4 mm thick x 9 mm high.
- .4 Glazing splines: neoprene manufacturer's standard dry glazing splines to suit aluminum extrusions, grey colour.
- .5 Glazing points and wire spring clips: corrosion resistant, manufacturer's standard.
- .6 Lock-strip gaskets: black neoprene to ASTM C 542-94(1999), H type U type for cavities spline type for recessed reglets type. Provide internal drainage channel with drainage holes in sill section. Injection mould one-piece corner sections and heat-seal to main gasket.
- .7 Primer-sealers and cleaners: to glass manufacturer's standard.
- .8 Breather tubes: to manufacturer's standard.
- .9 Mirror attachment accessories:
 - .1 Stainless steel clips.
 - .2 Plastic rosettes.
 - .3 Mirror adhesive, chemically compatible with mirror coating and wall substrate.
 - .4 Mirror frames: Stainless steel.

2.4 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 AFG
 - .2 Libbey-Owens Ford
 - .3 PPG
 - .4 Guardian

PART 3 - EXECUTION

3.1 Examination

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

3.2 Preparation

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

3.3 Workmanship

- .1 Remove protective coatings and clean contact surfaces with solvent and wipe dry.
- .2 Apply primer-sealer to contact surfaces.
- .3 Place setting blocks as per manufacturer's instructions.
- .4 Install glass, rest on setting blocks, ensure full contact and adhesion at perimeter.
- .5 Install removable stops, without displacing tape or sealant.
- .6 Provide edge clearance of 3 mm minimum.
- .7 Insert spacer shims to center glass in space. Place shims at 600 mm oc and keep 6 mm below sight line.
- .8 Apply cap bead of sealant at exterior void.
- .9 Apply sealant to uniform and level line, flush with sightline and tooled or wiped with solvent to smooth appearance.
- .10 Do not cut or abrade tempered, heat treated, or coated glass.

3.4 Exterior Glazing

- .1 Dry method - tape/tape and sealant:
 - .1 Cut glazing tape to proper length and set against permanent stops 5 mm below sightline. Install horizontal strips first, extend over entire width of opening before applying vertical strips. Weld corners together by butting tape and dabbing with sealant.
 - .2 Place glazing tape on glass in manner described above.

3.5 Interior Glazing

- .1 Dry method - tape/tape:
 - .1 Cut glazing tape to length and install against permanent stop, project 1.5 mm above sightline.
 - .2 Place glazing tape on free perimeter of glass in same manner described above.
-

3.6 Cleaning

- .1 Remove glazing materials from finish surfaces.
- .2 Remove labels after work is complete.
- .3 Clean glass and mirrors.

3.7 Protection of Finished Work

- .1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

PART 1 - GENERAL

1.1 References

- .1 CAN/CGSB-1.40-M89, Primer, Structural Steel, Oil Alkyd Type.
- .2 CAN/CGSB-19.21-M87, Sealing and Bedding Compound Acoustical.
- .3 ASTM C 645-00, Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

PART 2 - PRODUCTS

2.1 Materials

- .1 Non-loadbearing channel stud framing: to ASTM C 645-00, 92 mm stud size, roll formed from 0.91 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
- .2 Floor and ceiling tracks: to ASTM C 645-00, in widths to suit stud sizes, 32 mm flange height.
- .3 Metal channel stiffener: 38 x 19 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .4 Acoustical sealant: to CAN/CGSB-19.21-M87.
- .5 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

PART 3 - EXECUTION

3.1 Erection

- .1 Align partition tracks at floor and ceiling and secure at 600 mm o.c. maximum.
 - .2 Install dampproof course under stud shoe tracks of partitions on slabs on grade.
 - .3 Place studs vertically at 400 mm oc and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
 - .4 Erect metal studding to tolerance of 1:1000.
 - .5 Attach studs to bottom track using screws .
-

- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .9 Install heavy gauge single jamb studs at openings.
- .10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .12 Provide 40 mm stud or furring channel secured between studs for attachment of millwork and fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including coat and boot racks, grab bars and towel rails, attached to steel stud partitions. Provide double studs as required and as directed by Consultant.
- .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .14 Extend partitions to underside of structure except where noted otherwise on drawings.
- .15 At suspended bulkheads and partitions, brace back to structure as required at 1200mm o.c. Suspend bulkheads and partitions in strict accordance with manufacturer's instructions. Review method of suspension with Consultant prior to commencement of Work. Failure to do so will result in immediate rejection of Work.
- .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks to form double track slip joint.
- .17 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .18 Install two continuous beads of acoustical sealant or insulating strip under studs and tracks around perimeter of sound control partitions.

PART 1 - GENERAL

1.1 References

- .1 ASTM C 635-00 Specifications for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
- .2 ASTM C 636-96 Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

1.2 Design Criteria

- .1 Maximum deflection: 1/360th of span to ASTM C 635-00 deflection test.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit one representative model of each type ceiling suspension system.
- .3 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

1.4 Regulatory Requirements

- .1 Fire-resistance rated suspension system: according to ULC Design.

PART 2 - PRODUCTS

1.5 Materials

- .1 Intermediate duty system to ASTM C 635-00.
- .2 Basic materials for suspension system: commercial quality cold rolled steel zinc coated or aluminum sheet mill finished.
- .3 Exposed tee bar grid components: shop painted satin sheen white colour . Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
- .4 Hanger wire: galvanized soft annealed steel wire.
 - .1 3.6 mm diameter for access tile ceilings.
 - .2 to ULC design requirements for fire rated assemblies.
 - .3 2.6 mm diameter for other ceilings.

- .5 Hanger inserts: purpose made.
- .6 Carrying channels: 38 x 19 mm channel, of 1.2 mm thick galvanized steel.
- .7 Accessories: splices, clips, wire ties, retainers and wall moulding flush , to complement suspension system components, as recommended by system manufacturer.
- .8 At existing suspended ceiling systems to be extended, match existing components. Secondary Support System: Unistrut or equal complete with purpose made clamps and fastening systems as required, spanning between structural members. Submit shop drawings signed and sealed by member of Professional Engineers of Ontario (PEO).

PART 3 - EXECUTION

1.6 Installation

- .1 Installation: in accordance with ASTM C 636-96 except where specified otherwise.
- .2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.
- .3 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.
- .4 Secure hangers to overhead structure using attachment methods acceptable to Consultant. DO NOT SUSPEND FROM METAL DECK. Suspend from open web steel joints, beams or channels or provide secondary support systems spanning between structural members. Where secondary support systems are utilized, submit shop drawings signed and sealed by member of Professional Engineers of Ontario (PEO).
- .5 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
- .6 Lay out center line of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width and according to reflected ceiling plan.
- .7 Ensure suspension system is co-ordinated with location of related components.
- .8 Install wall mould to provide correct ceiling height.
- .9 Completed suspension system to support super- imposed loads, such as lighting fixtures diffusers grilles and speakers.
- .10 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150mm of each corner and at maximum 600mm around perimeter of fixture.

- .11 Interlock cross member to main runner to provide rigid assembly.
- .12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .13 Install access splines to provide 10 percent ceiling access.
- .14 Finished ceiling system to be square with adjoining walls and level within 1:1000.

1.7 Cleaning

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

PART 1 - GENERAL

1.1 Reference Standards

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88, Building Materials and Assemblies, Standard Method of Test for Surface Burning Characteristics of.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 653/A 653M-02a 653M-02a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM C 36/C 36M-01 36M-01, Specification for Gypsum Wallboard.
 - .3 ASTM C 79/C 79M-01 79M-01, Specification for Gypsum Sheathing Board.
 - .4 ASTM C 442/C 442M-01 442M-01, Specification for Gypsum Backing Board and Coreboard.
 - .5 ASTM C 475/C 475M-02 475M-02, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .6 ASTM C 514-01, Specification for Nails for the Application of Gypsum Board.
 - .7 ASTM C 630/C 630M-01 630M-01 630M-96a 630M-96a 630M-96a, Specification for Water-Resistant Gypsum Backing Board.
 - .8 ASTM C 840-02, Specification and Finishing of Gypsum Board.
 - .9 ASTM C 931/C 931M-02 931M-02, Specification for Exterior Gypsum Soffit Board.
 - .10 ASTM C 954-00, Specification for Steel Drill Screws for the Application of Gypsum Board.
 - .11 ASTM C 960/C 960M-01 960M-01, Specification for Predecorated Gypsum Board.
 - .12 ASTM C 1047-99, Accessories for Gypsum Wallboard and Gypsum Veneer.
 - .13 ASTM C 1280-99, Specification for Application of Gypsum Sheathing Board.
 - .14 ASTM C 1177/C 1177M-01 1177M-01 1178M-96 1178M-96 1178M-96, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .15 ASTM C 1178/C 1178M-01 1178M-01 1178M-96 1178M-96 1178M-96, Specification for Glass Mat Water-Resistant Gypsum Backing Board.

1.2 Environmental Requirements

- .1 Maintain temperature minimum 10°C, maximum 21°C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

- .2 Apply board and joint treatment to dry, frost free surfaces.

PART 2 - PRODUCTS

2.1 Gypsum Board

- .1 Standard board: to CAN/CSA-A82.27-M91 regular, type and thickness to match existing.

2.2 Fastenings and Adhesives

- .1 Nails, screws and staples: to CAN/CSA-A82.31-M91.
- .2 Stud adhesive: to CAN/CGSB 7125 ASTM C 557-99.
- .3 Laminating compound: as recommended by manufacturer, asbestos-free.

2.3 Accessories

- .1 Casing beads, corner beads fill type: 0.5 mm base thickness commercial grade sheet steel to ASTM C 1047-99 with Z275 zinc finish to ASTM A 525-93, perforated flanges; one piece length per location.
- .2 Acoustic sealant: to CAN/CGSB-19.21-M87 and Section 07900 - Sealants.
- .3 Polyethylene: to CAN/CGSB-51.34-M86, Type 2.
- .4 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .5 Joint compound: to CAN/CSA-A82.31-M91, asbestos-free.
- .6 Vinyl mouldings: mouldings for joint treatment of vinyl-faced gypsum board, to match colour, type and application of existing.

2.4 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Certain Teed
 - .2 CGC
 - .3 G-P Gypsum
-

PART 3 - EXECUTION

3.1 Bracing

- .1 Brace suspended assemblies as required to structure at 1200mm o.c. max. Conform strictly to manufacturer's specifications and instructions. Maintain continuity of fire separations at all times. Review method of suspension with Consultant prior to commencement of Work. Failure to do so will result in immediate rejection of Work.

3.2 Gypsum Board Application

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.
- .2 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 300 mm oc.
- .3 Apply single or double layer gypsum board to concrete block surfaces, where indicated, using laminating adhesive.
- .4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and other penetrations, in partitions where perimeter sealed with acoustic sealant.

3.3 Fire Rated Assemblies

- .1 Construct fire rated assemblies where indicated in strict accordance with specified ULC Design.

3.4 Accessories

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm oc using contact adhesive for full length.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.

3.5 Control Joints

- .1 Construct control joints of preformed units or two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.
- .2 Provide continuous polyethylene dust barrier behind and across control joints.
- .3 Locate control joints at changes in substrate construction at approximate 10 m spacing on long corridor runs at approximate 15 m spacing on ceilings.
- .4 Install control joints straight and true.

3.6 Expansion Joints

- .1 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.
- .2 Install expansion joint straight and true.

3.7 Access Doors

- .1 Install access doors to electrical and mechanical fixtures specified in respective Sections.
- .2 Rigidly secure frames to furring or framing systems.

3.8 Taping and Filling

- .1 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .2 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .3 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

PART 1 - GENERAL

1.1 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 144-02 93 , Standard Specification for Aggregate for Masonry Mortar.
 - .2 ASTM C 207-91(1997) 91 , Standard Specification for Hydrated Lime for Masonry Purposes.
 - .3 ASTM C 847-95(2000) 93 , Standard Specification for Metal Lath.
- .2 American National Standards Institute (ANSI)
 - .1 ANSI A118.1-1999 1992 , Specifications for Dry-Set Portland Cement Mortar.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86 M86 , Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CGSB 71-GP-22M 86 , Adhesive, Organic, for Installation of Ceramic Wall Tile.
 - .3 CAN/CGSB-75.1-M88 M88 , Tile, Ceramic.
- .4 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A5-93 93 , Portland Cement/Masonry Cement/Blended Hydraulic Cement.
 - .2 CAN/CSA-ISO 14040-97 97 , Environmental Management - Life Cycle Assessment - Principles and Framework.

1.2 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit duplicate 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
- .3 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

1.3 Maintenance Material

- .1 Provide maintenance materials in accordance with Section 01750 - Maintenance Materials, Special Tools and Spare Parts .
 - .2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
 - .3 Maintenance material to be of same production run as installed material.
-

1.4 Environmental Conditions

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 °C for 48 h before, during, and 48 h after, installation.

1.5 Waste Management

- .1 Separate corrugated cardboard in accordance with the Waste Management Plan and place in designated areas for recycling.
- .2 Close and seal tightly all partly used sealant containers and store protected in a well ventilated fire-safe area at moderate temperature.
- .3 Place used hazardous sealant tubes and other containers in areas designated for hazardous materials.
- .4 Place materials defined as hazardous or toxic waste in designated containers.

PART 2 - PRODUCTS

2.1 Ceramic Floor and Wall Tile

- .1 Ceramic tile:
 - .1 CT1: Ceramic floor tile: to CAN/CGSB-75.1-M88, Type 7, Class MR 1, 300x 300x 8mm size, square edges, matte slip resistant surface, 2 colours as selected by Consultant. 40% accent tile in pattern and location as directed by Consultant. Cerdisastone Graniti Series, Dotti, or Maksi as distributed by Centura or Graniti by Graniti Fiandre as supplied by Savoia, or Progetto by Floor Gres as supplied by Ciot Marble and Granite Inc. or equal as determined by the Consultant. The manufacturer and colours will be selected by the Consultant without adjustment to the contract price.
 - .2 CT2: Base, matching coved base with bullnose, 150x 100mm high.

2.2 Mortar and Adhesive Materials

- .1 Portland cement: to CAN/CSA-A5-93 , type 10 .
 - .2 Sand: to ASTM C 144-02.
 - .3 Hydrated lime: to ASTM C 207-91(1997) .
 - .4 Latex additive: formulated for use in portland cement mortar and thin set bond coat.
 - .5 Water: potable and free of minerals which are detrimental to mortar and grout mixes.
 - .6 Dry set mortar: to ANSI A118.1-1999 .
 - .7 Organic adhesive: to CGSB 71-GP-22M , Type 1.
-

2.3 Grout

- .1 Grout type and preparation for wall and floor application to manufacturer's instructions. Seal tile prior to grouting.
- .2 Grout colour to be selected by Consultant from manufacturer's full range.

2.4 Accessories

- .1 Thresholds: slate slab to match tile, 1/2" thick, bevelled one side , honed finish to exposed surfaces, size to suit door opening and frame width.
- .2 Sealant: in accordance with Section 07900 - Joint Sealers .
- .3 Floor sealer and protective coating: to tile and grout manufacturers' recommendations.

2.5 Mortar and Adhesive Mixes

- .1 Scratch coat: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand.
 - .2 Slurry bond coat: portland cement and water mixed to creamy paste. Latex additive may be included.
 - .3 Mortar bed for floors: 1 part portland cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included .
 - .4 Mortar bed for walls and ceilings: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included .
 - .5 Levelling coat: 1 part portland cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
 - .6 Bond or setting coat: 1 part portland cement, 1/3 part hydrated lime, 1 part water.
 - .7 Measure mortar ingredients by volume.
 - .8 Dry set mortar: mix to manufacturer's instructions.
 - .9 Organic adhesive: pre-mixed.
-

PART 3 - EXECUTION

3.1 Workmanship

- .1 Do tile work in accordance with Installation Manual 200 , "Ceramic Tile", produced by Terrazzo Tile and Marble Association of Canada (TTMAC), except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.
- .3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even.
- .4 Maximum surface tolerance 1:800 .
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .7 Lay out patterns as applicable for review and approval of Consultant. Provide drawing indicating pattern and colour separations.
- .8 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .9 Make internal angles square, external angles bullnosed.
- .10 Use round bullnose edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .11 Install divider strips at junction of tile flooring and dissimilar materials.
- .12 Allow minimum 24 h after installation of tiles, before grouting.
- .13 Clean installed tile surfaces after installation and grouting has cured.
- .14 Make control joints at 20' in each direction. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07900 - Joint Sealers . Keep building expansion joints free of mortar and grout.

3.2 Floor Tile

- .1 Install in accordance with applicable TTMAC detail.

3.3 Floor Sealer and Protective Coating

- .1 Apply in accordance with manufacturer's instructions.
- .2 Do not provide sealants and waxes on terrazzo, ceramic and other hard surfaced floors without reviewing products and methods of application with the Board's Caretaking Staff. Failure to comply with this requirement will result in the contractor stripping these floors in their entirety.

PART 1 - GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA B111-1974 (R1998), Wire Nails, Spikes and Staples.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.
 - .2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88, Surface Burning Characteristics of Building Materials.

1.2 Environmental Conditions

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

1.3 Maintenance Materials

- .1 Provide maintenance materials in accordance with Section 01700 - Contract Closeout and Final Cleaning.
- .2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.
- .3 Materials to be same production run as installed materials.

1.4 Regulatory Requirements

- .1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by a ULC.
-

PART 2 - PRODUCTS

2.1 Materials

- .1 Acoustic units for suspended ceiling system as manufactured to CAN/CGSB-92.1-M89.
 - .1 Type to match existing.
 - .2 Pattern to match existing.
 - .3 Flame spread rating of 25 or less.
 - .4 Noise reduction coefficient (NRC) designation of .65.
 - .5 Light reflectance range of min.75.
 - .6 Edge type square and rabbetted to match ceiling tiles in adjacent area.
 - .7 Colour white or coloured to match ceiling tiles in adjacent area.
 - .8 Size 600 x 1200 x 16 mm thick or to match ceiling tiles in adjacent area.
 - .9 Shape flat and rabbetted to match ceiling tiles in adjacent area.
- .2 Adhesive: type recommended by acoustic unit manufacturer.
- .3 Staples, nails and screws: to CSA B111-1974 (R1998) non-corrosive finish as recommended by acoustic unit manufacturer.
- .4 Polyethylene: to CAN/CGSB-51.33-M89, Type 2, 0.15 mm thick.
- .5 Hold down clips: purpose made clips to secure tile to suspension system, approved for use in fire-rated systems.
- .6 Light fixture protection boxes: five sided, trapezoidal of same material as lay-in acoustic tiles as specified in ULC design.
- .7 At existing suspended ceiling systems to be extended, match existing components.
- .8 Ceiling Mounted Projector Assembly:
 - .1 Ceiling Plate: Peerless CMJ-455 Type A above ceiling tile installation including miscellaneous hardware and suspension system.
 - .2 Projector Mount: Universal Mounting Bracket RPA-U.

2.2 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following grids manufacturers will be accepted.
 - .1 Armstrong
 - .2 Bailey
 - .3 Chicago Metallic
 - .4 Donn
- .2 Products in accordance with this specification by only the following ACT manufacturers will be accepted.
 - .1 Armstrong
 - .2 CGC
 - .3 CertainTeed

- .3 Products in accordance with this specification by only the following Ceiling Mounted Projector Plate manufacturers will be accepted.
 - .1 Peerless

PART 3 - EXECUTION

3.1 Installation

- .1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant.
- .2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.2 Suspension System

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

3.3 Ceiling Mounted Projector

- .1 Provide Ceiling Mounted Projector Assembly in accordance with manufacturer's specifications including associated accessories and suspension system.
- .2 Provide one per classroom as directed by Consultant or as shown on Drawings.

3.4 Interface With Other Work

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

PART 1: GENERAL

1.1 RELATED SECTIONS

- .1 Sections 04210 and 04220 – Brick and Concrete Unit Masonry.
- .2 Section 07900 - Sealants.
- .3 Section 09250 - Gypsum Board.
- .4 Section 09310 - Tile.

1.2 REFERENCES

- .1 ASTM E84-13a: Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 ASTM F710-11: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- .3 ASTM F1066-04(2010)e1: Standard Specification for Vinyl Composition Floor Tile.
- .4 ASTM F1303-04(2009): Standard Specification for Sheet Vinyl Floor Covering with Backing.
- .5 ASTM F1861-08(2012)e1: Standard Specification for Resilient Wall Base.

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01300.
- .2 Samples:
 - .1 Flooring: duplicate 300 x 300 mm size samples, illustrating colour and pattern selection for each flooring material specified.
 - .2 Base: duplicate 100 mm long samples, illustrating colour selection.
- .3 Submit manufacturer's maintenance instructions for inclusion into maintenance manuals specified in Section 01700.
- .4 Submit layout drawing showing field and accent tile pattern to Consultant for review in accordance with Section 01300.

1.4 EXTRA MATERIALS

- .1 Deliver to Owner on completion of work, and as he directs, 6 m² or 3%, whichever is greater, of each resilient flooring Product, of each pattern and colour, in labelled packages identifying:
 - .1 Manufacturer's name,
 - .2 Product's name,
 - .3 Product colour and pattern.
- .2 Package tile products neatly in original containers, to prevent damage.
- .3 Supply roll goods in full width rolls.
- .4 Store roll goods in upright position, with roll wrapped in a protective cover to prevent damage.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store Products undamaged in original wrapping or cartons.
- .2 Store Products for a minimum of three days prior to installation in warm (not less than 18°C) dry room with tiles stacked not over four cartons high.

1.6 AMBIENT SITE CONDITIONS

- .1 Maintain ambient air temperature of 20 degrees Celsius three days prior to, during, and 48 hours after installation of flooring materials.

- .2 Do not lay flooring in conditions of high humidity or where exposed to cold drafts.
- .3 In hot weather, protect flooring from direct sunlight.
- .4 Provide adequate ventilation.

1.7 WARRANTY

- .1 Submit an extended warranty in accordance with the General Conditions of the Contract.
- .2 Extended Warranty: for a period of 10 years, covering against delamination of adhesive, and covering against curling, breakage, bubbling, discolouration, and excessive wear to flooring materials.

PART 2: PRODUCTS

2.1 MANUFACTURERS

- .1 Manufacturers of vinyl composition tile having Product considered acceptable for use:
 - .1 Armstrong World Industries.
 - .2 Azrock by Tarkett.
- .2 Manufacturers of resilient base and trim having Product considered acceptable for use:
 - .1 Armstrong World Industries.
 - .2 Canada Base Company.
 - .3 Johnsonite.

2.2 MATERIALS

- .1 Vinyl Composition Tile (**VCT**): 305 x 305 mm size, 3.2 mm thick reinforced resilient vinyl, to ASTM F1066, Composition 1, Class 2; eg. Azrock Standard VCT - Standard Patterns, multiple colours selected by Consultant. Accent tiles to be provided in pattern of one tile every fourth tile both ways centred on room or in alternate pattern to be provided by Consultant at a later date.
- .2 Resilient Base (**RB**): thermoset vulcanized rubber, to ASTM F1861, Type TS, Style B - Cove; 100 mm high; 3 mm thick; complete with pre-moulded end stops and external corners; colour as selected by Consultant.
- .3 Reducer Strip: thermoset vulcanized rubber, smooth, purpose made to accommodate wheeled traffic and prevent tripping; tapered designs to suit nature of transition; colour as selected by Consultant.

2.3 ADHESIVES

- .1 Adhesive for Vinyl Composition Tile: Ultrabond ECO 711 by Mapei.
- .2 Adhesive for Rubber Tile Flooring: two-part polyurethane adhesive; Mondo PU 100 or PU 105.
- .3 Adhesive for Resilient Base: contact adhesive, water-based formulation; eg. Johnsonite 945.
- .4 Adhesive for Rubber Stair Nosings, Treads and Risers: two-part urethane adhesive, eg. Johnsonite 975.

2.4 ACCESSORIES

- .1 Subfloor Filler: white premix latex; as recommended by flooring manufacturer to be compatible with materials of this Section.
- .2 Primers: waterproof; as recommended by flooring manufacturer.
- .3 Sealers and Wax: as specified in Section 01700.

PART 3: EXECUTION

3.1 EXAMINATION

- .1 Before work commences to place the resilient flooring system, examine the areas to be covered and report any deficiency(s) or adverse condition(s) in writing to the General Contractor, Architect and Owner.
- .2 Verify surfaces designated to receive resilient base are even, smooth, free of gaps, holes and depressions.

- .3 Conduct all testing of concrete slabs to satisfy the requirements of the manufacturers.
- .4 Conduct additional tests as may be required by flooring manufacturers.

3.2 SUBSTRATE PREPARATION

- .1 Conform to ASTM F710.
- .2 Clean concrete substrate to remove deleterious matter which would impair adhesion of resilient flooring or sub-floor filler. Imperfections and irregularities (holes, voids, bumps, cracks, depressions, etc.) must be corrected, and surfaces must be smooth and even before the application of adhesive.
- .3 Prepare substrate to a smooth and flat surface, as follows:
 - .1 Remove sub-floor ridges and bumps by grinding or other means.
 - .2 Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
 - .3 Apply, trowel and float filler to leave smooth, flat, hard surface.
 - .4 Prohibit traffic until filler is cured.
 - .5 Vacuum clean substrate.
- .4 Prime substrate as and when recommended to ensure proper adhesion of finished flooring.

3.3 INSTALLATION

- .1 Install Products in accordance with manufacturer's installation guidelines.
- .2 Do not proceed with placement of the adhesive and resilient flooring until surfaces and conditions comply with the manufacturers requirements indicated in each of the manufacturers' instructions and good work practices. **Adhesive and Resilient Flooring Manufacturer(s) to provide their acceptance in writing to General Contractor, Architect and Owner that the conditions are acceptable for installation.**
- .3 Spread only enough adhesive to permit installation of materials before initial set.
- .4 Set flooring in place, press with heavy roller to attain full adhesion.
- .5 Lay flooring continuously from wall to wall in each area, **including beneath casework.**
- .6 Terminate flooring at centre line of door openings where adjacent floor finish is dissimilar.
- .7 Scribe flooring to walls, columns, floor outlets, and other appurtenances to produce tight joints.
- .8 Tile Flooring
 - .1 Lay tile flooring with joints and seams parallel to building lines to produce symmetrical tile patterns.
 - .2 Provide perimeter tile of similar size within any given area.
- .9 Resilient Base
 - .1 Install base on solid backing.
 - .2 Bond tight to wall and floor surfaces.
 - .3 Mitre internal corners.
 - .4 Use only pre-molded units at exposed ends and external corners.
 - .5 Scribe and fit to door frames and other interruptions.

3.4 FIELD QUALITY CONTROL

- .1 The Consultant will review the Work as specified in Section 01400.
- .2 Consultant Inspection: will include careful review of flooring surfaces along flooring perimeters and at terminations to ensure a neat, well-bonded application.
- .3 Make Good flooring that exhibits improper or inadequate bond to substrate.

3.5 CLEANING

- .1 Clean floor and base surfaces to requirements of manufacturer's instructions.
- .2 Seal and wax tile floors per flooring manufacturer's requirements.

3.6 PROTECTION

- .1 Protect finished floor until Substantial Performance of the Work by covering with a durable material or by keeping traffic off floor.

END OF RESILIENT FLOORING

PART 1 - GENERAL

1.1 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 3960-02 93 , Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.36-M97 97 , General Purpose Interior Varnish.
 - .2 CAN/CGSB-1.38-M91 M91 , Interior Enamel Undercoater.
 - .3 CGSB 1-GP-48M 78 , Primer, Marine, for Steel.
 - .4 CAN/CGSB-1.57-M90 96 , Alkyd, Interior, Semigloss, Enamel.
 - .5 CAN/CGSB-1.60-M89 97 , Interior Alkyd Gloss Enamel.
 - .6 CAN/CGSB-1.68-M91 M91 , Solvent Type Primer-Sealer for Interior Walls.
 - .7 CAN/CGSB-1.73-M91 97 , Exterior and Interior Enamel for Floors.
 - .8 CAN/CGSB-1.100-99 95 , Interior Latex Type, Flat Paint.
 - .9 CAN/CGSB-1.102-M89 M89 , Clear Alkyd Type Sealer.
 - .10 CAN/CGSB-1.118-95 95 , Interior Alkyd, Flat Finish.
 - .11 CAN/CGSB-1.119-2000 95 , Primer-Sealer, Wall, Interior Latex Type.
 - .12 CAN/CGSB-1.121-93 93 , Vinyl Pretreatment Coating for Metals (Vinyl Wash Primer).
 - .13 CAN/CGSB-1.126-M91 M91 , Vinyl Sealer for Wood.
 - .14 CAN/CGSB-1.143-98 M90 , Heat Resistant Aluminum Enamel, Silicone Alkyd.
 - .15 CAN/CGSB-1.145-M90 97 , Solvent-Based Pigmented Stain.
 - .16 CAN/CGSB-1.146-99 92 , Cold Curing, Gloss Epoxy Coating.
 - .17 CAN/CGSB-1.150-M91 M91 , Clear Lacquer for Wood Furniture.
 - .18 CAN/CGSB-1.153-M90 M90 , High Build, Gloss, Epoxy Coating.
 - .19 CAN/CGSB-1.165-M89 M89 , Cold Curing Epoxy Primer.
 - .20 CAN/CGSB-1.175-M89 97 , Polyurethane Interior Coating, Oil Modified, Clear, Gloss and Satin.
 - .21 CGSB 1-GP-180Ma 96 , Coating, Polyurethane, Two-Package, General Purpose.
 - .22 CAN/CGSB-1.188-96 96 , Emulsion Type Filler Masonry Block.
 - .23 CGSB 1-GP-193Ma 83 , Coating, High-Build Epoxy, Marine.
 - .24 CAN/CGSB-1.195-99 95 , Interior Semigloss Latex Paint.
 - .25 CAN/CGSB-1.198-2001 95 , Cementitious Primer (for Galvanized Surfaces).
 - .26 CAN/CGSB-1.202-96 96 , Interior Low Gloss Alkyd Enamel.
 - .27 CAN/CGSB-1.209-93 93 , Low Sheen Latex Interior Paint.
 - .28 CGSB 85-GP-1M 78 , Painting (New) Exterior Wooden Surfaces.
 - .29 CGSB 85-GP-2M 78 , Painting (Maintenance) of Exterior Painted Wooden Surfaces.
 - .30 CGSB 85-GP-10M 79 , Shop Painting Structural Steel.
 - .31 CGSB 85-GP-11M 80 , Painting Steel for Protection Against Continuous Wetting.
 - .32 CGSB 85-GP-13M 80 , Painting Structural Steel for Protection Against Heavy Industrial Atmospheres.
 - .33 CGSB 85-GP-14M 78 , Painting Steel Surfaces Exposed to Normally Dry Weather.

- .34 CGSB 85-GP-15M 78 , Painting, Maintenance, Exterior Steel Exposed to Normally Dry Weather.
- .35 CGSB 85-GP-16M 79 , Painting Galvanized Steel.
- .36 CGSB 85-GP-18M 80 , Painting, Maintenance, Exterior, Steel, for Protection Against Continuous Wetting.
- .37 CGSB 85-GP-20M 79 , Painting copper and Copper Alloys.
- .38 CGSB 85-GP-31M 79 , Painting Stucco, Masonry and Brick Surfaces.
- .39 CGSB 85-GP-32M 79 , Painting Concrete Floors.
- .40 CGSB 85-GP-33M 79 , Painting Interior Plaster and Wallboard.
- .41 CAN/CGSB-85.100-93 93 , Painting.

- .3 Canadian Painting Contractors' Association (CPCA).
 - .1 Painting Specifications Manual 1993 .

- .4 Canadian Standards Association (CSA)
 - .1 CSA Z760-94 94 , Life Cycle Assessment.

- .5 Environmental Choice Program (ECP)
 - .1 ECP-67- 95 , Recycled Water-Borne Surface Coatings.
 - .2 ECP-76- 98 , Surface Coatings.

- .6 Environmental Protection Agency (EPA)
 - .1 EPA-SW-846, Test Methods for Evaluating Solid Wastes.

- .7 International Organization for Standardization (ISO)
 - .1 ISO 14040/14041- 1997 , Environmental Management - Life Cycle Assessment.

- .8 National Fire Code of Canada 1995 .

- .9 Steel Structures Painting Council (SSPC).
 - .1 Systems and Specifications Manual 1989 .

1.2 Product Data

- .1 Submit product data in accordance with Section 01300.

- .2 Submit full records of all products used. List each product in relation to finish formula and include the following:
 - .1 Finish formula designation.
 - .2 Product type and use.
 - .3 CGSB number.
 - .4 Manufacturer's product number.
 - .5 Colour number s .
 - .6 Manufacturer's Material Safety Data Sheets (MSDS).
 - .7 Maximum VOC classification.
 - .8 Eco-Logo certification.

- .3 Submit manufacturer's installation and application instructions for each product specified.

1.3 Samples

- .1 Submit samples in accordance with Section 01300.
- .2 Submit duplicate 300 x 200 mm sample panels of each paint and plaster type specified.
- .3 Submit full range of available colours where colour availability is restricted.
- .4 Use 3 mm plate steel for finishes over metal surfaces. Use 12.5 mm birch plywood for finishes over wood surfaces. Use 50 mm concrete block for finishes over concrete or concrete masonry surfaces. Use 12.5 mm gypsum board for finishes over gypsum board and other smooth surfaces.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

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

1.6 Environmental Requirements

- .1 Conform to requirements of OPCA Manual.
- .2 Ventilation:
 - .1 Provide continuous ventilation during and after application of paint. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of application of paint.
- .3 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
- .4 Substrate and ambient temperature must be within limits prescribed in paint standard and by manufacturer to approval of Consultant.
- .5 Maintain minimum substrate and ambient air temperature of 5°C for Alkyd and 7°C for latex paints. Maximum relative humidity 85%. Maintain supplemental heating until paint has cured sufficiently.
- .6 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.
- .7 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.
- .8 Apply paint only when surface to be painted is dry, properly cured and adequately prepared.
- .9 Painting in occupied facilities to be carried out during silent hours only. Schedule operations to approval of Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.

- .10 Provide minimum 270 lx on surfaces to be painted.

1.7 Scheduling

- .1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Consultant for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.8 Extra Materials

- .1 Submit maintenance materials in accordance with Section 01750 -Spare Parts and Maintenance Materials, Special Tools and Spare Parts.
- .2 Submit one - four litre can of each type and colour of primer finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.
- .3 Deliver to Owner and store where directed.

1.9 Waste Management

- .1 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
 - .2 Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal.
 - .3 Close and seal tightly all partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
 - .4 Do not dispose of paints or solvents by pouring on the ground. Place in designated containers and ensure proper disposal.
 - .5 Solvent based paints, wood preservatives, stains and finishes which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner in accordance with hazardous waste regulations. Empty paint cans are to be dry prior to disposal or recycling (where available).
 - .6 Where paint recycling is available, collect all waste paint by type and provide for delivery to recycling or collection facility.
 - .7 Paints, stains, and finishes are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from the Provincial Ministries of Environment and Regional levels of Government.
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1.10 Colours

- .1 Provide paint according to Colour Schedule to be provided by Consultant at a later date. Allow for 2 field colours, and 4 accent colours. Each room will not exceed one field colour and 2 accent colours.

1.11 Inspection and Guarantee

- .1 The Bidder must be aware that the Board has instructed the Consultant to prepare a painting specification based upon the Painting Architectural Specification Manual prepared by the Ontario Painting Contractors' Association, 211 Consumers Road, Suite 305, Willowdale, ON, M2J 4G8.
- .2 The Manual consists of three main components:
 - .1 Evaluation and Choice of Systems - Surface Preparation
 - .2 Approved Product/Manufacture Listing - Specification Guide
 - .3 Inspection and Guarantee Program
- .3 Refer to the specifications for the first two components listed above. The Inspection Procedure will be complied with in every respect by the successful General Contractor and the Painting Contractor as follows:
 - .1 Upon issuance of a subcontract to the Painting Contractor, the General Contractor shall fill out our "Request for Assignment of an Inspector" Form. The Inspection fee, which is a percentage charge of the painting subcontract price, will be paid from the Allowances identified in the General Instructions. Provide a copy of the properly executed Inspector Form to the Consultant and confirm the accuracy of the subcontractor's painting bid.
 - .2 The Form will contain the following information:
 - .1 Name of Contractor
 - .2 Name and Description of Project
 - .3 Name and Address of the Architect
 - .4 Job Location
 - .5 Project starting date
 - .6 Contract Price
 - .7 Commencement of starting Date of painting.
 - .3 The Association will assign an Inspector to the project.
 - .4 The Painting Contractor must advise the Association office of the actual starting date of painting. Painting shall not commence until the Association has been notified and the Inspector makes the initial site visit.
 - .5 The Painting Contractor must supply the Inspector with a schedule of materials intended for use on the job at the commencement of the painting.
 - .6 During the painting application the frequency of inspections will be sufficient to ensure adequate Quality Control procedures in accordance with the Painting Manual and the Specifications.
 - .7 The Inspector will use Interim Inspection Reports during the Project. One copy of each of these reports will be given to the Painting Contractor, one copy to the General Contractor, and two copies to the Association office, one of which will be forwarded to the Consultant. On completion of the job, the final Inspection Report will be made and routed as noted.

.8 The Inspector will be required to check for proper preparation of surfaces, specified number of coats and that painting industry "generally accepted" painting practices are being carried out on the job.

.9 Any deficiencies must be corrected before the Guarantee is issued and final payment for painting made by the Board.

.10 The Guarantee must cover making good any defects in painting and decorating due to faulty workmanship or defective materials supplied by the Painting and Decorating Subcontractor which appear during a two year period, following "substantial" completion of the Contract or the date of "Fit for Occupancy", whichever occurs first.

PART 2 - PRODUCTS

2.1 Materials

- .1 Qualified products: only paint materials listed on the CGSB Qualified Products List are acceptable for use on this project.
- .2 Qualified products: only paint materials listed on the CPCA Approved Product Lists are acceptable for use on this project.
- .3 Qualified products: only paint materials listed as Eco-Logo Approved Products are acceptable for use on this project.
- .4 Paint materials for each coating formula to be products of a single manufacturer.
- .5 Low odour products: Whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour.
- .6 Water-borne surface coatings must:
 - .1 Meet or exceed all applicable governmental and/or industrial safety and performance standards.
 - .2 Manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by-laws and regulations including, for facilities located in Canada, the Fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .7 Water-borne surface coatings must not be formulated or manufactured with: aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .8 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0 °C or greater.
- .9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in the undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

- .2 Total Suspended Solids (TSS) in the undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .10 Water-borne surface coatings and recycled water-borne surface coatings must contain information describing proper disposal methods within their packaging.
- .11 Water-borne paints and stains and recycled water-borne surface coatings must not contain VOCs in excess of 250 g/L as determined by ASTM D 3960-02.
- .12 Water-borne varnishes must not contain VOCs in excess of 300 g/L.
- .13 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.
- .14 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- .15 The following must be performed on each batch of consolidated post-consumer material before the surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.
- .16 The manufacturing process must adhere to Lifecycle Assessment Standards as per ISO 14040/14041 , CSA Z760-94 .

2.2 Occupied Areas

- .1 Oil-based paints are not to be used in occupied areas, or areas which will be occupied within 72 hours of completion of painting. Alternate paint formulas will be provided by Consultant for such conditions.

2.3 Colours

- .1 Consultant will provide Colour Schedule after contract award.
- .2 Colour schedule will be based upon the selection of three base colours and three accent colours. No more than 6 colours will be selected for the entire project and no more than three colours will be selected in each area.
- .3 Selection of colours will be from manufacturers full range of colours.
- .4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .5 Perform all colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials allowed only with Consultant's written permission.
- .6 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.4 Paint Systems

- .1 Formulas as listed following may be substituted by system references from OPCA based on Chapters 4A and 4B of OPCA Manual and are OPCA Premim Grade.

2.5 Paint Finishes

- .1 Formula 6 (Latex): for concrete block and concrete brick walls apply:
 - .1 one coat Itex block filler CAN/CGSB-1.188-96.
 - .2 two coats low gloss enamel CAN/CGSB-1.209-93.
- .2 Formula 7 (Latex): for gypsum board, plaster hardboard composition board walls apply:
 - .1 one coat latex primer-sealer CAN/CGSB-1.119-2000.
 - .2 two coats flat finish CAN/CGSB-1.100-99.
- .3 Formula 10 (Alkyd): for wood trim panelling plywood cabinetry to receive paint finish apply:
 - .1 spot prime knots and resinous areas CAN/CGSB-1.126-M91.
 - .2 one coat enamel undercoat CAN/CGSB-1.38-M91.
 - .3 two coats semigloss enamel CAN/CGSB-1.57-M90.
- .4 Formula 19 (Latex): for galvanized and zinc coated metal apply:
 - .1 one coat cementitious primer CAN/CGSB-1.198-2001.
 - .2 two coats flat paint CAN/CGSB-1.100-99.
- .5 Formula 21 (Alkyd): for copper piping and fittings apply:
 - .1 one coat vinyl wash primer CAN/CGSB-1.121-93.
 - .2 two coats low gloss enamel CAN/CGSB-1.202-96.

- .6 Formula 22 (Alkyd): for cotton or canva insulation coverings apply:
 - .1 one coat latex primer-sealer CAN/CGSB-1.119-2000.
 - .2 two coats flat finish CAN/CGSB-1.118-95.

2.6 Clear Finishes

- .1 Formula 26 (Polyurethane): for woodwork to receive clear finish apply:
 - .1 one coat wood filler.
 - .2 one coat solvent based stain CAN/CGSB-1.145-M90. Type 2 (interior) Class B semi transparent.
 - .3 one coat oil modified clear polyurethane CAN/CGSB-1.175-M89 Type 2 satin.
 - .4 two coats oil modified clear polyurethane CAN/CGSB-1.175-M99 Type 2 satin.

2.7 Exterior Finishes

- .1 Formula 36: for primed ferrous metal surfaces apply:
 - .1 one coat spot priming CAN/CGSB-1.40-M89
 - .2 one coat lead primer CGSB 1-GP-140M
 - .3 two coats exterior enamel CAN/CGSB-1.59-M89
- .2 Formula 37: for galvanized and zinc coated metal apply:
 - .1 one coat vinyl wash primer CAN/CGSB-1.121-93
 - .2 one coat steel primer CAN/CGSB-140-M89
 - .3 two coats exterior enamel CAN/CGSB-1.59-M89.

2.8 Acceptable Manufacturers

- .1 Manufacturers as per OPCA Listings.

PART 3 - EXECUTION

3.1 General

- .1 Perform all painting operations in accordance with CAN/CGSB-85.100-93 except where specified otherwise.
- .2 Perform all painting operations in accordance with CPCA Painting Specifications Manual except where specified otherwise.
- .3 Apply all paint materials in accordance with paint manufacturer's written application instructions.

3.2 Preparation

- .1 Prepare surfaces to receive paint per Chapter 3 OPCA Manual.
- .2 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, bath accessories and all other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.
- .3 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .4 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Engineer.

3.3 Protection

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

3.4 Existing Conditions

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

3.5 Cleaning

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

3.6 Surface Preparation

- .1 Prepare new wood surfaces to CGSB 85-GP-1M.
- .2 Where possible, prime all surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
- .3 Prepare previously painted wood surfaces to CGSB 85-GP-2M.
 - .1 Apply vinyl sealer to CAN/CGSB-1.126-M91 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .4 Prepare stucco, brick, concrete masonry and concrete surfaces to CGSB 85-GP-31M.
- .5 Prepare concrete floors to CGSB 85-GP-32M. Prepare new concrete floor by acid etching. Rinse with clean water and thoroughly dry.
- .6 Prepare plaster and wallboard surfaces to CGSB 85-GP-33M.

3.7 Surface Preparation -Metal

- .1 Clean new metal surfaces to be painted by: removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with the following:
 - .1 Solvent cleaning: SSPC-SP-1.
 - .2 Hand tool cleaning: SSPC-SP-2.
 - .3 Power tool cleaning: SSPC-SP-3.
 - .4 Commercial blast cleaning: SSPC-SP-6.
 - .5 Brush-off blast cleaning: SSPC-SP-7.
- .2 Clean existing metal surfaces to be repainted by: removing loose, cracked, brittle or non-adherent paint, rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with following:
 - .1 Scrape edges of old paint back to sound material. Where remaining paint is thick and sound, feather exposed edges.
 - .2 Commercial blast clean rusted and bare metal surfaces where existing paint system has failed.
 - .3 Solvent cleaning: SSPC-SP-1.
 - .4 Hand tool cleaning: SSPC-SP-2.
 - .5 Power tool cleaning: SSPC-SP-3.
 - .6 Commercial blast cleaning: SSPC-SP-6.
 - .7 Brush-off blast cleaning: SSPC-SP-7.
- .3 Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air , or vacuum cleaning .
- .4 Touch up shop primer to CGSB 85-GP-10M with primer as specified in applicable section. Touch-up to include cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas.
- .5 Prepare galvanized steel and zinc coated steel surfaces to CGSB 85-GP-16M.
- .6 Prepare copper and copper alloys surfaces to CGSB 85-GP-20M.
- .7 Prepare new steel surfaces exposed normally to dry conditions to CGSB 85-GP-14M.
- .8 Prepare previously painted steel surfaces exposed normally to dry conditions to CGSB 85-GP-15M.
- .9 Prepare steel surfaces exposed to industrial environments to CGSB 85-GP-13M.
- .10 Prepare steel surfaces exposed to water or high humidity levels to CGSB 85-GP-11M CGSB 85-GP-18M .
- .11 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.8 Mixing Paint

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

3.9 Application

- .1 Method of application to be as approved by Consultant. Apply paint by brushroller air sprayer or airless sprayer . Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush application.
 - .1 Work paint into cracks, crevices and corners. Paint surfaces not accessible to brushes by spray, daubers or sheepskins.
 - .2 Brush out runs and sags.
 - .3 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application.
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.
- .5 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between each coat to remove visible defects.
- .8 Finish tops of cupboards, cabinets and projecting ledges, both above and below sight lines as specified for surrounding surfaces.
- .9 Finish inside of cupboards and cabinets as specified for outside surfaces.

- .10 Finish closets and alcoves as specified for adjoining rooms.
- .11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.10 Mechanical Electrical Equipment

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

3.11 Field Quality Control

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

3.12 Restoration

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

PART 1 - GENERAL

1.1 References

- .1 Aluminum Association Designation System for Aluminum Finishes - 1980.
- .2 ASTM A 526/A 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- .3 CAN/CGSB-11.3-M87 Hardboard.
- .4 CGSB 41-GP-30M Wallcoverings, Vinyl-Coated Fabrics.
- .5 CGSB 63-GP-2M-76 Windows, Extruded Aluminum, Vertical and Horizontal Sliding, Medium Duty.
- .6 CSA O121-M1978 (R1998) Douglas Fir Plywood.
- .7 CSA O151-M1978 (R1998) Canadian Softwood Plywood.
- .8 CAN3-O188.1-M78 Interior Mat-Formed Wood Particleboard.
- .9 CAN/CSA-A247-M86 (R1996) Insulating Fibreboard.
- .10 CAN/ULC-S102-M88 Surface Burning Characteristics of Building Materials and Assemblies.

1.2 Requirements of Regulatory Agencies

- .1 Surface burning characteristics of materials: listed and labelled by ULC.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
 - .2 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.
-

PART 2 - PRODUCTS

2.1 Basic Materials

- .1 Laminating adhesive: to manufacturer's standard.
- .2 Joint reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
- .3 Anchor clips, brackets and fasteners: concealed type recommended by manufacturer.

2.2 Tackboard Facings

- .1 Natural cork tackboards: single layer natural cork fine grain sheet, 6 mm thick, natural colour, listed and labelled.
 - .1 Classified as to surface burning characteristics in accordance with CAN/ULC-S102-M88, flame spread 55, smoke developed 55-70, fuel contributed 20.

2.3 Tackboard Core

- .1 Particle board: to CAN3-0188.1, Grade R.

2.4 Tackboard Fabrication

- .1 Fabricate tackboard panels to sizes indicated.
- .2 Factory laminate tackboards, consisting of 6mm cork sheet, with 12mm particleboard core.

2.5 Trim and Framing

- .1 Extruded aluminum: Aluminum Association alloy AA6063-T5. Minimum 1.5 mm wall thickness.
 - .2 Tackboard trim and framing: Architectural School Products Ltd. Series 205 perimeter trim or frame, map rail with cork insert, Series 212 bottom rail with integral chalk trough, of manufacturer's standard sections appropriate for installation conditions. Tackboard trim to match chalkboard trim.
 - .3 Accessories manufacturer's standard:
 - .1 Map hooks: 2 for each lineal 1200mm.
-

2.6 Aluminum Trim Finishes

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Clear anodic finish: designation AA- A31.
- .2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative shall meet requirements of CGSB 63-GP-2M, for coating Classes 1, 2 and 3 respectively.

2.7 Factory Installed Trim

- .1 Install trim on panels in factory. Make mitres and intersecting joints to hair-line fit, free of rough edges with concealed brackets to reinforce and hold joints tight and flush. No other joints permitted unless approved. No exposed fasteners permitted.
- .2 Overlap trim 6 mm onto panels. Provide closed ends for chalktroughs and open-end extrusions.
- .3 Factory fit assemblies too large for shipment to site in one piece, disassemble for delivery and site assembly.

2.8 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 ASP
 - .2 Global

PART 3 - EXECUTION

3.1 Installation

- .1 Install tackboards in accordance with manufacturer's instructions, to provide rigid, secure surface. Mount at height above floor as indicated.
- .2 Install trim and framing around tackboard panels. Make mitres and intersecting joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted. Overlap trim 6 mm onto panels. At existing exterior patterned brick wall in Kindergarten 103, provide spacers as required to accommodate projecting brickwork and provide edge trim to match at visible edges.
- .3 Mechanical attachment:
 - .1 To concrete or solid masonry use lag screw and expansion bolts or screws and fibre plugs as appropriate for stresses involved.
 - .2 To hollow masonry use toggle bolts or equivalent.

.3 To wood or sheet metal use screws. Secure into framing members in stud walls.

3.2 Cleaning

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

PART 1 - GENERAL

1.1 References

- .1 Aluminum Association Designation System for Aluminum Finishes - 1980.
- .2 ASTM A 526/A 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- .3 CAN/CGSB-1.81-M90 Primer, Alkyd, Air Drying for Vehicles and Equipment.
- .4 CAN/CGSB-1.88-92 Enamel, Alkyd, Air Drying and Baking, Gloss.
- .5 CAN/CGSB-1.104-M91 Enamel, Alkyd, Air Drying and Baking, Exterior and Interior, Semigloss.
- .6 CAN/CGSB-12.3-M91 Hardboard.
- .7 CAN/CGSB-34.16-M89 Sheets, Asbestos-Cement, Flat, Fully Compressed.
- .8 CGSB 63-GP-2M-76 Windows, Extruded Aluminum, Vertical and Horizontal Sliding, Medium Duty.
- .9 CSA O121-M1978 (R1998) (R1998) (R1998) (R1998) Douglas Fir Plywood.
- .10 CSA O151-M1978 (R1998) (R1998) (R1998) (R1998) Canadian Softwood Plywood.
- .11 CAN3-O188.1-M78 Interior Mat-Formed Wood Particleboard.
- .12 CAN/CSA-A247-M86 (R1996) (R1996) (R1996) (R1996) Insulating Fibreboard.

1.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01305.
- .2 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.

1.3 Maintenance Data

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01730 - Operation and Maintenance Manual.
- .2 Affix maintenance instruction labels to chalkboards.

PART 2 - PRODUCTS

2.1 Basic Materials

- .1 Laminating adhesive: to manufacturer's standard.
- .2 Joint reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
- .3 Anchor clips, brackets and fasteners: concealed type recommended by chalkboard manufacturer for fixed mounting.

2.2 Whiteboard Facings

- .1 Steel sheet: .8 mm thickness, commercial quality to ASTM A 526/A 526M-90 526M-90 526M-90 526M-90 526M-90, pre-cleaned and treated to ensure maximum adhesion of an acid resistant type B porcelain enamel finish writing surface for erasable markers in accordance with Porcelain Enamel Institute standards for chalkboard PEI. S104.

2.3 Whiteboard Core

- .1 Fibreboard: to CAN/CSA-A247-M86 (R1996), 11.1mm.

2.4 Backing

- .1 0.40 mm single piece stretcher-levelled zinc coated steel.

2.5 Whiteboard Fabrication

- .1 Fabricate whiteboard panels to sizes indicated.
- .2 Factory laminate whiteboards, consisting of
.8 mm thick facing sheet, with 11.1mm core and .4 mm thick backing sheet.
Adhesive in accordance with manufacturers recommendations.
- .3 Make finished panels flat and rigid and fit with joint reinforcement.
- .4 Fit joints between abutting whiteboard panels with joint reinforcement except where covering trim is required.

2.6 Whiteboard Finishes

- .1 Porcelain enamel: to Porcelain Enamel Institute Standards PEI S104 regards durability, smoothness of texture, colour continuity.
 - .1 Surface finish for erasable markers: white gloss colour.
-

2.7 Trim and Framing

- .1 Extruded aluminum: Aluminum Association alloy AA6063-T5. Minimum 1.5 mm thick.
- .2 Whiteboard trim and framing: perimeter trim or frame with coloured vinyl insert, map rail with cork insert, bottom rail with integral chalk trough, panel dividers, movable panel frames, guides, tracks and housing.
- .3 Accessories manufacturer's standard:
 - .1 Map hooks: 2 every 1200 mm oc.

2.8 Aluminum Trim Finishes

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Clear anodic finish: designation AA- A31.
- .2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative shall meet requirements of CGSB 63-GP-2M, for coating Classes 1, 2 and 3 respectively.

2.9 Factory Installed Trim

- .1 Install trim on panels in factory. Make mitres and intersecting joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted.
- .2 Overlap trim 6 mm onto panels. Provide closed ends for chalktroughs and open-end extrusions.
- .3 Factory fit assemblies too large for shipment to site in one piece, disassemble for delivery and site assembly.

2.10 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 ASP
 - .2 Global

PART 3 - EXECUTION

3.1 Installation

- .1 Install whiteboards in accordance with manufacturer's instructions, plumb and level, provide rigid, secure writing surface. Mount with bottom edge at height from floor as indicated. At existing patterned brick wall, provide spacers as required to accommodate projecting brick, and provide aluminum closure trim at visible edges to match chalkboard trim.
- .2 Install trim and framing around chalkboard panels. Make mitres and intersecting joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted. Overlap trim 6 mm onto panels.
- .3 Mechanical attachment:
 - .1 To concrete or solid masonry use lag screw and expansion bolts or screws and fibre plugs as appropriate for stresses involved.
 - .2 To hollow masonry use toggle bolts or equivalent.
 - .3 To wood or sheet metal use screws. Secure into framing members in stud walls.

3.2 Cleaning

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

PART 1 - GENERAL

1.1 Related Work

- .1 Section 10800 Toilet, Bath and Laundry Accessories.

1.2 References

- .1 ASTM A167-90 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM A526M-90 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- .3 CAN/CGSB-1.81-M90 Primer, Alkyd, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
- .4 CGSB 1-GP-88M-83 Enamel, Alkyd, Air Drying and Baking, Gloss.
- .5 CGSB 1-GP-104Ma-83 Enamel, Alkyd, Air Drying and Baking, Exterior and Interior, Semigloss.
- .6 CAN/CSA-B651-M90 Barrier-Free Design.

1.3 Samples

- .1 Submit samples in accordance with Section 01300.
- .2 Submit duplicate 300 x 300 mm samples of panel showing finished edge and corner construction and core construction.
- .3 Submit duplicate representative samples of each hardware item, including brackets, fastenings and trim.

1.4 Shop Drawings

- .1 Submit shop drawing in accordance with Section 01300.
 - .2 Indicate fabrication details, plans, elevations, hardware, and installation details.
-

PART 2 - PRODUCTS

2.1 Materials

- .1 Metal toilet partitions.
 - .1 Acceptable material: Pre-finished powder coated enamelled steel floor and wall mounted, Hadrian, GS, Shanahan, or equal.
- .2 Sheet steel: commercial quality to ASTM A526M with ZF001 designation zinc coating.
- .3 Minimum base steel thickness:
 - .1 Panels and doors: 0.8 mm.
 - .2 Pilasters: 1.0 mm.
 - .3 Reinforcement: 3.0 mm.
- .4 Stainless steel sheet metal: to ASTM A167, Type 304, satin finish.
- .5 Pilaster ceiling trim: 0.8 mm stainless steel chrome plated non-ferrous, 75 mm high.
- .6 Attachment: stainless steel brackets and tamperproof type screws and bolts.

2.2 Components

- .1 Hinges:
 - .1 Heavy duty, non-lubricating nylon bushings.
 - .2 Material/finish: stainless steel casting.
 - .3 Swing: inward and outward as shown.
 - .4 Return movement: gravity, non-rising.
 - .5 Adjustable door-open angle.
 - .6 Emergency access feature.
- .2 Latch set: surface mounted, combination latch, door-stop, keeper and bumper, stainless steel.
- .3 Wall and connecting brackets: stainless steel extrusion or casting.
- .4 Coat hook: combination hook and rubber door bumper, stainless steel.
- .5 Door pull: Barrier-free type suited for outswinging doors, stainless steel.

2.3 Fabrication

- .1 Doors, panels and screens: 25 mm thick, two steel sheets faces pressure bonded to honeycomb core, min. 600mm wide x 1200mm high mounted 150mm above finished floor or sizes shown on drawings.
- .2 Pilasters: 32 mm thick, constructed same as door, 200mm wide x 1350mm or as shown on drawings.

- .3 Provide formed and closed edges for doors, panels and pilasters. Miter and weld corners and grind smooth.
- .4 Provide internal reinforcement at areas of attached hardware and fittings. Temporarily mark location of reinforcement for tissue holders and grab bars.
- .5 Provide 0.8 mm thick type 430 stainless steel protective shields on urinal side of toilet partition panels next to urinals and on urinal screens. Make protective shields 1000 mm high with top of shield 1200 mm above finished floor. Make shields to full width of partition or screen panel. Fasten with stainless steel screws.

2.4 Finishes

- .1 Clean, degrease and neutralize steel components with phosphate or chromate treatment.
- .2 Spray apply primer to CAN/CGSB-1.81, 1 coat.
- .3 Spray apply finish enamel to CGSB 1-GP-88M, type 2 gloss CGSB 1-GP-104Ma, Type 2, semi-gloss, 2 coats and bake to smooth, hard finish 0.025 mm thick.
- .4 Finish: doors and pilaster/panels same colour as selected from manufacturer's custom colours, total one colours for project.

PART 3 - EXECUTION

3.1 Installation

- .1 Ensure supplementary anchorage, if required, is in place.
- .2 Do work in accordance with CAN/CSA-B651.

3.2 Erection

- .1 Partition erection.
 - .1 Install partitions secure, plumb and square.
 - .2 Leave 12 mm space between wall and panel or end pilaster.
 - .3 Anchor mounting brackets to masonry/concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors, to steel supports with bolts in threaded holes.
 - .4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.
 - .5 Provide for adjustment of ceiling variations with screw jack through steel saddles made integral with pilaster. Conceal ceiling fixings with stainless steel shoes.
 - .6 Provide templates for locating threaded studs through finished ceilings.
 - .7 Equip each door with hinges, latch set, and each stall with coat hook mounted on partition wall, mounting heights 4'. Adjust and align hardware for easy, proper function. Set door open position at full open. Install door bumper door mounting.

- .8 Equip outswinging doors with door pulls on inside and outside of door in accordance with CAN/CSA-B651.
- .9 Install hardware grab bars.
- .2 Floor supported and overhead braced partition erection.
 - .1 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device.
 - .1 Secure pilaster shoes in position.
 - .2 Secure headrail to pilaster face with not less than two fasteners per face.
 - .3 Set tops of doors parallel with overhead brace when doors are in closed position.
 - .2 Floor supported partition erection.
 - .1 Secure pilasters to floor with pilaster supports anchored with minimum 50 mm penetration in structural floor.
 - .2 Level, plumb and tighten installation with levelling device.
 - .3 Secure pilaster shoes in position.
 - .4 Set tops of doors level with tops of pilasters when doors are in closed position.
- .3 Screens erection.
 - .1 Provide urinal stall screens consisting of panel, pilaster and headrail as specified for toilet compartments as indicated.
 - .2 Anchor screen panels to walls with 3 panel brackets and vertical upright consisting of tubular headrail stock and end sockets, anchored to ceiling.
 - .3 Secure to supplementary anchorage above ceiling finish to receive screen vertical upright.

3.3 ADJUSTING

- .1 Adjust doors and locks for optimum, smooth operating condition.
- .2 Lubricate hardware and other moving parts.

3.4 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
- .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .4 Clean and polish hardware and stainless components.
- .5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

PART 1 – GENERAL

1.1 SUMMARY

.1 WORK INCLUDES

- .1 The products indicated on the Bid Form are current requirements of the Board. The Board, at its discretion, may require the successful bidder to add and/or delete and/or change products during the term of the award. The Board expects the successful bidder to be proactive in bringing new and more cost effective products to the attention of the Board.
- .2 All products to be shipped FOB Destination to any Simcoe Muskoka Catholic District School Board site in the Simcoe Muskoka Region. Successful bidder to provide off-load and positioning services. Any base or ramp requirements will be by SMCDSB.

1.2 REFERENCE

- .1 Drawing designations: "Pre- Fabricated Storage Unit" refer to Drawing SP3 Detail 9. Refer to Drawing SP1.

1.3 SUBMITTAL

- .1 Submit shop drawings in accordance with Section 01305.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01300 Submittals.

1.5 GUARANTEE

- .1 Submit a written Guarantee to the Board, that all work of this Tender shall be free from defects in workmanship and material for a minimum period of one (1) year from date of approved completion.
- .2 All defects (excluding vandalism) in materials and workmanship that become apparent during Guarantee period shall made good or material replaced at no cost to the Board.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging material at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Divert unused metal material from landfill to metal recycling facility as approved by Consultant.
- .5 Unused paint or coating material must be disposed of at an official hazardous material collection site as approved by Consultant.
- .6 Fold up metal banding, flatten and place in designated area for recycling.
- .7 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

1.7 LOCATION

- .1 Provide one (1) unit. Refer to Site Plan Drawing SP1.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- .1 Anchor Concrete Products LTD.”
1645 Sydenham Road,
Kingston, Ontario
Phone: (800)2230012

2.2 MATERIALS

- .1 Prefabricated Storage unit as manufactured by
“Anchor Concrete Products LTD.” Or equal. Submit shop drawings.
- .2 Walls, roof and base reinforced in accordance with CSA G30.18 (all rebar has 30mm cover).
- .3 Concrete: 35mpa @28 days, 5-7% air Vent. As per CSA A23.4-00.

Cast-in 16 gauge painted steel door frame.

Total roof load 5.9 kpa (min)

Max wind load 0.6 kpa

Total floor load 6.9 kpa

- .4 Dimensions (approximate size):
Width 3038mm x depth 3048mm
Door opening 1828mm x 2032mm
Overall height 2578mm
- .5 Finish:
Exposed aggregate (natural stone finish)
No joints between walls or between wall and roof for superior weather protection.
Delivered and placed as one piece (no site assembly required).
Seal between walls and base is a maintenance free butyl mastic sealant.
2 vents cast-in.
- .6 Doors and Hardware:
(2) 914x2032x44 thick hollow metal doors.
16 gauge steel with zinc base coat and exterior finish coat.
Spot welded edges and interior steel stiffeners for improved vandal resistance.
Three vandal-resistant hinges per door. Each door has a steel top cap and aluminum and fiber door sweep.
High quality deadbolt Schlage lock, 83t7k-stk-626 standard or equivalent
Each door has a spring softened chain check.
Non-active door has top & bottom pad bolts.
Aluminum drip edge (above doors).

PART 3 – EXECUTION

3.1 INSTALLATION

- .1 Provide prefabricated storage bunker on concrete slab in accordance with Architectural Drawing SP3 Detail 9
- .2 For concrete or asphalt surface: Bearing pad to be provided if leveling is required.

.3 Comply manufacturer`s installation instructions and approved shop drawings.

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1.0 Intent

- 1.1 The following specification is to give details of the interior door signage. No attempt is being made to discuss each piece of hardware, trim, or screw. Provide door sign at each door.

2.0 General Requirements

- 2.1 Work under this contract involves the supply and installation of the Room No. Sign, Room Name Sign, Pictographs and Handicapped Pictographs as indicated on the enclosed directories. Arch. Door No. is provided for reference only in locating the appropriate door for the installation of the sign.
- 2.2 Examine carefully all drawings and specifications to ensure that work can be satisfactorily carried out as shown before commencing work.

3.0 Products

- 3.1 Sizes shall be as follows:

.1	Single Line Designation	50mm high x 300mm long
.2	Two Line Designation	75mm high x 300mm long
.3	Room Number Only	50mm high x 150mm long
.4	Handicap Symbol	100mm high x 100mm long
.5	Male or Female Pictograph	100mm high x 50mm long
.6	Male/Female Pictograph	100mm high x 100mm long

- 3.2 Sign material shall be 3.2mm thick matte finish translucent acrylic sheet with 45 degree bevel edges. All routing shall be on the reverse side with paint fill. Colour of the acrylic sheet and paint shall be premium grade as selected by the Owner, one colour for the acrylic sheet and one colour for the paint (including letters, numbers, and border line).
- 3.3 Letters and numbers shall be 15mm high Helvetica Medium, upper case, routed on reverse side and filled with paint. Letters and numbers shall be centred within sign length and height.
- 3.4 Borderlines shall be routed on reverse side 1.5mm wide and filled with paint.
- 3.5 Pictographs and handicap symbol shall be same construction as name and number plates.
- 3.6 Screw holes shall be countersunk to accept screw heads.
- 3.7 Screws shall be #8 x 3/4" stainless steel with tamperproof heads. Supply plastic plugs for screws where necessary in masonry or gypsum board.
- 3.8 Braille:
- .1 Relief etc grade Braille into 3mm thick matte finish clear plexiglass cover sheets to be mounted over the General Office signage and M/F and Barrier Free Pictographs.
- .2 Braille work to CSA and OBO standards. Braille to be located in the bottom left of the cover sheet.sheet.

4.0 Samples

- 4.1 Submit sample of one room name sign, room number sign, pictograph and handicap symbol in selected colours to the Owner for approval prior to manufacture of remaining signs.

5.0 Installation

5.1 Install signs in locations as indicated using screws and double sided tape.

6.0 Additional Signs

The contractor is to allow in his price for the supply and installation of 12 additional signs averaging 10 characters long as directed by the school following the occupancy.

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 ASTM A 490M-00, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints.
- .2 ASTM A 526/A 526M-90 for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- .3 CAN/CGSB-1.81-M90 Drying and Baking Alkyd Primer for Vehicles and Equipment.
- .4 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
- .5 CGSB 31-GP-107Ma Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .6 CGSB 44-GP-7, Shelving, Steel, Modular.
- .7 CSA G40.21-98, Structural Quality Steels.
- .8 CSA W59-M1989 (R2001), Welded Steel Construction (Metal Arc Welding).

1.2 Design Requirements

- .1 Design and construct metal storage shelving to support uniform load of 500 lb per 48 inches of span and to support maximum load of 2000 lb per bay.
- .2 Design shelving to accommodate vertical adjustment of shelves in 50 mm increments and to permit easy assembly, expansion, dismantling and re-use of shelving component parts.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01305 - Shop Drawings.
- .2 Indicate shelving layouts, number of bays, number of shelves, number and size of drawers, bins, number of dividers, system of bracing and anchoring devices.

1.4 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
 - .2 Submit representative sample bay of specified shelving showing finish colour and including accessories.
-

1.5 Extra Materials

- .1 Provide spare shelves and end panels components for maintenance use. Store where directed. Identify each box.
- .2 Provide tools for assembly and disassembly, standard with metal storage shelving manufacturer.

PART 2 - PRODUCTS

2.1 Materials

- .1 Galvanized steel sheet: commercial grade to ASTM A 526/A 526M-90 with Z275 zinc coating.
- .2 Steel sections and plates: to CSA G40.21-98, Type 400W.
- .3 Steel bolts, nuts and washers: to ASTM A 490M-00.
- .4 Welding materials: to CSA W59-1989 (R2001).
- .5 Sheet aluminum: mill finish plain embossed pattern utility sheet.
- .6 Aluminum sections and plates: Aluminum Association alloy AA6063-T5.
- .7 Aluminum bolts, nuts and washers: Aluminum Association alloy AA6061-T6.

2.2 Shelving

- .1 Storage shelving: CGSB 44-GP-7, Type 2.

2.3 Components

- .1 Uprights: roll formed steel angles or tees with perforations to accommodate shelves and other components. Size and thickness of angles or tees shall support specified total load.
 - .2 Shelves: brake formed sheet metal, reinforced to carry specified loads. Punch holes in shelves to accommodate dividers and other components.
 - .3 Kickplates: formed sheet metal to close opening between bottom shelf and floor on front and on sides of shelving bay.
 - .4 Back: 0.6 mm core thickness steel sheet to enclose shelving bay extending from bottom shelf to top shelf.
 - .5 Side panels: 0.6 mm core thickness steel sheet panels to close ends of shelving bays or sections and as partitions between adjacent bays.
-

- .6 Dividers: reinforced sheet metal plates for subdividing shelves into bins. Provide for attachment of dividers to shelves immediately above and below dividers.
- .7 Bin fronts: formed sheet metal, attached to front edge of shelf to prevent small parts from falling over edge of shelf.
- .8 Gusset plates: heavy gauge metal plates to reinforce corner connections of shelving components.
- .9 Braces: provide sway braces for open type shelving. Use side sway braces on two exposed sides of each rack and at alternate bays. Use back sway braces on two end sections of each bank and on alternate bays.
- .10 Label holders: attachable to front edge of shelf with provision to hold paper or plastic label.
- .11 Drawers: of sizes indicated, complete with pull hardware, dividers and label holders.
- .12 Base plates: metal or plastic plates to take uprights and to protect floor surfaces.

2.4 Finish

- .1 Finish shelving system colour as specified by Consultant.
- .2 Condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma.
- .3 Apply one coat type 2 primer to CAN/CGSB-1.81-M90 and bake.
- .4 Apply two coats of type 2 enamel to CAN/CGSB-1.88-92 and bake to hard durable finish.
- .5 Manufacturers or brand names on face of units are not acceptable.

2.5 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 EZ Rect
 - .2 North American Steel
 - .3 Redirack
 - .4 Triple A

PART 3 - EXECUTION

3.1 Installation

- .1 Do metal storage shelving work in accordance with CGSB 44-GP-7 except where specified otherwise.
- .2 Install metal storage shelving in accordance with reviewed layout.
- .3 Brace, secure and anchor shelving units in place.
- .4 Make good baked enamel surfaces damaged during shipment or installation.

PART1 - GENERAL

1.1 Shop Drawings

- .1 Submit shop drawings or catalogue illustrations in accordance with Section 01300.
- .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

PART 2 - PRODUCTS

1.2 Materials

- .1 Sheet steel: commercial quality to ASTM A 526/A 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 526M-90 80 with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A 167-99, Type 304, with polished finish.
- .3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

1.3 Finishes

- .1 Chrome and nickel plating: to ASTM B 456-95 polished finish.
- .2 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma, apply one coat Type 2 primer to CAN/CGSB-1.81-M90 and bake, apply two coats Type 2 enamel to CAN/CGSB-1.88-92 and bake to hard, durable finish. Sand between final coats. Colour selected from custom range by Consultant.
- .3 Manufacturer's or brand names on face of units not acceptable.

1.4 Fixtures

- .1 Toilet tissue dispenser: Frost F-150 or equal.
- .2 Soap dispenser: Frost F-708A or equal supplied by Owner.
- .3 Grab Bars: 38mm stainless steel satin finish with peened gripping surface and concealed mounting. Straight 600mm Bar: Frost F-1001D-24P or equal with concealed mounting. L Shape: Frost F-L1003-30X30 DP or equal. Configuration as shown on drawings.

- .4 Flip up/ Swing up Safety Rail: Frost 1055-FTS or equal.
- .4 Mirrors: to CAN/CGSB-12.5-M86, 6mm thick, heavy galvanized steel back, stainless steel frame with mitred corners and tamperproof tilted mounting. Guaranteed against silver spoilage for 5 years. Frost F974FT series or equal, one per sink.
- .5 Washroom accessories of the same materials, construction and finishes, similar in function, design, appearance and conforming to the standards of those specified, manufactured by the following may be considered equal:
 - .1 Bobrick
 - .2 Bradley
 - .3 Frost
 - .4 Twin-Cee
 - .5 Watrous

1.5 Fabrication

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164-M92 (R1998) (R1998) (R1998) (R1998) (R1998) M1981.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

1.6 Acceptable Manufacturers:

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 Bobrick
 - .2 Bradley
 - .3 Frost
 - .4 ASI Watrous

PART 3 - EXECUTION

1.7 Installation

- .1 Install and secure accessories rigidly in place as follows:
 - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
 - .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
 - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
- .2 Use tamper proof screws/bolts for fasteners.
- .3 Fill units with necessary supplies shortly before final acceptance of building.
- .4 Provide di-electric separation at dissimilar metals in accordance with manufacturer's specifications.

1.8 Location and Quantity

- .1 Locate accessories where indicated and as follows. Exact locations determined by Consultant.
- .2 Paper towel dispenser:
 - .1 one per two sinks, one per sink minimum, and
- .3 Toilet tissue dispenser: one in each toilet compartment.
- .4 Soap dispenser:
 - .1 one per two sinks, one per sink minimum, and
- .5 Mirrors:
 - .1 One per sink 460mm x 610mm.
- .6 Grab bars:
 - .1 Locate as shown on drawings.
- .7 Flip up/ Swing up Safety Rail:
 - .1 Locate as shown on drawings.

PART 1 - GENERAL

1.1 References

- .1 Aluminum Association Designation System for Aluminum Finishes - 1980.
- .2 ASTM A 526/A 526M-90 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- .3 CAN/CGSB-1.81-M90 Primer, Alkyd, Air Drying for Vehicles and Equipment.
- .4 CAN/CGSB-1.88-92 Enamel, Alkyd, Air Drying and Baking, Gloss.
- .5 CAN/CGSB-1.104-M91 Enamel, Alkyd, Air Drying and Baking, Exterior and Interior, Semigloss.

1.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01305 - Shop Drawings.
- .2 Indicate location, type, size, arrangement, hardware, anchor or mounting details, and accessories.

1.3 Maintenance Data

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01730 - Operation and Maintenance Manual.
- .2 Affix maintenance instruction labels to chalkboards.

PART 2 - PRODUCTS

2.1 Coat Rack

- .1 Coat rack system Series 1000 Model STL 1001 as manufactured by Architectural School Products Ltd. or equal.
 - .1 Shelf: coat rack to consist of four 19mm O.D. square 18 gauge steel tubes closed and protected with form fitting black plastic end caps.
 - .2 Brackets: two-piece heavy duty die cast aluminum designed with an integral backplate that provides a sure grip fastening. All screw fastenings shall colour match bracket finish.
 - .3 Dovetail: mounting shall be heavy gauge extruded aluminum engineered for a slide fitting vertical adjustment of one full shelf with length to suit applicable model. Spacing as per manufacturer's standard but shall not exceed 1000mm.
 - .4 Finish: for shelf tubes, brackets and dovetail is durable electorstatically applied Duracron in manufacturer's standard colour green.

.5 Coat Hooks: Manufacturer's standard double prong molded ABS high-impact plastic formed to be non-turning, positive gripping and adjustable. Colour to be grey. Hooks to be arranged on second and fourth tubes of coat rack spaced 200mm and staggered.

- .2 Anchor clips, brackets and fasteners: concealed type recommended by manufacturer for fixed mounting.

PART 3 - EXECUTION

3.1 Installation

- .1 Install coat racks in accordance with manufacturer's instructions, plumb and level.

3.2 Cleaning

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

PART 1 - GENERAL

1.1 References

- .1 ASTM A 307-02, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- .2 ASTM 325M-92a, Specification for High-Strength Bolts for Structural Steel Joints Metric.
- .3 ASTM A 446/A 446M-93, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- .4 ASTM 490M-92a, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .5 ASTM 792-89, Specification for Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .6 CSSBI 30 M Standard for Steel Building Systems.
- .7 CSSBI Bulletin No. 7-1982, Snow Load Design Criteria for Steel Building Systems.
- .8 CSSBI Bulletin No. 9-1983, Care and Maintenance of Prefinished Sheet Steel Building Products.
- .9 CSA G40.21-98, Structural Quality Steels.
- .10 CAN/CSA-G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .11 CSA S16.01, Limit States Design of Steel Structures.
- .12 CAN/CGSB-1.40-M89, Primer, Structural Steel, Oil Alkyd Type.
- .13 CGSB 41-GP-6M, Sheets, Thermosetting Polyester Plastics, Glass Fiber Reinforced.
- .14 CAN/CGSB-93.3-M91, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.

