Specifications

For

ÉÉC Saint-Michel
Classroom Addition
29 Meadowvale Rd, Scarborough Ontario
M1C 1R7

Client:
Conseil Scolaire Catholique MonAvenir
110 Drewry Avenue
Toronto ON
M2M 1C8

Prime Consultant:
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Issued for Tender

Project Number: A22008

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This seal governs the materials bound into these Specifications except for the following:

DIVISION 1	GENERAL REQUIREMENTS
Section 01501	Soils Reports Geotechnical Report by Forward Engineering & Associates Inc. Soil Characterization Report No.1 by Forward Engineering & Associates Inc.
DIVISION 2	SITE WORK
Section 02270	Erosion and Sedimentation Control
Section 02311	Site Grading
Section 02701	Aggregates
Section 02721	Granular Base
Section 02723	Granular Sub-Base
Section 02741	Asphalt Paving
Section 02761	Pavement Markings

DIVISION 20 MECHANICAL (All Sections)

DIVISION 21 FIRE SUPRESSION (All Sections)

DIVISION 22 PLUMBING (All Sections)

DIVISION 23 HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) (All Sections)

End of Section

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A0-1 SUBJECT PROPERTY IN PARTIAL CITY'S HERITAGE REGISTER MAP
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A1-1 CONSTRUCTION & TREE PRESERVATION HOARDING PLAN
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End of Section

Room Finish Schedule

Room No.	Room Name	Floor		Base		Wall		Ceiling			Remarks
		mat'l	finish	mat'l	finish	mat'l	finish	mat'l	finish	height	
101	CORRIDOR	CONC	POR	-	RUB	CONC BLK	EP-PT	ACT	-	2800	
101A	EXISTING VESTIBULE	CONC	EX	-	RUB	CONC BLK	SG-PT	EX	EX	EX	
102	RESOURCE ROOM	CONC	POR	-	RUB	CONC BLK	SG-PT	ACT	-	2800	
103	RESOURCE ROOM	CONC	POR	-	RUB	CONC BLK	SG-PT	ACT	-	2800	
104	CLASSROOM	CONC	VCT	-	RUB	CONC BLK	SG-PT	ACT	-	2800	
105	CLASSROOM	CONC	VCT	-	RUB	CONC BLK	SG-PT	ACT	-	2800	
201	CORRIDOR	CONC	VCT	-	RUB	CONC BLK	EP-PT	ACT	-	2800	
202	CLASSROOM	CONC	VCT	-	RUB	CONC BLK	EG-PT	ACT	-	2800	
203	CLASSROOM	CONC	VCT	-	RUB	CONC BLK	EG-PT	ACT	-	2800	
901	STAIR 1	CONC	RSF	-	RUB	CONC BLK	EP-PT	GYP	EG-PT	3000	TREADS & RISERS TO BE ONE-PIECE RUBBER. STRINGERS TO BE RUBBER.
			POR		POR			ACT	-	1672	
902	STAIR 2	CONC	RSF	-	RUB	CONC BLK	EP-PT	GYP	EG-PT	3000	TREADS & RISERS TO BE ONE-PIECE RUBBER. STRINGERS TO BE RUBBER.
			POR		POR			ACT	-	1672	

LEGEND:

ACRYL	INTERIOR ACRYLIC PAINT	EP	EPOXY	P.LAM	PLASTIC LAMINATE	S/S	STAINLESS STEEL
ACT	ACOUSTIC CEILING TILE	EX	EXISTING	POR	PORCELAIN TILE	TER	TERRAZZO
BLK	BLOCK	EXP	EXPOSED	PT	PAINT	RSF	RUBBER SHEET FLOORING
CONC	CONCRETE	GYP	GYPSUM BOARD	SFT	SAFETY FLOORING	RUB	RUBBER BASE
CPT	CARPET	LEP	LATEX EPOXY	SG	SEMI-GLOSS	VCT	VINYL COMPOSITE TILE
EG	EGGSHELL	LVT	LUXURY VINYL TILE	SPF	SPORTS FLOORING		

End of Section

Door and Frame Schedule

Door No.	Door								Frame			FRR	Remarks
	width	height	thick	type	mat'l	finish	glass	grille	type	mat'l	finish		
101A	2-1000	2150	45	B	HM	PT	TG			HM	PT		**EX. VESTIBULE 101A.** DOORS TO SWING IN OPPOSITE DIRECTIONS. WITH THE DOOR ON THE RIGHT-HAND SIDE SWINGING IN THE DIRECTION OF TRAVEL TO THE EXIT. SMOKE TIGHT.
104	950	2150	45	C	HM	PT	TG			HM	PT		**CLASSROOM 104**
105	950	2150	45	C	HM	PT	TG			HM	PT		**CLASSROOM 105**
120	2-1225	2150	45	A	HM	PT				HM	PT		**EX. GYMNASIUM 120**
901a	1000	2150	45	B	AL	PRE	IGU / TG		TB	AL	PRE		**STAIR 1.** B.F. POWER DOOR OPERATOR, EXIT HARDWARE. COORDINATE WITH WINDOW SUPPLIER. DOOR & SIDELIGHTS TO BE SUPPLIED BY WINDOW SUPPLIER.
901b	1000	2150	45	B1	HM	PT	FL / TG			HM	PT	45M	**STAIR 1.** B.F. POWER DOOR OPERATOR.

Abbreviations

ADO – Automatic Door Operator AL – Aluminum AN – Anodized Clear B/S – Both Sides B.F. – Barrier Free
FL- Firelite Tempered Glass IGU – Insulated Glazed Unit PRE – Prefinished
PSF – Pressed Steel Frame PT – Paint TB – Thermally Broken TG – Clear Tempered Glass

Door and Frame Schedule

Door No.	Door								Frame			FRR	Remarks
	width	height	thick	type	mat'l	finish	glass	grille	type	mat'l	finish		
902a	1000	2150	45	B	AL	PRE	IGU / TG		TB	AL	PRE		**STAIR 2.** B.F. POWER DOOR OPERATOR, EXIT HARDWARE. COORDINATE WITH WINDOW SUPPLIER. DOOR & SIDELIGHTS TO BE SUPPLIED BY WINDOW SUPPLIER.
902b	1000	2150	45	B1	HM	PT	FL / TG			HM	PT	45M	**STAIR 2.** B.F. POWER DOOR OPERATOR.
202	950	2150	45	C	HM	PT	TG			HM	PT		**CLASSROOM 202**
203	950	2150	45	C	HM	PT	TG			HM	PT		**CLASSROOM 203**
901c	1000	2150	45	B1	HM	PT	TG			HM	PT	45M	**STAIR 1.**
902c	1000	2150	45	B1	HM	PT	TG			HM	PT	45M	**STAIR 2.**

End of Section

Abbreviations

ADO – Automatic Door Operator AL – Aluminum AN – Anodized Clear B/S – Both Sides B.F. – Barrier Free
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PSF – Pressed Steel Frame PT – Paint TB – Thermally Broken TG – Clear Tempered Glass

Colour Schedule

PART 1 - GENERAL

1.1 **Reference**

.1 Comply with requirements of Division 1. This Colour Schedule is to be read in conjunction with all other contract documents.

.2 Colour selections are based on specific manufacturers products and that further review and adjustments will be made once successful suppliers and/or manufacturers are known.

PART 2 - LIST OF FINISHES

1. Porcelain Tile:

1. **(POR-1):**

Manufacturer:	Daltile	
Collection:	Harmonist Through body, Coloured-Base	
Colour:	Serene Square	Solid cream with black flecks
Code:	HM20	
Shade Variation:	V-2	
Size:	305mm x 305mm (12” x 12”)	
Finish:	Matte	
Thickness:	7.94 mm (5/16””)	
Application:	Floor – Field in and Corridors and Stairs	

2. **(POR-2):**

Manufacturer:	Daltile	
Collection:	Harmonist Through body, Coloured-Base	
Colour:	Promise Square	Solid blue with white flecks
Code:	HM27	
Shade Variation:	V-2	
Size:	305mm x 305mm (12” x 12”)	
Finish:	Matte	
Thickness:	7.94 mm (5/16””)	
Application:	Floor – Accent in and Corridors and Stairs Wall Base – Cut to 100 mm x 305 mm (4” x 12”) in Corridors & Stairs	
Contact:	Warren Booth	416-568-7255

2. Grout:

1. **(GT-1)**

Manufacturer:	Mapei		
Colour:	**Match Existing** or 01 Alabaster		
Application:	Floor – sanded Karalastic/ Karabond		
Paired with Tile(s):	POR-1, POR-2		
Contact:	Mapei	Jeff McCoppen	905-799-6884

Colour Schedule

PART 2 - LIST OF FINISHES (cont'd)

3. Rubber Base:

1. **(RUB-1)**

Manufacturer:	Johnsonite
Colour:	**Match Existing** or 55 Silver Grey
Characteristics:	TightLock for Resilient Topset (Coved) TDCR-XX (Rubber)
Profile:	6.35 mm thick – wedge design with a toe (Coved)
Height:	111.1 mm (4-3/8")
Details:	Coved, complete with preformed inside/outside corners
Contact:	Janet Sayers 647-542-2514

4. Stair Treads, Risers and Landings:

1. **(RSF-1)**

Manufactuer:	Johnsonite | Tarkett
Product:	Rubber Stair Tread with Integrated Riser for Visually Impaired
Colour Palette:	MicroTone Speckled Rubber
Texture:	Hammered (Tread/Riser – VIHTR)
Colour:	129 Silk (WB)
Nosing Vision Strip:	40 Black Grit Tape Insert
Landing Tile:	MicroTone Speckled Rubber VL4 Cool Metal (CG) 610mm x 610mm (24"x24") Standard Tiles VIRCN – XX – B2, with 2" visually impaired grit tape insert
Rubber Stringer & Riser:	VL4 Cool Metal (CG)
Contact:	Janet Sayers 647-542-2514

Note: Stair nosing will require a contrasting colour strip to meet with ODA standards, preferably in a black colour. Contrasting nosing strip to meet CSC MonAvenir's approval.

5. Tactile Walking Surface Indicators:

1. **(TWSI-1)**

Manufacturer:	Kinesik Engineered Products Incorporated
Style:	Elan Tile - Porcelain Tactile Indicators
Finish:	Tactile walking surface indicator with truncated domes
Colour:	Vogue Black (black)
Size:	297mm x 297mm deep (12" x 12") Overall 10mm thick tile + 4mm dome height
Location:	**Top landing for Stair 1, 901 and Stair 2, 902 (in porcelain tile)**

2. **(TWSI-2)**

Manufacturer:	Eon Tile
Style:	Tactile Warning Surface - Rubber
Finish:	Tactile walking surface indicator with truncated domes
Colour:	Vogue Black (a black to match TSWI-1)
Size:	297mm x 297mm deep (12" x 12") Overall 3.2mm thick tile + 4mm dome height
Location:	**Mid landing for Stair 1, 901 and Stair 2, 902 (in resilient sheet flooring)**

Colour Schedule

PART 2 - LIST OF FINISHES (cont'd)

6. Vinyl Composite Tile:

1. **(VCT-1)**
Manufacturer: Armstrong Standard Excelon – Imperial Texture
Colour: 52505 Harlequin White (white with grey flecks)
Size: 305mm x 305mm (12" x 12") x 3.2mm (1/8")
Installation Method: Monolithic
Application: Floor – Field in Corridors
Contact: Unknown

2. **(VCT-2)**
Manufacturer: Armstrong Standard Excelon – Imperial Texture
Colour: 52514 Jubilee White (white with caramel flecks)
Size: 305mm x 305mm (12" x 12") x 3.2mm (1/8")
Installation Method: Monolithic
Application: Floor – Field in Classrooms
Contact: Unknown

3. **(VCT-3)**
Manufacturer: Armstrong Standard Excelon – Imperial Texture
Colour: 51811 Antique White (creamy yellow)
Size: 305mm x 305mm (12" x 12") x 3.2mm (1/8")
Installation Method: Monolithic
Application: Floor – Accent in Classrooms
Contact: Unknown

7. Transition Strip:

1. **(TRAN-1)**
Manufacturer: Schluter
Style: Schiene
Finish: Satin Anodized Aluminum (AE)
Size: 8mm (5/16")
Item No. AE 80
Contractor to verify correct item No. required
Location: VCT to Tile Transition Strips
Cap for all POR tiles (Base Tiles and Wall Tiles)

2. **(TRAN-2)**
Manufacturer: Schluter
Style: Quadec
Finish: Brushed Stainless Steel (EB)
Size: 8mm (5/16")
Item No. Q 80 EB
Contractor to verify correct item No. required
Location: Outside Corner trim for all wall tiles in washrooms

3. **(TRAN-3)**
Manufacturer: Schluter
Style: Dilex – AHK Cove Strip
Finish: Satin Anodized Aluminum (AE)
Size: 10mm (3/8")
Item No. AHK 1S 100 AE
Contractor to verify correct item No. required
Complete with connectors and end caps
Location: Universal, Family and Barrier-Free Washroom
Contact: Jeff Murray Centura 416-433-1475

Colour Schedule

PART 2 - LIST OF FINISHES (cont'd)

8. Plastic Laminate:

1. **(PL-1):**	Manufacturer:	Pionite	
	Colour Name & #:	Hardrock Maple WM791	
	Finish:	Suede	
	Application:	**Millwork Units (Base & Upper Cabinets)**	
	Contact:	Panolam Adrian Beck	416-970-4912
2. **(PL-2):**	Manufacturer:	Arborite Laminate	
	Colour Name:	Versailles Marble P-1016 RM	
	Finish:	Matte	
	Application:	**Countertops**	
	Contact:	Janet Bascoe-Spencer	C: 647-206-2916
3. **(PL-3):**	Manufacturer:	Arborite Laminate	
	Colour Name:	White Xabia P-311 RM	
	Finish:	Matte	
	Application:	**Control Panels**	
	Contact:	Janet Bascoe-Spencer	C: 647-206-2916

9. Paint:

1. **(PT-1)**	Manufacturer:	Dulux Paints	
	Colour:	China White	(White)
	Code:	DLX 1101-1	
	Application:	Wall – General Paint	
2. **(PT-2)**	Manufacturer:	Dulux Paints	
	Colour:	Toffee Crunch	(yellow)
	Code:	DLX 1207-4	
	Application:	Wall – Accent Paint	
3. **(PT-3)**	Manufacturer:	Dulux Paints	
	Colour:	**Match Existing**	(turquoise blue)
	Code:	???	
	Application:	Accent – Metal Truss (if applicable)	
4. **(PT-4)**	Manufacturer:	Dulux Paints	
	Colour:	**Match Existing**	(medium grey)
	Code:	???	
	Application:	Door Frames Interior Window Frames	
5. **(PT-5)**	Manufacturer:	Dulux Paints	
	Colour:	**Match Existing**	(light grey)
	Code:	???	
	Application:	Hollow Metal Doors	
	Contact:	Steven Whyte	416-420-3603

Colour Schedule

PART 2 - LIST OF FINISHES (cont'd)

10. Coat Racks & Hooks:

1.	Manufacturer:	Architectural School Products		
	Product:	See specifications for details.		
	Coat Rack Colour:	Grey		
	Coat Hook Colour:	Blue		
	Contact:	ASP	Michael Mendes	905-822-4287 ext. 233
	Note:	Colour selection is based on this manufacture's products. Equal or approved alternates may also be considered. Architect's approval is required prior to ordering.		

End of Section

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1-102 Standard Abbreviations (Cont'd)
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2-111 Chain Link Fencing at Gate Opening

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4-102 Control Joint at Exterior Cavity Wall (Section A + B)
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4-111 Electrical Fittings Locations
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DIVISION 5 – 1

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5-114 Roof Ladder Elevation
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5-132 Typical Stair Guard & Handrail Detail
5-133 Typical Stair Guard & Handrail Detail

DIVISION 6 – 0

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6-000b Millwork Details Reference Guide
6-001 Millwork Section Detail
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6-004 Millwork Section Detail
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6-013 Millwork Section Detail
6-016 Millwork Plan Detail
6-019 Millwork Plan Detail
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6-023 Millwork Plan Detail
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6-630 Wall Panel Detail At Coat Racks

DIVISION 7-0

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DIVISION 7-5

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7-544 Section Detail @ Canopy

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8-500 Hollow Metal Frame Details
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9-109 Ceiling Detail – TYP.