1.2 System Description

- .15 Type: beam and column.
- .16 Roof slope: minimum 1:3.
- .17 Wall system: none.
- .18 Roof system: standing seam or lapped seam panels.

1.3 Design Requirements

- .19 Design steel building system to withstand dead loads and live loads.
- .20 Maximum deflection:
 - .1 Roof cladding under full design load: 1/180 of clear span.
- .21 Design building roof to allow for thermal movement of component materials caused by ambient temperature range of -20 to 40 °C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .22 Roof shall be weathertight.
- .23 Provide for positive drainage to limits of assembly and water entering at joints.
- .24 Design building elements to accommodate, by means of expansion joints, any movement in element itself and between element and building structure caused by structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, water penetration or glass breakage.

1.4 Source Quality Control

- .25 Provide certification from steel building systems manufacturer that erector is qualified to erect system.

1.5 Shop Drawings

- .26 Submit shop drawing in accordance with Section 01300 - Submittals.
- .27 Submit shop drawings bearing stamp and signature of professional engineer registered in Province of Ontario.
- .28 Submit the following documents in accordance with CSSBI 30 M para 13:
 - .1 Erection drawings showing foundation loads, anchor bolt setting details part numbers, connections and assembly details.
- .29 Indicate plans and grid lines, structural members and connection details, bearing and anchorage details, roof cladding, framed openings, accessories, schedule of materials and finishes, camber, loads and reaction forces, fasteners and welds, sealant locations and details.
- .30 Indicate shop and erection details including cuts, copes, connections, holes, threaded fasteners, rivets and welds. Indicate welds by CSA welding symbols.

1.6 Certificates

- .31 Submit following documents in accordance with CSSBI 30 M para 14:
 - .1 Certification that building is in accordance with contract requirements.
 - .2 Structural analysis certification of building system.
 - .3 Certification stating design criteria used and loads assumed in design and placing sole responsibility for design of building components with steel building systems manufacturer.

1.7 Storage and Protection

- .32 Protect prefinished steel sheet during fabrication, transportation, site storage and installation in accordance with CSSBI Bulletin No. 9.
- .33 Handle and protect galvanized materials from damage to zinc coating. During storage space surfaces of galvanized materials to permit free circulation of air.

PART 2 - PRODUCTS

2.1 Materials

- .1 Pre-fabricated pre-finished steel structure to be square 4 sided hip roof with 4 columns min. 3600mm x 3600mm x 2400mm minimum clearance height as manufactured by

Poligon Open Air Structures or equal.

- .2 Structural steel: to CSA G40.21-98, pre-finished or shop primed and painted min. 2 coats.
- .3 Bolts: to ASTM A 307-02 or ASTM A 325M-00 or ASTM A 490M-00 as applicable complete with nuts and washers.
- .4 Welding materials: to CSA W59-1989 (R2001).
- .5 Shop primer paint: to CAN/CGSB-1.40-97.
- .6 Prefinished steel with factory applied polyvinylidene fluoride.
- .1 Class F2S .
- .2 Colour selected by Consultant from manufacturer's standard range .
- .7 Screws: corrosion resistant purpose made, head colour to match attached sheet.
- .8 Plastic sealants and adhesives as recommended by plastics manufacturer.
- .9 Insulation and tape: as recommended by steel building systems manufacturer.
- .10 Insulation adhesive: purpose made for insulation type and steel liner sheet, incombustible after initial set.
- .11 Vapour barrier and sealing tape: as recommended by steel building systems manufacturer.
- .12 Sealants: in accordance with Section 07900 - Joint Sealers and as recommended by sealant manufacturer.

2.2 Fabrication

- .13 Fabricate structural members in accordance with shop drawings and to CSA S16.01. Tolerance not to exceed those specified in CSSBI 30 M.
- .14 Provide holes for attachment of other work, as indicated.
- .15 Reinforce openings to maintain design strength.

2.3 Components

- .16 Roof System
- .1 Exterior sheet-roof: factory preformed steel sheet prefinished from manufacturer's standard

- profiles. Include closures, gaskets, caulking, flashing and fasteners to effect weathertight installation. Cut ends of sheets square and clean.
- .2 Accessories to roof cladding: brake or bend to shape, of material and finish to match roof cladding or wall cladding where applicable, comprising cap flashings drip flashings coping and closures for corners, fascia and soffit.
 - .3 Sub-purlins and clips: factory preformed steel sheet minimum 2 mm base metal thickness, pre-finished to match roof panels.
 - .4 Diagonal web members: factory preformed steel sheet, minimum 2 mm base metal thickness, pre-finished to match roof panels formed to profile from manufacturer's standard.
 - .5 Gussets, lateral spacers: factory preformed steel sheet, minimum 2 mm base metal thickness, pre-finished to match roof panels shop cut and formed to profile from manufacturer's standard.
- .17 Valley gutters
- .1 Form valley gutters from material and finish to match roof cladding material to size and profile with outlets as indicated. Provide:
 - .1 Support straps and fastenings,
 - .2 Flute fillers and sealants,
 - .3 Leaf screens and dams for outlets.
 - .4 Snow guards, if required for safety at access and exit doors.

2.4 Finishes

- .18 Prefinished steel with factory applied polyvinylidene fluoride.
 - .1 Class F2S.
 - .2 Colour selected by Consultant from manufacturer's standard range.
 - .3 Coating thickness: not less than 22 micrometres.
 - .4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D 822-01 as follows:
 - .1 Outdoor exposure period 5000 hours.
 - .2 Humidity resistance exposure period 5000 hours.
-
- .19 Prefinished steel with factory applied polyvinyl chloride.
 - .1 Class F1S F2S.
 - .2 colour selected by Engineer Consultant from manufacturer's standard range.
 - .3 Specular gloss: 30 units +/- 5 in accordance with ASTM D 523-89(1999).
 - .4 Coating thickness: not less than 200 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and

erosion rate less than 20 % to ASTM D 822-01 as follows:

- .1 Outdoor exposure period 5000 hours.
- .2 Humidity resistance exposure period 5000 hours.

PART 3 - EXECUTION

3.1 Erection

- .1 Do work in accordance with CSSBI Standard for Steel Building Systems 30 M except where specified otherwise.
- .2 Erect structural frame in accordance with shop drawings and to CSA S16.01. Erection tolerances not to exceed those specified in CSSBI 30 M.
- .3 Prepare galvanized structural steel surfaces for field welding by removing zinc before welding. After welding, chip away flux and prime with CGSB 1-GP-178-Ma.
- .4 Obtain written permission of Engineer Consultant prior to field cutting or altering of structural members.
- .5 Touch up with shop primer bolts, rivets, welds and burned or scratched surfaces where exposed at completion of erection.
- .6 Install wall cladding assemblies ensuring a completed installation.
- .7 Secure sub-girts to structural wall supports.
- .8 Secure roof cladding sheets to structural purlins beams. Terminate sheet ends over structural supports.
- .9 Secure side laps.
- .10 Continuously seal end and side laps.
- .11 Install roof assemblies ensuring a completed installation.
- .12 Install all necessary closures, gaskets, caulking sealants and flashings.
- .13 For roof system, ensure continuous vapour air dust-proof barrier seal by pre-caulking joints of ceiling panel.

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List of Acceptable Manufacturer

Spec. Reference Section	Equipment	Base Bid	Acceptable Alternate Manufacturer
15080	Duct Insulation	Knauf	Johns Manville Owens Corning Manson Alley
15080	Pipe Insulation	Knauf	Johns Manville Owens Corning Manson Alley
15115	Heating water chemical treatment system	Chem-Aqua	GE infra Structure Finnan Eng. Product
15120	Thermometer / Pressure Gauges	H.O. Trerice	Wiess Winters
15140	Back Flow Preventer	Watts	Bruckmann Honeywell
15140	Vacuum Breakers	Watts	Apollo
15140	Double Check Valve Assemblies	Watts	Apollo
15140	Non Freeze Wall hydrant	Zurn	Watts Enpoco
15150	Drainage Specialities	Zurn	J.R. Smith Ancon Watts
15150	Automatic Trap Seal Primer	PPP	Mifab Smith

15150	Grease Interceptor	Watts	Mifab Zurn
15184	Automatic Air vent	Taco	Spirax Sarco Maidomist
15184	Circuit Balancing Valves	Armstrong	Bell & Gossett Tour & Anderson
15184	Expansion Tanks	Amtrol	Armstrong Bell & Gossett Taco
15184	Air Separator	Amtrol	Armstrong Bell & Gossett Taco
15188	Glycol Freeze Protection System	Armstrong	Bell & Gossett
15301	Portable Fire Extinguisher	National Fire Equipment	Flag Pyrene
15301	Fire Extinguisher Cabinets	Wilson and Cousins	National
15410	Water Closets	American Standard	Crane
15410	Sinks	Franke	Kindred Elkay
15410	Lavatories	American Standard	Crane
15410	Faucet	Chicago Faucet	Delta Sloan Crane

15410	Eyewash	Guardian	Bradley Haws
15410	Thermostatic Mixing Valves	Lawler	Symmons Powers
15140	Mop Sink	Stern Williams	Zurn
15140	Fixture Carrier	Watts	Smith
15450	Pumps	Bell & Gossett	Grundfos Taco
15480	Plumbing Water Heater	Rheem Rudd	Lochinvar PVI
15501	Boiler	Weis McClain	De-Dietrich Viessmann
15730	Rooftop Unit	Johnson Controls	Carrier
15730	Energy Recovery Ventilator	Renewaire	Greenheck Venmar CES
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15730	Radiant Ceiling Panels	Airtex	Sterling hydronics Rosemex
15750	Radiant Ceiling Panels	Airtex	Sterling hydronics Rosemex
15760	Hydronic Cabinet Unit Heaters	Airtex	Sterling hydronics Rosemex
15770	Hydronic Wall	Airtex	Sterling hydronics

	Fins		Rosemex
15820	Flexible Duct Connection	Duro-Dyne	Ventfabrics Dynair
15820	Duct Dampers	Nailor	EH Price Titus
15820	Fire Damper	Nailor	EH Price Ruskin
15820	Acoustic Treatment of duct	John Manville	Knauf Manson
15830	Exhaust Fans	Greenheck	Penn-Barry Jenn
15840	Kitchen Exhaust Hood	Broan	Nutone
15840	Kitchen Hood Fire Suppression System	Guardian	
15850	Grilles and Diffusers	EH Price	Nailor Titus Krueger
15991	TAB Contractor	Damper Air Balancing inc.	Designtest & Balance Co. Ltd.
17800	Building Automation System Contractor	Johnson Controls Inc.	

1. **General**

(a) Scope of work

- (i) This section is intended to provide basic identification of the work, for the Contractor to determine upfront, the nature of the work involved in this Contract. In no way shall this article be interpreted as being a full representation of the work of this Contract.
- (ii) It is the Contractor's sole responsibility to examine all of the Commercial Documents, Specifications and Drawings issued.
- (iii) The work involves the following:
 - (A) Mechanical building systems for the subject building including provision of:
 - (I) Complete plumbing and drainage system as shown on the Drawings and as specified herein including all plumbing equipment, fixtures, fittings, piping, etc.
 - (II) Modification of the existing wet type sprinkler system as indicated on the drawings and as required per NFPA 13.
 - (III) Provision of a fire suppression system for the kitchen hood, as indicated on the drawings and as required per NFPA 96.
 - (IV) Provision of fire extinguishers as indicated on the drawings and as required per NFPA 10.
 - (V) Complete HVAC systems as shown on the Drawings and specified herein including HVAC systems, ductwork, exhaust fans, louvers, grilles and diffusers, etc.
 - (VI) Complete hydronic heating system as shown on the Drawings and as specified herein including glycol system, Boilers piping, pumps, controls and accessories.
 - (VII) Modifications to the existing Building Automation System (BAS) as shown on the Drawings and specified herein including all equipment, devices programming, wiring, conduits, transformers, relays etc.
 - (VIII) Provision of an engineered seismic restraint system for mechanical equipment and accessories.
 - (IX) Performance testing and balancing of all mechanical and related systems.
 - (X) Cutting, excavation, backfilling, compaction, patching and painting as required.
 - (XI) Detailed and timely communication and coordination with all other related trades to meet the intent of the design and to minimize risk of interferences and address any obvious ambiguities in the design documentation.

(b) Quality Assurance Programme (QAP)

- (i) Contractor shall follow the detailed QAP of the school board. The QAP includes:

- (A) Regular construction meetings,
 - (B) Inspection of rough-ins.
 - (C) Construction of mock-up for each mechanical system (HVAC, plumbing and Drainage and Fire protection system). The school board reserve the right to select the mock –up location. A 48 hours notice period is required by the school board after inspection request is made by contractor. Typical examples of mocks-up are as follows
 - (I) HVAC mock-up: Installation of 1 VAV box and associated ducts and air terminal devices.
 - (II) Plumbing mock-up: Typical connections for each type of fixtures.
 - (III) Fire protection: Installation of typical sprinkler piping and sprinkler head.
 - (IV) Typical piping, pipe fittings and Insulation mock-up.
 - (D) For mock-up's of mechanical system installed above ceiling, General/Mechanical contractor shall in no circumstance put the ceiling in position, without the review and acceptance of mock-up by the school board.
- (c) Scheduling of the work
 - (i) Contractor shall prepare a detailed construction schedule of work within 5 days from issuance of Letter of Award.
 - (ii) Construction schedule shall include the QAP timelines including mock-up construction date, mock-up review date and deficiency rectification timelines.
 - (iii) Co-ordinate all mechanical work with the work of other trades, and schedule and complete the work as required coinciding with the completion date established for the Project.
- (d) Codes, Regulations and Standards
 - (i) Comply with Municipal or Provincial Codes, Rules and Regulations and/or Authorities having jurisdiction, including TSSA.
 - (ii) Revisions issue: latest version as amended to date.
- (e) Permits, Certificates, Equipment Registration and Fees
 - (i) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA, local utility companies and municipalities.
 - (ii) Upon substantial completion of work, supply and turn over to the Consultant all required inspection certificates from governing authorities to certify that the work as installed conforms to the rules and regulations of the governing authorities.

- (iii) Permits
 - (A) Obtain permits required for the installation of mechanical trades work including:
 - (I) HVAC & Plumbing inspection
 - (II) Electrical inspection
 - (III) TSSA inspection
 - (B) Arrange for inspections and tests and pay all fees and costs for the permits, inspections and tests. Obtain permits immediately after notification of award of Contract.
 - (C) Obtain copies of Drawings from the Consultant for submission with application for permits.
- (iv) Material approvals
 - (A) Obtain special inspection and approvals by CSA and/or local authorities, for materials and equipment where required or as specified.
 - (B) Obtain such approval for the particular installation with the co-operation of the material supplier.
- (f) Working Drawings and Documents
 - (i) Design Drawing Intent
 - (A) The design Drawings are schematic in arrangement, and describe the general design intent but do not show the exact details for the installation. They are not fabrication or installation Drawings.
 - (B) The overall scope of work is suitably outlined on the Drawings with regard to sizes, locations, general arrangements and installation details, and has been generally coordinated for routing of services. The routing of ductwork, piping and equipment arrangement are shown more or less in diagrammatic form except where in certain cases the Drawings may include details giving the exact locations and arrangements required.
 - (C) The location of equipment, and the associated arrangement of piping, ductwork, and other material describes the general requirements of the work. Final location is dependent on the actual equipment supplied. The Consultant reserves the right to make reasonable adjustment of up to 1 m to the location of equipment, floor drains, routing of major piping and ductwork, at no additional cost to the Owner.
 - (D) In order to provide clarity to the arrangement of the work, not all details including valves, thermometers, pressure gauges, etc. are shown on the plan Drawings. Refer to schematic Drawings, standard details and the specification for these requirements. In the absence of specific details, the Contractor is expected to follow generally

accepted good installation practices. Alternatively, the Contractor shall submit a written request for Information (RFI) to the Owner/Consultant prior to submission of the bids and obtain a ruling prior to bidding or proceeding with the work.

- (E) Where specific installation dimensions for location of equipment and access space requirements are indicated on the Drawings, install to these requirements.
- (F) Where Standard Details are provided, these show the general installation requirements, and are applicable to each occurrence in the work, unless otherwise specified or shown.
- (G) Do not proceed with work where an obvious ambiguity is noted between tender documents. Notify the Engineer and obtain proper direction prior to proceeding with procurement or related construction work on site.

(ii) Coordination and Cooperation with Other Trades

- (A) Review design drawings of all other related disciplines including architectural, electrical, structural and site services. Coordinate scope of work between all trades and allow for adequate costs for all related work. Coordinate work with all trades to ensure a proper and complete installation of fully functioning system that can be properly maintained in future.
- (B) Notify all trades concerned of the requirements for openings, sleeves, insets and other hardware necessary for the installation and , where work is to be integrated with the work of other trades or is to be installed in close proximity with the work of the trades, carefully coordinate the work prior to installation.

(g) Coordination and Examination

(i) Examination

- (A) Carefully examine work and Drawings of all related trades and thoroughly plan the work in advance so as to avoid interferences.
- (B) Report defects which would adversely affect the work. Do not commence installation until such defects have been corrected.

(ii) Coordination

- (A) Coordinate work of Division 15 such that items will properly interface with work of other Divisions. Prepare installation and interference Drawings of all critical locations and submit to the Consultant for review.
- (B) Architectural Drawings, or in their absence, Mechanical Drawings govern all locations.

(h) Submittals

(i) Shop Drawings

- (A) Shop drawing shall be submitted electronically.
- (B) Conform to general conditions of contract and the following.
- (C) Shop Drawings showing more than one size or model will not be considered unless properly marked up.
- (D) For electrically driven, and fuel fired appliances, provide the following information:
 - (I) Electrical characteristics including voltage, phase, frequency and power rating.
 - (II) For motors, NEMA, Class and efficiency ratings
 - (III) Fuel input ratings, including flow rates and pressures
 - (IV) Equipment performance ratings, including flow rates, pressures, efficiencies, part load values and/or efficiencies (IPLV's), plotted flow characteristics (pump and fan curves) with operating points clearly plotted.
- (E) For other equipment include the following information:
 - (I) Equipment performance ratings, including flow rates, pressures drops.
 - (II) Electrical control power requirements
- (F) For all equipment, include the following:
 - (I) Equipment dimensions and weights.
 - (II) Itemized product description with optional items clearly marked as being included.
- (G) Provide wiring Shop Drawings:
 - (I) Wiring diagrams and schematics for all equipment which has electrical controls or devices furnished with the equipment.
 - (II) Wiring diagrams alone are not sufficient; schematic and interconnecting Detailed drawings and sequence of operation of all equipment are required for review.
 - (III) Clearly indicate the materials and/or equipment being supplied:
 - i. Details of construction, finish, accurate dimensions, capacities and performance.
 - ii. Certify Drawings correct for construction by the manufacturer, before submission.
 - iii. Identify Equipment Shop Drawings with designations as shown on the Drawings or in the Specifications.
 - iv. If not complied with, Shop Drawings will not be reviewed and will be returned to the Contractor.
 - (IV) Coordinate equipment which attaches to and/or where external wiring provided connects to other equipment.
 - v. Do such coordination whether such equipment is supplied under this or other contracts or subcontracts,

for which relevant information will be provided by
Owner/Consultant.

- (i) "As-Built" Record Drawings
 - (A) Maintain an accurate dimensional record of all underground piping and all deviations and changes in aboveground piping and equipment.
 - (B) On completion of the project, provide a CD containing as-built Drawings in Auto Cad format. Include CD's and hard copies of the as-built Drawings in each O&M manual.
- (j) Installation and Start-up Instructions
 - (i) Reference
 - (A) Submit copies of installation instructions and copies of start-up instructions for any item of equipment when requested by the Consultant.
- (k) Operating and Maintenance Instruction Manuals
 - (i) Reference
 - (A) In addition, include the following in the manuals:
 - (I) Non-dimensional layout showing location of all electrical devices on mechanical equipment.
 - (II) Operating instructions, including start-up and shut-down procedure.
 - (III) Lubricating instructions and recommended cycle of lubrication for each item of equipment, including various types of lubricants.
 - (B) All the above applies to component parts of equipment whether they are manufactured by the supplier of the equipment or are supplied as a component part of an item of equipment.
- (l) Cleaning, Testing and Approval Records
 - (i) Records
 - (A) Maintain records of all pressure tests and flushing and sterilization tests, glycol/water concentrations, inspections and approvals by the Plumbing Inspector.
 - (B) Forward these tests to the Owner on completion of the work.
 - (C) Forward to the Consultant, copy of records on site on completion of each test, cleaning operation, etc.
- (m) Dimensions and Quantities
 - (i) Dimensions

- (A) Dimensions shown on Drawings are approximate.
- (B) Verify dimensions by reference to Shop Drawings and field measurement.

(ii) Quantities

- (A) Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.

2. Products

(a) Materials and Equipment

(i) Materials

- (A) Use new materials and equipment, free from defects impairing strength and durability, as specified or specified equivalent.
- (B) Of Canadian manufacture wherever possible.
- (C) Labelled or listed as required Code and/or inspection authorities.
- (D) Design of mechanical systems has been based on the first listed supplier and model number/size stated on the Equipment Schedules on the Drawings. Bear all costs due to physical or performance differences between stated equipment and proposed equipment. These differences include but are not limited to size, layout, arrangement, connection size, location and/or quantity of connections, or performance differences such as noise, power requirements, flow, throw, etc.

(ii) Equipment/Structure Coordination

- (A) Locations and dimensions of curbs and roof and floor opening framing, where indicated on the Drawings, are based on an arrangement to suit the above named supplier.
- (B) Be responsible to verify the actual size requirements of the openings, and notify the Consultant immediately in case the dimension of the unit supplied and the connecting ductwork/piping, etc. are at variance with the dimensions given on the Drawings.
- (C) Bear all costs for modification of curbs and floor/roof openings resulting from failure to notify the Consultant prior to the fabrication or construction of opening framing and curb.

(b) Standard Specifications

(i) Product Quality

- (A) Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all Products provided comply with the latest issue of applicable

Standard Specifications issued by Authorities having jurisdiction.

- (B) Do not apply such Standard Specifications to decrease the quality of workmanship, products and services required by the Contract Documents.
- (c) Manufacturer's Nameplates
 - (i) Metal Nameplates
 - (A) Provided with raised or recessed lettering, on each piece of equipment.
 - (B) Mechanically fasten nameplate on a metal stand-off bracket arranged to clear insulation.
 - (C) Mount on same stand-off Underwriters Laboratories and/or CSA registration plates.
 - (ii) Nameplate Data
 - (A) Indicate:
 - (I) Size
 - (II) Capacity
 - (III) Equipment model
 - (IV) Manufacturer's name
 - (V) Serial number
 - (VI) Voltage
 - (VII) Frequency
 - (VIII) Phases

3. **Execution**

- (a) General
 - (i) Execute work in accordance with requirements specified in the various Sections of Division 15.
 - (ii) Coordinate all installation details and service requirements of equipment and accessories with other trades to eliminate conflicts prior to installation.
 - (iii) Mechanical equipment and accessories shall be installed in a manner that provides adequate access to equipment and also assists in reducing the effort for maintenance. Equipment shall only be installed at heights or in spaces that can be easily reached by a standard height ladder (i.e. not exceeding 3 metres). In case space constraints on site require installation of equipment in other locations or heights, contractor shall bring this to the Engineer's attention and direction, prior to commencing work.
 - (iv) Lay out work of each trade so that it does not interfere with work under other Divisions of Specifications.
 - (v) Make good any damage to Owner's property or other trade's work caused by improperly locating or carrying out of work.

- (vi) Supply anchor bolts and templates for installation by other Divisions.
- (vii) Location of pipes, ductwork, raceways and equipment may be altered without extra cost provided alteration is made before installation.
- (b) Protection
 - (i) Protect work and materials before, during and after erection from weather and other hazards and keep in a clean and orderly manner.
 - (ii) Protect pipe ends, valves and parts of equipment left unconnected to prevent damage or intrusion of foreign matter. Provide pipe caps for threaded male connections and plugs for threaded female connections.
 - (iii) Protect plumbing fixtures or mechanical equipment having a baked enamel finish by covering with polyethylene sheet securely held in place.
 - (iv) Protect finished floor slabs from scuffing, cracking, chipping, staining, cutting and other damage resulting from work of this Contract.
 - (A) Place 19 mm thick plywood under laid with 25 mm thick polystyrene insulation board adhered to same, over floor areas when working from, or over, such surfaces. Provide such protection below hoist rigs, ladders, pallets of material, and in other circumstances where the flooring is exposed to potential damage. Work damaged due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Owner, at no increase in Contract Price.
- (c) Painting
 - (i) Reference
 - (A) With the exception of prime painting of miscellaneous steel or any other specific requirements as specified under the respective Sections of Division 15, all equipment shall be factory painted.
 - (B) Factory applied finish painting:
 - (I) Factory prime and final coats applied to pumps, air moving units, un-insulated pressure vessels, unit heaters, convectors, grilles, diffusers and bare metal equipment items, in exposed to view applications such as mechanical rooms.
 - (II) Use heat resistant paint where conditions require (i.e. equipment/accessories installed in the vicinity of heaters). Protect factory finished equipment during construction, and clean at completion of work.
 - (C) Factory applied prime painting:
 - (I) Factory prime paint other equipment fabricated from iron or steel including access doors, dampers, metal radiation enclosures, and fire hose cabinets.
 - (II) In occupied areas of the building, touch up any damage to prime coat resulting from shipping or installation and leave ready for final painting under Division 9.

- (D) Field painting:
 - (I) Mechanical rooms: paint exposed galvanized metal surfaces with one coat of zinc dust galvanized primer and one coat of 100% alkyd base enamel.
 - (II) Clean rust and oil from exposed iron and steel work provided under this Division, whether or not it has been factory prime painted. Paint this equipment with one coat of chrome oxide phenolic base primer and one coat of 100% alkyd base enamel in an approved colour.

END OF SECTION

1. **General**

(a) Related work

(i) Other Divisions

- (A) Refer to other divisions of the Specifications and to the Drawings for work related to the mechanical work to avoid interferences with work of other trades (and other contractors) and to ensure proper completion of the work as a whole.

(b) General Construction Requirements

(i) Applicable Codes and Standards

- (A) Ontario Building Code-2012
- (B) Occupational Health and Safety Act and Regulations for Construction Projects, Ontario Regulation 691.
- (C) Owners Health and Safety Requirements

(ii) Measurements and Deviations

- (A) Where any parts of the mechanical work are specifically located by dimensions on the Drawings, check and verify these dimensions on site prior to installation.
- (B) Before installing piping, review architectural, structural and electrical Drawings with mechanical Drawings
 - (I) Where interference may occur and departures from arrangements as shown are required, consult with other trades involved, come to agreement as to changed locations or elevations and obtain approval of the Consultant for proposed changes before proceeding with the work.
- (C) Examine work of other trades or contractors, prior to commencement of mechanical installations.
 - (I) Report in writing, to the Consultant, any discrepancies which will affect mechanical installations.
 - (II) Failure to do so shall be considered acceptance of the conditions.
- (D) Where site conditions require minor deviations from indicated arrangements or locations, make such changes on approval of the Consultant without additional cost to the Owner.
- (E) Should any discrepancies occur during installation of mechanical work which will necessitate major revisions to the mechanical trades work or the work of other trades or contractors, notify the Consultant immediately and obtain written authorization before proceeding with the work.

- (iii) Building Attachments:
 - (A) Obtain prior written Consultant's approval before drilling, cutting or welding of the building steel or building structure for erection of materials or equipment.
- (iv) Overloading
 - (A) During installation of mechanical work, do not load any part of the building structure with a load greater than it is capable of bearing.
 - (I) Should any accident occur or damage result through the violation of this requirement, the contractor shall be held solely responsible.
 - (B) Design temporary supports used during installation as being equivalent to permanent supports.
 - (C) Remove temporary supports at completion of work.
- (v) Cutting and Patching
 - (A) Do not cut, remove or burn structural parts or sections of the building, whether they are steel, concrete or masonry without the written authorization of the Consultant.
 - (B) Should cutting, repairing, and patching of previously finished work of other trades be required to allow installation of mechanical work, pay all costs for the trade concerned to perform the work.

2. **Products**

- (a) Building Attachments
 - (i) Welding Studs
 - (A) Maximum size: 10 mm (3/8") for attaching miscellaneous materials and equipment to building steel.
 - (B) If the weight of materials or equipment require bolts or studs larger than 10mm (3/8") diameter, use steel clips or brackets, secured to building steel by (welding or) bolting as approved by the Consultant.
 - (C) Acceptable Manufacturers:
 - (I) Graham
 - (II) Omark
 - (III) Nelson
 - (ii) Self drilling expansion type concrete inserts:
 - (A) To secure miscellaneous equipment and materials to masonry or concrete construction already in place.

- (B) Of sufficient number and size to prevent concrete from breaking away.
- (C) The use of powder or power actuated fasteners will not be allowed unless prior written approval is obtained from the Consultant.
- (D) Acceptable Manufacturers:
 - (I) ITW "Redhead"
 - (II) Star "SSS"
 - (III) USM "Parabolt"
- (iii) Supports for any suspended items:
 - (A) Do not fasten/attach to or extend through steel pan type roofs or through concrete slab roofs.
- (iv) Beam clamps:
 - (A) 2-bolt design and of such type that the rod load is transmitted only concentrically to the beam web centreline.
 - (B) The use of "C" and "I" beam side clamps, etc., will not be allowed without written consent of the Consultant.
 - (C) Acceptable Manufacturers:
 - (I) Grinnell
 - (II) Myatt
 - (III) Carpenter & Paterson
- (v) Truss or steel joist roof or floor framing:
 - (A) Locate hangers at or within 150mm (6") of the joist top or bottom chord panel points
 - (B) Otherwise provide additional structural steel as required where hanger spacing does not coincide with joist spacing.
 - (C) Transmit hanger load only concentrically to the supporting truss or joist.
- (vi) Secondary structural steel members between trusses and/or joists:
 - (A) Locate at or within 150mm (6") of top or bottom chord panel points.
 - (B) Where the secondary structural steel member cannot be located at or near a truss or joist panel point, provide additional diagonal structural steel web member/members designed for the applicable load to the nearest panel point in the opposite chord member.
 - (I) The above condition may be waived if the load to be suspended between panel points is not in excess of 45kg (100 LB).

- (C) Diagonal hangers which will induce lateral stresses in the chord members of the joist will not be permitted.
- (b) Drives and Accessories
 - (i) Drives
 - (A) V-belt drives selection: 150 percent of the motor size rating.
 - (B) Sheaves: cast iron construction with machined grooves.
 - (I) Sheaves 75mm (3") size and larger diameter: taper lock bushings.
 - (II) Multi-belt drives: matched sets.
 - (III) Statically and dynamically balance all sheaves as an operating unit.
 - (C) Adjustable sheaves:
 - (I) Motors less than 1.1Kw (1.5 HP) rating: adjustable pitch motor sheave with diameter range selected to obtain specified RPM of the driven equipment at approximately the mid-point setting of the sheave.
 - (D) Fixed Sheaves:
 - (I) Motors of 1.1Kw (1.5 HP) and greater: solid type.
 - (II) Should such sheaves not provide design requirements under operating conditions, supply and install a new drive sheave of proper size at no increase in Contract Price.
 - (ii) Drive Couplings
 - (A) Acceptable Manufacturers:
 - (I) Falk
 - (II) Fast
 - (III) Thomas
 - (iii) Lubricating Devices
 - (A) Equipment to have oil reservoirs with level indicators, or pressure grease fittings.
 - (B) Inaccessible fittings: provide extended tubes to an accessible location.
 - (C) Grease fittings: Zerk or Alemite
 - (I) All fittings shall be of one type.
 - (iv) Drive Guards
 - (A) To OSHA requirements.
 - (B) Build guards of all welded construction on exposed rotating parts or elements and on all drives including the following:
 - (I) V-belt drives
 - (II) Flexible couplings

- (III) Gear drives
 - (C) Construction (except fan drives):
 - (I) Total enclosure type fabricated of minimum 1.3mm (18 ga.) black sheet steel.
 - (II) Hinged side to allow access for lubrication, inspection or removal of the drive parts.
 - (III) Maximum clearance of openings in guards to rotating parts: not to exceed 13mm (1/2").
 - (IV) Make provision for slide rail adjustment.
 - (D) Construction for fan drives:
 - (I) V-belt drives: total enclosure type as specified above.
 - (II) Enclosure sides: 13mm (1/2") mesh, 2.7mm (0.105") wire screening.
 - (III) Tachometer holes at shaft centres, reinforced as required to maintain rigidity of guard.
 - (E) Flexible drive coupling guards:
 - (I) Location: between motor and driven equipment
 - (II) Minimum 1.3mm (18 ga.) black sheet steel, securely fastened to the equipment base plate and readily removable.
 - (III) Leave a clearance of approx. 13mm to 25mm (1/2" to 1") between the guard and the coupling.
 - (IV) Extend the guard to within 13mm (1/2") of both motor and driven equipment housing.
 - (F) Rework any substandard guards supplied with mechanical equipment to conform to the above requirements.
- (c) Sealants, Concrete and Grouts
- (i) Pipe Sleeve Seals
 - (A) Acceptable Manufacturers:
 - (I) Thunderline "Link-Seal" Series LS
 - (II) Century-Line
 - (III) Metraflex
 - (ii) Concrete
 - (A) Strength: Unless otherwise noted, 25 MPa concrete: to CSA-A23.1/A23.2
 - (iii) Concrete Grouts
 - (A) Acceptable Manufacturers:
 - (I) Sternson "M-Bed Standard"
 - (II) Sika "Sikagrout 212"
 - (III) Master Builders "Construction Grout"
 - (IV) Meadows "CG-86"

- (V) Euclid "Euco NS Grout"
 - (VI) CPD "Non-Shrink Grout"
 - (iv) Bonding Agents
 - (A) Acceptable Manufacturers:
 - (I) Sika "Sikadur 32" Hi-Mod
 - (v) Caulking Compounds
 - (A) Acceptable Manufacturers:
 - (I) Denso-Plast
 - (vi) Firestopping
 - (A) ULC listed fire stopping assembly
 - (B) Rating to suit wall and floor penetrations
 - (C) Acceptable Manufacturers:
 - (I) Hilti
 - (II) Fire Stop Systems
 - (III) Dow Corning
 - (IV) 3M
 - (V) Tremco
 - (VI) A/D Fire Protection System
 - (VII) Johns Manville
- (d) Miscellaneous
 - (i) Access Doors
 - (A) Size:
 - (I) Minimum size: 300mm x 300mm (12" x 12") size, unless otherwise specified on the Drawings or in other divisions of the Specifications, or as required to replace or repair said equipment.
 - (II) Provide 600 x 600 size access doors where personnel entry is required.
 - (III) Where access doors are required to be located in fire rated walls, floors and ceilings, provide ULC listed and labelled units having a minimum rating in hours per OBC for the structure being penetrated.
 - (B) Material:
 - (I) Fabricated of 2.5mm (12 ga) bonderized steel.
 - (II) Fabricated of 2.5mm (12 ga) stainless steel in areas finished with tile or marble surfaces.
 - (III) Flush mounted, concealed hinges and screwdriver lock.
 - (IV) Plast lock and anchor straps.
 - (V) Doors to be of a type and fire rating to suit the particular type of wall or ceiling construction in which they are to be installed.

- (C) Acceptable Manufacturers:
 - (I) E.H. Price
 - (II) Titus
 - (III) Controlled Air
 - (IV) Williams (S.M.S.)
 - (V) Acudor
- (ii) Isolating Unions
 - (A) Acceptable Manufacturers:
 - (I) Epco
 - (II) Marpac "Petro"
 - (III) Corrosion Service
- (iii) Fabricated Equipment Supports (Floor Stands and Ceiling or Wall Mounted Supports)
 - (A) Structural steel members of welded construction or steel pipe and fittings, suitably braced and secured to the floor by mild steel floor pads or pipe flanges with bolts or anchors.

3. **Execution**

- (a) Equipment
 - (i) General
 - (A) Install equipment in a compact, neat and workmanlike manner.
 - (I) Align, level and adjust for satisfactory operation.
 - (II) Install in such a manner that connecting and disconnecting of piping and accessories can be made readily and that all parts are easily accessible for inspection, operation, maintenance and repair.
 - (B) Install and start up items of equipment in accordance with the manufacturer's printed installation and operating instructions.
 - (ii) Noise and Vibration
 - (A) Noise and vibration levels of equipment and systems shall be within design intent.
 - (B) If noise or vibration levels created by any mechanical equipment and systems and transmitted to occupied portions of building or other mechanical work are over the limits, make all necessary changes and additions as approved by the Consultant without additional cost.
 - (iii) Lubrication
 - (A) Lubricate all equipment prior to start up in accordance with the manufacturer's printed instructions.

- (B) Supply all lubrication including sufficient quantity for drainage and refilling of oil sumps, etc., when required by manufacturer's instructions.
- (iv) Equipment Bases and Pads
 - (A) Construct bases and pads for all mechanical equipment. Pads shall be constructed of concrete c/w reinforcement and dowels. Refer to structural drawings and specifications for details.
 - (B) Layout coordination:
 - (I) Verify size of bases shown on Drawings with actual requirements and advise the Consultant and the respective trades if change in size or shape of pad is required.
 - (C) Anchor bolts:
 - (I) Supply anchor bolts required for mechanical equipment unless indicated otherwise on the Drawings.
 - (II) Sleeve anchor bolts.
 - (III) Supply anchor bolts and sleeves to trade constructing bases in sufficient time for setting in formwork prior to placing concrete and provide anchor bolt location drawing or template for locating anchor bolts.
 - (1) Check anchor bolt locations for proper position before concrete is poured.
- (v) Setting and Alignment of Equipment
 - (A) Rotating equipment (fans, pumps, etc):
 - (I) Use millwrights to set and align to lines established with an engineer's level.
 - (II) Shim equipment using standard brass or bronze shim stock of suitable thickness to provide proper level and alignment.
 - (III) Place 25mm (1") minimum thick grout between equipment base and concrete pad or foundation.
 - (IV) Have the Consultant approve equipment settings for equipment mounted on concrete pads or foundations prior to grouting.
 - (V) Re-check alignment prior to start-up of equipment.
- (vi) Ceiling or Wall Mounting
 - (A) Where ceiling or wall mounting is indicated or required, provide a suspended platform, bracket or shelf.
 - (B) Materials: standard steel members and steel plates of welded construction throughout.
 - (C) Attach to building steel with rod hangers and beam clamps, or attach to precast structure as the case may be.

- (D) Place additional structural steel as required between building steel where beam spacing does not meet requirements.
 - (E) Do not use inserts unless specifically shown on the Drawings or approved by the Consultant / the school board for any particular item of equipment.
 - (F) Attach brackets or shelves to vertical member or sections of the building structure as hereinbefore specified.
 - (vii) Suspended Equipment Support: Provide double locknuts on suspended equipment supports as follows:
 - (A) Upper attachment
 - (I) Beam clamp: provide a double nut on end of beam clamp tie rod.
 - (II) Supplemental steel: double nut all mechanical fasteners fixing supplemental steel to building structural steel.
 - (B) Middle attachment
 - (I) Upper load bearing point, to beam clamp: not applicable.
 - (II) Upper load bearing point, to supplemental steel: double nut on top of load bearing point, single locknut on underside of bearing point
 - (III) Lower load bearing point, all: double nut on underside of bearing point, single locknut on top of bearing point.
 - (C) Lower attachment
 - (I) Trapeze hanger or equipment fastening: refer to middle attachment requirements above.
 - (D) Apply Loctite 242 to the second nut (and matchmark both nuts).
- (b) Miscellaneous Steel
 - (i) General
 - (A) Hang or support equipment, piping, ductwork etc., with miscellaneous structural supports, platforms, braces as may be required unless Drawings or other Sections of the Specifications state otherwise.
 - (ii) Materials and Fabrication
 - (A) Conform to:
 - (I) CAN/CSA-S16.1-M Limit Status Design of Steel Structures.
 - (II) CSA-G40.20/G40.21 grade 300W for General requirement for rolled or welded Structural Quality Steel CSA W47.1 - for qualification of welders.
 - (III) CSA W48.1-M - for electrodes (only coated rods allowed).
 - (IV) CSA W59-M - Welded Steel Construction (Metal Arc Welding).

- (V) CSA W117.2 - for safety in welding.
- (B) Construction:
 - (I) Welded construction wherever practicable.
 - (II) Chip welds to remove slag, and grind smooth.
 - (III) Bolted joints allowed for field assembly using high strength steel bolts.
- (iii) Painting and Cleaning
 - (A) Clean steel to Steel Structures Painting Council SSPC-SP6, Commercial Blast Cleaning.
 - (B) Apply one coat of oil alkyd primer conforming to CISC/CPMA 2.75 to all miscellaneous steel.
 - (C) In the field, touch up all bolt heads and nuts, previously unpainted connections and surfaces damaged during erection with primer as hereinbefore specified.
 - (D) Apply two coats of primer to all surfaces which will be inaccessible after erection.
 - (E) Thoroughly remove all foreign matter from steelwork on completion of installation.
- (c) Concrete Inserts
 - (i) General
 - (A) Install inserts required for attachment of hangers, either for suspension of piping or equipment.
 - (B) For masonry or poured concrete construction use expansion type units. Insert into the concrete after concrete has cured. Do not use anchors or inserts installed by explosive means.
- (d) Flashings
 - (i) Coordination
 - (A) Coordinate with general trades and roofing supplier.
 - (ii) Provide flashing and counter-flashing for all mechanical and related electrical penetrations through roof. Costs resulting from failure to comply with this requirement are the sole responsibility of the contractor.
 - (iii) Acceptable Manufacturer: Thaler Metal.
 - (A) Plumbing Vent: Thaler model MEF-1
 - (B) Flexible steel conduit: Thaler model MEF-2x
 - (C) Hot pipe: MEF-3A with stainless steel collar

- (D) Type B vents: MEF-4A
 - (E) Rigid conduit: MEF-AE1
 - (F) Gas Piping: MEF-9
- (e) Fire Stopping
 - (i) Submittals
 - (A) Submit shop Drawings, including the following information:
 - (I) ULC/CUL listing number
 - (II) Installation Drawings for each type of penetration
 - (III) Installation materials
 - (ii) General
 - (A) Seal piping, ductwork, conduits and miscellaneous support steel penetrating fire separations.
 - (B) Install fire stopping in accordance with manufacturer's instructions and ULC listing requirements.
 - (C) Provide a written report on completion of fire stopping, by area or floor if necessary, indicating the work is completed and ready for inspection. Do not cover over fire stopping, including installation of walls and ceilings, until work is inspected.
- (f) Access Doors
 - (i) General
 - (A) Access doors in ductwork are specified in Section 15820 "Ductwork Accessories".
 - (B) Supply access doors for installation by other trades in walls or ceilings where accessibility is required for the operation and/or maintenance of:
 - (I) Concealed valves
 - (II) Traps
 - (III) Cleanouts
 - (IV) Dampers
 - (V) Fan Coil Units
 - (VI) Controls equipment
- (g) Performance and Balancing
 - (i) Refer to section 15990 Start-up and Performance Testing.
- (h) Adjustment and Operation of Systems
 - (i) General
 - (A) When the work is complete:

- (I) Adjust equipment items of the various systems for proper operation within the framework of design intent, and the operating characteristics as published by the equipment manufacturer.
 - (II) Complete additional instructions are specified under the respective Sections of Division 15.
 - (B) The Consultant reserves the right to require the services of an authorized representative of the manufacturer in the event that any item of equipment is not adjusted properly.
 - (I) Arrange for such services and pay all costs thereof.
 - (II) After completion of adjustments, place systems in full operating condition and advise the Consultant that the work is ready for acceptance.
- (i) Acceptance
 - (i) General
 - (A) After all equipment has been installed and adjusted and all systems balanced:
 - (I) Conduct performance tests in the presence of the Consultant and the Owner.
 - (II) Arrange the time for these tests at the convenience of the Consultant and the Owner.
 - (III) Conduct tests under climatic circumstances to ensure complete and comprehensive tests and of such a manner and duration as the Consultant may deem necessary.
 - (B) During these tests:
 - (I) Demonstrate the correct performance of all equipment items and of the systems they comprise.
 - (II) Should any system or any equipment item fail to function as required, make such changes, adjustments or replacements necessary to meet performance requirements.
 - (III) Repeat tests until requirements have been fully satisfied and all systems accepted by the Consultant.
- (j) Coordination With Testing and Balancing work
 - (i) General
 - (A) Review with the Mechanical Contractor before fabrication:
 - (I) Location of balancing devices
 - (II) Test connections
 - (III) Access openings
 - (B) Report conditions which could affect optimum system performance.
 - (C) Inspection:

- (I) Assure that all testing, balancing and metering devices are installed properly and in pre-selected locations.
 - (II) Report any errors to the Consultant.
 - (III) The Mechanical Contractor shall obtain the approval of the Testing and Balancing Firm before relocating these devices due to field conditions.
- (ii) TAB Contractor Coordination
 - (A) Cooperate with the Mechanical Contractor giving adequate prior notification of request for services of tradesmen.
 - (B) Coordinate efforts so that items requiring replacement and/or delivery time (sheaves, motors, etc.) are tested as early as possible.
- (iii) Mechanical Contractor Coordination
 - (A) Cooperate with the Testing and Balancing Firm.
 - (B) Provide the following assistance and/or services:
 - (I) Schedule sufficient time so that the initial testing and balancing can be completed before occupancy begins and coordinate with the trades involved.
 - (II) Keep the Testing and Balancing Company informed of any major changes made during construction and provide same with a set of project Drawings and reviewed Shop Drawings.
 - (III) Provide balancing devices, test connections access openings, balancing probe inlets and plugs.
 - (IV) Clean and pre-run all equipment, filters, etc. and place all heating, ventilating and air conditioning systems into full operation and continue same during each working day of testing and balancing.
 - (V) Provide immediate labour from pertinent mechanical trades and tools, equipment and materials to make equipment and system alterations and adjustments, as required including control adjustments.
 - (VI) Make available all equipment data (Shop Drawing performance data and operating instructions) to the Testing and Balancing Firm.
 - (C) As part of the coordination effort, the Mechanical Contractor shall be fully responsible for systems constructed, installed and adjusted to Provide optimum performance as required by design intent. Any re-adjusting required as the result of spot checks by the Consultant shall be done at no increase in Contract Price.
 - (D) Nothing contained in this Section voids the responsibility of the Mechanical Contractor (Subcontractor) for systems constructed, installed and adjusted to achieve the design intent.

END OF SECTION

1. General

(a) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with 15010 "Basic Mechanical Requirements".
- (B) Submit layout Drawings showing each type and placement of manufactured, pre-fabricated roof piping support system. Submit details for fixing roofing pad to roof.

2. Products

(a) Materials

(i) Acceptable Manufacturers

- (A) Hangers:
 - (I) Anvil
 - (II) Myatt
 - (III) Carpenter & Paterson
 - (IV) Hunt
 - (V) B-Line
- (B) Insulation shields:
 - (I) Anvil
 - (II) Myatt
 - (III) Pipe Shields Inc.

(ii) Lower Attachment

- (A) Clevis hanger – steel pipe
 - (I) Standard weight black steel clevis hangers with level adjustment and locknut
 - (II) Anvil figures 260 and 300.
 - (III) For figure 260, provide clevis bolt spacer on insulated piping.
- (B) Clevis hanger – copper pipe
 - (I) Light weight black steel clevis hangers with copper coloured finish and plastic insert to suit local authority requirements, with level adjustment and locknut.
 - (II) Anvil figure CT-65.
- (C) Roller hanger
 - (I) Adjustable roller type hangers with locknuts.
 - (II) Rollers of sufficient width to clear the outside diameter of the insulation on the piping.

- (III) Support rollers at both ends, either by a yoke, swivel type hanger or by two adjustable rods with locknuts (double locknuts).
 - (IV) Anvil figure 177 or 171 as applicable.
 - (iii) Insulation Protection
 - (A) Insulation saddles, for welding to pipe:
 - (I) Anvil figure 160-165 as applicable.
 - (B) Insulation shields :
 - (I) Either shop fabricated, or manufactured plates of the size required to properly fit the outside diameter of the pipe insulation.
 - (II) Anvil figure 167, modified with holes at each end to suit 12 mm wide. stainless steel band clamps.
 - (III) Shop fabricate bearing plates conforming to the following table for various pipe sizes:

Pipe Size (NPS)	Length of Plate mm	Thickness of Plate mm
½ to 2	300	1.2
3 to 4	300	1.52
 - (IV) Form the bearing plates to the O.D. of the adjoining pipe insulation and extend the plate up to the horizontal centre line of the pipe.
 - (iv) Middle Attachment
 - (A) Machine threaded rods
 - (I) Black steel finish in concealed areas.
 - (II) Galvanized finish in mechanical rooms and exposed areas.
 - (v) Upper Attachments
 - (A) Beam clamps:
 - (I) Malleable iron C-Clamp with retaining clip, FM approved: Anvil figure 87, NPS ½ to NPS 2; maximum load: 180 kg.
 - (II) Malleable beam clamp FM approved: Anvil figure 218, NPS 2½ to NPS 8; maximum load: 540 kg.
 - (III) For pipes NPS 10 and larger, provide supplementary steel members supported from structural steel.
 - (IV) Do not use top beam clamps.
 - (B) Concrete inserts (new construction):
 - (I) Single hanger: Malleable iron body and nut, universal nut style: Anvil figure 282, to NPS 8.
 - (II) Continuous hanger: cold formed hot dipped galvanized strip steel with end caps: Power-Strut PS 449.
 - (C) Concrete clevis plates (existing concrete):

- (I) Carbon steel plate, with clevis attachment.
 - (II) Anvil figure 49.
 - (III) Do not use explosive driven anchors.
- (vi) Rooftop Pipe Supports
 - (A) Prefabricated pipe support system:
 - (I) Bases: injection moulded plastic, structurally reinforced.
 - (II) Framing: fabricated steel to ASTM A570 Grade 33 (stainless steel Type 304 to ASTM A 167), roll formed 2.7 mm (12 ga) thick tubular sections. Tubing perforated with nominal 14 mm diameter holes on nominal 50 mm centres on 3 sides.
 - (III) Hangers: as specified above.
 - (IV) Clamps, bolts, nuts and washers to suit installation, same material as framing members.
 - (V) Roof pads to suit roof construction.
 - (B) Acceptable Manufacturers:
 - (I) Portable Pipe Hangers
 - (II) Unistrut
- (vii) Riser Clamps
 - (A) Black steel double clamp: Anvil figure 261, supported at floors; Anvil figure 240, supported by hanger rods.
 - (B) Or approved equivalent
- (viii) Pipe Guides
 - (A) Outer hinged housing with sliding spider clamp.
 - (I) Carbon steel, black steel finish.
 - (II) Anvil figure 256.

3. **Execution**

- (a) Installation
 - (i) General
 - (A) Support or suspend piping with necessary hangers, structural supports and/or brackets, to prevent sagging, warping and vibration and to allow for movement due to expansion and contraction. Provide adequate number of expansion compensators of suitable materials as required to allow movement of pipe work.
 - (B) Place hangers and supports close to fittings, elbows, valves and/or other heavy parts.

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- (C) Do not allow loads of any nature to be transmitted through the piping connections to equipment not specifically designed for such loads.
 - (I) Where flexible connections are not called for at connections to equipment, support the pipe by stands attached to both pipe and supporting structure so that force in any direction is not transmitted to the equipment.
- (D) Place suitably dampened spring hangers at the first three supports from the equipment connection on piping subject to excessive movement or shock from any source, thermal expansion and contraction.
 - (I) Where it is evident that no undue loads will be transmitted to the equipment by the system concerned, i.e. small bore connections to comparatively large equipment, cold service piping not subject to shock, etc., then spring hangers may be omitted and standard hangers used.
- (E) Do not hang pipe from another pipe unless specifically shown on the Drawings.

(ii) Hanger Selection

- (A) Select lower attachment and insulation protection based on the following, unless otherwise shown on Drawings:

Pipe Size NPS	Operating Temperature		
	Less than 21°C	Between 21°C and 43°C	Greater than 43°C
	Insulated	Non-insulated	Insulated
2 and less, steel	Clevis and Shield	Clevis only	Clevis
2½ to 8, steel	Clevis and Shield	Clevis only	Roller and Saddle
½ to 4, copper	Clevis and Shield	Clevis	Clevis and Shield

- (B) Install temporary spacers between the insulation Shield and the pipe equal to the thickness of insulation specified. Refer to Section 15080 "Mechanical Thermal Insulation".
- (iii) Saddles and Roller Supports
- (A) Place saddles at roller supports for piping carrying liquids at 43°C (110°F) or higher.
 - (B) Weld saddles to black or galvanized steel piping.
 - (C) Refinish galvanized surfaces destroyed by the welding with a zinc rich paint such as W.R. Meadows "Galvafruid", Kerry Industries "ZRC" or Niagara Paint Inc. "PL052898" or Approved Equivalent.
- (iv) Insulation Shields

- (A) Place insulation shields at pipe supports for pipes carrying liquids at 21°C (70°F) or less.
- (B) Field or factory punch a hole at each end of the shield to allow a 12 mm stainless steel band clamp to pass through opening.
- (C) Secure shields with 2@ 12 mm stainless steel band clamps per shield.
- (v) Hanger Spacing - General
 - (A) Horizontal runs of plumbing and drainage piping: to hanger spacing requirements of the Ontario Building Code.
 - (B) Place additional hangers in locations where there are concentrated loads such as valves, specialties, etc.
- (vi) Hanger Spacing - Black Steel and Galvanized Pipe
 - (A) For horizontal runs of black or galvanized steel pipe, other than for plumbing service:
 - (B) Maximum distances between supports and with minimum diameter rods as follows:

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
½ Thru 1	10	2.0	2.7
1¼	10	2.0	2.7
1½	10	2.7	3.6
2	10	3.0	3.9
2½	12	3.3	4.2
3	12	3.6	4.5
4	16	4.2	5.0
6	19	5.0	6.4
8	22	5	6.8

- (vii) Hanger Spacing - Copper Tubing
 - (A) For horizontal runs of copper tubing for services other than plumbing:
 - (B) Maximum distances between supports and with minimum diameter rods as follows:

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
Thru ¾	10	1.5	1.8
1	10	1.8	2.4

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
1¼	10	2.0	2.7
1½	10	2.4	3.0
2	10	2.4	3.3
2½	12	2.7	3.9
3	12	3.0	4.2
4	16	3.6	4.8

(viii) Hanger Spacing - PVC or CPVC

- (A) For horizontal runs of PVC or CPVC for services other than plumbing.
- (B) Maximum distances between supports and with minimum rods sizes for un-insulated pipe as follows.

Pipe Size nps	Rod Size mm	Spacing			
		PVC 40	CPVC 40	PVC 80	CPVC 80
½	6	1.2	1.2	1.2	1.2
¾	6	1.2	1.2	1.2	1.5
1	6	1.2	1.5	1.5	1.8
1¼	6	1.2	1.5	1.5	1.8
1½	6	1.5	1.8	1.8	1.8
2	6	1.5	1.8	1.8	2.0
2½	6	1.8	2.0	1.8	2.4
3	6	1.8	2.0	2.0	2.4
4	6	2.0	2.4	2.4	2.7
6	6	2.4	2.4	2.7	3.0

- (C) For insulated pipe, reduce spacing by 30%.
- (D) Do not restrain axial movement
- (E) Spacing based on fluids with specific gravity of 1.0 and 26°C 80°F. For other conditions, use other published data approved by the Consultant.

(ix) Anchors and Guides

- (A) Provide anchors as required to maintain permanent location of pipe lines.
 - (I) Construct anchors for steel or galvanized pipe of approved steel straps and/or rods.
 - (II) For anchoring copper lines, use copper plated anchors, or use insulation bands between tubing and clamps if steel straps or rods are used.

- (B) Provide minimum two (2) pipe guides on each side of an expansion joint and expansion compensator.
 - (I) 1200 mm between each guide.
 - (II) Not more than 900 mm between last guide and start of expansion joint or expansion compensator.
 - (C) For special expansion joint/compensator or for special applications, where more than two guides on each side are required, follow manufacturer recommendations for location of guides.
- (x) Inserts
- (A) In new construction, set inserts onto formwork prior to pouring of concrete.
 - (I) Provide a 200 mm length of rebar and wire through insert.
 - (B) Mechanical rooms and other areas of multiple pipe runs.
 - (I) Provide continuous type insert channels at 1800 mm intervals along route of piping.
 - (II) Provide a 200 mm length of rebar and wire through insert.
- (xi) Upper Attachments - Structural Steel
- (A) For pipe size NPS 10 and larger supported from structural steel:
 - (I) Provide supplementary structural steel and weld or bolt to structural steel.
 - (II) Submit plan Drawings and details to the structural engineer for review.

END OF SECTION

1. **General**

(a) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
- (B) Submit schedule of Equipment Identification Nameplates for review.

(ii) Samples

- (A) Submit samples of piping, valve and ductwork identification markers.

2. **Products**

(a) Materials

(i) Equipment Identification

- (A) Laminated phenolic plastic with white finish and minimum 10 mm high black letters.
- (B) Three rows of text, based as shown in equipment Schedules.
 - (I) Line 1: Equipment ID (e.g. P-1)
 - (II) Line 2: Equipment Name (e.g. Northwest Zone Heating Pump)
 - (III) Line 3: Optional, up to 15 characters (e.g. Standby Pump)
- (C) This identification is in addition to manufacturer's nameplate data.

(ii) Ductwork Identification

- (A) Painted stencil lettering: 50 mm high.
- (B) Paint colour:
 - (I) Black paint on canvas covered insulated ductwork
 - (II) White paint on metal covered insulated ductwork
 - (III) White paint on un-insulated ductwork
- (C) Two levels of text in accordance with designations shown on Schedules:
 - (I) Level 1: Abbreviated name of air handling system for supply systems (e.g. AHU-1), or fan number for exhaust or ventilation only systems (e.g. F-1)
 - (II) Level 2: System name (e.g. General Supply)
- (D) Direction arrows: 65 mm high

(iii) Pipe Identification – Type 1 : Adhesive Labels

- (A) Pre-printed 6 mil thick vinyl cloth, plastic coated with pressure sensitive self-adhesive backing surface. On insulated pipe, use adhesive suitable for this application.
- (I) Pipe diameter (including insulation) 75 mm or less: 29 mm width, 25 mm high lettering. Length of labels as dictated by legend.
- (II) Pipe diameter (including insulation) greater than 75 mm: minimum width of 64 mm and with 50 mm high letters.
- (III) Primary label colour: to CAN/CGSB-24.3.
- (IV) Pipe label to include service pressure for steam, compressed air, natural gas (if more than one gas service pressure inside of building), and vacuum.
- (V) Legend: black with the legend printed in full wherever feasible.
- (B) Direction arrow banding tape: colour coded vinyl tape with pressure sensitive adhesive backing, 50 mm wide, with directional arrows.
- (C) Acceptable Manufacturers:
- (I) Brady
- (II) Safety Supply Co.
- (III) S.M.S
- (IV) Revere-Seton
- (iv) Pipe Identification – Type 2 : Coil Wrap Labels
- (A) Reversible direction, semi-rigid plastic vinyl, with subsurface printing, and integral direction arrows.
- (I) Up to 6" diameter: coil wrap six rows of printing
- (II) Over 6" diameter: saddle type with two rows of printing, fastened with stainless steel springs
- (III) Lettering Size:
- | Outside Dia. | Letter Height |
|----------------|---------------|
| Less than 16mm | 6mm |
| 19mm – 32mm | 13mm |
| 35mm - 60mm | 19mm |
| 64mm – 110mm | 32mm |
- (IV) Primary label colour: to CAN/CGSB-24.3.
- (V) Pipe label to include service pressure for steam, compressed air, natural gas (if more than one gas service pressure inside of building), and vacuum.
- (VI) Legend: black with the legend printed in full wherever feasible.
- (B) Acceptable Manufacturers:
- (I) Brady
- (II) Safety Supply Co.

- (III) S.M.S
 - (IV) Revere-Seton
 - (v) Valve Identification
 - (A) Laminated phenolic plastic with minimum 10 mm high lettering, with brass keychain.
 - (B) Minimum two lines of text:
 - (I) Line 1: valve designation
 - (II) Line 2: valve position instruction
 - (vi) Manufacturers
 - (A) Acceptable manufacturers
 - (I) S.M.S.
 - (II) Brady
 - (III) Safety Supply Co.
 - (IV) Revere-Seton

3. **Execution**

- (a) Installation
 - (i) Equipment Nameplates
 - (A) Identify mechanical and electrical equipment installed under this Division with nameplates describing the function or use of the particular equipment involved.
 - (B) Do not commence fabrication of nameplates until after receipt of the Consultant's review.
 - (C) Equipment includes, but not limited to:
 - (I) Equipment as shown on schedules and specified
 - (II) Motor starters
 - (III) Motor Control Centres
 - (IV) Pushbutton stations
 - (V) Control panels
 - (VI) Time switches
 - (VII) Disconnect switches
 - (VIII) Contactors or relays in separate enclosures
 - (IX) Main ducts (i.e. main supply, main return main outdoor air and main exhaust air ducts) for all HVAC systems.
 - (D) Equipment nameplates for Building Automation System components are specified under Section 17800 (Building Automation System).
 - (E) Securely fasten nameplates to the equipment with round-head cadmium plated steel self-tapping screws.
 - (ii) Ductwork Identification

- (A) Label ductwork installed under this Division to indicate the content and direction of flow.
- (B) Locate labels as follows:
 - (I) Within 1.5 m of air handling units and free standing fans.
 - (II) Within 3 m of divisions in exposed ductwork.
 - (III) On each exposed duct passing through a wall, partition or floor (one on each side of such wall, partition or floor).
 - (IV) At intervals not to exceed 15 m along every exposed duct run exceeding 15 m in length.
 - (V) On every concealed duct where it enters a floor area that it serves.
- (C) Labels to be visible from 1.5 m above the adjacent floor or platform.
- (D) Clean surfaces with a trisodium phosphate solution before application of paint.
- (iii) Piping Identification
 - (A) Label all piping installed under this Division to indicate the content and direction of flow with Type 1 or Type 2 labelling system.
 - (B) For piping carrying steam, compressed air and vacuum, show on label the pressure or vacuum, and working units as applicable.
 - (C) Locate labels as follows:
 - (I) At every end of pipe run, adjacent to the valve or item of equipment serviced.
 - (II) At valves, tees and changes of direction.
 - (III) On each exposed pipe passing through a wall, partition or floor (one on each side of such wall, partition or floor).
 - (IV) At intervals not to exceed 15 m along every exposed pipe run exceeding 15 m in length.
 - (V) At every access point on concealed piping.
 - (D) Labels to be visible from 1.5 m above the adjacent floor or platform.
 - (E) Type 1 Labels;
 - (I) Clean surfaces before application of labels.
 - (II) Secure label with direction arrow banding tape for full circumference of pipe, at each end of label.
 - (F) Natural gas piping: as specified above except provide labels every 6 m.
- (iv) Valve Tags
 - (A) Provide valve tags on all valves, except as follows:
 - (I) At plumbing fixtures.

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- (II) On steam, condensate, chilled water and heating water shut-off and balancing valves at equipment being served.
- (III) On isolation valves around control valves
- (B) Provide a valve identification directory for each system.
 - (I) Quantity: two (2) copies of valve identification directories for each system
 - (II) Documented as follows (example given):

Valve No.	Service	Valve Location	Nearest Column
V-1	West Heating Zone	Basement Mech Room	C-8

END OF SECTION

1. **General**

(a) General

- (i) Provide thermal insulation of all ducts that are either located outdoors or have the risk of being exposed to outdoor conditions. Insulate a minimum of 8 feet (2400 mm) of all outdoor air intake ducts and exhaust ducts connected to the air terminal device installed on the exterior wall of the building.

(b) Work Not Included

- (i) The following items are not to be insulated, or are factory insulated.
 - (A) Piping:
 - (I) Natural gas piping
 - (II) Fire protection piping in conditioned areas.
 - (III) Vertical sections of exposed sanitary and storm drainage piping
 - (B) Equipment:
 - (I) Domestic hot water heaters
 - (II) Packaged Rooftop unit
 - (III) Heating system expansion tanks
 - (IV) Air handling units with internal insulation
 - (C) Ductwork:
 - (I) Cabinet type fan coil units
 - (II) Internal acoustically insulated ductwork, except overlap thermal insulation 300 mm over the adjacent acoustic insulation section of the duct.
 - (III) Supply ductwork which is exposed to the occupied space, unless otherwise noted.

(c) Related Work

- (i) The following Work is provided under other Sections or Divisions of the Work:
 - (A) Internal acoustic insulation of ductwork: Section 15820 "Ductwork Accessories".
 - (B) Factory insulated ductwork: Section 15810 "Ductwork".

(d) Reference Standards

- (i) General
 - (A) Provide insulation materials and adhesives of fire retardant type with flame spread and smoke developed ratings not exceeding ULC, Government, or Municipal standards.

- (B) Fire retardant materials with flame spread/smoke developed ratings not exceeding 25/50 when tested in accordance with CAN/ULC-S102, and complying with the requirements stated in the building code having jurisdiction.
 - (C) Identify insulation, coverings and adhesives where required by Federal and/or Provincial health and safety WHMIS legislation.
 - (D) Asbestos-free materials.
- (ii) Reference Standards
 - (A) Comply with the latest edition of:
 - (I) NFPA 90-A
 - (II) NFPA 255, determination of flame spread rating and smoke development
 - (III) CAN/ULC-S102, determination of flame spread rating and smoke development
 - (IV) ASTM C-411, materials testing
 - (V) ASHRAE 90.1
- (e) Submittals
 - (i) Shop Drawings
 - (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
- (f) Product Delivery, Storage and Handling
 - (i) General
 - (A) Retain insulation materials in original cartons or containers until immediately prior to application and store in dry location.
 - (B) Keep adhesives in their original containers with manufacturer's name and catalogue number clearly stated. Protect contents against freezing.
- (g) Definitions
 - (i) For the purposes of this Section, the following definitions apply:
 - (A) "Conditioned supply ducts" - ductwork conveying air which has either been heated or cooled.
 - (B) "Concealed" - mechanical services and equipment located in: ceiling spaces above solid drywall and T-bar ceilings; space beneath raised floors; vertical service shafts; trenches; and non-accessible chases and furred spaces.
 - (C) "Exposed" - mechanical services and equipment in all other spaces not considered to be "concealed" as defined above. Services in tunnels are to be treated as "Exposed".

- (D) "Cold Piping" - piping carrying fluids at temperatures below 16°C (60°F)

2. **Products**

(a) Materials

- (i) Pipe Insulation: Thermal resistance of all duct and pipe insulation materials shall meet or exceed the requirements specified in ASHRAE 90.1.

(A) Type P1

- (I) Fiberglas: to ASTM C547
- (II) Rigid, split formed with pressure sensitive longitudinal adhesion strip
- (III) Reinforced all service vapour retarder jacket:
- (IV) Operating temperatures: -40 to 454°C (-40 to 850°F)
- (V) *Maximum* k value: 0.042 W/m°C @ 93°C
- (VI) Acceptable Manufacturers
 - (1) Knauf Pipe Insulation with ASJ-SSI jacket
 - (2) Johns Manville - Micro-Lok with AP-T plus jacket
 - (3) Owens Corning - SSL-II
 - (4) Manson Alley - K with all purposed APT jacket

(ii) Ductwork Insulation

(A) Type D1

- (I) Fiberglas: to ASTM C553
- (II) Flexible blanket
- (III) Reinforced all service vapour retarder jacket
- (IV) Operating temperatures: 4 to 121°C (40 to 250°F)
- (V) Density: 24 kg/m³
- (VI) *Maximum* k value: 0.036 W/m°C @ 24°C
- (VII) Acceptable Manufacturers
 - (1) Johns Manville - Microlite
 - (2) Knauf Fibreglass
 - (3) Owens Corning

(B) Type D2

- (I) Fiberglas: to ASTM C553
- (II) Semi-rigid board
- (III) Reinforced all service vapour retarder jacket
- (IV) Operating temperatures: 4 to 121°C (40 to 250°F)
- (V) Density: 48 kg/m³
- (VI) *Maximum* k value: 0.044 W/m°C @ 24°C
- (VII) Acceptable Manufacturers
 - (1) Knauf Fibreglass
 - (2) Johns Manville - Spin-Glass Series 814
 - (3) Owens Corning - 703/AF530

(iii) Insulation Finish

- (A) PVC (Polyvinyl Chloride) jacket
 - (I) Minimum thickness: 20 mil
 - (II) Maximum permeability: 0.09 perms
 - (III) Premoulded one-piece fitting covers
 - (IV) Tape: vinyl, pressure sensitive, colour matched
 - (V) Acceptable manufacturers:
 - (1) Johns Manville - Manville Zeston 2000
 - (2) ACWIL Insulations
 - (3) Sure Fit Systems
- (B) Metal jacket (For all outdoor ducts and pipes)
 - (I) Aluminum: stucco embossed, minimum 0.45 mm thick
 - (II) Fittings: custom made, swaged ring or lobster back style on bends, die shaped over fittings, valves, strainers and flanges
 - (III) Bands: 13 mm wide stainless steel with mechanical fasteners
 - (IV) Acceptable manufacturers:
 - (1) Alcan Canada Products - Thermaclad Type 1
 - (2) Childers Products Inc - Fab straps
 - (3) ITW Insulation System

(iv) Adhesives

- (A) Contact bond cement
 - (I) Quick setting for metal surfaces
 - (II) Acceptable manufacturers:
 - (1) Monsey Bakor - 200-37
 - (2) Foster - 85-75
- (B) Lap seal adhesive
 - (I) For joints and lap sealing of vapour barriers
 - (II) Acceptable manufacturers:
 - (1) Monsey Bakor - 230-39
 - (2) Foster - 85-75
- (C) Contact adhesive
 - (I) Acceptable manufacturers:
 - (1) Foster - 85-20
- (D) Lagging adhesive
 - (I) Acceptable manufacturers:
 - (1) Monsey Bakor - 120-18
 - (2) Foster - 30-36

(v) Mastic

- (A) Interior:
 - (I) Acceptable manufacturers:
 - (1) Monsey Bakor - 120-19

- (2) Foster - 30-35
- (B) Exterior, with vapour barrier:
 - (I) Acceptable manufacturers:
 - (1) Monsey Bakor - 130-11
 - (2) Foster - 65-07
- (C) Exterior, breather type:
 - (I) Acceptable manufacturers:
 - (1) Childers - CP-10
- (D) Exterior - aluminum colour finish:
 - (I) Acceptable manufacturers:
 - (1) USE Hickson - Hydroshield Mastic 451 with "Stormking" aluminum coating
- (E) Cutback asphalt:
 - (I) Acceptable manufacturers:
 - (1) Monsey Bakor - 700-01
 - (2) Foster - 60-25
- (vi) Miscellaneous Products
 - (A) Sealants:
 - (I) Acceptable manufacturers:
 - (1) Monsey Bakor - 230-39
 - (2) Foster - 30-80
 - (B) Vapour barrier tape
 - (I) Colour matched, foil faced vapour barrier tape
 - (II) 75 mm wide
 - (III) Vinyl backed or foil backed to suit insulation
 - (IV) Acceptable manufacturers:
 - (1) Johns Manville - Zeston Z-tape
 - (2) MacTac Canada Ltd - Vinyl Scrim or Foil Scrim Kraft
 - (3) Compac Corp
 - (4) Fattal Canvas Inc
 - (C) Bands
 - (I) Stainless steel or galvanized metal, 12 mm wide with mechanical cinch locks.
 - (D) Insulation cement
 - (I) Acceptable manufacturers:
 - (1) Partek – Hilcote
 - (E) Vapour barrier insulation coating
 - (I) Acceptable manufacturers:
 - (1) Monsey Bakor - 130-11
 - (2) Foster - 60-38

- (F) Weld pins, studs and clips
 - (I) Acceptable manufacturers:
 - (1) Midwest Fasteners Inc
 - (2) Continental Stud welding
 - (3) AGM
- (G) Caulking
 - (I) Fast-drying colour matched flexible butyl elastomer based vapour barrier sealant.

3. **Execution**

(a) Application

(i) General

- (A) Perform insulation Work using qualified insulating applicators, in accordance with latest trade application methods and to the Consultant's approval.
- (B) Clean all surfaces to be insulated to remove grime, grease, oil, moisture or other matter to ensure that insulation is applied to clean and dry surfaces.
- (C) Apply insulation under ambient temperature conditions in accordance with insulation or adhesive manufacturer's recommendations.
- (D) Do not apply insulation until such time as installation and testing of piping, ductwork and equipment has been inspected, verified, and accepted by the Contractor.
- (E) Apply insulation neatly and tightly in unbroken lengths and with ends of sections firmly and squarely butted together. Lap canvas (or other specified wrapping) well over joints and cement down well with adhesive.
- (F) At wall sleeves: extend insulation through to make insulation continuous.
- (G) At fire walls: terminate insulation at wall, and pack space between wall sleeve and duct or pipe as specified in Section 15050 "Basic Mechanical Material and Methods".

(ii) Piping

(A) General

- (I) Neatly finish insulation at pipe hangers, supports, sensors and interruptions.
- (II) At expansion joints in piping: apply insulation over sleeve of 1.6 mm metal, fabricated to fit around expansion joint without restricting movement of joint.

- (III) Provide sleeves which can be removed without damage to adjoining insulation to allow repacking and lubrication of expansion joint.
 - (IV) Provide sleeves minimum of 75 mm longer than expansion joint and fitted with insulation retaining flanges and with means for maintaining position of sleeve over expansion joint.
 - (V) At heat traced piping: make allowance in sizing inside diameter of insulation for tracing cable which will be provided under Electrical Contract.
- (B) Type P1
- (I) Lap and seal all joints (longitudinal and transverse). Use vapour barrier tape on transverse joints. Locate longitudinal joints on top of pipe.
 - (II) Insulate fittings, unions, flanges and valves with preformed block insulation or with segments cut from insulation of same type and thickness as pipe insulation.
 - (III) Form insulation on fittings and valves without voids. Secure in place with galvanized metal bands.
- (C) Drainage systems
- (I) Apply insulation on roof drain bodies with 100% coverage of adhesive.
 - (II) Insulate above ground sanitary drainage systems (above finished ceiling areas).
 - (III) Insulate above ground storm horizontal rainwater leaders, located beneath roofs.
- (D) Insulation termination points:
- (I) Terminate 75 mm from fittings
 - (II) Bevel insulation at 45 degree angle away from fitting
 - (III) Finish exposed face with insulating and finishing cement
- (E) Insulation protection inserts - cold piping systems under 15°C
- (I) Place an insert between support with insulation shield and pipe on cold piping NPS 1½ and larger
 - (II) Fabricate insert from Type P5 insulation
 - (III) Insert length: extending a minimum 150 mm beyond each end of insulation shield
 - (IV) Insert circumference: 360 degrees
 - (V) Insulation shield: to Section 15060 "Pipe Hangers"
 - (VI) Where insert material actual thickness is different from the actual thickness of the adjacent insulation, shave the insert to an equal thickness of the adjacent insulation
 - (VII) Bond the insulation shield to the insulation insert with adhesive and finish and seal complete assembly with vapour barrier insulation coating to form an unbroken vapour barrier, or,

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- (VIII) Finish insulation insert as part of the main pipe insulation, and provide two metal band clamps for each insulation shield and strap the shield to the finished pipe insulation.

(iii) Ductwork

(A) General

- (I) Insulate access doors or removable panels in ductwork as separate units to permit opening or removal without damage to adjoining insulation.

(B) Type D1

- (I) Fasten insulation with adhesive, applied in 150 mm wide strips at 300 mm centres.
(II) Tightly butt all edges and joints and seal with interior mastic and scrim foil tape.
(III) Tying cord may be used to temporarily hold insulation until adhesive has set.

(C) Type D2

- (I) Secure insulation with welded pins and speed washer type fasteners at 300 mm centres. Provide a minimum of two rows of fasteners on each side of duct.
(II) In addition to mechanical fasteners, adhere insulation with adhesive applied in 150 mm strips on 450 mm centres.
(III) Tightly butt all edges and joints and seal with interior mastic and scrim foil tape.
(IV) Cut off protruding ends of welded pins and cover speed washers with same tape.

(b) Insulation Selection

System	Max. Op. Temp °C (°F)	Pipe Size NPS	Insulation Type	Insulation Thickness mm
Equipment drain lines, safety valve vents, relief valve vents, condensate drain piping etc.	110 (230)	All	P1	25
Low temperature heating piping	60 (140)	Up to 4 5 and over	P1 P1	25 38
High temperature heating piping	93 (200)	All	P1	38

(c) Plumbing piping:

- (i) Insulate the following systems:

System	Max. Op. Temp °C (°F)	Pipe Size	Insulation Type	Insulation Thickness mm
City water piping	27 (80)	All	P1	25
Domestic cold water piping, including piping downstream of backflow preventers	27 (80)	All	P1	25
Domestic hot and re circulating water piping, including piping downstream of backflow preventers	82 (180)	Up to 2 2½ and over	P1 P1	25 38
Storm and sanitary drainage piping	38 (100)	All	P1	25
Hot water supplies to barrier free use lavatories (except when totally enclosed knee guard provided)	82 (180)	All	P1	12
Cold water supplies to barrier free use lavatories (except when totally enclosed knee guard provided)	82 (180)	All	P1	12
Sanitary drainage piping from barrier free use lavatories (except when totally enclosed knee guard provided)	82 (180)	All	P1	12

(d) HVAC ductwork:

(i) Insulate the following systems:

System	Location	Max. Op. Temp °C (°F)	Insulation Type	Insulation Thickness mm
Conditioned supply air ductwork	Exposed Concealed	65 (150)	D2 D1	38 38
Fresh air intake plenums and ductwork	Exposed Concealed	38 (100)	D2 D1	38 50
Return air ductwork	Exposed Concealed	38 (100)	D2 D1	38 38
Exhaust ductwork behind registers in high humidity areas	Concealed	38 (100)	D1	50
Exhaust air plenums and ductwork	Exposed Concealed	38 (100)	D1 D1	38 38

(e) Finish

(i) Piping

(A) Finish Indoor piping in accordance with the following:

System	Pipe	Fittings, Valves, etc
P1	PVC	(PVC)

(ii) Ductwork

- (A) Finish outdoor ductwork with aluminum jacketing.
- (B) Finish(indoor) exposed ductwork in accordance with the following:

System	Ductwork
D1	PVC
D2	PVC

(iii) General

- (A) Piping insulated with elastomeric foam insulation:
- (I) Indoors and outdoors - finish with one coat of white acrylic latex as recommended by insulation manufacturer.
- (B) Outdoor piping:
- (I) Finish insulated piping with a field or factory applied aluminum jacket. Fasten and caulk butt joints and secure with sheet metal screws. Locate longitudinal joints on bottom of pipe.
- (II) Alternatively, finish with two coats of outdoor type mastic - aluminum colour finish.
- (C) Outdoor ductwork:
- (I) Finish insulated ductwork with one layer of glass fibre fabric applied between two full mop coats of exterior mastic - aluminum colour. Topcoat with aluminum coating in accordance with manufacturer's direction. Store materials in a heated space prior to application.
- (II) Finish insulated ductwork with a 0.6 mm thick, field applied lock forming quality aluminum jacketing materials with a smooth finish. Provide a minimum overlap of 50 mm on each longitudinal and transverse seams. Do not allow mastic materials to come in contact with single ply membrane roofs.
- (III) Provide 20 mm wide, 0.38 mm thick S.S. insulation bands to secure aluminum jacketing materials in place. Clean up accidental spills immediately. Provide temporary drop sheets to protect the roof.

END OF SECTION

1. General

(a) Reference Standards

(i) Standards

- (A) CSA 390 M (Motor efficiency ratings)
- (B) IEEE 112 (Motor efficiency ratings) for three phase motors
- (C) IEEE 114 (Motor efficiency ratings) for single phase motors.
- (D) ASHRAE 90.1

(b) Codes and Regulations; Permits, Costs and Fees

(i) Codes

- (A) Electrical Safety Authority (ESA)

(ii) Permits

- (A) Obtain electrical permits and inspections and pay all costs for the portion of the Work performed by Division 15.

(c) Quality Assurance

(i) Contractor Qualifications

- (A) Electrical wiring for Mechanical Trades Work performed by a specialist firm with an established reputation in this field.

(d) Submittals

(i) Shop Drawings

- (A) Submit shop drawings in accordance with section 15010 "Basic Mechanical Requirements".
- (B) Include nameplate data, motor efficiencies, NEMA rating and insulation rating.

(e) Related Work

(i) The following Work will be performed by Division 16.

- (A) Power wiring between the electrical distribution system and motor or equipment.
- (B) Motor Control Centres (MCC).
- (C) Motor starters including variable frequency drives and soft-start starters, except where specified as an integral component of the mechanical equipment.

- (D) All Fused or un-fused disconnect switches.
- (E) Motor starters for integration of proposed equipment into the BAS.

2. **Products**

(a) Motors

(i) General

- (A) Motor nameplate rating:
 - (I) Not less than input brake horsepower of driven equipment plus 5%, at specified operating conditions, and;
 - (II) Not less than the scheduled minimum horsepower.
 - (III) Premium efficiency.
 - (IV) Selected for chemical duty or explosion proof where scheduled.
 - (V) Service factor: 1.15 minimum for three phase motors.

(ii) Single Phase Motors

- (A) Continuous duty, resilient mount.
 - (I) Motor rating: less than 375 W
 - (II) Voltage, frequency and RPM as scheduled.

(iii) Three Phase Motors, 350 W to 525 W:

- (A) EEMAC, Class B, Type F insulation, squirrel cage induction, continuous duty, ball bearing.
 - (I) Voltage, frequency and RPM as scheduled.
 - (II) Motor type: ODP with 90°C temperature rise (TEFC with 80°C temperature rise) unless otherwise scheduled.
 - (III) 1800 RPM or as scheduled.

(iv) Three Phase Motors, 750 W and larger:

- (A) EEMAC, T-Frame, Class B, Type F insulation, squirrel cage induction, continuous duty, ball or sleeve bearing.
 - (I) Motor efficiency: equal to or greater than Ontario Hydro motor efficiency ratings.
 - (II) Voltage, and frequency as scheduled.
 - (III) Motor type: ODP with 90°C temperature rise unless otherwise scheduled
 - (IV) 1800 RPM or as scheduled.

(v) Grounding Lug

- (A) Motors less than 15 kW:
 - (I) Ground lug on motor terminal box.

(vi) Winding Temperature Thermostat

- (A) Where required:

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- (I) Single phase, and three phase motors up to 15 kW located in air ducts, plenum chambers or in air stream inside air conditioning equipment.
 - (B) Type:
 - (I) Klixon Motor winding thermostats or Approved Equivalent
- (b) Wiring and Conduit
 - (i) Wire
 - (A) Refer to DIV 16 specifications.
 - (ii) Conduit
 - (A) Refer to DIV 16 specifications.
- (c) Equipment Service Lights
 - (i) Service Lights
 - (A) Pyrex globe, wire guard and 100 W incandescent lamp
 - (B) Acceptable Manufacturers:
 - (I) Crouse Hinds - Type ARB-31
 - (II) Killark - Type VOGB-100
 - (ii) Switches
 - (A) 20 ampere, single pole, with neon pilot light, installed in cast metal box.
 - (B) Acceptable Manufacturers:
 - (I) Smith & Stone - No. 4-4901

3. **Execution**

- (a) Installation
 - (i) Motor and Equipment Control
 - (A) Motor Control Centre, starters and/or disconnect switch for each motor or electrically connected item: provided by Electrical Division 16.
 - (I) Exception: disconnects which are specified as part of the equipment.
 - (ii) Power Conduit and Wire
 - (A) Provided by Mechanical Division 15:
 - (I) Line voltage thermostats, and wiring from thermostat to fan coil units, unit heaters and cabinet unit heaters.
 - (II) Hardwire interlock wiring between control devices (pressure switches, temperature switches, limit switches, etc.) and motor starters.

- (III) Between junction box provided by Division 16, to switch and equipment service lights.
- (B) Provided by Electrical Division 16:
 - (I) Power wiring at all voltages 120 VAC and higher to motors or equipment.
 - (II) To junction box on adjacent wall, column or ceiling for equipment service lights (marine lights).
- (iii) Control Conduit and Wire
 - (A) Provided by Mechanical Division 15:
 - (I) Control wiring, conduit and relays to interlock starters and connect safety and operating controls.
 - (B) Provided by Electrical Division 16:
 - (I) Fan shut-down and start-up relays and wiring for operation by the Fire Alarm System.
 - (II) Thermostats and wiring for electric heaters.
- (iv) Equipment Service Lights
 - (A) Mount switches in accessible location on outside of plenum.
 - (B) Provide one switch for each fan system.
 - (C) Provide minimum of one marine light per 3 m length of plenum.
- (v) Grounding
 - (A) Ground electrical equipment and wiring in accordance with Electrical Safety Authority and Local Authority's Rules and Regulations.
- (vi) Corrosion Protection Anodes
 - (A) Provide external corrosion protection anodes for:
 - (I) Buried ductile iron water mains, fittings, and hydrants.
 - (II) Metallic services as shown.

END OF SECTION

1. **General**

(a) Related Work

(i) Trenching, bedding and backfill:

- (A) For all buried services and drainage structures.

(ii) Pipe Hangers and Supports

- (A) To Section 15060 "Pipes, Hangers and Supports".

(iii) Piping

- (A) Hydronic Piping Section 15184
- (B) Natural Gas Piping Section 15191
- (C) Plumbing General Requirements Section 15400

(b) Reference Standards

(i) Pressure piping fabrication and installation

- (A) Ontario Plumbing Code.
- (B) Submit documentation of this certification with bid documents.

(c) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical requirements".
- (B) Submit shop Drawings for the following items and indicate where they are used and with which system
 - (I) Pipe materials
 - (II) Fittings
 - (III) Valves

(ii) Operation and Maintenance Data:

- (A) Submit printed operation instructions and maintenance data in accordance with Section 01700 "Material and Equipment" and 15010 "Basic Mechanical requirements".

2. **Products**

(a) Bedding and Backfill Material

(i) Materials

- (A) From bottom of trench to 300 mm above top of pipe:
 - (I) New Granular "A" material of bank run sand and gravel or crushed

stone of non-organic nature.

- (B) From 300 mm above top of pipe to underside of gravel sub base or landscaping soil:
 - (I) New granular material conforming to OPSS 1010 Granular "B" requirements.

(ii) Samples

- (A) If requested, submit hand carry samples of backfill materials in heavy duty, clear plastic bags to the Consultant at the job site prior to purchasing.
- (B) Material delivered to the job site will be inspected by the Consultant and any material considered unsuitable will be rejected.

(b) Escutcheon Plates

(i) Materials:

- (A) Heavy chrome plated cast brass or stamped metal.
- (B) Two piece construction complete with substantial hinges and positive latches.
- (C) Fit all plates with tempered springs to ensure positive attachment to the pipe.

(c) Pipe and Fittings – Pressure Piping - Ferrous

(i) General

- (A) Pressure class and pipe schedules as indicated in related Section and as specified herein.

(ii) Pipe

- (A) Carbon Steel - General use
 - (I) Black carbon steel: to ASTM A53 Grade B, Seamless or ERW
 - (II) Black carbon steel, for fire protection systems: to ASTM A795, A53, A135.
 - (III) Bevelled, plain as per piping data sheets
 - (IV) For buried pipe: "Yellow Jacket" polyethylene jacket coating, minimum 22 mil thickness

(iii) Fittings

- (A) Threaded (for pipe diameter 50mm and below only)
 - (I) Black banded malleable iron threaded fittings: to ASTM A197 and ANSI B16.3
 - (II) Black cast iron threaded fittings: to ASTM A126 Class A and ANSI B16.1
- (B) Flanged

- (I) Galvanized cast iron, flanged flat face: to ASTM A126 Class A and ANSI B16.1
 - (II) Black cast iron flanged flat face: to ASTM A126 and ANSI B16.4
- (C) Drainage
 - (I) Standard galvanized cast iron drainage fittings: to ANSI B16.12
- (D) Socket welded
 - (I) Forged steel socket welding type: to ASTM A105 Grade 2 and ANSI B16.11
 - (II) For underground pipe: Protect joints and fittings with Shaw "Shrink-Sleeves" or a coating of Denso Paste wrapped with Denso Tape applied with at least 50% overlap
- (E) Butt welded
 - (I) Seamless carbon steel butt weld fittings, with wall thickness to match pipe: to ASTM A234 WPB and ANSI B16.9
 - (II) For underground pipe: Protect joints and fittings with Shaw "Shrink-Sleeves" or a coating of Denso Paste wrapped with Denso Tape applied with at least 50% overlap
 - (III) Long radius elbows
 - (IV) .
- (F) Unions
 - (I) General Use
 - (II) Black malleable iron with brass ground joint and screwed ends: to ASTM A197 and ANSI B2.1
- (G) Flanges
 - (I) Welded
 - (1) Forged steel raised face slip-on or weld neck type: to ASTM A181 Grade 1 and ANSI B16.5
 - (2) Provide flat faced flanges for connection to cast iron valves, or equipment having a flat faced flange.
 - (II) Screwed
 - (1) Cast iron, galvanized, flat face, screwed: to ASTM A126 Class A and ANSI B16.1
- (iv) Flange Gaskets
 - (A) General Service Water < 94°C Max. Pressure: 1720kPa
 - (B) 1.6 mm thick red rubber, ring type for raised face flanges
 - (C) Full face type for flat faced flanges
 - (D) Hot Water 94°C - 152°C Max. Pressure: 6890 kPa
 - (I) 1.6 mm thick Garlock No. 3000 with nitrile binder flat ring type, asbestos-free material manufactured by Anchor or Phelps
 - (E) Gas piping, maximum pressure: 6890 kPa
 - (I) 1.6 mm thick Garlock No. 3000 with nitrile binder flat ring type,

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asbestos-free material manufactured by Anchor or Phelps

- (F) Compressed Air Piping, maximum pressure: 8200 kPa
 - (I) 1.6 mm thick Garlock No. 3200 with SBR binder flat ring type, asbestos-free material manufactured by Anchor or Phelps.
- (v) Flange Bolting
 - (A) General use
 - (I) Semi-finished hex head machine bolts, carbon steel: to ASTM A193 Grade B7
 - (II) Semi-finished hex nuts, carbon steel: to ASTM A194 Grade 2H
- (vi) Couplings
- (vii) Miscellaneous
 - (A) Plugs
 - (I) Class 3000, threaded, square head, machined from solid steel or forging: to ASTM A105 Grade 2
 - (B) Closures, welded
 - (I) Schedule 40 seamless butt welded caps, carbon steel, with wall thickness to match pipe: to ASTM A234 Grade B
 - (C) Thread compound
 - (I) General service: Teflon tape or Master metallic compound
 - (II) Petroleum based fluids service: Teflon base pipe thread compound
 - (III) Ammonia service: X-Pando
- (d) Pipe and Fittings – Pressure Pipe – Non Ferrous (use for domestic cold water, hot water and hot water recirc system)
 - (i) Copper Tubing
 - (A) Tubing
 - (I) Type “L” hard drawn copper tubing: to ASTM B88
 - (B) Fittings
 - (I) Wrought copper, solder joint, pressure type
 - (II) Solder to threaded adaptors as screwed valves or equipment
 - (C) Unions
 - (I) All bronze construction with ground joint
 - (II) Either solder joint or screwed ends as required
 - (ii) Copper Pipe
 - (A) Pipe
 - (I) Seamless copper pipe standard sizes: to ASTM B42 , or,
 - (II) Seamless red brass pipe standard sizes: to ASTM B43
 - (B) Fittings
 - (I) Brass or bronze threaded water fittings: to ANSI B16.15 “Cast

Bronze Threaded Fittings (Classes 125 and 250)"

- (C) Flanges and Flange Fittings
 - (I) Brass or bronze flanges and flange fittings: to ANSI B16.24
"Bronze Pipe Flanges and Flanged Fittings (Class 150 and 300)"
- (D) Flange Gaskets
 - (I) 1.6 mm thick red rubber, full face type
- (E) Flange Bolting
 - (I) Semi-finished hex head machine bolts, carbon steel: to ASTM A193 Grade B7
 - (II) Semi-finished hex nuts, carbon steel: to ASTM A194 Grade 2H
- (e) Pipe and Fittings – Pressure - Buried
 - (i) Polyethylene - Buried - Gas
 - (A) Pipe
 - (I) Series 120 psi polyethylene pipe: certified to CSA B137.1-M
 - (II) Smooth finish free of imperfections such as grooves and ripples
 - (B) Fittings
 - (I) Series 125 polyethylene socket welding type: certified to CAN3-B137.4-M
 - (II) Heat fusion joints, installed in accordance with manufacturer's installation manuals
 - (III) Install in accordance with CSA Z184-M and Z184S1 and CSA-B149.1
 - (ii) Ductile Iron – Buried -Domestic Water
 - (A) Pipe
 - (I) Centrifugal cast ductile iron: to AWWA C151
 - (II) Wall thickness Class (51)(52)(54): to AWWA C150
 - (III) Mechanical joint or bell and spigot push-on type ends: to AWWA C111
 - (IV) Cement mortar lined: to AWWA C104
 - (V) Polyethylene encasement: to AWWA C105
 - (B) Fittings
 - (I) Class 250 cast grey or ductile iron with mechanical joints: to AWWA C110
 - (II) Cement mortar lined: to AWWA C104
 - (III) Polyethylene encasement: to AWWA C105
 - (C) Joints
 - (I) Components for either mechanical or bell and spigot push-on type: to AWWA C111
 - (II) Adapters for connection to valves and non-bell and spigot fittings
 - (III) Brass wedges, inserts or copper bonding straps at all joints for electrical continuity

- (iii) PVC – Buried -Drainage
 - (A) Pipe and fittings
 - (I) Rigid PVC pipe to Can/CSA B137.3. c/w approved fittings.
- (iv) PVC - Buried
 - (A) Pipe
 - (I) Class 150 PVC DR18 pressure type, PVC resin: to ASTM D1784
 - (II) Class 200 PVC DR14 pressure type, PVC resin: to ASTM D1784
 - (B) Fittings
 - (I) Class 250 cast grey iron or ductile iron, mechanical joint ends to AWWA C110
 - (II) Tar coated outside
 - (III) Cement mortar lined: to AWWA C104
 - (IV) Polyethylene encasement: to AWWA C105
 - (C) Joints
 - (I) To AWWA C-900 and CAN3-B137.3
 - (II) Maximum working pressure: 1035 kPa at 23°C
- (f) Pipe and Fittings – Drainage Systems
 - (i) Weeping tile drain piping system
 - (A) Refer to geo tech report for specifications and provide accordingly.
 - (ii) Cast Iron Soil Pipe-Above Grade- Sanitary and Storm Drainage
 - (A) Pipe and fittings
 - (I) Cast iron soil pipe: to CAN/CSA-B70-M
 - (II) Plain end pipe and fittings
 - (B) Joints
 - (I) Bell and spigot, with lead and oakum joints
 - (II) NPS 8 and smaller: Neoprene sleeves with stainless steel gear type clamps, where approved by local authorities
 - (iii) PVC Soil Pipe
 - (A) Pipe - Below Grade - Sanitary and Storm Drainage
 - (I) All sizes: to CAN/CSA-B181.2 "PVC Drain, Waste and Vent Pipe and Pipe Fittings"
 - (II) Bell and spigot ends
 - (III) Rubber ring gaskets with bell
 - (B) Pipe - Below Grade - Storm Drainage (Alternate)
 - (I) 2" to 6": to CSA B182.1-M
 - (II) 8" and up: to CSA B182.2-M
 - (III) Bell and spigot ends
 - (IV) Rubber ring gaskets with bell
 - (C) Fire Stop Seal for Combustible Pipe

- (I) Certification: to CAN4-S115-M tested at a pressure differential of 50 Pa (0.007 psi)
 - (II) Fire stop rating: Class F
 - (III) Fire resistance rating: not less than that of the fire separation being penetrated.
 - (D) Acceptable Manufacturers:
 - (I) 3M - Ultra Plastic Pipe Device
- (iv) Copper – DWV-Vent Piping
 - (A) Pipe
 - (I) Hard drawn copper drainage tube (DWV): to ASTM B306
 - (B) Drainage fittings
 - (I) Wrought copper solder joint: to ANSI B16.29
 - (II) Cast brass solder joint: to CSA B158.1
- (g) Valves
 - (i) General
 - (A) Gate valves re-packable under pressure, when fully open
 - (B) Plug valves packed with lubricant suitable for service
 - (C) Globe and check valves provided with composition discs suitable for type of service
 - (D) Renewable seats on iron body valves
 - (E) Materials

ASTM B62	Bronze valves - gate, globe and check - steam rated 125 and 150 psig
ASTM B61	Bronze valves - gate, globe and check - steam rated 200 and 350 psig
ASTM B283 C3770	Brass valves - ball valves
ASTM A126 Class B	Iron valves - gate, globe and check
 - (F) Markings

MSS-SP-25	Steam or WOG (water, oil and gas) rated pressure, manufacturer's trademark, size
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 - (G) End Connections

ANSI B2-1	Threaded ends
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ANSI B16.18	Soldered ends
ANSI B16.10	Face to face dimensions

(H) Testing and Materials

MSS-SP-80	Bronze valves, gate, globe and check
MSS-SP-70	Iron gate valves
MSS-SP-85	Iron globe valves
MSS-SP-71	Iron check valves
MSS-SP-67	Butterfly valves

(ii) Gate Valves

(A) GTV 1

- (I) Class 125 bronze body, screwed ends, solid or split wedge disc, rising stem
- (1) Crane Fig 1700
 - (2) Jenkins Fig 990AJ
 - (3) Kitz Fig 24

(B) GTV 2

- (I) Class 125 iron body, OS&Y bronze mounted, flanged ends
- (1) Crane Fig 465 ½
 - (2) Jenkins Fig 454J
 - (3) Kitz Fig 72

(C) GTV 3

- (I) Class 125 bronze body, screwed ends, rising stem, wedge disc, screw-in bonnet
- (1) Crane Fig 428
 - (2) Jenkins Fig 990AJ
 - (3) Grinnell Fig 3010
 - (4) Newman Hattersley Fig 608
 - (5) Toyo Red-White Fig 293
 - (6) Kitz Fig 24

(D) GTV 4

- (I) 175 psi working pressure, to AWWA C-500, non-rising stem, iron body, bronze mounted, renewable seat rings, stuffing box and packing gland, mechanical joint ends. Valve box to grade, with guide plate and cover identifying the service. Valves and valve box finish: two heavy coats of coal tar enamel. Provide one extension key for each valve box installed.
- (II) Valve
- (1) Jenkins Fig 2397A

- (III) Box
 - (1) Bibby VB Series
 - (2) Canada Valve Fig 1322
 - (3) Mueller Fig A769
 - (E) GTV 5
 - (I) 175 psi WOG, ULC and FM approved, iron body, bronze mounted, cast iron disc, resilient seat, mechanical joint ends, non-rising stem, square operating nut. Finish: two heavy coats of coal tar enamel
 - (1) Clow
 - (2) Mueller Canada
 - (F) GTV 6
 - (I) 175 psi WOG, ULC and FM approved, iron body, bronze mounted, OS&Y, flanged ends
 - (1) Clow
 - (2) Mueller Canada
 - (G) GTV 7
 - (I) Class 125, bronze body, wedge disc, non-rising stem, solder ends
 - (1) Crane Fig 1701
 - (2) Kitz Fig 41
 - (3) Jenkins Fig 993AJ
- (iii) Globe Valves
 - (A) GLV 1
 - (I) Class 125 bronze body, screwed ends, solid or split wedge disc, rising stem
 - (1) Crane Fig 7
 - (2) Jenkins Fig 106BJ
 - (B) GLV 2
 - (I) Class 125 iron body, bronze mounted, yoke bonnet, composition disc, renewable and regrindable bronze set ring, flanged
 - (1) Crane Fig 351
 - (2) Jenkins Fig 2342J
 - (3) Kitz Fig 76
 - (C) GLV 3
 - (I) Class 125 bronze body, composition disc and solder ends
 - (1) Crane Fig 1702
 - (2) Jenkins Fig 995AJ
 - (3) Kitz Fig 10
- (iv) Ball Valves
 - (A) BV 1
 - (I) Class 150-600 WOG brass body, screwed ends, teflon ends, teflon seats, teflon packing, bronze or chrome plated, solid ball and lever handle with plastic protector, AGA and CGA approved for gas

service

- (1) Crane Fig F9203-B
- (2) Jenkins Fig 201J
- (3) Kitz Fig 58

(B) BV 2

- (I) Class 150-600 WOG brass body, soldered ends, teflon ends, teflon seats, teflon packing, bronze or chrome plated, solid ball and lever handle with plastic protector, AGA and CGA approved for gas service
 - (1) Crane Fig F9223-B
 - (2) Jenkins Fig 201J or 202J
 - (3) Kitz Fig 58 or 59

(v) Butterfly Valves

(A) BFV 1

- (I) Class 150 full tapped lug type, cast iron body, bronze disc, 304 stainless steel shaft, EPDM seat, notched top plate
- (II) Lever lock handle for valve sizes NPS 6 and smaller
- (III) Worm gear operator with handwheel for valves NPS 8 and larger
 - (1) Crane Fig 44 BXZ
 - (2) Jenkins Fig 2232Elj
 - (3) Apollo Fig Series 143

(B) BFV 2

- (I) 175 psi ULC and FM approved full lug, cast iron body, bronze disc, EPDM seat,
- (II) Lever lock handle for valve sizes NPS 6 and smaller
- (III) Worm gear operator with handwheel for valves NPS 8 and larger
- (IV) Indicator flag painted "safety yellow" and provision for mounting supervisory switch
 - (1) Grinnell

(C) BFV 3, Domestic Water

- (I) 2-1/2" - 6" (DN65-DN150), 300 psi (2065 kPa) maximum pressure rating, with copper tubing sized ends. Cast bronze body to UNS C87850. (Alloy code shall be cast or stamped into the valve body.) Elastomer encapsulated ductile iron disc, ASTM A-536, Grade 65-45-12, with integrally cast stem. Bubble tight, dead-end or bi-directional service, with memory stop for throttling, metering or balancing service. Valve may be automated with electric operation.

(vi) Plug Valves

(A) PV 1

- (I) Class 175 WOG rating, lubricated plug valve, semi-steel body, tapered plug, screwed ends, wrench operated
 - (1) Rockwell-Nordstrom Fig 142
 - (2) Newman-Milliken Fig 170M
 - (3) Walworth Fig 1796

(B) PV 2

- (I) Class 175 WOG rating, lubricated plug valve, semi-steel body, tapered pug, flat faced flanged ends drilled to 125 lb (862 Pa) ANSI
 - (II) Valves NPS 6 and less: manual lever operated
 - (III) Valves NPS 8 and larger: worm gear operated
 - (1) Rockwell-Nordstrom Fig 143
 - (2) Newman-Milliken Fig 172M
 - (3) Walworth Fig 1797F
- (vii) Check Valves
- (A) CV 1
 - (I) Class 125 horizontal swing check valve, bronze body, screwed ends, screwed cap and regrindable bronze disc
 - (1) Crane Fig 1707
 - (2) Jenkins Fig 996AJ
 - (3) Grinnell Fig 3300
 - (4) Newman Hattersley Fig 47
 - (5) Toyo Red-White Fig 236
 - (6) Kitz Fig 22
 - (B) CV 3
 - (I) Class 125 wafer type non-slam check valve, cast iron body, bronze plates and Buna-N seals.
 - (II) Install between two flat faced flanges as specified for piping NPS 4 and larger
 - (1) Mission Valve "Duo-Chek"
 - (2) Ritepro "Check Rite"
 - (3) Gestra "RK" Series
 - (4) Crane Fig R-1-66-4-F-1-X
 - (5) Centerline 800 Series
 - (6) Grinnell Fig 300
 - (7) Jenkins Fig R-1-66-4-F-1-X
 - (C) CV 4
 - (I) Class 125 horizontal swing check, bronze body, screwed ends, screwed cap and regrindable bronze disc
 - (1) Crane Fig 37
 - (2) Jenkins Fig 4092J
 - (3) Grinnell Fig 3300
 - (4) Newman Hattersley Fig 47
 - (5) Toyo Red-White Fig 236
 - (6) Kitz Fig 22
 - (D) CV 5
 - (I) Class 125 ULC and FM approved for 175 psig (1200 Pa) WOG, iron body, bronze mounted, horizontal swing check, bolted cap, flanged ends
 - (II) For above ground or in valve pit
 - (1) Clow

- (E) CV 6
 - (I) Class 150 lift check, bronze body, screwed ends, screw-in cap, stainless steel or bronze disc, bronze seat ring
 - (1) Crane Fig 27
 - (2) Jenkins Fig 119J
 - (3) Newman Hattersley Fig 42
 - (4) Kitz Fig 36
- (F) CV 7
 - (I) 2"(DN50) through 3"(DN80) Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, stainless steel non-slam tilting disc, stainless steel spring and brass shaft, nickel-plated seat surface, 365 psi (2517 kPa).
 - (II) 4"(DN100) through 12"(DN300) Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, elastomer encapsulated ductile iron disc suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 300 psi (2065 kPa).

(viii) Circuit Balancing Valves

- (A) 2"(DN50) and Smaller Sizes: 300 psi (2065 kPa), y-pattern, globe type with soldered or threaded ends, non-ferrous brass copper alloy body, EPDM o-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter.
- (B) 2-1/2"(DN65) and Larger Sizes: 300 psi (2065 kPa), y-pattern, globe type with flanged ASTM A536 ductile iron body, all other metal parts of brass copper alloy, EPDM O-ring seals. 8, 12 or 16-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter.
- (C) Acceptable Manufacturers
 - (I) Armstrong
 - (II) Bell & Gossett
 - (III) Tour and Anderson

3. **Execution**

(a) Trenching, Bedding and Backfill

(i) General

- (A) Extent:
 - (I) For buried services inside building and to 1.5 m outside building wall.
- (B) Trench depth:
 - (I) To 75 mm(150 mm) below the correct elevation and slope established for the bottom of the pipe.

- (C) Bedding:
 - (I) Refill the bottom elevation of the trench with hand-placed bedding materials.
 - (II) Thoroughly compact to the approval of the Consultant.
 - (III) At pipe hubs or couplings, remove bedding in the bottom of the trench as necessary to provide for even and constant support for each length of pipe.
 - (D) Shoring:
 - (I) Provide adequate shoring, bracing and sheeting in pipe trenches
 - (II) Place barriers and temporary crossings as necessary to ensure support, safety and protection at all times.
 - (E) Unstable soil conditions:
 - (I) When encountered, advise the Consultant.
 - (II) Excavate pipe trenches to a depth as directed by the Consultant and then backfill to the correct grade with bedding material.
 - (F) Backfill:
 - (I) Where joints occur, do not backfill until joint testing is approved by the Consultant.
 - (II) Hand place backfill to 300 mm above the top of the pipe in 100 mm layers taking particular care to place and compact the backfill simultaneously on both sides of the pipe.
 - (III) From 300 mm above the top of the pipe backfill in 150 mm layers and mechanically compact.
 - (G) Keep excavations dry at all times.
 - (H) Compaction:
 - (I) Mechanically tamp and thoroughly compact each layer of new granular bedding and backfill material to 95 percent Modified Proctor Density.
 - (I) In fill areas, allow a minimum clearance of 100 mm on all sides of the pipe passing under or through building grade beams to prevent possible damage from settling of building. If a greater settlement can be expected, increase the clearance to prevent possible damage.
 - (J) Remove and dispose of excess excavated material off-site.
- (b) General Piping Construction Methods
- (i) General
 - (A) Standards:
 - (I) To ANSI Sections B31.1 to B31.9 as applicable to service, unless specified otherwise herein.
 - (II) Do not use soldered joints in compressed air piping.
 - (B) Inserts, sleeves and anchors:
 - (I) Avoid unnecessary cutting of masonry.

- (II) Supply inserts, sleeves, and anchors to other trades for building in as the Work proceeds.
 - (III) Arrange with other trades to leave openings, slots and chases to accommodate later installation of mechanical Work.
 - (C) Inspect pipe and fittings for soundness and clean off all dirt and other foreign matter immediately prior to installation.
 - (I) Reject all damaged items.
 - (D) Pipe layout:
 - (I) Install piping in the most direct, straight and functional manner possible.
 - (II) Except where otherwise shown, install all vertical lines plumb, and run horizontal lines parallel to building walls.
 - (III) Install piping close to walls, partitions and ceilings.
 - (IV) On multiple runs of piping, space piping to allow for installation of insulation and for proper servicing of valves.
 - (E) Conceal piping in finished areas and rooms within walls or ceilings, and in furred spaces elsewhere.
 - (I) Provide access doors or panels as hereinafter specified for access to concealed piping specialties, etc.
- (ii) Expansion and Contraction
 - (A) Installation:
 - (I) Install all piping free from strain and distortion due to expansion and contraction: to Section 6, Chapter 3 of ANSI B31.1, except as hereinafter modified.
 - (II) Allow for expansion and contraction by offsets, expansion U-bends or loops.
 - (III) Expansion joints of any type will not be allowed unless specifically indicated on the Drawings or specified under another Section of this Division for a particular installation.
 - (B) Expansion/contraction allowance criteria:
 - (I) Steel pipe: 25 mm movement per 30 m of pipe.
 - (II) Brass and copper pipe: 38 mm movement per 30 m of pipe
 - (III) Temperature difference: for each 55°C (100°F) temperature difference from 21°C (70°F) ambient.
 - (IV) Fabricate expansion bends in steel pipe from pipe sections and long radius welding elbows.
 - (C) Swing and swivel joints:
 - (I) On steam or hot water heating piping for connections from mains to risers and from risers to radiation and other heating units.
 - (II) Use at least five fittings from main to riser including tee in main.
 - (III) Use at least four fittings from riser to heating unit including tee in riser.
- (iii) Lines, Grades and Slopes

- (A) Install piping in conformity with elevations and grades indicated on the Drawings using axis lines and bench marks provided under General Construction.
 - (I) Verify such axis lines and bench marks.
 - (II) Lay out the Work and be responsible for lines, elevations, measurements, etc., required for installation of the Work.
- (B) Slopes:
 - (I) Slope piping drains and sewers as indicated on the Drawings.
 - (II) Install so that slope between elevations shown on the Drawings is even and constant.
 - (III) Install liquid and air lines free of pockets and pitch to drain at low points in the line with valves or traps installed as required for drainage of the lines.
- (C) Minimum slopes:
 - (I) As shown on Drawings; if not shown, then as follows.
 - (II) Drainage piping, NPS 3 and less: 1:50.
 - (III) Drainage piping, NPS 4 and larger: 1:100.
 - (1) In special circumstances as provided for under the Codes and Regulations and the express approval of the Consultant, drains of NPS 4 size and larger may be laid at a lesser slope.
 - (IV) Domestic water lines: pitch to low points so that all lines may be completely drained.
 - (V) Hot water heating lines: slope up 1:500 in direction of flow.
 - (VI) Compressed air, natural gas, fuel oil: slope down 1:1000 in direction of flow.
- (D) Where pipe slope causes pipe to rise to top of ceiling space, or fall to bottom of structural members, ceiling space or defined service space, Provide risers as follows:
 - (I) Domestic water lines: Provide drain valve at bottom of low point, and Provide riser to increase elevation of piping.
 - (II) Hot water heating, chilled water and condenser water lines: provide automatic air vent, complete with drainage piping, at high point, provide drain valve at bottom of low point and Provide riser to lower elevation of pipes.
 - (III) Compressed air, fuel oil: Provide a minimum a 75 mm deep dirt pocket with capped end, drain valve and provide riser to increase elevation of piping.
 - (IV) Natural gas: Provide a drip pocket with capped end, drain valve and Provide riser to increase elevation of piping. Pocket depth to be the greater of: 75 mm deep or equal to diameter of pipe. Pocket diameter to be the lesser of: NPS 2 or gas main pipe diameter.
- (iv) Immersion Wells and Sensing Bulbs
 - (A) Fitting size:
 - (I) Pipe size NPS 2½ size and less: increase pipe length for 300 mm to minimum one pipe size larger to maintain equivalent

unobstructed cross sectional area.

- (B) Pack immersion wells in piping for liquids up to a temperature of 150°C (300°F) with a mineral type grease prior to installation of sensing bulb.

- (v) Piping Connections to Mains

- (A) Gas and compressed air lines:
 - (I) Make branch connections to respective horizontal piping of larger diameter to the upper quadrant of the larger pipe.
- (B) Water piping:
 - (I) Make down feed piping connections to horizontal supply and return mains to the bottom quadrant of the mains.

- (c) System Requirements

- (i) Plumbing

- (A) Install complete plumbing, drainage and vent piping for washrooms, etc, in accordance with the Ontario Building Code.
 - (B) Size vent lines based on developed pipe length and hydraulic load.
 - (C) Arrange piping within pipe spaces behind washroom fixtures to allow unimpeded access to piping for servicing.

- (ii) Copper Pipe - Type L

- (A) Provide dielectric unions or couplings at all connections between copper tubing and ferrous piping

- (iii) Copper Pipe - Buried

- (A) Provide dielectric unions at connection between cast iron or ductile iron water main and copper tubing
 - (B) When required by Municipal authority, provide 900 mm long copper gooseneck after corporation stop at connection to water main. Connection at water main to be at 45 degrees and gooseneck to have minimum 160 mm radius bend.

- (iv) PVC - Buried - Pressure and Drainage Piping

- (A) Provide a tracer wire directly over PVC pipe

- (v) PVC Drainage, Waste and Vent Piping

- (A) Below grade: install in accordance with CSA B182.11 and manufacturer's recommendations.
 - (B) Above grade: install in accordance with CSA B181.11 and B181.12 and manufacturer's recommendations.
 - (C) Provide fire stop seals on all fire separation penetrations, except at

connections through concrete floor slabs to non-combustible water closets.

- (D) Do not use combustible piping in return air ceiling plenums or vertical riser shafts.

(d) Sleeves

(i) Installation Requirements

- (A) Provide where piping passes through foundations, above grade floors and walls.
- (B) Materials
 - (I) Schedule 40 black steel pipe or type "K" copper tubing for installation in foundations or floors
 - (II) 1 mm (20 ga.) galvanized sheet steel where installed in above grade walls.
- (C) Terminate sleeves flush with finished ceilings, walls and floors on grade.
 - (I) For piping passing through floors above grade extend sleeve a minimum of 75 mm above the floor.
- (D) Sleeve sizes
 - (I) Large enough to pass full thickness of pipe covering where same is used.
 - (II) With sufficient clearance between pipe/insulation and sleeve to allow for any lateral movement of piping due to expansion and contraction.
- (E) Assume responsibility for the setting of all sleeves necessary for this Work in masonry walls during construction or in concrete forms before concrete is poured.
- (F) Coat exterior surface of all sleeves of ferrous material with a heavy asphalt emulsion.

(ii) Foundation Sleeves

- (A) For pipes entering structures from below grade, seal the annular space between sleeve and pipe with prefabricated seals.

(iii) Firestopping

- (A) Provide firestopping on pipes passing through firewalls, fire separation walls or through walls, partitions or floors which are considered as serving as firestops.
 - (I) Provide at partitions around washrooms.
 - (II) Seal the space around the pipe, in the sleeve, in accordance with Section 15050 "Basic Mechanical requirements".

(iv) Pipe Sleeves Through Roofs

- (A) Supplied and installed under other Contracts or under Roofing Section,

unless specifically shown otherwise on the Drawings.

- (v) Future Services
 - (A) Fill sleeves for future use with lime mortar.
- (vi) Escutcheon Plates
 - (A) Place escutcheon plates on bare piping passing through finished walls or floors.
- (e) Flashing
 - (i) Refer to Section 15050 "Basic Mechanical Material for details
- (f) Joints, Unions, Flanges and Fittings
 - (i) Pipe Joints
 - (A) Preparation
 - (I) Ream pipe ends and thoroughly clean all dirt, cuttings and foreign matter from pipe after cutting and threading.
 - (II) Thoroughly clean all fittings, valves and equipment before connections are made.
 - (III) Cut copper tubing with a tube cutter and clean the joining surfaces of the tubing and fitting with fine emery cloth. Wipe clean with a dry cloth.
 - (B) Cast iron pipe sleeve joints
 - (I) For cast iron plain end soil pipe, install sleeve type couplings such as Titan Foundry Type MJ, or Bibby MJ Series 2000 in strict accordance with manufacturer's printed instructions.
 - (C) Cast iron bell and spigot joints
 - (I) Make joints either neoprene compression type preformed gaskets such as Bibby "Bi-seal", and caulk in such a manner to produce a permanently tight joint.
 - (II) Cold caulking compound in cord form such as W.R. Meadows PC4 may also be used.
 - (III) Assemble preformed neoprene gaskets to manufacturer's printed instructions.
 - (D) Mechanical joints:
 - (I) Assemble mechanical joint on ductile iron pressure pipe with cast iron gland, rubber sealing gasket and high strength malleable iron bolts in accordance with the manufacturer's recommendations.
 - (E) Soldered joints:
 - (I) Make soldered joints on copper tubing in accordance with the following usage:

	Service	Solder Type
<u>1.</u>	Domestic Hot and Cold Water	95/5 with matching flux
<u>2.</u>	Drainage, Waste, Vent	50/50 with matching flux
<u>3.</u>	Compressed air service	"Sil-Fos" silver solder or brazed.

(II) Do not use core type solder.

(F) Threaded joints:

(I) Use Teflon tape or Masters metallic compound with the compound applied to the male threads only and particular care taken to prevent the compound from reaching the interior of the pipe or fittings.

(G) Carbon steel welded joints:

(I) To ANSI B31.1 Section IX for welding.

(II) Fusion welded joints made by electric arc welding, gas metal arc welding, or oxy-acetylene gas welding.

(III) Ensure that supervisory staff, fitters and welders are fully conversant with the requirements laid down by that Standard prior to the commencement of welding.

(IV) Employ qualified welders holding a current up-to-date Provincial Certificate for the process and rating involved as required by the Provincial Regulations.

(V) Unless more stringent methods of inspections are specified the Consultant will visually inspect welded joints for fusion of metal, icicles, alignment, etc.

(VI) Remove any defects and remake the joint to his satisfaction.

(VII) For welding of materials other than carbon steel, conform to the requirements specified in the relevant section of the Specification.

(ii) Unions and Flanges

(A) Provide unions or flanges in the following locations:

(I) For by-passes around equipment or control valves or devices in piping systems.

(II) At connection to steam traps and in by-passes around traps.

(III) At connections to equipment. Locate between shut-off valve and equipment.

(IV) In screwed or solder joint drainage tubing at inlet side of trap.

(B) If unions are concealed in walls, partitions or ceilings, build access thereto.

(C) Provide dielectric unions or isolating type companion flanges at all connections between copper tubing and ferrous piping.

(I) Brass body valves between ferrous piping and copper tubing is acceptable as a dielectric union.

- (D) Flange joints
 - (I) Assemble joints with appropriate flanges, gaskets and bolting.
 - (II) Allow clearance between flange faces such that the connections can be gasketed and bolted tight without undue strain on the piping system, with flange faces parallel and bores concentric.
 - (III) Centre gaskets on the flange faces so as not to project into the bore.
 - (IV) Lubricate bolts before assembly and Provide 2 hardened steel washers under the head of each unit to assure uniform bolt stressing.
 - (V) Machine off raised face flanges when joining to a flat companion flange and use a full face gasket.
 - (VI) Follow gasket manufacturer's instructions for correct bolting procedure.
 - (VII) Use calibrated torque wrench and tighten bolts in recommended sequence in four equal steps to required final torque value.

(iii) Fittings

- (A) Couplings
 - (I) Minimize couplings on runs of pipes.
 - (II) Do not use running couplings in any pipeline.
 - (III) NPS 2 and smaller: threaded coupling.
 - (IV) NPS 2½ and larger: welded joints.
- (B) Fittings and ancillary items installed in systems operating at pressures in excess of 103 kPa:
 - (I) Register in accordance with CSA B51-M.
- (C) Eccentric reducer fittings
 - (I) To provide proper drainage or venting of the lines.
 - (II) At change of pipe sizes.
 - (III) At connections to equipment and control valves.
 - (IV) Do not use bushings.
- (D) Tee connections in welded piping
 - (I) Factory fabricated standard butt weld fittings.
 - (II) Bonney Forge "Weldolets", "Thredolets" or "Sockolets".
 - (III) Mitering, notching or direct welding of branches to mains is not permitted.
- (E) Change of direction
 - (I) Use standard pipe fittings.
 - (II) Use long radius welded steel elbows unless short radius elbows are specifically authorized by the Consultant.
 - (III) Mitered joints or field fabricated pipe bends are not permitted.
- (F) Tees, copper tubing
 - (I) Direct connection of branch into main using "T-Drill" method may be used where allowed by the Code, in lieu of manufactured tee fittings.

(g) Valves

(i) Installation

(A) General

- (I) Wherever possible, source valves from one manufacturer.

(B) Where required

- (I) At locations shown on the Drawings.
(II) At all piping connections to equipment.
(III) At all connections to control valves or control devices.
(IV) Where required for sectionalizing a system or floor.
(V) Check valves wherever required to ensure flow of liquid in one direction.

(C) Type

- (I) Shut-off service: gate, butterfly type, and ball (quarter-turn).
(II) Throttling service: double regulating, globe or plug type for throttling purposes.

(D) Drain valves

- (I) Hose thread outlet connection or valve with long nipple on outlet at all low points of each water system and above all riser or branch stop valves for proper drainage of lines.

(E) Valve chains

- (I) Provide chain wheel operators and operating chain for valves located more than 2000 mm above floor or walkway.
(II) Provide chain of sufficient length to extend to within 2000 mm of operating platform or floor for free handing chains, or to within 1500 mm of floor in locations where chain can be secured to wall or column. Secure chain to wall or column with a wall hook.
(III) Chain wheels using rustproof chain complete with guide and of size recommended by valve manufacturer for proper operation of valve.

(h) Inspection and Testing

(i) Pressure Leak Testing

- (A) Make specified pressure tests on all piping included in this Contract.
(B) Furnish all pumps, compressors, gauges and connectors necessary for the tests.
(C) Test sections as authorized by the Consultant to accommodate construction schedule. However, test complete systems on completion of the Work.
(D) Conduct tests in the presence of:
(I) Consultant
(II) Personnel of governing authorities having jurisdiction

- (E) Notify above personnel in ample time to permit them to be present.
- (F) Conduct tests before piping is painted, covered or concealed.
- (G) Disconnect pumps or compressors used for applying the test pressure, during the test period.
- (H) Disconnect and/or remove equipment or specialties not designed to withstand the test pressure during the test and reconnect same after completion of test.
- (I) Promptly correct any defects that develop through tests and re-test to the complete satisfaction of the Consultant and other parties involved.
- (J) Forward copies of all final tests on all pressure and drainage piping and a copy of governing authority approvals to the Consultant immediately on acceptance of tests and/or approvals.
- (K) Final payment for the Work will not be made until the above has been received.

(ii) Hydrostatic Tests

- (A) Conduct tests for a minimum period of 2 hours, or longer when requested by the Consultant or governing authority at the test pressure specified under the respective Section of the Specifications.
- (B) Test requirements:
 - (I) Pressure to remain constant over test period to a pressure of 1½ times the operating pressure but not to exceed the material pressure class rating.
 - (II) Exterior surfaces of pipe or fittings free of cracks or other form of leak.
 - (III) Tests to be performed at a constant ambient temperature.

(iii) Pneumatic Tests

- (A) Initially pressurize the system with air to approximately one-half the specified operating pressure but not to exceed 345 kPa.
 - (I) Examine joints for leaks with a soapsuds solution.
 - (II) Repair leaks as detected.
 - (III) Repeat test and repairs until soap test passes.
- (B) Provide a final pressure test on the system with air to the test pressure specified under the respective Section of the Specifications.

(iv) Natural Gas Piping

- (A) Conduct final tests in accordance with the requirements of the local Utility or governing authority.
- (B) If feasible, make tests when ambient air temperature is approximately constant.
 - (I) Corrections for pressure change due to temperature differential

shall be allowed as approved by the Consultant.

- (v) Drainage and Potable Water Testing
 - (A) Test drainage piping and potable water piping in accordance with requirements of The Ontario Building Code, latest edition, and any additional requirements of applicable local by-laws.
- (vi) Specific Test Requirements
 - (A) Test the following services with compressed air or inert gas at 1½ times the working pressure, but in no event less than 345 kPa.
 - (I) Natural Gas Piping
 - (II) Distilled Water Piping
 - (III) Vacuum Piping
- (i) Pre-Operational Cleaning
 - (i) Temporary Connections
 - (A) Make temporary cross-overs, blank-off equipment connections, install drain and fill lines for circulating cleaning fluid through piping.
 - (ii) Flushing of Piping Systems
 - (A) Flush water piping with water flowing at a velocity of not less than 1.8 m/sec, for a period of 15 minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.
 - (B) Thoroughly clean, prior to fabrication, sections of new piping which cannot be isolated for flushing purposes.
 - (C) Thoroughly clean, insofar as possible, welded joints by swabbing interior of pipe with swabs soaked with a caustic solution.
 - (D) Flush stainless steel piping with water as described above, then immediately flush with design product fluid. Do not leave city water or chlorinated water in piping.
 - (iii) Glycol Systems
 - (A) Clean systems with neutral pH, non-chromate chemical cleaner to remove sludge oil and debris. Use cleansing compound at rate of 10 kg per 5000 litres of water in system.
 - (B) Circulate cleaner for 72 hours at room temperature then drain and refill with water with and inhibitor.
 - (C) Circulate inhibitor treated water for an additional six hours and drain.
 - (D) Refill each system with working fluid and add chemicals to provide protection against corrosion.
 - (E) Recirculate fluid for four hours and test samples from system for iron

content. Drain, refill, and add chemicals so that total iron content in system is less than 1 ppm. (When iron content of glycol system is satisfactory, add glycol to achieve design concentration.)

- (j) Weeping tile drain piping system
 - (i) Refer to geo tech report for installation details and install accordingly.

END OF SECTION

1. **General**

- (a) Summary
 - (i) Section Includes
 - (A) Labour, products, equipment and services necessary to complete the work of this Section.
- (b) References
 - (i) American Society of Mechanical Engineers (ASME)
 - (ii) Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - (iii) Material Safety Data Sheets (MSDS).
- (c) Design Criteria
 - (i) Water Test Analysis
 - (A) Chemical treatment supplier to obtain a water sample from site and conduct water quality analysis prior to submission of shop drawings.
 - (B) Adjust the design and/or selection of equipment as necessary to suit measured water quality.
- (d) Submittals
 - (i) Shop Drawings
 - (A) Submit shop drawings in accordance with section 15010.
 - (ii) Operation and Maintenance Data
 - (A) Submit information for incorporation in operating manual for each internal water treatment system. Include schematic drawings, data sheets for equipment, and step by step instructions for testing procedures.
- (e) On-Site Training
 - (i) Provide instruction for operating personnel during start-up and commissioning.
- (f) Service
 - (i) For the first year of operation during the Warranty period, provide qualified Representative to visit on monthly basis to:
 - (ii) Review water analyses, records, correspondences and reports created since previous visit.

- (iii) Test water samples with portable test kit.
- (iv) Check performance and records of treatment, feeding, testing, and plant operation.
- (v) Submit written service report at completion of service call.
- (vi) Provide annual review of water treatment system performance.

2. **Products**

(a) Outline Description

(i) General

- (A) Provide packaged chemical control systems as described herein.
- (B) Systems to be complete with chemical drums, pre-mixed chemical solutions
- (C) Chemical system to be designed for truck delivery of 200 liters pre-mixed chemical drums, with pump delivering the chemical via installed piping to a feed tank located in the mechanical room.
Acceptable Manufacturers:
 - (I) Chem-Aqua
 - (II) GE infrastructure water and process technologies
 - (III) Finnan Eng. Product limited

(b) Materials

- (i) Piping, Schedule 80 PVC

(c) Closed Loop Heating And Cooling Systems

(i) Heating Water Treatment

- (A) Corrosion control equipment and chemicals are required for each of following closed circuit heating systems:

(B) System Data:

Type of System:	Closed / Re-circulating
Recirculation Rate, L/s	T.B.D.

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Temperature Range:	40°C to 65°C
Estimated System Volume, Litres	1000
Chemical System Type	Pot Feeder

- (C) Chemical System Type
- (D) Pot feeders: cast steel
- (E) Working pressure: 2000 kPa
- (F) Working temperature: 110°C
- (G) Fitted with cartridge type filter for filtrate quality of 20 microns
- (H) Sized to handle 5% of pump capacity

3. **Execution**

- (a) Manufacturer's Instructions
 - (i) Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- (b) Installation
 - (A) Install HVAC water treatment systems in accordance with requirements and standards of authorities having jurisdiction, except where specified otherwise.
 - (B) Ensure adequate clearances to permit performance of servicing and maintenance of equipment.
 - (C) Install crosses at changes in direction. Install plugs in unused connections.
- (c) Cleaning Of Mechanical System
 - (A) Provide copy of recommended cleaning procedures and chemicals for approval by Owner's representative
 - (B) Flush 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. Use chemicals to inhibit corrosion of various system materials that are safe to handle and use.
 - (C) Examine and clean filters and screens, periodically during circulation of cleaning solution, and monitor changes in pressure drop across equipment.

- (D) Drain and flush system until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
 - (E) Disposal of cleaning solutions approved by authority having jurisdiction.
- (d) Water Treatment Services
 - (i) Provide water treatment monitoring and consulting services for period of one year after system start-up. Service to include:
 - (A) Initial water analysis and treatment recommendations.
 - (B) System start-up assistance.
 - (C) Operating staff training.
 - (D) Visit plant every 15 days during period of operation and as required until system stabilizes, and advise on treatment system performance.
 - (E) Provide necessary recording charts and log sheets for one year operation.
 - (F) Provide necessary laboratory and technical assistance.
 - (G) Provide clear, concise, written instructions and advice to operating staff.

END OF SECTION

1. **General**

- (a) Related work
 - (i) Hydronic piping Section 15184
 - (ii) Natural Gas Piping Section 15191
 - (iii) Plumbing General Requirements Section 15400
- (b) Submittals
 - (i) Shop Drawings
 - (A) Submit shop drawings in accordance with section 15010 "Basic Mechanical Requirements".
 - (ii) Operation and Maintenance Data:
 - (A) Submit printed operation instructions and maintenance data in accordance with section 15010 "Basic Mechanical Requirements".

2. **Products**

- (a) Thermometers and Pressure Gauges
 - (i) General
 - (A) Scale Reading Units:
 - (I) Thermometers to read both Fahrenheit and Celsius scale.
 - (II) Pressure gauges to read both psi and kPa.
 - (III) Gauge stems and separable sockets of sufficient length to provide for proper insertion in piping or equipment in which they are installed.
 - (B) Products are identified by model designations from H.O. Trerice Co. and to be used as a guide to establish standard of construction. Comparable products are acceptable from the following manufacturers:
 - (I) H.O. Trerice Company
 - (II) Weiss
 - (III) Winter's Thermogauges Limited
 - (ii) Direct Reading Thermometers
 - (A) Industrial 230 mm scale length, variable angle type, liquid filled, aluminum case
 - (I) H.O. Trerice Company - A400 series
 - (II) Weiss
 - (III) Winters

- (B) Bi-metal dial type, 125 mm diameter, variable angle, stainless shell type 300 series case and stem with calibration screw.
 - (I) H.O. Trerice Company - B85600 series
 - (II) Weiss
 - (III) Winter's Thermogauges Limited
- (iii) Remote Reading Thermometers
 - (A) 115 mm diameter, liquid filled or gas activated type, braided bronze armor over copper capillary, stainless steel bulb and cast aluminum case for surface mounting.
 - (I) H.O. Trerice Company - Series No. L80300 (liquid filled)
 - (II) Weiss
 - (III) Winter's Thermogauges Limited
- (iv) Thermometer Wells
 - (A) Provide wells in pipelines as follows:
 - (I) For copper pipe: brass.
 - (II) For steel pipe: brass or stainless steel.
- (v) Conversion Kit
 - (A) Retrofit kit for converting wells of straight liquid filled thermometers to accept bi-metal dial thermometers.
- (vi) Direct Reading Pressure Measurement
 - (A) Dial type, 100 mm diameter, glycerine liquid filled
 - (I) Case: stainless steel type 304
 - (II) Movement: stainless steel
 - (III) Tube and socket: stainless steel type 304
 - (IV) Adjustable pointer
 - (V) 2-way gauge cock
 - (VI) Operating temperature range, glycerine: -17°C to 115°C (0°F to 240°F)
 - (VII) Operating temperature range, silicone: -34°C to 240°F (-30°F to 240°F)
 - (VIII) Accuracy: ASME B40.1 Grade 1A $\pm 1\%$ full scale
 - (IX) Approved Manufacturers
 - (1) H.O. Trerice Company - Series 700
 - (2) Weiss
 - (3) Winter's
- (vii) Differential Pressure Measurement at pumps, refrigeration machines and where shown
 - (A) Same as for Direct Reading Pressure Measurement, and:
 - (I) Maximum registering pointer
 - (II) Impulse snubber

(III) 3 way switching valve

(b) Strainers and Filters

(i) "Y" Pattern Strainers

- (A) NPS 2 and under:
 - (I) "Y" pattern
 - (II) Class 125 (860 kPa) bronze body
 - (III) Screwed ends and screwed cleanout.
- (B) NPS 2-1/2 and larger:
 - (I) "Y" pattern
 - (II) Class 125 (860 kPa) cast iron body
 - (III) Flanged ends and bolted cleanout cap or grooved ends with coupled cap
 - (IV) Blow-off drain connection.
- (C) Screen material: Perforated stainless steel with 1/16 or 1/8 inch openings or 20 mesh stainless steel unless otherwise noted
- (D) Manufacturers:
 - (I) Kitz
 - (II) Victaulic series 732 / w732
 - (III) Erwel
 - (IV) Spirax Sarco
 - (V) Streamflo
 - (VI) Brooks – Hart

(c) Miscellaneous

(i) Pressure Relief Valves

- (A) ASME rated, selected of relieving flow at 25% above the working pressure.
- (B) Body construction and trim: to suit specific service.
- (C) Manufacturers
 - (I) STM Specialty Sales
 - (II) Watts
 - (III) Fisher
 - (IV) Consolidated

(ii) Drain Valves

- (A) NPS ½ brass sediment faucets with hose outlets
- (B) Manufacturers
 - (I) Emco 10740
 - (II) Cambridge Brass 32W201

3. **Execution**

(a) Installation – Thermometers and Pressure Gauges

(i) General

- (A) Installation height: not greater than 3 m from floor or platform.
- (B) Installation heights exceeding 3 m from floor or platform: install remote reading thermometers and gauges, with dial mounted at 1500 mm above floor or platform, on steel or aluminum plate.

(ii) Thermometers

- (A) Install thermometers in wells.
- (B) Install wells with extension necks in piping or equipment that is to be insulated.
- (C) Provide thermometers at inlet and outlet of:
 - (I) Water heating coils
 - (II) Domestic hot water heater inlet and outlet
 - (III) and as shown

(D) Thermometer Ranges

System	Scale Range
Domestic cold water	-5 °to 40°C
Domestic hot water	10 °to 75°C
Heating Water	10 °to 115°C
Glycol	5° to 115°C

(iii) Pressure Gauges

(A) Selection

- (I) Normal operating reading: between $\frac{1}{2}$ and $\frac{2}{3}$ of full scale or range and expected maximum and minimum readings are within range.
- (B) Provide pressure gauges at inlet and outlet of:
 - (I) Pressure reducing valves
 - (II) Pumps (pressure differential)
 - (III) and as shown
- (C) For direct pressure measurement, provide for each gauge:
 - (I) $\frac{1}{4}$ turn bronze ball valve complete with lever handle
 - (II) Pressure snubber
- (D) For differential pressure measurement, provide for each gauge:
 - (I) 3-way 3 position (left-off-right) switching valve with lever handle

- (II) Pressure snubber
 - (III) Impulse dampener
 - (IV) Syphons for gauges in steam service
 - (V) Isolation diaphragms where shown for gauges in corrosive service
- (iv) Test Plugs
 - (A) Provide test plugs for temporary insertion of thermometers and pressure gauges at locations shown on drawings.
- (b) Installation – Strainers and Filters
 - (i) “Y” Strainers
 - (A) Horizontal installation: install with minimum 300 mm clearance between bottom of strainer and any obstruction.
 - (B) Vertical installation: install with basket drain pointing down, and with minimum 300 mm clearance between bottom of strainer and any obstruction.
 - (C) Provide drain valve complete with chain and cap on all strainers.
 - (D) Remove baskets, clean and replace at time of building handover.
 - (c) Installation – Miscellaneous
 - (i) Pressure Relief Valves
 - (A) Install relief valves downstream of pressure reducing valves, and on pressure vessels where shown.
 - (B) Provide discharge elbow drain, and pipe drain with NPS ¾ pipe to nearest floor drain.
 - (ii) Drain Valves
 - (A) Provide at:
 - (I) Low points of water piping systems in order to completely drain each system
 - (II) Other locations as shown

END OF SECTION

1. General

(a) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".

(ii) Operation and Maintenance Data:

- (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

(b) Reference Standards

- (i) Back-Flow Preventers: to CAN/CSA B64 standard series

2. Products

(a) Back Flow Preventers

(i) General

- (A) Products are identified by model designations from Watts and to be used as a guide to establish standard of construction. Comparable products are acceptable from the following manufacturers:

- (I) Watts
- (II) Brukmann
- (III) Honeywell

(ii) Vacuum Breakers, Pressure Type (PVB)

- (A) To CSA B64.1.2 for back-siphonage, no back pressure.
- (B) Working pressure: to 1200 kPa.
- (C) Spring loaded single float and disc with independent first check, complete with shut-off valves and ball type test cocks, and continuous working temperatures to 60°C (140°F)
- (I) Watts - 800M4QT
 - (II) Apollo

(iii) Double Check Valve Assemblies (DCVA)

- (A) To CSA B64.5
- (B) Two independent check valves, checks replaceable for repair and testing.
- (C) Working pressure: to 1200 kPa.
- (D) NPS ½ to NPS 2: complete with quarter turn shut-off valves and bronze strainer, and continuous working temperatures to 60°C

- (140°F)
 - (I) Watts 007QTS
 - (II) Apollo
 - (III) Zurn
- (E) NPS 2½ to 10: complete with non-rising stem gate valves, and continuous working temperatures to 43°C (110°F)
 - (I) Watts 709 NRS RW
 - (II) Apollo
 - (III) Zurn
- (iv) Backflow Preventer with Intermediate Atmospheric Vent (DCAP)
 - (A) To CSA B64.8
 - (B) Two independent check valves with intermediate vacuum breaker and relief vent
 - (C) Working pressure: to 1200 kPa
 - (D) NPS ½ to NPS ¾: all bronze construction
 - (I) Watts 9D
 - (II) Apollo
 - (III) Zurn
 - (E) NPS 3/8 for lab faucets
 - (I) Watts NLF9
 - (II) Apollo
 - (III) Zurn
 - (F) NPS 3/8 for vending machine water supply
 - (I) Watts 9BD
 - (II) Apollo
 - (III) Zurn
- (v) Reduced Pressure Principle (RP)
 - (A) To CSA B64.4
 - (B) Two independent check valves with intermediate relief valve, shut-off valves and ball type test cocks.
 - (C) Working pressure: to 1200 kPa
 - (D) NPS ½ to NPS 2: complete with quarter turn shut-off valves and bronze strainer
 - (I) Watts 009QT-S - for working temperatures up to 60°C (140°F)
Or Approved equivalent
 - (II) Watts 909QT-S-HW - for working temperature up to 99°C (210°F) or Approved Equivalent
 - (E) NPS 2½ to NPS 10: complete with shut-off gate valves and bronze strainer, and continuous working temperatures to 43°C (110°F)

- (I) Watts 909-NRS RW – S
 - (II) Apollo
 - (III) Zurn
 - (F) RPP valves complete with air gap drain collectors
 - (I) Watts 909AG
 - (II) Apollo
 - (III) Zurn
 - (G) Backflow preventer test kit: pressure gauge, colour coded needle valves and hose, adaptors, replaceable hose filters.
 - (I) Watts TK-99E
 - (II) Apollo
 - (III) Zurn
- (b) Miscellaneous Equipment
- (i) Make-up Water Feeder Valves
 - (A) Line size, complete with relief valve and strainer
 - (I) Taco No. 329
 - (II) Armstrong No. RD11
 - (III) Watts No. U5LP
 - (ii) Water Pressure Reducing Valve
 - (A) Spring loaded, cast iron body, synthetic rubber diaphragm, solid bronze trim.
 - (I) Leslie "Hi-Flo" Class WK
 - (II) Singer
 - (III) Trerice
 - (iii) Shock Absorbers (Water hammer arrester)
 - (A) Water hammer type, sized in accordance with P.D.I.-WH201
 - (I) Watts
 - (II) Zurn "Shoktrols A-1700-75"
 - (III) S-M-S "P.P.P. Type II"
 - (iv) Non-Freeze Wall Hydrants (NFHB)
 - (A) Non-freeze box type, flush mounting to wall, with NPS 3/4 hose connection, self-draining, integral hose end vacuum breaker, hinged locking cover, galvanized wall sleeve, ground joint union elbow adapter and operating key.
 - (I) Zurn Z-1320
 - (II) Watts HY-725
 - (III) Enpoco HY72
 - (v) Internal Hose Bibb (HB)
 - (A) Hose bib shall be indoor, exposed type, complete with 3/4" male

threaded x 3/4" internal 90 degree connection, integral vacuum breaker, and shall be suitable for installation with concealed supply piping in a 6" deep concrete block wall.

- (I) Watts SC8-4
- (II) Zurn
- (III) Enpoco

(vi) Trap Seal Primers

- (A) Refer to Section 15150 "Drainage Specialties".

3. Execution

(a) Installation

(i) Back Flow Preventers

- (A) Provide backflow preventers selected in conformance to CSA B64.10, where a connection is made between any system conveying potable water and a system carrying non-potable water or any other liquid.
- (B) Install backflow preventers where shown on Drawings, in accordance with manufacturers recommendations, and as follows:
 - (I) Locate RPP devices at 1200 mm above finished floor.
 - (II) Locate VB devices exposed as close to fixture connection as possible.
 - (III) Provide drain collector at relief valves and NPS 3/4 drain from DCAP and RPP devices and run drain to nearest floor drain.
- (C) Testing:
 - (I) Provide the services of an independent inspection agency to verify operation of all backflow prevention devices provided with testing ports.
 - (II) Provide inspection tag on each such device.
 - (III) Submit test results to Building Plumbing Inspector and the Consultant.

(ii) Make-up Water Valves

- (A) Locate in domestic water lines to heating and cooling systems where shown.

(iii) Water Pressure Reducing Valves

- (A) Locate in domestic water lines as shown, with capacity and pressure reduction ratings as shown.
- (B) Provide pressure gauge on upstream and downstream side of PRV, complete with pet-cock.
- (C) Provide pressure relief valve suitably sized and pipe to drain.

(iv) Shock Absorbers

- (A) Locate shock absorbers in hot and cold water lines:
 - (I) At far ends of mains
 - (II) At branch lines to each flush valve and quick closing valve
 - (III) At dead ends of branch piping or to groups of plumbing fixtures
 - (IV) At isolated individual plumbing fixtures
 - (V) As shown
- (v) Wall Hydrants
 - (A) Verify wall thickness at each hydrant to ensure correct hydrant length.
- (vi) Hose Bibs
 - (A) Mount 1050 mm above finished floor.
 - (B) Provide a line mounted vacuum breaker selected for continuous pressure.

END OF SECTION

1. General

(a) Related Work

- (i) Roof Drains: Provided by Division 15, installed by Division 7.

(b) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".

(ii) Operation and Maintenance Data

- (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. Products

(a) Drainage Specialties

(i) General

(A) Acceptable Manufacturers:

- (I) Zurn Industries Ltd.
- (II) Jay R. Smith
- (III) Ancon
- (IV) Watts

- (B) Zurn catalogue numbers are specified to indicate quality and features required. Sizes as shown on Drawings.

(b) Floor Drains

(i) General Construction

- (A) Drain body to have tapped primer connection.

- (B) The type letter allocated to the following list of floor drains identifies that particular drain on the Drawings.

(ii) FD (Finished Areas)

- (A) Two-piece epoxy coated cast iron body with double drainage flange, weep holes, non-puncturing flashing collar, adjustable heavy duty 13 mm thick, 150 mm round. polished nickel bronze head and strainer, sediment bucket, and push-on, caulked or "MJ" bottom outlet.

- (I) Zurn ZZN-415-KA
- (II) Watts FD100-C-6-1-5
- (III) Jay R Smith

(iii) FD (Unfinished Areas, Mechanical Room)

- (A) Three-piece all epoxy coated cast iron body, membrane flashing clamp with weep holes and adjustable 8" (203mm) diameter ductile iron grate. and push-on, caulked or "MJ" bottom outlet.
 - (I) Zurn
 - (II) Ancon
 - (III) Jay R Smith
- (iv) FFD (Finished Areas)
 - (A) Two-piece epoxy coated cast iron body with double drainage flange, weep holes, non-puncturing flashing collar, adjustable 150 mm dia. nickel bronze head and combination strainer and 75 mm x 225 mm oval funnel, and caulked or "MJ" bottom outlet.
 - (I) Zurn ZN-415-BF
 - (II) Ancon
 - (III) Jay R Smith
- (v) FFD (Unfinished Areas, Mechanical Room)
 - (A) Three-piece all epoxy coated cast iron body, membrane flashing clamp with weep holes and adjustable 8" (203mm) diameter ductile iron grate with 4" x 9" (101.6mm x 228.6mm) C.I. oval funnel. oval funnel, and caulked or "MJ" bottom outlet.
 - (I) Zurn
 - (II) Ancon
 - (III) Jay R Smith
- (vi) Scupper Drain c/w backwater valve
 - (A) Elevator pit Drain, all duco coated cast iron body, flashing clamp with seepage openings, bronze backwater valve and 170mm x 240mm secured C.I. grate. For angle installation provide 1510SGBV with backwater valve.
 - (I) Jay R Smith series 7000
 - (II) Zurn
 - (III) Watts
- (vii) Floor Drain Traps and Primers
 - (A) Trap seal primer valves: cast brass body, vacuum breaker and NPS ½ sweat connections.
 - (I) Zurn Z1022A
 - (II) Ancon
 - (III) Jay R Smith
 - (B) Automatic trap seal primer assemblies (electrically operated): Trap primers and distribution units c/w cabinet, timer, distribution manifold and solenoid valve.
 - (I) PPP Model PT-8, watts
 - (C) Trap seal primer line:
 - (I) NPS ¼ polyethylene piping

(c) Roof drains

(i) Roof Drain-RD

- (A) Epoxy finished cast iron body, removable bayonet locking mushroom type Aluminum dome strainer, non-puncturing waterproofing membrane flashing clamp with integral gravel stop, threading connection. Complete with roof sump receiver, underdeck clamp, solid gasketed extension clamp studs, waterproof flange and aluminum dome.

- (I) Zurn Z-121-ZA
- (II) Ancon
- (III) Jay R Smith

(d) Drainage Cleanouts

(i) Buried Piping

- (A) Flush floor type: cast iron ferrule with inside caulked or spigot connection outlet, seal plug and nickel brass frame and cover suitable for type of floor in which it is to be installed, e.g. tile, terrazzo, carpet, concrete, etc. Include membrane clamping device for installation in membrane floors.

- (B) For heavy duty traffic areas:

- (I) Zurn Series ZX-1612-SP
- (II) Ancon
- (III) Jay R Smith

- (C) For light duty areas:

- (I) Zurn Series ZN-1602-SP
- (II) Ancon
- (III) Jay R Smith

- (D) For terrazzo areas:

- (I) Ancon
- (II) Jay R Smith
- (III) Zurn

- (E) For tiled areas:

- (I) Ancon
- (II) Jay R Smith
- (III) Zurn

- (F) For carpeted areas:

- (I) Ancon
- (II) Jay R Smith
- (III) Zurn

- (G) For heavy traffic unfinished areas:

- (I) Ancon
- (II) Jay R Smith
- (III) Zurn

(ii) Exposed Piping

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- (A) Cast iron piping in exposed location or in accessible pipe chases: cast iron body with straight threaded, coated plug having a tapered shoulder that seats against a lead seal.
 - (I) Zurn Z-1616 or Zurn 1445
 - (II) Ancon
 - (III) Jay R Smith
 - (B) Copper stack piping in exposed locations or in accessible pipe chases: Bronze cleanout tee, bronze ferrule and cover, secured to ferrule by bronze cap screws.
 - (C) Access Cover for Cleanouts Concealed in Walls: type to suit wall surface and construction.
 - (D) Cover for cleanouts at base of vertical sanitary stacks or rainwater leaders: bolted type, neoprene gasket, and brass cap screws or bolt studs, unless shown otherwise on Drawings.
- (e) Miscellaneous Products
- (i) Grease Interceptor
 - (I) Grease interceptor shall be epoxy coated from inside and outside fabricated steel grease interceptor with flow rate and grease holding capacity as indicated in mechanical schedule.
 - (II) Unit shall include removable baffle, deep seal trap, non-removable stainless steel calibrated orifice plate and cover-all cover with low pressure grease accumulating chamber and draw off hose.
 - (III) Entire unit shall be housed in epoxy coated fabricated steel housing with epoxy coated non-skid cover with adjustable interceptor carries brackets and integral anchoring flange.
 - (IV) Unit shall be c/w control panel and high level alarm system.
 - (V) Acceptable Manufacturer: Watts GI-150-AH, Zurn, Mifab

3. **Execution**

(a) Installation

(i) Floor Drains

- (A) Provide each floor drain installation with a deep seal "P" trap unless otherwise shown, complete with trap primer connection tapping to conform with code requirements.

(ii) Floor Drain Primers

- (A) Provide each floor drain with a trap seal primer.
 - (I) Exception: floor drains located in shower stalls, group showers and other locations where the floor is exposed to water on a daily basis.
- (B) Use trap seal primer valves where a domestic cold water line serving a washroom fixture (preferably a water closet) is within 50 feet of the floor

drains.

- (I) Above ground floor drains: Provide an NPS ½ Type K copper pipe to primer connection on drain body.
- (II) Below ground floor drains: Provide an NPS ½ Type K copper pipe to within 300 mm of the floor line. Provide 3/8" white polybutylene tubing from this point and connect to drain body.
- (C) Install trap primer in truss space or other accessible location, or as directed by the Consultant.
- (D) In other areas with remote floor drains, use an automatic trap seal primer assemblies.
- (E) Provide electrically operated trap seal primers for the traps in the tunnels.

(iii) Cleanouts

- (A) Locate drainage cleanout fittings in drainage piping:
 - (I) At locations indicated on the Drawings
 - (II) At base of each vertical stack or rainwater leader
 - (III) As required to comply with applicable plumbing code

(iv) Back-Water Valves

- (A) Provide where shown.

(v) Grease Interceptor

- (A) Unit shall be installed as per manufacturer's standard.
- (B) Co-ordinate with div 16 for power requirements of control panel.

(vi) Expansion Joints

- (A) Provide horizontal expansion joints on suspended drainage pipe which:
 - (I) Is welded
 - (II) Crosses a building expansion joint, whether the pipe is welded or not

END OF SECTION

1. **General**

- (a) Related work
 - (i) Pipes, Valves and Fittings: to Section 15110 "Pipes, Fittings and Valves"
 - (ii) Piping Specialties (general items): to Section 15120 "Piping Specialities"
- (b) Reference Standards
 - (i) Comply with the following:
 - (A) Technical Standards & Safety Act
 - (B) ANSI/ASME B31.9 - Building Services Piping Code, as specified
 - (ii) Materials
 - (A) To CSA B51 - M1991 with:
 - (I) Cast iron to ASTM A-278-84, Class 30 or ASTM A-126-84 Class B.
 - (II) Bronze to ASTM B62-82a.
 - (III) Stainless steel: to ASTM A351-84b, ASTM A-167-84, ASTM A-276-84 or ASTM A-564-79.
 - (IV) Schedule 40 steel pipes with compatible threaded (upto 50 mm) and flanged (65 mm and above) fittings.
 - (B) Bolting requirements:
 - (I) To ASTM A307-84.
- (c) Permits, Equipment Registration and Fees
 - (i) General
 - (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.
 - (ii) Equipment Certification
 - (A) Equipment and fittings designated as pressure vessels or Class "H" fittings as per CSA B51-97, Part 1, require:
 - (I) ASME stamped
 - (II) CRN registration
 - (iii) Registration
 - (A) Register the following pressure vessel and pressure piping systems:
 - (I) Building heating and cooling water systems operating at: pressures exceeding 1100 kPag; or temperatures exceeding 121°C.