End of Section

AC/ACT	ACOUSTIC CEILING TILE
ACR	ACRYLIC
AD	AREA DRAIN
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AGGR	AGGREGATE
AL	ALUMINUM
AP	ACOUSTIC PANEL
APG	ARMOURED PLATE GLASS
APPROX.	APPROXIMATE
ARCH	ARCHITECTURAL
AS SPEC.	AS SPECIFIED
ASPH	ASPHALT
ASS'Y	ASSEMBLY
ATTEN.	ATTENUATION
A/V	AIR VAPOUR
BAT	BATTENS
BC	BOTTOM CURB
BD	BOARD
BF	BARRIER-FREE
BITUM.	BITUMINOUS
BKCS	BOOKCASE
BLDG	BUILDING
BLK	BLOCK
BLKHD	BULKHEAD
BM	BEAM
BOT	BOTTOM
BRK	BRICK
BUR	BURLAP
C	CHAIR
CB	CATCH BASIN
CFI	CONCRETE FACED INSULATION
CEM	CEMENT
CER	CERAMIC TILE
CG	CORNER GUARD
CHBD	CHALKBOARD
CI	CAST IRON
CJ	CONTROL JOINT
CL	CENTRE LINE
CLB	CENTRE LINE OF BLOCK
CLG	CEILING
CLO	CLOSET
CLR	CLEAR
CM	COFFEE MACHINE
CNTR	COUNTER
CO	CASED OPENING
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONSTR.	CONSTRUCTION
CONT.	CONTINUOUS
CORR	CORRIDOR
CP	CONTROL PANEL
CPAN	COMPOSITE PANEL
CPT	CARPET
CTG	COATING
CTR	CENTRE
CTSK	COUNTER SUNK
C/W	COMPLETE WITH
CV	CONVECTOR
DBL	DOUBLE
DEPT	DEPARTMENT
DET.	DETAIL
DF	DRINKING FOUNTAIN
DG	DOUBLE GLAZE
DH	DOUBLE HUNG
DIA.	DIAMETER
DIM	DIMENSION
DISP	DISPENSER
DK	DECK
DN	DOWN
DO	DOOR OPENING
DS	DOWNSPOUT
DW	DISHWASHER
DWG	DRAWING
DWR	DRAWER
E	EAST
EA.	EACH
EF	EXHAUST FAN
EJ	EXPANSION JOINT
EL	ELEVATION
ELECT	ELECTRICAL
EMER	EMERGENCY
EN	ENAMEL
ENCL	ENCLOSURE
EP	EPOXY
EQ	EQUAL
EQMT	EQUIPMENT
ES	EGG SHELL
EX.	EXISTING
EXPAN	EXPANSION
EXP	EXPOSED
EXT	EXTERIOR
FA	FIRE ALARM
FAAP	FIRE ALARM ANNUNCIATION PANEL
FD	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FORCED FLOW HEATER
FG	FIXED GLASS
FHC	FIRE HOSE CABINET
FIN	FINISH
FL	FLOOR
FLASH	FLASHING
FLEX.	FLEXIBLE
FLUOR	FLUORESCENT
FLT	FLOAT
FOB	FACE OF BLOCK
FOB(EX.)	FACE OF BLOCK (EXISTING)
F.PT	FLAT PAINT
FR	FRIDGE
F.RET	FIRE RETARDENT
FRR	FIRE-RESISTANCE RATED
FT	FOOT or FEET
FTG	FOOTING
FURR	FURRING
FUT	FUTURE
F&G	FELT & GRAVEL
GA	GAUGE
GALV	GALVANIZED
GB	GRAB BAR
GL	GLASS
GL.BL.	GLAZED BLOCK
GND	GROUND
GR	GRADE
GSR	GAS SERVICE REGULATOR
GRA	GRAVEL
GWG	GEORGIAN WIRE GLASS
GYP	GYPSUM
HB	HOSE BIB
HC	HOLLOW CORE
HDWD	HARDWOOD
HD	HAND DRYER
HDWE	HARDWARE
HGT	HEIGHT
HM	HOLLOW METAL
HORIZ.	HORIZONTAL
HP	HYDRO POLE
HR	HOUR
HSS	HOLLOW STEEL SECTION
HTG	HEATING
HW	HOT WATER HEATER
ID	INSIDE DIAMETER
IFOB	INSIDE FACE OF BLOCK
IMP	INSULATED METAL PANEL
INV	INVERT
INSUL	INSULATION
INT	INTERIOR
JAN	JANITOR
JT	JOINT
KIT	KITCHEN
LAM	LAMINATE
LAV	LAVATORY
LDIG	LIGHT DIFFUSING INSULATED GLASS
LEP	LATEX EPOXY PAINT
LF	LATERAL FILE
LF	LATERAL FILE
LKR	LOCKER
LP	LIGHTING PANEL
LS	LIGHT STANDARD
LT WT	LIGHT WEIGHT
LV	LATERAL FILE
LVT	LUXURY VINYL TILE
M	METAL
MAX.	MAXIMUM
MCT	MARMOLEUM COMPOSITE TILE
M.D.F.	MEDIUM DENSITY FIBREBOARD
MECH	MECHANICAL
MEMB	MEMBRANE
MFR	MANUFACTURER
MGAT	MAKE GOOD ALL TRADES
MH	MAINTENANCE HOLE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MOR	MORTAR
MR	MOISTURE RESISTANT
MSB	MEDIUM SAND BLAST
MTD	MOUNTED
MUL	MULLION
MW	MICROWAVE

FOR CONTINUATION SEE DWG. NO. 1-102

Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: STANDARD ABBREVIATIONS

DATE: January 2023

SCALE: N.T.S.

DRAWN: K+

PROJECT NO: A22008

PROJECT NAME: ÉÉC SAINT-MICHEL
Classrooms Addition

CHECKED:

DWG NO: 1-101

REV. 0

N	NORTH
ND	NAPKIN DISPOSAL
NIC	NOT IN CONTRACT
NO. or #	NUMBER
NOM.	NOMINAL
NS	NON SLIP
NTS	NOT TO SCALE
OA	OVER ALL
OBS	OBSCURE
O.C.	ON CENTRE
OFB	OUTSIDE FACE OF BLOCK
OD	OUTSIDE DIAMETER
OHD	OVERHEAD DOOR
OPNG	OPENING
OPP	OPPOSITE
OWSJ	OPEN WEB STEEL JOIST
P	PLASTIC
PARG	PARGING
PART	PARTITION
PB	PARTICLE BOARD
PC	PRECAST
PERF	PERFORATED
PG	PLATE GLASS
PL	PLATE
P.LAM	PLASTIC LAMINATE
PLAS.	PLASTER
PLY	PLYWOOD
PNEU	PNEUMATIC
POL	POLISHED
POR	PORCELAIN TILE
PP	POWER PANEL
PPG	POLISHED PLATE GLASS
PR	PAIR
PREFIN	PREFINISHED
PT	PAINT
PTD	PAPER TOWEL DISPENSER
QT	QUARRY TILE
R	RISER
RAD	RADIUS
RD	ROOF DRAIN
REF	REFERENCE
REFR	REFRIGERATOR
REINF	REINFORCED
RESIL.	RESILIENT
REQ.	REQUIRED
RFG	ROOFING
RGTR	REGISTER
RH	ROOF HOPPER
RM	ROOM
RO	ROUGH OPENING
RTT	RESILIENT TERRAZZO TILE
RUB	RUBBER
RWL	RAIN WATER LEADER
S	SOUTH
SC	SOLID CORE
SCHED	SCHEDULE
SD	SOAP DISPENSER
SECT	SECTION
SG	SEMI GLOSS
SH	SHELF
SHR	SHOWER
SHT	SHEET
SIL	SILICONE
SIM	SIMILAR
SL.BLK.	SLAG BLOCK
SP	SPRAYED
SPAN	SPANDREL PANEL
SPEC.	SPECIFICATION
SPF	SPORTS FLOORING
SPG	SPANDREL GLASS
SP.BK.	SPLASHBACK
SQ	SQUARE
SS	STAINLESS STEEL
SSCG	STAINLESS STEEL CORNER GUARD
SSKP	STAINLESS STEEL KICKPLATE
S.SUR.	SOLID SURFACE
ST	STOVE
STA	STATION
STD	STANDARD
STN	STAIN
STL	STEEL
STG	STORAGE
STRUCT	STRUCTURAL
STY	STYLE
SUP	SUPPORT
SUSP	SUSPENDED
SVF	SHEET VINYL FLOORING
SYM	SYMMETRICAL
T	TREADS
TB	TOWEL BAR
TBL	TABLE
TC	TOP OF CURB
TEC	TECTUM
TEL	TELEPHONE
TER	TERRAZZO
T&G	TONGUE & GROOVE
THK	THICK
THRES	THRESHOLD
TKBD	TACKBOARD
T/O	TOP OF
TPG	TEMPERED PLATE GLASS
TR	TRIM
TRAN	TRANSITION
TTD	TOILET TISSUE DISPENSER
TV	TELEVISION
TW	TOP OF WALL
TYP.	TYPICAL
UNF	UNFINISHED
UNGL	UNGLAZED
UNIV.	UNIVERSAL
U.O.N.	UNLESS OTHERWISE NOTED
UR	URINAL
U/S	UNDERSIDE
VRT	VINYL REINFORCED TILE
VSF	WINYL SAFETY FLOOR
VWC	VINYL WALLCOVERING
W	WEST
W/	WITH
W.C.	WATER CLOSET
WD	WOOD
W/O	WITHOUT
WHBD.	WHITEBOARD
WP	WATERPROOF
WR	WASHROOM
WSCT	WAINSCOT
WT	WEIGHT
WWM	WELDED WIRE MESH

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ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: STANDARD ABBREVIATIONS (CONT'D)

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE: January 2023

DRAWN: K+

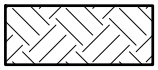
CHECKED:

SCALE: N.T.S.

PROJECT NO: A22008

DWG NO: 1–102

REV. 0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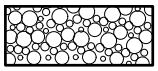
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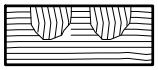
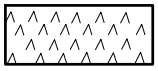

ROCK

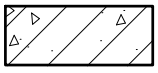

CINDER OR
SLAG FILL

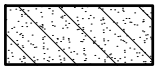

SAND, PLASTER
& CEMENT

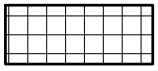

CAST–IN–PLACE
CONCRETE

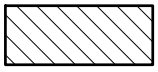

PRECAST CONCRETE

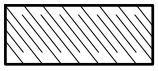

LIGHT WEIGHT CONCRETE

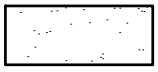

CONCRETE BLOCK

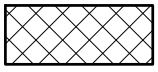

SLAG BLOCK

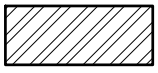

GLAZED SLAG BLOCK

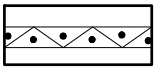

FACE BRICK

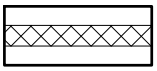

FIRE BRICK

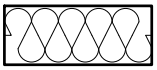

FACING STONE

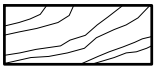

SPRAY FOAM INSULATION

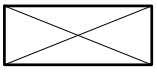

METAL, STEEL

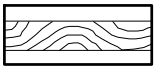

TERRAZZO

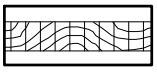

QUARRY TILE

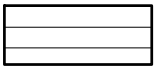

BATT INSULATION

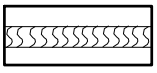

FINISHED WOOD

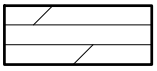

WOOD BLOCKING

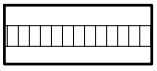

WOOD STUD
PARTITION

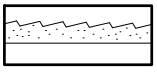

INSULATION WOOD
STUD PARTITION

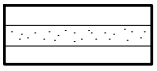

METAL STUD
PARTITION


INSULATION METAL
STUD PARTITION

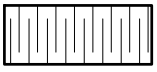

PLYWOOD/M.D.F./PARTICLE BOARD

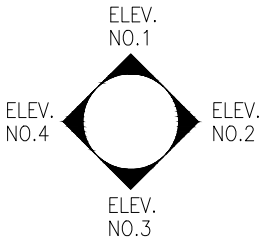

ACOUSTIC TILE


METAL LATH
& PLASTER


GYPSUM BOARD


TECTUM


RIGID INSULATION



INTERIOR ELEVATION
SEQUENCE

Kingsland +
ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

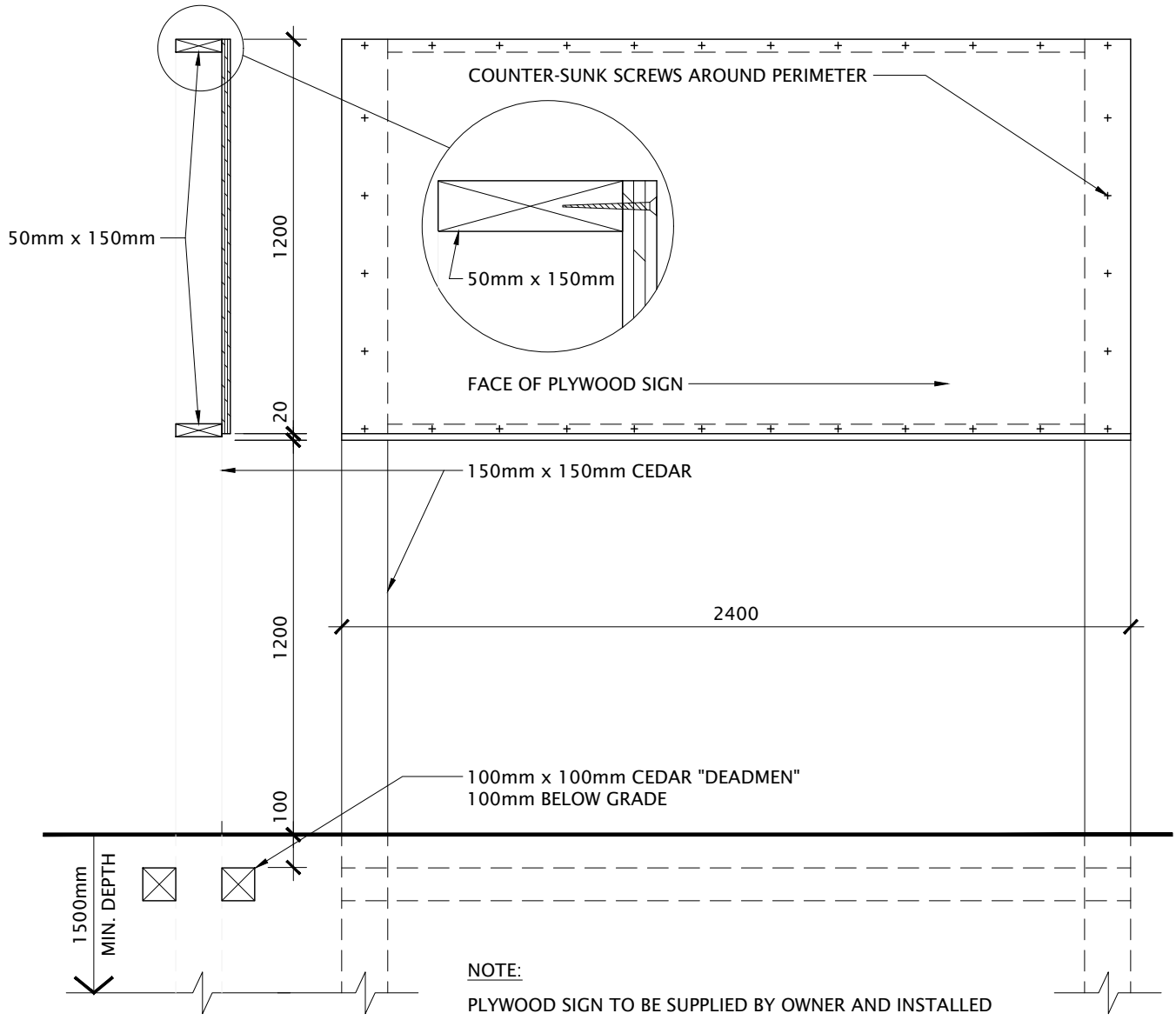
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
STANDARD SYMBOLS

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE:	SCALE:
January 2023	N.T.S.
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 1–103 / REV. 0



NOTE:

PLYWOOD SIGN TO BE SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR.

PROVIDE ALL THE FRAMING AND FOUNDATION REQUIRED FOR THE PROPER INSTALLATION.

SECTION

ELEVATION

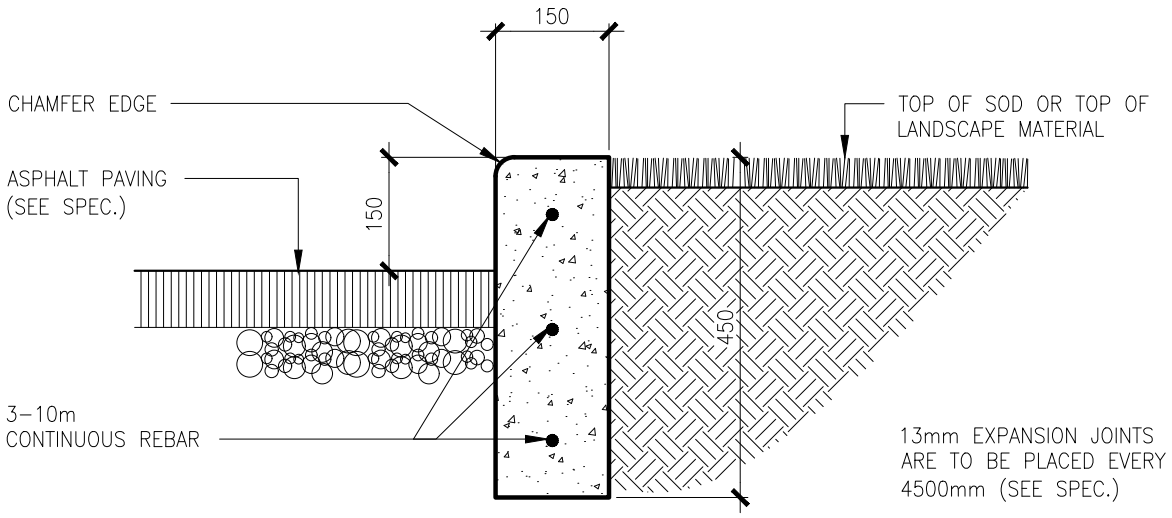
Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

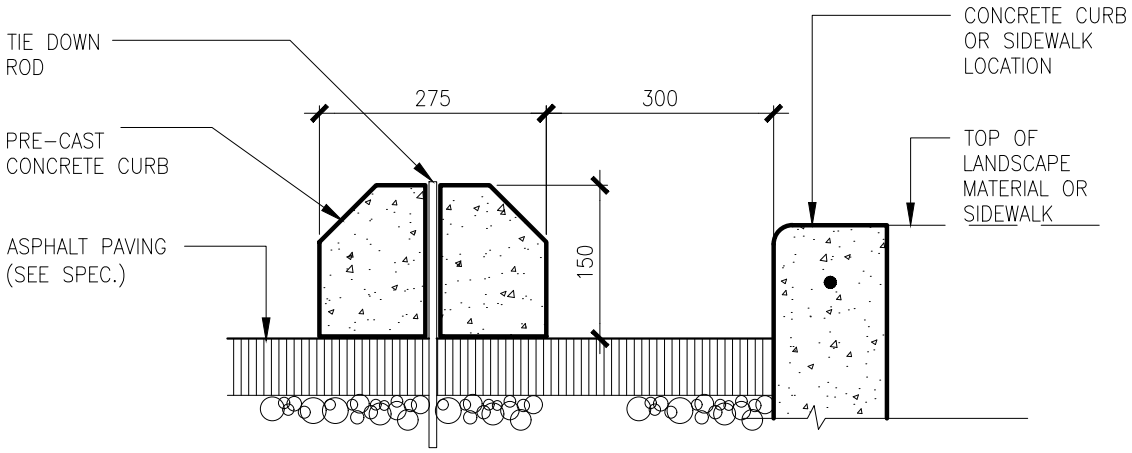
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: JOB SITE SIGN	DATE: January 2023	SCALE: 1:20	
	DRAWN: K+	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 1–106	REV. 0