- (d) Design Criteria
 - (i) Glycol Heating (Scheduled Temperature)
 - (A) Operating Temperatures:
 - (I) Supply: 5-82°C (41-180°F)
 - (II) Return: 13-43°C (55-130°F)
 - (B) Design Pressures: 860 kPa.
- (e) Submittals
 - (i) Shop Drawings
 - (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
 - (ii) Operation and Maintenance Data
 - (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".
- (f) Testing
 - (i) General
 - (A) Test piping in Consultant's presence, in accordance with testing requirements specified in Section 15110 "Pipes, Fittings and Valves" and with tests and test pressures hereinafter specified for various services.
 - (B) Lines may be tested in sections as authorized by the Consultant to accommodate construction schedule. However, test complete systems on completion.
 - (ii) Hydronic Systems
 - (A) Hydrostatically test hydronic (water) piping at 1.5 times the operating pressure or at 862 kPa pressure whichever is greater.

2. **Products**

- (a) Pipeline Specialities
 - (i) Automatic Air Vents
 - (A) Construction:
 - (I) Float operated with brass or cast iron body
 - (II) Rated working pressure: 690 to 1035 kPa
 - (B) Acceptable Manufacturers:
 - (I) Taco Hy-Vent (35 to 150 psi, 240 F)
 - (II) Spirax Sarco 13 WS (150 psi, 200 F)
 - (III) Spirax Sarco 13 W (150 psi, 450 F)
 - (IV) Maidomist

(ii) Circuit Balancing Valves

(A) Construction:

- (I) Positive shut-off calibrated balancing valves with hand wheel and division ring scale
- (II) Flow measuring disconnects
- (III) Metal tag with chain listing design flow rate, metered fluid, and meter reading for design flow rate
- (IV) Minimum working pressure: 1035 kPa
- (V) Combined accuracy of valve and meter: manufacturer certified to be within $\pm 2\%$ of actual flow
- (VI) NPS 2 and smaller: Ametal (copper-alloy) or brass body with screwed ends
- (VII) NPS 2½ and larger: Ductile iron or cast iron body with flanged or grooved ends

(B) Acceptable Manufacturers:

- (I) Armstrong – CBV
- (II) Bell and Gossett
- (III) Tour & Anderson

(b) Hydronic Specialities

(i) Diaphragm type expansion tanks

(A) Construction:

- (I) Pre-charged cylindrical steel pressurized tank with heavy duty Butyl rubber diaphragm suitable for 115°C (240°F) operating temperature.
- (II) working pressure: 860 kPa with ASME stamp and certification.
- (III) Air precharged to 84 kPa.
- (IV) Connections:
 - (1) Standard tire valve for charging.
 - (2) system connection as indicated
 - (3) Min 19 mm drain connection
- (V) Lifting Lug
- (VI) Saddles for horizontal installation or base mount for vertical installation.
- (VII) Estimated System Pressure Range: 20-60 Psig
- (VIII) Estimated System Temperature Range: 50-180 F

(B) Manufacturers:

- (I) Amtrol Extrol
- (II) Armstrong
- (III) Taco Tacotrol
- (IV) Bell & Gossett

(ii) Hydronic System Pressure Safety Relief Valves

(A) Construction:

- (I) Brass or iron body

- (II) ASME stamped
 - (III) Adjustable pressure setting from 55 to 172 kPa above system operating pressure at point of connection
 - (IV) Operating differential pressure from open to close not more than 20 kPa
- (B) Acceptable Manufacturers:
 - (I) Watts
 - (II) Bell and Gossett
- (iii) Suction Diffuser
 - (A) Construction:
 - (I) NPS 2 and under: cast iron body with screwed connections
 - (II) NPS 2½ and over: ductile iron or cast iron body with grooved or flanged connections
 - (III) Disposable stainless steel fine mesh screen
 - (IV) Screen blow down connection
 - (V) Permanent magnet particle trap
 - (VI) Full length stainless steel straightening vanes
 - (VII) Pressure gauge tapings
 - (B) Acceptable Manufacturers:
 - (I) Bell & Gossett FTP screwed, FLG-flanged
 - (II) Taco Series "SD"
 - (III) Armstrong Suction Guide
- (iv) Water Pressure Reducing Valves
 - (A) Construction:
 - (I) Self-contained hydraulic pilot controlled type.
 - (II) Single seated with resilient disc in iron body.
 - (III) Bronze seat for pressure drops below 480 kPa.
 - (IV) Stainless steel seat for pressure drops 480 kPa and over.
 - (V) Diaphragm suitable for 120°C (250°F) service.
 - (B) Acceptable Manufacturers:
 - (I) Watts
 - (II) Bell and Gossett
- (v) Triple duty valve
 - (A) A combination shut-off, center-guided non-slam check valve and calibrated balance valve in one device, sizes as shown on drawings. Valves shall be flanged connections. The triple-duty valve has a cast iron body, brass seat, cast bronze disc and SS stem. A calibrated nameplate and memory button allow return of the valve to the balanced position after shut-off. The stem shall be backseating type to allows repacking under full-line pressure.
 - (B) The valve stem shall be stainless steel with flat surfaces provided for adjustment with open-end wrench.

- (C) For Grooved Piping: The valve body shall be ductile iron with grooved ends and Armstrong anti-rotation Armgrip® lugs on the inlet and outlet of the body.
- (D) Flange adapters shall be ductile iron flanges with anti-rotation lugs and EPT gaskets.
- (E) For ANSI 150 (PN16) Welded Flanged Piping: The valve body shall be Cast Iron with ANSI 125 (PN16) flanged ports.
- (F) For ANSI 300 Welded Flanged Piping: The valve body shall be Ductile Iron with ANSI 250 (PN25) flanged ports.
- (G) The valve shall be selected and installed in accordance with the manufacturer's instructions and be suitable for the pressure and temperature specified.
- (H) Acceptable Manufacturers:
 - (I) Bell & Gossett
 - (II) Taco
 - (III) Armstrong
- (vi) Air Separator
 - (A) The air separator shall be heavy duty cast iron designed to function satisfactorily at working pressures up to 150 psi (10.3 bar) and liquid temperatures up to 250°F (121°C). The air separator shall have an internal diffuser and a coalescing medium design that will trap and collect air bubbles to be released at the top of the separator.
 - (B) Acceptable Manufacturers:
 - (I) Amtrol
 - (II) Bell & Gossett
 - (III) Taco
 - (IV) Armstrong

3. **Execution**

(a) Pipeline Specialities

(i) Air Vents

- (A) Install automatic air vents at high points of water piping systems and also in any other location noted on Drawings.
- (B) Install automatic air vent with 150 mm high, line size or NPS 4 size air pocket, whichever is smaller, and NPS ¾ isolating gate valve and piping to inlet connection of air vent.
- (C) Connect discharge to nearest funnel or hub drain or as shown on Drawings.

- (D) Provide manual air vents at all high points in the system and where required for efficient elimination of air from the system.
- (ii) Drain Valves
 - (A) Install drain valves at low points of water and compressed air piping systems in order to completely drain each system, and also in any other location noted on Drawings.
- (iii) Circuit Balancing Valves
 - (A) Provide balancing valves at all locations shown on the Drawings and as required to result in accurate flow balancing.
 - (B) Install valves in accordance with supplier's instructions.
 - (C) Make meters available to the Testing and Balancing Contractor during the balancing of the systems.
 - (D) Turn over meters to the Owner at Substantial Completion.
- (b) Hydronic Specialities
 - (i) Expansion tanks
 - (A) Tank Type:
 - (I) Diaphragm type for closed water systems
 - (B) Safety valves:
 - (I) Provide code rated water relief valve, located in piping near tank. Set relief pressures to maintain 70 kPa at highest point in system with pumps off.
 - (C) Drains:
 - (I) Pipe relief valve, relief connection on backflow preventer, and relief connection on make-up assembly to nearest open drain.
 - (ii) Glycol Systems
 - (A) In addition to the above requirements, provide the following for glycol systems:
 - (I) Provide glycol make-up line from glycol fill system, and valved drain line from bottom of each tank piped to glycol mixing tank.
 - (II) Pipe relief valves and valved drain line from bottom of each tank to glycol mixing tank.
 - (III) Connect and wire controls for pump and alarm system.
 - (iii) Pressure Safety Relief Valves
 - (A) Install on expansion tanks and other pressure vessels in accordance with relevant codes

- (B) Pipe outlets to drain.
- (iv) Pressure Reducing Valves
 - (A) Install pressure reducing valve stations with shut-off valve on either side of assembly and 115 mm pressure gauges on upstream and downstream sides of station
- (c) Flushing of Piping Systems
 - (i) Applicable Systems
 - (A) Flush water piping systems in accordance with Section 15110 "Pipes, Fittings and Valves".
 - (I) Flush water piping with water flowing at a velocity of not less than 1.8 m/sec, for a period of 15 minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.
 - (B) Thoroughly clean, prior to fabrication, sections of new piping which cannot be isolated for flushing purposes
 - (C) Thoroughly clean, insofar as possible, welded joints by swabbing interior of pipe with swabs soaked with a caustic solution.

END OF SECTION

1. **General**

(a) General

- (i) Freeze protection shall be provided for the following systems:

- (A) Glycol heating systems

(b) Related Work

- (i) Hydronic Piping

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(c) Design Criteria

- (i) Supply Water Quality

- (A) To be verified by the Contractor.

- (ii) Glycol Heating System

- (A) Operating Temperatures and Pressures:

- (I) Supply: -20°C (-5°F)

- (II) Maximum working pressure: 900 kPa

- (B) Glycol Concentration:

- (I) Glycol: water mixture strength by volume: 40%

(d) Submittals

- (i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".

- (ii) Operation and Maintenance Data

- (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

(e) Permits, Equipment Registration and Fees

- (i) General

- (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

2. **Products**

(a) Materials

- (i) Glycol Feed Systems

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- (A) Provide premixed glycol solution or mix concentrated glycol and water to achieve specified strength mixture for filling the entire system.
 - (B) Provide glycol systems with following major components:
 - (I) Mixing tank
 - (II) Circulating/feed pump c/w piping and valves
 - (III) Controls
 - (C) Glycol make-up unit and mixing tank:
 - (I) Polypropylene Plastic tank
 - (II) Steel frame
 - (III) Hinged gasketed cover with counterweight balanced hold-open mechanism.
 - (IV) Overflow, inlet and suction connections and pump mounting arrangement.
 - (V) Close-coupled all bronze centrifugal feed pump with strainer, foot valve and discharge isolation valves. Manual diverter valve for purging air and agitating contents.
 - (VI) Packaged controls including pressure switches, low water cut-off to shut down pump when glycol reaches low level and high water alarm.
 - (VII) Volt free contacts: common hgh/low press and low water level suitable for communication with Building Automation System.
 - (VIII) Transfer pump with strainer, foot valve and discharge isolation valves. Manual diverter valve for purging air and agitating contents.
 - (IX) Electrical: ac adaptor 120v 60 hz to 24VDC 50 watt ac.
 - (D) Acceptable Manufacturers:
 - (I) Armstrong Model GLA-S-HP-1
 - (II) Xylem (Bell and Gossett)
- (ii) Propylene Glycol
- (A) Industrial type coolant formulated with corrosion inhibitors.

3. **Execution**

- (a) Installation
 - (i) Mixing Tank
 - (A) Install mixing tank.
 - (B) Provide wiring to transfer pump.
- (b) Flushing and Filling of Piping Systems
 - (i) Applicable Systems

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- (A) Flush glycol water piping in accordance with Section 15110 "Pipes, Fittings and Valves".
 - (I) Flush water piping with water flowing at a velocity of not less than 1.8 m/sec, for a period of 15 minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.
 - (B) Thoroughly clean, prior to fabrication, sections of new piping that cannot be isolated for flushing purposes.
 - (C) Thoroughly clean, insofar as possible, welded joints by swabbing interior of pipe with swabs soaked with a caustic solution.
- (ii) Filling of Glycol Systems
 - (A) After system has been cleaned out and tested for leaks, fill with water through temporary water meter to obtain total system volume.
 - (B) Drain water from system and fill with pre-mixed glycol solution first with calculated volume of concentrated glycol then make up to system volume with water.
- (iii) Testing
 - (A) Circulate solution for one week and then take samples for testing for percentage concentration by specific gravity method, in glycol supplier's laboratory.
 - (B) Submit results of analysis.
- (iv) Corrective Action
 - (A) If correction of concentration is required, amount of mixture to be drawn from system to be calculated and drained into original containers. To this volume add water or glycol in calculated amounts to correct concentration in system, and recharge into system.
 - (B) Provide 24 hours notice before draining and refilling to correct concentration.
 - (C) Circulate after correcting concentration for a further 24 hours and retest concentration. Submit final report with historical data showing dates and times, results of each analysis, calculations and corrections made, and final concentration.
- (c) Chemical Supplies
 - (i) Supply ten, 20 litre pails of premixed propylene glycol to the Owner at Substantial Completion.

END OF SECTION

1. **General**

(a) Design Criteria

(i) Natural Gas Distribution System

- (A) Primary and Secondary gas service meter sizing: Gas input requirement shall be as per the schedules.
- (B) Building distribution pressure is 2 psi.

(b) Codes and Regulations; Permits, Costs and Fees

(i) Install, test and purge to current codes:

- (A) Natural Gas Installation Code CAN/CGA-B149.1.

(c) Permits, Equipment Registration and Fees

(i) General

- (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

(ii) Permits

- (A) Arrange and pay charges for new gas service into building as shown.
- (B) Arrange and pay charges for a gas meter installation, including regulators and service valves, as required by the local Gas Utility Company.

(d) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with section 15010 "Basic Mechanical Requirements".

(ii) Operation and Maintenance Data

- (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. **Products**

(a) Piping, Joints and Fittings

(i) Buried Piping

- (A) Pipe: Yellow polyethylene piping manufactured to CAN/CSA-B137.4
- (B) Joining: Heat fusion joints to manufacturers printed procedures and

recommendations.

(C) Fittings: Yellow polyethylene fittings manufactured to CAN/CSA-B137.4 or CAN/CSA-B137.4.1

(D) Acceptable Products:

(I) KWH Pipe WEHOGAS approved polyethylene gas distribution pipe.

(ii) Above Ground Piping

(A) Steel pipe: to ASTM A 53, Schedule 40 seamless as follows:

(I) NPS ½ to 2, screwed

(II) NPS 2-½ and over, plain end, welded.

(B) Copper tube: to ASTM B 75M.

(iii) Jointing Material

(A) Screwed fittings: pulverized lead paste

(B) Welded fittings: to CSA W47.1

(C) Flanged gaskets: non-metallic flat

(D) Soldered: to ASTM B 32

(iv) Fittings

(A) Steel pipe fittings, screwed, flanged or welded:

(I) Malleable iron: screwed, banded, Class 150

(II) Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5

(III) Welding: butt-welding fittings

(IV) Unions: malleable iron, brass to iron, ground seat, to ASTM A 47M

(V) Bolts and nuts: to ANSI B18.2.1

(VI) Nipples: schedule 40, to ASTM A 53

(B) Copper pipe fittings, screwed, flanged or soldered:

(I) Cast copper fittings: to ANSI B16.18

(II) Wrought copper fittings: to ANSI/ASME B 16.22

(v) Valves

(A) Provincial code approved, lubricated type.

(b) Specialties

(i) Pressure Reducing Regulating Valves

(A) Spring loaded, quick response regulator with stabilizer vent, partial internal relief, suitable for service with downstream solenoid valves.

(I) Fisher S202

(II) or approved equivalent

- (ii) Safety Relief Valves
 - (A) Throttling type relief valve.
 - (B) Size valves so that combined capacity of relief port of gas regulator and of relief valve will provide relief capacity equal to total capacity of pressure reducing station.
 - (I) Fisher 289 series
- (iii) Blocking (Shut-Off) Solenoid Valves
 - (A) Approvals
 - (I) CGA listed to CAN. 1-6.5-78
 - (II) CGA listed to CAN/CGA-3.9-M87
 - (III) CSA listed to CSA C22.2, No. 139
 - (B) Brass or aluminum body, normally closed (NC) solenoid natural gas valve, 120 VAC, to NPS 2.
 - (I) Ascoelectric Ltd or approved equivalent.
- (iv) Bleed (Vent) Solenoid Valves
 - (A) Approvals
 - (I) CSA listed to CSA C22.2, No. 139
 - (B) Brass or aluminum body, normally open (NO) solenoid natural gas valve, 120 VAC, to NPS 2½.
 - (I) Ascoelectric Ltd
- (v) Safety Shut-Off Valves
 - (A) Approvals
 - (I) CGA 3.9
 - (II) FM listed
 - (III) IRI listed for block/bleed/vent
 - (B) Gray iron body, normally closed (NC), rising stem valve, solenoid actuated control, DPDT switch to indicate valve closed position. Valve to only open when power is supplied to the solenoid. (Automatic) (or) (Manual) opening (as shown on Drawings). NPS ¾ to NPS 6.
 - (I) Maxon 5000-CP (automatic opening)
 - (II) Asco General H117A (automatic opening)
 - (III) Maxon 808-CP (manual opening)
 - (IV) Ascoelectric 8044 (manual opening)

3. **Execution**

(a) Installation – General Piping

(i) Piping

- (A) Buried Piping: Polyethylene
 - (I) Install piping to manufacturers recommendations

- (II) Protect piping where it terminates above ground with metallic sheathing riser that extends a minimum of 150 mm below grade.
 - (III) Install tracer wire or equivalent tracing media so piping can be located from the surface.
 - (IV) Install warning tape above piping located minimum of 300 mm below grade and at least 300 mm above piping.
 - (B) Exposed piping:
 - (I) NPS 2 and smaller: screwed
 - (II) NPS 2½ and larger: welded with butt weld fittings
 - (C) Concealed piping:
 - (I) NPS 2 and smaller: welded with socket weld fittings
 - (II) NPS 2½ and larger: welded with butt weld fittings
 - (D) Equipment connections:
 - (I) NPS 2 and smaller: screwed unions
 - (II) NPS 2½ and larger: flanges
 - (E) Branch connections:
 - (I) May be welded directly into main provided main is more than NPS 4 and branch is at least 2 pipe sizes smaller than main
 - (II) Cut openings in main true and bevelled
 - (III) Do not project branch pipes inside main pipe
 - (IV) Size openings to prevent entry of welding metal and slag into pipes
 - (F) Saddle type branch welding fittings used on mains:
 - (I) Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding
 - (G) Dirt Pockets:
 - (I) At each connection to equipment.
 - (II) At all low points in piping systems.
 - (H) Make-up joints in screwed pipe with joint compound.
 - (I) Provide clearance for maintenance of equipment, valves and fittings.
 - (J) Ream pipe after cutting to length, clean off scale and dirt inside and outside of pipe.
 - (K) Cap ends during construction to prevent entry of foreign matter.
 - (L) Slope piping down in direction of flow to low points.
 - (M) Use eccentric reducers at pipe size change installed FOT to provide positive drainage.
- (ii) Valves
- (A) Install valves with stems upright or horizontal.

- (B) Install valves at branch take-offs to isolate each piece of equipment.
- (b) Installation – Regulating and Control Devices
 - (i) Pressure Reducing Stations
 - (A) Provide, pressure reducing stations where required, consisting of pressure regulating valve, relief valve, isolating valves and pressure gauges on both sides of pressure reducing station.
 - (ii) Pressure Reducing Regulators
 - (A) Provide regulator control lines, where required, and connect to downstream piping a minimum of 8 to 10 pipe diameters from the regulator and any elbows.
 - (iii) Relief Valves
 - (A) Select relief valves based on wide open (valve failure condition) flow rates and not on regulated flow rate.
 - (iv) Vents
 - (A) Run vent piping from relief connection on gas regulator and relief valves up through roof. Provide roof sleeves and flashing. Terminate pipe with turn down bend, and protect opening with stainless steel insect screen, to approval of authorities having jurisdiction.
 - (B) Individual vent line sizes:
 - (I) Equal to relief port connection size where total length of vent is less than 15 metres
 - (II) One size larger than port connection size where total length of vent is between 15 m and 30 m
 - (III) One additional size larger for each additional 15 m of pipe length
 - (C) Combined vent line sizes:
 - (I) Individual vent lines can be combined into common vents, where the variance between the inlet pressures of all relief devices is less than 10%, and the variance between the outlet pressures of all relief devices is less than 10%
 - (II) Size the combined vent to have a cross sectional area equal to the largest relief device opening, plus 50% of the total area openings of all other devices.
 - (v) Safety, Blocking and Vent Solenoid Valves
 - (A) Install valves in accordance with manufacturer's recommendations.
- (c) Connections to Municipal Services
 - (i) Natural Gas Supply
 - (A) Make arrangements with local Gas Company for installation of an

underground gas service, gas meter, main pressure reducing station, and connection thereto at location indicated.

- (B) Include costs levied by the Gas Company for provision, installation, and connection of this service.

(d) Equipment Installation

(i) General Requirements

- (A) Set equipment in place, align, connect and place in operation with:
- (B) Controls set for efficient, stable operation.
- (C) Initial lubrication and oil sumps filled.
- (D) Connections and required safety devices installed.
- (E) Protect equipment from damage during and after installation, and on completion of Work ensure that equipment is free from cracks, scratches, discolouration, tool marks, and other defects.
- (F) Thoroughly clean finished surfaces before acceptance of the Work.
- (G) Install heater vents complete with necessary supports, hangers, braces, roof flashing, storm collar, and round top.

END OF SECTION

1. **General**

(a) References

- (i) Comply with applicable requirements of the latest issue of the following Standards:

- (A) NFPA 10: Portable Fire Extinguishers
- (B) OFC: Ontario Fire Code

(b) Submittals

- (i) Shop Drawings
 - (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".

2. **Products**

(a) Fire Extinguisher Cabinets

(i) Construction

- (A) Finished walls: Size: nominal 203 mm x 432 mm x 127 mm fully recessed.
- (B) Stainless steel, 304 grade #4 finish, black tub and surrounding rim
- (C) 12 gauge hollow channel door and rebated frame
- (D) Concealed piano hinges
- (E) Door latch and 5 mm plate glass in door

(ii) Acceptable Manufacturers

- (A) National Fire CTE-300-5
- (B) Wilson and Cousins
- (C) Cronin

(b) Fire Extinguishers

(i) General Purpose (FE-1)

- (A) ABC dry chemical type complete with full operating charge and without CFCs, HCFCs, and halons.
- (B) Size and location per NFPA 10, OFC, and local fire department requirements (where shown on Drawings), and as specified.
- (C) Minimum size and rating: 5 lb. capacity, 3A:10 BC rating.

- (D) Include wall mounting bracket suitable for extinguisher supplied for all extinguishers not installed in fire extinguisher or fire hose cabinets.
- (E) Acceptable Manufacturers
 - (I) National Fire Equipment A3C-050E-SH
 - (II) Flag
 - (III) Pyrene
- (ii) General Purpose (FE-2) Mechanical Rooms
 - (A) ABC dry chemical type complete with full operating charge.
 - (B) Size and location in NFPA 10, OFC, and local fire department requirements where shown on Drawings, and as specified.
 - (C) Minimum size and rating: 10 lb. capacity, 4A, 60 BC rating.
 - (D) Include wall mounting bracket suitable for extinguisher supplied.
 - (E) Acceptable Manufacturers
 - (I) National Fire Equipment ABC-10G
 - (II) Flag
 - (III) Pyrene

3. **Execution**

- (a) Fire Extinguisher Cabinets
 - (i) Fire extinguishers in finished areas shall be installed in fully recessed stainless steel cabinets in finished areas. Exposed installation in Mechanical, Electrical and Communication rooms..
 - (ii) Coordinate with General Trades.
 - (iii) Install where shown or arrange for General Trades to install. Turn over to General Trades in a timely manner to meet schedule.
- (b) Fire Extinguishers
 - (i) Provide fire extinguishers as follows:
 - (A) Where shown on Drawings.
 - (B) In each fire extinguisher cabinet.
 - (C) In each service room, mechanical room, electrical, computer data and telecom room and each janitor's room.
 - (ii) Coordinate mounting installation of wall mounting bracket with General Trades.
 - (iii) Install fire extinguishers in cabinets and/or on brackets at time of final inspection.

St. Paul's CES

Portable Fire Extinguishers

Section 15301

Child Care Addition

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100 James A. McCague Ave

Alliston, Ontario

SMCDSB P00467 / WKL 17033

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END OF SECTION

1. General

(a) General

- (i) Provide Work of this Section in accordance with the Contract Documents including, but not limited to, the following:
 - (A) Piping Systems:
 - (I) Sanitary drainage, storm drainage and venting system within building(s) including connection to buried sanitary sewer 1.5 m outside building wall
 - (II) Domestic cold, hot and re-circulating water piping to plumbing fixtures within building
 - (III) Domestic cold water piping to 1.5 m outside building wall
 - (IV) Excavation, bedding, and backfilling of pipe trenches for buried piping inside building and to 1.5 m outside the building.
 - (B) Equipment:
 - (I) Plumbing specialties
 - (II) Drainage specialties
 - (III) Plumbing fixtures and fittings
 - (IV) Hot water heaters
 - (V) Pumps

(b) Related Work

- (i) Work performed under other Sections
 - (A) Buried city water main from connection to municipal water service at property line, to 1.5 m outside building: Site Services.
 - (B) Buried storm, sanitary and process drains and sewers from 1.5 m outside building wall: Site Services.
 - (C) Excavating, bedding and backfilling for buried storm, sanitary and process drains and structures from 1.5 m outside building: Site Services.
 - (D) Electrical wiring: Division 16.

(c) Codes and Regulations; Permits, Costs and Fees

- (i) Comply with latest issue of Codes, Standards and Regulations, including revisions and amendments thereto as adopted and published at date of tender closing:
 - (A) Ontario Building Code.
 - (B) Ontario Water Resources Act, Ministry of Housing Regulation No. 815.
 - (C) Local Municipal Authorities.

(d) Submittals

- (i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
- (ii) Operation and Maintenance Data
 - (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".
- (e) Testing and Inspection
 - (i) Testing
 - (A) To Section 15110 "Pipes, Fittings and Valves"
 - (ii) Flushing and Sterilization
 - (A) Sterilize water piping connected to Municipal water supply in accordance with local municipal requirements. Flush each system after completion by allowing full flow of water through the system for a period of 15 minutes or longer when directed by the Consultant.
 - (B) After flushing of the system is completed, perform a 24 hour contact sterilization treatment by treating the water with 50 ppm of chlorine as recommended in AWWA Specification C-651.
 - (C) After sterilization period has elapsed, flush system to reduce chlorine content to an acceptable level, but not less than 30 minutes.
 - (D) Remove and clean strainer screens after flushing operation is completed. Repeat two weeks after initial operation of systems and within two weeks after Substantial Completion.

2. **Products**

- (a) Piping
 - (i) Refer to Section 15110 "Pipes Fittings and Valves" and relevant sections.
- (b) Plumbing and Drainage Products
 - (i) Refer to relevant sections.

3. **Execution**

- (a) Installation
 - (i) General
 - (A) Install complete plumbing, drainage and vent piping within washrooms, etc. in accordance with the Ontario Building Code, standard trade practice and as specified herein.
 - (B) Arrange piping within pipe spaces behind washroom fixtures to allow unimpeded access to piping for servicing.
 - (ii) Balancing Valves

- (A) Where two or more branches connect to a domestic hot water re-circulating line, provide each return branch with a globe or circuit balancing valve.
- (iii) Air Handling Equipment Drains
 - (A) Provide drains for fan casings, air handling equipment, and low points in ductwork in locations and in arrangements as indicated on the Drawings, or as required by design. Drain piping is as specified for Sanitary Drainage, with deep seal copper trap. Install trap seal equivalent to not less than 1½ times the maximum static pressure in duct system.
- (b) Equipment Installation
 - (i) General Requirements
 - (A) Set equipment in place, align, connect and place in operation with:
 - (B) Controls set for efficient, stable operation.
 - (C) Initial lubrication and oil sumps filled.
 - (D) Connections and required safety devices installed.
 - (E) Protect equipment from damage during and after installation, and on completion of the Work ensure that equipment is free from cracks, scratches, discolouration, tool marks, and other defects.
 - (F) Thoroughly clean finished surfaces before acceptance of the Work.
 - (G) Install heater vents complete with necessary supports, hangers, braces, roof flashing, storm collar, and round top.

END OF SECTION

1. General

- (a) General
 - (i) Design is based on American standard plumbing fixtures.
- (b) Submittals
 - (i) Shop Drawings
 - (A) Submit Shop Drawings in accordance with 15010 "Basic Mechanical Requirements".
 - (B) Operation and Maintenance Data
 - (C) Submit printed operation instructions and maintenance data in accordance with "15010 "Basic Mechanical Requirements".

2. Products

- (a) Plumbing Fixtures
 - (i) General Requirements
 - (A) CSA approved plumbing fixtures and fittings, of make, type and size specified herein.
 - (B) Comply with the current water saving ratings of the Ontario Building Code, and ASHRAE/IEEE 90.1.
 - (C) Lavatory faucet: maximum 1.3 L/min at 413 kPa
 - (D) Kitchen faucet: maximum 5.7 L/min at 413 kPa
 - (E) Shower heads: maximum 7.6 L/min at 550 kPa
 - (F) Water Closets: maximum 4.8 L/flush
 - (G) Urinals: 0.5 L/flush
 - (H) Plumbing supplies and fixture trim material to be of CSA approved plumbing brass with chrome plated finish, and of make and type specified.
 - (I) Each item to bear name of manufacturer or identifying trademark.
 - (J) Manufacturer's standard design and material specification as indicated by trade name and/or catalogue number, and as described.
 - (K) Type number allocated to each style of fixture identifies that particular fixture on Drawings.
 - (ii) Water Closets - Type WC-2 - Barrier Free

(A) Floor Mounted Toilet – Tank Type –Barrier Free

American Standard Cadet Flowise Right Height Pressure-Assisted Elongated #2467.601.020 Low Consumption Toilet, 3483.001, 4142.601, 419 mm high, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, elongated bowl, white finish, Floor Mounted, siphon jet flush action, 4.2 L (1.1 US Gal) per flush, raised sanitary bar, 305 mm x 254 mm (12" x 10") water surface, two (2) piece, 'Speed Connect' tank assembly, siphon jet flush action, raised sanitary bar, bolted tank cover, 305 mm (12") rough-in, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, floor outlet, bolt caps. Provide bolted tank cover. Provide trip lever on open side of Toilet (wide side) if required - to meet local codes. Centoco #820STSS.407 Toilet Seat, extra heavy duty, for elongated bowl, open front, solid plastic, with cover, stainless steel self-sustaining check hinges, metal flat washers stainless steel posts and nuts. McGuire #LFH166LKN3 Toilet Supply, chrome plated finish polished brass, heavy duty angle stops, 13 mm (1/2") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, escutcheon and flexible copper risers. Provide Floor Flange, (same material as the connecting pipe drain), with all brass bolts and with rubber gasket. Water Closets - Type WC-1, Standard use.

(B) Floor Mounted Toilet – Tank Type

American Standard Cadet Flowise Pressure-Assisted Elongated #2462.100.020 Low Consumption Toilet, 3481.001, 4142.100, 381 mm high, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, elongated bowl, white finish, Floor Mounted, siphon jet flush action, 4.2 L (1.1 US Gal) per flush, raised sanitary bar, 305 mm x 254 mm (12" x 10") water surface, two (2) piece, 'Speed Connect' tank assembly, siphon jet flush action, raised sanitary bar, unbolted tank cover, 305 mm (12") rough-in, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, floor outlet, bolt caps. Centoco #1500STSCSS.407 Toilet Seat, extra heavy duty, for elongated bowl, open front, solid plastic, less cover, stainless steel self-sustaining check hinges, metal flat washers stainless steel posts and nuts. McGuire #LFH166LKN3 Toilet Supply, chrome plated finish polished brass, heavy duty angle stops, 13 mm (1/2") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, escutcheon and flexible copper risers. Provide Floor Flange, (same material as the connecting pipe drain), with all brass bolts and with rubber gasket.

(iii) Countertop mount Sink, double Handle Faucet S-1

Franke Commercial #LBS1308P-1/1 Single Bowl Countertop Mount Sink, 1 hole, 384 mm (15-1/8") wide x 402 mm (15-13/16") long x 203 mm (8") high deep, counter mounted, backledge, grade 18-10 18 GA. (1.2 mm) type 304 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece.

Chicago Faucets #430-E2805-ABCP Single Handle Faucet, chrome plated finish, center hole only, ECAST construction lead free (equal or less than 0.25%) ECAST brass construction, volume control and Hot Water Limit Stop cartridge, 1.9 LPM (0.5 GPM) vandal resistant pressure compensating Econo-Flo non-aerating spray outlet, 241 mm (9-1/2") projection rigid cast brass spout, single metal lever handle. Lawler #570-86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8912CB P-Trap, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend.

(iv) Countertop Mount Sink , double Handle Faucet S-2

- (A) Franke Commercial #LBS4608P-1/1 Single Bowl Countertop Mount Sink, 1 hole, 460 mm (18-1/8") wide x 478 mm (18-13/16") long x 203 mm (8") high deep, counter mounted, backledge, grade 18-10 18 GA. (1.2 mm) type 304 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. Chicago Faucets #430-E2805-ABCP Single Handle Faucet, chrome plated finish, center hole only, ECAST construction lead free (equal or less than 0.25%) ECAST brass construction, volume control and Hot Water Limit Stop cartridge, 1.9 LPM (0.5 GPM) vandal resistant pressure compensating Econo-Flo non-aerating spray outlet, 241 mm (9-1/2") projection rigid cast brass spout, single metal lever handle. Lawler #570-

86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8912CB P-Trap, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend

- (v) Wall Hung Basin, Single Handle Faucet S-3 – Barrier Free
 - (A) American Standard Wheelchair #9141.011.020 basin, 3 holes, 4" (102 mm) center, 509 mm x 686 mm x 168 mm (20-1/16" x 27" x 6-5/8") high, vitreous china, white finish, for carrier with concealed arms, front overflow, faucet ledge. Chicago Faucets 420 Series #420-E2805ABCP Single Handle Faucet, chrome plated finish, ECAST construction lead free (equal or less than 0.25%) cast brass body, volume control and hot water limit stop ceramic cartridge, 1.9 LPM (0.5 GPM) vandal resistant pressure compensating Econo-Flo non-aerating spray outlet, 131 mm (5-3/16") projection reach, lever handle. Lawler #570-86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #155WC Offset Open Grid Drain, cast brass one piece top, 17 GA. (1.5 mm) mm tubular 32 mm (1-1/4") tailpiece. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. McGuire PROWRAP #PW2000WC Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes. Watts #WCA-411-WC Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

- (vi) Countertop Mount Sink, Single Handle Faucet S-4
 - (A) Franke Commercial #LBS6808P-1/1 Single Bowl Countertop Mount Sink, 1 hole, 508 mm (20") wide x 521 mm (20-1/2") long x 203 mm (8") high deep, counter mounted, backledge, grade 18-10 18 GA. (1.2 mm) type 304 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. Chicago Faucets #430-E34VP-ABCP Single Handle Faucet, chrome plated finish, center hole only, ECAST construction lead free (equal or less than 0.25%) ECAST brass construction, volume control and Hot Water Limit Stop cartridge, 5.7 LPM (1.5 GPM) vandal resistant pressure compensating Softflo aerator outlet, 241 mm (9-1/2") projection rigid cast brass spout, single metal lever handle. Lawler #570-86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8912CB P-Trap, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend.
- (vii) Countertop Mount Sink, Two Handle Faucet S-5
 - (A) Franke Commercial #LBD6408P-1/3 Double Bowl Countertop Mount Sink, 3 holes, 8" (203 mm) center, 794 mm (31-1/4") wide x 521 mm (20-1/2") long x 203 mm (8") high deep, spillway, counter mounted, backledge, grade 18-10 18 GA. (1.2 mm) type 304 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. Chicago Faucets 1100 Series #1100-GN8AE35-317AB two handles Faucet, chrome plated finish, ECAST construction lead free (equal or less than 0.25%) cast brass body, Quatern compression operating cartridge, 5.7 LPM (1.5 GPM) pressure compensating Softflo aerator outlet, 203 mm (8") projection rigid/swing gooseneck spout, 102 mm (4") metal vandal proof wristblade sixteen point tapered broach handle with blue and red index buttons. Lawler #570-86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks,

offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8912CB P-Trap, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, box flange and seamless tubular wall bend.

(viii) Wall Hung Basin, Single Handle Faucet S-6

- (A) American Standard Murro with Everclean #0954.004EC.020/0062.000EC.020 basin, 3 holes, 4" (102 mm) center, 540 mm x 520 mm x 165 mm (21-1/4" x 20-1/2" x 6-1/2") high, vitreous china, white finish, for carrier with concealed arms, rear overflow, recessed self-draining faucet ledge. American Standard 0062.000EC.020 Semi-pedestal P-trap cover Chicago Faucets 420 Series #420-E2805ABCP Single Handle Faucet, chrome plated finish, ECAST construction lead free (equal or less than 0.25%) cast brass body, volume control and hot water limit stop ceramic cartridge, 1.9 LPM (0.5 GPM) vandal resistant pressure compensating Econo-Flo non-aerating spray outlet, 131 mm (5-3/16") projection reach, lever handle. Lawler #570-86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #155A Open Grid Drain, cast brass one piece top, 17 GA. (1.5 mm) tubular 32 mm (1-1/4") tailpiece. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. Watts #WCA-411 Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

(ix) Wall Hung Basin, Single Handle Faucet S-7

- (A) American Standard Murro with Everclean #0954.004EC.020/0062.000EC.020 basin, 3 holes, 4" (102 mm)

center, 540 mm x 520 mm x 165 mm (21-1/4" x 20-1/2" x 6-1/2") high, vitreous china, white finish, for carrier with concealed arms, rear overflow, recessed self-draining faucet ledge. American Standard 0062.000EC.020 Semi-pedestal P-trap cover Chicago Faucets 420 Series #420-E2805ABCP Single Handle Faucet, chrome plated finish, ECAST construction lead free (equal or less than 0.25%) cast brass body, volume control and hot water limit stop ceramic cartridge, 1.9 LPM (0.5 GPM) vandal resistant pressure compensating Econo-Flo non-aerating spray outlet, 131 mm (5-3/16") projection reach, lever handle. Lawler #570-86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #155A Open Grid Drain, cast brass one piece top, 17 GA. (1.5 mm) tubular 32 mm (1-1/4") tailpiece. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. Watts #WCA-411 Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

(x) Wall Hung Basin, Single Handle Faucet S-7 Barrier Free

- (A) American Standard Murro with Everclean #0954.004EC.020/0062.000EC.020 basin, 3 holes, 4" (102 mm) center, 540 mm x 520 mm x 165 mm (21-1/4" x 20-1/2" x 6-1/2") high, vitreous china, white finish, for carrier with concealed arms, rear overflow, recessed self-draining faucet ledge. American Standard 0062.000EC.020 Semi-pedestal P-trap cover Chicago Faucets 420 Series #420-E2805ABCP Single Handle Faucet, chrome plated finish, ECAST construction lead free (equal or less than 0.25%) cast brass body, volume control and hot water limit stop ceramic cartridge, 1.9 LPM (0.5 GPM) vandal resistant pressure compensating Econo-Flo non-aerating spray outlet, 131 mm (5-3/16") projection reach, lever handle. Lawler #570-86820, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C (95 °F) and 46 °C (114.8 °F). Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex.

copper tubing to suit installation. Provide tempered water to hot side of faucet. McGuire #155A Open Grid Drain, cast brass one piece top, 17 GA. (1.5 mm) tubular 32 mm (1-1/4") tailpiece. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. McGuire PROWRAP #PW2000 Sanitary Covering vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes. Watts #WCA-411 Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

(xi) Countertop Mount Kitchen Sink, Two Handle Faucet KS-1

- (A) Franke Commercial #LBT6407CB-1/3 Triple bowl Countertop Mount Sink, 3 holes, 8" (203 mm) center, 1178 mm (46-3/8") wide x 522 mm (20-9/16") long x 178 mm (7") high deep, counter mounted, backledge, grade 18-10 20 GA. (0.9 mm) type 302 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. Chicago Faucets #527-919SLA-613-ABCP two handles Faucet, chrome plated finish, ECAST construction lead free (equal or less than 0.25%) cast brass body, Quatern compression operating cartridges, 3.8 LPM (1.0 GPM) flow, 229 mm (9") projection L type swing spout and spray valve, 60 mm (2-3/8") metal vandal proof lever handles with blue and red index buttons. McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. McGuire #8904C P-Trap, heavy cast brass adjustable body, with slip nut, 51 mm (2") size, shallow wall flange and seamless tubular wall bend.

(xii) Emergency Eyewash – Wall Mounted

- (A) Guardian #G1750P-T, Wall Mounted, eye/face wash, 11-3/4" (298 mm) diameter, orange ABS plastic bowl, two (2) FS-Plus spray heads with fliptop dust cover and filter, powder coated cast aluminum flag handle activation, 1/2" (13 mm) IPS chrome plated brass stay-open ball valve with Teflon seal, heavy duty cast

aluminum wall bracket with corrosion resistant powder coated finish, chrome plated brass tailpiece and trap with 1-1/2" (38 mm) IPS waste connection, 1-1/4" (32 mm) NPT female outlet - Unit is third party certified by IAPMO to meet ANSI Z358.1-2014, the Uniform Plumbing Code cUPC and the National Plumbing Code of Canada. Eyewash/Facewash fixture should be installed 4 to 10 feet from the mixing valve. For Emergency Thermostatic Mixing Valve, Lawler model # 911E/F Provide shut-offs at emergency mixing valve

(xiii) Emergency Eyewash Thermostatic mixing valve - Type TMV-2

- (A) Lawler #911E/F, Emergency Thermostatic Mixing Valve for Eyewash or Eye/Face Wash, lead-free brass and stainless steel design, vandal-resistant temperature adjustment, stainless steel sliding piston control device allow cold flow through both the fixed and variable bypass, 13 mm (1/2") N.P.T. Outlet, positive hot water shut-off, liquid-filled thermostatic motor control mechanism, 29 °C (84.2 °F) factory set temperature, standard 69.8 °F (21 °C) - 89.6 °F (32 °C) temperature range, 26 LPM (6.9 GPM) flow capacity at 30 psi (207 kPa) pressure drop across the valve, 7.57 LPM (2.0 GPM) min. Flow rate, 18 LPM (4.8 GPM) bypass flowrate at 30 psid. (See 911E/F) Provide shut-offs at emergency mixing valve

(xiv) Mop Sink MS-1 - Two handle - manual faucet

- (A) Stern Williams #SBC-1700 corner Service / Mop Sink, 610 mm (24") x 610 mm (24") x 305 mm (12") deep, Floor Mounted, terrazzo composed of pearl gray marble chips and Portland cement ground smooth, sealed to resist stain, one piece stainless steel cast integral on threshold, 152 mm (6") drop at threshold, cast brass drain with stainless steel strainer, 3"(75mm) outlet. Chicago Faucets #897-369VP-XK Wall Mounted Two Handle Manual Faucet, chrome plated, 8" (203mm) centerset, solid brass exposed body, ceramic 1/4 turn cartridges, unrestricted hose end outlet, 200 mm (7-7/8") from wall to outlet reach, integral atmospheric vacuum breaker, metal red and blue index buttons 60 mm (2-3/8") long lever handles with vandal resistant screw. Wall brace support. Stern Williams T-35 Hose and Wall Hook 36" (914mm) long hose with 3/4" (19mm) chrome coupling, stainless steel wall bracket. Stern Williams T-40 Mop Hanger stainless steel #4 finish, 24" (610mm) long with 3 rubber spring loaded clips. Stern Williams BP Back Splash Panel 20 gauge type 304 stainless steel. Provide P-Trap, same material as the connecting pipe drain.

(xv) Thermostatic Mixing Valve – Type TMV-1

- (A) Temperature Mixing valves shall be of thermostatic type with liquid filled thermal motor. It shall have

bronze body construction with replaceable corrosion resistant components. Valve construction shall employ a sliding piston control mechanism. Sliding piston and liner shall be of stainless steel material. Valve shall come equipped with union end stop and check inlets with removable stainless steel strainers. Valve shall control temperature from a low flow of 2 gpm. Valve shall provide protection against hot or cold supply line failure and thermostat failure.

- (B) Unit to include a dial thermometer, shut-off valve, cabinet and union on tempered water outlet. Unit is completely assembled and tested with necessary fittings, nipples and escutcheons.
- (C) Cabinet shall have 16G carbon steel construction. Co-ordinate with Architect for type of finish and type of cabinet (Recessed, semi-recessed or surface).

(b) Approved manufacturers

(i) Plumbing fixtures are:

- (A) American Standard
- (B) Crane

(ii) Stainless steel sinks

- (A) Franke
- (B) Kindred
- (C) Elkay

(iii) Mop Sink

- (A) Zurn
- (B) Stern Williams

(iv) Faucet

- (A) Chicago Faucet
- (B) Sloan
- (C) Delta
- (D) Crane

(v) Thermostatic Mixing Valve

- (A) Lawler
- (B) Symmons
- (C) Powers
- (vi) Eyewash
 - (A) Guardian
 - (B) Bradley
 - (C) Haws

3. **Execution**

- (a) Installation
 - (i) Water Flow Rate: coordinate with the LEED consultant and adjust the flow rates of faucets and valves to meet the LEED requirements.
 - (A) Flush valve urinals and water closets.
 - (B) Adjust flush valves to provide specified water flow rate based on manufacturer's calibration data for valve open time vs inlet water pressure.
 - (ii) Barrier Free Use
 - (A) Rough-in and install plumbing fixtures and drinking fountains at the recommended height for normal or handicapped use as applicable to location.
 - (B) Water closets:
 - .1 Seat located between 400 and 460 mm above the floor
 - .2 Horizontal position is between 460 and 480 mm between centerline of fixture and at least one adjacent side wall
 - .3 Lavatories / Sinks:
 - .1 Top not more than 840 mm above floor
 - .2 Horizontal position is not less than 460 mm from centerline of fixture and side wall
 - .4 Insulate exposed supplies and drain

END OF SECTION

1. General

(a) Work Included

- (i) This Section governs the materials and installation of closed hydronic systems associated with building heating. The following systems, where applicable, shall be installed as specified herein.
- (ii) Hydronic hot water (40% Glycol)
- (iii) Domestic hot water recirculation

(b) Testing & Approving Agencies

- (i) Where items of equipment are required to be provided with compliance to U.L., A.G.A., or other testing and approving agencies, the contractor may submit a written certification from any nationally recognized testing agency, adequately equipped and competent to perform such services, that the item of equipment has been tested and conforms to the same method of test as the listed agency would conduct.

(c) Submittal Data

- (i) Provide manufacturer's literature for all products specified in this Section, which will be installed under this project.
- (ii) Provide performance curves for all pumps. Plot the specified operating point for each pump on its respective curve.
- (iii) Provide complete literature for all components of packaged systems. These include pump performance, expansion tank capacity, data for all accessories and valves and complete wiring diagrams specific to the exact unit to be supplied. The wiring diagram shall indicate all required field and factory wiring.

2. **Products**

(a) General

- (i) Units shall be as detailed herein and shall be completely factory wired, tested and name-plated before shipment. Pump manufacturer shall be ISO-9001 certified.
- (ii) Pumps shall meet types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule drawings. Refer to schedules for unit performance.
- (iii) Units shall be specifically designed for hot water heating systems as indicated on the drawings. Complete unit shall be ETL-Canada listed.
- (iv) Pumps shall conform to ANSI/HI 9.6.3.1 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI 9.6.1-1997 standards for Centrifugal and Vertical Pumps for NPSH Margin.
- (v) Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned (laser alignment) after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EISA.
- (vi) The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 1.1-1.5-1994, section 1.4.6.1.1 for recommended acceptable unfiltered field vibration limits (as measured per H.I. 1.4.6.5.2, Figure 1.108) for pumps with rolling contact bearings.
- (vii) Pumps shall be designed for operation at 225° F and 175 PSIG working pressure unless scheduled otherwise on the drawings.
- (i) Base mounted pumps shall have the seismic capability to withstand a horizontal load of 0.5g, excluding piping and/or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting pump operation.

(b) In-Line Centrifugal Pumps (P-1 and P-2)

- (i) Furnish and install pumps with capacities as shown in the equipment schedule. Pumps shall be in-line type , close-coupled, single stage design, for installation in vertical or horizontal position, and capable of being serviced without disturbing piping connections.
- (ii) Pump volute shall be of Class 30 cast iron, and impeller shall be of bronze/brass, enclosed type, keyed and secured to the solid steel shaft by a locking capscrew or nut.
- (iii) The liquid cavity shall be sealed off at the motor shaft by and internally-

flushed mechanical seal with ceramic seal and carbon steel ring, suitable for continuous operation at 225 °F. A shaft sleeve shall completely cover the wetted area under the seal.

- (iv) Pumps shall be rated for maximum of 175 psi working pressure. Casings shall have gauge ports at nozzles, and vent and drain ports in casing.
 - (v) Motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans. It shall have heavy-duty grease lubricated ball bearings, completely adequate for the maximum load for which the motor is designed.
 - (vi) Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
 - (vii) Pumps shall be c/w built-in VFD's.
 - (viii) Pumps shall be suitable for and selected to circulate a solution of 40% propylene glycol and 60% water.
 - (ix) Acceptable manufacturers: Xylem-Bell & Gossett, Grundfos, and Taco
- (c) Domestic Hot Water Recirculation Pumps (P-3 and P-4)
- (i) Furnish and install all bronze construction in-line circulating pumps as illustrated on the plans and in accordance with the following specifications:
 - (A) Pumps shall be c/w built in VFD.
 - (B) The pump shall be of the horizontal system lubricated type specifically designed and guaranteed for quiet operation.
 - (C) Pump to be suitable for 225° F (107° C) operation at 150 PSIG (10 Bar) working pressure.
 - (D) The pumps shall have a ceramic shaft supported by carbon bearings. Bearings shall be lubricated by the circulating fluid.
 - (E) Motor stator to be isolated from circulating fluid through use of stainless steel can. Rotor to be sheathed in stainless steel. Motors shall be non-overloading at any point on the pump curve. Motors to have built-in impedance protection.
 - (F) The pump manufacturer shall be ISO-9001 certified.
 - (ii) Acceptable manufacturers: Xylem-Bell & Gossett, Grundfos, and Taco

3. **Execution**

(i) General

- (A) All pumps shall be fitted with a discharge multi-purpose balancing valve, triple duty valve or other means of providing system balance, isolation, and check feature for reverse flow. The valve shall be straight or angle pattern and shall be field convertible between the two. The valve shall be ductile iron and rated for 250 psi working pressure for all jobs. The valve flanges shall be matched to suit the working pressure of the piping components on the job; with either ANSI class 125 flanges or ANSI class 250 flanges. The valve shall include the following components; non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation. Valve shall be serviceable under full system pressure.
- (B) All pump suctions to be fitted with a multifunction inlet suction diffuser. The suction guide body and cover plate shall be ductile iron and be rated for 250 psi for all jobs. The guide flanges shall be matched to suit the working pressure of the piping components on the job; with either ANSI class 125 flanges or ANSI class 250 flanges. The suction guide shall include the following components; full length S.S. straightening vanes, permanent S.S. strainer, disposable 16 mesh bronze start up strainer, blow down ports, and metering ports. For those pumps where an inlet guide fitting is not installed, there should be five pipe diameters of straight undisturbed flow going into the pump suction.
- (C) All pumps shall be fitted with one 4 ½" dial pressure gauge piped to the inlet and outlet pump flanges. The gauge is to be isolated from each flange via ¼" ball valve. This gauge is to be used to take the differential across the pump unless otherwise indicated.
- (D) Contractor shall install pump in accordance with the manufacturer's instructions. Contractor shall level each pump.
- (E) Pipe connections to pumps shall be made in such a manner so as not to exert any stress on pump housings. If necessary to meet this requirement, provide additional pipe supports and flex connectors.
- (F) Pumps shall **NOT** be run dry to check rotation.
- (G) Change start-up strainers to permanent strainer upon acceptance of the job. Provide a blow down valve on each strainer and terminate with hose thread or extend blow down line to nearest floor drain.

- (H) Pumps start-up shall be performed by factory trained personnel of the pump manufacturer and shall submit start-up report and installation verification report for each pump.
- (ii) Stainless steel core mount sleeve assembly
 - (A) Provide for each sump pit.
 - (B) Install as per manufacturer's recommendations.

END OF SECTION

1. **General**

(a) Codes and Regulations

- (i) Conform to the latest edition of the Codes and Standards referenced herein.
- (ii) Pressure Ratings
 - (A) Suitable for working pressure of 1035 kPa.
- (iii) Efficiency and Stand-by Loss Ratings
 - (A) To ASHRAE/IES 90.1
- (iv) Gas fired hot water heaters to:
 - (A) CAN 1.4.1 or CAN 1.4.3
 - (B) CGA Certification requirements

(b) Submittals

- (i) Shop Drawings
 - (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
 - (B) Provide certification for compliance to ASHRAE 90.1 for efficiency and stand-by loss ratings. Operation and Maintenance Data:
 - (C) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. **Products**

(a) General Requirements

- (i) Connections up to NPS 3 to be screwed and over NPS 3 to be flanged.
- (ii) Water heaters to be factory pre-piped and pre-wired, except where devices are specified to be shipped loose to be installed by others.
- (iii) Provide gas pressure regulators in gas train to suit gas distribution pressure.

(b) Gas Water Heater (DHW-1)

- (i) The Water Heater shall be CSA certified, Heater shall have a storage capacity of 55 USG, output rating of 95000 BTU/H, a recovery rating of 115 gal/hr (436 L/hr) at 100 deg. F (55.6 deg. C) rise and a maximum hydrostatic working pressure of 160 psi (1200kpa), Natural type, direct vent design, using ULC S636 CPVC Venting system. Water heater shall meet or exceed the thermal efficiency ASHRAE/IESNA 90.1 and shall have a minimum efficiency of 95%. Have foam insulation having a

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maximum U value of 0.8W/m² and a CSA Certified and ASME rated T&P relief valve, brass drain valve, burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up; Be approved for 0" clearance to combustibles. Heater shall be supplied with maintenance-free powered anode. The control shall be integrated solid-state temperature and ignition control device with integral diagnostic, graphic user interface, fault history display, and shall have digital temperature readout.

(A) Venting

- (I) ULC S636 CPVC venting system .Provide combustion air and venting as per manufacturer standard and as per codes.

(B) Accessories

- (I) ASME rated temperature and pressure relief valve
- (II) Manual reset high temperature safety cut-out
- (III) Flow switch interlock
- (IV) Gas train including automatic gas valve, gas pressure regulator, and 100% safety shut-off

(C) Electrical

- (I) 120 VAC, 1φ complete with transformer

(ii) Approved Manufacturer

- (I) Rheem-Ruud
- (II) Lochinvar
- (III) PVI

3. **Execution**

(a) Installation

(i) General

- (A) Follow manufacturer's recommendations.
- (B) Install all items shipped loose.
- (C) Install all items specified whether supplied with equipment or not
- (D) Provide valved drain from each tank to nearest funnel or hub drain.
- (E) Pipe-up T&P relief valve down to floor.
- (F) Connect up to cold water supply lines and domestic hot water distribution piping.
- (G) Provide thermometer on outlet piping from hot water tank (and as shown).

(ii) Gas Water Heaters

- (A) Make gas connections to heater.
- (B) Install vent that appliance is certified for as a minimum requirement.
- (C) Size and install venting system as per manufacturer's recommendations. Include all necessary supports, hangers, braces, flashing, storm collar, and round top.
- (D) Submit venting system layout c/w calculations for review.

END OF SECTION

1. **General**

(a) Reference Standards

(i) Boiler

(A) Design to:

- (I) CSA B149.1-10-Natural Gas and Propane Installation Code,
- (II) CAN1-3.1-77 (R2011) Industrial and Commercial Gas Fired Boiler

(B) Electrical Components:

- (I) Electrical equipment and wiring to CSA 22.2 and Ontario Electric Code.
- (II) Product Labelling:
- (III) Boiler/burner package to bear ULC, CSA or CGA label.

(b) Permits, Equipment Registration and Fees

(i) General

- (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

(c) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with 15010 "Basic Mechanical Requirements".

(ii) Operation and Maintenance Data:

- (A) Submit printed operation instructions and maintenance data in accordance with 15010 "Basic Mechanical Requirements".

2. **Products**

(a) Boilers B-1 c/w primary pump

- (i) Furnish and install packaged, modulating, sealed combustion, power-vented, high efficiency gas-fired boiler with stainless steel fire-tube heat exchangers that use outside air for combustion.
- (ii) Boiler shall have an independent laboratory rating of < 20 PPM for Oxides of Nitrogen (NOx) to meet the requirements of South Coast Air Quality Management District in Southern California and the requirements of Texas Commission on Environmental Quality.

- (iii) Boiler shall be capable of full modulation firing with a turn down of up to 10 to 1
- (iv) Boiler to conform to Section IV of the ASME Boiler and Pressure Vessel Code.
 - (A) Fire-tube stainless steel heat exchanger to be fire tested and hydrostatically pressure tested at factory in accordance with ASME requirements.
 - (B) Maximum allowable working pressure 80 PSIG water as listed on the rating label.
 - (C) Boiler and controls to comply with applicable regulations.
 - (D) Boiler shall be fully factory packaged.
- (v) Other manufacturer or other Weil-McLain boiler must comply with specifying engineer's requirements, including:
- (vi) Full intent of these specifications.
- (vii) Provide complete submittal including literature, manuals, wiring diagrams, fuel piping diagrams, and a list of similar installations. Any alternate must be of similar size and footprint, piping configuration, clearance requirements and heating surface.
- (viii) Submittal presented to engineer at least seven working days before bid opening for approval. Substitutions are not permitted after contract is awarded.
- (ix) Boiler Construction
 - (A) Boiler heat exchanger:
 - (I) Fire-tube stainless steel heat exchanger.
 - (II) The boiler must have non-metallic condensate collector to capture condensate from both, the vent system and heat exchanger.
 - (B) Factory Assembled and Tested.
 - (C) Boiler main components:
 - (I) The combustion chamber will be sealed and located at the top which will be of counter flow design to assure that sediment and any lime that might form will fall to the bottom away from the crown sheet area.
 - (II) Boiler shall be supplied with a gas valve designed with negative pressure regulation (fan venturi effect "pulls" gas through valve rather than gas pressure "pushing" gas through valve). Negative pressure regulation enables the

- boiler to operate in a safe condition at 3.5" W.C. inlet gas pressure. The inlet (natural or propane) gas pressure to the boiler gas valve should be a minimum of 3.5" W.C. and a maximum of 14" W.C. If inlet gas pressure exceeds 13" W.C., a 100% lock-up type gas pressure regulator of adequate size must be installed in gas supply piping and adjusted to prevent pressure in excess of 13" W.C.
- (III) The burner shall be premix combustion type, made with stainless steel and a woven metal fiber outer covering to provide a wide range of modulating firing rates.
 - (IV) The boiler shall be equipped with a variable speed blower system capable of modulating the boiler firing rate.
 - (V) The boiler shall be equipped with a device capable of controlling the air/fuel ratio through a 10 to 1 for turndown ratio.
 - (VI) The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics.
 - (VII) Primary Pump Taco 0014 or equivalent
- (x) Venting and Combustion Air
- (A) Boiler must be capable of using outside air piped directly to boiler for combustion. Inlet and termination of these pipes must be connected to either through-the-roof or sidewall terminations as recommended by the manufacturer.
 - (B) Internal vent pipe must be non-metallic.
 - (C) The boiler shall be direct vent using Refer to section 15560 for boiler breeching.
- (xi) Boiler Trim
- (A) All electrical components to be of a high quality.
 - (B) Water boiler controls furnished:
 - (I) High limit temperature control with manual reset (190 degrees F maximum allowable boiler water temperature).
 - (II) Combination pressure-temperature gauge. Gauge dial clearly marked and easy to read.
 - (III) ASME certified pressure relief valve set to relieve at 30 PSIG.
 - (IV) Flue gas, outlet water temperature, and return water temperature sensors.
 - (V) Low water protection with manual reset.
 - (VI) Built-in freeze protection.
- (xii) Boiler Control to be UL 353 Listed with:

- (A) Built-in MODBUS communication.
- (B) 4 circulator contacts.
- (C) Auxiliary input/output capability.
- (D) Variable temperature zones that require no mixing valves.
- (E) 3 thermostat inputs.
- (F) Outdoor reset for each priority.
- (G) Zone and priority based setup options.
- (H) 2 Network and 2 local priorities available on each cascaded boiler.
- (I) Flue gas, outlet water temperature, and return water temperature sensors.
- (J) LCD display and 5 button interface.
- (K) Alarm contact that triggers during manual lockout, flame failure, high temperature limit and low water cut off.
- (L) Remote modulation capable of interfacing with Building Automation Systems and Multiple Boiler Systems.
- (M) Ability to control additional heat demand.
 - (1) The boiler shall be provided with complete instruction manuals, including:
- (N) Boiler Installation Manual.
- (O) User's Manual.
- (xiii) Approved Manufacturers:
 - (A) Weil McLain
 - (B) De Dietrich
 - (C) Viessmann,

3. **Execution**

- (a) Installation
 - (i) General
 - (A) Follow manufacturers printed installation instructions.
 - (B) Install boilers level and plumb on concrete pad/on wall as shown on drawings. Arrange piping as to provide adequate clearance for

service and operation. Pipe safety relief valves to glycol fill station and drain valves to floor drain. Install thermometers and pressure gauges on supply and return piping no higher than 1800 mm above floor. Install relief valve sized to suit boiler input and located upstream of any shut-off valve. Conform to manufacturers installation instructions and piping schematic on Drawings. Extend each gas pressure relief (full size) through roof and terminate with gooseneck and screen.

- (C) Upon notification of completion of the installation, boiler manufacturer shall furnish the services of a field technician, to start the boiler and provide combustion tests over the operating range and issue report to the Consultant indicating system acceptance as installed.
- (D) Provide two power supplies for each boiler i.e one for controls and one for burner.
- (E) Install all items shipped loose
- (F) Make piping, wiring and breeching connections.
- (G) Install combustion air vent to outside as per applicable codes and standards
- (H) Install vent to outside as per applicable codes and standards
- (I) Provide condensate drain piping c/w p-trap and acid neutralizer for each boiler flue vent. Terminate condensate drain piping over nearest fd/ffd as per code.

END OF SECTION

1. **General**

(a) General

- (i) Coordinate with Section 17800 "BAS-Building Automation System" for related scope of work. All equipment shall have all the necessary hardware, software, relays, transformers etc as required for complete integration into the existing "JCI", BACnet based BAS.

(b) Permits, Equipment Registration and Fees

(i) General

- (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

(c) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".

(ii) Operation and Maintenance Data:

- (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. **Products**

(a) Gas Fired, DX Cooling Packaged Rooftop HVAC Unit c/w insulated roof curb, roof curb vibration rail and engineered screening system

(i) General:

- (A) Rooftop Unit shall have two compressors with independent R-410A refrigeration circuits to provide 2 stages of cooling. The unit shall be easily installed on a roof curb, roof curb vibration rail. The units shall be self-contained and assembled on rigid full perimeter base rails allowing for 3-way forklift access and overhead rigging. Unit shall be completely charged with R-410A, wired, piped, and tested at the factory to provide a quick and easy field installation. Unit shall be down airflow. Independent economizer designs are used down discharge applications, as well as all tonnage sizes.
- (B) Unit shall be factory assembled, single package, (Elec/Elec, Gas/Elec), designed for outdoor installation. They shall have built in field convertible duct connections for down discharge supply/return or horizontal discharge supply/return and be available with factory installed options or field installed

accessories. The unit shall be factory wired, piped and charged with R-410A refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. The cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall be CSA certified to ANSI Z21.47 and UL 1995/CAN/CSA No. 236-M90 standards.

(ii) Construction

- (A) Unit cabinet shall be constructed of galvanized steel with exterior surfaces coated with a non-chalking, powder paint finish, certified at 1000 hour salt spray test per ASTM-B117 standards. Indoor blower sections shall be insulated with up to 1" thick insulation coated on the airside. Either aluminum foil faced or elastomeric rubber insulation shall be used in the unit's compartments and be fastened to prevent insulation from entering the air stream. Cabinet doors shall be hinged with toolless access for easy servicing and maintenance. Full perimeter base rails shall be provided to assure reliable transit of equipment, overhead rigging, fork truck access and proper sealing on roof curb applications. Disposable 2" filters shall be furnished as standard and be accessible through hinged access door. Fan performance measuring ports shall be provided on the outside of the cabinet to allow accurate air measurements of evaporator fan performance without removing panels or creating bypass of the coils. Condensate pan shall be slide out design, constructed of a non corrosive material, internally sloped and conforming to ASHRAE 62-B9 standards. Condensate connection shall be a minimum of $\frac{3}{4}$ " I.D. female and be rigid mount connection.
- (B) The outdoor fans shall be of the direct drive type, discharge air vertically, have aluminum blades riveted to corrosion resistant steel spider brackets and shall be dynamically balanced for smooth operation. The outdoor fan motors shall have permanently lubricated bearings internally protected against overload conditions and staged independently. A cleaning window shall be provided on two sides of the units for coil cleaning.
- (C) Refrigerant Components
 - (I) Compressors: Shall be fully hermetic type, direct drive, internally protected with internal high-pressure relief and over temperature protection. The hermetic motor shall be suction gas cooled and have a voltage range of + or - 10% of the unit nameplate voltage.
 - (II) Compressors Shall have internal spring isolation and sound muffling to minimize vibration and noise, and be externally isolated on a dedicated, independent mounting.
 - (III) Evaporator coils shall have aluminum plate fins

- mechanically bonded to seamless internally enhanced copper tubes with all joints brazed. Special Phenolic coating shall be available as a factory option.
- (IV) Evaporator coils shall be of the direct expansion, draw-thru design.
 - (V) Condenser coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed or Micro-Channel aluminum tube, aluminum fins. Special Phenolic coating shall be available as a factory option. Condenser coils shall be of the draw-thru design. Refrigerant Circuit and Refrigerant Safety Components shall include: Independent fixed-orifice or thermally operated expansion devices. Solid core filter drier/strainer to eliminate any moisture or foreign matter. Accessible service gage connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.
 - (VI) The unit shall have two independent refrigerant circuits, equally split in 50% capacity increments.
- (D) Unit Controls shall be from BAS only.
- (I) Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor: Loss-of-charge/Low-pressure switch, High-pressure switch, Freeze condition sensor on evaporator coil. If any of these safety devices trip, the LCD screen will display the alarm message.
 - (II) Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection.
 - (III) Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
 - (IV) Unit control board shall have on-board diagnostics and fault message display
 - (V) Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to a selectable value as low as 0 °F.
 - (VI) Control board shall monitor each refrigerant safety switch independently.
- (E) Gas Heating Section Heat exchanger and exhaust system shall be constructed of aluminized steel and shall be designed with induced draft combustion with post purge logic, energy saving direct spark ignition, and redundant main gas valve. The heat

exchanger shall be of the tubular type, constructed of T1-40 aluminized steel for corrosion resistance and allowing minimum mixed air entering temperature of 40 °F. Burners shall be of the in-shot type, constructed of aluminum-coated steel. All gas piping shall enter the unit cabinet at a single location, through either the side or bottom, without any field modifications. An integrated control board shall provide timed control of evaporator fan functioning and burner ignition. Heating section shall be provided with the following minimum protection:

- (1) Primary and auxiliary high-temperature limit switches.
 - (2) Induced draft pressure sensor.
 - (3) Flame proving controls.
 - (4) All two stage gas units shall have two independent stages of (60% 1st stage, 100% 2nd stage) 6-1/2 through 12-1/2 ton.
 - (I) Unit shall be capable of starting and running at 125 °F outdoor temperature, exceeding maximum load criteria of AHRI Standard 340/360. The compressor, with standard controls, shall be capable of operation down to 0 °F outdoor temperature. Unit shall be provided with fan time delay to prevent cold air delivery before heat exchanger warms up. (Gas heat only)
 - (II) All unit power wiring shall enter unit cabinet at a single factory provided location and be capable of side or bottom entry to minimize roof penetrations and avoid unit field modifications. Separate side and bottom openings shall be provided for the control wiring.
 - (III) Warranties: Compressor – 5 Years, Heat Exchanger – 10 Years, Stainless Steel Heat Exchanger – 15 Years, Elect. Heat Elem. – 5 Years, Parts – 1 Year.
 - (IV) Provide 14" high roof curb c/w engineered roof curb rail vibration isolation system
- (F) Air Filters
- (I) Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. Two inch thick glass fiber disposable media filters shall be provided.
 - (II) 2" Pleated Filters - Unit shall be provided with two inch MERV 13 filters and shall be provided with a filter removal tool.
- (G) Fans And Motors
- (I) Provide fan section with forward curved, double width, double inlet, centrifugal type fan.
 - (II) Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
 - (III) Provide units with belt driven, supply fans with adjustable

- motor sheaves.
 - (IV) Outdoor and Indoor Fan shall be permanently lubricated and have internal thermal overload protection.
 - (V) Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
 - (VI) Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
- (iii) Operating Controls
- (A) Unit shall be complete with safety and diagnostic controls.
 - (B) Unit shall be suitable for full and seamless integration into an existing DDC based building automation system.
 - (C) Unit controls shall be suitable to provide complete control of space temperature throughout the year and also provide control of space humidity during summer season in the dehumidification mode.
 - (I) Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor: Loss-of-charge/Low-pressure switch, High-pressure switch, Freeze condition sensor on evaporator coil. If any of these safety devices trip, the LCD screen will display the alarm message.
 - (II) Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection.
 - (III) Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
 - (IV) Unit control board shall have on-board diagnostics and fault message display
 - (V) Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to a selectable value as low as 0 °F.
 - (VI) Control board shall monitor each refrigerant safety switch independently.
 - (D) Provide factory-wired roof top units with 24 volt control circuit with control transformers, contactor pressure lugs or terminal block for power wiring. Units shall have single point power connections.
 - (E) Provide unit mounted non-fused disconnect switch in accordance with Division-16 specifications.

- (F) Economizer Preferred Cooling: Compressor operation shall be integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2°F per minute. Compressor low ambient lockout overrides this function.
- (iv) Roof Curb
 - (A) Manufacturer shall provide factory supplied 14" high roof curb, suitable for down flow configuration, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.
 - (B) Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.
 - (C) Provide through the base electrical connection.
- (v) Acceptable manufacturers: Johnson Controls and Carrier.
- (b) Energy Recovery Ventilator (ERV)
 - Roof Mounted air to air, plate cross flow heat exchanger
 - Construction:
 - (i) General: Air-to-Air Energy Recovery Ventilators shall be fully assembled at the factory and consist of a fixed-plate cross-flow heat exchanger with no moving parts, an insulated double wall G90 galvanized 20-gauge steel cabinet, outdoor air hood with bird screen, motorized outside air intake damper, filter assemblies for both intake and exhaust air, enthalpy core, supply air blower assembly, motorized exhaust air damper, exhaust air hood, exhaust air blower assembly and electrical control box with all specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection. Entire unit with the exception of field-installed components shall be assembled and test operated at the factory.
 - (ii) Cabinet:
 - (A) Materials: Formed double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
 - (B) Outside casing: 20 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Painted components as supplied by the factory shall have polyester urethane paint on 20 gauge G90 galvanized steel.
 - (C) Access doors shall be hinged with airtight closed cell foam

gaskets. Door pressure taps, with captive plugs, shall be provided for cross-core pressure measurement allowing for accurate airflow measurement.

- (D) Unit shall have factory-installed duct flanges on all duct openings
 - (E) Cabinet Insulation: Unit walls and doors shall be insulated with 1 inch, 4 pound density, foil/scrim faced, high density fiberglass board insulation, providing a cleanable surface and eliminating the possibility of exposing the fresh air to glass fibers, and with a minimum R-value of 4.3 (hr-ft²-°F/BTU).
 - (F) Enthalpy core: Energy recovery core shall be of the total enthalpy type, capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air. No condensate drains shall be allowed. The energy recovery core shall be designed and constructed to permit cleaning and removal for servicing. The energy recovery core shall have a ten year warranty. Performance criteria are to be as specified in AHRI Standard 1060.
 - (G) Control center / connections: Energy Recovery Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections to the [non-fused][fused] disconnect.
 - (H) Passive Frost Control: The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10°F and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.
 - (I) Motorized Isolation Damper(s): Exhaust Air and Fresh Air motorized damper(s) of an AMCA Class I leakage type shall be factory installed.
- (iii) Blower Section
- (A) Blower section construction, Supply Air and Exhaust Air: Blower assemblies shall have TEFC motor (s), and a belt driven forward-curved blower(s).
 - (B) Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

(iv) Motors:

- (A) Blower motors shall be Premium Efficiency, EISA compliant for energy efficiency. The blower motors shall be totally enclosed (TEFC) and be supplied with factory installed motor starters.
- (B) Belt drive motors shall be provided with adjustable pulleys and motor mounts allowing for blower speed adjustment, proper motor shaft orientation and proper belt tensioning.

(v) Unit Controls

- (A) Fan control: Motor starter and contactor / Onboard VFD, fresh air stream and exhaust air stream
- (B) Sensors: Dirty filter monitor for both airstreams.
- (C) Timeclock: Digital Time Clock with up to 8 on/off cycles per day or 50 per week, 24VAC power, with battery backup protection of program settings against power failure to energize unit
- (D) Factory-installed microprocessor controller and sensors: Has factory-installed hardware and software to enable the building automation interface via Modbus/BACnet to monitor, control, and display status and alarms
- (E) The microprocessor controller shall be capable of operating at temperatures between -20F to 160F
- (F) The microprocessor controller shall be a DIN rail mounting type
- (G) Factory-installed microprocessor controller shall come with backlit display that allows menu-driven display for navigation and control of unit
- (H) The microprocessor controller shall have the ability to communicate with the BAS via BACnet MSTP/IP
- (I) The microprocessor controller shall have integrated Ethernet interface and a web server for displaying unit parameters.
- (J) The microprocessor controller shall have an internal programmable time clock that will allow the user to add up to different occupancy schedules and add holidays
- (K) The microprocessor control shall be capable of integral diagnostics
- (L) The microprocessor control shall be capable of IP or SI unit display.

- (M) The microprocessor controller shall at a minimum offer the ability for three modes of determining occupancy: a dry contact, the internal time clock or the BAS
- (N) A remote user terminal to allow for remote monitoring and adjustment of parameters, allowing ease of control access without going outdoors or into the mechanical room if desired by the user.
- (O) The microprocessor controller shall have at a minimum (10) universal inputs/outputs (AI, DI, AO) and have (6) six relay outputs (DO)
- (P) The microprocessor controller shall have an integrated fieldbus port
- (Q) The microprocessor controller shall have the capability for I/O expansion
- (R) The microprocessor controller shall have a micro USB port to load the application program, the unit parameters, saving logs, etc.
- (S) The sensors that will be required for control are:
 - (I) Temperature sensor for fresh air and exhaust air
 - (II) Temperature and humidity sensor for outside air, return air.
 - (III) Differential pressure sensors for filter alarms
 - (IV) Differential pressure sensors for measuring pressure drop across energy recovery core and for determining airflow in both airstreams.
 - (V) Adjustable current switches
- (c) The microprocessor controller shall have the capability to monitor the unit conditions for alarm conditions. Upon detecting an alarm, the microprocessor controller shall have the capability to record the alarm description, time, date, available temperatures, and unit status for user review. A digital output shall be reserved for remote alarm indication. Alarms to be also communicated via BAS as applicable. Provide the following alarm functions:
 - (I) Outside air temperature sensor alarm
 - (II) Outside air humidity sensor alarm
 - (III) Return air temperature sensor alarm
 - (IV) Return air humidity sensor alarm
 - (V) Fresh air sensor alarm
 - (VI) Exhaust air sensor alarm
 - (VII) Dirty filter alarm
 - (VIII) Supply and exhaust air proving alarm
 - (IX) Outside airflow sensor alarm
 - (X) Exhaust airflow sensor alarm
 - (XI) Duct static pressure sensor alarm
 - (XII) Airflow out of range alarm

- (B) Display the following on the face of microprocessor controller
 - (I) Unit on
 - (II) Outdoor air temperature
 - (III) Outdoor air humidity
 - (IV) Return air temperature
 - (V) Return air humidity
 - (VI) Supply air temperature
 - (VII) Airflows in both airstreams
 - (VIII) Unit on/off
 - (IX) Fan on/off
 - (X) Damper status
 - (XI) Alarm digital display
 - (ii) Acceptable manufacturers : Renewaire, Venmar CES
- (d) Architectural zero penetration engineered screening system (For RTU-1 and ERV-1)
 - (i) Construction
 - (A) The engineered screening system shall be sliding louvered panel type.
 - (B) The screening system shall have assembly kit which shall mount directly to equipment. No roof penetrations are allowed. No field modifications such as trimming, cutting or sizing of panels are allowed.
 - (C) The kit shall have construction of 18 gauge aluminium track, 16 gauge galvanized steel, 22 gauge painted satin coat louvered panels.
 - (D) The paint shall be powdered polyester with a baked-on finish that meets ASTM B-117-85 standard for 500 hours salt spray. ASTM D 3363-74 standard for H-2H pencil hardness and ASTM – D 3359-83 for adhesion. Provide sample colour paint chip to the Architect for colour selection.
 - (E) Provide shop drawings and calculations for wind loading and seismic forces as per FBC, OBC and UBC. Shop drawings and calculations shall bear the signed stamp of professional engineer licensed to practice in the province of Ontario.
 - (F) Co-ordinate with manufacturers of RTU and ERV for exact unit dimensions and maintenance access requirements.
- (e) Variable Air Volume (VAV) Boxes
 - (i) Construction

- (A) Terminals shall be constructed of not less than 22 gauge galvanized steel, able to withstand a 125 hour salt spray test per ASTM B-117. Stainless steel casings, or galvanized steel casings with a baked enamel paint finish, may be used as an alternative. The terminal casing shall be mechanically assembled (spot-welded casings are not acceptable).
 - (B) Casing shall be internally lined with 1/2" thick, 4 pound per cubic foot skin, dual density fiberglass insulation, rated for a maximum air velocity of 3600 f.p.m. In addition to using adhesive complying with NFPA 90A, the insulation shall incorporate a secondary mechanical fastener attached to the unit casing wall (clench nail). Adhesive as the only method of fastening the insulation to the casing is not acceptable. Maximum thermal conductivity shall be 0.24. Insulation must meet all requirements of ASTM Standards C1071, (fibrous glass duct lining insulation) G21, (Resistance of synthetic polymers to fungi) UL 181 (materials for the fabrication of air duct and air connector systems) and NFPA 90A (Installation of air conditioning and ventilating systems). Raw insulation edges on the discharge of the unit must be covered with metal liner to eliminate flaking of insulation during field duct connections. Simple "buttering" of raw edges with an approved sealant is not acceptable.
 - (C) All appurtenances including control assemblies, control enclosures, hot water heating coils, and electric heating coils shall not extend beyond the top and bottom of the unit casing. At an inlet velocity of 2000 f.p.m., the static pressure drop across the basic terminal or basic terminal with a sound attenuator shall not exceed .08" W.G. for all unit sizes.
- (ii) Primary Air Valve
- (A) The primary air valve shall consist of a minimum 22 gauge cylindrical body that includes embossment rings for rigidity. The damper blade shall be connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners. The shaft shall be manufactured of a low thermal conducting composite material, and include a molded damper position indicator visible from the exterior of the unit. The damper shall pivot in self lubricating bearings. The damper actuator shall be mounted on the exterior of the terminal for ease of service. The valve assembly shall include internal mechanical stops for both full open and closed positions. The damper blade seal shall be secured without use of adhesives. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure.

(iii) Primary Air Flow Sensor

- (A) Differential pressure airflow sensor shall traverse the duct using the equal cross sectional area or log-linear traverse method along two perpendicular diameters. Single axis sensor shall not be acceptable for duct diameters 6" or larger. A minimum of 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03" w.g. at an air velocity of < 450 FPM. Documentation shall be submitted which substantiates this requirement. Brass balancing taps and airflow calibration charts shall be provided for field airflow measurements.

(iv) Hot Water Coil

- (A) Single duct terminal shall include an integral hot water coil where indicated on the plans. The coil shall be manufactured by the terminal unit manufacturer and shall have a minimum 22 gauge galvanized sheet metal casing. Stainless steel casings, or galvanized steel casings with a baked enamel paint finish, may be used as an alternative. Coil to be constructed of pure aluminum fins with full fin collars to assure accurate fin spacing and maximum tube contact. Fins shall be spaced with a minimum of 10 per inch and mechanically fixed to seamless copper tubes for maximum heat transfer. Each coil shall be tested at a minimum of 350 PSIG under water.

(v) Sound Attenuator

- (A) Sound attenuator shall be provided for all VAV boxes and shall be designed to maintain a maximum NC level of 35 in all occupied spaces. The attenuator and terminal unit shall be single piece construction at least 50" long. Attenuator casing shall be constructed as specified for the base terminal.

(vi) Controls

- (A) DIRECT DIGITAL CONTROLS
- (B) Terminal boxes shall be shipped with factory installed direct digital controllers.
- (C) Controller option is to communicate on the Johnson Controls N2 or Bacnet field network. Each controller is to utilize an integral

stepper drive actuator, be self-tuning, and utilize PRAC. (Pattern Recognition Adaptive Control) All of the terminal box controllers are to be factory commissioned with all parameters set for the box operation. Parameters to be set must include minimum flow, maximum flow, inlet size, K-factor, and address. Each terminal box is to have a permanently affixed quality label certifying that the controller has been configured and tested.

- (D) Any terminal box including a hot water reheat coil shall have a factory furnished whip to connect the field mounted control valve with the terminal box controller.

- (vii) Acceptable manufacturers: Johnson Controls, EH Price, Nailor and Titus

3. **Execution**

- (a) Installation

- (i) Refer to all other related sections (e.g. identification, motors and wiring, start-up and commissioning and refrigerant piping).
 - (ii) Control Wiring
 - (A) The contractor shall be responsible for the interconnecting control wiring between the outdoor unit and control wiring between remote controllers, centralised control and relevant components. This work shall be co-ordinated with the Electrical / Controls Contractor for the routing and trunking of the cables.
 - (B) All control wiring are to be carried out in 2 core 16 AWG shielded cabling with colour coding and tagged with ID number at 3 metre intervals as per schematics for ease of identification and maintenance.
 - (C) Control wiring shall not be run next to power wiring. A minimum space of 100mm between both control and power cables shall apply.
 - (iii) Condensate Pipework
 - (A) A condensate line shall be installed to each fan coil unit. This shall be installed and insulated all as per the standard specification. Minimum size of condensate pipes to be 25mm (1 inch) copper, insulated and pumped or by gravity from each fan coil unit, drains to run 1:80 min falls.
 - (B) Install all equipment as indicated on the Drawings and as per the manufacturer's instructions.
 - (iv) Manufacturer to certify installation of units as well installation of refrigerant piping and also supervise the actual start-up and

commissioning of the units.

- (v) Install and wire all accessories shipped loose with units for fully operating systems.

End of Section

1. **General**

(a) General

- (i) Coordinate with Section 17800 "BAS-Building Automation System" for related scope of work. All equipment shall have all the necessary hardware, software, relays, transformers etc as required for complete integration into the proposed BAS.

(b) Permits, Equipment Registration and Fees

(i) General

- (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

(c) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".

(ii) Operation and Maintenance Data:

- (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. **Products**

(a) Fully recessed ceiling mounted hydronic unit heaters

- (i) Refer to architectural reflected ceiling plans and room finish schedule in addition to mechanical drawings to determine location, quantity and finish if radiant panels.
- (ii) Panels shall run continuously from wall to wall and specified width are minimum allowable.
- (iii) Construction
 - (A) Radiant panels shall consist of extruded aluminium with copper tubing of 0.504 in (12.8 mm I.D. mechanically attached to the aluminium face plate. The copper tube shall be held in place by an aluminium saddle which extends more than half way around the diameter of the tube. A non hardening heat conductive paste shall be placed between the copper tubing and the aluminium face plate. Panels shall weigh no more than 2.15 lb/ft² (10.5 kg/m²) when operating. The use of adhesive and/or clips to attach the copper tube to the extrusion will not be acceptable.

- (B) Panels shall be finished as per architect's selection.
- (C) Heating output of the units shall be controlled via wall mounted temperature sensor and BAS that will switch the unit ON/OFF and also modulate the control valve to maintain a pre-set temperature set point.
- (iv) Acceptable manufacturers: Airtex, Sterling hydronics and Rosemex

3. **Execution**

(a) Installation

- (i) Co-ordinate with other trades working the ceiling. Refer to architectural and mechanical details for installation requirements.
- (ii) All interconnecting of radiant panels by the mechanical contractor shall consist of 3/8" (9.0 mm) nominal, 0.5" (12.8 mm) O.D. soft copper tubing or as recommended by manufacturer. Multiple panels shall be circuited to ensure serpentine flow over complete length of zone. Individual serpentine panel coils connected in series is unacceptable for multiple panel zones.
- (iii) All radiant panels shall run continuous from wall-to-wall and shall be field trimmed to length ensuring adequate expansion allowance while maintaining panel end coverage by architectural mouldings. Inactive filler panels will be permitted only where indicated on drawings.
- (iv) All radiant panels shall be installed by personnel wearing clean white gloves, to avoid soiling of panel face. Hanger wires for safety and seismic restraints shall be installed at 4 ft. (1220 mm) o.c. or as recommended by manufacturer.
- (v) All system piping shall be thoroughly cleaned, flushed, drained and refilled before radiant panels are connected into the system.
- (vi) Each group or zone of coils shall be given a pressure test in accordance with procedures specified elsewhere.
- (vii) No installation of finished radiant panels shall begin until all glazing has been completed.
- (viii) All active panels shall be covered with a minimum of 1" (25mm) thick batt insulation
- (ix) Provide all interconnecting wiring
- (x) Install in accordance with manufacturer's current installation guideline.
- (xi) Protect installed product and finished surfaces from damage during construction.

End of Section

1. **General**

(a) General

- (i) Coordinate with Section 17800 "BAS-Building Automation System" for related scope of work. All equipment shall have all the necessary hardware, software, relays, transformers etc as required for complete integration into the proposed BAS.

(b) Permits, Equipment Registration and Fees

(i) General

- (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

(c) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".

(ii) Operation and Maintenance Data:

- (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. **Products**

(a) Fully recessed ceiling mounted hydronic cabinet unit heaters

(i) Construction

- (A) Casing shall be constructed of 16 Gauge (1.5 mm) satin coat steel throughout with electrostatically applied powder coat prime finish. Casing shall incorporate an integral piping pocket, removable front panel and hinged access door to electrical junction box. Recessed units shall be furnished with a recessing frame.
- (B) Coils shall be ½" (13mm)copper tube with ripped aluminium fins and sweat connections. Coils ti be factory tested with air at 300 psig (2070 kPa)
- (C) Fans shall be double width double inlet, forward curved centrifugal type, balanced for quiet vibration free operation.
- (D) Motor shall be 3 speed permanent split capacitor, open type, resiliently mounted, incorporating sleeve bearings and internal

automatic re-set overload protection.

- (E) Units must be CSA approved and bear the CSA label.
 - (F) Provide factory installed options:
 - (I) 3-speed plus off fan switch
 - (II) Modulating speed control
 - (III) Cleanable wire frame filter
 - (IV) Internal insulation
 - (V) Fused starter with toggle switch
 - (VI) Line voltage thermostat
 - (VII) Key lock door access
 - (G) Heating output of the units shall be controlled via wall mounted temperature sensor and BAS that will switch the unit ON/OFF and also modulate the control valve to maintain a pre-set temperature set point.
- (ii) Acceptable manufacturers: Airtex, Sterling hydronics and Rosemex

3. **Execution**

- (a) Installation
 - (i) Provide all interconnecting wiring
 - (ii) Install in accordance with manufacturer's current installation guideline.
 - (iii) Protect installed product and finished surfaces from damage during construction.

End of Section

1. **General**

- (a) General
- (b) Permits, Equipment Registration and Fees
 - (i) General
 - (A) Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.
- (c) Submittals
 - (i) Shop Drawings
 - (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
 - (ii) Operation and Maintenance Data:
 - (A) Submit printed operation instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. **Products**

- (a) Ceiling/wall mounted hydronic unit heaters
 - (i) Construction
 - (A) Units shall be CSA approved and UL listed.
 - (B) Enclosure shall be slope top and slope bottom inlet. Enclosure cabinet shall be constructed of 16 gauge satin coat steel with electro statically applied powder coat prime finish. Unless otherwise indicated, cabinets will be supported at the top by a 25mm joggle strip mounted to the wall and at the bottom by support brackets on not more than 1.2m centres. Enclosure cabinets shall have pencil proof louver.
 - (C) Enclosure cabinets shall be constructed of 16 gauge c/w satin coat steel with electrostatically applied powder coat prime finish. Unless otherwise indicated, cabinets will be supported at the top by a 25mm joggle strip mounted to the wall and at the bottom by support brackets on not more than 1.2m centres. Enclosures to have factory gusset plates to maintain shape during shipment and installation. Enclosure cabinets shall have pencil proof louvres.
 - (ii) Acceptable manufacturers: Airtex, Sterling hydronics, Rosemex

3. Execution

(a) Installation

- (i) Provide all interconnecting piping and valves arrangement.
- (ii) Install in accordance with manufacturer's current installation guideline.
- (iii) Protect installed product and finished surfaces from damage during construction.

End of Section

1. General

(a) Reference Standards

(i) Comply with the latest edition of the following:

- (A) SMACNA Standards
- (B) ASHRAE Standards
- (C) ASTM A 525M, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

(b) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
- (B) Submit shop Drawings for all products and equipment specified.

(c) Coordination

- (i) Prepare coordination and fabrication Drawings at a minimum scale of 1:50 $\frac{1}{4}"=1'-0"$ and coordinate with other trades affected by this Work to ensure access to other portions of the Work is not impeded by the ductwork systems.
- (ii) Maintain these Drawings on site and make them available for review by the Consultant when requested.

(d) Project Conditions

(i) Environmental Requirements

- (A) Maintain a space work temperature not less than the minimum ambient working temperature as required by the duct sealant manufacturer requirements. Remove and replace all ductwork sealant installed where the space temperature is less than these recommendations.

(ii) Protection

- (A) Temporarily cap-off ductwork openings to protect against dirt accumulation inside the ductwork.

2. **Products**

(a) Ductwork

(i) All ductwork shall be fabricated as per SMACNA.

(ii) Materials

(A) Round Ductwork

- (I) Spirosafe round duct system by Lindab or equivalent approved materials.
- (II) All buried round ductwork shall be galvanized steel construction, shall be adequately sloped towards the mechanical room, stiffened and protected against damage from concrete materials and soil loads.
- (III) The buried ductwork shall be factory coated with PVC materials to prevent damage from moisture and chemicals.

(B) Galvanized steel sheet :

- (I) Z275 (G90) for unpainted ductwork
- (II) ZF075 (A25) designation zinc coating to ASTM A653/A653M for painted ductwork

(C) Flexible Ductwork (only above T-bar ceilings)

- (I) Return air plenums: ULC approved aluminum core construction with mechanical lock spiral joints and insulated with 25mm thick insulation and covered with a vinyl outer sleeve.
 - (1) Flexmaster –T/L-VT
- (II) Non-return air plenums: ULC approved aluminum core construction with mechanical lock spiral joints and insulated with 25mm insulation and covered with a mylar outer sleeve.
 - (1) Flexmaster – T/L-MT
- (III) Return and exhaust system (except in high humidity areas such as shower rooms): ULC approved aluminum core construction with mechanical lock spiral joints.
 - (1) Flexmaster – T/L

(D) Solder for watertight ductwork:

- (I) To ASTM Standard B32

(E) Metal Duct Sealant – High Velocity Duct Sealer

- (I) 3M EC800
- (II) Foster #30-02
- (III) Hardcast Iron Grip #601
- (IV) Duro-Dyne S-2
- (V) Transcontinental Equipment "MP".

3. **Execution**

(a) Ductwork

(i) General

- (A) Install ductwork in arrangement shown on Drawings in accordance with standards and recommended practices of ASHRAE and SMACNA. Provide required offsets and transitions, whether specifically indicated or not, to facilitate duct installation and to avoid interference with building structure, piping, equipment and services.
- (B) Duct sizes as shown on Drawings. Where ducts are to have internal acoustical liner, adjust duct size to accommodate acoustic liner thickness; clear inside dimensions as shown on Drawings.
- (C) Fabricate ductwork free from vibration, rattle or drumming under operating conditions; reinforce, brace, frame, place gaskets, etc. to comply with performance criteria.
- (D) Place galvanized screens of 13 mm x 13 mm mesh x 2.7 mm diameter wire for air intakes, exhausts and open ends of ductwork.
- (E) Install ductwork in locations and at elevations appropriate to ceiling heights shown on Drawings. Where required to be concealed, install ductwork in furred spaces provided in walls and ceilings. Where there is no provision for concealment install duct as close as possible to walls, partitions and overhead structures to attain maximum headroom and clearance.
- (F) Where shape of duct changes, install transition piece so that angle of side of transition piece does not exceed 15 degrees from straight run of duct being connected, unless shown otherwise on Drawings. For transitions where more than one side converges or diverges use the following:
 - (I) Converging transition: maximum included angle 30°
 - (II) Diverging transition: maximum included angle 20°

(ii) Pressure Class / Seal Class

- (A) Fabricate ductwork to SMACNA pressure classification as follows unless otherwise noted on Drawings.
- (B) Seal ductwork in accordance with SMACNA sealing requirements as follows:
 - (I) Seal Class "A": All transverse joints, longitudinal seams, and duct wall penetrations.
 - (II) Seal Class "B": All transverse joints, and longitudinal seams only

- (III) Seal Class "C": Transverse joints only
- (IV) Seal Class "D": None

System	Pressure Class	Sealing Class
Constant Volume Supply	+3" (750 Pa)	B
Building Exhaust (Washroom exhaust, general exhaust)	+/-2" (500 Pa)	C
Fire Rated (exhaust)	+/-3" (750 Pa)	B

(iii) Sleeves

- (A) Install sleeves where ducts pass through walls or floors. Pack space between duct and sleeve with mineral wool and seal both ends with non-flammable fire resistant sealing compound. Install sheet metal closure plates on each side of wall to cover sleeve.
- (B) Sleeves: of the same sheet material as for ductwork and one gauge thicker.

(iv) Air Intakes and Exhausts

- (A) At air intakes, exhausts and open ends in ductwork install removable galvanized screens securely fastened in place.

(v) Equipment Connections

- (A) Install neoprene gasketed flanged joints at duct connections to air conditioning units, coils, etc. Fabricate flanges from mild steel angles to match equipment flanges.
- (B) Install air terminal units (TU) and silencers (S) independent of ductwork, with rods or angles of sizes adequate to support load.

(vi) Paint Finish and Touch-Up

- (A) In office areas paint interior of ductwork for at least 300 mm behind supply and exhaust grilles with matte black paint to render ductwork invisible from occupied space.
- (B) Touch-up galvanized steel damaged as a result of fabrication, including welding, with zinc dust galvanized primer.

(vii) Supports and Hangers

- (A) Support intervals:
 - (I) Ducts up to 1500 mm in width : minimum 2400 mm centres

- (II) Ducts 1500 mm in width and over : 1200 mm centres
 - (B) Steel Angle Hangers:
 - (I) Provide steel angle hangers for supporting all ductwork.
 - (II) Mild steel rod hangers of 10 mm dia. minimum size, with 38 mm x 38 mm x 3 mm steel angle across bottom of duct and attach hanger to angle (not the duct).
 - (C) Install miscellaneous steel angles or channels as required between joists or building steel for structural support of duct where building framing spacing does not coincide with the required hanger spacing.
- (b) Rectangular Ductwork
- (i) General
 - (A) Material: galvanized steel for unpainted ductwork, unless otherwise shown on Drawings.
 - (B) Metal thickness and construction methods as specified herein for various size ranges of ducts.
 - (C) Cross-break flat surfaces of duct between joints, or between joints and intermediate reinforcements, to prevent vibration or buckling.
 - (D) Seal joints on all rectangular ductwork with high velocity duct sealer. Duct-tape will not be allowed.
 - (ii) Joints
 - (A) Longitudinal joints: Pittsburgh Lock joints tightly closed along full length of seam.
 - (B) Transverse joints: Ductmate, Nexus or TDC connections of class to suit size of duct and pressure of system.
 - (iii) Fittings
 - (A) Elbows, transition sections and take-off fittings: use metal one gauge heavier than thickness specified for duct in which they are installed.
 - (B) Radius elbows: standard radius design with inner radius equal to width of elbow unless shown otherwise, Pittsburgh Lock seams, and with ends to match transverse joints of duct.
 - (C) Square elbows: where elbows are shown as square type, fit elbows with air turning vanes of double blade construction.

(c) Round Ductwork

(i) General

(A) Shop fabricate round ductwork from helically wound galvanized steel sheet strips with spiral lock seam.

(B) Thickness as follows:

Duct Diameter	Thickness of Sheet Metal
200 mm or less	0.5 mm (26 ga.)
228 mm to 560 mm	0.6 mm (24 ga.)
600 mm to 810 mm	0.8 mm (22 ga.)

(C) Secure joints with sheet metal screws and seal with approved sealant.

(ii) Joints

(A) Longitudinal seam: spiral wound seam type RL-1 (grooved lock) or RL-4 (butt weld)

(iii) Fittings

(A) All fittings equipped with double lipped U-profile EPDM rubber gasket.

(B) Ninety degree (90°) elbows: smooth centre line radius of 1.5 times duct diameter. Alternatively, use elbows of five piece construction, subject to prior approval of the Consultant.

(C) Forty five degree (45°) elbows: use three piece construction.

(D) Branch connections to mains: eccentric conical configuration.

(d) Speciality Duct Systems

(i) Flexible Type Round Ducts

(I) Maximum length of flexible duct for connecting diffusers with the main ductwork shall not exceed 1000mm.

(ii) Waterproof Ductwork

(A) Slope fresh air intake ducts down at 1:100 to permit moisture induced by air intake to be drained. Install 38 mm drain flange in bottom of duct at low point. Continuously solder or seal joints in exterior air intake duct to prevent dripping of moisture through joints.

- (B) In areas having high humidity, fabricate exhaust ductwork without seams in bottom of duct for at least 3 m of duct run behind register and slope duct up away from register.
- (e) Inspection, Testing and Balancing
 - (i) Cleaning
 - (A) Prior to start-up of fans, blow out complete systems of ductwork with high velocity air for not less than two hours using where possible the installed air handling equipment to full capacity and by blanking off duct sections to achieve required velocity. Do not install air filters prior to blow-out of ductwork systems. Use auxiliary portable blowers for cleaning where installed fan systems are not adequate to blow out complete system free from dust and dirt.
 - (B) After duct systems have been blown out, clean interior of plenums, coils, and register, grille or diffuser outlet collars with industrial type vacuum cleaner. On completion of cleaning process, install filters before placing systems in final operation.
 - (ii) Balancing of Air Systems
 - (A) Balance air handling systems in accordance with Section 15990 "Start-up & Performance Testing".

END OF SECTION

1. **General**

(a) General

- (i) Provide Work of this Section in accordance with the Contract Documents including, but not limited to, the following:

- (A) Balancing dampers, motorized dampers, backdraft dampers, and fire dampers
- (B) Flexible duct connections
- (C) Turning vanes and extractors
- (D) Sound attenuation

(b) Related Work

- (i) Automatic control damper operators: provided under Section 17800 "BAS-Building Automation System".

(c) Submittals

(i) Shop Drawings

- (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
- (B) Submit Shop Drawings for all equipment and materials specified.

2. **Products**

(a) Ductwork Accessories

(i) Flexible Duct Connections

(A) Material:

- (I) Heavy glass fabric double coated with neoprene and attached to 0.6 mm (24 ga) metal strips 75 mm wide.
- (II) Fabric length between metal strips:
 - (1) Minimum 75 mm for ducts of maximum size in either dimension or diameter of 750 mm or less
 - (2) 150 mm for ducts of 775 mm size and larger.

(B) Acceptable Manufacturers:

- (I) Duro-Dyne "Grip-Loc Type SMFN"
- (II) Ventfabrics "Ventglas"
- (III) DynAir

(ii) Turning Vanes

- (A) Material: Hollow airfoil type, fabricated of same material as duct in which they are installed.
 - (B) Acceptable Manufacturers:
 - (I) Duro-Dyne
 - (II) Dynair
 - (III) Aero-Dyne
- (iii) Access Doors in Ductwork and Plenums
 - (A) Hand Door:
 - (I) Construction: 0.7 mm (24 ga) galvanized steel, double flanged frame and insulated door complete with insulation backing plate.
 - (II) Fasteners: zinc plated cam-lock fasteners, minimum two per door, with safety retaining chain.
- (iv) Probe Inlets
 - (A) Material:
 - (I) Ventlok No. 699 or Duro-Dyne IP-1 or IP-2 Test Opening Enclosures complete with locking cap, chain, gaskets, insulating plug and extensions for insulated ductwork.
- (b) Operating Dampers
 - (i) Automatic Control Dampers
 - (A) General:
 - (I) Modulating control dampers: Opposed blades
 - (II) Two position control dampers: Parallel blades except where indicated otherwise.
 - (B) Damper blades and frames
 - (I) Extruded aluminum 6063-T5
 - (II) Maximum blade length: 1.2 m without internal frame support
 - (III) Maximum blade length: 1.2 m without internal frame support
 - (IV) Blade edge seals: EPDM gaskets
 - (V) Frame side seals: extruded TPE or cambered stainless steel
 - (VI) Frame style: flanged to duct.
 - (VII) Jack shaft: extendable, combination of aluminum, and zinc/nickel coated steel
 - (VIII) Damper leakage: 50 l/s per m² damper face area at 1 kPa differential static pressure.
 - (C) Bearings:

- (I) Thermal plastic resin copolymer, nylon or oil impregnated bronze,
 - (II) At blade axles, linkage devices, etc.
 - (D) Damper blades and frame for outside exhaust and intake air applications
 - (I) As above
 - (II) Operating temperature: -40°C to 68°C
 - (III) Thermally broken and insulated blades; expanded polyurethane foam insulation
 - (IV) Damper leakage: 21 l/s per m² damper face area at 1 kPa differential static pressure.
 - (E) Acceptable Manufacturer:
 - (I) Tamco - Series 1000
 - (II) Nailor Industries – Series 2000
 - (III) Tamco - Series 9000 SC (exhaust and air intake applications)
 - (IV) Nailor – Series 2000IBF (exhaust and air intake applications)
- (ii) Manual Balancing Dampers
- (A) Rectangular Ductwork:
 - (I) Galvanized channel type frames, non-binding pre-lubricated type interconnecting and operating linkages
 - (II) Blades: minimum 1.6 mm (16 ga) thick material, opposed blade style
 - (III) Manual operator and locking type quadrant as required for synchronous operation and setting of blades.
 - (IV) Blade width: maximum 200 mm.
 - (V) Blade length: length coinciding with frame opening on horizontal plane to maximum length of 1200 mm.
 - (VI) Locking quadrant: Galvanized steel locking quadrant with “Open – Closed” labels, 50 mm insulation stand-off.
 - (VII) Acceptable Manufacturers:
 - (1) Nailor – Series 1810/1820 with HL2 quadrant
 - (2) EH Price
 - (3) Titus
 - (B) Round Ductwork - Medium Pressure Butterfly Damper
 - (I) Galvanized steel frame 0.9 mm (22 ga) with stiffening beads up to 300 mm dia.; 0.9 mm (20 ga) over 300 mm duct size.
 - (II) Blade: laminated galvanized steel 0.9 mm (22 ga), or single layer of 1.6 mm (16 ga), open and closed end stops, Celcon bearings, polyethylene blade edge seal, 13 mm dia drive shaft

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- (III) Locking quadrant: Galvanized steel locking quadrant with "Open – Closed" labels, 50 mm insulation stand-off.
 - (IV) Acceptable Manufacturers:
 - (1) Nailor – Series 1000 with HL2 quadrant
 - (2) EH Price
 - (3) Titus
- (C) Round Ductwork - Low Pressure Butterfly Damper
 - (I) Galvanized steel frame 0.9 mm (22 ga) with stiffening beads up to 300 mm dia.; 0.9 mm (20 ga) over 300 mm duct size.
 - (II) Blade: galvanized steel 0.9mm (22 ga) up to 300 mm dia.; 0.9 mm (20 ga) over 300 mm duct size, 6 mm 1/4" dia drive shaft
 - (III) Locking quadrant: Galvanized steel locking quadrant with "Open – Closed" labels, 50 mm insulation stand-off.
 - (IV) Acceptable Manufacturers:
 - (V) Nailor – Series 1890 with HLQ-SB quadrant
 - (VI) EH Price
 - (VII) Titus
- (D) Splitter damper:
 - (I) Do not use splitter dampers.
- (E) Spin-on collar with manual damper
 - (I) Galvanized steel frame 0.9mm
 - (II) Galvanized steel blade 0.9mm with 6mm diameter drive shaft.
 - (III) Locking quadrant: galvanized steel locking quadrant, 50mm stand-off, 1.27mm with handle and wing nut locking.
 - (IV) Acceptable manufacturers
 - (1) Flexmaster Canada Series 1806 Deluxe Spin-on
- (iii) Volume Extractors in Ductwork:
 - (A) Use where noted on Drawings
 - (B) Acceptable Manufacturers
 - (I) Titus Model AG225 with #3 manual operator.
 - (II) Nailor Model EX-1
 - (III) EH Price
- (iv) Relief Dampers
 - (A) Acceptable Manufacturers:
 - (I) Farr (American Warming and Ventilating Inc.) Model PR-10
 - (II) Field
 - (B) Counterbalanced type of size shown on Drawings and as

specified herein, vertical mounting and horizontal air flow, factory set for static pressure shown on Drawings.

- (C) Dampers to have parallel blades, 50 mm x 13 mm x 3 mm steel channel frame, 1.6 mm (16 ga) aluminum blades, steel axles with ball bearings, adjustable counterbalances, counterweights, and inter-connecting linkage.

(c) Fire Dampers

(i) Fire Dampers

- (A) ULC labelled fire dampers of hinged, fusible link type with channel frames, break away connections, blades and housing and conforming to NFPA 90A and UL555 requirements. Use "Type B" fire dampers for rectangular or square ductwork and "Type C" fire dampers for round ductwork. Type B dampers with a sleeve (Type BS) or any variation is not acceptable.
- (B) Blades shall be out of air stream.
- (C) Dampers designed to close while the system fans are operating.
- (D) Closure link: fusible link which can be released, tested and re-latched for testing.
- (E) Construct fire dampers and frames of same material as duct in which they are installed.
- (F) Fire resistance rating shall be at least equal to the fire resistance rating of the fire rated assembly in which it will be installed.
- (G) Acceptable Manufacturers:
 - (I) E.H. Price Dampers
 - (II) Nailor – "D" series
 - (III) Ruskin

(d) Acoustic Treatment

(i) Acoustic Duct Insulation

- (A) Rigid Board
 - (I) Rigid coated fibreglass duct liner conforming to CAN/ULC S102-M88, CGSB 51-GP-11M, NFPA 90A and 90B
 - (II) Fibreglass firmly bonded with thermosetting resin into a rigid board.
 - (III) Air surface protected with tough reinforced coating including an EPA registered antimicrobial agent
 - (IV) Operating temperatures: to 120°C/250°F
 - (V) Density: 48 kg/m³ / 3.00 lb/ft³

- (VI) k value: $0.033 \text{ W/m}^{\circ}\text{C}$ @ 24°C $0.23 \text{ BTU}\cdot\text{in/ft}^2\text{F}$ @ 75°F
- (VII) Acoustical Performance:
 - (1) 25mm thick; 0.7 NCR
 - (2) 38mm thick; 0.8 NCR
 - (3) 50mm thick; 0.95 NCR
- (VIII) Acceptable manufacturers
 - (1) John Manville – Permacote Linacoustic R-300
 - (2) CertainTeed – ToughGard Rigid Liner Board
 - (3) Knauf – Rigid Plenum Liner
 - (4) Manson
- (B) Flexible duct liner
 - (I) Flexible coated fibreglass duct liner conforming to CAN/ULC S102-M88, CGSB 51-GP-11M, NFPA 90A and 90B
 - (II) Fibreglass firmly bonded with thermosetting resin into a flexible blanket.
 - (III) Air surface protected with tough reinforced coating including an EPA registered antimicrobial agent
 - (IV) Operating temperatures: to 120°C 250°F
 - (V) Density: 24 kg/m^3 1.5 lb/ft^3
 - (VI) k value: $0.035 \text{ W/m}^{\circ}\text{C}$ @ 24°C $0.24 \text{ BTU}\cdot\text{in/ft}^2\text{F}$ @ 75°F
 - (VII) Acoustical Performance:
 - (1) 13mm thick; 0.55 NCR
 - (2) 25mm thick; 0.7 NCR
 - (3) 38mm thick; 0.85 NCR
 - (4) 50mm thick; 0.95 NCR
 - (VIII) Acceptable manufacturers
 - (1) John Manville – Permacote Linacoustic HP of RC
 - (2) CertainTeed – ToughGard R Duct Liner
 - (3) Knauf – Duct Liner EM
 - (4) Manson
- (C) Fasteners:
 - (I) Fasten acoustic liner to inside of duct with weld pins with integral heads.
 - (II) Use fasteners of securing pins of size and length as required by insulation weight, thickness, fastener spacing and design.
 - (III) In addition to mechanical type fasteners, adhere insulation to inside of duct with Foster No. 81-99 or Monsey Bakor No. 230-04 fire retardant adhesive. Seal all joints with Foster no. 30-36 of Monsey Bakor No 120-09 mastic sealant.
 - (IV) Edge sealing treatment Product recommended by the insulation manufacturer.

- (D) Acceptable Manufacturers:
 - (I) Owens Corning
 - (II) Manson
 - (III) Knauf
 - (IV) Manville

3. **Execution**

(a) General

- (i) Refer to and comply with applicable requirements specified in Section 15050 "Basic Mechanical Material and Methods".
- (ii) Install miscellaneous steel framing, supports, braces, etc. as required to hang or support equipment and ductwork as specified herein, and as shown on Drawings.
- (iii) Flexible Duct Connections
 - (A) Use flexible duct connections between fans and/or air handling units and connecting ductwork, between unit components, in ducts at building expansion joints, and in other locations shown on Drawings
 - (B) Install flexible connectors with fabric in folds, not drawn tight.
 - (C) Install internal guides to prevent flexible connection from collapsing on suction side of fans.
 - (D) For installation between sections of air handling units, install flexible connectors suitable for connecting to flanges of casings where so provided.
- (iv) Turning Vanes
 - (A) Provide hollow airfoil type turning vanes in ductwork where shown on Drawings and in 90 degree square duct elbows, fabricated of same material as duct in which they are installed.
- (v) Access Doors
 - (A) Provide access doors in ductwork and for plenums to allow servicing, maintenance, and inspection of:
 - (I) Control dampers
 - (II) Fire dampers
 - (III) Fire detectors
 - (IV) Control elements
 - (V) As shown on Drawings
 - (B) Provide "Hand Doors" in ductwork of sizes as follows:

Access Type	Duct Dimension	Access Door Size
One hand and sight	Less than 400 mm	300x150 mm
Two hands and sight	Between 400 mm and 500 mm	450x250 mm
Head and Shoulders	Between 500 mm and 760 mm	530x356 mm
Body plus ladder	Between 760 mm and 1320 mm	635x430 mm

(vi) Balancing Dampers

- (A) Use rectangular opposed blade dampers at the following locations:
 - (I) At floor connections to riser shafts/ducts.
 - (II) In supply and return ductwork where main ducts are split into two more trunks
 - (III) At rectangular branch duct connections to main or trunk ducts.
 - (IV) As shown.
- (B) Do not use splitter dampers.
- (C) Use low pressure butterfly dampers at the following locations:
 - (I) At branch connections on the downstream side of terminal boxes
 - (II) At individual branch outlets serving grilles or diffusers
- (D) Dampers supplied with diffusers or grilles are to be used to balance $\pm 10\%$ of indicated airflow, are NOT in lieu of branch dampers

(vii) Volume Extractors in Ductwork:

- (A) Use where noted on Drawings

(viii) Fire Dampers

- (A) Install fire dampers in accordance with suppliers instructions, and with retaining angles on both sides of wall or floor and fastened to

damper collars.

- (B) Install fire dampers with adjacent access door as required to permit re-opening of damper and replacement of fusible link.

(ix) Relief Dampers

- (A) Install steel angle or channel frames at wall openings as required to mount relief damper (complete with fire damper) as shown on Drawings.

(x) Probe Inlets

- (A) Install probe inlets in ductwork at locations as follows:
 - (I) In main supply and return ducts
 - (II) Inlet and outlet side of fans
 - (III) Other locations as required by Testing and Balancing Trade, to permit testing, balancing and measurement of air quantities and static pressure in air handling systems.
- (B) Locate probe inlets a sufficient distance from elbows or transition sections to ensure stable readings of non-turbulent air and install 75 mm from corners and at 150 mm centres across long side of duct.

(b) Acoustic Duct Insulation and Silencers

- (i) Install internal acoustic insulation in specific sections of ductwork and/or plenums as shown on Drawings as follows:
 - (A) Install in accordance with the requirements of NAIMA Fibrous Glass Duct Liner standard, and SMACNA HVAC Duct Construction Standards.
 - (B) Adhere insulation to ductwork and plenums using 100% coverage of adhesive
 - (C) In addition to adhesive, secure duct liner with welded pins with integral heads spacing in accordance with NAIMA and SMACNA Standards
 - (D) Install metal nosing at leading edge of all insulation.
 - (E) Seal all edges, not already factory sealed, with sealer recommended by manufacturer of insulation. All factory or field cut edges of insulation such as at spin in locations etc must be buttered, treated and sealed.
 - (F) Coat joints and weld pins after installation with two coats of sealant.

- (G) In high velocity ductwork, greater than 20.3 m/sec, install perforated or expanded metal inner liner over acoustic lining.
- (H) Cut off ends of welded impaling pins after application of self-locking washers.
- (I) Failure to follow duct liner construction recommendations will result in ductwork being rejected and must be removed from site.
- (ii) Use silencers in ductwork where shown on Drawings to attenuate airborne noise generated in air distribution systems.
- (iii) Fabricate cross talk silencers:
 - (A) Housing: galvanized steel, to SMACNA pressure class 1" standard.
 - (B) Liner: rigid coated duct liner installed as previously described.
 - (C) Size: as shown on Drawings.
 - (D) Shape: as shown on Drawings.
 - (E) Provide a sheet metal nosing at both open ends of duct to close off cut edge of liner.

END OF SECTION

#

1. General

- (a) Work Included
 - (i) Provide work of this Section in accordance with the Contract Documents.
- (b) Summary
 - (i) Section Includes: Exhaust fans and heaters
- (c) Reference Standards
 - (i) Comply with the latest edition of the standards referenced herein:
 - (A) Fans: designed and constructed in strict conformity with the AMCA Standards and bearing the "Certified Rating Seal".
 - (B) Applicable sections of CSA C22.2 No. 113 for fan construction and installation.
- (d) Submittals
 - (i) Shop Drawings
 - (A) Submit shop drawings in accordance with Sections 15010 "Basic Mechanical Requirements.
 - (B) Submit manufacturer's certified shop drawings to the Consultant and include:
 - (I) Complete information on fan construction and performance
 - (II) Performance curves over full range from shut-off to free delivery
 - (III) Drive details
 - (IV) Make, type and catalogue number of bearings
 - (V) State hour rating of bearings when specified.
 - (ii) Operation and Maintenance Data
 - (A) Submit printed operating instructions and maintenance data in accordance with Sections 01700 "Material and Equipment" and 15010 "Basic Mechanical Requirements".
 - (B) Maintenance Materials

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(C) Provide and turn-over to Owner at time of Substantial Completion one V-belt set for each size used.

(I) Where more than one fan uses the same set size, provide only one set.

(e) Quality Assurance

- (i) Performance ratings: Conform to AMCA standard 211 and 311. Fans must be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for air and sound performance seal.
- (ii) Classification for Spark Resistant Construction, levels A, B, and C conform to AMCA 99.
- (iii) Each fan shall be given a balancing analysis which is applied to wheels at the outside radius. The maximum allowable static and dynamic imbalance is 0.05 ounces (Balance grade of G6.3).
- (iv) Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.
- (v) The High Wind models have been analyzed and stamped by a state license P.E. to the ASCE 7-02 Standard which meets the IBC, Florida and Miami-Dade codes.
- (vi) Each High Wind model is subject to be certified by a third party to the ASTM E330 Static Pressure Difference Standard.
- (vii) All High Wind models have been analyzed using Computational Fluid Dynamics (CFD). The CFD simulates the flow of high speed (150MPH) winds over the surface of objects.
- (viii) The Finite Element Analysis (FEA) is the results from the CFD and it can accurately predict the stress, strain, and deflection resulting from high wind loads.

(f) Delivery, Storage, And Handling

- (i) Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.
- (ii) Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer's instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual.
- (iii) Handling: Handle and lift fans in accordance with the manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

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(g) Warranty

- (i) 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 a limitation of, other rights Owner may have under Contract Documents.
- (ii) The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid.
- (iii) Motor Warranty is warranted by the motor manufacturer for a period of one year. Should motors furnished by us prove defective during this period, they should be returned to the nearest authorized motor service station.

(h) Maintenance

- (i) Refer to Manufacturer's Installation, Operation and Maintenance Manual (IOM), to find maintenance procedures.

2. **Products**

(a) Belt Driven , roof mounted, centrifugal exhaust fans

- (i) General Description:
 - (A) Downblast fans shall be suitable for roof mounted applications.
 - (B) Maximum continuous operating temperature shall be 180 Fahrenheit (82.2 Celsius)
- (ii) Construction
 - (A) Wheel:
 - (I) Non-overloading, backward inclined centrifugal wheel constructed of aluminum.
 - (II) Statically and dynamically balanced in accordance to AMCA Standard 204-05
 - (III) The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency
 - (IV) Single thickness blades shall be securely riveted or welded to a heavy gauge back plate and wheel cone.

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(B) Motors:

- (I) Motor enclosures: Totally enclosed fan cooled.
- (II) Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
- (III) Motor shall be mounted on vibration isolators, out of the airstream.
- (IV) For motor cooling shall be achieved by drawing fresh air into the motor compartment through an area free of discharge contaminants.
- (V) Motor shall be accessible for maintenance

(C) Shafts and Bearings:

- (I) Fan shaft shall be ground and polished solid steel with an anti corrosive coating
- (II) Permanently sealed bearings or pillow block ball bearings
- (III) Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
- (IV) Bearings shall be 100% factory tested.
- (V) Fan Shaft first critical speed shall be at least 25 percent over maximum operating speed

(D) Housing:

- (I) Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum.
- (II) Shroud shall have an integral rolled bead for extra strength.
- (III) Shroud shall be drawn from a disc and direct air downward.
- (IV) Lower windband shall have a formed edge for added strength.
- (V) Motor cover shall be drawn from a disc.

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- (VI) All housing components shall have final thicknesses equal to or greater than preformed thickness.
- (VII) Curb cap shall have pre-punched mounting holes to ensure correct attachment.
- (VIII) Housing shall have rigid internal support structure and shall be leak proof.
- (E) Housing Supports and Drive Frame:
 - (I) Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
- (F) Vibration Isolation:
 - (I) Double studded or pedestal mount true isolators.
 - (II) No metal to metal contact.
 - (III) Sized to match the weight of each fan.
- (G) Disconnect Switches:
 - (I) NEMA rated: 4
 - (II) Positive electrical shut-off.
 - (III) Wired from fan motor to junction box installed within motor compartment.
- (H) Drive Assembly:
 - (I) Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
 - (II) Belts: Static free and oil resistant.
 - (III) Pulleys: Cast type, keyed, and securely attached to wheel and motor shafts.
 - (IV) Motor pulleys are adjustable for final system balancing.
 - (V) Readily accessible for maintenance.
- (I) Roof Curb
 - (I) Roof curb shall be heavy duty insulated type.
 - (II) Minimum height shall be 350 mm.

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- (iii) Acceptable Manufacturer:- Greenheck, Penn-Barry and Jenn

3. **Execution**

(a) General

(i) Fan installation

- (A) Install as per manufacturer's recommendations.

(ii) Air Balancing

- (A) Adjust variable pitch fan/motor sheaves during balancing to achieve specified air quantities.

- (B) Provide sheaves and belts for final air balance.

(iii) Preparation

- (A) Ensure roof openings are square, accurately aligned, correctly located, and in tolerance.

- (B) Ensure duct is plumb, sized correctly, and to proper elevation above roof deck. Install duct as specified in Section 15810 "Ductwork".

(iv) Adjusting

- (A) Adjust exhaust fans to function properly

- (B) Adjust Belt Tension

- (C) Lubricate bearings

- (D) Adjust drive for final system balancing

- (E) Check wheel overlap

(v) Cleaning

- (A) Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction

(vi) Protection

- (A) Protect installed product and finished surfaces from damage during construction

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- (B) Protect installed exhaust fans and heaters to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion

END OF SECTION

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1. General

- (a) Work Included
 - (i) Provide work of this Section in accordance with the Contract Documents.
- (b) Summary
 - (i) Section Includes: Kitchen hood and Kitchen hood fire suppression system
- (c) Reference Standards
 - (i) Comply with the latest edition of the standards referenced herein:
 - (A) Applicable building codes
 - (B) NFPA
- (d) Submittals
 - (i) Shop Drawings
 - (A) Submit shop drawings in accordance with Sections 15010 "Basic Mechanical Requirements.
 - (B) Submit manufacturer's certified shop drawings to the Consultant
 - (ii) Operation and Maintenance Data
 - (A) Submit printed operating instructions and maintenance data in accordance with Section 15010 "Basic Mechanical Requirements".

2. Products

- (a) Electric Kitchen Exhaust Hood
 - (i) General Description:
 - (A) Kitchen hood shall be ULc certified.
 - (B) Kitchen hood shall be c/w 3 speed electronic control with boost mode.
 - (C) Filters shall be suitable for cooking grease and shall be professional type filters.
 - (D) Hood finish shall be as stainless steel or as per architect's recommendation.

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- (E) Kitchen hood shall have three-level light settings c/w compatible dual halogen bulbs.
 - (F) Kitchen hoods shall have sensors to detect excessive heat that turns unit to high automatically.
- (ii) Acceptable manufacturers: Broan and Nutone
- (b) Electronic Kitchen Hood Fire Suppression System (Guardian G300-B)
 - (i) General
 - (A) Fire suppression system shall be ULc listed
 - (B) Fire suppression system shall be compatible with kitchen hood. Make arrangements to install 2 nos fire suppression nozzles on underside of hood.
 - (C) System shall consist of a pre-assembled enclosure extinguisher assembly, sensor assembly, distribution nozzle assembly and one electrical shutoff assembly.
 - (D) Co-ordinate with architect for the location of enclosure assembly. Preferred location is on kitchen hood cabinet over the stove and exhaust hood.

3. **Execution**

- (a) General
 - (i) Kitchen exhaust hood
 - (A) Install as per manufacturer's recommendations.
 - (ii) Kitchen hood fire suppression system
 - (A) Install as per manufacturer's recommendations.
 - (B) Co-ordinate with other trades for location and electrical power requirements
 - (iii) Cleaning
 - (A) Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction
 - (iv) Protection
 - (A) Protect installed product and finished surfaces from damage during construction

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- (B) Protect installed exhaust fans and heaters to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion

END OF SECTION

1. General

- (a) General
 - (i) Provide Work of this Section in accordance with the Contract Documents including, but not limited to, the following:
 - (A) Air handling diffusers, registers and grilles
- (b) Related Work
 - (i) Door grilles: provided under General Trades scope of work.
- (c) Submittals
 - (i) Shop Drawings
 - (A) Submit Shop Drawings in accordance with Section 15010 "Basic Mechanical Requirements".
 - (ii) Submit Shop Drawings for all products and equipment specified.

2. Products

- (a) Diffusers, Registers and Grilles
 - (i) General
 - (A) Neck size, dimensions and capacity as shown on Drawings. Catalogue numbers of first named supplier are listed on Drawings to show required type and style.
 - (B) Acoustic and airflow performance is based on catalogued information of the indicated manufacturer and model as shown on Drawings or schedules. Other named manufacturer products must match these implied performance criteria.
 - (C) Border and frame as required to suit wall and ceiling construction.
 - (ii) Square and Pattern Diffusers (Type A)
 - (A) Steel construction with baked white enamel finish, unless otherwise shown.
 - (B) Coordinate size with actual ceiling sizes. Supply true imperial or metric sizes to match ceiling.
 - (C) Radial opposed blade damper
 - (D) Acceptable Manufacturers:
 - (I) E.H. Price SPD series

- (E) Nailor Industries Inc.
- (F) Titus
- (G) Krueger
- (iii) Exhaust/Return Grilles
 - (A) Steel construction with baked white enamel finish, unless otherwise shown.
 - (B) Blade orientation parallel to the long dimension.
 - (C) Opposed blade damper in black finish.
 - (D) Acceptable Manufacturers:
 - (I) E.H. Price Series 80
 - (II) Nailor Industries Inc.
 - (III) Titus
 - (IV) Krueger
- (iv) Fire Rated Door Grilles
 - (A) Frame shall be 18 gauge SRC and adjustable blades shall be 16 gauge.
 - (B) Louver shall have a spring loaded fusible link mechanism.
 - (C) Louver shall be UL listed FM approved.
 - (D) Louver shall be tested and classified in accordance with UBC7-2-94, ASTM E152, CAN/ULC S104 and NFPA 252.
 - (E) Acceptable Manufacturers:
 - (I) Nailor Industries Inc Model# 61DGD-FR.
 - (II) E.H. Price
 - (III) Titus
 - (IV) Krueger

3. **Execution**

- (a) General
 - (i) Supply diffusers and registers to deliver indicated air quantities shown with throw to reach intended space limits without increasing the sound level of room. Provide blank-off baffles where required and equalizing deflectors on diffusers and in other locations as shown or required.
 - (ii) Coordinate placing of diffusers, registers and grilles in ceilings with electrical and ceiling installation trades and exact location to final approval of the Consultant.

- (iii) Install fire rated door grilles in accordance with NFPA 80.

END OF SECTION

1. General

(a) General

- (i) The scope of work for this section shall be jointly completed by the controls contractor (JCI), the Tab contractor and the mechanical contractor.
- (ii) Perform the Work of this Section including but not limited to the following:
 - (A) Performance testing and balancing of heating, ventilating, air conditioning and liquid systems
 - (B) Survey of installed automatic controls and verification of functional performance.
 - (C) Measuring and reporting all specified space noise levels.
 - (D) Test performance of all vibration isolation equipment.
 - (E) Rechecking of testing and balancing during the alternate (heating/cooling) season.

(b) Related Work in Other Sections

- (i) Factory testing, and calibrating of equipment or control systems.
- (ii) Testing and checking of equipment supplied by other Divisions, except where such equipment forms an integral part of the mechanical systems.

(c) Coordination

- (i) The Contractor shall provide the following assistance and/or services to the Testing and Balancing firm.
 - (A) Schedule sufficient time so that initial testing and balancing can be completed before occupancy begins and coordinate with trades involved.
 - (B) Keep Testing and Balancing firm informed of any major changes made during construction and furnish same with a set of Project Drawings and reviewed Shop Drawings.
 - (C) Furnish balancing devices, test connections access openings, balancing probe inlets and plugs.
 - (D) Clean and pre-run all equipment, filters, etc. and place all heating, ventilating and air conditioning systems into full operation and continue same during each working day of testing and balancing.
 - (E) Provide immediate labour from pertinent mechanical trades and

tools, equipment and materials to make equipment and system alterations and adjustments, as required including control adjustments.

(F) Building Management System technical representative to operate the BMS during air and water balancing testing.

(G) Make available all equipment data (Shop Drawing Performance Data and operating instructions) to the Testing and Balancing Firm.

(H) Fuel fired heating equipment manufacturer service representative, or other qualified service company technical representative, for performance testing of heating equipment. Testing and Balancing Firm witnesses and records all test results.

(ii) As part of the coordination effort, the Contractor shall be fully responsible for systems constructed, installed and adjusted to provide optimum performance as required by design intent. Any re-adjusting required as the result of spot checks by the Consultant shall be done at no increase in Contract Price.

(d) Submittals

(i) Submit layout Drawings and Report Format a minimum 14 days prior to start of air and water balancing on-site.

(A) Report Format

(I) Submit proposed format of initial report.

(II) Include a complete list of instruments and tests for which they are to be used as they relate to this Project, including date of last calibration

2. **Products**

(a) Not Applicable.

3. **Execution**

(a) Required Reports

(i) Provide the following Start-Up and Performance Testing reports:

(A) Equipment start-up report

(B) Authorities report

(C) Air and water balancing report

(D) Controls / BMS operation report

- (E) Alternate Season test report
 - (ii) Report Format
 - (A) Prepare test forms in MS Excel or Word format. Results of tests may be filled in by hand.
 - (B) Include the following header information for each test report:
 - (I) Owner Name
 - (II) Project Name
 - (III) Contractor Name
 - (IV) Consultant Name
 - (V) Name of Test Report
 - (C) Include the following on the front sheet of the consolidated report:
 - (I) Contractor Company Name
 - (II) Name and signature of the person submitting the report
 - (III) Date of report
 - (IV) The following statement: "The undersigned certifies that the test results recorded in this report are correct and that results have been witnessed by the trade responsible for the test".
 - (iii) Submit the above tests in a hardcopy form, separately bound from the Operations and Maintenance manuals, and in Adobe Acrobat PDF format.
- (b) Equipment Start-up Report
- (i) Provide a consolidated test report for all equipment, including the following start-up tests:
 - (A) Equipment/System Summary tests
 - (B) Equipment/System start-up test.
 - (C) Manufacturer's start-up test
 - (ii) Equipment/System Summary Tests
 - (A) Provide a test report in spreadsheet format which summarizes the following data for each piece of equipment which is powered or has automatic controls:
 - (I) Equipment ID and name
 - (II) Motor rotation (bump test) - result and initialled by the Contractor
 - (III) Equipment Start-Up report status - status and initialled by the Contractor
 - (IV) Manufacturer Start-Up report status – status and initialled by the Contractor

- (V) Test completion date
- (B) Provide a test report in spreadsheet format which summarizes the following data for pressure testing of piping systems:
 - (I) System name
 - (II) System limits (if system is not tested in its entirety)
 - (III) Type of test (pneumatic, hydrostatic)
 - (IV) Pressure at start of test
 - (V) Pressure at end of test
 - (VI) Duration of test
 - (VII) Contractor dated and initialled.
- (C) Provide a test report in spreadsheet format which summarizes the following tests for equipment served by liquid, gas or vapour systems
 - (I) Equipment ID and name
 - (II) Isolation valves are in the open position – status and initialled by the Contractor
 - (III) Backflow preventers have been tested - status and initialled by the Contractor
 - (IV) Pressure relief valves installed – record setpoint and initialled by the Contractor
- (iii) Equipment/System Start-Up Test Report
 - (A) Provide a separate start-up report for each piece of the following equipment. The SMACNA “Systems Ready to Balance Check List”, where applicable, may be used for this report.
 - (I) HVAC Units
 - (II) Duct Systems
 - (III) Pumps
 - (IV) Heat Exchangers
 - (V) Air compressors
 - (VI) Refrigeration Equipment
 - (VII) Hydronic piping systems
- (iv) Manufacturer's Start-Up Test
 - (A) Provide a separate start-up report for each piece of the following equipment, utilizing the manufacturer's start-up check list. This report may be prepared by the manufacturer's service representative.
 - (I) Packaged AC equipment
 - (II) Domestic hot water heaters
 - (III) Air compressors
 - (IV) Control systems – see Section 17800 “Building Automation System”

- (c) Authorities Review
 - (i) Submit copies of authorities-having-jurisdiction inspection and test reports, including:
 - (A) Plumbing and drainage municipal inspector reports
 - (B) TSSA pressure vessel and piping inspection reports
 - (C) ESA field certification reports
- (d) Air and Water Balancing
 - (i) Provide air and water balancing report: to Section 15991 "Air and Water Balancing".
- (e) Controls / Building Management System
 - (i) Provide controls test reports: to Section 17800 "Building Automation System".
- (f) Alternate Season Testing
 - (i) Provide alternate season test report: to Section 15991 "Air and Water Balancing".
- (g) Deficiencies
 - (i) Immediately report to the Consultant, any deficiencies in the systems or equipment performance resulting in design requirements being unobtainable.
- (h) Draft Report
 - (i) On completion of the start-up, testing, adjusting and balancing of all systems, submit to the Consultant, two (2) typewritten copies of a full report on all tests, adjustments, and balancing performed, including the following:
 - (A) Summary of all systems
 - (B) Testing methods and instrumentation
 - (C) Start-Up reports
 - (D) Authorities Having Jurisdiction reports
 - (E) Air systems testing and balancing data
 - (F) Liquid systems testing and balancing data
 - (G) Attachments including systems schematics with numbered terminals for referring to data above.

- (ii) After review by the Consultant and at the Consultants direction, retest up to 10% of all measurements in locations as directed by the Consultant, at no cost extra to the Contract.
- (i) Interim Report
 - (i) After completion of any retesting described above, submit three (3) typewritten copies of the interim report, in a 3-hole "D" style binder and two (2) CD-R electronic copies in Adobe Acrobat ver.6 PDF format.
 - (ii) This report is required to obtain Substantial Performance of the Contract.
- (j) Final Report
 - (i) Submit to Consultant following completion of alternate season testing and balancing. Submit three (3) typewritten copies and two (2) CD-R Adobe PDF in the same formats as the initial report specified above.
- (k) Spot Check
 - (i) Before acceptance of the air and water balancing report, the Consultant may request to witness spot-checks of the report results.
 - (ii) If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in the opinion of the Consultant, re-balance entire affected system(s) at no increase in Contract Price.
- (l) Acceptance
 - (i) The Substantial Performance of the Mechanical Work will be considered reached when the interim Start-Up and Performance Testing report is accepted by the Consultant and in the opinion of the Consultant all systems have been satisfactorily installed, operated tested, balanced, and adjusted to meet the specified and intended performance.
 - (ii) The substantial performance will not depend upon alternate season testing as specified hereafter, however, make such relevant repairs or modifications deemed necessary during this re-checking as part of the guarantee of the Work.
 - (iii) The total performance of the Contract will not be considered reached until the alternate season testing and balancing is completed and the final report submitted and accepted by the Consultant.
- (m) Additional Testing
 - (i) The Consultant may request such additional testing in connection with this Project as deemed necessary.

END OF SECTION

1. General

(a) Summary

(i) Section Includes:

- (A) Materials and installation for balancing and certification of HVAC air and liquid systems.
- (B) Sustainable requirements for construction and verification.

(b) References

- (i) Associated Air Balance Council (AABC).
- (ii) National Standards for Total System Balance 2002.
- (iii) Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- (iv) Material Safety Data Sheets (MSDS).

(c) Design Requirements

- (i) Perform air and water balancing, to minimum requirements specified in AABC, National Standards manual.
- (ii) Air and water balancing shall be separately done in the heating season and the cooling season.

(d) Flow Rate Tolerance

- (i) Airflow: Minus 5% to plus 5%.
- (ii) Heating water/glycol systems: Minus 2% to plus 2%.

(e) Submittals

- (i) Co-ordinate submittal requirements and provide submittals.

(f) Product data:

- (i) Submit manufacturer's printed product literature, specifications and data sheet for testing and balancing equipment.
- (ii) Instructions: submit manufacturer's installation instructions.

(g) Reports:

- (i) Submit 4 copies of Balancing and Certifying Report upon completion of work.
- (ii) Report Format: AABC Test and Balance Procedures manual. Include recommendations where additional balancing devices

should be installed. Include actual test procedure details, initial and final balanced performance figures.

- (h) Quality Assurance
 - (i) Engage balancing agency accredited by the Associated Air Balance Council (AABC).
 - (ii) National Building Comfort Testing Association (NBCTA)
 - (iii) Measurement Instruments: calibrated to AABC recommendations.
- (i) Approved TAB agents
 - (i) Damper Air Balancing Inc.
 - (ii) Designtest and Balance Co Ltd.

2. **Products**

- (a) NOT USED

3. **Execution**

- (a) Adjusting and balancing
 - (i) Balance all air and water systems to provide the specified air and water flow rates.
 - (ii) Perform system balancing to AABC - Test and Balance Procedures.
 - (iii) Permanently mark valve, damper and other adjustment device settings in their balanced position.
 - (iv) Set and lock memory stop balancing devices.
 - (v) Balance liquid systems only after successful balancing of air systems.
- (b) Field Quality Control
 - (i) Performance Verification:
 - (A) Perform random flow readings in presence of the Consultant after completion of balancing report. If inconsistencies are noted between balancing report and random readings, re-balance entire system and re-submit balancing report until random readings coincide with report at no additional cost.

END OF SECTION

1. General

(a) General

- (i) The existing school building has a Johnson Controls Inc. (JCI) Building Automation System (BAS) consisting of Metasys NAE, incorporating BACnet protocol. The intent of this project is to provide equipment complete with factory installed controllers that are compatible with the existing BAS, modify the existing BAS and field devices as necessary and also provide additional monitoring and control functions as required to accommodate the proposed CCEY additions.
- (ii) Acceptable manufacturer is Johnson Controls Inc.
- (iii) It is expected that the proposed BAS modifications will provide similar features and functionality.
- (iv) The documentation contained in this section and other contract documents pertaining to Controls is schematic in nature. The Contractor shall provide all necessary hardware and software to implement the functions shown or as implied in the contract documents. All hardware and software components provided as part of this section shall meet or exceed the latest industry standards.
- (v) System configuration, control and monitoring shall be performed via a web-based interface. The web interface device shall host all related graphics and controls logic for monitoring and control via a password protected, regional network. Password protection shall include a secure, multi-level access as specified elsewhere or as directed by the Owner's representatives.
- (vi) All system controllers shall utilize a peer-to-peer communications scheme to communicate with each other.
- (vii) The Contractor shall allow for all programming efforts related to transferring of data points from other BACnet devices and also include for creation of suitable graphics to represent all components of the mechanical and electrical systems on the BAS workstation & to provide web access for all interconnected systems and for all transferred data points.

(b) Quality Assurance

- (i) The proposed product line must have an installed history of demonstrated satisfactory operation of 2 years since date of final completion in at least 10 installations of comparative size and complexity. Submittals shall document this requirement with references.
- (ii) The BAS / Control System shall be furnished, engineered, and installed by a licensed Controls Contractor or System Integrator (SI). All Work provided under this section shall be Provided by direct employees of the SI or under the direct supervision of the SI personnel.
- (iii) System Integrator Qualifications
 - (A) The SI must be regularly engaged in the service and installation of

BACnet Controls based systems as specified herein, The SI shall have a minimum of 10 years experience in the sales, installation, engineering, programming servicing and commissioning of the proposed BAS.

- (B) The system integrator must be an authorized factory direct representative in good standing of the manufacturer of the proposed hardware and software components.
- (C) The SI shall have an office within 350 miles of the building site that is staffed with a minimum of 2 technicians who have successfully completed the factory authorized training of the proposed manufacturer's hardware and software components. SI must provide proof of required training. The SI capabilities shall include engineering and design of control systems, programming, electrical installation of control systems, troubleshooting and service.
- (D) The system integrator shall Submit a list of no less than three (3) similar Projects, which have BACnet based Building Systems as specified herein installed by the system integrator These Projects must be on-line and functional such that the Owner's/User's representative can observe the system in full operation.

(iv) Hardware and Software Component Manufacturer Qualifications

- (A) The manufacturer of the hardware and software components must be primarily engaged in the manufacturer of BACnet based systems as specified herein, and must have been so for a minimum of five (5) years.
- (B) The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the Owner or his agent.
- (C) The manufacturer of the hardware and software components as well as its subsidiaries must be a member in good standing of the Tridium and the BACnet Association.
- (D) The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- (E) The manufacturer of the hardware and software components must be authorized to certify BACnet Integrators as defined by the BACnet association.
- (A) Acceptable manufacturers of the hardware and software components as specified herein are as follows: Johnson Controls Inc.

(c) CODES & STANDARDS

- (i) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- (ii) ASHRAE Guide Guideline 13 – specifying DDC Systems
- (iii) ASHRAE 90.1 Energy Standard for Buildings Except Low Rise Residential Buildings
- (iv) ASHRAE 135: BACnet A Data Communication Protocol for Building Automation and Control Networks. American Society of Heating, Refrigerating and Air conditioning Engineers, Inc. current edition including all related addenda shall apply.
- (v) Electronics Industries Alliance:
 - (A) EIA709.1A99 Control Network Protocol Specification
 - (B) EIA709.399: Free Topology Twisted Pair Channel Specification
 - (C) EIA232: Interface between Data Terminal Equipment and Data Circuit Terminating Equipment Employing Serial Binary Data Interchange
 - (D) EIA458: Standard Optical Fiber Material Classes and Preferred Sizes
 - (E) EIA485: Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.
 - (F) EIA472: General and Sectional Specifications for Fiber Optic Cable
 - (G) EIA475: Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications
 - (H) EIA573: Generic and Sectional Specifications for Field Portable Polishing Device for Preparation Optical Fiber and all Sectional Specifications
 - (I) EIA590: Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant and all Sectional Specifications
- (vi) Underwriters Laboratories
 - (A) UL 506 Specialty Transformers
 - (B) UL 508A Industrial Control Panels
 - (C) UL 916 Energy Management Systems.
 - (D) UL 1449 Surge Protective Devices

- (vii) NEMA Compliance
 - (A) NEMA 250: Enclosure for Electrical Equipment
 - (B) NEMA ICS: General Standards for Industrial Controls. 2.5
- (viii) NFPA/CSA Compliance
 - (A) NFPA 70 National Electrical Code (NEC)
 - (B) NFPA 72 National Fire Alarm and Signaling Code
 - (C) NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
 - (D) CSA C22.1 Canadian Electrical Code, CEC, Part 1, Safety Standard for Electrical Installations.
 - (E) OESC Ontario Electrical Safety Code
- (ix) Institute of Electrical and Electronics Engineers (IEEE)
 - (A) IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - (B) IEEE 802.3: CSMA/CD (Ethernet - Based) LAN
 - (C) IEEE 802.4: Token Bus Working Group (ARCNET - Based) LAN
- (x) International Organization For Standardization (ISO)
 - (A) ISO 8802-3: Information Technology - Telecommunications and Information Exchange Between Systems
- (d) Submittals
 - (i) General
 - (A) Meet all applicable Submittal requirements of Division 1, Division 15, and the following including listed below and in the Submittal check list.
 - (B) Provide to the Consultant and Owner all information or data necessary to determine compliance with these Specifications.
 - (C) Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, including specific requirements indicated.
 - (D) All Drawings and Diagrams shall be machine drafted using AutoCAD 2000 or later, or Microsoft Visio. At Project closeout, provide vellum plots and CD copy of control Drawings and layout Drawings to the Owner.
 - (E) Provide system device and LAN conduit routing Drawing, using building

plans for a background. All controllers, gateways, hubs, devices and communication cabling shall be accurately shown, except that individual sensor I/O wiring and devices need not be shown. Layout Drawings shall be the same size as the Engineer's construction documents.

- (ii) Hardware - Include a complete list of materials of equipment to be used, including technical data, performance curves, Project Specification sheets and installation/maintenance instructions.
- (iii) Control System Diagrams - Provide schematic diagrams for each controlled system. Illustrate the relationship between control system and controlled equipment. Show all control elements. Show all terminations and cable/tube numbers.
 - (A) Provide equipment interface details using actual equipment termination information. Blank terminals or "field verify" is not acceptable.
 - (B) Provide individual diagrams for each mechanical system. If two systems are identical, then a single diagram may represent multiple mechanical systems. Notations like "this part here only applies to units xxx", etc. are not acceptable.
 - (C) The sequence of operation shall reference a schematic diagram of the controlled system. The sequence of operation shall describe in words the control strategies utilized, worded in such a way to serve as an informative reference to the maintenance and service personnel who will be responsible for unit operation.
 - (D) Each component and instrument on the control diagrams shall have a unique tag number such as temperature element "TE-1". The sequence of operation verbiage shall make specific reference to the individual component tag numbers, such as "Controller (C-1) compares the space temperature sensor (TE-1) to set point, and modulates hot water heating coil valve (V-1) as required". The mechanical system being controlled shall be schematically drawn and show the measurement and control points, such as "TE-1" and "V-1".
- (iv) Point List - Provide a point list for each system controller including both inputs and outputs (I/O) point, point number, the controlled device associated with the I/O point and the location of the I/O device. Use naming convention consistent with control diagrams and sequence of operation.
- (v) Software manuals - Include software manuals that describe programming, testing, system overview. The manuals shall include a detailed description of each software feature including editing and writing control programs, reading or modifying printout and logs, adding, deleting and modifying user password, creating and modifying graphics. software manuals may be Provided on CD ROM in lieu of paper copy. If submitted as a CD ROM, the vendor shall arrange to review the software manuals with the Consultant at the Consultant's office.
- (vi) Other Items Requiring Submittals

- (A) Point to point and basic function commissioning forms to be used on site for the start, test and check of network components and systems.
 - (B) List of specific personnel who will be involved in the system installation and commissioning.
 - (C) Functional performance test documentation and procedures to be used in commissioning control sequences.
- (vii) Operation and Maintenance Manuals shall be submitted indicating the correct procedures and processes to operate and maintain the system. O&M's shall be delivered hard copy and on a CD-ROM developed specifically for the Project. Contractor shall submit (3) copies of the Operation and Maintenance Manuals.
- (viii) Parts List shall be submitted listing: manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delay.
- (e) Commissioning & Training
 - (i) Commissioning & Training requirements shall be as described below.
 - (A) All on-site commissioning shall be carried out via a laptop (or a desktop) computer specifically provided by the vendor for this purpose. Commissioning shall be carried out cooperatively with the Owner's representatives prior to commencing the training sessions. Commissioning shall include, verification of the identification of all field devices and wiring, detailed testing of all control loops, and review and adjustment of all control point values,
 - (B) Instruct the operators how to accomplish control of the system. Include basic troubleshooting and override of equipment and controls in the event of system failure.
 - (C) Training Allowance: Provide not less than 8 hours formal training to the Owner's designated operations personnel.
 - (D) Trainers - Persons conducting the training shall be knowledgeable in the workings of the system, and shall be regularly engaged in training exercises, so as to Provide effective training. Acceptability of the trainers shall be at the discretion of the Owner.
 - (E) Training Manuals - Include the following in training manuals.
 - (I) Manufacturer's training brochures.
 - (II) Operation and maintenance manuals.
 - (III) Completed commissioning report.
 - (IV) "As-built" Drawings.
 - (V) Manufacturer's Operation Manuals.
 - (VI) Software interaction sheets to be used in instructing students how to use the control system, on a command-by-command basis.
 - (F) Training Classes - Prior to conducting training, prepare and submit for

approval the proposed training literature and topics. Submit this information at least two weeks prior to the first class.

- (G) Provide approved training manuals to the Owner at least one week prior to the first class.
- (H) Provide Audio Visual Tutorials both in a CD format and on the manufacturers website instructing on the operation of the software tools as Provided under this Specification.

(f) **Warranty**

- (i) The BAS / Control System shall be free from defects in workmanship and material under normal use and service. If within 2 (two) years from the date of substantial completion, the installed equipment is found to be defective in operation, workmanship or materials, the building systems Contractor shall replace, repair or adjust the defect at no cost. Service shall be Provided within 24 hours upon notice from Owner's designated representative.
- (ii) Work shall have a single warranty date, even if the Owner has received beneficial use due to early system start-up. If specified work is split into multiple contracts or into a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
- (iii) The warranty shall extend to material that is supplied and installed by the Contractor. Material supplied but not installed by the Contractor shall be covered per the above to the extent of the product only. Installation labor shall be the responsibility of the trade Contractor performing the installation.
- (iv) All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

2. Products

(a) **Network Architecture and Devices**

- (i) Network Architecture and Protocol - The intent of this Specification is to Provide a high speed, peer-to-peer network incorporating bus topology using open protocol system, with specific conformance to the BACnet Physical and Logical Layer guidelines in all unitary, terminal unit and other devices. The minimum baud rate shall be 78,000 baud for TP/FT-10 communication between controllers and 1,250,000 baud for TP/XF-1250 communication between network devices that are not communicating over the Ethernet.
- (ii) Strict compliance to the BACnet communications protocol, as defined in ASHRAE standard 135, shall be required for all communication between controllers, network devices, and personal computers to assure interoperability between all devices within the building network. Where necessary or desired, BACnet packets may be encapsulated into TCP/IP messages to take advantage of an Ethernet infrastructure.

- (iii) To facilitate facility expansion or to support large Wide Area Networks (WANs) the Network Interface shall directly support a minimum of 4 logical networks using the same physical network (Ethernet).
 - (iv) All controllers and network devices shall contain Type 1 Network Transceivers for 78kbs transmission speeds or Type 2 Network Transceivers for 1.25 mbs transmissions speeds.
 - (v) The ability to support bi-directional access to any remote field level controller shall be supported by a single point of connection from anywhere on the network including communication over the Ethernet.
 - (vi) All ethernet based BACnet networks shall maintain a Bus topology in order to maintain network integrity and improve network diagnostics and maintenance. Star network topologies shall not be accepted.
 - (vii) All Network wiring – See Part 7 - Execution
 - (viii) The system shall be configured and connected to the internet via standard telephone line or Ethernet LAN.
- (b) Network Devices
- (i) Network devices shall service multiple functions on the network depending on network design, communication medium and needed task. These functions include: management of traffic on the network, reconfiguring and strengthening of signals, the conversion of BACnet protocol into TCP/IP packets for transmission over the Ethernet, global activities such as alarms, trends and scheduling, control logic, and protocol conversion. Programming and configuration tools for the network devices shall be Provided as plug-ins.
 - (A) BACnet Routers and Repeaters - The network router shall be designed to route messages from a segment, sub-net, or domain in full duplex communication mode. Routers shall utilize BACnet protocol transport, network, session layers to transparently route messages bound for a node address in another sub-net or domain. Routers shall be fully programmable and permit a systems integrator to define message traffic, destination, and other network management functions utilizing BACnet. The routers, shall be capable of DIN rail or panel mounting and be equipped with status LED lights for Network traffic and power. A router may not manage more than 60 nodes on any single channel so as to allow for future expansion. Equip each router with a network transceiver on each network port (inbound and outbound) as dictated by the network type.
 - (B) Repeaters - A repeater or signal booster may only be used to increase the signal strength of the communications. Under no circumstances may it be used in the place of a router.
 - (C) BACnet to Ethernet – All network devices that Provide for a communication interface between BACnet and the Ethernet shall comply with BACnet Network Services standards.

- (I) The BACnet to Ethernet Network devices shall Provide for the following global functions if required in the sequence of operation. All functions shall be Provided with a graphical user interface.
 - (II) Scheduling – Provide for the individual schedules as required in the sequence of operation and the associated points schedule. Scheduling functions shall include:
 - (III) Daily schedules – Provide for a minimum of 6 different event changes per day with the ability to set different state values for each event.
 - (IV) Holiday – Provide for a minimum of 4 separate holiday schedule that can be implemented for any day.
 - (V) Global scheduling function – Provide for the ability to implement a permanent and temporary global schedule that will override multiple schedules in multiple network devices. Any temporary global schedule shall be erased once the time period of the schedule elapses.
 - (VI) Alarm Management – Provide for the Management and reporting of alarms as required in the sequence of operation.
 - (VII) Data Log management – Provide for the logging of all points as shown on the associated Points Schedule. Log intervals shall be as frequent as one minute intervals. Log Data shall be exportable to other applications via SQL or XML.
- (1)

(c) Building Automation System Controllers

- (i) All controllers shall be BACnet Certified BTL Listed. Provide controllers that can meet the required sequence of operation that can be configured rather than custom programmed. Under no circumstances shall custom programming be implemented using Neuron C code without the use of an overlay of the manufacturer's Graphical Programming Language or Object Oriented Basic Code. All controllers shall be designed for easy installation and servicing including removable enclosures, removable terminals, and factory applied labels for all I/O. All internal points shall be fully supported by the Graphical User Interface (GUI), allowing the user to easily modify them and monitor them. All of the internal programming points (e.g. variables, constants, PIDs, timers, inputs and outputs) shall be exposed to the network on dedicated network variable outputs. Each controller shall be provided with an XIF file that is fixed from the manufacture (not allowing any field modifications). Such XIF file shall be a part of the manufacturer's normal Product offering. XIF files that can be modified in the field by the System Integrator shall not be allowed. Controller programs and schedules shall contain non-volatile flash memory. Upon a loss of power all controllers shall perform a self restart.
- (ii) Programmable Controllers (PCs) – a controller designed for more complex sequences of operations such as built up AHUs, central plant operations, electrical monitoring, and control and management for chillers, boilers and generators. The web-based interface shall allow for the flexibility of custom control programming to meet the needed sequences of operation.