1 CONCRETE CURB DETAIL



2 PRE-CAST CONCRETE PARKING CURB DETAIL

*DOES NOT APPLY TO GRADE LOADING POSITIONS – REFER TO SECTION 2/A3–4

Kingsland ARCHITECTS INC.
KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
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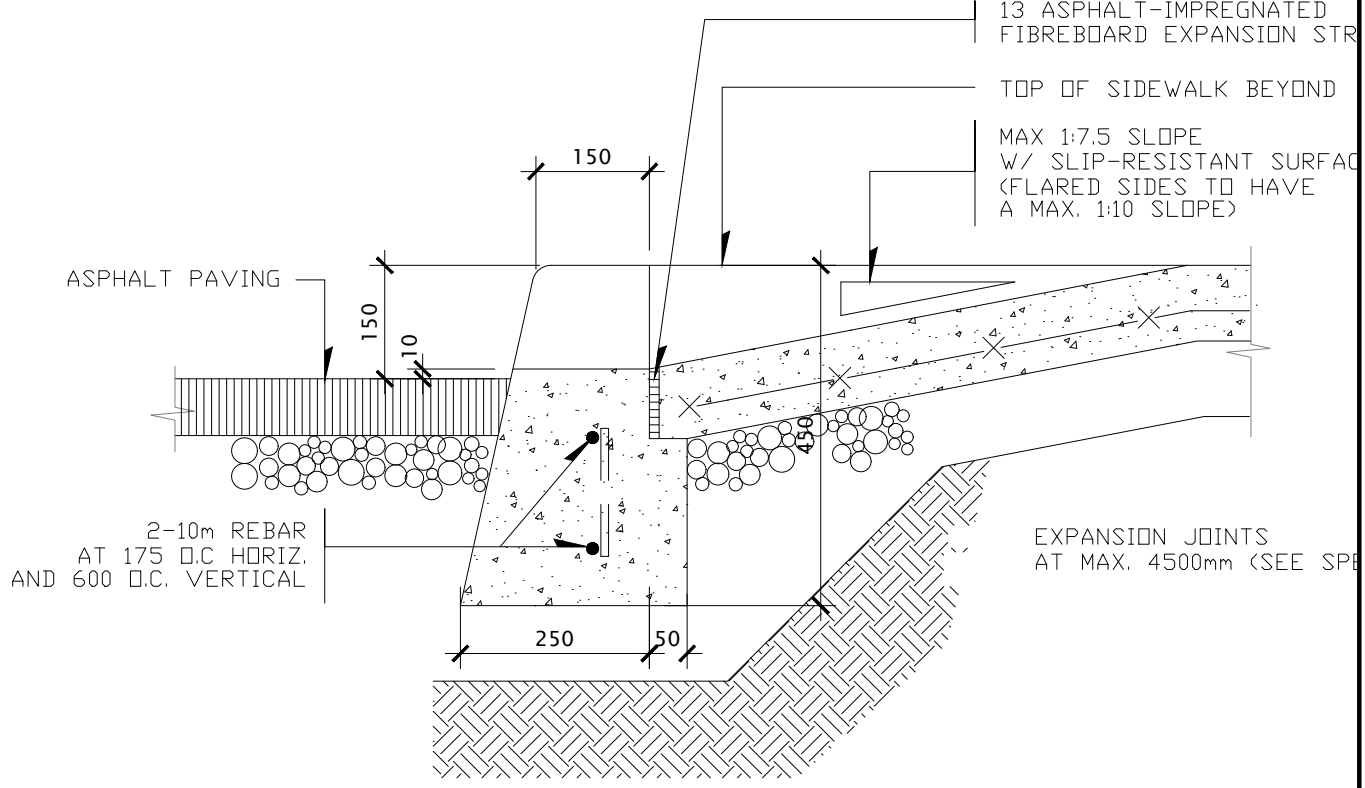
ISSUED:

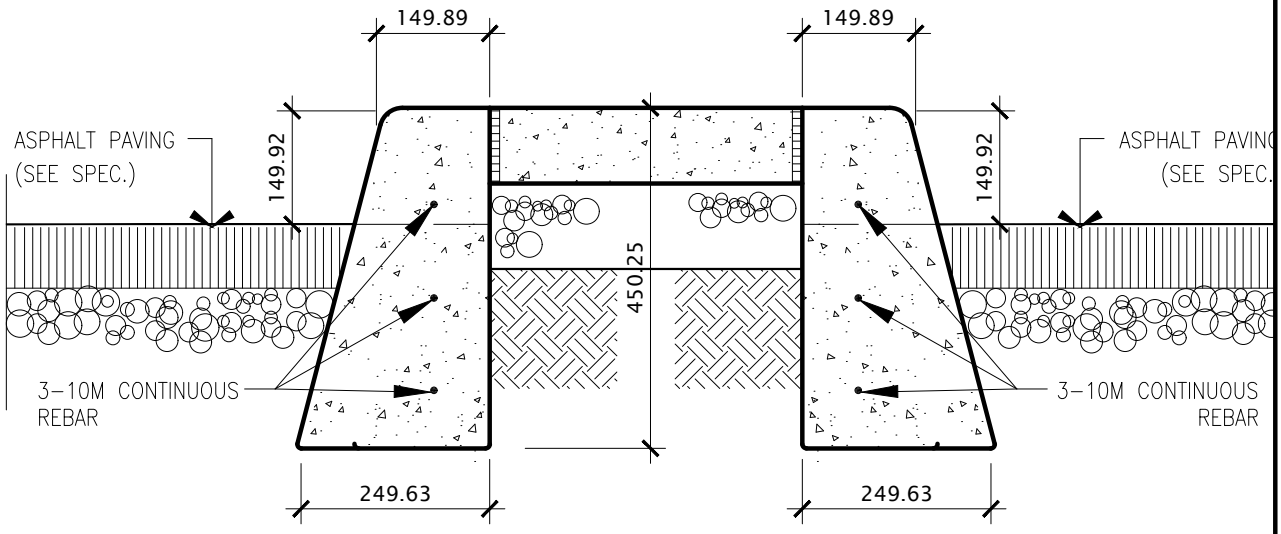
ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: PAVING AND CURB DETAILS	DATE: January 2023	SCALE: 1:10	
	DRAWN:	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 2–100	REV.

*** NOTE: RAMP MUST CONFORM TO OBC 3.8.3.2.(3)



1 CONCRETE CURB AT DEPRESSION



2 CONCRETE CURB AT PARKING ISLAND

10mm EXPANSION JOINTS ARE TO BE EVERY 4500mm (SEE SPEC)

Kingsland ARCHITECTS INC.

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219 Dufferin Street , Suite 308b
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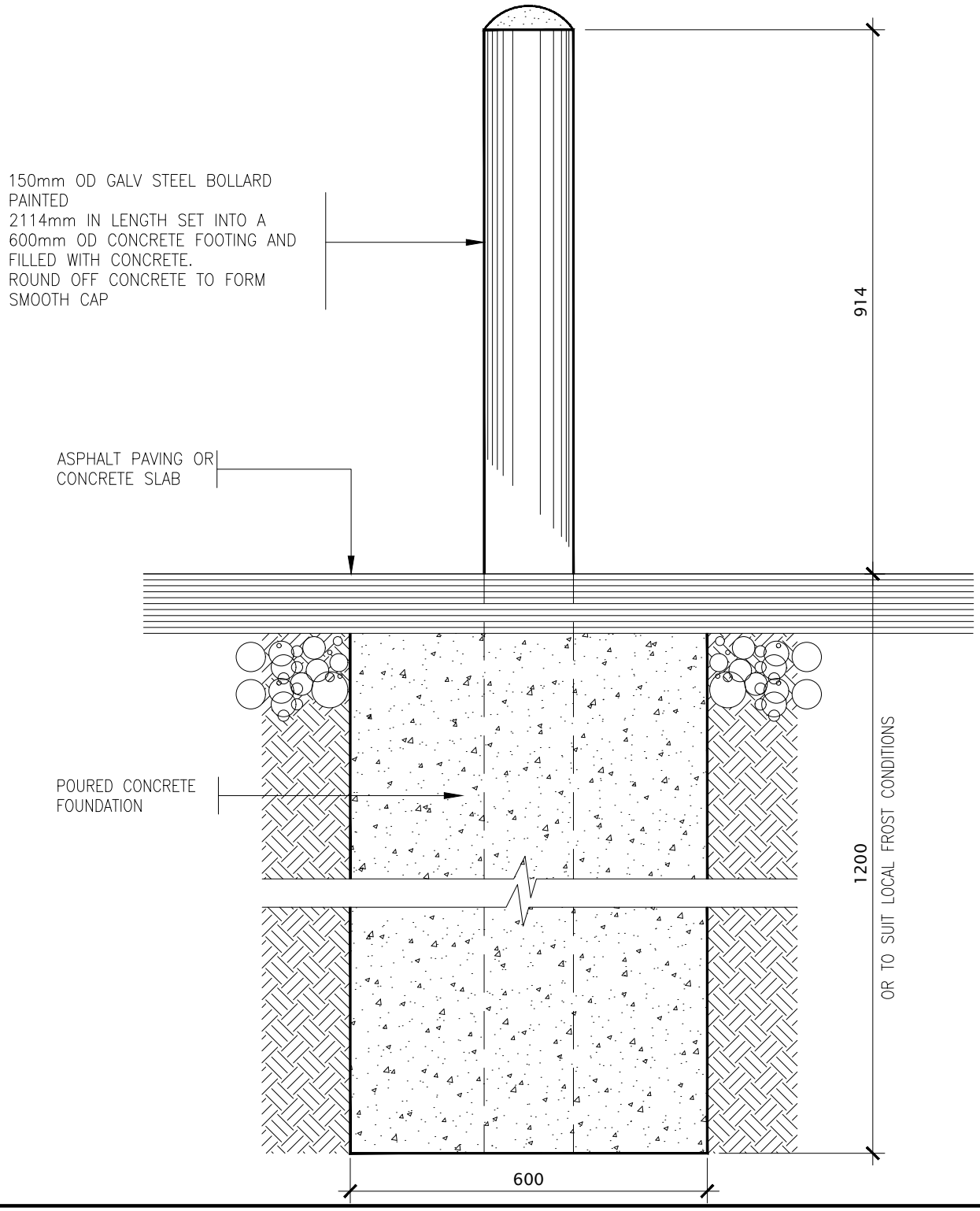
fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: CONCRETE AND ASPHALT PAVING DETAIL	DATE: January 2023	SCALE: 1:10	
	DRAWN:	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 2-103	REV.



Kingsland + ARCHITECTS INC.

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219 Dufferin Street , Suite 308b
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fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: TYPICAL BOLLARD DETAIL

PROJECT NAME: ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN:

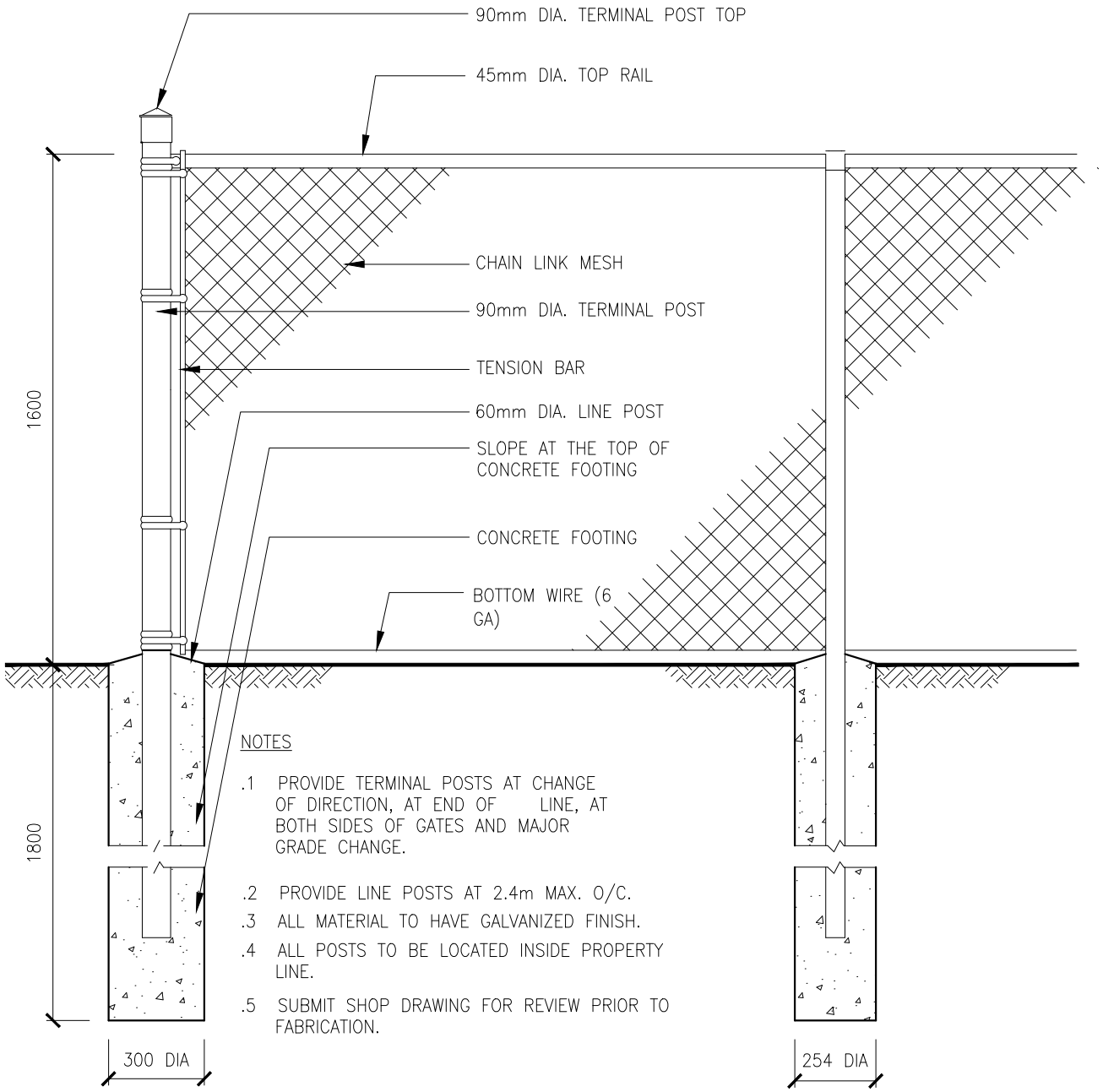
CHECKED:

SCALE: 1:10

PROJECT NO: A22008

DWG NO: 2–105

REV.



NOTES

.1 PROVIDE TERMINAL POSTS AT CHANGE OF DIRECTION, AT END OF LINE, AT BOTH SIDES OF GATES AND MAJOR GRADE CHANGE.

.2 PROVIDE LINE POSTS AT 2.4m MAX. O/C.

.3 ALL MATERIAL TO HAVE GALVANIZED FINISH.

.4 ALL POSTS TO BE LOCATED INSIDE PROPERTY LINE.

.5 SUBMIT SHOP DRAWING FOR REVIEW PRIOR TO FABRICATION.

ELEVATION (VIEW FROM OUTSIDE)

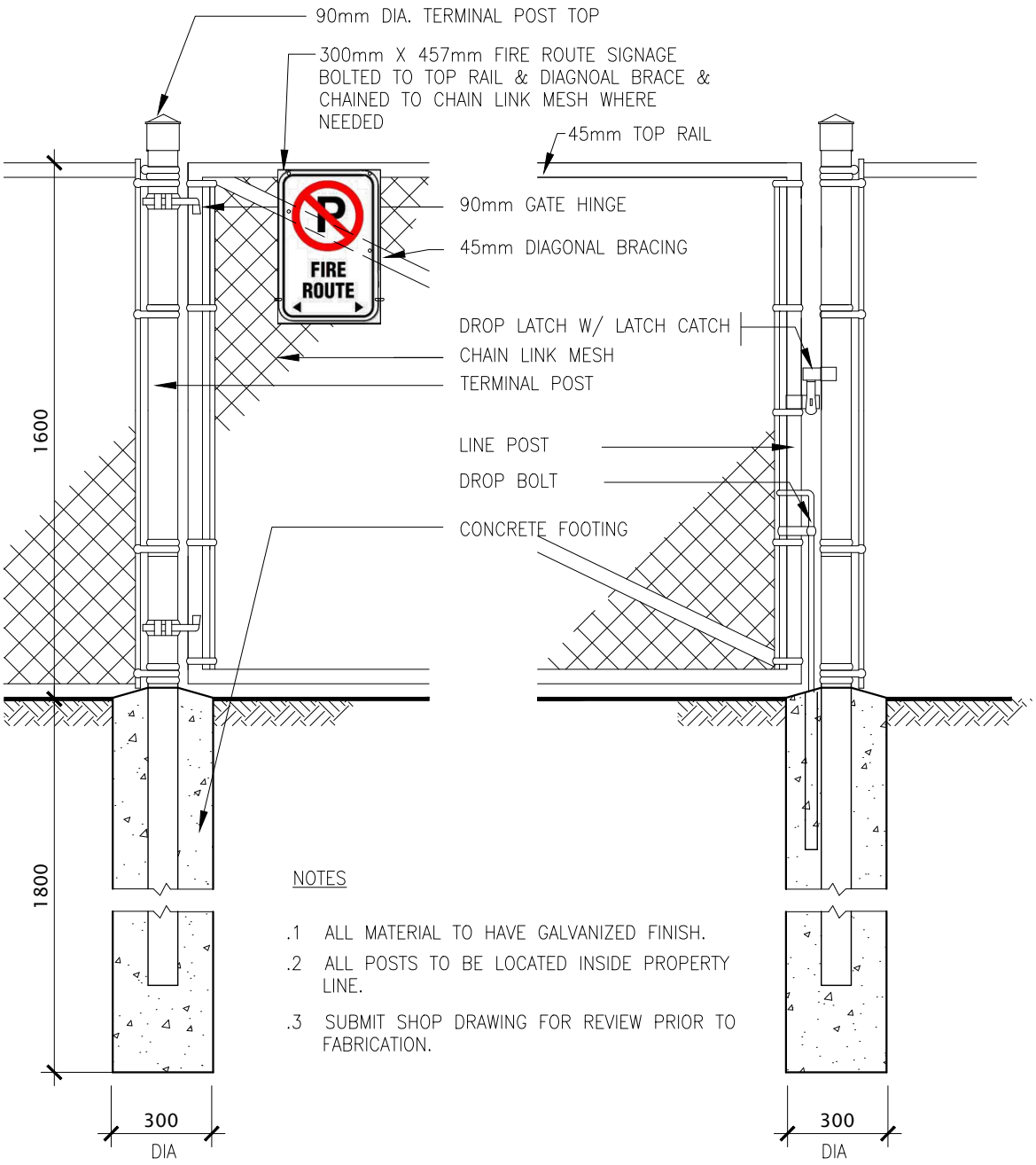
Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: CHAIN LINK FENCING	DATE: January 2023	SCALE: 1:10	
	DRAWN:	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 2–110	REV. 0



NOTES

.1 ALL MATERIAL TO HAVE GALVANIZED FINISH.