- (A) Inputs – Analog inputs shall have the following minimum level of performance: 16-bit A to D resolution; allow monitoring of platinum 100 ohms, platinum 1000 ohm, nickel 1000 ohms, thermistor 10K type II, thermistor 10K type III, voltage input 0-10VDC, current input 4-20mA, digital input, pulsed input minimum 2 Hz.
 - (B) Outputs – Outputs shall be either software configurable to be either analog or digital or dedicated digital only - Analog outputs shall be selectable as voltage of 0-10 VDC (linear) or 4-20mA or Digital outputs shall be 0-12 VDC (off/on), floating or PWM. Outputs shall have an adjustable range of 2 seconds to 15 minutes. Output Resolution shall be a minimum 8 bits digital / analog converter. All individual outputs and power supply shall be protected by an auto reset fuse. There shall be an LED status indicator on each of the outputs.
 - (C) Hand/Off/Auto Switches - Provide for the manual override and adjustment of all Analog and Digital outputs through a three position switch giving the selection of Hand, Off and Auto (HOA). A HOA shall be Provided for each separate digital and analog output from the controller and be an integral part of the controller. HOA switches external from the controller shall not be accepted. For the Analog outputs the Hand position of the switch shall Provide for the adjustment of the output signal through a linear scaled potentiometer. The position of the HOA shall be monitored and an alarm shall be delivered to the Graphical User Interface should the switch be in an Off or Hand position. An indicating LED shall be Provided on the controller for each HOA indicating position of the switch. For all Analog outputs, the indicating LED shall Provide a linear indication of the position of the Potentiometer through a variation in the intensity of the indicator LED and be Provided as a numerical value that can be viewed at the Graphical User Interface.
 - (D) Enclosures – Provide for a plastic enclosure with a separate back plate with terminals such that the electronic portion of the controller can be easily removed for ease of installation and servicing.
- (d) Configurable Controllers (CCs)
- (i) A controller designed through its I/O configuration and configurable control logic shall be used for a specific type mechanical equipment. All CC's shall be BACnet certified under the appropriate application profiles.
 - (ii) Performance: Provide software selectable universal inputs. Analog inputs - shall have the following minimum level of performance: 12-bit A to D resolution; manage Type II and III 10Kohm thermistors with an accuracy of: $\pm 0.5^{\circ}\text{C}$; $\pm 0.9^{\circ}\text{F}$, voltage input 0-10VDC, current input 4-20mA, digital input, and a Potentiometer. For VAV Applications Provide a differential pressure input sensor built in to the controller with a 16 bit A to D resolution an adjustable range of 0 " to 1" H₂O (0-248.8 Pa) static pressure with a minimum accuracy of $\pm 3\%$. Minimum response time shall be 0.5 seconds from input to output time.
 - (iii) Output – Analog outputs shall have the following minimum level of performance:

Tri-mode Voltage of 0-10 VDC (linear), digital 0-12 VDC (off/on) or PWM. All analog outputs shall be equipped with an auto-reset fuse. Output Resolution shall be a minimum 8-bit digital/analog converter. Digital outputs shall be Provided with a minimum of a triac output rated at 24VAC and 1 amp. All analog outputs shall be fuse protected

(iv) CC Features:

- (A) The CC shall be Provided with an optimum start program internal to its control logic. The optimum start shall be activated by a SNVT_tod_event signal from its associated scheduler on the network.
- (B) The CC shall allow the use of its spare I/O as dumb I/O to be shared over the network to other controllers such as PC, where a sequence of operation can be applied to the I/O. Such applications shall include but not be limited to exhaust fan control, heaters, light control, etc.
- (C) All physical inputs and outputs by the controller should have its own network variables outputs (NVO). NVO associated to an input should be changeable in type and length up to 4 bytes. Others should be of the type SNVT_switch. so as to allow for greater flexibility in the sharing of information over the network.
- (D) Enclosures – Provide for all CCs a plastic enclosure with a separate back plate with terminals such that the electronic portion of the controller can be easily removed for ease of installation and servicing.

(e) Special Purpose Configurable Controllers (SPCC)

- (i) A controller designed with unique functions and features particular to a specific type of mechanical equipment or applications that may be less common and or standardized in its use and application.
 - (A) SPCC – Thermostat (SPCCT) – A self contained controller with a built-in user interface that is intended for installation in the occupied space of the building. The SPCCT shall have the following features:
 - (I) The SPCCT shall be a microprocessor based controller with all of its control logic, sensors, inputs and outputs, network communication and user interface Provided within a manufacture Provided enclosure specific to the application. The enclosure shall be aesthetically appealing with a modern design that will fit in with the architecture of the building. A sample of the SPCCT shall be Provided as part of the submittal process.
 - (II) The SPCCT shall be programmed through the user interface contained within the controller and through the LNS plug-in.
 - (III) The User interface display shall be Provided with 3 levels of password protection: Level 1 – Lockout with view only and time adjustment; Level 2 - schedule override and mode settings; Level 3 – full access to all parameters. Where required in the sequence of operation Provide for within Level 2 access the ability to change

- the units of measure displayed for temperature from Fahrenheit to Celsius. The display shall be back lighted for easy viewing.
- (IV) If required within the sequence of operation, Provide for a control schedule and time clock within the SPCCT. The control schedule shall Provide for a separate schedule for each day of the week with 4 events per day. The real time clock will have a six hour power reserve time
 - (V) The SPCCT shall utilize a PI (proportional and integral) control algorithm. Upon power failure, all programmed schedules and parameters must be retained in non volatile flash memory. Progressive temperature recovery shall be a standard feature. Two configurable digital/binary inputs will be available as well as two remote temperature sensor inputs for outdoor air and remote room/return air monitoring. Built-in frost protection, which can be disabled, will energize the heating as soon as the ambient temperature falls below 45°F (5°C). An auxiliary digital/binary output, which can be configured for normally open or normally closed operation, will also be available.
- (B) Lighting Control (SPCC-LC) – A standalone BACnet based microprocessor lighting control panel that contains line and or low voltage relays for control of the lighting circuits along with the appropriate schedules and local user interface.
- (I) The SPCC-LC shall Provide as a minimum the following functionality;
 - (1) Occupant-Sensitive Operating Scenarios
 - (2) Schedule With Flick Warn
 - (3) Time-delay Overrides With Flick Warn
 - (4) Common Area Interlock With Egress Timer
 - (5) Master Switch Control With Flick Option
 - (6) Cleaning Lights
 - (7) Automatic Daylight Switching With Occupant Interlock/Override
 - (8) Status and Runtime Data
 - (II) It shall be composed of multiple controllers, with the capacity to manage input switches and sensors, output relays as well as lighting sequences and groups, enabling the user to configure and monitor a very large number of different lighting schemes and schedules.
 - (III) The SPCC-LC shall provide, as a minimum, the ability to interface with the hardware of the associated relay panels to allow for minimal disruption to the existing high voltage panel wiring. The SPCC-LC shall be capable of providing all logic, control, runtime data, status information, and communications functions. From any built-in operator interface of any display unit, the ability to read the status of the lighting relays and switches shall be provided.
 - (IV) The SPCC-LC shall allow for the configuration of up to 16 schedules, each comprised of 7 weekday and 4 holiday schedules, using the lighting scheduler plug-in, which should also be LNS

based.

- (V) The SPCC-LC display unit shall allow for the local display of lighting points as described in 5.2. It shall also contain an astrological time clock that allows for the real time calculation of the geographic location using latitude and longitude information. This is to allow for precise and efficient outside lighting control.
- (VI) The SPCC-LC shall be able to control the General Electric® three-wire relay or a two wire Aromat relay.

(f) BAS Software Tools

- (i) Provide two copies of all tools necessary for the development, maintenance, expansion and use of the BAS described within these Specifications. All software tools shall be compatible with the latest version of Microsoft Windows. For the purpose of this Specification software tools shall be divided into the following categories and meet these specified requirements.
 - (A) Network Management Tool (NMT): A software tool set that Provides for the development and management of Building Automations Systems networks. It shall Provide the following minimum functionality:
 - (I) Creation of databases through device / node installation. This application shall support multiple clients on the LAN including User Interface devices.
 - (II) Provide for device / node configuration and or programming using LNS plug-ins
 - (III) Support copy-paste function for network, subsystem and device
 - (IV) Provide for device / node diagnostics.
 - (V) Provide for device / node maintenance activities
 - (VI) Provide for the management of LNS plug-ins.
 - (VII) Provide for network variable binding.
 - (VIII) Provide for network variable browser.
 - (IX) Provide for the monitoring of network variable and configuration properties in real-time.
 - (X) Provide for support of a client-server operating system with a single LNS Server and multiple interoperating client applications
 - (XI) Provide for support of a full client-server operating system with multiple LNS Servers and multiple interoperating client applications
 - (XII) Provide for Provide System diagnostics.
 - (XIII) Provide for management of the database
- (ii) Field Level Controller Programming; Software tools used for the configuration and custom programming of the Configurable Controllers (CCs), Programmable Controllers (PCs) and or the Special Purpose Configurable Controller (SPCCs). These tools shall be Provided as a LNS plug-in. The programming tools shall perform the following functions:
 - (A) PC programming shall be accomplished by either: Text based codes similar to the BASIC programming language combined with objects to define normal controller functions such as PID loops, optimum start stops,

I/O configurations, timers, schedules, trends, and network variables or; Graphical programming language (GPL) where objects are used to define different portions of the control sequence. All control sequences programmed into the PC shall be stored in non-volatile memory. Systems that only allow selection of sequences from a library or table are not acceptable. All code must be exportable to a library for future use.

- (B) CC and SPCC – Provide for the programming of the required sequence of operation through an intuitive menu driven selection process. No text code or graphical programming will be allowed. The configuration tools menu shall define items such as I/O configurations, set point, delays, PID loops, optimum start stops, and network variables settings. The configuration tool must indicate the device status and allows system override
- (C) Field Level Controller Programming tools shall Provide for the viewing and manipulation in real time all hard I/O and soft points including constants, variables, NVI, NVO, SCPT, UCPT, SNVT, UNVT through a table menu or browser. Any point may be hidden from view for easier operation. Provide the ability to save view configurations settings along with a short cut to the browser that does not require the operating the NMT.
- (D) BACnet plug-ins shall be provided free of charge and be compatible with the current published versions of the network management tool that is provided as part of this Project. The wizard software shall be available for public access from the manufacturer's web site. The SI shall demonstrate as part of their prequalification as to how they intend to comply with these requirements. Should BACnet Plug-ins as specified herein not be available then the SI shall Provide the following:
 - (I) Provide one copies of the programming or configuration tools (excluding the UIP and GUI tools) along with any manufacture specific software tools required to operate the programming or configuration tools. Such tools shall be provided with a permanent and operating system transferable license.
 - (II) Provided free of charge to the Owner or his designated agent for a period of 10 years the latest manufactures updates to the software described in Section 4.1B.
 - (III) Provide a statement, as part of the prequalification, signed by an officer of the Manufacture validating the performance of the requirements in Section 4.1B.
- (iii) Network Level Device Programming: Programming software used to configure or program the Network Level Devices. This tool shall be Provided as a BACnet plug-in.
- (iv) User Interface Design (UID) design tools used to create a graphical or text based user interface. A library of preprogrammed components shall be Provided to simplify creation of animated graphics and placement of dynamic point values on the graphical screens. The graphic screen creation shall be accomplished by a drag and drop programming as opposed to line code programming. The line code programming shall be available for advanced screen design and editing. All linking of the data points from the BACnet data base to the graphics shall be

completed from within the graphical tool set. The tools shall allow for the creation of graphics in animation and 2 and 3 dimensional formats. The software shall place no restriction on number: of points used or tags in the system; of users; or on connectivity to other database aware applications. The software shall be capable of being backed up and restored by commercially available backup mechanisms. Note that this software can be Provided as a separate tool set from the GUI.

- (v) Graphical User Interface (GUI) Operating System: Tools used to Provide for user access to the day to day operation of the BAS. These tools shall include for the display, management and adjustment of all points within the system using a direct BACnet driver to BACnet network. The following functions shall be included within this toolset:
 - (A) Administrative functions – Provide all necessary administrative functions to insure a complete secure and reliable GUI. Provide a minimum these administrative functions:
 - (I) Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators access for viewing and/or changing each system application, full screen editor, and object. Provide five levels of password protection ranging from view only to full administrative functions.
 - (II) On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall Provide the relevant data for that particular screen.
 - (III) Manual Database Save and Restore
 - (IV) System Diagnostics. The system shall automatically monitor the operation of network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator
 - (B) Graphics Display. The system graphics shall be able to be modified while on line. An operator with the proper password level shall be able to add, delete, or change graphics.
 - (I) All analog I/O values shall be available to be displayed in imperial and or metric units, with plain English descriptors based upon the Owner's preference.
 - (II) Standard Graphics: All graphics shall be created from a library of standard HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, fans, pumps, coils, valves, piping, dampers, ductwork, etc. contained within the UIP where possible. If custom graphical objects are required, the objects must be stored within the library of the UIP
 - (III) Where floor plan graphics are required, AutoCAD files shall be Provided by Owner for use in developing floor plan graphics.

- (IV) As a minimum, the operating software shall permit the operator to perform the following tasks with a minimum knowledge of the HVAC Control System Provided and basic computing skills.
 - (V) View data (temperature, flowrate, etc.) on HVAC equipment, and/or lighting, card access, and intrusion detection equipment.
 - (VI) Navigate multiple sites.
 - (VII) Locate potentially faulty equipment through audible or visible alarms.
 - (VIII) Override values and states of all equipment as allowed by their respective password level.
- (C) Provide the following Dynamic Graphics.
- (I) Show all motor-driven equipment, liquid level control, and temperature deviations from set point in floor plan graphics.
 - (II) Show animation by shifting image files based on the status of the point (e.g. moving fan, filling tank, room getting warmer, etc.)
 - (III) All mechanical system controlled or monitored by the BAS
 - (IV) Use pictorial representation of components. Provide the current status of all I/O points being controlled and applicable to the mechanical system.
 - (V) Provide overall floor plan of each floor, showing individual air handler zones. and space temperature zones. Show heating and cooling zones in a range of colors, which shows deviations from set points. The colors shall be updated dynamically as zones' comfort conditions change. Show space sensor locations for each zone, with set points.
 - (VI) Lighting floor plan. Show each floor lighting control zone and override push buttons.
 - (VII) Point values, adjustment and override. Provide dynamic point values that are refreshing at a rate of no less than a 20 second interval. All points in override shall be displayed as a separate color from the normal state.
- (D) Programming tool access. Provide for access to any programming tools required for the configuration and programming of the BAS through a direct link contained within the graphics associated with the controller to be programmed. This function shall not require the inclusion of a BACnet network management tool
- (E) Trend log management. Display all required trended points in a color graphical format on a XY axis. Provide for the display of up to 10 points on a single graph each with a separate color and a legend to describe the point displayed and the associated color. Date time range shall be selectable from 1 minute to 1 year or more. Provide for a zoom function and a time, date, value stamp that corresponds to the mouse cursor position on the graph. All data shall be exportable in a suitable format for external review, records and manipulation (i.e SQL format to an access database as well as a .csv file).
- (F) Provide means to automatically perform and display results of averaging

calculations for all meters (Electric, Gas and water).

- (G) Scheduling – Provide for a graphical display of a monthly calendar that allow for implementation of six individual change of states per day plus 4 separate special day schedules. Implementation of special day shall be implemented with a drag and drop function on to the calendar. All resulting time schedules shall be viewable by placing the cursor over the selected day. The scheduling functions shall be Provided as a BACnet plug-in and be opened from any graphic page without the need for a BACnet based network management tool.
- (H) Alarm Management – All alarms from any BACnet device residing on the network shall be reported and logged in an alarm management tool resident in the GUI. The alarms shall be displayed in a table with user defined groups that can be arranged by column, reported date, priority, trouble, disabled, acknowledged and unacknowledged status. Each alarm shall have a user defined name associated with it along with a descriptive action to take. All alarmed points shall have the ability to be delivered to designated reporting devices such as a printer, alpha numeric pager, cell phone, email or to an audio visual device. Each alarm shall have the ability to have its reporting location designated based upon a 24 hour 365 day schedule where as a different designated reporting destination can be specified based upon the time of day and the day of week. The alarms that are not acknowledged within a user defined period of time shall be Provided with 2 additional level escalated levels of reporting. Provide the ability to export all alarm histories in a csv, access or excel format.

(vi) Energy Reports:

- (A) System shall include an easily configured energy reporting tool that provides the capabilities described in this section. The energy reporting tool shall be accessible through the same user interface (Web browser or operator workstation software) as is used to manage the BAS. The energy reporting tool shall be preconfigured to gather and store energy demand and consumption data from each energy source that provides metered data to the BAS. Meter data shall be stored at 5 minute intervals unless otherwise specified in the Sequence of Operation. This data shall be maintained in an industry standard SQL database for a period of not less than five years.
- (B) The energy reporting tool shall include provisions for future additions and expansions with up to 30% spare capacity.
- (C) The user shall have an option of entering benchmark data for an individual facility or a group of facilities.
- (D) The user shall have the option of displaying and printing any of the following data on any chart generated by the energy reporting tool:
 - Low, High & Average values of the metered parameters,

- Peak demand KW, KVA,
- Heating and/or cooling degree days for the time period being displayed.

(g) User Interfaces

- (i) GUI Personal Computer – The PC Provided as the primary means of access into the BAS. It shall contain all the required software tools as described in Section 4 - BAS Software Tools.
 - (A) PC Hardware shall be state-of-the-art desktop system with adequate capacity, speed and memory storage.
 - (B) PC Operating System – The PC shall be IBM compatible and shall be provided with Microsoft Windows professional Operating Systems software and the latest version of Symantec Antivirus Software including a 1 year upgrade subscription service to the Symantec software.
- (ii) LCD Display – A wall-mounted easy-to-operate User Interface that Provides direct read / write access to any point on the network. The LCD Display shall Provide the following:
 - (A) Configuration shall be through an easy to use LNS plug-in that can directly access any point within the BACnet data base. The configuration shall be through a menu driven format that allows for quick and easy setup. At total of 250 points shall be available for display and or control in groups of 50. Each group shall have a 13 alpha numeric character descriptor and each point shall have up to a 16 character alpha numeric descriptor.
 - (B) The Display shall consist of an alphanumeric LCD display of 16 lines x 16 characters, and a multi-function keyboard. The display shall have a graphical logo displayed on its default screen. This logo shall be a standard monochrome bitmap of 89x128 pixels that the user can download into the device to replace the existing one with.
 - (C) Schedule function – The LCD Display unit shall contain 16 scheduler objects with network variable outputs of changeable types. The scheduler functions shall be the same as Provided in the FPC and accessed through an BACnet Plug-in. The network variable types should be standard and should support at least the following 3 types: SNVT_occupancy, SNVT_tod event, SNVT_hvac_mode
 - (D) The LCD display unit shall have a real time clock that supports daylight saving time. The schedule and real time clock information must be accessible and modifiable directly through the keypad and the LCD interface. The schedule shall be displayed in a monthly calendar format
 - (E) The LCD Display shall be Provided as a surface mount or flush mount as shown on the mechanical Drawings.

(h) Peripheral Devices

(i) Temperature Sensors and Transmitters - General Sensor & Transmitter Requirements

- (A) Provide sensors and transmitters required as outlined in the input/output summary and sequence of operation, and as required to achieve the specified accuracy as specified herein.
- (B) Temperature transmitters shall be equipped with individual zero and span adjustments. The zero and span adjustments shall be non-interactive to permit calibration without iterative operations. Provide a loop test signal to aid in sensor calibration.
- (C) Temperature transmitters shall be sized and constructed to be compatible with the medium to be monitored. Transmitters shall be equipped with a linearization circuit to compensate for non-linearities of the sensor and bridge and Provide a true linear output signal.
- (D) Temperature sensors shall be of the resistance type and shall be either platinum 1k ohm or 10k ohms type II as specified elsewhere
- (E) Thermistors are acceptable Provided the mathematical relationship of a thermistor with respect to resistance and temperature with the thermistor fitting constraints is contained with the CU operating software and the listed accuracy's can be obtained. Submit proof of the software mathematical equation and thermistor manufacturer fitting constants used in the thermistor mathematical/expressions. Thermistors shall be of the Thermistor (NTC) Type with a minimum of 100 ohm/°F resistance change versus temperature to insure good resolution and accuracy. Thermistors shall be certified to be stable $\pm 0.24^{\circ}\text{F}$ over 5 years and $\pm 0.36^{\circ}\text{F}$ accurate and free from drift for 5 years.
- (F) CU operating software shall be equipped with a self-calibrating feature for temperature sensors.
- (G) The following accuracy's are required and include errors associated with the sensor, lead wire and A to D conversion.
 - (I)

Point Type	Accuracy
Outside Air	0.5°F
Chilled Water	0.5°F
Room Temperature	1.00°F
Hot Water/Steam	0.75°F
Duct Temperature	0.5°F
Sensors Used in Energy Water (BTU) or Process Calculations	0.1°F
- (H) Sensors used in BTU or process calculations shall be accurate to $\pm 0.10^{\circ}\text{F}$ over the process temperature range. Submit a manufacturer's calibration report indicating that the calibration certification is traceable to the National Bureau of Standards (NBS) Calibration Report Nos.

209527/222173.

- (I) Thermowells
 - (I) When thermowells are required, the sensor and well shall be supplied as a complete assembly including well head and greenfield fitting.
 - (II) Thermowells shall be pressure rated and constructed in accordance with the system working pressure
 - (III) Thermowells and sensors shall be mounted in a threadolet or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
 - (IV) Thermowells shall be constructed of the following materials:
Chilled and Hot Water: brass;
 - (V) Steam: 316 stainless steel; Brine (salt solutions): marine grade stainless steel.
- (J) Outside Air Sensors
 - (I) Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be Provided with a solar shield.
 - (II) Sensors exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.
 - (III) Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
- (K) Duct Type Sensors
 - (I) Duct mount sensors shall mount in a hand box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A neoprene grommet (sealtite fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.
 - (II) Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Duct sensors probe shall be constructed of 304 stainless steel.
 - (III) For outdoor air duct applications, use a weatherproof mounting box with weatherproof cover and gasket.
 - (IV) Averaging Duct Type Sensors - For ductwork greater any dimension than 48 inches and/or where air temperature stratification exists, utilize an averaging sensor with multiple sensing points. The averaging sensor shall be a 304 stainless steel tube with holes extending across the duct or plenum to be sampled. A bleed hole outside the duct or plenum causes air to enter the sample tube and exit at the bleed hole, thus bathing the sensor in average air. The averaging sensor shall be installed complete with end cap, compression fittings, gaskets, mounting flange and required accessories. Provide capillary supports at the sides of the duct to support the sensing string.
- (L) Acceptable Manufacturers:
 - (I) Duct/Immersion Sensors – Mamac
 - (II) Room Sensors – Distech Controls or Mamac

- (III) Or approved equivalent
- (M) Relative Humidity Sensors/Transmitter
 - (I) The sensor shall be a solid state, resistance type relative humidity sensor of the Bulk Polymer Design. The sensor element shall be washable and shall resist surface contaminations.
 - (II) Humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2 wire isolated loop powered, 4-20 mA, 0-10 VDC linear proportional output.
 - (III) The humidity transmitter shall meet the following overall accuracy including lead loss and A to D conversion.
 - (IV) Room Type Sensor $\pm 3\%$ RH
 - (V) Provide a single point humidity calibrator, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
 - (VI) Acceptable Manufacturers: Mamac, ACI, VERIS, HYCAL, Bapi,
 - (VII) Or approved equivalent
- (N) Flow, Pressure, and Electrical Measuring Apparatus
 - (I) Traverse Probe Air Flow Measuring Stations- Traverse probes shall be a dual manifold, cylindrical, type constructed of 3003 extruded aluminum with an anodized finish to eliminate surface pitting and unnecessary air friction. The multiple total pressure manifolds shall have sensors located along the stagnation plane of the approaching air flow and without the physical presence of forward Projecting sensors into the airstream. The static pressure manifold shall incorporate dual offset static tips on opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as $\pm 20^\circ$ in the approaching airstream.
 - (II) The air flow traverse probe shall not induce a measurable pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presences in the airstream. Each air flow measuring probe shall contain multiple total and static pressure sensors placed at equal distances along the probe length. The number of sensors on each probe and the quantity of probes utilized at each installation shall comply with the ASHRAE Standards for duct traversing.
 - (III) Traverse probes shall be accurate to $\pm 25\%$ of the measured airflow range down to 0.25" WC static pressure.
 - (IV) Each flow measuring station shall be complete with its own dedicated microprocessor with a 4-line, 80 character, Alpha Numeric display and full function key pad. The panel shall be fully programmable and display calculated CFM directly on a LED monitor on the panel face.
 - (V) Each station shall log air flow rates in real time and download data to its control unit (CU) via a RS-232 interface.
 - (VI) Provide 24 volt 1 phase power to each flow measuring station.
 - (VII) Acceptable Manufacturers: Air Monitor, Brandt, Air Sentinel, Or approved equivalent
- (O) Current Sensing Switches - Current sensing switch shall be self-powered

with solid-state circuitry and a dry contact output. Current sensing switches shall consist of a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over current up to twice its trip into range.

- (P) Relays - Relays other than those associated with digital output cards shall be general purpose, enclosed plug-in type with 8-pin octal plug and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required.
- (Q) Solid State Relays (SSR): Input/output isolation shall be greater than IOE9 ohms with a breakdown voltage of 1500V root mean square or greater at 60 Hz. The contact life shall be 10 x 10 E6 operations or greater. The ambient temperature range of SSRs shall be -20 to +140F. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release time shall be for 100 milliseconds or less. Transient suppression shall be Provided as an integral part of the relay.

3. **Execution**

(a) Examination

(i) Verification

- (A) Verify that all systems are ready to receive the Work.
- (B) The Project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Consultant for resolution before rough-in Work is started.
- (C) The Contractor shall inspect the site to verify that equipment is installable as show, and any discrepancies, conflicts, or omissions shall be reported to the Consultant for resolution before rough-in Work is started.
- (D) The Contractor shall examine the Drawings and Specifications for other parts of the Work, and if head room or space conditions appear inadequate or if any discrepancies occur between the plans and his Work and the plans for the Work of others, he shall report such discrepancies to the Consultant and shall obtain written instructions for any changes necessary to accommodate his Work with the Work of others.

(ii) General Installation Requirements

- (A) Install all control components in accordance with manufacturer's instructions and recommendations.
- (B) Provide mixing dampers of parallel blade construction arranged to mix streams. Provide separate minimum outside air damper section adjacent to variable outside air damper.

- (C) Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide nameplates for instruments and controls inside cabinet and nameplates on cabinet face.
 - (D) After completion of installation, test and adjust control equipment. Submit data showing setpoints and final adjustments of controls.
 - (E) Install equipment, piping, wiring/conduit parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
 - (F) Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
 - (G) Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
 - (H) All equipment, installation, and wiring shall comply with acceptable industry Specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.
- (iii) Ethernet Network Connection
 - (A) All neVICES that require a connection to the LAN or access to an ISP shall be approved by the Owner's Information Technology representative prior to installation.
 - (B) All ethernet communication connections shall be Provided by the Owner or Contractor.
- (b) Electrical System Installation
 - (i) Comply with all Division 16 Installation Requirements.
 - (ii) Provide interlock wiring between supply and exhaust fans, electrical wiring for relays (including power feed) for temperature and pressure indication.
 - (iii) Provide power wiring, conduit and connections for low temperature thermostats, high temperature thermostats, alarms, flow switches, actuating devices for temperature, humidity, pressure and flow indication, point resets and user disconnect switches for electric heating, appliances controlled by this Section.
 - (iv) Provide all other wiring required for the complete operation of the specified systems.
 - (v) Where required install all wiring raceway systems complying with the requirements of the National Electrical Code. All required conduit shall be installed in EMT.
 - (vi) Provide interlock wiring between supply and exhaust fans, electrical wiring for relays (including power feed) for temperature and pressure indication.
 - (vii) Surge Protection and Lighting Protection

- (A) All equipment and all communication media shall be suitably protected from damage associated with electrical surge and lightning strike. Submittal and approval is required for all such devices.
 - (B) All input-output hardware and instrumentation located outdoors shall be isolated using approved surge suppression devices.
 - (C) All telephone modem connections shall be isolated using approved surge suppression devices.
 - (D) All building-to-building communication connections shall be isolated using approved surge suppression devices.
 - (E) All temperature control panels and controllers shall be Provided with a control power transformer with fuse protection on both the primary and secondary sides.
- (viii) Provide electrical disconnecting means for servicing, for each control panel, digital controller, router, transformer, power supply, and other devices that are served by 120VAC or higher voltage.
- (ix) Enclosures shall be suitable for the environment (EEMAC 1 or EEMAC 12) in which they will be installed and shall be fabricated of 14ga. steel with sub-panels for component mounting and have removable, hinged doors. Enclosures shall be sized to house the controllers, power supplies, transformers, relays, wire duct and miscellaneous equipment required to support the application. Enclosures shall be provided for all controllers that are not located within an OEM provided mechanical equipment or on a VAV box.
- (x) Enclosure power supply shall provide at least one 40VA and one 100VA transformer with individual on/off switches and circuit breakers and two 120VAC outlets. Enclosures and power supplies shall be UL listed Class II.
- (xi) Network Communication Requirements
- (A) Wired network communication shall be via channels consisting of a 22 AWG unshielded twisted pair in compliance with manufacturers recommendations for BACnet communications
 - (B) In all communication conduits, Provide one spare twisted pair to be installed, tagged and labeled at each end.
 - (C) Communication conduits shall not be installed closer than six feet from high power transformers or run parallel within six feet of electrical high power cables. Care shall be taken to route the cable as far from interference generating devices as possible.
 - (D) There shall be no power wiring, in excess of 30 VAC rms, run in conduit with communications wiring.
- (xii) Input/Output Control Wiring
- (A) Platinum 1k ohm and thermistor 10k ohms type II wiring shall be two-wire

- or four-wire twisted, shielded, minimum number 22 gauge.
- (B) Other analog inputs shall be a minimum of number 22 gauge, twisted, shielded.
- (C) Binary control function wiring shall be a minimum of number 18 gauge.
- (D) Analog output control functions shall be a minimum of number 18 gauge, twisted, shielded.
- (E) Binary input wiring shall be a minimum of number 18 gauge.
- (xiii) Splices in shielded cables shall consist of terminations and the use of shielded cable couplers, which maintain the integrity of the shielding. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties as specified herein.
- (xiv) Conduit and Fittings
 - (A) Conduit for Control Wiring, Control Cable and Transmission Cable: Electrical metallic tubing (EMT) with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.
 - (B) Outlet Boxes (Dry Location): Sheradized or galvanized drawn steel suited to each application, in general, four inches square or octagon with suitable raised cover.
 - (C) Outlet Boxes (Exposed to Weather): Threaded hub cast aluminum or iron boxes with gasket device plate.
 - (D) Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National Electrical Codes. Enclosure type shall be suited to location.
 - (E) Install low voltage power and LAN communication trunks in conduit in the following locations regardless of local building code allowances otherwise.
 - (I) Mechanical rooms.
 - (II) Electrical rooms.
 - (III) Vertical risers (exception: fire rated continuous closet like a telephone closet).
 - (IV) Open Areas where the wiring will be exposed to view or tampering.
 - (F) Conceal conduit within finished shafts, ceilings and wall as required. Install exposed conduit parallel with or at right angles to the building walls.
- (xv) Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used Provided that:
 - (A) Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
 - (B) All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.

- (xvi) Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
 - (xvii) Where Class 2 wiring is run exposed, wiring to be run parallel along a surface or perpendicular to it, and NEATLY tied at 3m (10 ft.) intervals.
 - (xviii) All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to-wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
 - (xix) Plug or cap all unused conduit openings and stub-ups. Do not use caulking compound.
 - (xx) Route all conduit to clear beams, plates, footings and structure members. Do not route conduit through column footings or grade beams.
 - (xxi) Set conduits as follows:
 - (A) Expanding silicone fire stop material sealed watertight where conduit is run between floors and through walls of fireproof shaft.
 - (B) Oakum and lead, sealed watertight penetration through outside foundation walls.
 - (xxii) Cap open ends of conduits until conductors are installed.
 - (xxiii) Where conduit is attached to vibrating or rotating equipment, flexible metal conduit with a minimum length of 18 inches and maximum length of 36 inches shall be installed and anchored in such a manner that vibration and equipment noise will not be transmitted to the rigid conduit.
 - (xxiv) Where exposed to the elements or in damp or wet locations, waterproof flexible conduit shall be installed. Installation shall be as specified for flexible metal conduit.
 - (xxv) Provide floor, wall, and ceiling plates for all conduits passing through walls, floors or ceilings. Use prime coated cast iron, split-ring type plates, except with polished chrome-plated finish in exposed finished spaces.
- (c) Temperature Sensors
- (i) Temperature sensor assemblies shall be readily accessible and adaptable to each type of application in such manner as to allow for quick, easy replacement and servicing without special tools or skills.
 - (ii) Strap-on mountings shall not be permitted.
 - (iii) Outdoor installations shall be; of weatherproof construction or in appropriate NEMA enclosures. These installations shall be protected from solar radiation and wind effects. Protective shield shall be stainless steel.
 - (iv) Sensors shall be with enclosure where located in finished space.

- (v) Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only and shall not be located in dead air spaces or positions obstructed by ducts, equipment, and so forth. Locations where installed shall be within the vibration and velocity limit of the sensing element. Ducts shall be securely sealed where elements or connections penetrate ducts to avoid measuring false conditions.
 - (vi) All sensors measuring temperatures in pipes larger than 2 inches in diameter or in pressure vessels shall be supplied with wells properly fabricated for the service. Wells shall be noncorrosive to the medium being measured and shall have sufficient physical strength to withstand pressures and velocities to which they are subjected. Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to effect proper flow across the entire area of the well.
 - (vii) All field sensors, transmitters, actuators, switches, etc. shall be field calibrated. The calibration shall be guaranteed for the period of the control system warranty. Any corrections or re-calibration required during the warranty will be performed at no cost to the Owner. Calibration methods, means, instruments, and standards shall be in strict accordance with ISO-9000 standards.
- (d) Controls Valves, Control Dampers and Actuators (Low Voltage -24V)
- (i) Control Valves.
 - (A) Control valves shall be properly selected by the controls contractor for the required duty and application.
 - (B) Contractor shall ensure that each control valve can be serviced, including adjustment and removal of the actuator.
 - (C) All control valves shall have unions installed at each inlet and outlet to permit removal of the valve for servicing.
 - (D) Valves shall be installed with stems vertical where possible. Where space conditions require valves to be mounted with stems greater than 45° off vertical the actuator shall be externally supported. In no case will the control valve be mounted with the stem greater than 90° off of vertical.
 - (E) Two way modulating Control valves shall be designed to work with electronic actuator with a 20 mm stroke. Control valves shall be suitable for water and water+40% propylene glycol.
 - (F) Control valves shall have direct coupled bonnet, equal percentage and linear flow characteristics, stainless steel trim, pressure rating of 250 psi, rangeability greater than 100:1, ANSI leakage class IV, cartridge type packing for easy service.
 - (ii) Control Dampers.
 - (A) Contractor shall verify service access requirements of the control dampers, and confirm that each control damper can be serviced, including adjustment and removal of the actuator.

- (B) Furnish interconnecting hardware, linkages, locking devices, etc. for installation of multiple section dampers.
- (e) Access Doors.
 - (i) Contractor shall Provide access doors of adequate sizes or other approved means of access through ducts for service to control equipment.
- (f) Hydronic Flow meters.
 - (i) Provide suitable insertion type, turbine flow meters to monitor system flow rates as indicated on the drawings.
 - (ii) Sensing method shall be impedance sensing (non-magnetic and non-photo electric)
 - (iii) Volumetric accuracy shall be 0.5% of reading at calibrated velocity.
 - (iv) Sensing element shall be designed for easy removal without shutting down or draining of the system volume.
 - (v) Temperature and pressure rating of the flow meter elements shall be carefully selected to ensure adherence to the system design values.
- (g) Instrument Enclosures and Control Panels
 - (i) Securely mount all control panels and enclosures to wall or structure using bolts, anchors, etc. Mount enclosures and control panels with top at 60 inches above finished floor, unless noted otherwise. Field fabricate enclosure mounting rack from Unistrut, Kindorf, or approved equivalent, where required. Locate enclosures and control panels to ensure full door swing.
 - (ii) Seal all conduit entrances into enclosures and control panels, water tight.
 - (iii) Locate enclosures indoors where possible. Provide drains and block heaters for all panels located outdoors.
- (h) Identification of Hardware and Wiring
 - (i) All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information.
 - (ii) Permanently label or code each point of field terminal strips to show the instrument or item served.
 - (iii) Identify control panels with minimum 1 inch letters on nameplates.
 - (iv) Identify all other control components with permanent labels. Identifiers shall match record documents.
 - (v) Affix engraved tags plates on each motor starter controlled through the EMS. Minimum tag size shall be 1 in. X 3 in. Minimum lettering size shall be 3/16 in. high. Tag shall be red with white lettering. Tags shall indicate the following:

CAUTION

**This equipment is operating under automatic
control and may start at any time without warning**

- (vi) Identify room sensors relating to terminal box or valves with nameplates.
- (i) Cleaning
 - (i) Contractor shall clean up all debris resulting from his or her activities on a daily basis. The Contractor shall remove all cartons, containers, crates, etc. under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.
 - (ii) At the completion of the Work in any area, the Contractor shall clean all of his/her Work, equipment, etc., making it free from dirt and debris, etc.
 - (iii) At the completion of Work, all equipment furnished under this Section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.
- (j) Protection
 - (i) The Contractor shall protect all Work and material from damage by his/her Work or workers, and shall be liable for all damage thus caused.
 - (ii) The Contractor shall be responsible for his/her Work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her Work against theft or damage, and shall carefully store material and equipment received on-site that is not immediately installed. The Contractor shall close all open ends of Work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.
- (k) Field Quality Control
 - (i) All Work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.
 - (ii) Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and/or wiring runs shall be installed parallel to building lines and properly supported.
 - (iii) Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the Work.

(I) Performance Evaluation/Acceptance Procedure

- (i) General. - Acceptance of the control system depends in part upon successful demonstration of control system performance. The SI shall prepare a detailed final functional test and verification plan indicating in a step-by-step logical fashion, the procedures by which the control system will be tested. This shall include the following procedures:
 - (A) Sequence of Operation - Demonstrate all sequences of operation.
 - (B) Test Documentation - Provide standard formatted documentation for each controlled system and element test.
 - (C) Pre-Testing - The control system installer shall have performed pre-testing of all tests on all components before final testing. If during final testing more than 10 percent of the points or sequences checked are found to be faulty, the Contractor shall halt the test and re-check all parts of the system test.
 - (D) Testing Plan. Submit test plan for approval not less than 4 weeks prior to tests. Meet with the Owner's representative, discuss the test plan, and make necessary revisions. The test plan shall include, as a minimum, for each control system and sub-system the following:
 - (I) System name.
 - (II) List of devices with brief description of functional purpose of each.
 - (III) The expected signal values transmitted by the sensors/transmitters.
 - (IV) The expected signal values transmitted by the controller to the controlled device or actuator.
 - (V) The expected values of the control medium from limit-to-limit.
 - (VI) A description of the instrumentation required to test the system, including proof of calibration.
 - (VII) A detailed step-by-step process in conducting test and verification.
 - (VIII) Log sheets on which expected and actual values will be recorded.
 - (IX) Other criteria for test to indicate that the system is operating in accordance with Contract requirements.
- (ii) Testing - Inform the Consultant and the Owner of all test dates for attendance, so that the Consultant and/or Owner may attend the test if desired. Perform all tests. Correct all system malfunctions found in the testing procedure. Retest as required. If Owner's representative does not witness test, Provide performance certification.
- (iii) Acceptance - The control systems will not be accepted as meeting the requirements of Completion until all tests described in this Specification have been performed to the satisfaction of both the Consultant and the Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the completion requirements if stated as such in writing by the Owner's representative.

(m) Sequence Of Operations

(i) Rooftop HVAC System

- (A) A pre-engineered rooftop HVAC system is part of this project.
- (B) Refer to specification section 15730 HVAC Equipment for details of equipment, controls.
- (C) The rooftop system shall be supplied with a BACnet controller and shall allow full access to all monitoring and control points for the system via the BAS.
- (D) The Contractor shall allow for all programming efforts related to transferring of data points from other BACnet devices and also include for creation of suitable graphics to represent all components of the HVAC system on the BAS workstation & to provide web access for all interconnected systems and for all transferred data points.
- (E) All set points values indicated in the sequence of operations shall be field adjustable.
- (F) Refer to BAS points list of details of required monitoring, control and software points.
- (G) RTU-1: This unit serves majority of perimeter and interior areas of the building.

(ii) Summer Operation:

- (A) If the outdoor air enthalpy is above the return air enthalpy, the unit shall automatically switch to the summer mode.
- (B) In the summer mode of operation, the perimeter heating and the in floor heating system shall be de-energized.
- (C) Minimum outdoor air mode:
 - (I) If the outdoor air enthalpy is higher than the return air enthalpy, the unit shall operate in the minimum outdoor air mode.
 - (II) In the minimum outdoor air mode, the outdoor air dampers shall close down to the minimum outdoor air position and the barometric exhaust shall relieve the building pressure to maintain minimum exhaust flow condition.
 - (III) The 3 stages of cooling shall be switched in sequence to maintain maximum return air temperature set point, initially set at 75 degrees F.

(iii) Economizer mode:

- (A) If the outdoor air enthalpy is lower than the return air enthalpy, the unit shall operate in the economizer mode.
- (B) In the economizer mode, The cooling system shall be switched off and the outdoor air dampers shall opened in stages to the maximum outdoor air

position and the power exhaust fan shall operate in stages based on building differential pressure input. Motorized Damper (MD) MD-1 shall open allowing outdoor air intake. MD-3 shall be closed. MD-2 shall be in open position.

(iv) Winter Operation:

- (A) If the outdoor air temperature is equal to or below 50 degrees F, the unit shall automatically switch to the winter mode.
- (B) In the winter mode, the VAV box shall be controlled (max to 30% flow) in sequence with the reheat coils (0-100% capacity via modulating valve) to maintain a pre-determined supply air set point.
- (C) The "radiant" perimeter heating system shall be controlled (0-100% capacity) to maintain a pre-determined space air temperature.
- (D) The unit shall operate in the minimum outdoor air mode as follows:
 - (I) The cooling system shall be switched off and supply fan shall run.
 - (II) In the minimum outdoor air mode, the outdoor air dampers shall close down to the minimum outdoor air position and the power exhaust fans shall be staged to maintain a minimum exhaust flow condition as per the air balancing schedule.

(v) Zone Control-Summer Operation:

- (A) The building is divided into multiple zones and each zone is served by a variable air volume (VAV) box complete with reheat coil as indicated on the drawings.
- (B) At partial cooling load conditions, a strategically located, wall mounted temperature sensor shall control the operation of the VAV box actuator to modulate supply of air into the space.
- (C) At minimum space load condition, the VAV box shall deliver approximately 30% of room supply air flow to satisfy the minimum ventilation requirement of the space.

(vi) Unit heaters

- (A) Unit heaters shall be controlled via BAS by low voltage remote wall mounted temperature sensor.
- (B) Unit heaters shall be de-energized if the outside air temperature is equal to or above 55 degrees F. (field adjustable).
- (C) The fan shall be cycled to operate prior to energizing the heating stages.
- (D) Space temperature set point shall be maintained by switching the heater stages. Number of control stages shall match the specified stages of the unit heater.
- (E) Provide suitable wiring and conduits to accomplish the staged control of

unit heaters.

(vii) Vestibule heaters

- (A) Vestibule heaters shall be controlled via BAS by low voltage remote wall mounted temperature sensor.
- (B) The vestibule heater shall be de-energized if the outside air temperature is equal to or above 55 degrees F. (field adjustable).
- (C) The fan shall be cycled to operate prior to energizing the heating valve.
- (D) Space temperature set point shall be maintained by modulating the heater control valve.
- (E) Provide suitable wiring and conduits to accomplish the staged control of unit heaters.

(viii) Mechanical room ventilation system

- (A) Upon rise of space temperature above the set point, open motorized outdoor air intake damper.
- (B) Fan shall run to maintain space temperature set at the BAS.
- (C) Fan status and space temperature shall be monitored via BAS.
- (D) Interlock operation of exhaust fan with the gas detection system.

(ix) Miscellaneous exhaust fans (To limit space temperature during summer)

- (A) Fan shall run to maintain space temperature set at the BAS.
- (B) Fan status and space temperature shall be monitored via BAS

(x) Energy Recovery System

- (A) Fan shall be operated (start/stop) by BAS and shall run continuously in the occupied mode.
- (B) Interlock operation of ERV fans with the operation of corresponding indoor Rooftop AC unit.
- (C) Provide monitoring of common alarm and ERV status on the BAS (i.e. defrost mode, normal operating mode, failure alarm, other alarm conditions)

(xi) Heating plant-Secondary circuit:

- (A) All heating control valves shall be opened to minimum position (field adjustable) prior to starting the lead secondary pump.
- (B) The lead secondary pump shall be started at minimum speed when the outdoor air temperature falls to approximately 60°F (field adjustable).
- (C) Alternate the lead pump every 7 days. If the lead pump fails to start within

5 seconds after enabled, start the lag pump.

- (D) Alarms shall be generated if pump status fails to prove ON when pump is enabled or pump status fails to shut off when pump is disabled.

(xii) Secondary pressure control:

- (A) The pump speed shall be modulated to maintain the differential pressure set point, which is set by the water balancer.
- (B) Alarms shall be created if the differential pressure is more or less than 10% from the set point.
- (C) Boilers and primary pumps shall be controlled in sequence to maintain a pre-set supply water temperature set point which shall be reset based on the outdoor air temperature.

(n) BAS Points List

GENERAL	Binary		Analog		S/Ware	Alarms
	Input	Output	Input	Output		
Outdoor Air Temperature			X			
Outdoor Air Relative Humidity			X			
Outdoor Airflow sensor (ERV)			X			Monitor individual OA flow and generate separate alarms if any of the outdoor airflow falls below 15% of the minimum prescribed values.
Time					X	
Weekday/Weekend/Holiday Schedule					X	

BOILER	Binary		Analog			Alarms
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	Input	Output	Input	Output	S/Ware	
Boiler Start/Stop		X				
Boiler Status	X					
Common "Fault"-Boiler Panel	X				X	
Heating Water Temperature Set Point (Leaving)					X	
Heating Water Temperature (Leaving)			X			
Heating Water Temperature (Return)			X			
Boiler Alarm					X	High and Low Temperature Alarms
HEATING WATER PUMPS (Applies to all Primary and Secondary pumps).	Binary		Analog			Alarms
	Input	Output	Input	Output	S/Ware	
Pump Start/Stop		X				
Pump Status	X					
Pump speed control	X			X		Via differential pressure transmitter.
Duty sharing (Equal Run times for Run & Stand-by Pumps only)					X	
2 way valve control				X		For reheat coils and radiant heating system.
Rooftop HVAC Unit	Binary		Analog			Alarms
	Input	Output	Input	Output	S/Ware	

Unit Start/Stop,		X				
Unit Status,	X					
Air filter Status,	X					
Mode of operation (Heating/Cooling)		X				Allow for control of heating or cooling stage as required.
Supply Air Temperature			X			
Space Temperature			X			
Outdoor airflow measurement (accuracy of +/- 15% of minimum OA value) & modulation of OA damper to meet IAQ requirements			X	X		OA Damper Control
Economizer operation & Control			X	X		Based on Differential Enthalpy.
Dehumidification mode		X			X	
Hot gas bypass control		X			X	
Common system alarm		X			X	X
ERVs (Typical for each fan-supply and exhaust)	Binary		Analog			Alarms
	Input	Output	Input	Output	S/Ware	
System Start/Stop		X				
Fan Status (Supply & Exhaust)	X					
Defrost cycle	X					
Outdoor airflow measurement (accuracy of +/- 15% of minimum OA			X	X		OA Damper Control

value) & modulation of OA damper to meet IAQ requirements						
EXHAUST FANS (Typical for each exhaust fan system)						Alarms
	Input	Output	Input	Output	S/Ware	
System Start/Stop		X				
System Status	X					
Motorized damper operation Open/Close)		X				
Damper Status	X					Provide end switch for damper status
Space temperature (Cooling) control		X				
Space Air Temperature Set point					X	
Space Air High Temperature Alarm					X	High temp alarm
EXHAUST FANS (Typical for mechanical room ventilation system)	Binary		Analog			Alarms
	Input	Output	Input	Output	S/Ware	
System Start/Stop		X				Based on space temperature or input from gas monitoring system
System Status	X					
Motorized damper operation Open/Close)		X				
Damper Status	X					Provide end switch for damper status

Space temperature (Cooling) control		X				
Space Air Temperature Set point					X	
Space Air High Temperature Alarm					X	High temp alarm
HYDRONIC HEATERS (Typical for each heater)	Binary		Analog			Alarms
	Input	Output	Input	Output	S/Ware	
Heater Start/Stop		X				
Heater Status	X					
Space temperature (Heating) control		X				Cycle the fan and modulate control valve
Space Air Temperature Set point					X	
Space Air Low Temperature Alarm					X	Low temp alarm
DOMESTIC HOT WATER SYSTEM	Binary		Analog			Alarms
	Input	Output	Input	Output	S/Ware	
Supply Water Temperature (at heater outlet)			X			
Supply Water Temperature (at the most remote point in the loop)			X			
Supply Water Temperature set point					X	
Re-circ pump Start/stop Control		X				Run pump to maintain a pre- set temperature of hot water in the longest loop.

Re-circ pump status	X					
Common alarm	X	X				Input from heater, output to BAS.
MISC. OTHER SYSTEMS / DATA POINTS	Binary		Analog			Alarms
	Input	Output	Input	Output	S/Ware	
Sanitary drainage pump sets-common alarm	X					Pump failure
Trap Seal primer	X	X				Need fault input from the trap seal primer system
Space temperatures of all mechanically ventilated areas			X			

END OF SECTION

(o)

1 GENERAL

1.1 GENERAL REQUIREMENTS

- 1.1.1 Comply with the Simcoe Muskoka Catholic District School Board General Conditions and Request for Quotations and Division 16.

1.2 APPLICATION

- 1.2.1 This Section applies to and is an integral part of all succeeding Sections of this Division of the specification.

1.3 DEFINITIONS

- 1.3.1 The following are definitions of words found in Sections of this Specification and on associated drawings:

- 1.3.2 "Concealed" - hidden from normal sight in furred spaces, shafts, crawl spaces, ceiling spaces, walls and partitions;

- 1.3.3 "Exposed" - all work normally visible to building occupants;

- 1.3.4 "Provide" (and tenses of "Provide") - supply, install and connect complete.

- 1.3.5 "Install" (and tenses of "install") - install, and connect complete;

- 1.3.6 "Supply" - Supply only.

- 1.3.7 "Work" - all equipment, permits, materials and labour to provide a complete electrical installation as required and detailed in Drawings and Specification.

- 1.3.8 "Authorities" or "Authorities Having Jurisdiction" - any and all current laws and/or by-laws of any federal, provincial or local authorized agencies having jurisdiction over the sum total or parts of the work including, but not restricted to the Municipal Planning and Building Department, Municipal Fire Department, Labour Canada, The Provincial Fire Marshall, The Local Hydro Supply Authority, The Ontario Building Code, The Construction Safety Act, Municipal Public Works Department, the Ontario Electrical Safety Code (Canadian Electrical Code with Ontario Supplement), hereinafter referred to as the "Code", the Electrical Safety Authority and all Inspection Bulletins.

- 1.3.9 "Drawings and Specifications" - "the Contract Drawings and Specifications".

- 1.3.10 "Consultant" shall mean the firm of Moon-Matz Ltd., or other person authorized to act on their behalf.

1.4 WORK INCLUDED

- 1.4.1 The work shall include all labour, materials, equipment, permits, inspections and tools required to supply and install new 100A, 347/600V, 3PH, 4W main distribution panel, 25 kVA 600-120/240, 1PH, 3W single phase transformer, 200A, 120/240V, 1PH, 3W distribution panel, power distribution, lighting, lighting control, public address, fire alarm, telephone services and access control to serve childcare addition to school building as described but not necessarily limited to items, in the following sections:

- .1 Section 16010 Electrical General Provisions
- .2 Section 16100 Electrical Basic Materials and Methods
- .3 Section 16400 Electrical Distribution
- .4 Section 16505 Lighting Systems
- .5 Section 16525 Lighting Control
- .6 Section 16720 Security System
- .7 Section 16721 Fire Alarm System
- .8 Section 16745 Telephone and Data
- .9 Section 16762 Intercom System
- .10 Section 16770 Public Address System

1.5 SCHEDULING OF PRODUCT DELIVERY

- 1.5.1 Every effort must be made to ensure delivery of all materials and products in the Contract Documents on time. At commencement of contract, assist Contractor in preparation of schedule of order dates for items requiring long delivery periods.

1.6 EXAMINATION OF SITE

- 1.6.1 Prior to submitting a tender carefully examine conditions at the site, which may or will affect the work. Refer to and examine all contract documents, including room finish schedules to determine finished, partially finished and unfinished areas of the building.
- 1.6.2 Ensure that materials and equipment are delivered to the site at the proper time and in such assemblies and sizes so as to enter into the building and to be moved into the spaces where they are to be located without difficulty. Be responsible for any cutting and patching involved in getting assemblies into place.

1.7 QUALITY ASSURANCE PROGRAM

- 1.7.1 Contractor shall follow the Simcoe Muskoka Catholic District School Board's quality assurance process (QAP) and procedures.
- 1.7.2 As part of the Simcoe Muskoka Catholic District School Board's QAP, contractor shall construct mock-ups for all electrical services including lighting system, public address system, fire alarm system, security system and power distribution.
- 1.7.3 After construction of mock-ups, an inspection of the mock-ups by the Simcoe Muskoka Catholic District School Board shall be requested by contractor. Typical inspection notice period for the school board to conduct mock-up inspection shall be 48 hours.
- 1.7.4 A typical lighting system mock-up construction shall include LED luminaire arrangements, associated dimming switches, occupancy sensors, photocells and demonstration of BAS controls. The Simcoe Muskoka Catholic District School Board reserves the right to decide which equipment and controls shall be constructed as a part of mock-up.

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- 1.7.5 The school board reserves the right to inspect all or selected electrical rough-ins for lighting systems, fire alarm system, security system and/or the public address system.
- 1.7.6 Provide a typical mock-up for all distribution and control systems. Location of mock-up shall be suggested by the Simcoe Muskoka Catholic District School Board. The contractor shall not install the T-bar ceiling tiles or otherwise conceal work in ceiling spaces until after Simcoe Muskoka Catholic District School Board has inspected the mock-ups and provided comments to the contractor on how to proceed with construction.
- 1.7.7 Contractor shall rectify all deficiencies highlighted by the Simcoe Muskoka Catholic District School Board after the first inspection of the mock-up. After the deficiencies have been rectified by the contractor, the contractor shall request an inspection by the Simcoe Muskoka Catholic District School Board to inspect all the rectified deficiencies. The ceiling shall not be closed for any reason until all the highlighted deficiencies are rectified to the satisfaction of the Simcoe Muskoka Catholic District School Board and the work shown by the mock-up is allowed to proceed to completion by the Simcoe Muskoka Catholic District School Board and the Consultant.
- 1.8 **SCHEDULING OF THE ELECTRICAL WORK:**
- 1.8.1 Co-ordinate all electrical work with the work of other trades, and schedule and complete the work as required coinciding with the completion date established for the Project.
- 1.8.2 Provide a detailed construction schedule indicating milestones. Contractor shall consider QAP procedure timelines (including mock-up and inspection time) in construction schedule.
- 1.8.3 Submit the Construction Schedule for the Simcoe Muskoka Catholic District School Board's approval.
- 1.9 **GENERAL CODES AND STANDARDS:**
- 1.9.1 The contractor shall comply with the following codes and standards:
- .1 Comply with the Ontario Building Code and Canada Labour Code, Part 4.
 - .2 Where provisions of pertinent codes or local by-laws conflict with these Specifications and Drawings or each other, comply with the more stringent provisions.
 - .3 Operating voltages shall comply with CAN3-C235-83 (R2015).
 - .4 Ground system shall comply with CSA Standard C22.1.
 - .5 Abbreviations for electrical terms: to CSA Z85
- 1.9.2 Provide new materials bearing certification marks or labels acceptable under Ontario Electrical Safety Code.
- .1 Equipment must bear, on manufacturer's label, certification mark or label acceptable under Electrical Safety Authority.
- 1.9.3 Provide units of same manufacture where two or more units of same class or type of equipment are required.
- 1.9.4 Manufacturer's names are stated in this Specification to establish a definite basis for tender submission and to clearly describe the quality of product that is desired for the work.

1.9.5 Standard Specifications

- .1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all products provided comply with latest issue of applicable Standard Specifications issued by authorities having jurisdiction, but such Standard Specifications shall not be applied to decrease the quality of workmanship, products and services required by the Contract Documents.

1.9.6 Electrical Codes and Permits:

- .1 The work shall be tendered on and shall be carried out in accordance with these Drawings and Specifications and shall comply with the essential requirements of the latest editions of the Canadian Electrical Code C. 22.1 and the Electrical Safety Code (together with applicable bulletins issued by the Inspection Department of Electrical Safety Authority). In no instance, however, shall the standards established by the Drawings and Specifications be reduced by any of the codes referred to above. In the event of conflicting requirements, the codes shall take precedence over these Contract Documents and the Engineer's decision shall be final.
- .2 Arrange for and obtain all necessary permits, inspection and approvals from authorities having jurisdiction, and also pay all applicable fees. The Contractor shall conform with all Municipal Codes and By-laws which affect the work.
- .3 Applicable Codes
 - .1 Ontario Electrical Safety Code
 - .2 Canadian Electrical Code with applicable regional amendments
 - .3 Ontario Building Code
 - .4 National Building Code
 - .5 Ontario Fire Code
 - .6 National Fire Code and Fire Commissioner Canada requirements
- .4 Before starting any work, submit the required number of copies of Drawings and Specifications to the Electrical Safety Authority and the local authority for approval and comments. Comply with any changes requested as part of the Contract, but notify the Engineer immediately of such changes for proper processing of these requirements. Prepare and furnish any additional Drawings, details or information as may be required by the Engineer.
- .5 On or before the completion of this Contract, obtain at own expense, the necessary certificate of inspection from the Inspection Branch of the Electrical Safety Authority of Ontario and forward same to the Engineer.
- .6 Equipment and material must be acceptable to Electrical Safety Authority.
- .7 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.
- .8 Supply and install warning signs, nameplates and glass covered Single Line Diagrams as required by Electrical Safety Authority.

- .9 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose.

1.10 REQUIREMENTS OF DRAWINGS:

1.10.1 Contract:

- .1 The electrical Specifications and Drawings specify complete systems. Include all labour and material required.
- .2 The intent is to provide the Owner a complete system and while no attempt has been made to detail or list each individual part required, include all parts and labour reasonably implied by these documents in order to deliver to the Owner the complete systems ready for operation.
- .3 Drawings and specifications augment each other, and any item reasonably implied in one but omitted in the other is interpreted as sufficiently covered, and must be provided.
- .4 Comply with all requirements herewith, so that the Contract and all Work to be done under it, can and will be carried on in a workmanlike manner, properly, satisfactorily, continuously, and expeditiously, to completion, in all respects, to the satisfaction of the Owner.
- .5 The Drawings for electrical work are essentially performance drawings, partly schematic, intended to convey the scope of work and extent of work. They only indicate general arrangement and approximate location of apparatus, fixtures and general typical sizes and locations of equipment and connections. The Drawings do not intend to show architectural, structural or mechanical details.
- .6 Do not scale Drawings, but obtain information involving accurate dimensions to structure from those shown on Architectural and Structural Drawings, or by site measurements of existing areas. Follow the Electrical Drawings in laying out the work but consult general Construction Drawings as well as detail Drawings to become familiar with all conditions affecting the work, and verify spaces in which the work will be installed and structures to which it will be attached.
- .7 This Division does not delegate functions or Work to any specific trade.
- .8 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.). Alter, at no additional cost, the location of materials and/or equipment up to 3m, or as directed, provided that the changes are made before installation and do not necessitate additional material or labour.
- .9 Leave space clear and install work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by other trades. Verify all equipment sizes in relation to space allowed and check all clearances.
- .10 Confirm on the site, the exact location and mounting elevation of equipment and fixtures as related to Architectural or Structural details. Confirm location of outlets and/or connection points for equipment supplied by other trades.

1.11 SHOP DRAWINGS:

- 1.11.1 Pay careful attention to all shop drawings and review comments and ensure that all requirements are fully complied with.
- 1.11.2 Submit prior to commencement of work for review, manufacturer's or vendor's drawings for all products being furnished except cable (up to 1000V), wire and conduit. Include rating, performance, specification sheets, descriptive literature, schematic and wiring diagrams, dimensional layouts and weights of components as well as complete assembly.
- 1.11.3 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences. Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.
- 1.11.4 Submit prior to commencement of work for review, properly identified shop drawings showing in detail the design and construction of all equipment and materials as requested in sections of the specification governed by this Section.
- 1.11.5 Obtain and comply with the manufacturer's installation instructions.
- 1.11.6 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS", stamp each copy with your company name, date each copy with the submittal date, and sign each copy. Shop drawings which are received and are not endorsed, dated and signed will be returned for re-submittal.
- 1.11.7 The Consultant will stamp shop drawings as follows:
- | | | |
|----|----------------------|-----|
| .1 | Drawing: Reviewed | () |
| .2 | Reviewed as Modified | () |
| .3 | Revise and Resubmit | () |
| .4 | Not Reviewed | () |
- 1.11.8 If "REVIEWED" is checked-off, the shop drawing is satisfactory. If "REVIEWED AS MODIFIED" is checked-off, the shop drawing is satisfactory subject to requirements of remarks put on shop drawing copies. If "REVISE AND RE-SUBMIT" is checked-off, the shop drawing is entirely unsatisfactory and must be revised in accordance with comments written on shop drawing copies and resubmitted. If "NOT REVIEWED" is checked-off, the shop drawing is in error of submission, not applicable for this project.
- 1.11.9 This review by the Consultant/Engineer is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant/Engineer approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the contract documents. Be 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 co-ordination of the work as well as compliance with codes and inspection authorities such as C.S.A., etc.
- 1.11.10 Coordinate Work of this Division such that items will properly interface with Work of other Divisions.

- 1.11.11 Architectural Drawings, or in the absence of Architectural Drawings, Mechanical Drawings govern all locations.

1.12 SUBSTITUTIONS

- 1.12.1 When only one manufacturer's catalogued trade name is specified, provide only that catalogued trade name, material or product.
- 1.12.2 When more than one manufacturer's trade name is specified for a material or product, the choice is the bidders.
- 1.12.3 No substitution is allowed upon award of contract.

1.13 DIMENSIONS AND QUANTITIES

- 1.13.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurement.
- 1.13.2 Quantities or lengths indicated in Contract Documents are approximate only and shall not be held to gauge or limit the Work.
- 1.13.3 Make necessary changes or additions to routing of conduit, cables, and the like to accommodate structural, mechanical and architectural conditions. Where raceways are shown diagrammatically run them parallel to building column lines.

1.14 EQUIPMENT LOCATIONS

- 1.14.1 Devices, fixtures and outlets may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3 m without adjustment to Contract price.
- 1.14.2 Switch, control device and outlet locations are shown diagrammatically.

1.15 WORKING DRAWINGS AND DOCUMENTS

- 1.15.1 Contractor may be required to prepare working detail drawings supplementary to the contract drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of materials and or apparatus occur, or where work due to architectural and structural considerations involves special study and treatment. Such drawings may be prepared jointly by all trades affected, or by the one (1) trade most affected with due regard for and approval of the other trades, all as the Consultant will direct in each instance. Such drawings must be reviewed by the Consultant before the affected work is installed.
- 1.15.2 Carry out all alterations in the arrangement of work which has been installed without proper study and approval, even if in accordance with the contract documents, in order to make such work come within the finished lines of walls, floors and ceilings, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.

1.16 INSTALLATION DRAWINGS

- 1.16.1 Prepare installation drawings for equipment, based upon approved Vendor drawings, to check required Code clearances, raceway, busway and cable entries, sizing of housekeeping pads and structure openings. Submit installation drawings to Consultant for review.

1.17 "AS BUILT" RECORD DRAWINGS

- 1.17.1 Maintain a set of Contract Drawings on site and record all deviations from the Contract Documents. As a mandatory requirement, recording must be done on the same day deviation is made. Be responsible for full compliance with this requirement.
- 1.17.2 Mark locations of feeder conduits, junction and terminal boxes and ducts or conduits run underground either below the building or outside the building.
- 1.17.3 Where conduit and wiring are underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.
- 1.17.4 Record deviations from branch circuit numbers shown on Drawings.
- 1.17.5 Prepare diagrams of interconnecting wiring between items of equipment including equipment supplied by Owner and under other Specification Sections.

1.18 SINGLE LINE DIAGRAM

- 1.18.1 Reproduce this diagram in drawing form under glazed frame and mount in Electrical Room and provide copies of these diagrams to the Consultant and include in the Maintenance Manuals.

1.19 TEST REPORTS

- 1.19.1 For each check and test performed prepare and submit a Test Report, signed by the Test engineer, and where witnessed, by the Consultant.
- 1.19.2 Include record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number.
- 1.19.3 Include calibration record, percentage error and applicable correction factors.
- 1.19.4 Submit a Certified Test Report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each product and part of Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

1.20 FACTORY WITNESS TESTS

- 1.20.1 Prior to Consultant attendance at factory for witness testing, perform the following:
 - .1 Successfully conduct test to be witnessed.
- 1.20.2 Following successful testing, inform the Consultant, in writing, that tests to be witnessed have been successfully performed.

1.21 FIRE BARRIERS

- 1.21.1 Where electrical material or devices pass through fire rated separations, make penetrations and provide fire barrier seals with a fire resistance rating equivalent to the rating of the separation.
- 1.21.2 Prior to installation, submit for review, proposed fire barrier seal materials, method of installation and ULC system number.

1.21.3 Acceptable Manufacturers:

- .1 A/D Fire Protection Systems
- .2 Dow Corning
- .3 Fire Stop Systems
- .4 IPC Flamesafe Firestop
- .5 Nelson Electric
- .6 3M
- .7 Tremco

1.22 **MISCELLANEOUS METAL FABRICATIONS**

- 1.22.1 Provide miscellaneous structural supports, platforms, braces, brackets and preformed channel struts necessary for suspension, attachment or support of electrical. All supports, platforms, brackets and channel struts shall be made of stainless steel material.

1.23 **SLEEVE AND FORMED OPENING LOCATION DRAWINGS**

- 1.23.1 Prepare and submit to the Consultant for review and forwarding to the appropriate Sub-trade, drawings indicating all required sleeves. Such drawings shall be completely and accurately dimensioned and shall relate sleeves, recesses, and formed openings to suitable grid lines and elevation datum. Begin to prepare such drawings immediately upon notification of acceptance of tender and award of contract. Make all modifications to locations as directed by Structural Engineer at no extra cost to contract.

1.24 **SUPERINTENDENCE**

- 1.24.1 Maintain at the job site, at all times, qualified personnel and supporting staff, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.
- 1.24.2 The supervising personnel and their qualifications are subject to the approval of the Consultant.

1.25 **PATENTS**

- 1.25.1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent right, and save the Owner and Consultant harmless of loss or annoyance on account of suit, or claims of any kind for violation of infringement of any letters, patent or patent rights, by this Subcontractor or anyone directly or indirectly employed by him or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement or such letters, patent or rights.

1.26 **RIGHTS RESERVED**

- 1.26.1 Rights are reserved to furnish any additional detail drawings, which in the judgment of the Consultant may be necessary to clarify the work and such drawings shall form a part of this contract.

1.27 METALS

- 1.27.1 Steel construction required solely for the work of electrical trades and not shown on architectural or structural drawings shall be provided by this trade in accordance with applicable code requirements.

1.28 FLASHING

- 1.28.1 Flash electrical parts passing through or built into a roof, an outside wall, or a waterproof floor.
- 1.28.2 Provide sleeves passing through outside walls with lead or copper flashing as directed.

1.29 WORKMANSHIP

- 1.29.1 Install equipment, ductwork, conduit and cables in a workmanlike manner to best suit space, to present a neat appearance and to function properly to the satisfaction of the Consultant.
- 1.29.2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore.
- 1.29.3 Include in the work all requirements of manufacturers shown on the shop drawings or manufacturers installation instruction.
- 1.29.4 Replace work unsatisfactory to the Consultant without extra cost.
- 1.29.5 Make provision to accommodate future plant and equipment indicated on drawings.
- 1.29.6 Protect from damage all equipment delivered to the site and during installation. Any damage or marking of finished surfaces shall be made good to the satisfaction of the Consultant.

1.30 MOUNTING HEIGHTS

- 1.30.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- 1.30.2 If mounting height of equipment is not indicated verify before proceeding with installation.

1.31 OWNER RIGHT TO RELOCATE ELECTRICAL ITEMS

- 1.31.1 The Owner reserves the right to relocate electrical items (light fixtures, battery pack) during construction, but prior to installation, without cost, assuming that the relocation per item does not exceed 3 m (10'-0") from the original location. No credits shall be anticipated where relocation per item of up to and including 3m reduces materials, products and labour.
- 1.31.2 Should relocations per item exceed 3m from the original location the contract price will be adjusted accordingly.
- 1.31.3 Necessary changes, due to lack of co-ordination, and as required and when approved, shall be made at no additional cost, to accommodate structural and building conditions. The location of pipes and other equipment shall be altered without charge to the Owner, if approved, provided the change is made before installation.

1.32 **OPERATING AND MAINTENANCE INSTRUCTION MANUALS**

1.32.1 Each copy of the manual shall include:

- .1 A set of as-built prints;
- .2 Letters of Owners Instructions;
- .3 Final Electrical Safety Authority Certificate of Inspection;
- .4 Verification Certificates for all systems as specified hereinafter;
- .5 A copy of "reviewed" shop drawings;
- .6 Complete explanation of operation principles and sequences;
- .7 Complete installation and user manuals;
- .8 Complete part lists with numbers;
- .9 Recommended maintenance practices and precautions;
- .10 Parts manual and repair manuals
- .11 Complete wiring and connections diagrams;
- .12 Certificates of guarantee;
- .13 Single Line Diagram

1.32.2 Ensure that operating and maintenance instructions are specific and apply to the models and types of equipment provided.

1.33 **TRIAL USAGE**

1.33.1 The Consultant/Engineer reserves the right to use any system, piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same, or for the purpose of learning operational procedures, before the final completion and acceptance of the work. Such tests shall not be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the above due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials or workmanship of any kind. Supply all labour and equipment required for such tests.

1.33.2 Perform and pay for all costs associated with any testing required on the system components where, in the opinion of the Consultant/ Engineer the equipment manufacturer's ratings or specified performance is not being achieved.

1.34 **INSTRUCTION TO OWNERS**

1.34.1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of all systems and equipment.

1.34.2 Arrange for, and pay for services of service engineers and other manufacturer's representatives required for instruction in the operation of systems and equipment.

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1.34.3 Submit to the Consultant at the time of final inspection a complete list of systems stating for each system:

- .1 Date instruction were given to the Owner's staff.
- .2 Duration of instruction.
- .3 Name of persons instructed.
- .4 Other parties present (manufacturer's representative, consultants, etc.)

1.34.4 Obtain the signature of the Owner's staff verifying that they properly understood the system installation, operation and maintenance requirements, and that they have received the specified manuals and "as-built" drawings.

1.35 **SYSTEM ACCEPTANCE**

1.35.1 Submit original copies of letters from the manufacturers of all systems indicating that their technical representatives have inspected and tested the respective systems and are satisfied with the method of installation, connection and operation.

1.35.2 These letters shall state the names of persons present at testing, the methods used, and a list of functions performed with location and room numbers where applicable.

1.36 **CLEANING**

1.36.1 Before energizing any systems, inspect and clean the inside of panel boards, switchgear, and cabinets to ensure that they are completely free from dust and debris.

1.36.2 Clean all polished, painted and plated work bright.

1.36.3 Remove all debris, surplus material and all tools

1.36.4 Carry out additional cleaning operating of systems as specified in other sections of this Division.

1.37 **PAINTING WORK SUPPLIED UNDER DIVISION 16**

1.37.1 Touch up minor chips or damage to electrical equipment, installed in this Division, with standard, factory supplied, enamel finish.

1.37.2 Colour code, as specified herein, outlet boxes, pull boxes, junction boxes by applying a small dab of paint to inside of each item during installation.

1.37.3 Colour code, as specified herein, all exposed ducts, conduits, outlet boxes, and similar items by applying a 25 mm (1") wide band of paint around ducts and conduits adjacent to boxes described in above paragraph and on both sides of wall penetration.

1.38 **REMOVALS**

1.38.1 Co-ordination Between New and Existing Installations

- .1 Provide interfacing components between new and existing systems as necessary for proper performance and operation.

1.38.2 Existing Services

- .1 Ensure existing services remain undisturbed and energized except where indicated.
- .2 Disconnect and remove abandoned wiring materials and devices.

1.38.3 Modifications to Existing Structures

- .1 Provide new electrical equipment to existing structures as detailed on drawings. Remove existing devices as shown and as required. Salvage existing circuits for reuse as noted.

1.38.4 Interruption of Services

- .1 Maintain existing systems in existing school at all times during construction.
- .2 Obtain Consultant's written approval before interrupting any service. Long outages are not acceptable.
- .3 Provide temporary services to maintain continuity in the event that services must be interrupted.

1.38.5 Premium Time

- .1 Power shutdowns to the site will only be allowed on weekends between the hours of Friday 12.00 midnight to Sunday 12.00 midnight. Include all costs for this overtime work in the contractor's tender bid.
- .2 Include cost of premium time in tender price for work during nights, weekends or other time outside normal working hours necessary to do the work and maintain electrical services in operation.
- .3 Premium time is to include work by local hydro authority, ESA and any other authorities having jurisdiction as required.

1.38.6 Use of Existing Material And Equipment

- .1 Unless noted otherwise, do not use any existing panels, boxes and wiring materials unless shown on drawings.

1.38.7 Demolition

- .1 Demolish existing work, where indicated, and remove from site.
- .2 Execute all demolition work so as to create minimum vibration or dust within and outside the building. Obtain Consultant's approval of methods before proceeding.

1.39 STUDIES AND ANALYSES

- 1.39.1 Conduct an electrical arc flash hazard analysis as prescribed under (NFPA 70E) CSA Z462 and provide a written report to Owner summarizing the findings and recommended control measures to be taken. The arc flashing analysis results must be deemed acceptable before the equipment purchase.
- 1.39.2 The study shall be prepared for the entire electrical distribution system.
- 1.39.3 Provide arc flash labels on all electrical equipment.

1.39.4 Provide report in hard copy and electronic copy.

1.40 **SALVAGE MATERIALS**

1.40.1 Remove from site materials in renovated areas that are not to remain or be reused, unless noted as remaining property of Owner.

2 **Products**

Nil

3 **Execution**

Nil

END OF SECTION 16010

1 GENERAL

1.1 GENERAL REQUIREMENTS

- 1.1.1 Comply with the Toronto District School Board General Conditions, Request for Quotations and Division 16.

1.2 SCOPE OF WORK

- 1.2.1 Supply all labour, tools, service and equipment and provide all the materials required to complete the electrical work specified in Division 16.

1.3 SHOP DRAWINGS

- 1.3.1 Shop drawings need not be submitted for standard manufactured items and materials provided they are as specified.

1.4 QUALITY ASSURANCE

- 1.4.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.4.2 The General Contractor (GC) is responsible to co-ordinate the relevant contractors to provide and commission the power distribution system together with mechanical equipment, lighting fixtures and controls and other equipment served.

1.5 QUALITY ASSURANCE

- 1.5.1 All components shall be C.S.A. and/or U.L.C approved listed and labelled.