.2 ALL POSTS TO BE LOCATED INSIDE PROPERTY LINE.

.3 SUBMIT SHOP DRAWING FOR REVIEW PRIOR TO FABRICATION.

ELEVATION (VIEW FROM OUTSIDE)

Kingsland + ARCHITECTS INC.

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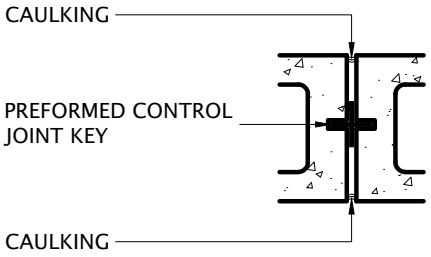
ph 416.203.7799
fax 416.203.7763

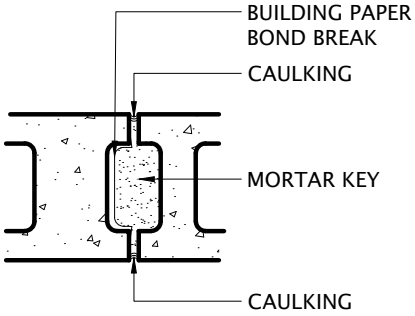
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: CHAIN LINK FENCING AT GATE OPENING	DATE: January 2023	SCALE: 1:10	
	DRAWN:	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 2-111	REV. 0

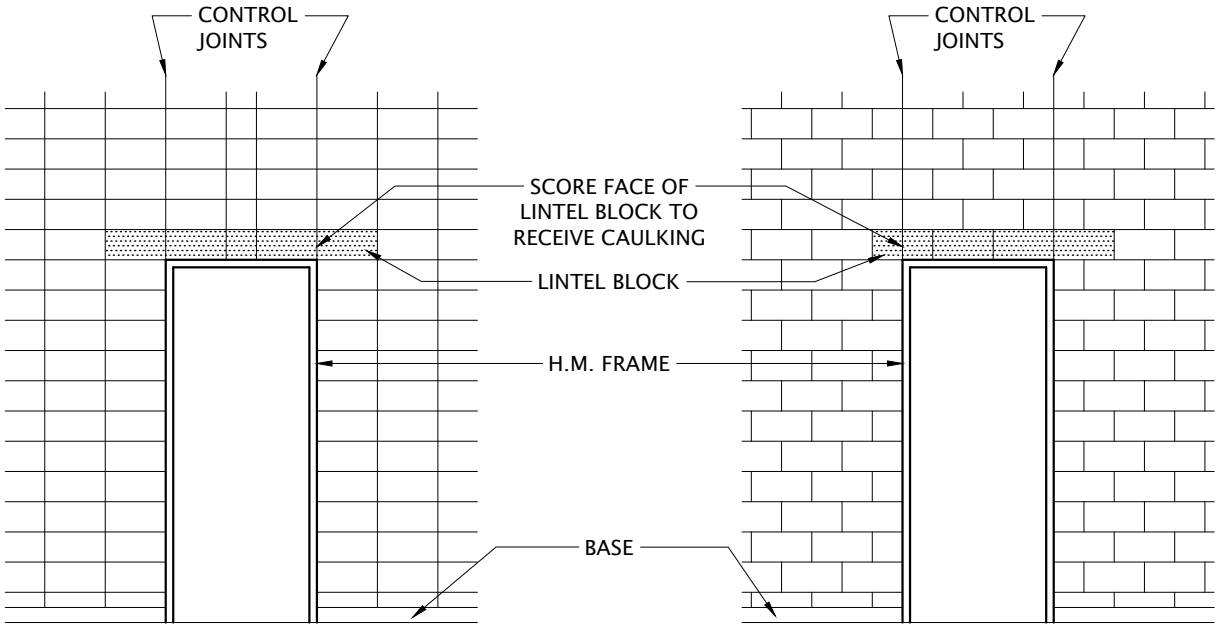


CONTROL JOINT FOR NON LATERAL STABILITY OF WALL



CONTROL JOINT FOR LATERAL STABILITY OF WALL

SECTION PLANS



STACK BOND ELEVATION

RUNNING BOND ELEVATION

NOTE: EXTEND CONTROL JOINT TO U/S OF STRUCTURE ABOVE

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ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: CONTROL JOINT AT INTERIOR DOOR

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE: January 2023

DRAWN: K+

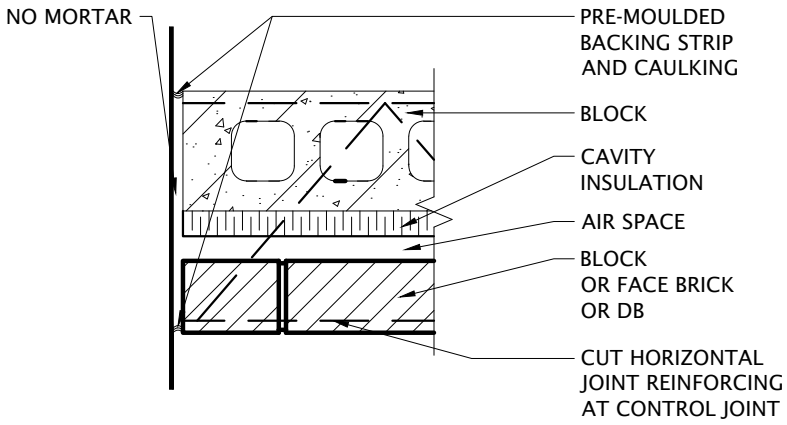
CHECKED:

SCALE: N.T.S.

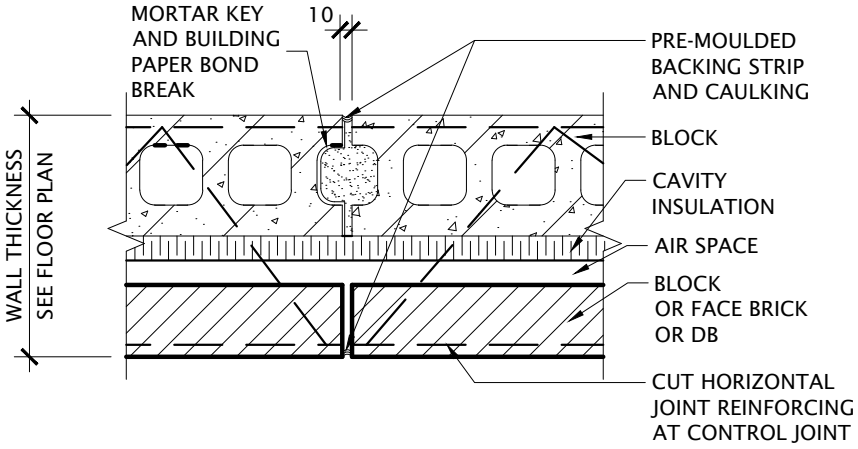
PROJECT NO: A22008

DWG NO: 4–101

REV. 0



SECTION PLAN - TYPE A



SECTION PLAN - TYPE B

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ISSUED:

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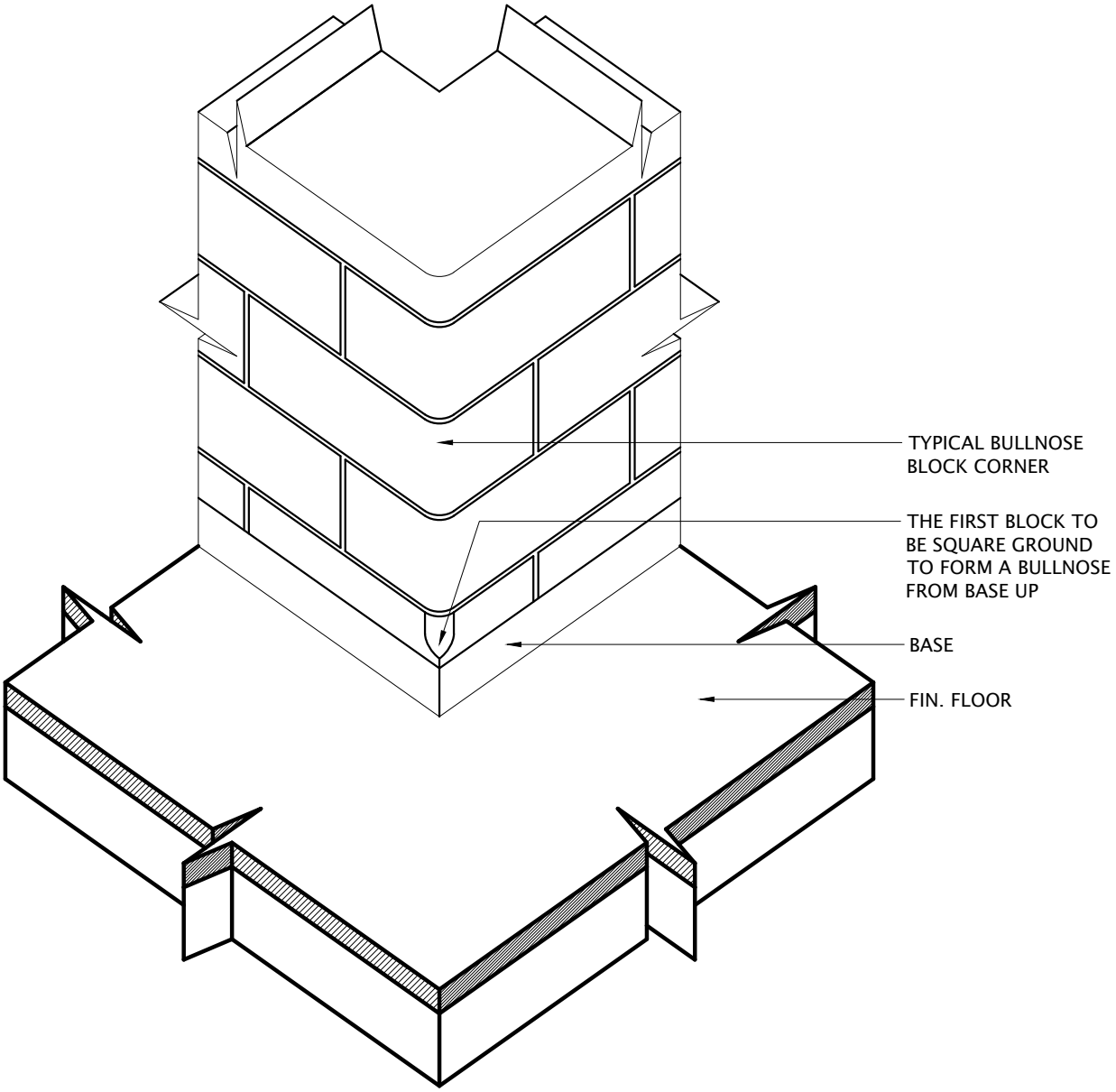
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: CONTROL JOINT AT EXTERIOR CAVITY WALL

PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition

DATE: January 2023	SCALE: N.T.S.
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 4–102 / REV. 0



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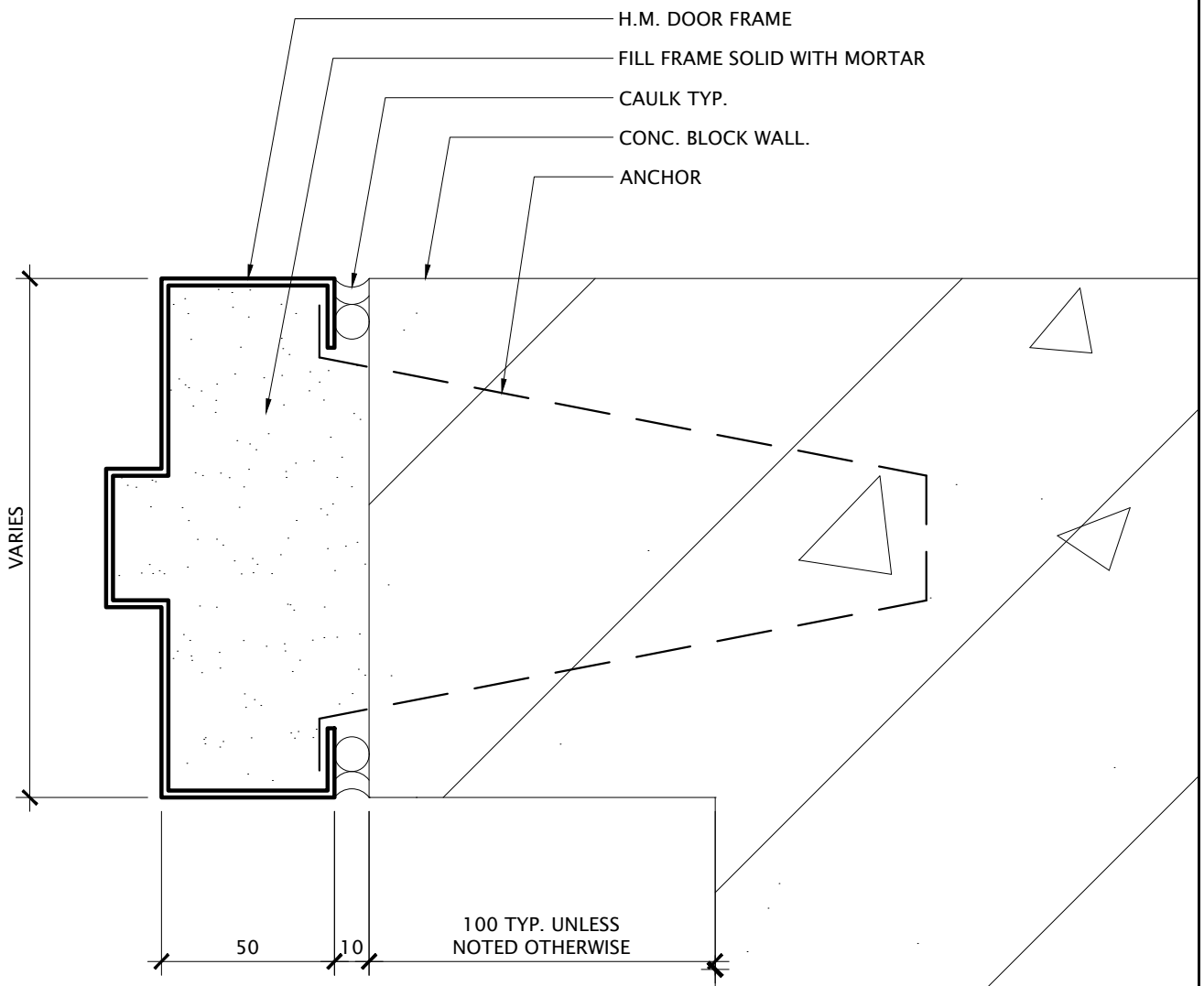
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: TYP. BULLNOSE BLOCK CORNER DETAIL

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 4–103 / REV. 0



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ISSUED:

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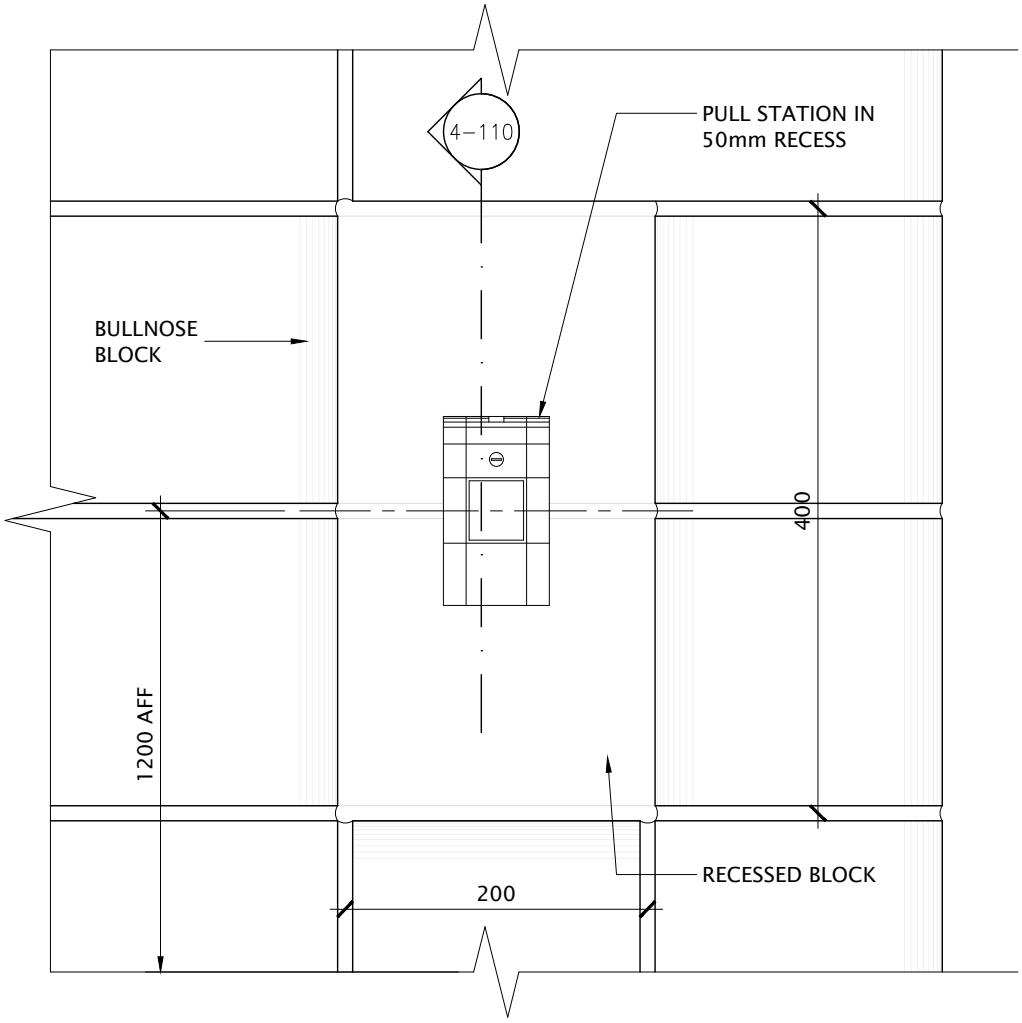
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
TYP. DOOR JAMB
AT BLOCK WALL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:2
PROJECT NO: A22008
DWG NO: 4–107
REV. 0



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ARCHITECTS INC.

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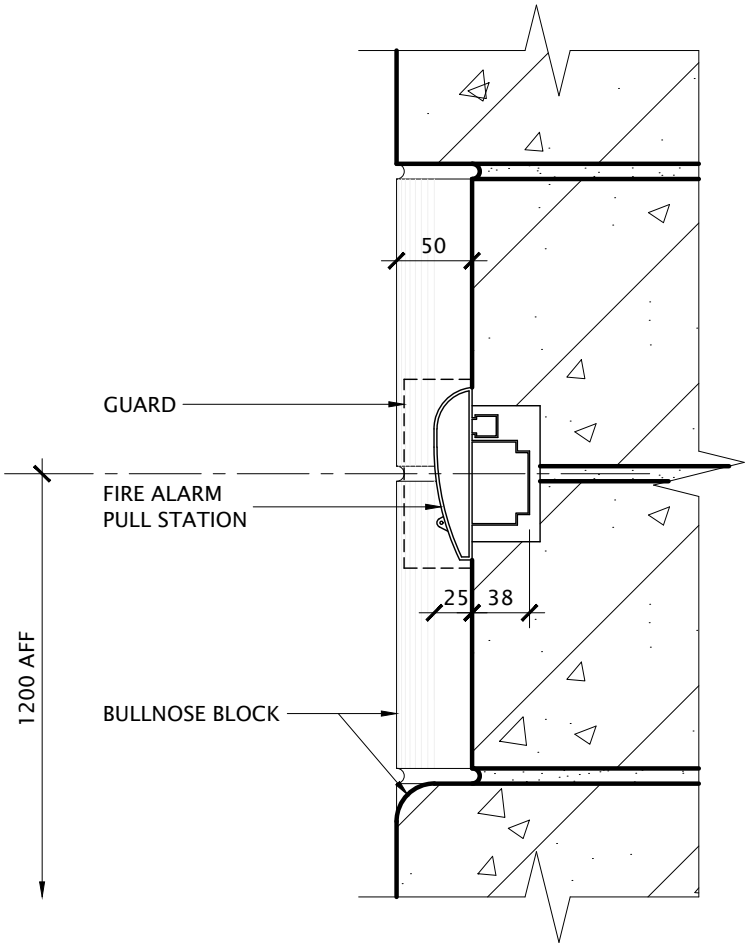
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
RECESSED FIRE ALARM
PULL STATION TYP. ELEVATION

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 4–109 / REV. 0



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ISSUED:

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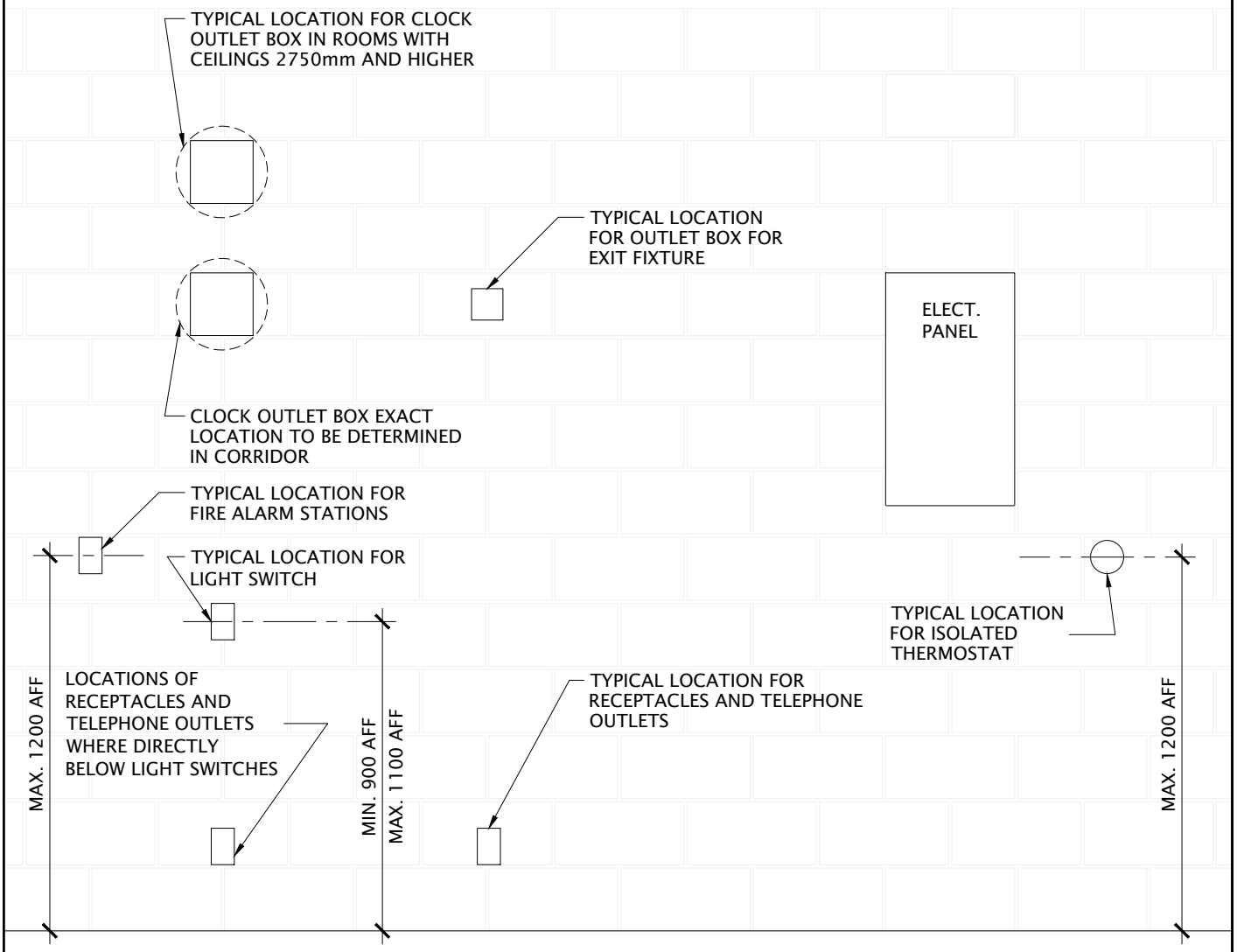
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
RECESSED FIRE ALARM
PULL STATION TYP. SECTION

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 4–110
	REV. 0



NOTE:

1. BOTTOM EDGES OF ALL COVER PLATES (RECEPTACLES, TELEPHONE OUTLETS, PILOT LIGHTS AND LIGHT SWITCHES) SHALL BE EXACTLY LEVEL WITH TOP OF BLOCK AND SHALL NOT OVERLAP JOINT.

2. REFER TO SCHEDULE FOR HEIGHTS OF RECEPTACLES AND TELEPHONE OUTLETS.

3. TOP OF FACE PLATES OF ALL PANELS SHALL BE EXACTLY LEVEL WITH TOP OF 10TH BLOCK AND SHALL NOT OVERLAP JOINT.

4. COORDINATE WITH MECHANICAL & ELECTRICAL

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ISSUED:

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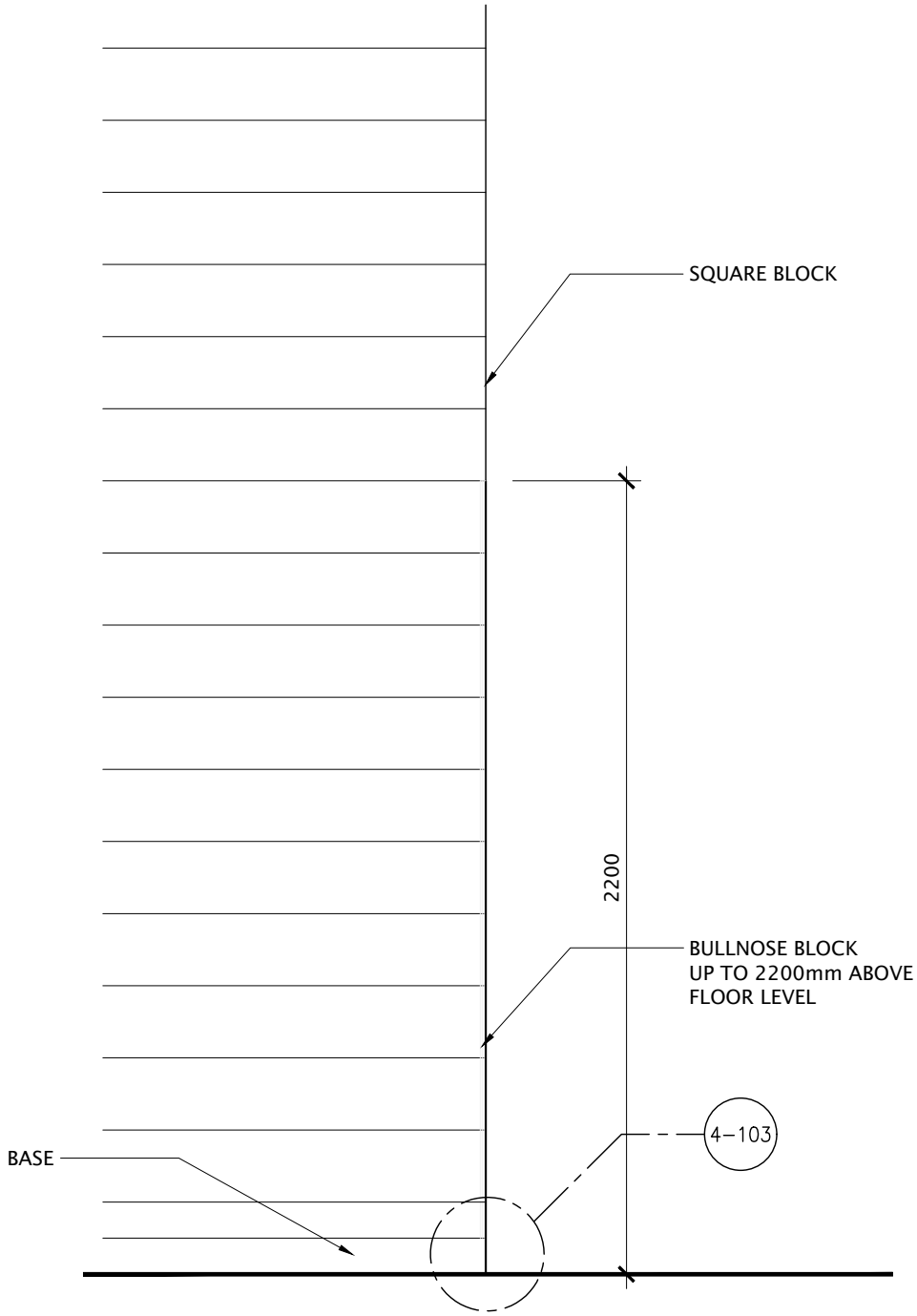
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: TYPICAL ELECTRICAL FITTINGS LOCATION	DATE: January 2023	SCALE: 1:20	
	DRAWN: K+	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 4–111	REV. 0



CORNER BLOCK WALL CONDITION

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ISSUED:

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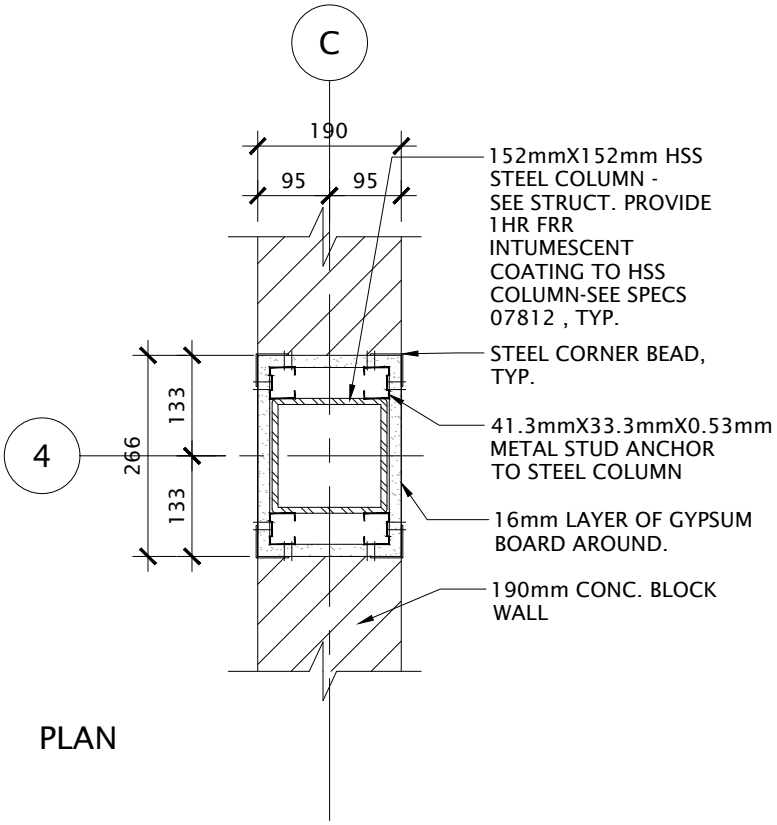
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: TYPICAL BULLNOSE BLOCK AT CORNER WALL CONDITION	DATE: January 2023	SCALE: N.T.S.	
	DRAWN: K+	PROJECT NO: A22008	
PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition	CHECKED:	DWG NO: 4-112	REV.



PLAN

NOTES

GYPSUM BOARD SHALL BE APPLIED VERTICALLY WITHOUT HORIZONTAL JOINTS.

1. GYPSUM BOARD SHALL BE ATTACHED TO STEEL STUDS WITH SCREWS SPACED NOT MORE THAN 305MM OC.
2. STUDS SHALL BE FABRICATED OF GALVANIZED STEEL NOT LESS THAN 0.53MM THICK AND NOT LESS THAN 41.3MM WIDE WITH LEGS NOT LESS THAN 33.3MM LONG AND SHALL BE 12.7MM LESS THAN THE ASSEMBLY HEIGHT.
3. CORNER BEADS SHALL:
   - 3.1. BE FABRICATED OF GALVANIZED STEEL THAT IS NOT LESS THAN 0.41MM THICK,
   - 3.2. HAVE LEGS NOT LESS THAN 31MM LONG,
   - 3.3. BE ATTACHED TO THE GYPSUM BOARD OR STUD WITH 25.4MM SCREWS SPACED NOT MORE THAN 305MM OC
   - 3.4. HAVE THE ATTACHING FASTENERS PENETRATE THE STEEL STUD MEMBER.