2 PRODUCTS

2.1 CONDUIT AND RACEWAYS

2.1.1 Conduits and Fittings

- .1 Rigid PVC Conduit
 - .1 To CAN/CSA C22.2 No. 211.2
- .2 Rigid Galvanized Steel Conduit:
 - .1 To CAN/CSA C22.2 No. 45-M.
 - .2 Rigid thickwall steel threaded conduit
- .3 EMT
 - .1 To CSA C22.2 No. 83-M
 - .2 EMT galvanized cold rolled steel tubing
- .4 Liquid Tight Flexible Steel Conduit Fittings.
 - .1 To CSA 22.2 No. 56.
 - .2 Liquid-tight flexible steel conduit with PVC cover.
 - .3 Watertight connectors with nylon insulated throat.
- .5 Rigid Steel Conduit Fittings
 - .1 To CAN/CSA C22.2 No. 18
 - .2 Steel cast fittings

- .3 Expansion fittings, watertight with integral bonding jumper suitable for linear expansion and 19 mm³/₄" deflection in all directions
- .6 Liquid Tight Flexible Steel Conduit Fittings
 - .1 Watertight connectors with nylon insulated throat
- .7 EMT Fittings
 - .1 Compression type, steel (cast fittings not acceptable).
 - .2 Gland compression connectors with insulated throats
 - .3 Compression couplings
- .8 Minimum size conduit will be 21mm diameter.
- .9 EMT shall not be used in interior areas below grade.
- .10 Rigid steel conduit shall be used in interior areas below grade.
- .11 All conduit shall contain a separate dedicated ground conductor.
- .12 All conduit must have adequate support systems complete with approved fittings, outlet boxes, junction boxes, sealing fittings and drains as indicated or as required. Provide hot dipped galvanized steel beam clamps, hot dipped galvanized steel channel type supports where required. Provide six (6)mm threaded galvanized steel rods to support suspended channels and provide all necessary galvanized steel spring loaded bolts, nuts, washers and lock washers. Support systems shall be Thomas & Betts Superstrut or equal.
- .13 Provide all conduit, fittings and ducts necessary to complete the distribution of all power, lighting and control conductors to electrical equipment specified under the corresponding Section. Include that necessary for connecting to mechanical heating and ventilating equipment, also equipment specified under other Divisions.
- .14 Fasten conduit with malleable PVC coated galvanized steel two-hole straps at intervals to suit code requirements and job conditions.

2.2 FASTENINGS, SUPPORTS AND SLEEVES

- 2.2.1 Galvanized steel, size and load rating to suit application.
- 2.2.2 One hole steel straps to secure surface mounted conduits or surface mounted cables 50 mm dia. and smaller. Two hole steel straps for conduits and cables larger than 50 mm.
- 2.2.3 Beam clamps to secure conduits to exposed steel work.
- 2.2.4 Channel type supports for two or more conduits.
- 2.2.5 6 mm minimum dia. threaded rods to support suspended channels.
- 2.2.6 6 mm minimum dia. U-bolts.
- 2.2.7 Sleeves - schedule 40 steel pipe minimum I.D. 13 mm larger than O.D. of conduit or cable passing through.
- 2.2.8 Acceptable Manufacturers: Burndy, Electrovert, Unistrut.

2.3 JUNCTION BOXES

- 2.3.1 Code gauge (galvanized) sheet steel EEMAC Type 1 size as required by code for number and size of conduits, conductors and devices, complete with covers, corrosion resistant screws, terminals and mounting channels.
- 2.3.2 Screw-on sheet steel covers to match enclosure for surface mounting boxes.
- 2.3.3 Covers with 25 mm minimum extension around for flush-mounted junction boxes.

2.4 CONDUIT BOXES - GENERAL

- 2.4.1 Size boxes in accordance with latest edition of Electrical Safety Authority (ESA) Electrical Safety Code.
- 2.4.2 Code gauge, galvanized pressed steel for EMT.
- 2.4.3 Steel cast boxes for rigid thickwall threaded steel conduit.
- 2.4.4 Corrosive resistant coated: cast boxes for corrosive resistant coated rigid steel conduit with same finish as conduit.
- 2.4.5 200 mm square or larger outlet boxes as required for special devices.
- 2.4.6 Gang boxes where wiring devices are grouped except in classified hazardous areas.
- 2.4.7 Blank cover plates for boxes without wiring devices.
- 2.4.8 50 mm x 100 mm outlet boxes for devices, ganged for grouped devices, barriers where required by code.

2.5 PULL BOXES

- 2.5.1 Code gauge galvanized sheet steel welded construction, EEMAC Type 1.
- 2.5.2 Screw-on galvanized sheet steel covers for surface mounting boxes.
- 2.5.3 Covers with 25 mm minimum extension around, for flush mounted pull boxes.

2.6 RIGID CONDUIT BOXES

- 2.6.1 Zinc electroplate and polymer enamelled cast FS boxes with factory-threaded hubs and mounting feet for surface mounted switches and receptacles, with gasketed coverplate for exterior work and wet areas.

2.7 OUTLET BOXES - FITTINGS

- 2.7.1 Bushings and connectors with nylon insulated throats.
- 2.7.2 Knock-out fillers to prevent entry of foreign materials.
- 2.7.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- 2.7.4 Double locknuts and insulated bushings for sheet steel metal boxes.

2.8 BRANCH CIRCUIT CONDUCTORS

2.8.1 Conductors

- .1 ASTM Class B, soft drawn, electrolytic copper
- .2 Stranded

2.8.2 Insulation

- .1 CSA type RW90 XLPE (-40°C)
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600V rated
 - .4 For maximum 90°C conductor temperature
 - .5 For installation at minimum -40°C temperature
 - .6 To CSA C22.2 No. 38

2.8.3 Branch circuit conductors up to and including #12 AWG shall be solid. Branch circuit conductors in sizes larger than #12 AWG shall be stranded. All branch circuit conductors shall be constructed of 90% conductive copper, unless otherwise noted, and shall be approved for 600 volts.

2.8.4 Electric service, distribution and special conductors are specified in this Section and/or on the drawings.

2.9 WIRE AND CABLE CONNECTORS

2.9.1 Copper compression type wire and cable terminations for #8 AWG and larger conductors, colour keyed, sized to suit. Long barrel NEMA 2 hole lugs for sizes #1/0 AWG and larger.

- .1 Acceptable Manufacturers: Thomas & Betts series 54000, Ideal Powr-Connect, Burndy Hylug.

2.9.2 Twist type splicing connectors, copper, sized to suit, with black nylon or plastic shroud for tee connections in #10 AWG and smaller conductors.

- .1 Acceptable Manufacturers: Thomas & Betts spring type, Ideal Twister, Marr Marrette.

2.9.3 Conductor compression splice for #10 AWG or smaller.

- .1 Acceptable Manufacturers: Thomas & Betts STA-Kon series, Ideal Splices, Burndy

2.10 HEAT SHRINKABLE TUBING INSULATION, HEAVY WALL

2.10.1 Acceptable Manufacturers: Thomas & Betts, Shrink-Kon series, Ideal Thermo-Shrink, TS-46, Raychem tubing WCSM, 3M cable sleeve ITCSN.

2.11 SLEEVES

2.11.1 In concrete slabs, except as noted below, sleeves shall be #24 gauge galvanized steel or factory fabricated plastic sleeves, each with an integral flange to secure the sleeve to form work construction.

2.11.2 In waterproof concrete slabs and in other slabs where waterproof sleeves are required sleeves shall be Schedule 40 mild steel galvanized.

2.12 ESCUTCHEON PLATES

- 2.12.1 One-piece chrome plated steel sized to completely cover sleeves and complete with set screws to secure the plates to the conduit. Split plates will not be acceptable.

2.13 INSERTS, BEAM CLAMPS FASTENERS, EQUIPMENT HANGERS AND SUPPORTS

- 2.13.1 Inserts for concrete formwork shall be Crane Canada type, #4-M Unistrut, or approved equal cast iron inserts, multiple type where required.
- 2.13.2 Inserts for precast concrete and existing concrete shall be lead cinch anchors of "WEJ-IT" or self-drilling "STARR" or "PHILLIPS" anchors.
- 2.13.3 Beam clamps for hanging and support to structural steel shall be Crane Canada Ltd., or equal.

2.14 WATER RESISTANT PROTECTION

- 2.14.1 Where the area is sprinklered and electrical distribution equipment is located in sprinklered areas, enclosures shall be louvred and gasketed and provided with water-tight roof assemblies with overhanging drip shields. The equipment shall be fabricated by the manufacturer in such a way as to prevent sprinkler fluid from entering the equipment and/or interfering with its operation as per the requirements of C.S.A. C22.1 Rule 26-006.
- 2.14.2 Weatherproof equipment where noted in the specifications and or drawings shall have EEMAC 4X enclosures in accordance with the requirements of C.S.A. C22.2 No. 94 Standard.

2.15 FINISH

- 2.15.1 Equipment enclosure finish: baked grey enamel, ANSI 49 or ANSI 61.

3 EXECUTION

3.1 GENERAL CONDUIT AND CONDUCTOR INSTALLATION REQUIREMENTS

- 3.1.1 Install conduit and conductors concealed in all finished areas, and concealed to the degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished area such as Electrical Rooms and Mechanical Rooms, unless otherwise noted on the drawings or specified herein. Refer to and examine the architectural drawings and room finish schedules to determine finished, partially finished and unfinished areas of the building.
- 3.1.2 Where conduit and/or conductors are exposed, arrange same to avoid interference with other work and parallel to the building lines, where horizontal conduits and/or conductors are exposed, install as high as possible. Do not install conduit and/or conductors within 150mm of flue or heating pipes or equipment.
- 3.1.3 Route conduits, supports and other equipment to avoid interference with asbestos or other designated substances as described in Designated Substance Survey. If interference with asbestos or other designated substances cannot be avoided, follow Owner's guidelines for abatement of the asbestos and other designated substances.

3.2 CONDUIT AND EMT - GENERAL

- 3.2.1 Run parallel or perpendicular to building lines.
- 3.2.2 Group raceways wherever possible. Support on channels.
- 3.2.3 Install expansion joints as required.
- 3.2.4 Run raceways in web portion of structural steel columns and beams.
- 3.2.5 Do not drill structural members to pass through.
- 3.2.6 Use rigid PVC conduit underground or in concrete slab. Do not use core-line conduit.
- 3.2.7 EMT shall not be used in interior areas below grade.
- 3.2.8 Rigid steel conduit shall be used in interior areas below grade.
- 3.2.9 Locate raceways not less than 125 mm clear where parallel to steam or hot water lines with a minimum of 75 mm at crossovers.
- 3.2.10 Use metallic raceway where temperatures exceed 75°C or where enclosed in thermal insulation.
- 3.2.11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- 3.2.12 Dry conduits out before installing wire.
- 3.2.13 All conduits to contain insulated green ground wire.
- 3.2.14 Install 6 mm diameter nylon pull cord in empty raceways.
- 3.2.15 EMT and non-metallic conduits to contain insulated green ground wire.
- 3.2.16 BX armoured cable shall only be used for the final 1m termination between the equipment and main conduit run junction box. BX cable shall not be used in any other way on this project.

3.3 CONDUIT AND FITTINGS

3.3.1 Minimum conduit sizes:

- .1 Surface installation 21mm trade size conduit

3.3.2 Conduit application and type:

Application	Type
.1 Outdoor areas below grade	rigid PVC
.2 Indoor areas above grade surface mounted	EMT
.3 Indoor areas above grade embedded	rigid PVC

3.3.3 Connection to motors and equipment subject to vibration use liquid tight flexible steel conduit.

3.3.4 Use field threads on rigid conduit of sufficient length to draw conduits up tight.

- 3.3.5 Do not bend coated steel conduit. Use elbows for deflections.
- 3.3.6 Do not install conduit in or under slab.
- 3.3.7 Use factory "ells" where 90° bends are required for 27mm trade size and larger conduits.
- 3.3.8 Bend conduit offsets cold. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Prevent the entrance of water and lodging of concrete, plaster, dirt, or trash in conduit, boxes, fittings, and equipment during course of construction.
- 3.3.9 Where conduit joints occur in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible.
- 3.3.10 Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc., with standard galvanized plumber's pipe caps.
- 3.3.11 Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.
- 3.3.12 Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings, or floors, and fill void between sleeve and conduit with caulking. If fire-rated caulking is required by code, use same class as walls, ceilings or floors.
- 3.3.13 Terminate conduit stubbed up through concrete floor for connection to free standing equipment with a coupling flush with finish floor, and extend rigid conduit to equipment, except where required, use flexible conduit from a point 150 mm above floor.
- 3.3.14 Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit bushing to be fully seated against end of conduit.
- 3.3.15 Mechanically bend steel conduit.
- 3.3.16 Install sealing condulets in conduits at hazardous area boundaries.
- 3.4 **JUNCTION BOXES**
 - 3.4.1 Install junction boxes in inconspicuous but accessible locations. Secure to structure.
 - 3.4.2 Install terminal blocks on mounting rails, for termination of each wire and cable regardless of size.
 - 3.4.3 Only one voltage source is permitted in a junction box.
 - 3.4.4 Install barriers to separate different auxiliary systems
- 3.5 **PULL BOXES**
 - 3.5.1 Install pull boxes in inconspicuous but accessible locations. Secure to structure.
 - 3.5.2 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
 - 3.5.3 Only one voltage source is permitted in a pull box.
 - 3.5.4 Install barriers to separate different auxiliary systems.

3.6 **OUTLET AND CONDUIT BOXES**

- 3.6.1 Install conduit outlet boxes for conduit up to 32 mm and pull boxes for larger conduits.
- 3.6.2 Support boxes independently of connecting conduits.
- 3.6.3 Seal boxes during construction to prevent entry of debris, dust and dirt.
- 3.6.4 For flush installations mount plaster rings to box, flush with wall surface to permit wall finish to come within 6 mm of opening.
- 3.6.5 Provide correct size of openings in boxes for conduit, armoured cable connections. Reducing washers will not be acceptable.

3.7 **INSTALLATION OF BRANCH CIRCUIT CONDUCTORS**

- 3.7.1 Install wiring in raceways unless noted otherwise.
- 3.7.2 Minimum wire sizes:
 - .1 Power and lighting -No. 12 AWG
 - .2 Control -No. 14 AWG
- 3.7.3 Wire and cable application and type:
 - .1 Branch circuits other than those covered above use RW90
 - .2 Equipment feeders and circuits use RW90
 - .3 Underground and under slab raceways, duct banks, direct burial use RWU90.
- 3.7.4 Use lubricant when pulling wires into conduit. Ensure that wires are kept straight and are not twisted or abraded.
- 3.7.5 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- 3.7.6 Junctions of all conductors shall be done with Ideal Wing nut #450 Series (Black) for conductors from #14 AWG to #8 AWG.
- 3.7.7 For all conductors larger than #8 AWG junctions shall be done with Burndy Servit connectors wrapped with 3 M #33 Scotch tape.

3.8 **CONNECTORS**

- 3.8.1 Install compression terminations and splices in accordance with manufacturer's written instructions.
- 3.8.2 Make splices in junction boxes.
- 3.8.3 Make connections in lighting circuits with twist type splicing connectors.
- 3.8.4 Terminate and splice conductors No. 8 and larger at terminal blocks in junction boxes.
- 3.8.5 Seal terminations and splices exposed to moisture, corrosive conditions or mechanical abrasions with heavy wall heat shrinkable insulation.

3.9 **INSTALLATION OF ESCUTCHEON PLATES**

- 3.9.1 Provide escutcheon plates over all exposed conduit passing through walls, floors, ceilings, partitions, furrings etc., in finished areas.

3.10 **INSTALLATION OF INSERTS, BEAM CLAMPS, FASTENERS, HANGERS AND SUPPORTS**

- 3.10.1 Install all inserts, beam clamps, fasteners, and similar hardware required for conduit, duct, raceway, conductor, etc., and equipment hanger and/or support materials to best suit structural details.
- 3.10.2 Accurately and properly set concrete inserts in the concrete framework.
- 3.10.3 For runs of three (3) or more conduits, raceways, or conductors in concrete formwork, use multiple type inserts used for the smallest conduit in the group.
- 3.10.4 Where inserts are required in precast concrete and in concrete work where concrete inserts have not been installed, drill a neat hole of the proper diameter and depth in the concrete and insert an anchor to accept the hanger rod, bolt, etc., or where concrete mass permits, use self-drilling concrete anchors.
- 3.10.5 Fasten hangers and support provisions to brick or masonry with expansion shields and machine bolts, or for light loads, use plugs, and screws.
- 3.10.6 In cavity walls and/or ceilings use two (2) wing toggles and for heavy loads, provide steel anchor plates with two (2) or more toggles to spread the load.
- 3.10.7 Provide beam clamps for attaching, hanging and/or support provisions to the Consultant, weld the hanging and support provisions to the structural steel.
- 3.10.8 Explosive power actuated fasteners will not be permitted unless specific approval for their use has been obtained from the Consultant.

3.11 **PAINTING AND FINISHES**

- 3.11.1 Provide all painting and patching to match existing services as required.
- 3.11.2 All exposed electrical fittings, supports, hangers, frames conduit, racks, boxes, raceways and similar material and apparatus shall be galvanized or finished with corrosion resistant primer ready to accept paint. Take special care when priming work exposed to the elements or in wet areas to prevent rust or corrosion from damaging adjacent surfaces.
- 3.11.3 Touch up and/or repaint any factory finished equipment that has been scratched or otherwise damaged during installations.
- 3.11.4 Provide for all patching and painting for all removals and as required. Painting shall be completed to the approval of the Consultant and Owner. Paint shall match adjacent surfaces. Include all costs.
- 3.11.5 Where cutting, patching, fire stopping and construction involves painted surfaces these must be painted to match the surrounding surfaces or as directed by Consultant.

3.12 STANDARD IDENTIFICATION

- 3.12.1 Identify electrical work as specified below.
- 3.12.2 For each piece of electrical equipment and for any other piece of equipment where specified in this Section, provide engraved lamacoid identification nameplates. Nameplates shall generally be lamacoid black with white letters and with bevelled edges, secured to apparatus with stainless steel screws. Warning signs, if and when required, shall be red with white lettering.
- 3.12.3 Exact nameplate wording and sizes must be approved by and confirmed by the Consultant prior to manufacture.
- 3.12.4 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting the outside of the covers. Paint colours shall be in accordance with the following schedule:
- 3.12.5 Colour code conductors, throughout to identify phases, neutrals and grounds by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs. Colours shall be as follows:
- | | | | |
|----|---------|---|-------|
| .1 | Phase A | - | Red |
| .2 | Phase B | - | Black |
| .3 | Phase C | - | Blue |
| .4 | Ground | - | Green |
| .5 | Neutral | - | White |

3.13 CUTTING AND PATCHING

- 3.13.1 Inform other trades in time concerning required openings. In work already finished, cutting and patching shall be done by the trades installing the affected work at the expense of Division 16. Obtain the approval of the Consultant, before doing any cutting.

3.14 FIELD FABRICATED METAL WORK

- 3.14.1 Clean and prime paint field fabricated metal work.
- 3.14.2 After fabrication deburr, scrape, grind smooth, wire brush with power brush and degrease metal work.
- 3.14.3 Prime paint steel with 1 coat of CISC/CPMA 2.75 oil alkyd primer.
- 3.14.4 Prime paint aluminum as follows: wash with detergent solution and wipe down with SSPC-SP1 solvent. Apply Glidden #Y-5229 primer to 1.5 mils DFT.
- 3.14.5 For brass and bronze alloy materials, prepare as for aluminum but apply 1 coat of CAN/CGSB-1.40-M zinc chromate primer.

3.15 TESTS

- 3.15.1 Branch circuit balancing.

- 3.15.2 Connect all new branch power circuits to existing panelboards so as to balance the actual loads (wattage) within 5%.

END OF SECTION 16100

1 General

1.1 GENERAL REQUIREMENTS

- 1.1.1 Comply with the Simcoe Muskoka Catholic District School Board General Conditions, Request for Quotations and Division 16.

1.2 REFERENCES

- 1.2.1 Section 16010 Electrical General Provisions also applies to and is a part of this Section of the Specification.
- 1.2.2 Conform to latest issues, amendments and supplements of following standards:
- | | |
|--------------------|-------------------------------|
| CSA C22.2 No. 4-M | Enclosed Switches |
| CSA C22.2 No. 5.1M | Moulded Case Circuit Breakers |

1.3 SCOPE OF WORK

- 1.3.1 Supply all labour, tools, services and equipment and provide all materials and equipment required to complete service and distribution work in accordance with this section of the specification and the drawings.

1.4 QUALITY ASSURANCE

- 1.4.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.4.2 The General Contractor (GC) is responsible to co-ordinate the relevant contractors to provide and commission the power distribution system together with mechanical equipment, lighting fixtures and controls and other equipment served.
- 1.4.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- 1.4.4 All equipment shall be constructed to EEMAC standard and shall carry the CSA label or the contractor shall obtain Electrical Safety Authority approval.
- 1.4.5 All equipment shall be suitably noted for the system available fault and HRC fuses shall comply with CSA C22.2 No. 106.

1.5 SUBMITTALS

- 1.5.1 Refer to General Requirements and submit shop drawings for the following:
- .1 Breakers
 - .2 Distribution Panels
 - .3 Transformers
 - .4 Surge Protection
 - .5 Disconnect Switches
 - .6 Motor Starters

.7 Hand Dryer

2 **Products**

2.1 **REFERENCES**

2.1.1 Refer to Section 16100 Basic Materials and Methods. This Section also applies to and is part of this section of the specifications.

2.2 **DISTRIBUTION PANELBOARDS**

2.2.1 The panelboards shall be as scheduled on drawings and as specified herein after.

2.2.2 Ratings

- .1 Panelboards rated 240 Vac or less shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 22,000 amperes RMS symmetrical.
- .2 Panelboards rated 240 Vac or less shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 35,000 amperes RMS symmetrical.
- .3 Panelboards shall be labelled with a CSA short circuit rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings of installed frames. It shall state the conditions of the CSA series ratings including:
 - .1 Size and type of upstream device.
 - .2 Branch devices that can be used.
 - .3 CSA series short circuit rating.

2.2.3 Construction

- .1 Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
- .2 Trims for Branch Circuit Panelboards (other than Power Distribution Panelboards) shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Furnish semi flush cylinder lock and catch assembly to secure hinged door over circuit breaker handles. Provide door-in-door type construction so that the trim may be opened to access wireways without removing the trim from the panel. All trims shall have concealed mounting hardware when the door is closed.
- .3 Power Distribution Panelboard trims shall cover all live parts. Switching device handles shall be accessible.
- .4 Surface trims shall be same height and width as box.
- .5 A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
- .6 All locks shall be keyed alike.

2.2.4 Bus

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- .1 Main bus bars shall be silver flashed copper, sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
 - .1 A insulated ground bus shall be included in all panels.
 - .2 200% rated insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

2.2.5 Enclosure

- .1 Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the Canadian Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
- .2 Enclosures shall be provided with one (1) blank end and one end with knockouts.
- .3 Enclosures shall be sprinklerproof , type 1.

2.2.6 The panelboard shall be selected so that it can fit into the space available in the electrical room and shall meet the requirements of the Ontario Electrical Safety Code.

2.2.7 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

2.2.8 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.2.9 Lock-on devices for security alarm, emergency lighting, lighting control and exit light circuits.

2.2.10 Provide equipment identification. Identify electrical equipment with nameplates as follows: Lamicoid 3 mm thick plastic engraving sheet, black face, white core (red face with white core for fire alarm and emergency), mechanically attached with self tapping screws.

2.2.11 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.2.12 Acceptable manufacturers are Eaton, Schneider Group (Square D), Siemens or approved equal.

2.3 TRANSFORMERS

2.3.1 Use transformers of one manufacturer throughout the Project.

2.3.2 Design:

- .1 Type: ANN. All transformers to be delta-wye configuration unless otherwise noted on the Contract Drawings.
- .2 Phases, kVA and voltages as indicated on the plans, 60Hz.
- .3 Provide voltage taps of 2 ± 2.5 per cent FCAN (Full Capacity above Normal) and FCBN (Full Capacity below Normal).
- .4 Insulation: 220°C Class-H, 150°C temperature rise.

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- .5 All windings are to be copper.
- .6 Basic Impulse Level (BIL): Standard.
- .7 Hipot: Standard.
- .8 Average Sound Level: 65dBA (measure 1 metre from enclosure).
- .9 Impedance at 170°C: Five (5) per cent.
- .10 Enclosure: Type two sprinkler proof, removable metal front panel.
- .11 Mounting: Floor or wall, as indicated on the Contract Drawings.
- .12 Transformer to meet CSA C802.2 efficiencies at 35 per cent of rated load.
- .13 Finish in accordance with sections 16010 and sections 16100.

2.3.3 Accessories:

- .1 Grounding Terminal: Inside enclosure.
- .2 External vibration pads equal to Mason Super 'W'.
- .3 Nameplate shall be stainless steel.

2.3.4 Equipment Identification:

- .1 Provide equipment identification in accordance with sections 16010 and sections 16100.
- .2 Label Size: 6mm (1/4") letters.

2.3.5 Finish:

- .1 Finish enclosure exterior in accordance with section 16010 and 16100.
- .2 Transformer to be painted ANSI-61 grey.

2.3.6 Acceptable Manufacturers:

- .1 Delta
- .2 Marcus Transformer
- .3 Hammond Power Solutions
- .4 Rex Power Magnetics
- .5 or approved equal

2.4 **SURGE PROTECTION**

2.4.1 General

- .1 The TVSS shall be listed by ETL, UL, or other nationally recognized test laboratory to UL's 1283 and UL's 1449 standards (latest edition, latest revision), and not merely the

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components or modules. All TVSS's shall be Type 1 for use in Type 1 and Type 2 locations.

- .2 The TVSS shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only four (4) modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.
- .3 Obtain all surge suppression devices through one source from a single manufacturer.
- .4 The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 115% for 277 and 600V systems.
- .5 All TVSS's shall be equipped with a comprehensive monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.
- .6 All TVSSs shall be Total Protection Solutions by Innosys or approved equivalent. No unit will be accepted as an "approved equivalent" unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, independent third party per mode surge testing, and all other requirements of this Specification.
- .7 Each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing at an independent, nationally recognized test laboratory. To be considered for approval, the manufacturer must submit a test report on a unit which was tested with internal over current fusing in place. The test shall include a 1.2 X 50 μ sec 6000V open circuit voltage waveform and an 8 X 20 μ sec 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 μ sec waveform. To complete the test, another identical surge shall be applied to verify the unit's survival. Compliance is achieved if the suppression voltage found from the two impulses does not vary by more than +10%. Test data on an individual module is not acceptable.

2.4.2 Subpanel and Lighting Panel Protection:

- .1 TVSS(s) for this location shall be as indicated on project drawings. TVSS shall be separate from panelboard. Integral TVSS shall not be acceptable.
- .2 Subpanels and lighting panels shall be protected by a Total Protection Solutions panel mounted TVSS, model TK-TT2-100-3Y208-F-L for 120/208 (4W+G).
- .3 The manufacturer shall showing Measured Limited Voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 2002, categories A1 & A3 ring wave, 180 degree phase angle, category B3 Ringwave, and UL suppressed voltage ratings, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, which shall be no higher than ANSI/IEEE C62.41-1991 Measured Limiting Voltage requirements.

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- .4 The unit shall have a peak surge current of no less than 120kA/phase, 60kA/mode, 8 X 20 us waveform, single impulse, verified by third party test reports with testing per Nema LS-1.
- .5 Internal Fusing - Overcurrent Protection
 - .1 Each Metal Oxide Varistor, or other primary suppression component, shall be individually fused for safety and performance to allow the TVSS to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses. Overcurrent fusing that limits the listed peak surge current of the TVSS is not acceptable. Replaceable cartridge type per phase or per mode overcurrent fusing is not acceptable where there is more than one MOV per mode.
 - .2 For arc quenching capability, minimization of smoke and contaminants in the event of a failure, and to ensure the safest possible design, all surge components, current carrying paths and fusing shall be packed in fuse grade silica sand.
 - .3 Fusing shall be present in every mode, including Neutral-to-Ground.
 - .4 The fusing shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied.
- 2.4.3 The TVSS for subpanel protection shall be capable of attenuating internally generated ringing type transients and noise, and shall have an enhanced transient filter supported by a specification sheet which lists the IEEE A1 Ring Wave let-through levels no higher than those set forth above.
- 2.4.4 Because of space limitation, the LP Units enclosure shall not exceed 4.0" D x 4.0" W x 12.0" H to allow close-to-the load installation on flush mount panels and between adjacent panelboard. For recessed panels, a flush mount cover plate shall be provided with each unit.
- 2.4.5 The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability, and shall have at minimum a Nema 1 steel enclosure.
- 2.4.6 The TVSS shall come standard with not less than a Thirty Year Warranty, and the warranty shall include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period.
- 2.4.7 Fire Alarm Control Panel Power Filter:
 - .1 Provide external power filter – Total Protection Solutions from Innosys, Load Track LTE model TK-LTE120-15A, 120V, 1P, 2W+Grd. or approved equivalent mounted outside and as close to the fire alarm control panel three-chassis cabinet as possible. Performance characteristics include:
 - .2 Enhanced Transient Filter (ETF).
 - .3 UL 1449, UL1283, UL479A approved.
 - .4 Peak surge current 70kA per phase.
 - .5 Filters with gas tubes, spark gaps, silicon avalanche diodes will not be acceptable.
- 2.5 **DISCONNECT SWITCHES**
 - 2.5.1 Fusible or non-fused disconnect switch in CSA EEMAC 4X enclosure (stainless steel) as indicated.
 - 2.5.2 Provision for padlocking in on-off off switch position by three locks.

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- 2.5.3 Mechanical interlocked door to prevent opening when handle on ON position.
- 2.5.4 Fuses: size as indicated.
- 2.5.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.
- 2.5.6 Quick-make, quick-break action.
- 2.5.7 ON-OFF switch position indication on switch enclosure cover.
- 2.5.8 All disconnects should have a method of proving the blades have opened when turned off. Provide window or indicating lights and probe test points.
- 2.6 **MOTOR STARTERS**
 - 2.6.1 Provide starters for motorized mechanical equipment, in accordance with the following Specification and the motor control requirements indicated on the Contract Drawings.
 - 2.6.2 Unless otherwise indicated, starters shall be combination type adjustable instantaneous trip circuit breaker with full voltage non reversing magnetic type for across the line starting. Full protection of each phase shall be provided in the starters by means of one overload relay in each phase. Under voltage protection shall be provided by the starter coil (drop out on 65 per cent of rated voltage) unless otherwise noted.
 - 2.6.3 All starters shall be provided with:
 - .1 Selector switch hand/off/automatic or push button control to start/stop, as indicated.
 - .2 "ON" pilot light (red or green) as indicated.
 - .3 Elapsed time meter.
 - .4 2 NO and 2 NC electrical interlocks. These requirements are a minimum for all starters. Extra accessories shall be provided as shown on the Contract Drawings.
 - 2.6.4 Unless otherwise noted, starters, for single phase motors, shall be type MS 115 volt, thermal overload protected manual starting switches with an "ON/OFF" toggle switch, a neon pilot light and a surface or flush mounting EEMAC enclosure to suit the application. If, in certain cases, automatic or remote operation is required, magnetic starters shall be provided for single phase with unfused disconnects.
 - 2.6.5 Disconnects shall be heavy duty, front operated with a handle suitable for padlocking in the "OFF" position and arranged so that the enclosure cover cannot be opened while the handle is in the "ON" position. Operating mechanisms shall be quick break" positive acting with visible blades and a line terminal shield. Fusible units shall be complete with fuse clips and suitable for HRC fuses unless otherwise noted. Each unit shall be equipped with solderless lugs and front cover nameplate identifying the catalogue number and electrical characteristics. Enclosures for disconnects shall be EEMAC-4X weatherproof, number of poles and fuse requirements as indicated on the drawings. Where indicated on drawings provide molded case motor rated breakers.
 - 2.6.6 Unless otherwise indicated, fuses shall be Gould Shawmut Class "J" series CJ, HRC fuses for constant running equipment and Class "J" series AJT time delay type for equipment that cycles "ON" and "OFF".
 - 2.6.7 Magnetic Motor Starters

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- .1 Enclosure: Steel, EEMAC-4X (stainless steel).
- .2 EEMAC (IEC) type combination magnetic motor starters, fusible disconnect type (HMCP magnetic trip circuit breaker type) with overload relay and heater element in each phase.
- .3 Rating: Minimum size-1.
- .4 Door Mounted Accessories:
 - .1 Pushbuttons or three-position HOA selector switches, heavy duty (oil tight) type.
 - .2 Pilot Lights: Heavy duty, transformer, press to test, red.
 - .3 Control Transformer: 120V secondary, fused, sized to suit control circuit load plus 50VA.
 - .4 Auxiliary Contacts: Minimum one spare NC, one spare N.O.
 - .5 For control voltage from an external source:
 - .6 Provide terminals, covered with hard insulating guard.
 - .7 Apply a lamacoid warning plate on the outside of the starter cover describing the source of outside control power.
 - .8 Acceptable Manufacturers:
 - .1 Allen-Bradley
 - .2 Eaton
 - .3 Schneider Group
 - .4 Siemens
 - .5 Or approved equal

2.6.8 Relays

- .1 Totally enclosed plug-in type relay with four form-C contacts, operating coil to suit required voltage. Complete with mounting socket.
- .2 Acceptable Manufacturers:
 - .1 Allen-Bradley
 - .2 Eaton
 - .3 Schneider Group
 - .4 Siemens
 - .5 Or approved equal

2.7 **GROUNDING EQUIPMENT**

- 2.7.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- 2.7.2 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- 2.7.3 Insulated grounding conductors: green, type RWU.
- 2.7.4 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- 2.7.5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
- 2.7.6 Grounding and bonding bushings.

2.7.7 Protective type clamps.

2.7.8 Bolted type conductor connectors.

2.7.9 Thermit welded type conductor connectors.

2.7.10 Bonding jumpers, straps.

2.7.11 Pressure wire connectors.

2.8 **HAND DRYER**

2.8.1 Hand dryers shall be Bobrick model no. B-7120 or approved equivalent complete with white cover, 208V, 1.9kW, 1-phase, 60 Hz.

2.8.2 Contractor shall co-ordinate finish with architect.

2.8.3 Contractor shall co-ordinate mounting locations in washrooms with Simcoe Muskoka Catholic District School Board.

3 **Execution**

3.1 **GENERAL**

3.1.1 Protect equipment from dust, debris, moisture, and physical damage, with sealed envelope of plastic or other impervious material until building is enclosed and cleaned and equipment is energized.

3.1.2 Protect from condensation by maintaining at suitable temperature above 0°C.

3.1.3 Finish equipment enclosures to ANSI 49 or ANSI 61, baked grey enamel.

3.1.4 Arrange and pay for services of manufacturer's representative during testing and commissioning of switchboard.

3.2 **INSTALLATION OF PANELBOARDS**

3.2.1 Locate panelboards and fasten to wall/concrete housekeeping pad.

3.2.2 Connect main secondary service to line terminals of main breaker.

3.2.3 Connect load terminals of distribution devices to feeders.

3.2.4 Check factory made connections for mechanical security and electrical continuity.

3.2.5 Run grounding conductors from ground bus to building ground to suit the Electrical Safety Code.

3.2.6 Check trip unit settings and or fuse sizes against the co-ordination study to ensure proper working and protection of components.

3.2.7 Balance phases to the maximum extent possible.

3.2.8 Co-ordinate with local supply authority and board manufacture for shipment and installation of metering components at board manufacture's fabrication plant.

3.2.9 Connect the metering cabinets as required with conduit and provide slack coiled conductors in the cabinet.

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3.2.10 The provision of meters, wiring and connections will be carried out by Toronto Hydro.

3.3 **INSTALLATION TRANSFORMERS**

3.3.1 Mount dry type transformers, as per Contract Documents. Transformers are to be floor mounted on a wall-ceiling mounting bracket support structure.

3.3.2 Provide external vibration isolation pads under transformer.

3.3.3 Ensure adequate clearance around transformer for ventilation.

3.3.4 Install transformers in level upright position.

3.3.5 Remove shipping supports only after transformer is installed and just before putting into service.

3.3.6 Loosen isolation pad bolts until no compression is visible.

3.3.7 Make primary and secondary connections with flexible conduit and in accordance with wiring diagram.

3.3.8 Energize transformers after installation is complete.

3.4 **INSTALLATION OF MOTOR STARTERS AND MECHANICAL EQUIPMENT**

3.4.1 All motor starters for mechanical equipment shall be supplied, installed and connected under this Division except where starters are included as part of a mechanical "package" and which will be provided under Division 15 but wired and connected under this Division.

3.4.2 Provide line voltage disconnect switches at each piece of electrically operated mechanical equipment to meet Code Requirements.

3.4.3 All motors shall be wired and connected under this Division. The Contract Drawings do not necessarily show the exact location of wiring to motors and it shall be the responsibility of this Division to fully co-ordinate this work with Division 15.

3.4.4 Mechanical Controls: Be responsible for the provision of 120V line side power connections to all control apparatus where detailed or required to make the system operational.

3.5 **GROUNDING INSTALLATION GENERAL**

3.5.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories and connect to the existing building ground system. Where EMT is used, run ground wire in conduit.

3.5.2 Install connectors in accordance with manufacturer's instructions.

3.5.3 Protect exposed grounding conductors from mechanical injury.

3.5.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

3.5.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

3.5.6 Soldered joints not permitted.

- 3.5.7 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- 3.5.8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- 3.5.9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- 3.6 **SYSTEM AND CIRCUIT GROUNDING**
- 3.6.1 Install system and circuit grounding connections to neutral of distribution panels.
- 3.7 **GROUNDING FIELD QUALITY CONTROL**
- 3.7.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.
- 3.7.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.
- 3.7.3 Perform tests before energizing electrical system.
- 3.8 **TESTING AND INSPECTION OF POWER DISTRIBUTION SYSTEM**
- 3.8.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).
- 3.8.2 The GC is responsible to co-ordinate with the relevant trades to provide and commission the power distribution system.
- 3.8.3 Include in the tender price the cost of on-site inspection and testing of the following main distribution equipment.
- .1 600V Distribution Equipment
 - .2 120/240V Distribution Equipment
 - .3 Transformer
 - .4 Grounding System
 - .5 Short circuit and coordination study
 - .6 Arc Flash Study
- 3.8.4 This engineering inspection and testing shall be done prior to the system being energized and shall include the following items where applicable:
- .1 Testing, cleaning and where necessary, calibrating all relays and circuit breaker trip devices.
 - .2 Function test of protection and control devices.
 - .3 Megger test interconnecting cables.
 - .4 Replacement of fuses destroyed or damaged during the start- up or testing;

- 3.8.5 Acceptance tests shall be conducted in the presence of and to the satisfaction of the Consultant.
- 3.8.6 Make good any defects indicated in the equipment and in the installation by the tests.

END OF SECTION 16400

1 **General**

1.1 **GENERAL REQUIREMENTS**

1.1.1 Comply with the Simcoe Muskoka Catholic District School Board General Conditions, Request for Quotations and Division 16.

1.2 **REFERENCES**

1.2.1 Section 16010 Electrical General Provisions also applies to and is a part of this Section of the Specification.

1.2.2 Conform to latest issues, amendments and supplements of following standards:

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Recommended Practices for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .3 United States of America, Federal Communications Commission (FCC)
 - .1 FCC (CFR47) EM and RF Interference Suppression.
- .4 CSA C22.2 No. 9.0 General Requirements for Luminaires
- .5 CSA C22.2 No. 66.1 Low Voltage Transformers - Part 1: General Requirements
- .6 CSA C22.2 No. 66.2 Low Voltage Transformers - Part 2: General Purpose Transformers
- .7 CSA C22.2 No. 66.3 Low Voltage Transformers - Part 3: Class 2 and Class 3 Transformers
- .8 CSA C22.2 No. 141
- .9 CSA C22.2 No. 250.0 Luminaires
- .10 IEEE C62.41 Recommended Practices for Surge Voltages in Low-voltage AC Power Circuits
- .11 UL 1598 Luminaires
- .12 UL 8750 Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.3 **SCOPE OF WORK**

1.3.1 Supply all labour, tools, services and equipment and provide all materials and equipment required for a complete lighting system in accordance with this section of the specification and the drawings.

1.4 **QUALITY ASSURANCE**

- 1.4.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.4.2 The General Contractor (GC) is responsible to coordinate the Lighting System Contractor and the BAS Contractor to commission the lighting system in conjunction.
- 1.4.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- 1.4.4 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval.
- 1.4.5 Provide all products and services in accordance with the following codes and standards:
 - .1 OESC - Ontario Electrical Safety Code
 - .2 CSA - Canadian Standards Association
 - .3 UL/C - Underwriters' Laboratories of Canada

1.5 SUBMITTALS

- 1.5.1 Refer to Division 1 General Requirements and submit shop drawings for the following:
 - .1 Lighting Fixtures
 - .2 Running Man Pictogram Signs
 - .3 Remote Heads
 - .4 Emergency Battery Units
- 1.5.2 Submit certified copies of photometric test data, for each luminaire type, prepared by independent testing laboratory. Photometric data to include total input watts, candlepower summary, candlepower distribution, zonal lumen summary, luminaire efficiency, coefficient of utilization table, lamp type, ballast type and manufacturer, and lumen rating in accordance with IESNA testing procedures.
- 1.5.3 Photometric data to include spacing criterion.
- 1.5.4 Provide photometric calculations for all areas with proposed fixtures with the shop drawing submission.

2 Products

2.1 REFERENCES

- 2.1.1 Refer to Section 16100 Basic Materials and Methods. This Section also applies to and is part of this section of the specifications.

2.2 LIGHTING FIXTURES

- 2.2.1 Interior LED Luminaires:
 - .1 Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).

- .2 Each luminaire shall be rated for a minimum operational life of 50,000 hours as defined by IES LM-80 and TM-21. LED fixtures shall provided with 0- 10V dimming.
- .3 Each luminaire shall be designed to operate at an average operating temperature of 25°C.
- .4 The operating temperature range shall be -10°C to +25°C.
- .5 Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated at the average operating temperature.
- .6 The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
- .7 Each luminaire shall be listed with a nationally recognized testing laboratory (including but not limited to UL, CSA, ETL) under UL 1598 and UL 8750, or an equivalent standard from a recognized testing laboratory.
- .8 The luminaire shall operate from a 60 HZ ± 3 HZ AC line over a voltage ranging from 110 volt to 347 volt (as specified in Lighting Fixture Schedule). The fluctuations of line voltage shall have no visible effect on the luminous output.
- .9 The luminaire shall have a power factor of 0.90 per cent or greater at all standard operating voltages
- .10 Total harmonic distortion (THD) (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 per cent at any standard input voltage.
- .11 The lumen output shall not decrease by more than 20 per cent over the minimum operational life The lumen output shall not decrease by more than 20 per cent over the minimum operational life.
- .12 Light Color/Quality:
 - .1 Corrected Color temperature (CCT) range between 3,500K and 4,100K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the two-D CIE chromaticity chart .
 - .2 The color rendition index (CRI) shall be 80 or greater.
- .13 The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life
- .14 The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply for the luminaire shall be integral to the unit.
- .15 The assembly and manufacturing process for the Solid-State Lighting luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
- .16 The optical assembly of the luminaire shall consist of a ribbed metal reflector system and extruded refracting optical lens with high-transmission internal diffusion film applied to the inside of the refracting lens. No individual LED images shall be visible to the occupant.

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- .17 The electronics/power supply enclosure shall be internal to the Solid-State Lighting luminaire and be accessible per UL requirements
- .18 Electrical connections between power, driver and LED boards must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation from the room side and all electrical components must be able to be replaced without removing the fixture from the ceiling.
- .19 Housings shall be fabricated from post or pre-painted cold rolled steel.
- .20 Each refractor or lens shall be made from UV inhibited high impact plastic (such as acrylic or polycarbonate) or heat and impact resistant glass,
- .21 Polymeric materials (if used) of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. The lenses (lens) of the luminaire are excluded from this requirement.
- .22 Each luminaire shall have the manufacturer's name, trademark, model number, serial number, date of manufacture (month-year), and lot number as identification permanently marked inside the each unit.
- .23 The following operating characteristics shall be permanently marked inside each unit: rated voltage and rated power in Watts and Volt-Ampere.
- .24 The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the Luminaires for a period of five (5) years after acceptance of the Luminaires. Replacement Luminaires shall be provided promptly after receipt of Luminaires that have failed at no cost to the customer. All warranty documentation shall be provided to the owner.

2.2.2 Outdoor LED Luminaires:

- .1 Luminaire to have an internal label per ANSI C136.22.
- .2 Nominal luminaire input wattage shall account for nominal applied voltage and any reduction in driver efficiency due to sub-optimal driver loading.
- .3 Luminaires to start and operate in -40°C to +40°C ambient.
- .4 Luminaires to be designed for ease of component replacement and end-of-life disassembly.
- .5 Construction of the luminaire to be a single piece die cast aluminum housing (exclusive of an electrical access door) with integral heat sinking provisions.
- .6 Access door to the main compartment to be a single piece die cast aluminum part.
- .7 Light engines to use lenses comprised of molded acrylic with UV inhibitors.
- .8 Light engines to use a metal core printed circuit board.
- .9 Driver's rated case temperature to be suitable for operation in the luminaire operating in the ambient temperatures indicated above, with an expected service life of 100,000 with less than 5 per cent failure rate.

- .10 Driver to accept the voltage or voltage range indicated on drawings at 60 Hz, and to operate normally for input voltage fluctuations of plus or minus 10 per cent.
- .11 Driver to have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.
- .12 Driver to be mounted in direct contact with the luminaire housing to promote low operating temperature.
- .13 Luminaires to have a maximum Total Harmonic Distortion (THD) of 20 per cent at full input power and across specified voltage range.
- .14 Luminaire to be listed for wet locations.
- .15 Luminaires to be CSA approved.
- .16 Mechanical design of protruding external surfaces (heat sink fins) to facilitate hose down cleaning and discourage debris accumulation.
- .17 Liquids, fans or other moving parts integrated for the purpose of cooling the luminaire are not allowed.
- .18 Minimum Color Rendering Index (CRI) to be 75.
- .19 The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the Luminaires for a period of five (5) years after acceptance of the Luminaires. Replacement Luminaires shall be provided promptly after receipt of Luminaires that have failed at no cost to the customer. All warranty documentation shall be provided to the owner.

2.3 **RUNNING MAN PICTOGRAM SIGNS**

- 2.3.1 The equipment shall operate with universal 2-wire AC input voltage of 120 to 347VAC at less than 2.5W and universal 2-wire DC input voltage from 6 to 24VDC at less than 1.5W for single and double face signs.
- 2.3.2 The equipment shall be suitable for wall, end, or ceiling mount.
- 2.3.3 The housing shall be constructed of rugged extruded aluminum and have a maximum depth of 2-1/2". The faceplate(s) shall be constructed of extruded aluminum and shall incorporate a protective clear polycarbonate panel. Each face plate shall come standard with two legend films for pictogram and direction selection.
- 2.3.4 The light source shall be white light-emitting diodes (LED) and shall provide even illumination in normal and emergency operation.
- 2.3.5 The pictogram sign shall meet CSA 22.2 No.141 latest edition.
- 2.3.6 The pictogram signs shall be manufactured by Emergi-Lite, Beghelli or approved equivalent.

2.4 **RUNNING MAN PICTOGRAM SIGNS WITH BATTERY AND REMOTE HEADS**

- 2.4.1 The equipment frame shall be of industrial grade polyvinyl chloride with gaskets around both sides of the frame contour. The back plate shall be made of 1/8" thick aluminum sheet and shall include knock-outs for installation on an electrical box.

- 2.4.2 Each face plate shall come standard with two legend films for pictogram and direction selection.
- 2.4.3 The light source shall be long-life white light-emitting diodes (LED). The unit shall have attached a lower compartment containing two emergency heads with adjustable swivels and long-life MR16 LED.
- 2.4.4 The heads shall be installed on a shield housing made of cast aluminum and protected by a shock-absorbent, clear polycarbonate cover.
- 2.4.5 The standard AC input voltage shall be 120/347VAC.
- 2.4.6 The equipment shall be equipped with a magnetic test switch and one LED pilot light protected by the face plate.
- 2.4.7 The unit shall perform auto-test functions managed by a micro-controller and shall automatically self-test for one minute every 30 days, 10 minutes in the 6th month and 30 minutes annually. When a fault is detected, the bi-color pilot light shall turn from green to red and flash following a particular code. The code description shall be displayed on a label next to the pilot light to identify the failure type: battery, charger circuitry, LED lights for the signage, or emergency lights.
- 2.4.8 The combination unit shall be approved CSA C22.2 No.141 latest edition.
- 2.5 **REMOTE HEADS**
 - 2.5.1 Lamp head and stem shall be injection molded, impact resistant, flame retardant thermoplastic and shall require no tool for aiming or adjustment. The lens shall be inverse concave design and fully adjustable for aisle or area distribution during installation without the need to energize the lamp.
 - 2.5.2 Visual identification of distribution shall be provided through position of adjustment pins.
 - 2.5.3 Fixture shall be supplied with a canopy for installation on any four inch octagonal box. Housing shall be designed to allow for lamp replacement if required.
 - 2.5.4 Remote head lamps shall be MR16 LED.
- 2.6 **BATTERY UNITS**
 - 2.6.1 The battery shall be sealed, maintenance-free lead acid type, 15 years expected life with capacity as shown on drawings.
 - 2.6.2 The battery micro-controller board shall supply the rated load for a minimum of a 1/2 hour to 87.5% of the rated battery voltage. The unit shall be rated 120V, 60 Hz and be CSA listed.
 - 2.6.3 The charger shall be fully computer tested and its charge voltage factory set to $\pm 1\%$ tolerance. Chargers with field-adjusted potentiometers are not acceptable.
 - 2.6.4 A pulse-type charger shall be employed to promote long battery life and reduce the potential for grid corrosion. The charger shall provide a continuous high charge to recharge the battery, and when the battery is at full capacity, the charger will shut off.

- 2.6.5 Periodically the charger shall provide a pulse of energy to keep the battery topped off. The pulse charger shall be precisely regulated and shall charge the battery in relation to its temperature, state of charge and input voltage fluctuations.
- 2.6.6 The charger shall be current limited, temperature compensated, short-circuit proof and reverse polarity protected.
- 2.6.7 The unit shall be furnished with an electronic lockout circuit, which will connect the battery when the AC circuit is activated, and an electronic brownout circuit, which will activate the emergency lights when utility power dips below 75% of nominal voltage.
- 2.6.8 A low voltage battery protection circuit shall be provided and will disconnect the load when the battery reaches the end of discharge.
- 2.6.9 The unit shall self-test for 1 minute every 30 days, 10 minutes every 6 months and 30 minutes every 12 months. The unit shall be capable of full recharge in compliance with CSA specifications.
- 2.6.10 The unit shall be furnished with a sealed dust tight relay, a test switch and diagnostic LED indicator lights to continuously monitor the status of the unit: Battery Failure, Battery Disconnected, Charger Failure, Lamp Failure, Service Alarm, AC "ON", Charger High Rate.
- 2.6.11 The emergency lighting heads shall require no tools for orientation.
- 2.6.12 The lamps mounted on the battery unit shall be MR16 LED.

3 Execution

3.1 GENERAL

3.1.1 General

- .1 Provide supports for luminaires. Support single units from luminaire studs in outlet boxes. Swivel mount stems. Provide concrete inserts at points of luminaire support in unfinished areas where a concrete slab serves as ceiling. Provide support from concrete floor and roof steel above ceiling as applicable.
- .2 Align luminaires in rows, maintain required heights, and install luminaires clear of other Work.
- .3 Keep luminaires covered and protected from construction dust and debris until building is broom clean and free of suspended dust clouds.
- .4 When installation is complete, demonstrate operation to satisfaction of Owner.
- .5 Support luminaires in an approved manner to comply with the Ontario Electrical Safety Code and the Ontario Building Code.
- .6 Provide steel luminaire studs, brackets and hangers. Where luminaires are hung on chain hangers, Provide chain of closed link type capable of supporting ten times luminaire weight. Use U-bolts for chain ends; S-hooks are not acceptable.

3.1.2 Installation – Emergency Battery Units

- .1 Install emergency battery units where shown. Support on brackets supplied by manufacturer.
- .2 Aim heads to properly illuminate exit path.

3.1.3 Commissioning of the lighting system

- .1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).
- .2 The GC is responsible to coordinate the Lighting System Contractor and the BAS Contractor to provide and commission the lighting system.

END OF SECTION 16505

1 General

1.1 GENERAL REQUIREMENTS

- 1.1.1 Comply with the Simcoe Muskoka Catholic District School Board General Conditions, Request for Quotations and Division 16.

1.2 REFERENCES

- 1.2.1 Section 16010 Electrical General Provisions also applies to and is a part of this Section of the Specification.

1.3 SCOPE OF WORK

- 1.3.1 Supply all labour, tools, services and equipment and provide all materials and equipment required for a complete lighting control system in accordance with this section of the specification and the drawings.
- 1.3.2 Provide a complete, easy to use and maintain computer-based lighting control system that does not require a manufacturer's representative to change programming or schedules for any reason including addition or removal of lighting fixtures from the system.
- 1.3.3 Lighting system shall be integrated into the BAS system for controls with:
- .1 Lighting Control Panel
 - .2 Security system

1.4 QUALITY ASSURANCE

- 1.4.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.4.2 The General Contractor (GC) is responsible to co-ordinate the Lighting System Contractor and the BAS Contractor to provide and commission the lighting system in conjunction with the Building Automation System.
- 1.4.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- 1.4.4 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval.
- 1.4.5 Provide all products and services in accordance with the following codes and standards:
- .1 OESC - Ontario Electrical Safety Code
 - .2 CSA - Canadian Standards Association
 - .3 UL/C - Underwriters' Laboratories of Canada

1.5 SUBMITTALS

- 1.5.1 Refer to Division 1 General Requirements and submit shop drawings for the following:
- .1 Lighting Control System Main Control Panel

- .2 All equipment and modules housed within main lighting control panel
- .3 Occupancy Sensors
- .4 Photocells (Daylight Sensors)
- .5 Dimming Switches

1.5.2 Submit lighting control single line diagram showing all devices in system and explaining sequences of operation during shop drawing review stage.

1.5.3 Submit programmed sequences for rooms/corridors during shop drawing review stage.

2 Products

2.1 REFERENCES

2.1.1 Refer to Section 16100 Basic Materials and Methods. This Section also applies to and is part of this section of the specifications.

2.2 LIGHTING CONTROL SYSTEM

2.2.1 The lighting control system is a networked system that communicates via RS485. The system must be able to communicate with fully digital centralized relay panels, relay sub-panels, breaker panels, digital switches, photocells, various interfaces and shall include all operational software.

2.2.2 The intent of the Specification is to integrate all lighting control into one system.

2.2.3 Distributed lighting control shall be provided using a networked relay sub-panels. A centralized relay panel shall control corridors and site lighting. All lighting control system panels and modules shall be housed in the electrical room, in one enclosure if possible, unless otherwise noted by Consultant.

2.2.4 Lighting control system shall include all hardware and software. Software to reside within the lighting control system. System shall provide local access to all programming functions at the master lighting control panel (LCP) and remote access to all programming functions via dial up modem and through any standard computer workstation running an industry standard internet browser.

2.2.5 Non-networked, non-digital, non-server capable systems not acceptable.

2.2.6 The lighting control system shall be integrated into and controlled by the Building Automation System. The lighting control system shall be easy to use and maintain. The lighting control system shall not require a manufacturer's representative to change programming, schedules or BAS control for any reason including addition or removal of lighting fixtures, switches or control functions from the system. The lighting control system shall be installed in conjunction with the BAS.

2.3 RELAY PANELS

2.3.1 NEMA rated enclosure with screw cover or hinged door. Other NEMA types optional.

2.3.2 1.31mm² (16AWG) steel barrier shall separate the high voltage and low voltage compartments of the panel and separate 120V and 347V.

- 2.3.3 LCP input power shall be capable of accepting 120V or 347V without rewiring.
- 2.3.4 Control electronics in the low voltage section shall be capable of driving 2 to 48, 30A, 18,000 short-circuit current rating (SCCR) rated latching relays, control any individual or group of relays, provide individual relay overrides, provide a master override for each panel, store all programming in non-volatile memory, after power is restored return system to current state, provide programmable blink warn timers for each relay and every zone, and be able to control relays that default to "Open", "Normally Open Latching" (NOL) or relays that default to "Closed", "Normally Closed Latching" (NCL).
- 2.3.5 Lighting control system shall be digital and consist of a Master LCP, Slave LCPs, Micro LCPs with up to eight individual relays, digital switches, digital interface cards and if required, panel boards. All system components shall connect and be controlled via a single Cat-6, four twisted pair cable with RJ-45 connectors, providing real time two-way communication with each system component. Analog systems are not acceptable.
- 2.4 RELAYS**
- 2.4.1 UL Listed 30 Amp, Latching, 18,000 SCCR, 120VAC Ballast and HID and 20 Amp Tungsten at 120VAC.
- 2.4.2 Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two number 8.37mm² (8AWG) wires on both the line and the load side. Systems that do not allow for individual relay replacement or additions are not acceptable.
- 2.4.3 Relays to be rated for 250,000 operations minimum at a full 30A lighting load, default to closed at normal power loss, Normally Closed Latching (NCL).
- 2.4.4 Optional relay types available shall include Normally Open Latching (NOL) relay rated for 250,000 operations, a 600V two-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.
- 2.5 RELAY SUB-PANELS**
- 2.5.1 Relay sub-panels shall have up to 8 to 30A, 18,000 SCCR rated lighting relays and shall control all lighting in the designated area indicated on the plans and be networked to centralized relay panels, relay sub-panels, smart breaker panels, digital switches, photocells, various interfaces. Each relay sub-panel shall provide minimum 300mA at 12/24VDC for powering occupancy sensors. Relay sub-panels that require a separate occupancy sensor power pack are not acceptable.
- 2.5.2 Relay sub-panels shall provide a minimum 4-programmable photocell inputs, a minimum 4-programmable occupancy sensor inputs and matrixed contact closure inputs. This requirement is to insure integration of entire lighting system into one networked, lighting control system.
- 2.5.3 Relay sub-panels shall be capable of outputting minimum four and up to eight independent 0V to 10V dimming signals, one independent dimming signal at each of eight relays. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid-point, end point, trim, fade up rate, fade down rate, time delay and enable/disable masking. All photocell setting must be remotely accessible. Systems providing On, Off with Time Delay only, and system that do not provide remote access are not acceptable.

2.6 LOW VOLTAGE SWITCHES

- 2.6.1 All switches shall be digital and communicate via RS 485. Contact closure style switches, except as specified for connection to the relay sub-panel matrixed contact closure inputs, shall not be acceptable. The programming for a digital switch will reside in the switch itself, via double erasable programmable read-only memory (EPROM). Any digital switch button function shall be able to be changed locally or remotely via BAS, modem, Internet or Ethernet.
- 2.6.2 Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. System shall provide capability to locally and remotely program each individual switch button, monitor and change function of each button locally and remotely. Each button shall be capable of being programmed for 'On' only, 'Off' only, 'On/Off' (toggle), 'Raise' (Dim up) and 'Lower' (Dim down). Switches requiring low voltage control wires to be moved from one input terminal to another to accomplish these functions are not acceptable.
- 2.6.3 Keyed switches shall be programmable and connect to the lighting controls system bus.
- 2.6.4 Digital switches for high abuse areas shall be vandal resistant, contain no moving parts, and be touch sensitive and available with up to three buttons in a single-gang. Multi gang versions shall also be available.
- 2.6.5 Touch pads shall be Stainless Steel and capable of handling high abuse. High abuse switches shall connect to the lighting control system digital bus. Each high abuse switch touch button shall be able to be control any relay or any group in any panel or panels that is part of the lighting control system. Each touch button shall be able to be programmed for 'On', 'Off', 'Toggle' or 'Maintain' operation.
- 2.6.6 All programming shall be done locally or remotely via dial up modem or web interface as described in other paragraphs of this section. High abuse switches shall be able to be enabled or disabled digitally. Each touch pad is to be identified as to function by an engraved label. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cm spark) without any interruption or failure in operation.
- 2.6.7 Switch Stations shall provide manual switching of lighting load(s) controlled by a relay or group of relays.
- 2.6.8 Switches shall be low voltage, momentary switches and shall be available with one, 2, 3, or 4 Buttons with LED Indication and 2 Button raise/lower dimming. The switch stations shall be available in white (WH) or ivory (IV) colour and the finish shall be co-ordinated with the architect.
- 2.6.9 Switches shall be injection molded and designed to mount in a standard single gang junction box with standard decorator-style plate opening.
- 2.6.10 Switches shall have removable buttons for field replacement. Button replacement may be completed without removing the switch from the wall.
- 2.6.11 Switches with LED indication shall have a green LED that is illuminated when the switch is in the ON state.

- 2.6.12 Switches shall be programmable from the lighting control panel user interface or remotely.
- 2.6.13 Switches shall have 4" low voltage CLASS 2 leads for connection to lighting control panel inputs. The switch shall have wiring diagram indicated by a label affixed to the switch housing. Dimming switches shall connect to the panel via standard CAT6 cable and connectors.
- 2.6.14 Switches shall be capable of continuously dimming fixtures with no sudden changes in light level (i.e. large steps) or other visually irritating means of raising or lowering light levels.

2.7 **OCCUPANCY SENSORS**

- 2.7.1 Sensor shall provide automatic switching of lighting load(s) within an area/zone based on the presence of human activity.
- 2.7.2 Sensor shall have a microprocessor to optimize the sensor behavior to fit occupant usage patterns and adjust sensitivity and time delay to changing conditions.
- 2.7.3 Sensor shall not require any manual adjustment at the time of installation or during operation.
- 2.7.4 Sensor shall adapt automatically to changing room conditions.
- 2.7.5 Sensor shall utilize either passive infrared, ultrasonic, or both passive infrared and ultrasonic technology to detect motion. Sensor shall not react to noise or ambient sound.
- 2.7.6 Sensor's microprocessor shall monitor PIR background levels and automatically make corresponding adjustments.
- 2.7.7 Sensor shall incorporate a dual element pyrometer and 12-element cylindrical Fresnel lens.
- 2.7.8 Sensor shall be provided with a variety of mask inserts for PIR rejection to prevent false tripping.
- 2.7.9 Sensor's microprocessor shall monitor ultrasonic frequency changes and automatically make corresponding adjustments.
- 2.7.10 Sensor's microprocessor shall automatically adapt to a continuous airflow situation.
- 2.7.11 Sensor shall be powered by the lighting control panel directly for a maximum of 8 sensors for 4 and 8 Relay panels and 24 sensors for 16 and 24 relay panels.
- 2.7.12 Sensor shall have an ultrasonic frequency of 32kHz or 40kHz depending on model.
- 2.7.13 Sensor coverage shall range from 0 to 2000 sq. ft. depending on model.
- 2.7.14 Sensor shall be available with a 110 degree, 180 degree, or 360 degree field of view.
- 2.7.15 Sensor shall recognize, as a false on, the failure to detect motion 6 seconds after motion is detected initially (turning on the lighting). The sensor shall decrease the sensitivity in response to the false on.
- 2.7.16 Sensor shall feature an 8-second time out install test mode, which will automatically revert to standard time out one hour after being put into test mode.
- 2.7.17 Sensor shall have manual controls and override switches to force manual adjustments.

- 2.7.18 Sensor shall have controls behind a cover to resist tampering. All controls shall be accessible from the front of the sensor.
- 2.7.19 Sensor shall have timer that can be adjusted manually from 8 to 30 minutes.
- 2.7.20 Sensor sensitivity shall be adjustable from 0% to 100%.
- 2.7.21 Sensor shall have a control knob that sets the minimum setting for the timer in automatic mode.
- 2.7.22 Sensor shall have control knobs for setting the initial automatic sensitivity adjustments.
- 2.7.23 Sensor shall include non-volatile memory for retaining device settings during power outages.
- 2.7.24 Sensor shall have a switch to restore factory settings.
- 2.7.25 Sensor shall have real time motion indicator LEDs visible from the front of the unit. Red = Infrared, Green = Ultrasonic.
- 2.7.26 Sensor shall be available with a Form C isolated dry relay contact for interfacing the sensor to auxiliary systems.
- 2.7.27 Sensor shall be ceiling mounted.

2.8 **PHOTOCELL (DAYLIGHT SENSOR)**

- 2.8.1 Sensor shall provide automatic daylight harvesting switching of lighting load(s) controlled by a relay or group of relays. When used with the dimming option, the sensor shall provide daylight harvesting capability via full range dimming.
- 2.8.2 Sensor shall be a closed loop daylight sensor with an internal photodiode that measure the ambient light in the space.
- 2.8.3 Sensor shall provide programmable ON & OFF set points.
- 2.8.4 Sensor shall support 4 light level ranges: 0.3-30fc, 3-300fc, 30-3,000fc and 60-6,000fc. Light level ranges shall be selectable via jumper switch.
- 2.8.5 Sensor shall display real time foot candle levels at the lighting control panel user interface.
- 2.8.6 For daylight harvesting switching, to prevent cycling, sensor shall have programmable ON delay and OFF delay settings.
- 2.8.7 Sensor may be programmed for active and inactive times using the CX Panel masking program function.
- 2.8.8 Sensor shall be ceiling or wall mounted in the appropriate location for measuring the available daylight.

2.9 **POWER PACKS**

- 2.9.1 Power packs shall accept and switch 120 or 347VAC, be plenum rated, and provide Class-2 power for up to 14 remote sensors.
- 2.9.2 Power pack shall securely mount to junction location through a threaded 13mm chase nipple. Plastic clips into junction box shall not be accepted. All Class-1 wiring shall pass through

chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

- 2.9.3 When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class-1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- 2.9.4 Power pack shall incorporate a Class-1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20A switching of all load types and be rated for 400,000 cycles.
- 2.9.5 Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

2.10 INTERFACES

- 2.10.1 Interfaces: For future expansion capability, provide all of the following interfaces:

- .1 Dry contact input interface card that provides 14 programmable dry contact closure inputs. Use shielded cable to connect input devices to interface card.
- .2 Interface card providing digital communication from one system bus to another system bus, allowing up to 12,000 devices to communicate.
- .3 A voice prompted telephone override interface module. Interface module shall accept up to three phone lines and allow up to three simultaneous phone calls. Voice prompted menu and up to 999 unique pass codes shall be standard with each interface module.
- .4 Software pre-installed to run Graphical Interface Software. Software shall provide via local or remote PC a visual representation of a specific area or the total area of the project. Full graphic pages shall be designed to the Owner's specifications. The Owner to provide to manufacturer all necessary files and criteria.
- .5 Direct digital interface to panel boards. Relay panel and panel board circuits shall appear on the system software as similar, yet distinct, items and maintain all functions and features of the system software.
- .6 Direct digital interface to building automation systems using DDC protocols such as BACnet, Metasys (N2) and ModBus that accept on/off commands, time schedules and report status of all relays in all panels in real time. Interface cards shall "self-populate" each individual relay and each group to the BAS. All BAS system programming required shall be the responsibility of the BAS system provider.

2.11 DIMMING MODULES

- 2.11.1 Each dimming module shall provide capability for eight industry standard 0 - 10vdc dimming channels each capable of sinking a maximum of 30mA of current supplied by dimming

ballast(s) or LED drivers. The dimming option card shall be plug-in style for simple field installation where required.

2.11.2 Eight 0 - 10vdc dimming control connections shall be provided per card via removable plug-in terminal blocks. The dimming control lines shall automatically open upon loss of normal control power to the lighting control panel insuring that all connected dimmed loads will be at 100% brightness if connected to emergency power.

2.11.3 Each dimming option card shall provide four RJ45 jacks for connection of single gang decorator style dimming switches. Provide capability for manual raise/lower, on/off and preset type low voltage switches. Dimmers shall also be controllable via panel schedules, daylight harvesting via photocell, and integral demand response limiting feature.

2.12 **ACCEPTABLE MANUFACTURERS**

2.12.1 Acceptable manufacturers of the lighting control system are Hubbell Controls, Acuity Controls or Eaton Lighting Controls.

3 **Execution**

3.1 **GENERAL**

3.1.1 Equipment Installation

.1 Mount relay control cabinet adjacent to respective lighting panel board. Cabinet shall be surface mount on 19mm thick fire retardant treated plywood backboards. The plywood to be primed and painted. Wiring between relay control cabinet and panelboards to be per local codes and acceptable industry standards. Neatly lace and rack wiring in cabinets. During construction process, protect all interior components of each relay panel and each digital switch from dust and debris.

.2 Switches: Provide outlet boxes, single or multi-gang, as shown on the Contract Drawings for the low voltage digital switches. Mount switches as per Contract Drawings. Supply faceplates per Specifications. Supply and install the required low voltage cable, Category 6, four twisted pair, with RJ-45 connectors and snagless boots (commonly referred to as Cat-6 patch cable) between all switches and panels. Field-test all Cat-6 patch cable with a recognized cable tester. All low voltage wire to be run in conduit.

.3 Wiring:

.1 All wiring shall be installed in conduit.

.2 Do not mix low voltage and high voltage conductors in the same conduit. No exceptions.

.3 Ensure low voltage conduits or control wires do not run parallel to current carrying conduits.

.4 Place manufacturer supplied "terminators" at each end of the system bus per manufacturer's instructions.

.5 Neatly lace and rack wiring in cabinets.

.6 Plug in Cat-6 patch cable that has been field-tested with a recognized cable tester, at the indicated RJ-45 connector provided at each lighting control device, per manufacturer's instructions.

- .7 Use Cat-6 patch cables for all system low voltage connections. Additional conductors may be required to compensate for voltage drop with specific system designs. Use shielded cable for dry contact inputs to lighting control system.
- .8 All items on the bus shall be connected in sequence (daisy chained). Star and spur topologies are not acceptable.
- .9 The lighting control system shall be installed by the Contractor who shall make all necessary wiring connections to external devices and equipment, to include photocells. Wire shall be as per manufacturer instructions.
- .4 Sensors:
 - .1 Provide all necessary supports required for mounting occupancy and daylight sensors so that they operate properly for the intended programmed sequences at various areas. Comply with manufacturer's installation and calibration instructions. Co-ordinate mounting, wiring and programming of the sensors with the Lighting System Contractor, BAS Contractor and the QAP requirements.

3.1.2 Installation and Set-Up

- .1 Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to approved shop drawings for location of line and low-voltage areas. It is the responsibility of the Contractor to verify with lighting control manufacturer all catalogue information and specific product acceptability.
- .2 For approved line voltage type relay sub-panel switches connected to matrixed inputs of the relay sub-panel, furnish number 0.82mm² (18AWG) solid conductors. For all other digital switches provide wiring required by system manufacturer.
- .3 For digital switches provide wiring required by system manufacturer.
- .4 Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.
- .5 Panels shall be located so that they are readily accessible and not exposed to physical damage.
- .6 Panel locations shall be furnished with sufficient working space around panels to comply with the Ontario Electrical Safety Code.
- .7 Panels shall be securely fastened to the mounting surface by at least four points.
- .8 Unused openings in the cabinet shall be effectively closed.
- .9 Cabinets shall be grounded as specified in the Ontario Electrical Safety Code.
- .10 Lugs shall be suitable and listed for installation with the conductor being connected.
- .11 Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.
- .12 Maintain the required bending radius of conductors inside cabinets.

- .13 Clean cabinets of foreign material such as cement, plaster and paint.
- .14 Distribute and arrange conductors neatly in the wiring gutters.
- .15 Follow the manufacturer's torque values to tighten lugs.
- .16 Before energizing the panel board, the following steps shall be taken:
 - .1 Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.
 - .2 Remove shipping blocks from component devices and the panel interior.
 - .3 Remove debris from panel board interior.
- .17 Follow manufacturers' instructions for installation and all low voltage wiring.
- .18 Comply with energy code lighting control system "Acceptance Requirements". Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are installed and calibrated properly. This is the installing Contractor's responsibility. Verify requirements with the Owner.
- .19 Provide a point-to-point wiring diagram for the entire lighting control system. Diagram must indicate exact mounting location of each system device. This accurate "as built" shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell. Original to be given to the Owner, copies placed inside the door of each lighting control panel (LCP).

3.1.3 Service Support and Training

- .1 Start Up: Contractor shall contact manufacture to schedule commissioning of the system.
- .2 Telephone factory support shall be available at no additional cost to the Owner both during and after the warranty period of two (2) years from the date of Substantial Completion. The manufacturer, at no added cost, shall provide additional remote programming via modem as required to the Owner for the operation life of the system. Upon request by the Owner, the manufacturer shall provide remote dial up software at no added cost to system the Owner. No exceptions.
- .3 Once the system is commissioned and accepted by the Consultant, the Contractor will provide a two (2) hour on-site training session by a factory trained technician, which will cover system operation, maintenance, troubleshooting and tour of the system. Contractor will coordinate with the Owner to determine the date and time of training.

3.1.4 Cleaning

- .1 Clean photocell lens as recommended by manufacturer.
- .2 Clean all switch faceplates.

3.1.5 Commissioning of the Lighting System

- .1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).

- .2 The GC is responsible to co-ordinate the Lighting System Contractor and the BAS Contractor to provide and commission the Lighting System complete with luminaires, controls, integration and programming.
- .3 The GC shall include the costs of and co-ordinate the work of the Lighting System Contractor and the BAS Contractor through the mock-up phase and through to project completion.

END OF SECTION 16525

1 GENERAL

1.1 WORK INCLUDED

- 1.1.1 Provide equipment to expand the existing security system including motion sensors, electric strikes, card readers, tie-in to the fire alarm control panel and other devices. The existing security system provider is Huronia Alarms.
- 1.1.2 The GC shall include the costs to provide the services of Huronia Alarms to perform the work.
- 1.1.3 Provide all communication cables, power distribution, conduit, junction boxes, rough-ins and programming necessary to provide the security system devices complete. All wiring to be new in new conduit.

1.2 SUBMITTALS

- 1.2.1 Refer to Division 1 General Requirements and submit shop drawings for the following:

- .1 Card readers
- .2 Electric Strikes
- .3 Motion Sensors
- .4 Method of connection to Building Automation System and fire alarm control panel
- .5 Universal washroom door controller and emergency flasher system

1.3 QUALITY ASSURANCE

- 1.3.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.3.2 The General Contractor (GC) is responsible to co-ordinate the Security System Contractor and the BAS Contractor to provide and commission the security system in conjunction with the Building Automation System.
- 1.3.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- 1.3.4 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval.
- 1.3.5 Provide all products and services in accordance with the following codes and standards:
 - .1 OESC - Ontario Electrical Safety Code
 - .2 CSA - Canadian Standards Association
 - .3 UL/C - Underwriters' Laboratories of Canada

1.4 RELATED SECTIONS

- 1.4.1 Section 16100 – Electrical Basic Materials and Methods

2 PRODUCTS

2.1 SECURITY SYSTEM

- 2.1.1 The security system devices shall interface and be controlled by the existing security control panel in the school. Existing control sequences are to remain in place. The new security system devices shall be tied into the BAS through the existing security control panel. The existing security system control panel shall be tied into the fire alarm control panel.
- 2.1.2 Provide motion detectors as shown on the drawings. Dual technology (microwave and infrared) motion detectors shall have fresnel lens, multi-segment mirror and automatic temperature compensation.
- 2.1.3 Provide card readers and electric strikes as shown on the drawings. Co-ordinate electric strikes and card readers with the architect and door hardware supplier to ensure the correct door is selected for the security application. Provide all necessary wiring in conduit.
- 2.1.4 Card readers shall be G-Prox II HID compatible or approved equivalent.
- 2.1.5 Contractor shall provide connection between security panel and fire alarm control panel for co-ordinated function of security system during fire alarm condition. The contractor shall provide an illustration the cabling and devices they will use to connect the security system control panel and the fire alarm control panel. The cable type and devices between the two systems shall be co-ordinated.

2.2 UNIVERSAL WASHROOM DOOR CONTROLLER AND EMERGENCY FLASHER SYSTEM

- 2.2.1 The Universal Washroom Door Controller and Emergency Flasher system consists of the .
- 2.2.2 A qualified electrician familiar with OESC and local code requirements shall install this product package.
- 2.2.3 Coordinate with architectural division for barrier free door operators, electric strike and all accessories. Provide power as indicated on electrical drawings. Electrical contractor to coordinate with architectural drawings and general contractor for installation requirements and wiring methods. Report any discrepancies to the consultant prior to conduit rough-in.
- 2.2.4 Universal washroom kit for emergency call assistance to latest Accessibility for Ontarians with Disabilities Act and Ontario Building Code requirements. The emergency call system barrier-free restroom kit consists of the following from Camden Door Controls, Mississauga office tel: 905-366-3377 or reviewed equivalent:
- 2.2.5 CX-WC13FM series
- .1 - CM-45/855SE1 (illuminated door push plate - push to lock)
 - .2 - CM-45/4 (push/exit switches)
 - .3 - CX-33 (advanced logic controller)
 - .4 - CX-MDA (magnetic door contact)
- 2.2.6 CX-WEC10 series

- .1 - CM-450R/12 (push/pull mushroom push button)
- .2 - CM-AF50ISO (led annunciator c/w sounder)
- .3 - CM-SE21A (signage)
- .4 - CM-AF140SO (dome light with sounder)

2.2.7 CM-170/22 (off-auto-hold key switch)

2.2.8 Dado panic strip model #DADO/HI/R/950/DL/B (tape switch)

2.2.9 AC/DC control transformer, suitable for the system requirements for Camden Door Controls.

2.2.10 12/24V DC power supply suitable for the system requirements for Camden Door Controls.