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ISSUED:

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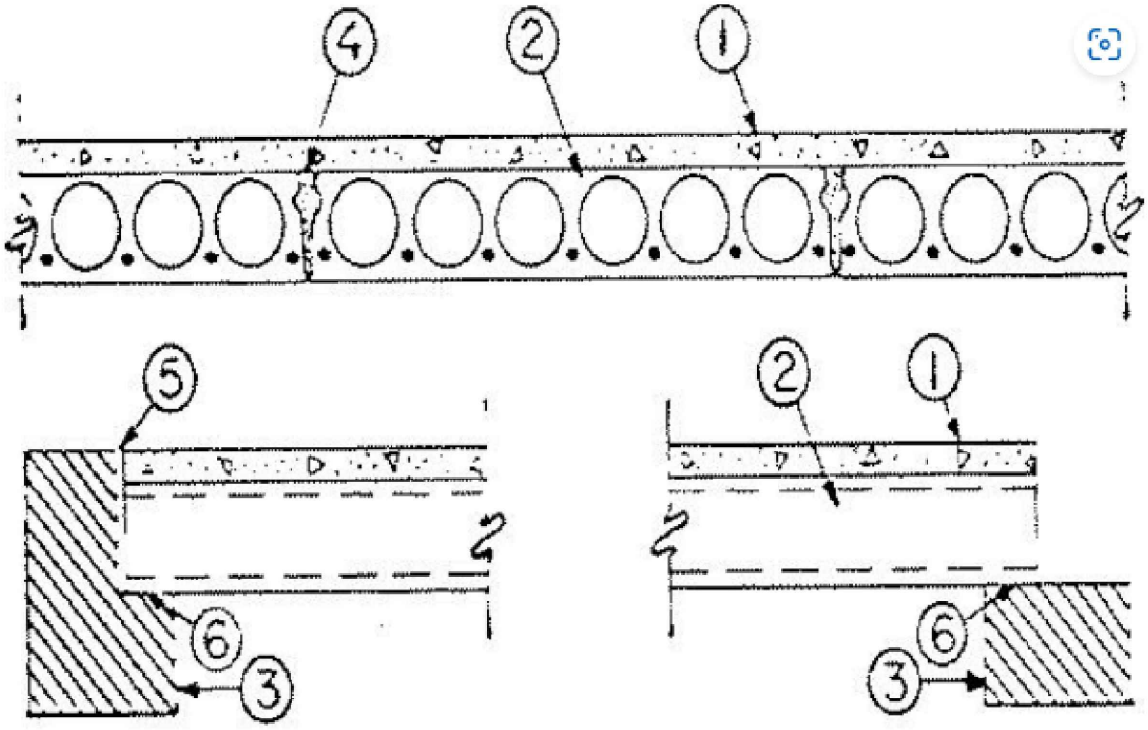
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: 1HR FIREPROOFING @ STEEL COLUMN	DATE: January 2023	SCALE: 1:10	
	DRAWN:	PROJECT NO: A22008	
PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition	CHECKED:	DWG NO: 4–114	REV. 1



Restrained End Detail

Unrestrained End Detail

SECTION DETAILS FOR DESIGN NO. BXUV7 . J957 ACCORDING TO CAN/ULC-S101 FOR 1 HR FRR FOR CONC. HOLLOWCORE SLAB AND BEAMS

ASSEMBLY COMPONENTS (REFER TO ULC WEBISTE: https://iq.ulprospector.com/en/profile?e=14200):

1. **CONCRETE TOPPING** — 3000 PSI COMPRESSIVE STRENGTH, 110 TO 153 PCF UNIT WEIGHT. FOR 1A. TO 1H (REFER TO ULC WEBISTE)
2. **PRECAST CONCRETE UNIT** — NOMINAL 10 IN. THICK UNITS. NORMAL WEIGHT AGGREGATE. CROSS SECTION SIMILAR TO THE ABOVE ILLUSTRATION- SEE A3-3 FOR BUILDING SECTIONS.
3. **END DETAILS** — RESTRAINED AND UNRESTRAINED- SEE STRUC.
4. **JOINT** — CLEARANCE BETWEEN SLABS AT BOTTOM, FULL LENGTH, 1/16 IN. MIN, 5/16 IN. MAX. GROUTED FULL LENGTH WITH SAND-CEMENT GROUT (3500 PSI MIN COMPRESSIVE STRENGTH) TO A MAX DEPTH OF 4-1/2 IN. THIS DEPTH MAY BE MAINTAINED BY PLACING A COMPRESSIBLE MATERIAL IN THE BOTTOM OF THE JOINT BEFORE APPLYING GROUT. NOTE: A 3/4 IN. LATERAL EXPANSION JOINT TO BE PROVIDED THE FULL LENGTH AND DEPTH OF THE SLABS EVERY 14 FT. EXPANSION SHOULD BE OBTAINED WITH NONCOMBUSTIBLE, COMPRESSIBLE MATERIAL, FOR EXAMPLE, 24 SHEETS OF 1/16 IN. THICK CERAMIC FIBER PAPER (TOTAL THICKNESS EQUALS 1-1/2 IN.).
5. **END CLEARANCE** — CLEARANCE FOR EXPANSION AT EACH END OF SLABS SHALL BE EQUAL TO (3/16 PLUS OR MINUS 1/16 IN.) L/17 IN., WHERE "L" IS EQUAL TO LENGTH OF SPAN IN FEET.
6. **MIN BEARING** — 1-1/2 IN.
7. **BEAM** — (OPTIONAL, NOT SHOWN) — W8X28 MIN SIZE.-SEE STRUC. THE PRECAST CONCRETE UNITS SHALL BE WELDED TO THE TOP FLANGE OF THE BEAM BY MEANS OF WELD PLATES (SPACED 48 IN. OC MAX) INCORPORATED IN THE UNITS.
8. **SPRAY-APPLIED FIRE RESISTIVE MATERIALS*** — (NOT SHOWN) — APPLIED BY MIXING WITH WATER AND SPRAYING IN ONE OR MORE COATS TO THE FINAL 7/16 IN. THICKNESS ON THE STEEL BEAM FOLLOWING THE BEAM CONTOUR. SURFACES OF THE BEAM SHALL BE CLEAN AND FREE OF DIRT, LOOSE SCALE AND OIL. MIN AVG AND MIN IND DENSITY OF 15/14 PCF RESPECTIVELY. MIN AVG AND MIN IND DENSITY OF 22/19 PCF RESPECTIVELY FOR TYPES Z-106, Z-106/G, Z-106/HY. MIN AVG AND MIN IND DENSITY OF 19/18 PCF RESPECTIVELY FOR TYPE 7GP AND 7HD. FOR METHOD OF DENSITY DETERMINATION, REFER TO DESIGN INFORMATION SECTION. FOR 8A. TO 8D. (REFER TO ULC WEBSITE)

NOTE:

1. **FOR CONCRETE HOLLOWCORE SLAB COVER THICKNESSES AND FIRE RATINGS REFER TO STRUC.**

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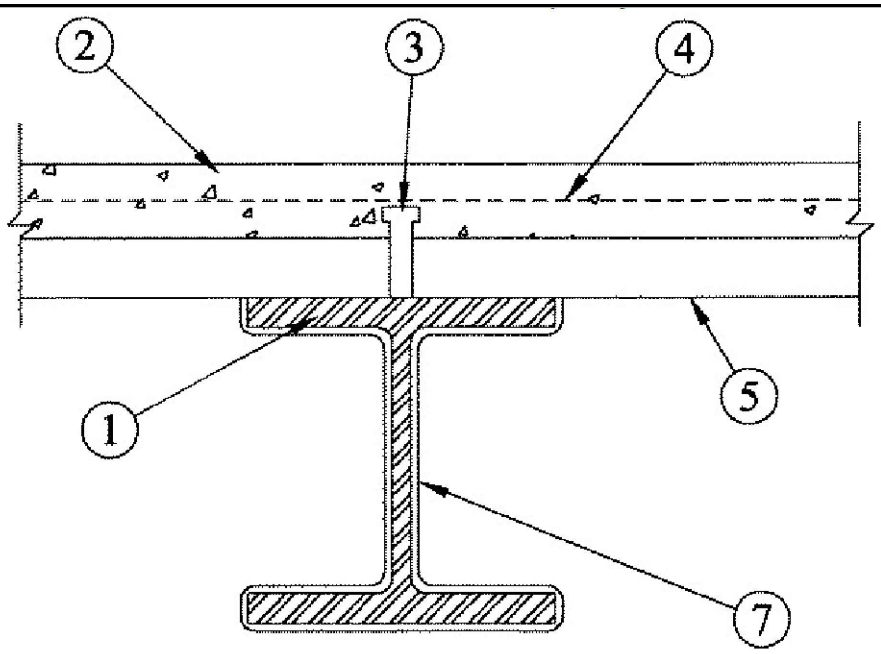
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: MIN. 1HR FRR CONC. HOLLOWCORE SLAB ASSEMBLY BXUV7 . J957 (CAN/ULC-S101)	DATE: January 2023	SCALE: N.T.S.	
	DRAWN:	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 4–115	REV. 0



SECTION DETAIL FOR DESIGN NO. BXUV7 . N634 ACCORDING TO CAN/ULC-S101 FOR 1 HR FRR FOR STEEL BEAMS

ASSEMBLY COMPONENTS (REER TO ULC WEBSITE: https://iq.ulprospector.com/en/profile?e=14415):

1. **STEEL BEAM** — MINIMUM BEAM SIZES AS SHOWN IN TABLE BELOW-SEE STRUC. BEAMS SHALL BE FREE OF DIRT, LOOSE SCALE AND OIL. BEAMS SHALL BE PRIMED WITH A METAL ALKYD PRIMER AT A NOMINAL THICKNESS OF 2 MIL OR AN EPOXY PRIMER AT A NOMINAL THICKNESS OF 1 MIL..
2. **NORMAL WEIGHT OR LIGHTWEIGHT CONCRETE** — COMPRESSIVE STRENGTH 3000 PSI. FOR NORMAL WEIGHT CONCRETE EITHER CARBONATE OR SILICEOUS AGGREGATE MAY BE USED. UNIT WEIGHT 145 LBS/CU FT. FOR NORMAL WEIGHT CONCRETE AND 110 LBS/CU FT. FOR LIGHTWEIGHT CONCRETE. MIN CONCRETE THICKNESS, AS MEASURED FROM TOP PLANE OF STEEL FLOOR AND FORM UNITS IS 2-1/2 IN. SEE STRUC.
3. **SHEAR CONNECTOR** — (OPTIONAL) — STUDS, 3/4 IN. DIAM HEADED TYPE OR EQUIVALENT PER AISC SPECIFICATIONS WELDED TO THE TOP FLANGE OF BEAM THROUGH THE STEEL FLOOR UNITS.END CLEARANCE — CLEARANCE FOR EXPANSION AT EACH END OF SLABS SHALL BE EQUAL TO (3/16 PLUS OR MINUS 1/16 IN.) L/17 IN., WHERE "L" IS EQUAL TO LENGTH OF SPAN IN FEET.
4. **WELDED WIRE FABRIC** — 6X6-10/10 SWG.
5. **STEEL FLOOR OR FORM UNITS** — 1-1/2, 2 OR 3 IN. DEEP FLUTED UNITS, WELDED TO BEAM.
6. **MINERAL WOOL INSULATION** — (NOT SHOWN) — MIN 4 PCF MINERAL WOOL INSULATION CUT INTO PIECES AND FIRMLY PACKED INTO, AND COMPLETELY FILLING THE SPACES BETWEEN THE FLUTES OF THE STEEL FLOOR AND FORM UNITS AND THE TOP FLANGE OF THE BEAM. MINERAL WOOL IS NOT REQUIRED WHEN THE TOP FLANGE OF THE BEAM IS PROTECTED WITH INTUMESCENT COATING AT THE SAME THICKNESS SHOWN IN THE TABLE IN ITEM 7.
7. **INTUMESCENT FIRE-RESISTIVE MATERIALS*** — COATING SPRAY OR BRUSH APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AT THE MIN DRY THICKNESS AS SHOWN IN THE TABLE BELOW. THE THICKNESS SHOWN BELOW INCLUDES THE PRIMER THICKNESS. WHEN MINERAL WOOL (ITEM 6) IS USED, THE TOP SURFACE OF THE BEAM NEED NOT BE PROTECTED WITH COATING. FOR PRODUCTS REFER TO ULC WEBSITE.

NOTE: FOR BEAM SIZES- SEE STRUC. BELOW ARE MIN. BEAM SIZES.							
BEAM SIZE	BEAM W/D	UN - RESTRAINED BEAM RATING	RESTRAINED BEAM RATING	MIN. DRY THICKNESS (NW CONC.) MILS	MIN. DRY THICKNESS (NW CONC.) MM	MIN. DRY THICKNESS (LW CONC.) MILS	MIN. DRY THICKNESS (LW CONC.) MM
W8X24	0.70	1		35	0.88	35	0.88
W8X24	0.70	1-1/2		59	1.48	60	1.52
W8X24	0.70	2		98	2.47	100	2.53
W8X28	0.81	1		22	0.56	24	0.60
W8X24	0.70		1	35	0.88	35	0.88
W8X24	0.70		1-1/2	35	0.88	35	0.88
W8X24	0.70		2	69	1.74	70	1.78

8. **TOP COAT** — (NOT SHOWN) — TYPE TNEMEC 740 REQUIRED FOR EXTERIOR USE WITH TYPE SPRAYFILM WB5, APPLIED AT A MINIMUM DRY THICKNESS OF 7 MILS OVER THE INTUMESCENT MATERIAL. SEE CLASSIFICATION INFORMATION IN THE MASTIC AND INTUMESCENT COATING (CDWZ) CATEGORY, ISOLATEK INTERNATIONAL, FOR MIXING REQUIREMENTS.

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ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: MIN. 1HR FIREPROOFING @ STEAL BEAM BXUV7 . N634 (CAN/ULC-S101)

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE: January 2023

DRAWN:

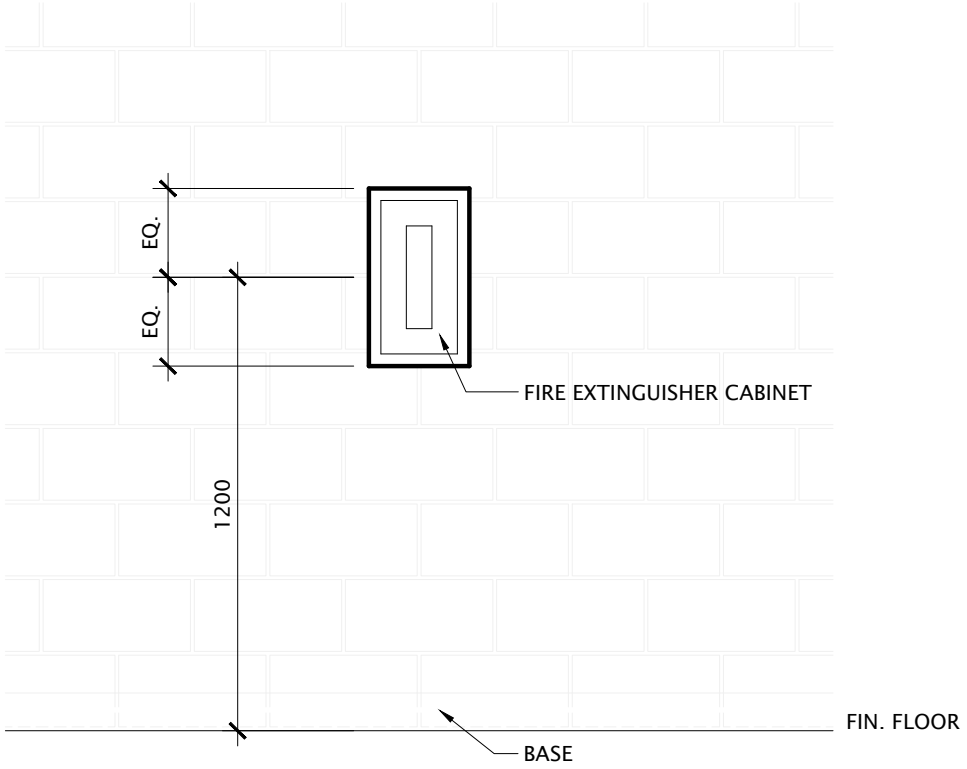
CHECKED:

SCALE: N.T.S.

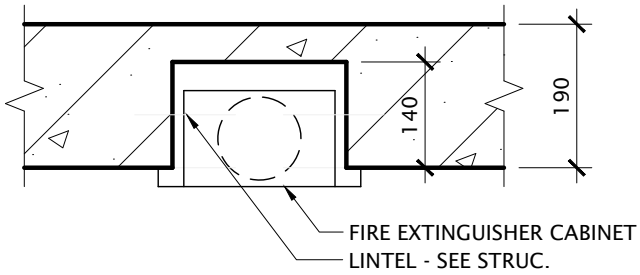
PROJECT NO: A22008

DWG NO: 4–116

REV. 0



ELEVATION



PLAN
N.T.S.

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ISSUED:

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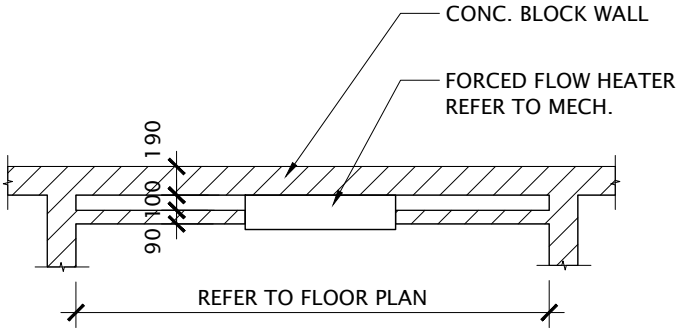
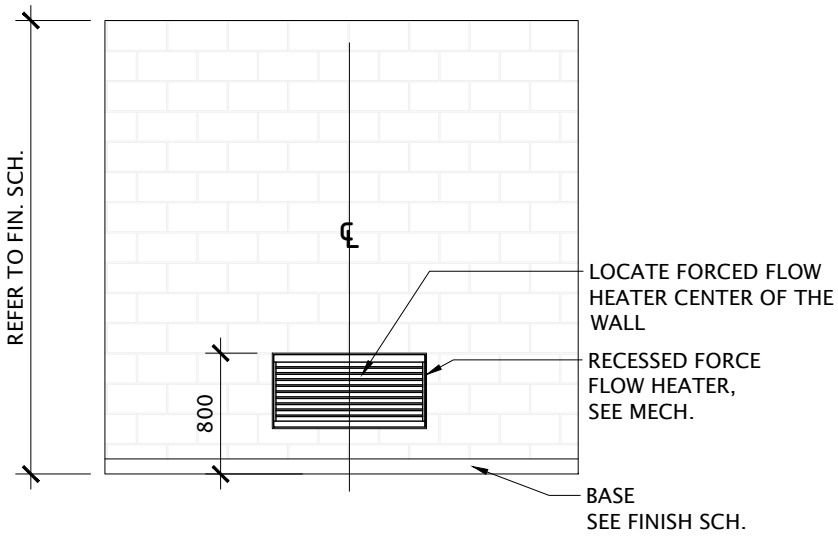
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: DETAIL AT RECESSED FIRE EXTINGUISHER CABINET

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE: January 2023	SCALE: 1:20
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 4–117 / REV. 0





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ISSUED:

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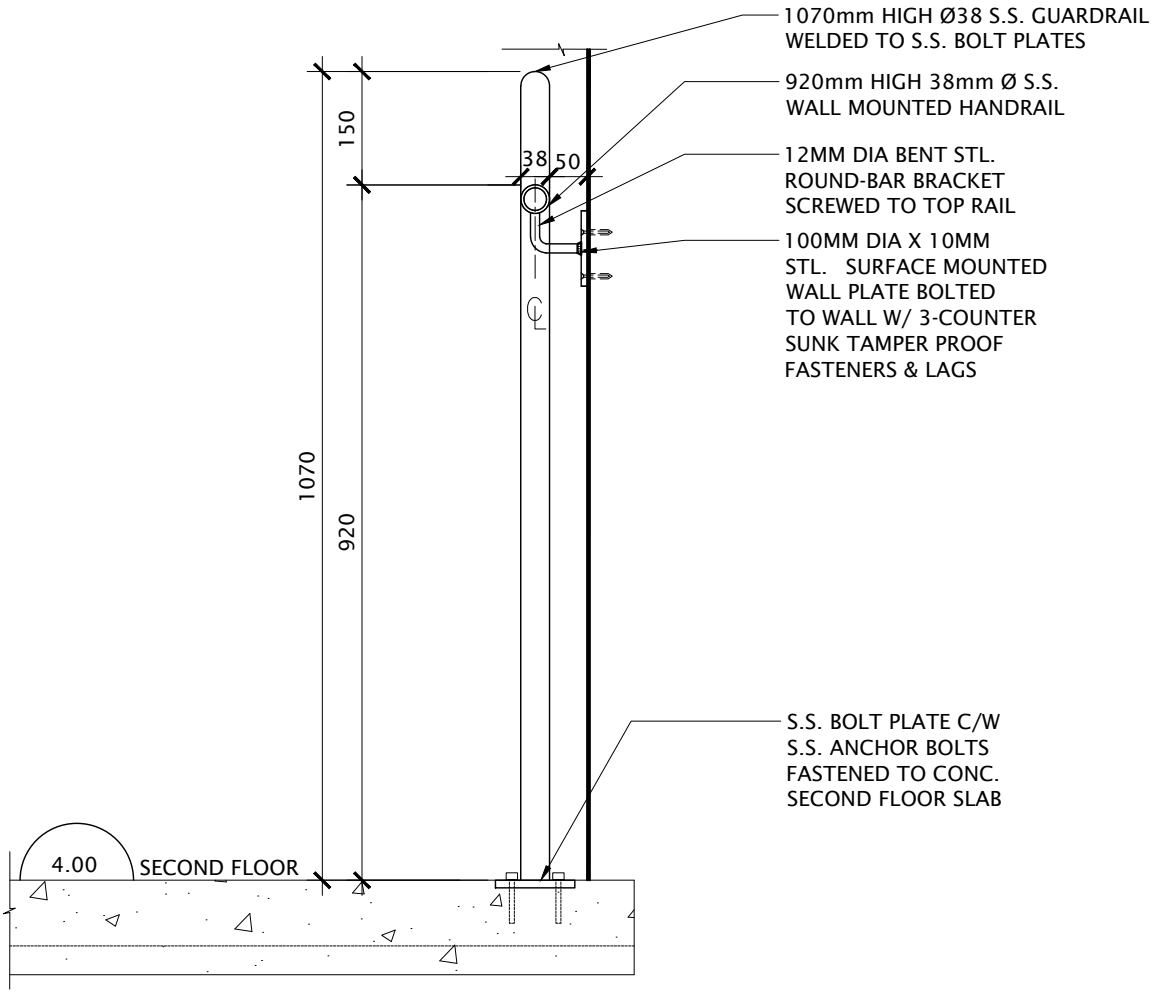
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
RECESSED
FORCE FLOW HEATER

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:50
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 4–118 / REV. 0



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ISSUED:

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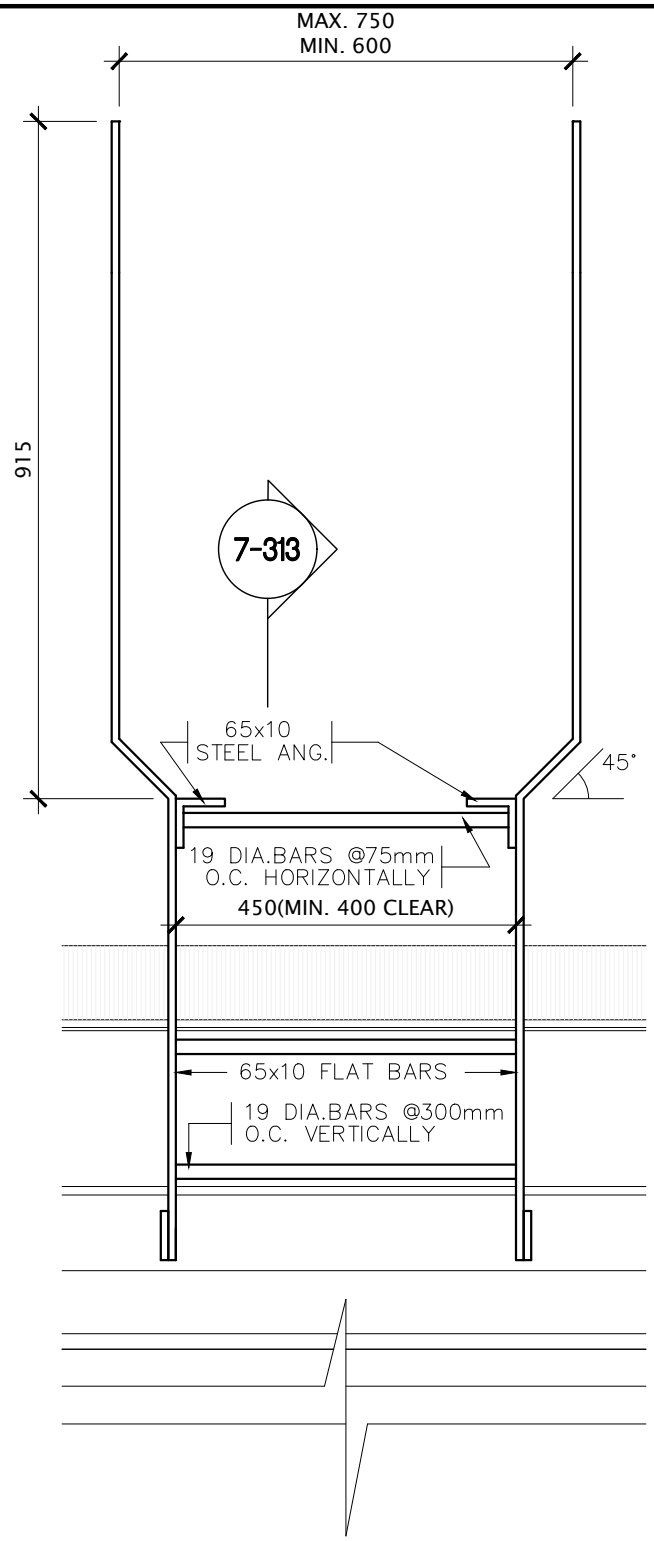
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
TYPICAL STAIR WALL MOUNTED HANDRAIL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 5–104 / REV.



NOTE: ALL STEEL TO BE HOT DIPPED GALVANIZED.
PROVIDE ENGINEERED SHOP DRAWING.

Kingsland + ARCHITECTS INC.

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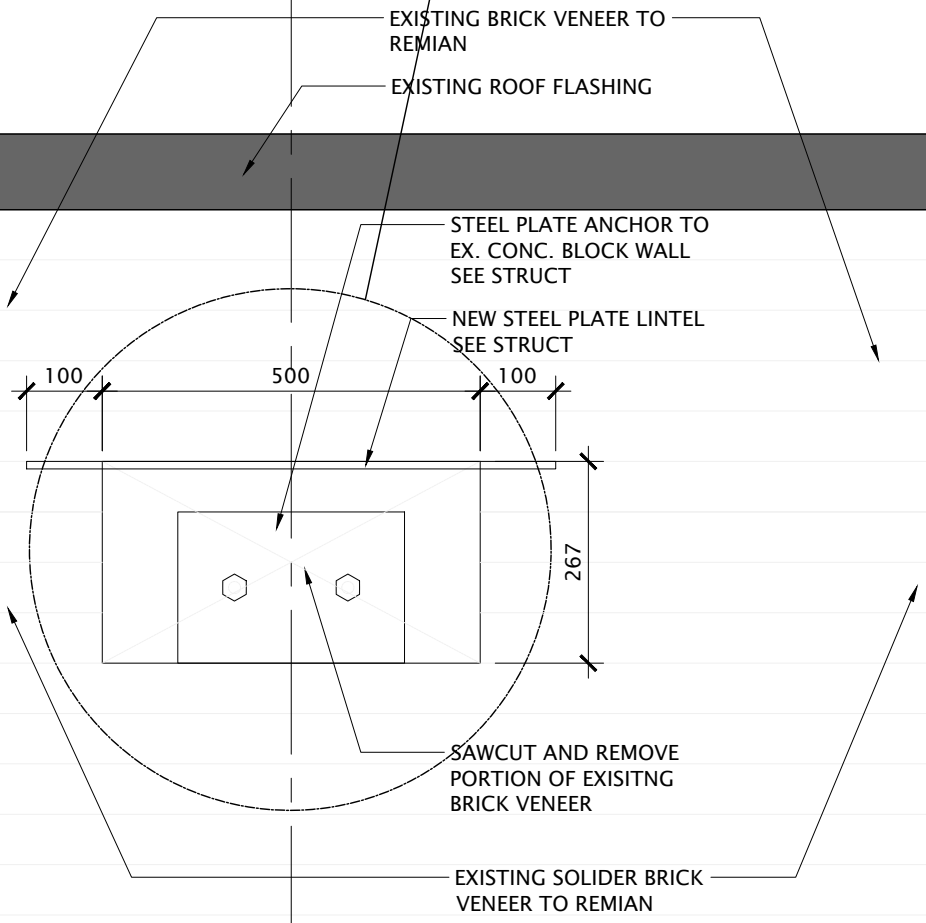
ph 416.203.7799
fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: ROOF LADDER ELEVATION	DATE: January 2023	SCALE: 1:10	
	DRAWN: DT	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 5-114	REV.



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fax 416.203.7763

ISSUED:

DRAWING NAME:
POCKET DETAIL @ EXT. WALL FOR STRUCTURE INSTALLATION

PROJECT NAME:
Clearview Meadows Elementary School

DATE: Sept. 2018

DRAWN: DT

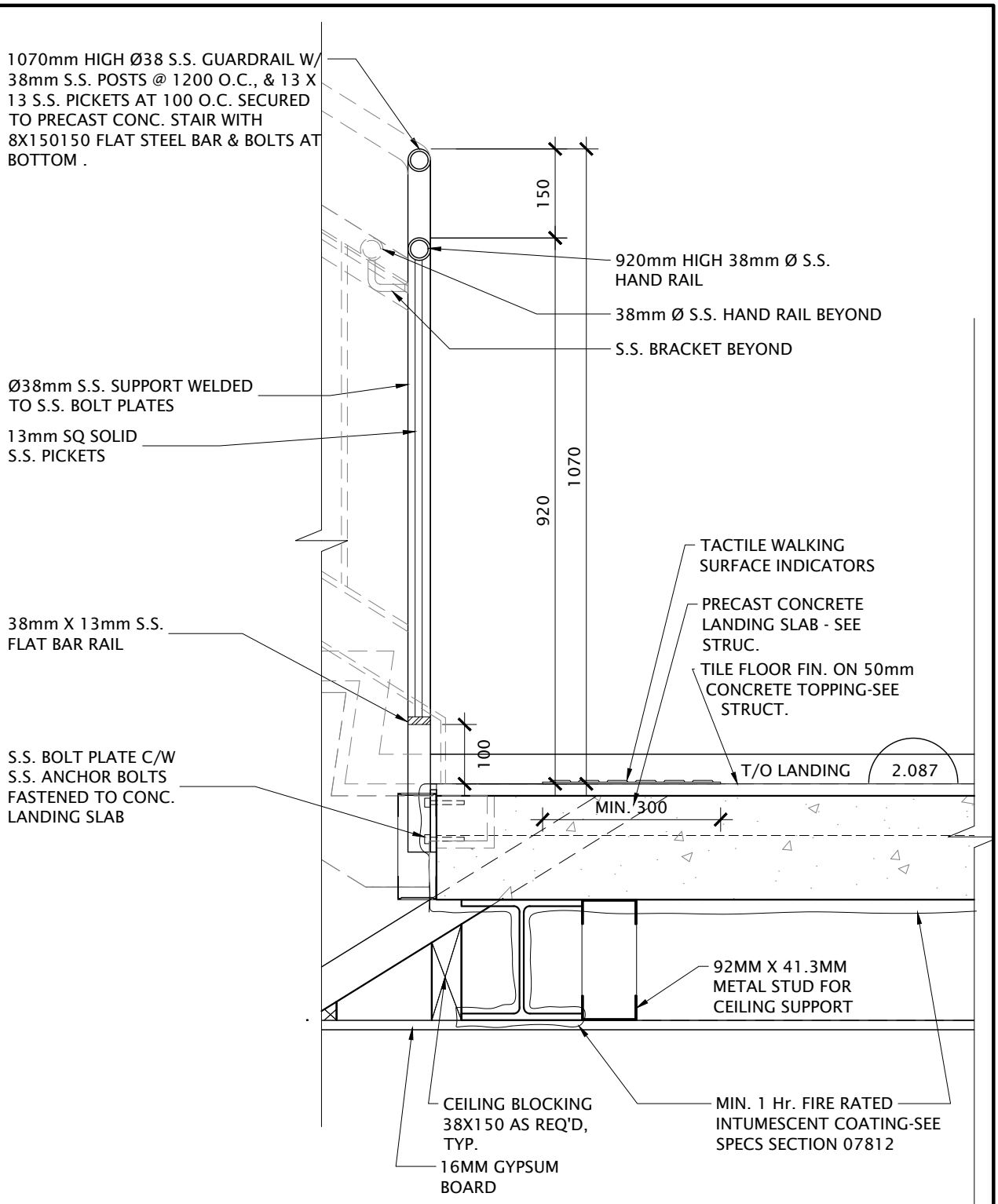
CHECKED:

SCALE: 1:10

PROJECT NO: A17018

DWG NO: 5-115

REV.



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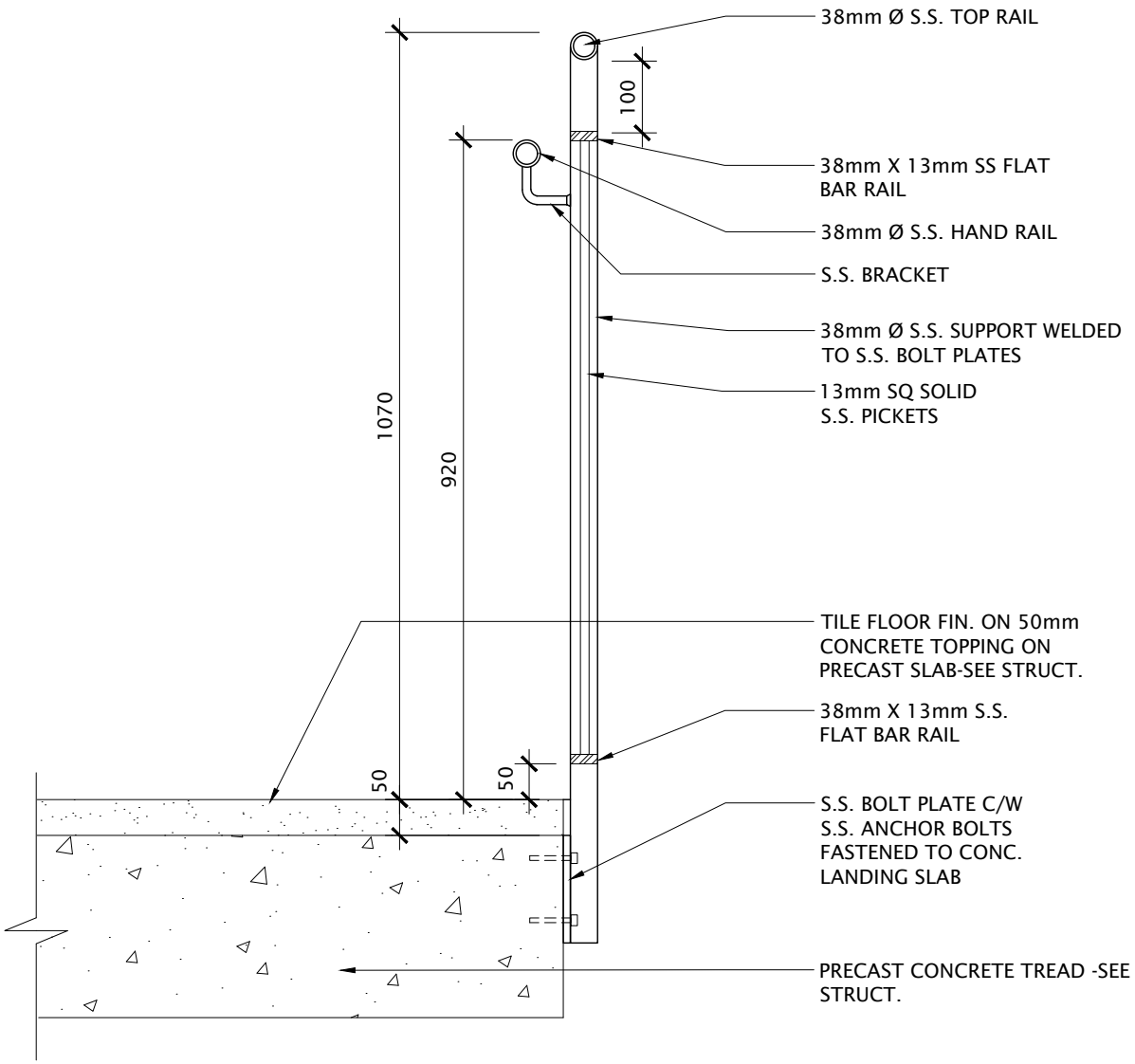
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