2.2.11 An emergency sign that contains the words "IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY BUTTON AND AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE" in letters at least 25 mm high with a 5 mm stroke and that is posted above the interior emergency button. All components listed shall be supplied and installed by division 16. Install barrier free washroom kit as per manufacturer's recommendations.

2.2.12 Provide wiring in conduit and connection to existing security control panel. Provide programming at security control panel and fire alarm control panel so universal washroom door locks released during fire alarm condition. Co-ordinate sequence of operation of other equipment with Simcoe Muskoka Catholic District School Board, Head Caretaker, daycare administration and Principal.

3 EXECUTION

3.1 INSTALLATION OF SECURITY SYSTEM COMPONENTS

- .1 All wiring shall be new and installed in new conduit. Minimum wiring size is #14 or as required by security system provider. Minimum conduit size is 21mm.
- .2 Install the equipment indicated in strict accordance with the Ontario Electrical Safety Code, manufacturer's recommendations and as indicated on the Drawings.
- .3 Provide all auxiliary hangers, fittings, connectors, supports and miscellaneous materials necessary to install the system.
- .4 Co-ordinate rough-ins with architect and door hardware supplier.
- .5 Provide signage and audible and visual signals at universal washroom in accordance with Ontario Building Code requirements. Co-ordinate the mounting of the signage and accessories with other work.
- .6 Commissioning of the Security System
 - .1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).
 - .2 The GC is responsible to co-ordinate the Security System Contractor and the BAS Contractor to provide and commission the Security System complete with devices and programming.
 - .3 The GC shall include the costs of and co-ordinate the work of the Security System Contractor and the BAS Contractor through the mock-up phase and through to project completion.

- .4 A commissioning test shall be conducted to demonstrate to the Consultant and Owner that the alarm system was installed in accordance with the Specifications and operating correctly.
- .5 A simulation of each type of alarm shall be conducted to verify that an alarm is correctly registered and transmitted to the central monitoring services. The keypad and control panel shall be exercised to ensure that all functions and programming capabilities are operating correctly and as specified.
- .6 This commissioning test shall be repeated should the system not operate correctly during the first test. The supplier shall make the necessary repairs and the test shall be re-scheduled. The Contractor shall be responsible for the cost of the Consultant's time and expenses related to the additional test.

END OF SECTION 16720

1 GENERAL

1.1 RELATED SECTIONS

- 1.1.1 Comply with the Simcoe Muskoka Catholic District School Board Request for Quotations and Division 16.

1.2 DESCRIPTION

- 1.2.1 This section of the specification includes the furnishing, installation, and connection of an addressable, single-stage, intelligent reporting, microprocessor controlled, addressable, fire detection and emergency voice alarm communication system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.
- 1.2.2 The fire alarm system shall comply with requirements of CAN/ULC Standards. The system shall be electrically supervised and monitor the integrity of all conductors.
- 1.2.3 The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.
- 1.2.4 Each designated zone shall transmit separate and different alarm, supervisory and trouble signals.
- 1.2.5 The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- 1.2.6 The system and its components shall be Underwriters Laboratories of Canada listed under the appropriate ULC testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the CAN/ULC-S524-2008 Standard.
- 1.2.7 The installing company shall employ qualified Fire Alarm Technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 SCOPE OF WORK

- 1.3.1 Existing fire alarm systems shall be operational during construction. Provide all necessary equipment, wiring, conduits, temporary power etc as required to meet this requirement.
- 1.3.2 The existing fire alarm control system is Notifier NFS-320C and it shall be replaced with a Notifier NFS2-640 to serve the existing school building and addition to the existing school building. No substitutions allowed. The existing fire alarm zoning, circuits and programming shall be extended and transferred to the new fire alarm control panel. Provide new wiring in conduit, devices, zoning and programming to provide fire alarm system at new daycare addition.

- 1.3.3 The GC shall include the costs to provide the services of Huronia Alarms to perform the work.
- 1.3.4 The contractor shall provide a new passive graphic framed at the existing location to show the alarm and supervisory zones for the entire building including the new zones at the new addition.
- 1.3.5 The system shall be designed such that each Data Communication Link (DCL) is limited to only 80% of its total capacity at initial installation.
- 1.3.6 Basic Performance:
 - .1 Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class A Data Communication Link (DCLA).
 - .1 Initiation Device Circuits (IDC) shall support Class A wiring as part of an addressable device connected by the DCLA Circuit
 - .2 Notification Appliance Circuits (NAC) shall support Class A wiring as part of an addressable device connected by the DCL Circuit.
 - .3 On Class A configurations a single ground fault or open circuit on the system Signalling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
 - .4 Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- 1.3.7 Basic System Functional Operation
 - .1 When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
 - .1 The System Alarm LED shall flash.
 - .2 A local piezo electric signal in the control panel shall sound.
 - .3 The 640 character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 - .4 Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
 - .5 All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.
- 1.4 **QUALITY ASSURANCE**
 - 1.4.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
 - 1.4.2 The General Contractor (GC) is responsible to co-ordinate the Fire Alarm System Contractor and the BAS Contractor to provide and commission the fire alarm system in conjunction with the Building Automation System.
 - 1.4.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.

- 1.4.4 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval.
- 1.4.5 Provide all products and services in accordance with the following codes and standards:
 - .1 OESC - Ontario Electrical Safety Code
 - .2 CSA - Canadian Standards Association
 - .3 UL/C - Underwriters' Laboratories of Canada
- 1.5 **SUBMITTALS**
 - 1.5.1 General:
 - .1 Submit shop drawings in digital format.
 - .2 Submit fire alarm verification report in digital and hard copy formats.
 - .3 All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible ULC listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
 - .4 All substitute equipment proposed as equal to the equipment specified herein, shall meet or exceed the following standards. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.
 - 1.5.2 Shop Drawings:
 - .1 Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - .2 Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
 - .3 Show annunciator layout, configurations, and terminations.
 - 1.5.3 Manuals:
 - .1 Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
 - .2 Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
 - .3 Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

- .4 Approvals will be based on complete submissions of manuals together with shop drawings.

1.5.4 Software Modifications

- .1 Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
- .2 Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications onsite. Modification of software shall not require power down of the system or loss of system fire protection while modifications are being made.

1.5.5 Certifications:

- .1 Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.6 WARRANTY

- 1.6.1 All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one (1) year from the date of substantial performance. The full cost of maintenance, labour and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.7 APPLICABLE PUBLICATIONS:

- 1.7.1 The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only.
- 1.7.2 National Building Code of Canada.
- 1.7.3 Ontario Building Code and local amendments.
- 1.7.4 Canadian Electrical Code.
- 1.7.5 Ontario Electrical Safety Code and Bulletins.
- 1.7.6 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S524, Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525, Audible Signal Appliances for Fire Alarm.
 - .3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
 - .4 CAN/ULC-S527, Control Units.

- .5 CAN/ULC-S528, Manual Pull Stations.
- .6 CAN/ULC-S529, Smoke Detectors.
- .7 CAN/ULC-S530, Heat Actuated Fire Detectors.
- .8 CAN/ULC-S531, Smoke Alarms.
- .9 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.
- .10 CAN/ULC-S537, Verification of Fire Alarm Systems.

1.7.7 National Fire Protection Association (NFPA):

- .1 No. 12 CO2 Extinguishing Systems (low and high)
- .2 No. 12B Halon 1211 Extinguishing Systems
- .3 No. 13 Sprinkler Systems
- .4 No. 13A Halon 1301 Extinguishing Systems
- .5 No. 15 Water Spray Systems
- .6 No. 16 Foam/Water Deluge and Spray Systems
- .7 No. 17 Dry Chemical Extinguishing Systems
- .8 No. 17A Wet Chemical Extinguishing Systems
- .9 No. 72 National Fire Alarm Code
- .10 No. 101 Life Safety Code
- .11 No. 2001 Clean Agent Fire Extinguishing Systems

1.7.8 All requirements of the Authorities Having Jurisdiction (AHJ).

1.8 **APPROVALS**

1.8.1 The system shall have proper listing and/or approval from the following nationally recognized agencies:

- .1 ULC Underwriters Laboratories Canada.

1.8.2 The Fire Alarm Control Panel and all transponders shall meet the modular listing requirements of Underwriters Laboratories of Canada. Each subassembly, including all printed circuits, shall include the appropriate ULC modular label. This includes all printed circuit board assemblies, power supplies, and enclosure parts. Systems that do not include modular labels may require return to the factory for system upgrades, and are not acceptable.

2 PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

- 2.1.1 All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signalling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- 2.1.2 All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.
- 2.1.3 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRING

2.2.1 Conduit:

- .1 Conduit shall be in accordance with Ontario Electrical safety Code (OESC) and all applicable bulletins.
- .2 All wiring shall be installed in conduit or raceway unless 'FAS Fire Alarm Cable Armoured Foil Shield' is used. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
- .3 Cables must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.
- .4 Wiring for 24 volt control, alarm notification, emergency communication and similar power limited auxiliary functions may be run in the same conduit as initiating and signalling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- .5 Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

2.2.2 Wiring

- .1 All fire alarm system wiring must be new.
- .2 Wiring shall be in accordance with local, provincial and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of

conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signalling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

- .3 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system.
- .4 Wiring used for the multiplex communication circuit (DCL) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the DCL communication circuit.
- .5 The system shall permit the use of IDC and NAC wiring in the same conduit with the multiplex communication loop.
- .6 All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; A trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
- .7 All analog voice speaker and analog telephone circuits shall use twisted/shielded pair to eliminate cross talk.
- .8 FAS Fire Alarm Cable Armoured Foil Shield c/w red tint (by National Cables) is allowed to run with no conduit.

2.2.3 Terminal Boxes, Junction Boxes and Cabinets:

- .1 All boxes and cabinets shall be CSA listed for their intended purpose.
- .2 Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on Data Communication Link connected to intelligent reporting devices.
- .3 The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labelled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL

- 2.3.1 The main FACP Central Console shall be a NOTIFIER Model NFS2-640 (no substitutions allowed) and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, control circuits, and notification appliance circuits, local and remote operator terminals, printers, annunciators, and other system controlled devices.

2.3.2 Operator Control

- .1 Acknowledge Switch:

- .1 Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. In addition, the FACP shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.
- .2 Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
- .2 Signal Silence Switch:
 - .1 Depression of the Signal Silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto silence timers.
- .3 Drill Switch:
 - .1 Depression of the Drill switch shall activate all programmed notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
- .4 System Reset Switch:
- .5 Depression of the System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall report if active. Active notification appliance circuits shall not silence upon Reset. Systems that deactivate and subsequently reactivate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall be re-evaluated after the reset sequence is complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re report upon reset.
- .6 Lamp Test:
 - .1 The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

2.3.3 System Capacity and General Operation

- .1 The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.
- .2 The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
- .3 It shall also include four Class B or Class A programmable Notification Appliance Circuits.

- .4 The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
- .5 The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
- .6 The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
- .7 The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
- .8 The FACP or each network node shall provide the following features:
 - .1 Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
 - .2 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the requirements of CAN/ULC-S527.
 - .3 Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
 - .4 Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
 - .5 The ability to display or print system reports.
 - .6 Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
 - .7 PAS presignal, allowing delay of a fire alarm up to 180 seconds after the start of alarm processing.
 - .8 Rapid manual station reporting (under 3 seconds) for activation of notification circuits within 10 seconds of initiating device activation.
 - .9 Periodic detector test, conducted automatically by the software.
 - .10 Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

- .11 Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
 - .12 Walk test, with a check for two detectors set to same address.
 - .13 Control-by-time for non-fire operations, with holiday schedules.
 - .14 Day/night automatic adjustment of detector sensitivity.
 - .15 Device blink control for sleeping areas.
- .9 The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."

2.3.4 Network Communication

- .1 The FACP shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

2.3.5 Central Microprocessor

- .1 The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
- .2 The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
- .3 The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
- .4 A special program check function shall be provided to detect common operator errors.
- .5 An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
- .6 For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program

the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the CAN/ULC-537 requirements for verification after system modification.

2.3.6 System Display

- .1 The system shall support the following display mode options:
 - .1 The CPU with no display option shall allow the fire alarm control panel to function as a data-gathering panel when the panel is connected to a network with an Onyx Works or Network Control Annunciator (NCA). In this application, the Onyx Works or NCA shall provide all of the necessary controls and indicators to be used by the system operator. Programming of the CPU may be accomplished from the Onyx Works or by use of a laptop PC with the software programming utility connected directly to the CPU.
 - .2 80 character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.
 - .3 640-character display option. The design of the CPU shall provide for a configuration with the 640 Character display mounted on the front of the CPU in place of the standard 80-character display.
- .2 The display shall provide all the controls and indicators used by the system operator:
 - .1 The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
 - .2 The 640-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
- .3 The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
- .4 The display shall also provide Light-Emitting Diodes.
 - .1 The 80-character display shall provide 12 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, ALARM SILENCED, Controls Active, Pre-Discharge, Discharge and Abort.
 - .2 The 640-character display shall provide 11 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY EVENT, SYSTEM TROUBLE, ALARM SILENCED,

DISABLED POINTS, OTHER EVENTS, CPU FAILURE and Controls Active.

- .5 The display shall have QWERTY type keypad.
 - .1 The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
 - .2 The 640-character display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility.
- .6 The system shall support the display of battery charging current and voltage on both the 80-character LCD display.

2.3.7 Data Communication Loop (DCL)

- .1 Each FACP or FACP network node shall support up to two DCLs. Each DCL interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each DCL shall be capable of Class A or B wiring.
- .2 CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

2.3.8 Serial Interfaces

- .1 The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting ULC Listed Information Technology Equipment (ITE) peripherals.
 - .1 One EIA-232 interface shall be used to connect an ULC-Listed 40 or 80 column printer. Printers that are not ULC-Listed are not considered acceptable substitutes.
 - .2 One EIA-232 interface shall be used to connect an ULC-Listed 40 or 80 column printer. Printers that are not ULC-Listed are not considered acceptable substitutes.
 - .3 One EIA-232 interface shall be used to connect a ULC-listed CRT terminal. This interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset,

or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.

- .4 The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
- .5 The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

2.3.9 Enclosures:

- .1 The control panel shall be housed in a ULC listed cabinet suitable for surface or semi flush mounting. The cabinet and front shall be corrosion protected, given a rust resistant prime coat, and manufacturer's standard finish.
- .2 The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
- .3 The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left hand side.

2.3.10 Power Supply:

- .1 A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
- .2 Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
- .3 Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
- .4 The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
 - .1 Ground Fault LED
 - .2 AC Power Fail LED
 - .3 NAC on LED (4)
- .5 The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
- .6 The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
- .7 All circuits shall be power-limited, per ULC requirements.

2.3.11 Auxiliary Field Power Supply - Addressable

- .1 The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
- .2 The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
- .3 The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per ULC requirements.
- .4 The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
- .5 The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
- .6 The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (DCL) or other multiplexed means. Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the DCL shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
- .7 The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the DCL.
- .8 The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
- .9 The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
- .10 The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
- .11 Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.

- .12 The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
- .13 When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
- .14 When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
- .15 The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
- .16 An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

2.3.12 Field Charging Power Supply (FCPS)

- .1 The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
 - .1 The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
 - .2 The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs shall be available for connection to the Notification devices.
 - .3 The FCPS shall include an attractive surface mount backbox.
 - .4 The Field Charging Power Supply shall include the ability to delay the AC fail delay.
 - .5 The FCPS include power limited circuitry.

2.3.13 Specific System Operations

- .1 Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed ULC window and have a minimum of 9 levels.
- .2 Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

- .3 Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
- .4 Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - .1 Device status
 - .2 Device type
 - .3 Custom device label
 - .4 View analog detector values
 - .5 Device zone assignments
 - .6 All program parameters
- .5 System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
- .6 System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
- .7 Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
- .8 Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
- .9 Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
- .10 The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
 - .1 Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.

- .2 Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
- .3 All devices tested in walk test shall be recorded in the history buffer.
- .11 Waterflow Operation: An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
- .12 Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
- .13 Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.
- .14 Non-Alarm Input Operation: Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.
- .15 Combo Zone: A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4 **SYSTEM COMPONENTS**

2.4.1 Programmable Electronic Sounders:

- .1 Shall be a System Sensor SpectrAlert Advance which is listed to CAN/ULC-S525, Audible Signal Appliances, Fire Alarm.
- .2 Shall operate on 24 VDC nominal.
- .3 Shall be field programmable with three audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern without the use of special tools.
- .4 Shall produce a sound level of at least 90 dBA measured at 10 feet from the device.
- .5 Shall be flush or surface mounted as shown on plans.

2.4.2 Strobe lights shall meet the requirements of CAN/ULC-524, Installation of Fire Alarm, and be fully synchronized, and shall meet the following criteria:

- .1 Shall be a System Sensor SpectrAlert Advance which consists of a xenon flash tube and associated lens/reflector system, is listed to CAN/ULC-S526 and shall be approved for fire protective service.
- .2 Strobe intensity shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

- .3 The flash rate shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
 - .4 Shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, 185.
- 2.4.3 Strobe lights shall meet the requirements of CAN/ULC-524, Installation of Fire Alarm, and be fully synchronized, and shall meet the following criteria:
- .1 Shall be a System Sensor SpectraAlert Advance which consists of a xenon flash tube and associated lens/reflector system, is listed to CAN/ULC-S526 and shall be approved for fire protective service.
 - .2 Strobe intensity shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
 - .3 The flash rate shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
 - .4 Shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, 185.
- 2.4.4 All audible and visual signal devices shall be UL listed and labeled as such.
- 2.4.5 In finished areas, the speakers and strobe signal devices shall be installed in surface mounted red finish backbox with no knockouts.
- 2.4.6 In finished areas, audible signal device shall consist of cone speaker with sound output of 88dBA at 10 feet tapped at 2 watts, 25/70volt operation with ¼, ½, 1 and 2 watts taps, suitable for mounting on wall mounted backbox, square red grille. Strobe shall be synchronized with field selectable illumination of 15/30/75/110 cd using xenon flashtube under lexan lens with "FIRE" marking. Devices shall be Notifier #E70 series.
- 2.4.7 In Utility Rooms such as Mechanical Rooms etc. units shall be heavy duty construction consisting of sealed high compression driver with output upto 95dBA @10 feet 10 feet tapped at 2 watts, 25/70volt operation with ¼, ½, 1 and 2 watts taps, suitable for mounting on wall mounted backbox, square red grille. Unit installed in non-climate controlled environment shall be c/w weatherproof boxes.
- 2.4.8 Provide suitable synchronizing module to suit signaling requirements. These synchronizing modules shall be installed in separate enclosure outside of the panel tub.
- 2.5 **SYSTEM COMPONENTS ADDRESSABLE DEVICES**
- 2.5.1 Addressable Devices General
- .1 Addressable devices shall provide an address setting means using rotary decimal switches.
 - .2 Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches. Devices which use a binary address or special tools

for setting the device address, such as a dip switch are not an allowable substitute.

- .3 Detectors shall be Analogue and Addressable, and shall connect to the fire alarm control panel's Signalling Line Circuits.
- .4 Addressable smoke and thermal detectors shall provide dual (2) status LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs can be programmed off via the fire control panel program.
- .5 The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity can be automatically adjusted by the panel on a time of day basis.
- .6 Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by ULC as meeting the calibrated sensitivity test requirements of CAN/ULC-S529 Smoke Detector.
- .7 The detectors shall be ceiling mount and shall include a separate twist lock base which includes a tamper proof feature.
- .8 The following bases and auxiliary functions shall be available:
 - .1 Sounder base rated at 85 dBA minimum.
 - .2 Form C Relay base rated 30VDC, 2.0A
 - .3 Isolator base
- .9 The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
- .10 Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (example: ION, PHOTO, THERMAL).

2.5.2 Addressable Manual Fire Alarm Box (manual pull station)

- .1 Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
- .2 All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
- .3 Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

- .4 The manual pull station shall be provided with a shield assembly of clear Lexan polycarbonate and associated mounting hardware that must be lifted to use the manual pull station. The shield shall accommodate the size of the manual pull station. The shield shall be provided with a battery-powered horn sounding 86 dB at 10 feet when the shield is lifted. The horn shall be provided with a 9V battery. The fire alarm system shall not be activated when the shield is lifted.

2.5.3 Intelligent Photoelectric Smoke Detector

- .1 The detectors shall use the photoelectric (light scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analogue level of smoke density.

2.5.4 Intelligent Laser Photo Smoke Detector

- .1 The intelligent laser photo smoke detector shall be a spot type detector that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.
- .2 The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
- .3 The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.
- .4 The laser detector shall not require expensive conduit, special fittings or PVC pipe.
- .5 The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
- .6 The laser photo detector shall not require other cleaning requirements than those listed in CAN/ULC-S529 Smoke Detector. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
- .7 The laser photo detector shall include two bi-colour LEDs that flash green in normal operation and turn on steady red in alarm.

2.5.5 Intelligent Ionization Smoke Detector

- .1 The detectors shall use the dual chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analogue level of products of combustion.

2.5.6 Intelligent Multi Criteria Acclimating Detector

- .1 The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector

shall utilize advanced electronics that react to slow smouldering fires and thermal properties all within a single sensing device.

- .2 The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
- .3 The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

2.5.7 Intelligent Thermal Detectors

- .1 Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate of rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signalling line circuit.

2.5.8 Intelligent Duct Smoke Detector

- .1 The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analogue monitoring and alarm verification from the panel.
- .2 When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

2.5.9 Addressable Dry Contact Monitor Module

- .1 Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel DCLs.
- .2 The IDC zone shall be suitable for Class A operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- .3 For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 23/ 4 inch (70 mm) x 11/ 4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include an LED.

2.5.10 Two Wire Detector Monitor Module

- .1 Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2 wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

- .2 The IDC zone may be wired for Class A operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

2.5.11 Addressable Control Module

- .1 Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered polarized audio/visual notification appliances.
- .2 The control module NAC shall be wired for Class A with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
- .3 Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised ULC listed remote power supply.
- .4 The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

2.5.12 Addressable Relay Module

- .1 Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

2.5.13 Isolator Module

- .1 Isolator modules shall be provided to automatically isolate wire to wire short circuits on a DCL Class A branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the DCL loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
- .2 If a wire to wire short occurs, the isolator module shall automatically open circuit (disconnect) the DCL. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- .3 The isolator module shall not require address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- .4 The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.5.14 Smoke Control Annunciator

- .1 On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell

pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the National Building Code of Canada, and CAN/ULC-S527.

- .2 The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDs and one momentary switch which allow the following functions: An Amber LED to indicate an OFFNORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
- .3 Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
- .4 All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
- .5 It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.5.15 Serially Connected Annunciator Requirements

- .1 The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi drop) two wire communications loop. The system shall support two 6,000 ft. EIA485 wire runs. Up to 32 annunciators, each configured up to 64 points, may be connected to the connection, for a system capacity of 2,048 points of annunciation.
- .2 An EIA485 repeater shall be available to extend the EIA485 wire distance in 3,000 ft. increments. An optional version shall allow the EIA485 circuit to be transmitted over fibre optics. The repeater shall be ULC listed.
- .3 Each annunciator shall provide up to 64 alarm and 65 trouble indications using a long life programmable colour LED's. Up to 64 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ONLINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
- .4 The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
- .5 Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.

- .6 An optional module shall be available to utilize annunciator points to drive EIA485 driven relays. This shall extend the system point capacity by 2,048 remote contacts.
- .7 The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

2.6 **BATTERIES AND EXTERNAL CHARGER**

2.6.1 Battery:

- .1 Shall be 12 volt, Gel Cell type.
- .2 Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
- .3 The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

2.6.2 External Battery Charger:

- .1 Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120/240volt 50/60 hertz source.
- .2 Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
- .3 Shall have protection to prevent discharge through the charger.
- .4 Shall have protection for overloads and short circuits on both AC and DC sides.

2.7 **RELAYS AND SWITCHES**

- 2.7.1 Provide double voltage relays as required. Double voltage relays shall be electrically operated, electrically held with coils of the voltage as required to suit the particular control scheme.
- 2.7.2 Relays, other than double voltage, for contact current of up to 10 amperes shall be electrically operated, electrically held and shall have coils of the voltage and the number of contacts to suit the particular control scheme.
- 2.7.3 Relays mounted in panels shall be of the open type and those mounted remotely shall be in their own heavy duty enclosures.
- 2.7.4 Water flow switches, ULC approved, shall be installed where called for on drawings and where required by applicable codes. The flow switch shall be connected to indicate alarm on the fire alarm panel. Flow switch shall be Potter type VSR-F or approved equal.
- 2.7.5 Valve limit switches, ULC approved, shall be installed where called for valve limit switches shall be Potter OSYSU-A or approved equal. Where a valve receives a specialized valve supervisory switch provide such switches.

2.8 **POWER FILTER**

2.8.1 Provide an external power filter – Total Protection Solutions by Joslyn, Load Track LTE model TK-LTE120-30A-RJ, 120V, 1P, 2W+Grd. as close to the fire alarm control panel as possible. Performance characteristics include:

- .1 Enhanced Transient Filter (ETF).
- .2 UL 1449, UL1283, UL479A approved.
- .3 Peak surge current 70kA per phase.
- .4 Filters with gas tubes, spark gaps, silicon avalanche diodes will not be acceptable.

2.9 **REMOTE LCD ANNUNCIATOR:**

2.9.1 The existing annunciator shall be reused and expanded to provide annunciation for the new zones.

2.9.2 Annunciator shall have LCD display with 24 lines of 40 characters each. Annunciator shall be provided with programmable control switches and associated LEDs.

2.9.3 Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.

2.9.4 Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

2.9.5 The LCD shall display the following information relative to the abnormal condition of a point in the system:

- .1 40 character custom location label.
- .2 Type of device (e.g., smoke, pull station, waterflow).
- .3 Point status (e.g., alarm, trouble).

2.9.6 Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable when the LCD is placed in "disabled" mode. Acknowledge, Silence and Reset operation shall be the same as the FACP.

2.10 **PASSIVE GRAPHIC PLAN:**

2.10.1 Passive graphic plan to be a minimum 297mm x 420mm wall mounted pictorial representation of the building indicating building outline with fire detection zones. The plan shall indicate separately all levels, with appropriate zones showing exit doors, stairwells and elevators, main power supply, fire alarm panel, annunciator, sprinkler system and other monitored components. Graphic plan to be engraved on acrylic material and installed beside annunciator panel depicting proper orientation. Annunciator location to be engraved in red. Ensure graphic building plan corresponds with 'Fire Safety Plan' drawings.

2.11 **MONITORING PANEL:**

- 2.11.1 Actuation of any fire alarm initiating devices shall cause the system local alarm panel to transmit a digital signal, on the location any type of alarm, to a central alarm monitoring location and to annunciate it on the local keypad.
- 2.11.2 Monitoring of the system shall be by way a ULC Listed module complete with dual line digital communicator installed and operating in conformance with the standards noted in OBC 3.2.4.7.4. Submit ULC certificate certifying installation and monitoring.
- 2.11.3 Provide monitoring panel and all required assembly adjacent to FACP. Monitoring panel to be DSC PC1832 by Fire Monitoring Of Canada and provided with "CAN ULC S561 Certificate". Final location of monitoring panel to be determined on site in case of not adequate space adjacent to FACP.

2.12 **FIRE ALARM SYSTEM INITIATED FAN SHUT-DOWN**

- 2.12.1 Where required and scheduled on the drawings, interlock fan starters and control panels with the building fire alarm system so that upon actuation of the alarm system the fans will shut down as required. Suitable contacts shall be provided in the fan starters for fire alarm shut down or start up interlocking wiring. Connect sprinkler system alarm contacts into the fire alarm system so that a flow of water through the sprinkler system will actuate the fire alarm system. Connect the sprinkler supervisory contacts into the fire alarm system so that a trouble alarm is initiated when required. Verify interlocking of fan starters after new fire alarm control panels have been installed.

3 **EXECUTION**

3.1 **INSTALLATION**

- 3.1.1 Installation shall be in accordance with the CAN/ULC S-524 Installation of Fire Alarm standard, local and provincial codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- 3.1.2 All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- 3.1.3 All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- 3.1.4 Manual Pull Stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 1050mm and not less than 1200mm to the top of the device, above the finished floor.

3.2 **TYPICAL OPERATION**

- 3.2.1 Actuation of any manual station, smoke detector heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:

- .1 Activate all programmed NAC circuits.
- .2 Actuate all strobe units until the panel is reset.
- .3 Release all door locks controlled by security panel at doors to adjacent zones on the floor from that the alarm was initiated.
- .4 Duct type smoke detectors shall, in addition to the above functions shut down the ventilation system or close associated control dampers as appropriate.
- .5 Activation of any sprinkler system low pressure switch or valve tamper switch shall cause a system supervisory alarm indication.

3.3 TESTING

- 3.3.1 Provide the service of a competent, factory trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with CAN/ULC S537.
- 3.3.2 Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- 3.3.3 Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- 3.3.4 Verify activation of all flow switches.
- 3.3.5 Open initiating device circuits and verify that the trouble signal actuates.
- 3.3.6 Open Data Communication Link and verify that the trouble signal actuates.
- 3.3.7 Open and short notification appliance circuits and verify that trouble signal actuates.
- 3.3.8 Ground initiating device circuits and verify response of trouble signals.
- 3.3.9 Ground Data Communication Link and verify response of trouble signals.
- 3.3.10 Ground notification appliance circuits and verify response of trouble signals.
- 3.3.11 Check presence and audibility of tone at all alarm notification devices.
- 3.3.12 Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.
- 3.3.13 Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- 3.3.14 When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.4 **FINAL INSPECTION**

- 3.4.1 At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.
- 3.4.2 Contractor to coordinate for the inspection and provide the consultant and Client with a copy of final inspection report.

3.5 **INSTRUCTION**

- 3.5.1 Provide instruction as required for operating the system. Hands on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- 3.5.2 Instruct and demonstrate operation of manual pull station covers and that the covers themselves do not activate the fire alarm system alarm condition.
- 3.5.3 The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."
- 3.5.4 Provide in the operations and maintenance manuals sequences of operation, maintenance instructions, the final set of shop drawings, device list, as-built wiring diagrams and plans showing the as-built wiring run configurations.

3.6 **COMMISSIONING OF THE FIRE ALARM SYSTEM**

- 3.6.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).
- 3.6.2 The GC is responsible to co-ordinate the Fire Alarm System Contractor and the BAS Contractor to install and commission the Fire Alarm System complete with all devices.
- 3.6.3 The GC shall include the costs of and co-ordinate the work of the Fire Alarm System Contractor and the BAS Contractor through the mock-up phase and through to project completion.

END OF SECTION 16721

1 GENERAL

1.1 WORK INCLUDED

- 1.1.1 Provide telephone handsets and data outlets in day-care new rooms complete with data/voice cables back to existing telephone backboard in existing electrical room and network switch in existing LAN room.
- 1.1.2 Provide all communication cables, power distribution, conduit, junction boxes, pull strings and rough-ins necessary to operate the telephone handsets and data outlets. All wiring shall be new in new conduit.
- 1.1.3 The GC shall include the costs to provide the services of Huronia Alarms to perform the work.

1.2 SUBMITTALS

- 1.2.1 Refer to Division 1 General Requirements and submit shop drawings for the following:

- .1 Handsets
- .2 Data Outlets
- .3 Cables
- .4 Racks
- .5 Media Convertors
- .6 Patch Panels

1.3 QUALITY ASSURANCE

- 1.3.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.3.2 The General Contractor (GC) is responsible to co-ordinate the Security System Contractor and the BAS Contractor to provide and commission the security system in conjunction with the Building Automation System.
- 1.3.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- 1.3.4 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval.
- 1.3.5 Provide all products and services in accordance with the following codes and standards:
 - .1 OESC - Ontario Electrical Safety Code
 - .2 CSA - Canadian Standards Association
 - .3 UL/C - Underwriters' Laboratories of Canada

1.4 RELATED SECTIONS

- 1.4.1 Section 16100 – Electrical Basic Materials and Methods

2 PRODUCTS

2.1 TELEPHONE AND DATA OUTLET COMPONENTS

- 2.1.1 Handsets shall be Avaya J129 or approved equivalent. Handset model and programming to be co-ordinated with Simcoe Muskoka Catholic District School Board.
- 2.1.2 Each voice/data outlet requires two CAT-6 data cables. These outlets are to support both voice and data. All horizontal network / voice cables are to be blue in colour.
- 2.1.3 Data and telephone outlets shall have adhesive label indicating source/terminal. Finishes of data and telephone outlets to be co-ordinated with the architect.

2.2 CAT6 CABLES AND PATCH PANELS

- 2.2.1 All horizontal data cables are to be Category 6 type and adhere to the following conditions:
 - .1 All cables being installed shall be fully terminated at both ends unless otherwise specified.
 - .2 Patch panel terminations shall meet or exceed the TIA/EIA T568a Category 6 cable installation standards.
 - .3 End devices shall be fully terminated to T568-A standards on modular wall face plates or surface mount boxes as specified by Owner.
 - .4 All cable runs shall conform to TIA/EIA Category 6 Installation specifications and guidelines.
 - .5 Cable bundles shall not exceed more than 25 cables and be secured with either Velcro type cable ties.
 - .6 All cables shall be secured to all available cable raceways and under floor trays with Velcro type ties.
- 2.2.2 Labelling of all cables shall have at each end as a minimum the cable identifier, source and destination codes.
- 2.2.3 Provide network patch panels with a minimum of 24 ports each.
- 2.2.4 All patch panels at network racks shall be of flat type. These patch panels shall to be installed as per the rack elevation drawings.
- 2.2.5 Cat-6 patch panels designated as "Data" patch panels will only terminate cables designated for data transmission.
- 2.2.6 Cat-6 patch panels designated as "telephone" or "voice" patch panels will only terminate cables designated as voice or telephone (including VoIP) transmissions.
- 2.2.7 Each Patch panel will be labelled as per the Owner's IT labelling standards.
- 2.2.8 All punch down terminations shall conform to TIA/EIA T568-A standard and meet all requirements for Category 6 cable installation.
- 2.2.9 Patch panels shall be Panduit CPP24FMWBLY or approved equal and shall have the following features:

- .1 Rear mounted faceplates allow modules to be flush with front of patch panel
- .2 Accept Modules for UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes
- .3 Pre-printed numbers above each port for easy identification
- .4 White write-on areas for port and/or panel identification
- .5 Mount to standard EIA 19" racks or 23" racks with optional extender brackets
- .6 Have minimum 24 spaces available for modules
- .7 Shall be flat patch panel type.

2.3 FIBER OPTIC CABLES AND PATCH PANELS

2.3.1 Multi-Mode Fiber Cable

- .1 Cable shall be OM3 50/125micron core/cladding, enhanced grade, multimode, and graded index glass fiber. All materials in the cable shall be dielectric.
- .2 The manufacturer shall be Corning Cable Systems or approved equivalent.
- .3 Cable shall be comprised of individually jacketed, and uniquely identified fibers with an overall orange sheath suitable for outdoor underground installation.
- .4 Multi-Mode Performance
 - .1 Installed fiber shall meet or exceed the following performance specifications.

Wavelength (nm)	Max. Attn. (dB/Km)	Min Bandwidth (Mhz*Km)
850	3.0	1500
1300	1.0	500

- .2 Indoor Plenum / Riser Cable
 - .1 Plenum rated cable shall be used for all interior installations. Installed cable shall meet or exceed the following specifications:
 - .2 Tight buffered 900 um, mechanical strippable Teflon (for plenum applications).
 - .3 EIA/TIA -598 color coding for fiber optic cable.
 - .4 Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
 - .5 Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
 - .6 Capable of a minimum crush resistance of 850 lb./in.
- .5 Fiber Patch Cables
 - .1 All fiber patch cables will be Panduit Opti-Core 10gig 50/125 or 9/125 as required or approved equivalent manufacturer. All fiber patch cables shall conform to industry standard colour identification for single, multi, and 10GbE requirements.

- .6 Fiber Termination
 - .1 All backbone and field fiber cables are to be terminated at the appropriate rack-mounted patch panel. This is to be sized according to the number of strands being terminated, and is to allow for 50% future expansion. All strands of each cable are to be terminated using LC type connectors. A minimum of 3 meters of slack cable is to be left.
 - .2 All strands are to be extended to the appropriate rack-mounted fiber termination enclosure using LC type terminations at the rack patch panel. These are to be enclosed in Core Flex or other protective flexible ENT conduit orange in colour. This conduit is to terminate within the rack fiber enclosure patch panel tray.
- .7 Fiber Optic Media Converters
 - .1 Fiber optic media converters to be manufactured by IFS, Perle or approved equivalent.
 - .2 Media convertors shall be housed in a modular chassis type enclosure readily mountable into the rack.
 - .3 All media convertors in the chassis shall share the same power source.
 - .4 The chassis shall function so that the media convertor modules can be inserted and removed with no impact to the rest of the system. Upon insertion, a media convertor module shall automatically draw power and begin functioning. It shall be possible to place modules in any slot and in any order.
 - .5 Converters shall be provided to serve all devices requiring fiber optic cables.

2.4 RACKS

- 2.4.1 Network rack in daycare office shall be Middle Atlantic model no. MFR-1627KM or approved equivalent. Contractor shall co-ordinate this model with the Simcoe Muskoka Catholic District School Board IT department at time of construction.
- 2.4.2 The General Contractor shall confirm the finish with the architect prior order.
- 2.4.3 The rack shall feature a plexiglass front door.
- 2.4.4 All rack doors shall be lockable. Contractor shall provide locking to Simcoe Muskoka Catholic District School Board standard.
- 2.4.5 The rack shall feature passive cooling.
- 2.4.6 The rack dimensions shall be 575mmWx862mmHx695mmD and feature 16 standard rack unit spaces.
- 2.4.7 Contractor shall provide rack complete with mounting rails and hardware for mounting equipment.
- 2.4.8 The rack power distribution unit shall be Middle Atlantic model no. PD-815RA-PL or approved equivalent.
- 2.4.9 The contractor shall provide power distribution equipment in the rack to serve the devices mounted in the rack.

3 EXECUTION

3.1 INSTALLATION OF TELEPHONE AND DATA SYSTEMS COMPONENTS

- .1 Handsets shall be installed on classroom control panels such that they cannot easily be knocked over when a user enters/exits the room or uses the thermostat or dimming switches.
- .2 All cables shall be new and installed in new conduit. Minimum conduit size is 21mm.
- .3 Route all cables and cable raceways parallel to or perpendicular to building structure.
- .4 All cables shall be installed as single continuous "home-run" pulls from connector block to connector block, or from rack in the communications room to device.
- .5 All data/communication cables shall be installed in conduit.
- .6 Communication cable and infrastructure shall be independently supported.
- .7 Minimum clearance distance requirements shall be observed:
 - .1 125 mm from power lines of 2 KVA or less.
 - .2 305 mm from high voltage lighting (including fluorescent).
 - .3 1000 mm from transformers and motors
- .8 All cable shall be free of tension at both ends as well as over the length of the run.
- .9 Contractor shall take care to assure that during and upon completion of the installation, all cables are free of kinks, sharp bends, twists, gouges, cuts or any other physical damage which may cause physical or electrical characteristic alterations to the cables.
- .10 Contractor to observe all minimum bend radius and tension limitations, etc., as specified by the cable manufacturer when installing the cables.
- .11 Co-ordinate connection to the network switch and telephone backboard with Simcoe Muskoka Catholic District School Board. Provide all of the necessary cables in conduit.
- .12 CAT 6 Cable Testing
 - .1 Upon completion of the cable installation, the Contractor shall perform complete copper cable certification tests, according to all manufacturer's requirements for warranty and all testing required by TIA/EIA, including, but not limited to:
 - .1 Continuity checks on each cable, checking for opens and shorts.
 - .2 Cable length (Channel and Permanent Link).
 - .3 Correct pair polarity.
 - .4 Correct cable labelling at both ends.
 - .2 All installed Category 6 cabling shall be tested to certification levels based on industry standards. Every cable link in the installation will be tested for the following and meet or exceed Category 6 standards:
 - .1 Wire Map
 - .2 Length
 - .3 Insertion Loss
 - .4 NEXT Loss
 - .5 PS NEXT Loss
 - .6 ACR-F Loss
 - .7 PS ACR-F Loss

- .8 Return Loss
 - .9 Propagation Delay
 - .10 Delay Skew
 - .3 Descriptions of the proposed calibration procedure shall be submitted to the Consultant for approval prior to beginning any testing.
 - .4 The installed twisted-pair horizontal links shall be tested from the Intermediate Distribution Frame (IDF) in the communication room to the telecommunication wall outlet in the work area for compliance with the "Permanent Link" performance specification as defined in the Category 6 Standard.
 - .5 The installed twisted-pair backbone links shall be tested from end to end for compliance with the "Permanent Link" performance specification as defined in the Category 6 Standard.
 - .6 Tests shall be performed with connectors installed.
 - .7 Any cable or component not satisfactorily passing tests or failing to meet quality
 - .8 Installation standards as described in the specification shall be repaired and/or replaced as directed by the Consultant at the Contractor's expense.
 - .9 The Contractor shall prepare complete cable test reports for all installed cables for review and acceptance by the Consultant prior to acceptance of the cabling system.
 - .10 The cable tester shall be calibrated to the type of cable being tested prior to beginning the cable certifications.
 - .11 An Owner's representative shall be invited to witness the field testing. The representative shall be notified 5 business days prior to the start of the testing. All test results shall be provided to the Owner before the job will be considered complete.
- .13 Fiber Optic Cable Installation and Testing
- .1 Each strand of fiber in a cable shall be tested with an OTDR for length and transmission anomalies while on the reel before installation.
 - .2 After Installation and Termination:
 - .1 All multi-mode fiber strands shall be tested end-to-end for bi-directional attenuation, 850 nm/1300 nm. Tests shall be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer's instructions for the test set being utilized.
 - .2 Tests shall ensure that the measured link loss for each strand does not exceed the "worst case" allowable loss defined as the sum of the connector loss (based on the number of mated connector pairs at the EIA/TIA-568 B maximum allowable loss of 0.75 dB per mated pair) and the optical loss (based on the performance standard above)
 - .3 After termination, each fiber shall be tested with an ODTR for length, transmission anomalies, and end-to- end attenuation. Results shall be recorded and supplied to Owner in the operations and maintenance manuals.
 - .4 After termination and bulkhead mounting, each terminated fiber shall be tested for end-to-end loss with a power meter/light source. Results shall be recorded and supplied to Owner in the operations and maintenance manuals.
 - .5 The maximum allowable attenuation for any splice or termination is 0.3 dB
 - .6 The contractor shall review all end faces of field terminated connectors with a fiber inspection scope following the final polish. Connector end faces with

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hackles, scratches, cracks, chips and or surface pitting shall be rejected and re-polished or replaced if re-polishing will not remove the end face surface defects. The recommended minimum viewing magnifications for connector ends are 100X for multimode fiber.

- .14 Contractor shall co-ordinate rack associated junction and outlet box locations in daycare office with Simcoe Muskoka Catholic District School Board prior installation of conduits for power and communications cables.
- .15 Commissioning of the Telephone and Data Systems Components
 - .1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).
 - .2 The GC is responsible to co-ordinate with the relevant trades to commission the telephone and data communications network system.
 - .3 The GC shall include the costs of and co-ordinate the work of the Telephone and Data System Contractor and the other relevant trades through the mock-up phase and through to project completion

END OF SECTION 16745

1 GENERAL

1.1 WORK INCLUDED

- 1.1.1 Provide intercom devices at daycare entrance and daycare office. The daycare office intercom device shall be the master unit.
- 1.1.2 Provide a standalone universal washroom door controller and emergency flasher system complete with push button and emergency sign in universal washroom room #173. The sign shall read "IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY BUTTON AND AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE".
- 1.1.3 Provide emergency call button intercom devices at daycare office and universal washroom. The daycare office intercom device shall be the master unit.
- 1.1.4 Provide all communication cables, power distribution, conduit, junction boxes, rough-ins and configuration necessary to operate the intercom devices. All wiring shall be new in new conduit.
- 1.1.5 The GC shall include the costs to provide the services of Huronia Alarms to perform the work.

1.2 SUBMITTALS

- 1.2.1 Refer to Division 1 General Requirements and submit shop drawings for the following:
 - .1 Daycare entrance intercom devices
 - .2 Universal washroom emergency call intercom devices

1.3 QUALITY ASSURANCE

- 1.3.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.3.2 The General Contractor (GC) is responsible to co-ordinate the Intercom System Contractor and the other relevant trades to provide and commission the intercom systems in conjunction with the other relevant work.
- 1.3.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- 1.3.4 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval.
- 1.3.5 Provide all products and services in accordance with the following codes and standards:
 - .1 OESC - Ontario Electrical Safety Code
 - .2 CSA - Canadian Standards Association
 - .3 UL/C - Underwriters' Laboratories of Canada

1.4 RELATED SECTIONS

- 1.4.1 Section 16100 – Electrical Basic Materials and Methods

2 PRODUCTS

2.1 DAYCARE ENTRANCE INTERCOM SYSTEM

- 2.1.1 The intercom devices at daycare entrances shall be manufactured by Aiphone.
- 2.1.2 The intercom devices shall include a master station located in the daycare office and a substation located at the entrance monitored.
- 2.1.3 Wiring between the master station and substation shall be minimum 2#16AWG+GRD in minimum 21mm conduit.
- 2.1.4 The substation shall feature:
 - .1 A colour video camera with audio intercom.
 - .2 Pan-tilt-zoom camera lens controlled by master station.
 - .3 Call button at substation to initiate call to master station.
 - .4 Substation shall feature white LED for use in low-light conditions.
- 2.1.5 The master intercom station shall be Aiphone model no. JK-1MD.
- 2.1.6 The intercom substation at the daycare entrance shall be Aiphone model no. JK-DV.

2.2 UNIVERSAL WASHROOM EMERGENCY CALL INTERCOM DEVICES

- 2.2.1 The universal washroom emergency call intercom devices shall be manufactured by Aiphone.
- 2.2.2 The intercom devices shall include a master station located in the daycare office and a substation located at the universal washroom.
- 2.2.3 Wiring between the master station and substation shall be minimum 2#16AWG+GRD in minimum 21mm conduit.
- 2.2.4 The substation shall feature:
 - .1 Call button at substation to initiate call to master station. Call button shall be red mushroom SPST switch.
 - .2 Communication shall be hands-free after actuation of the push button at the substation. Communication at master station shall be push to talk and release to listen.
- 2.2.5 The master intercom station shall be Aiphone model no. LEM-1.
- 2.2.6 The intercom substation at the universal washroom shall be Aiphone model no. LE-SSR.
- 2.2.7 The intercom station in the universal washroom shall be labeled with a sign that contains the words "CALL DAYCARE RECEPTION" in letters at least 25 mm high with a 5 mm stroke and that is posted above the intercom station in the universal washroom.

3 EXECUTION

3.1 INSTALLATION OF INTERCOM SYSTEM COMPONENTS

- .1 All wiring shall be new and installed in new conduit. Minimum wiring size is #16 or as required by device supplier. Minimum conduit size is 21mm.
- .2 Provide power circuits, rough-ins, communications cables, conduit, junction boxes and pull strings to serve the devices.
- .3 Co-ordinate mounting height, position and depth of substation devices at entrance and in universal washroom with architect.
- .4 Co-ordinate mounting of master station in daycare office with architect, Simcoe Muskoka Catholic School Board, principal, head caretaker and daycare administration.
- .5 Co-ordinate the locations of the master intercom units for the daycare entrance and the universal washroom emergency call system communications devices in main office with architect, Simcoe Muskoka Catholic School Board, principal, head caretaker, daycare administration and Ontario Building Code requirements.
- .6 Commissioning of the Intercom System and Universal Washroom Emergency Call System
 - .1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).
 - .2 The GC is responsible to co-ordinate the Intercom System and Universal Washroom Emergency Call System Contractor and the other relevant trades to provide and commission the intercom systems complete with devices and programming.
 - .3 The GC shall include the costs of and co-ordinate the work of the Intercom System Contractor and the other relevant trades through the mock-up phase and through to project completion.

END OF SECTION 16762

1 GENERAL

1.1 WORK INCLUDED

- 1.1.1 Provide new equipment including speakers and handsets for the new addition (Day-Care) wired and controlled from the existing public address system as shown. The existing public address system is Bogen Multicom 2000.
- 1.1.2 Provide all communication cables, power distribution, conduit, junction boxes, pull strings and rough-ins necessary to operate the public address system. All wiring shall be new in new conduit.

1.2 SUBMITTALS

- 1.2.1 Submit shop drawings for all components of the public address system and a riser diagram indicating all components and wiring details for each system.

1.3 QUALITY ASSURANCE

- 1.3.1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program)
- 1.3.2 The General Contractor (GC) is responsible to co-ordinate the Public Address System Contractor and the other relevant trades to provide and commission the public address system in conjunction with other relevant work.
- 1.3.3 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- 1.3.4 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval.
- 1.3.5 Provide all products and services in accordance with the following codes and standards:
 - .1 OESC - Ontario Electrical Safety Code
 - .2 CSA - Canadian Standards Association
 - .3 UL/C - Underwriters' Laboratories of Canada

1.4 RELATED SECTIONS

- 1.4.1 Section 16100 – Electrical Basic Materials and Methods

2 PRODUCTS

2.1 PUBLIC ADDRESS SYSTEM

- 2.1.1 Administrative stations shall consist of DTMF dialling telephone sets with a four line by 16-character LCD display panel. They shall be equipped with a standard 12 key push button dialling keypad. Additionally, there shall be nine dedicated function keys, three programmable "soft keys", and ten programmable "speed dial" keys. The unit shall also feature a handsfree speakerphone. The user shall maintain control over the ring volume, speakerphone volume, and the handset volume. Phones utilizing membrane-type keypads or requiring special function keys to perform common functions shall not be accepted as an equal. Optionally, a loudspeaker may be connected at each administrative station location.

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There shall be provision to monitor the status of the outside lines interconnected to the system. It shall also be possible to place outside line calls on hold by use of the "hold key".

- 2.1.2 All types of stations shall utilize the same type of field wiring. Future station alterations to require only station type change, not field wiring or system head-end alterations. All field wiring and system head-end equipment shall support any type of station, at the time of installation. If the enhanced capabilities of the administrative stations are required, an additional two conductors shall be provided to each administrative station to facilitate this purpose.
- 2.1.3 There shall be no limit to the number of administrative display stations within the total capacity of the system (e.g. a 240 station will support 240 administrative display stations).
- 2.1.4 It shall be possible at any time to change the type of station at any location without extensive rewiring. Systems which limit the quantity of each station type, or require future additional equipment and/or system expansion to provide additional administrative telephones shall not be accepted as an equal.
- 2.1.5 It is of utmost importance that emergency calls from staff stations receive prompt attention. It is therefore, important that there be an alternate destination in case the call does not get answered at the primary location. To this end:
- 2.1.6 Staff generated Emergency calls shall be treated as the highest system priority. Therefore, all Emergency calls shall announce at the top of the call queue of their respective administrative telephone(s). Should that emergency call go unanswered for 15 seconds, the call should re-route to an alternate speaker station then prompt the caller to make a verbal call for help. During the transfer, the original administrative telephone shall continue to ring the distinctive Emergency ring. Should the Emergency transfer to station have an associated administrative telephone; it too shall ring the distinctive Emergency ring.
- 2.1.7 The Emergency transfer to station shall be field programmable.
- 2.1.8 Should the original administrative telephone be engaged in a non-emergency conversation, its conversation shall be automatically terminated, indicated with an alert tone, and then reconnected to the station, which generated the Emergency call.
- 2.1.9 Should the administrative telephone be engaged in an Emergency conversation, successive emergency calls shall log into the call queue as well as transfer to the emergency transfer station for their verbal call for help. Upon termination of the initial emergency conversation, the next one shall immediately ring the administrative telephone.
- 2.1.10 Systems failing to transfer unanswered Emergency calls or failing to immediately connect to the administrative telephone shall not be deemed as equal.
- 2.1.11 There shall be a system facility-wide emergency all-call feature. The emergency all-call shall be accessed by dialling "911" from designated administrative phones or by the activation of an external contact closure which shall give the third audio program input emergency status. The Emergency "911" all-call function shall have the highest system priority and shall override all other loudspeaker related functions including time tone distribution. Considering that emergencies are to be treated with the highest level of concern, systems in which the Emergency-All-Call page from an administrative telephone is not the highest priority shall not be deemed as equal. Upon picking up the receiver and dialling "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not

be required to memorize complicated key sequences in order to access emergency functions. The emergency all-call shall capture complete system priority, shall be transmitted over all speakers. It shall also activate an external relay, which can be used to automatically override other systems. Systems without emergency all-call, or systems with all-call that cannot be activated by external means, or which do not capture complete system priority or activate an external relay, shall not be acceptable.

- 2.1.12 There shall be at least four built-in dedicated emergency alarm tones. Each may be accessed by dialling a three-digit number (912 through 915) from designated administrative telephones. These emergency tones should be separate from the time tones. Systems using external alarm generators, or having less than four emergency alarm tones shall not be acceptable. Upon picking up the receiver and dialling "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access emergency alarm tones.
- 2.1.13 There shall be four (4) external-function relay driver outputs, accessible from designated administrative telephones by dialling a four-digit number. These outputs remain set until accessed and reset at a later time. The user shall have the ability to review the status of each relay driver. This feature may also be pre-programmed by the user so that automatic activity of this driver occurs. This feature shall be supported by a plain English menu, prompting the user through the fields without requiring the user to remember any dialling sequences. Systems, which require the user to remember any dialling sequences, or systems, which require the user to remember, complicated dialling schemes or prompt the user via cryptic commands shall not be deemed equal. Systems without relay driver outputs for control of external functions shall not be acceptable. Upon picking up the receiver and dialling "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access external relay functions.
- 2.1.14 There shall be a program-material interface included, which shall accept up to three (3) Bogen D-Series program modules. Systems requiring an external program source interface shall not be acceptable.
- 2.1.15 There shall be an optional outside line feature. The optional circuitry shall interface with the station ports of an external telephone system, and shall provide facilities for up to sixteen (16) incoming lines which shall be designated by the user to ring "day" and "night" enhanced staff or administrative stations. Where an administrative station is designated to receive outside line calls, the phone shall ring with a unique tone and the outside line number shall appear on the display panel. The option shall also provide the ability to make outside line calls from enhanced staff or administrative stations. This ability shall be programmable for each phone and there shall be three (3) access levels: no access, restricted access (local calls only), or unrestricted access (local and long-distance calls). This feature shall be capable of supporting DIL, DISA and a password protected DISA function. Security is of the utmost concern. The password DISA feature shall be accessible only from an off-premise security office, which monitors the facilities security system. It shall function as follows: Upon confirmation of the password DISA number, the system shall allow security personnel to dial access any station and monitor the activity without the preannounce and the privacy tones. This will then allow the security office to determine exactly what actions need to be taken. The monitoring security personnel shall have provision to access other stations should the perpetrator move locations.

- 2.1.16 The system shall provide for field-programmable three or four digit architectural station numbers.
- 2.1.17 An architectural-number/station-number cross-reference shall be field-accessible to facilitate service.
- 2.1.18 There shall be an automatic level control for return speech during amplified-voice communications.
- 2.1.19 Each station loudspeaker shall be assignable to any one, any combination, or all of eight (8) paging zones. Systems with less than eight (8) paging zones shall not be acceptable.
- 2.1.20 Each station loudspeaker shall be assignable to any one, any combination, or all, of eight (8) time-signalling zones. Systems with less than eight (8) time-signalling zones shall not be acceptable.
- 2.1.21 THERE SHALL BE EIGHT (8) TIME-SIGNALLING SCHEDULES WITH A TOTAL OF 1024 USER-PROGRAMMED EVENTS. Each event shall sound one of eight (8) user-selected tones. It shall be possible to assign each schedule to a day of the week, or manually change schedules from an authorized administrative telephone. Systems, which do not provide eight (8) time-signalling schedules or a choice of eight (8) time tones, shall not be acceptable.
- 2.1.22 An internal program clock (with battery back-up) shall be included, allowing a total of 1024 user-programmed events. It shall be possible to synchronize the program clock with an external master clock. Systems, which do not provide an internal program clock not meeting these specifications, shall provide an external program clock that does. This external program clock shall then synchronize daily with the system clock to ensure that all time displays are the same.
- 2.1.23 There shall be eight (8) time signalling schedules. It shall be possible to assign each schedule to a day of the week, or manually change schedules from an authorized administrative telephone.
- 2.1.24 There shall be a zone-page/all-page feature that is accessible by selected enhanced staff and administrative stations.
- 2.1.25 There shall be automatic muting of the loudspeaker in the area where a page is originating.
- 2.1.26 There shall be a pre-announce tone signal at any loudspeaker selected for voice paging. Upon picking up the receiver and dialling "#", a menu shall appear on the display prompting the user to enter the next digit. In this way, the user shall not be required to memorize complicated key sequences in order to access paging functions.
- 2.1.27 There shall be a voice-intercom feature that is accessible by selected enhanced staff stations and all administrative stations.
- 2.1.28 There shall be a periodic privacy tone signal at any loudspeaker selected for amplified-voice communication. These tones shall only occur when the user on the telephonic end is silent for more than fifteen seconds. The fifteen-second timer shall reset it each time the telephonic user finishes speaking. This shall eliminate the periodic interruption of open voice communication, while maintaining monitor signalling to the personnel at the speaker end of the conversation.

- 2.1.29 There shall be a pre-announce tone signal at any loudspeaker selected for voice-intercom communication.
- 2.1.30 Privacy and pre-announce tone signals shall be capable of being disabled during system initialization.
- 2.1.31 There shall be an automatic switchover to private telephone communication should the person at the loudspeaker pick up his handset. Upon picking up the receiver and dialling the first digit of the number of the station to be called, that number shall appear on the display along with a loudspeaker symbol, prompting the user to enter the next digits. There shall be no confusion as to the type of conversation that is to be established.
- 2.1.32 There shall be a telephonic communication feature, which is accessible by all enhanced staff and administrative stations.
- 2.1.33 There shall be an audible ring signal announcing that a call has been placed to that station.
- 2.1.34 Upon picking up the receiver and dialling "****", a telephone symbol shall appear on the display, prompting the user to enter the number of the station to be called. There shall be no confusion as to the type of conversation that is to be established.
- 2.1.35 There shall be an automatic disconnect of staff handsets left off-hook to prevent them from tying up communications channels. The station shall receive a busy signal and shall automatically disconnect after 45 seconds. Systems shall also be capable of doing off hook emergency call in.
- 2.1.36 There shall be an automatic disconnect of administrative and enhanced staff stations to prevent them from tying up communications channels. When a station goes off-hook and does not initiate a call within ten seconds, the station shall receive a busy signal and shall automatically disconnect after 45 more seconds.
- 2.1.37 Staff and enhanced staff stations may be programmed to ring an administrative telephone during day hours and another administrative telephone during night hours. Day and night hours shall be user-programmable. Assignment of staff stations shall not be restricted to any particular administrative station. Systems that limit the number and assignment of staff call-in to particular administrative station or groups of administrative stations shall not be acceptable.
- 2.1.38 Each staff station shall be programmable for three levels of call-in, as follows:
 - .1 Level 1 - Normal/Emergency
 - .2 Level 2 - Urgent/Emergency
 - .3 Level 3 – Emergency
- 2.1.39 Staff stations programmed for access level 1 or 2 shall be able to initiate an emergency call by repeated flashing of the hook switch or repeated pressing of the call-in switch. Systems, which require additional switches and/or conductors to initiate an emergency call, shall not be acceptable.
- 2.1.40 Emergency calls from staff stations shall interrupt a non-emergency call in progress at the designated administrative phone. The administrator shall receive a warning tone and be

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connected to the emergency caller. The disconnected party shall receive a busy signal. Systems, which do not provide emergency call interrupt, shall not be acceptable.

- 2.1.41 It shall be possible to connect a single push emergency call-in switch to any staff or enhanced staff station, without effecting normal station operation.
- 2.1.42 In addition to any of the above, it shall be possible to provide a single push Emergency Call In button, regardless of the stations functional level described above.
- 2.1.43 Calls from staff stations shall be logged into queue for the designated administrative telephones. Administrative phones shall ring for a period of 45 seconds when they receive a call, and then stop ringing:
- 2.1.44 Each queue shall first be sorted according to call priority (emergency calls, then urgent calls, and then normal calls). Calls are sorted within each priority level on a first-in first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems, which do not sort calls according to priority and order received, shall not be acceptable. 1) The display shall simultaneously show up to four calls pending. Additional calls, beyond four (4), shall be indicated by an arrow pointing down thus prompting the user that additional calls are waiting.
- 2.1.45 It shall be possible to answer any incoming call simply by picking up the handset while it is ringing. It shall not be necessary to hit any buttons to answer a call.
- 2.1.46 "Single-Button" response. It shall be possible to answer any incoming staff call after the ringing has stopped by pressing a single button (key) on the administrative telephone. The system shall automatically call the first station shown on the display.
- 2.1.47 If there are any remaining calls on the queue when the administrative phone is hung up, a re-ringing signal shall sound at the phone alerting the user to their presence.
- 2.1.48 It shall be possible to scroll through the call-waiting queue and answer calls in any order. It shall be possible to delete all unanswered normal and urgent calls. Simply pressing the "*" button twice shall auto-dial the station appearing in the top of that current display window.
- 2.1.49 Unanswered normal and urgent calls shall remain in their respective queues for a user-programmable length of time, then be automatically deleted. Emergency calls shall be deleted from their queue only by answering the call.
- 2.1.50 Other than Emergency calls, the user shall have the ability to answer calls in random order. Emergency calls shall be responded to in the order in which they are received.
- 2.1.51 Enhanced staff stations shall receive dial tone upon going off-hook. Outgoing calls are made by dialling the desired station. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switchover from loudspeaker to private telephone communication should the person pick up his handset. Enhanced staff stations shall be programmable for one:
- 2.1.52 Level 4 shall permit dialling any administrative station, toggle program material on/off at their location by use of the telephone dial pad, have access to outside lines (if so authorized), but designated to receive outside line calls, and call-forward to other enhanced staff phones or administrative phones. They shall also have the ability to be programmed to restrict dial access to any other stations telephonic device only.

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- 2.1.53 Level 5 capabilities of the level 4 station plus dial any administrative or staff station phone or loudspeaker and make conference calls or transfer calls.
- 2.1.54 Capabilities of the Level 5 station plus single-zone page and all-zone page. All enhanced staff stations shall be able to initiate an emergency call by flashing the hook switch or utilizing a dedicated Emergency-Call switch. The Emergency-Call switch shall generate the pulses necessary to create an Emergency Call in. Emergency calls shall ring the designated day/night administrative station. If the emergency call is not answered within a predetermined time period the loudspeaker at the calling station will be connected to the emergency station. Telephones with dial pads in the classrooms shall have the ability to generate emergency calls in addition to their normal functions. Systems, which do not allow for Emergency call generation directly from a dial type telephone shall supply separate call switches to meet this function.
- 2.1.55 Enhanced staff stations shall be able to make a normal call to any administrative telephone by dialling the number. Enhanced staff stations shall also be able to initiate an emergency call by flashing the hook switch. Emergency calls shall ring the designated day/night administrative station and then their speaker will be connected to the emergency station if not answered within a predetermined time period.
- 2.1.56 Administrative stations shall receive dial tone upon going off-hook. Outgoing calls are made by dialling the desired stations. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switchover from loudspeaker to private telephone communication should the person pick up his handset. Additionally, the user may answer the call via built in speakerphone, merely by selecting such. System functions are accessed by going off-hook and dialling "9". Further operations are menu assisted in all cases. All administrative telephones shall permit the following operations:
- .1 Direct-dial private two-way telephone communications with other administrative stations, enhanced staff stations and handset stations. This shall not be limited by any station grouping and shall not occupy more than a single communication path.
 - .2 Direct-dial two-way amplified-voice communications with any station loudspeaker. This shall not be limited by any station grouping and shall not occupy more than a single communication path.
 - .3 Toggle reception of program material on/off at their speaker station by use of the telephone dial pad.
 - .4 Administrative stations shall be equipped with a 4-line by 16-character alphanumeric display panel.
 - .5 The display shall normally show the time-of-day and day of week, the current time signalling schedule, and the numbers of up to four stations calling in along with the call-in status of each station (normal, urgent, emergency). Enhanced administrative stations will additionally display the status of the interconnected outside lines and maintain the ability to place those calls on hold. When dialling from the administrative phone, the display shall indicate the station number and type of station (loudspeaker or handset) being dialled.

- .6 The display shall also provide user-friendly menu selections to assist the operator when paging and distributing program material. Displays shall be in English with internationally recognized symbols for maximum ease of use. Systems which require the operator to memorize long lists of operating symbols or control codes shall not be acceptable.

2.1.57 Administrative stations shall be programmable for three levels of system access, as follows:

- .1 Level 7 - Shall permit dialling any station in the system, turn program material on/off at their location, scroll, erase and auto-dial call-waiting queue, make conference calls and transfer calls, call forward to other administrative stations, make all-zone pages and emergency all-zone pages, have access to outside lines and be designated to receive outside line calls.
- .2 Level 8 - Capabilities of the Level 7 station plus select and distribute/cancel program material to and combination of stations, paging zones or all zones; set/reset alarm/external functions and zone page.
- .3 Level 9 - Capabilities of Level 8 station plus bump or join a conversation in progress, manually initiate time tones and have access to system and station programming functions (when accompanied by a valid password).
- .4 Program selection, and its distribution or cancellation shall be accomplished from a designated administrative telephone, with the assistance of the menu display system. Distribution and cancellation shall be to any one, or combination of speakers, or any zone(s), or all zones. Systems, which rely on switch banks to perform the above functions, shall not be accepted as an equal.
- .5 It shall be possible, via an administrative telephone, to manually initiate any of eight (8) tones. The tones shall be separate and distinctly different from the emergency tones. The tone selected shall continue to sound until it is cancelled, or until the administrative phone is placed back on-hook.

2.1.58 Each administrative telephone shall maintain a unique queue of all stations calling that particular phone.

2.1.59 Program selection, distribution or cancellation shall be accomplished from a designated administrative telephone, with the assistance of the menu display system.

2.1.60 Select shall be from any one of three possible audio program inputs, or none.

2.1.61 Distribution and cancellation shall be to any one, or combination of speakers, or any zone(s), or all zones.

2.1.62 Upon selecting a program source, the selecting administrators loudspeaker shall automatically activate and function as a monitor speaker. The loudspeaker shall remain active as long as the administrator is in the program selection/distribution/cancellation menu of the display.

2.1.63 It shall be possible to, at any time, select, redirect or cancel the program distribution to any station, zone or all locations.

2.1.64 Systems, which require the office personnel to leave their workstation and go into the equipment cabinet simply to accomplish these functions, shall not be acceptable.

- 2.1.65 Systems, which rely solely on switch banks to perform the above functions, shall not be accepted as an equal.
- 2.1.66 Upon picking up the receiver and dialling "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access program distribution functions.
- 2.1.67 System programming shall be from an administrative telephone with Level 9 access. All system programming data shall be stored in nonvolatile memory. A valid password shall be required to gain access to the following programmable functions:
- .1 Set Day and Time.
 - .2 Program time-signalling events, time signalling schedules, and assign schedules to days of the week.
 - .3 Program time signalling zones.
 - .4 Program paging zones.
 - .5 Manually change time signalling schedules.
- 2.1.68 Upon picking up the receiver and dialling "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access system-programming functions.
- 2.1.69 System initialization shall be accomplished from an administrative telephone with Level 9 access. All system initialization data shall be stored in nonvolatile memory. A password (separate from the password necessary for system programming) shall be required to gain access to the following system initialization parameters:
- .1 Bell duration for each time zone.
 - .2 Queue timeout.
 - .3 Day start/night start time.
 - .4 Designate emergency station.
 - .5 System programming password.
 - .6 Architectural dialling.
 - .7 Privacy beep.
 - .8 Preannounce tone.
- 2.1.70 Station Initialization shall be accomplished from an administrative phone with Level 9 access. All station initialization data shall be stored in nonvolatile memory. A password (separate from the password necessary for system programming) shall be required to gain access to the following station initialization parameters:
- .1 Set station access level.

- .2 Set station architectural number.
 - .3 Set day administrator.
 - .4 Set night administrator.
 - .5 Assign access to outside lines.
- 2.1.71 The system shall be capable of being interfaced with either an on-site or off-site computer for system configuration programming and system diagnostics. It shall be possible to change the baud rate of the system.
- 2.1.72 Diagnostics shall also be built into the administrative telephones and accessible only by authorized personnel. Diagnostics shall indicate passes and failures of system memory, system clock, all audio busses, tone generators, DTMF generators and decoders and the integrity of the field wiring.
- 2.1.73 The diagnostics feature shall be completely menu driven. It shall be possible to individually select the test and card, or all to run diagnostics on. This shall be a standard feature of the system and supplied at the time of installation. It shall be accessible only by authorized stations and personnel.
- 2.1.74 Systems not capable of supporting the computer interface for programming and diagnostics, nor supportive of built-in diagnostics for the end user shall not be deemed as equal.
- 2.1.75 The system shall provide the capacity to control remotely located telemedia video sources via any DTMF type telephone in the system. Telemedia video sources, which may be controlled, shall include any infrared controllable; videocassette recorder, video laser disk, and cable television converter box. The telemedia control panel shall also have the ability to control infrared controllable; compact disk players, cassette players, AM/FM tuners, or any other infrared controllable source/device.
- 2.1.76 Equipment:
- .1 Provide amplifiers, power supplies, control cards and relay modules at the existing public address system rack necessary to operate the public address system at the new areas.
 - .2 Power Amplifiers shall be HTA-125A-125 watt.
 - .3 Administrative display phones shall be Bogen Model MCDS4 or approved equivalent. The administrative telephone display panel shows the time of day and day of week, the current time signalling schedule, and the station numbers and call-in priority of staff stations that have called that particular administrative station. A single key response is used to scroll the display and auto dial response calls. A two key actuation is required to erase normal and urgent calls. Depending upon the system access level, an administrative station can use display menus to activate zone pages, alarm signals and external functions, as well as select program sources and distribute or cancel a program to any or all speakers or zones. Administrative stations have the option of dialling either the loudspeaker or phone at each station location. An automatic switch from phone-to-intercom to phone-to-phone communication is made when the staff handset is lifted. The administrative station shall contain ten user programmable speed dial function/locations and also three user programmable "soft key" locations.

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There shall be handsfree speakerphone. A built-in program clock, with battery back up, is included to automatically control class change or other signals. The clock may be synchronized with a master clock. 1024 events may be programmed into the system's eight time signalling schedules.

- .4 Room phones shall be Mitel Astra 8004 wall-mounted or approved equivalent. Enhanced staff stations can dial administrative stations, initiate emergency calls, and enable or disable the reception of program material at their location. Depending upon the level of system access, enhanced staff stations can dial other staff stations, perform all-call, zone pages, and conference call and call transfer. Provide as shown on the plans. Staff stations can be assigned to initiate calls at three levels; normal/emergency, urgent/emergency, and emergency. Emergency calls ring the administrative phone with a special tone and will interrupt a non-emergency call in progress. An integral emergency announce feature (no external amplifier necessary) gets prompt attention when needed by routing unanswered emergency calls to a designated emergency station. Emergency calls continue to ring until answered.
- .5 Speakers:
 - .1 Square classroom and corridor speakers and grilles (ceiling mounted-flush) shall be Enforcer Model E86CWT5SA Mounted in an EBB8SF enclosure with T-bar support where required.
 - .2 Round classroom and corridor speakers and grilles (ceiling mounted-flush) shall be Enforcer Model E86CWT5RA Mounted in an EBB8RFS enclosure with T-bar support where required.
 - .3 Square classroom speakers (wall surface mounted) shall be Enforcer Model E86CWT5SABB.
 - .4 Round corridor speakers (ceiling surface mounted) shall be Enforcer Model E86CWT5CC.
 - .5 Outdoor horns shall be Bogen SPT-15A or Enforcer EMH15.
- .6 Wiring shall be done per manufacturer's recommendation, Provo #992252. All terminal connections to be on barrier strips.
 - .1 Classroom and staffroom locations Provo #992252 home run.
 - .2 Speaker to phone (in-room run) Provo #992252.
 - .3 Cabling shall be provided in accordance with requirements of governing authorities and system manufacturer and at least the following minimum requirements:
 - .4 Paging cable for centrally amplified system - 2-pair, solid copper, FT-6 rated, twisted, unshielded cable, of a gauge suitable for the overall design of the system;
 - .5 Paging cable for distributed amplified system - 2-pair, solid copper, FT6 rated, twisted unshielded cable, or a gauge suitable for the overall design of the system;
 - .6 Paging cable for all speakers shall be one (1) pair twisted FT-6 rated, AWG 18 type with an overall PVC jacket, zoned per floor and as shown on riser diagram including exterior;
 - .7 The microphone cable shall be one (1) pair twisted, shielded 22 AWG stranded conductors, PVC jacket.
- .7 Terminal Blocks
 - .1 All conductors in all terminal cabinets, equipment rack, etc., shall be terminated on Bix punch blocks.

3 EXECUTION

3.1 INSTALLATION OF PUBLIC ADDRESS SYSTEM

- 3.1.1 Provide a complete, fully operational public address paging system and install all devices in accordance with the manufacturer's instructions. Desk mount the main control consoles where shown and connect complete. Confirm exact location of outlets with Owner; prior to roughing-in. Provide a main console in each of the Administration office and Principal's room. Paging speakers shall be located throughout the corridors, classrooms, offices, general-purpose rooms and mechanical/electrical rooms. Paging speakers shall be organized in different zones to reduce need for "all -call" paging. Zones can be revised easily at main control console via software programming. Wiring to speakers in classrooms, offices, mechanical/electrical rooms, multi purpose room, staff rooms and caretaker's room, etc. shall be each "home run" back to central equipment location. Corridor speakers shall be grouped in zones.
- 3.1.2 Program the consoles and provide paging in zones in accordance with the Owner's requirements, when installation is complete. Confirm exact requirements with Owner. Paging zones shall be flexibly programmed for each area as follows:
- .1 Each classroom;
 - .2 Corridors (multi-zones per floor);
 - .3 Washrooms zoned with corridors;
 - .4 Gymnasium;
 - .5 Mechanical/electrical rooms;
 - .6 Administration rooms;
 - .7 Exterior.
- 3.1.3 Rack mount central control unit and amplifiers where shown.
- 3.1.4 Provide ceiling speakers in backboxes with baffles where shown, flush with the finished ceiling and walls. Secure backboxes from the structure. Connect complete.
- 3.1.5 Install exterior horn speakers where shown. Provide suitable weather-proof backboxes. Connect complete to control unit via required relays. Confirm exact mounting heights and locations prior to roughing-in.
- .1 Provide microphone jacks where shown including at least one (1) in the administration area and one (1) in Principal's office. Secure each to a single gang flush wall mounted outlet box and connect complete. Microphone jacks shall be "home run" wiring back to central equipment rack.
 - .2 Provide wall mounted speakers and handsets and install in classrooms.
 - .3 Provide new wiring in new conduit to all devices and connect complete.
 - .4 Provide emergency call switches in handicap washrooms as shown.
 - .5 Provide telephone handset with call switch and speakers in mechanical rooms.

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- .6 Label each cable run in 2-places, 3' (1 m) apart, at each end after being pulled and trimmed. Identify runs individually.
- .7 All cabling to be new, FT6 type and installed in new conduit. Minimum conduit size is 21mm when Wiremold is not used. Speaker cable terminations to be punched down into a labelled connection block arrangement (IDC) provided with paging system and be neatly tie wrapped and secured. Speaker runs to be terminated on terminal strips integral with speakers.
- .8 In addition to requirements specified in Section 16010, note that instructions and demonstrations shall be provided for a minimum of 16 hours which shall include a three (3) hour refresher session a minimum of at least two (2) weeks after the initial session.
- .9 Field wiring should terminate to a "CROSSOVER" BIX termination. The rack side of the BIX will terminate to 25 pair Amphenol cables with male plugs. The rack would be equipped with 25 pair female Amphenol cable, so that the rack can be detached from the field wiring by undoing the Amphenol plugs.
- .10 Four sets of operational manuals are required. Included in these manuals should be a disc with the system programming information, a disc with system programming software and a disc of the as-built drawings in PDF and AutoCAD format.

3.1.6 Commissioning of the Public Address System

- .1 Refer to Section 16010 Item: 1.7 (Quality Assurance Program).
- .2 The GC is responsible to co-ordinate the Public Address System Contractor and the other relevant trades to provide and commission the public address system complete with devices and programming.
- .3 The GC shall include the costs of and co-ordinate the work of the Public Address System Contractor and the other relevant trades through the mock-up phase and through to project completion.

END OF SECTION 16770