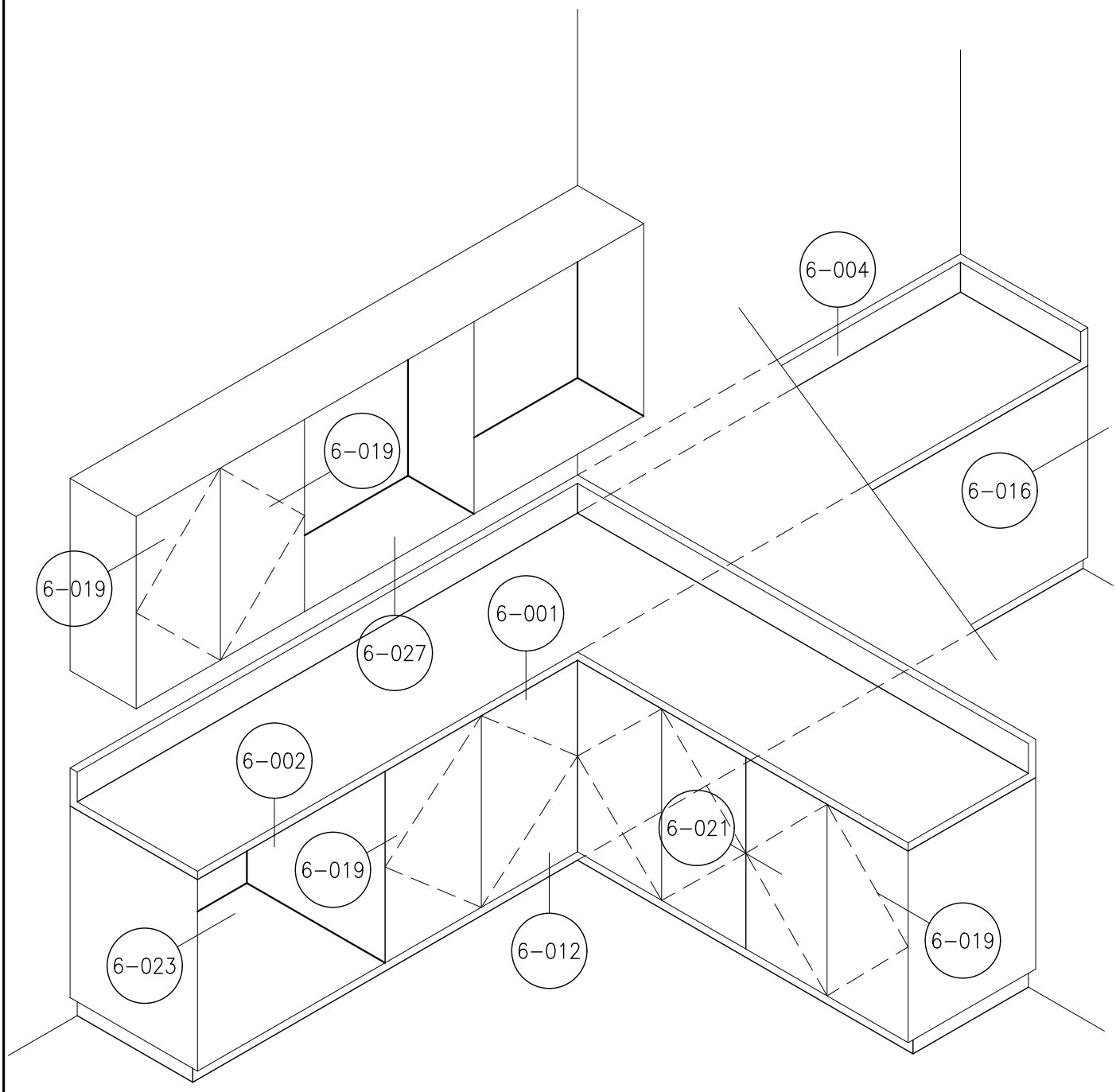
DRAWING NAME:
TYPICAL STAIR GUARD & HANDRAIL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:10
DRAWN: D.T.	PROJECT NO: A22008
CHECKED:	DWG NO: 5–132
	REV.



Kingsland ARCHITECTS INC. KINGSLAND + ARCHITECTS INC 219 Dufferin Street , Suite 308b Toronto, Ontario M6K 3J1 ph 416.203.7799 fax 416.203.7763	ISSUED: ONTARIO ASSOCIATION ARCHITECTS COLIN J. KINGSLAND LICENCE 4549	DRAWING NAME: TYPICAL STAIR GUARD & HANDRAIL DETAIL PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	DATE: January 2023 DRAWN: D.T. CHECKED:	SCALE: 1:10 PROJECT NO: A22008 DWG NO: 5–133 REV.



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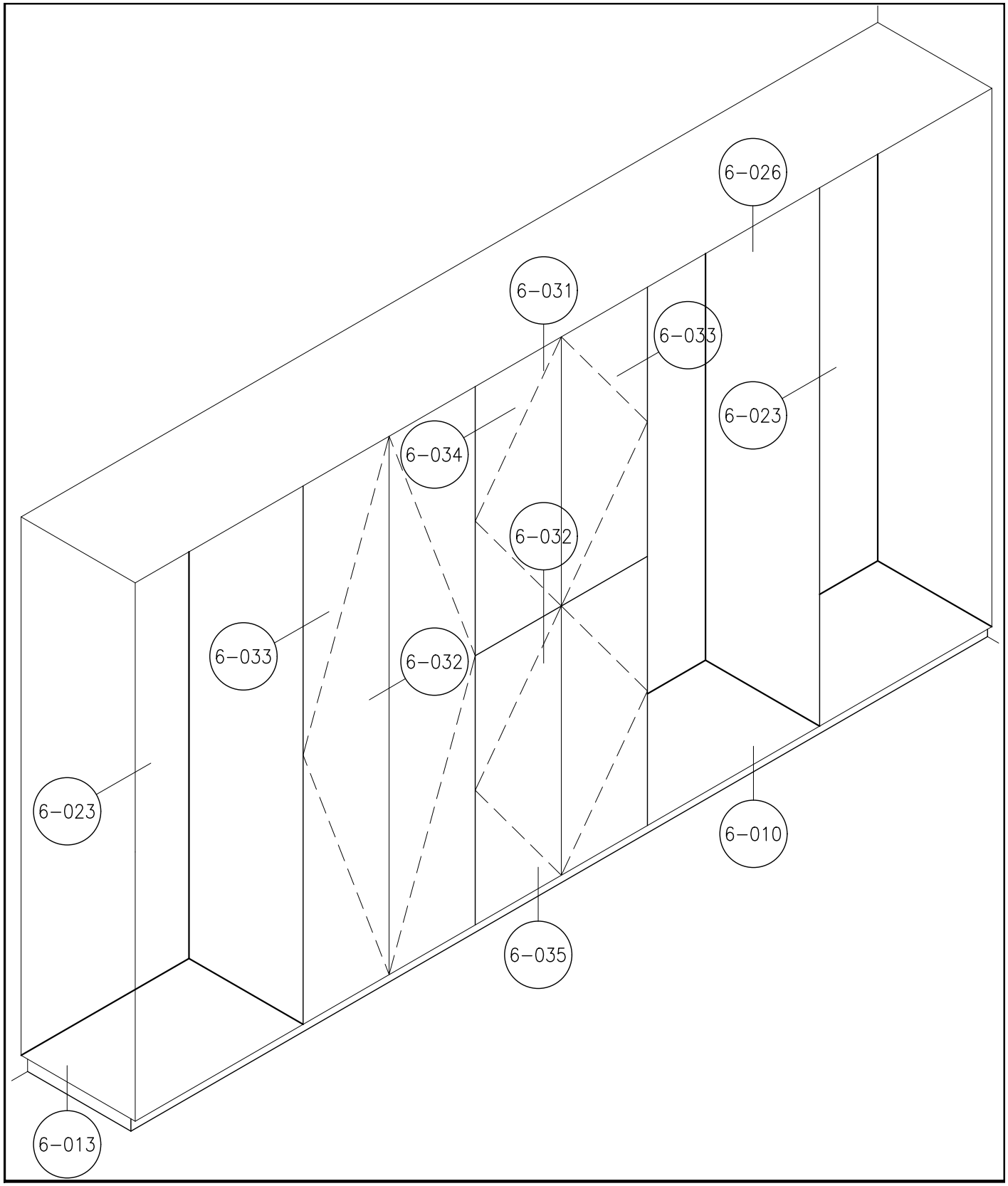
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK DETAILS
REFERENCE GUIDE

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: N.T.S.
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 6–000a / REV. 0



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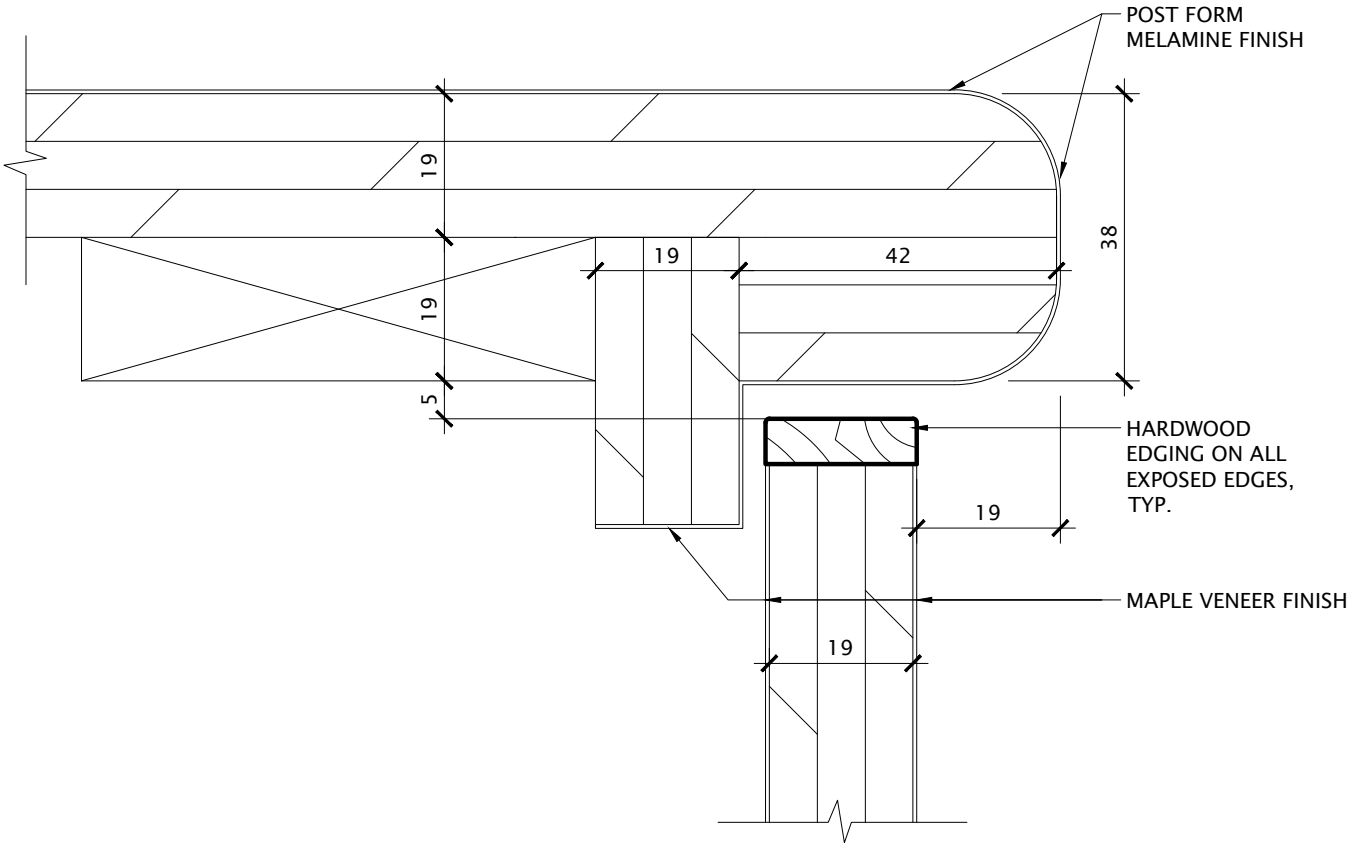
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK DETAILS
REFERENCE GUIDE

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: N.T.S.
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 6-000b
	REV. 0



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COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN: K+

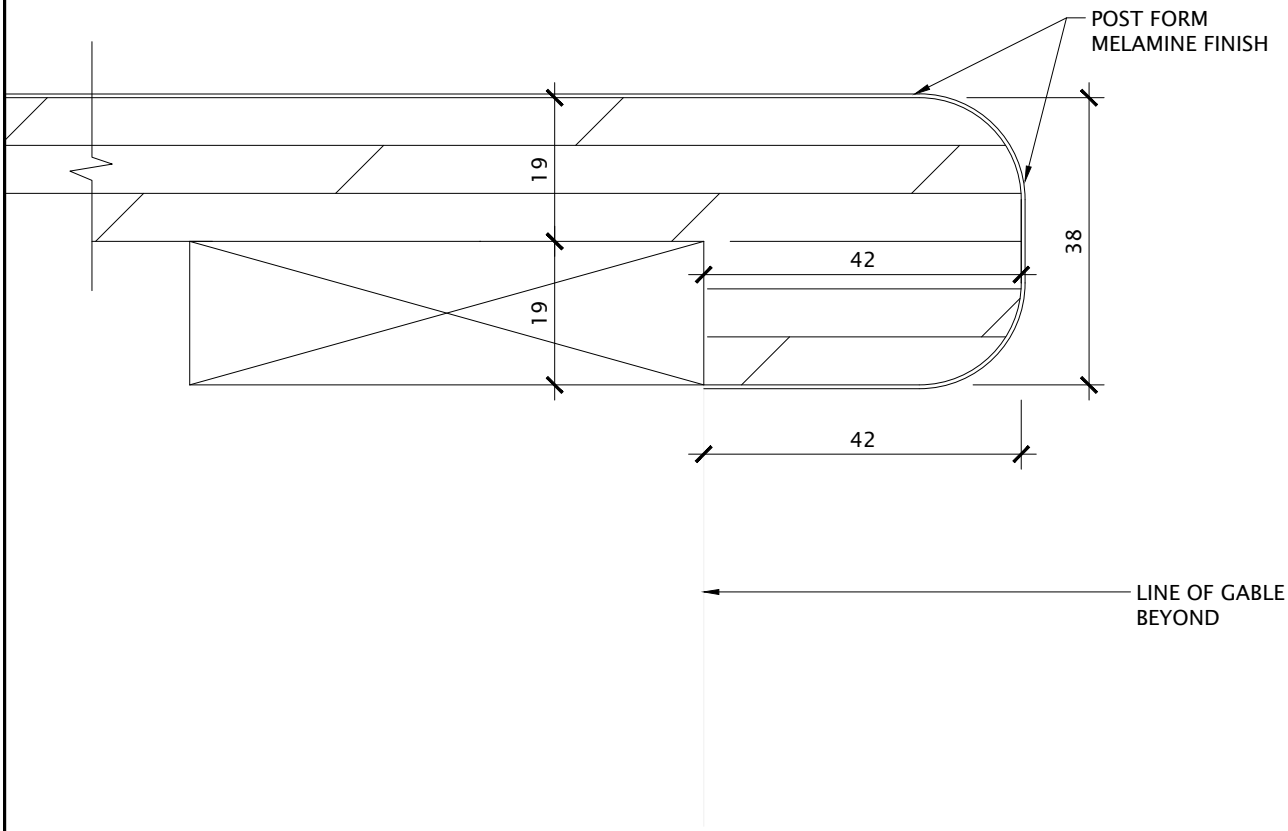
CHECKED:

SCALE: 1:1

PROJECT NO: A22008

DWG NO: 6-001

REV.



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LICENCE
4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN: K+

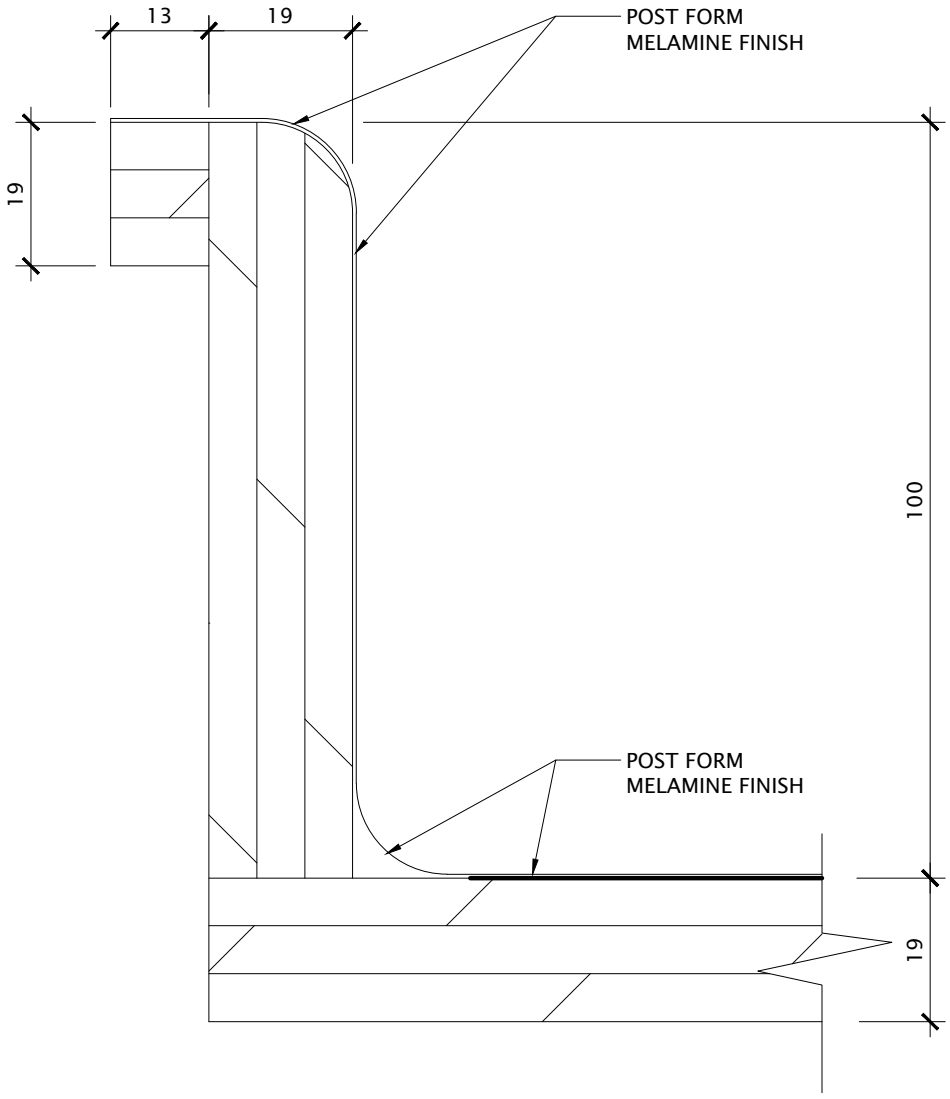
CHECKED:

SCALE: 1:1

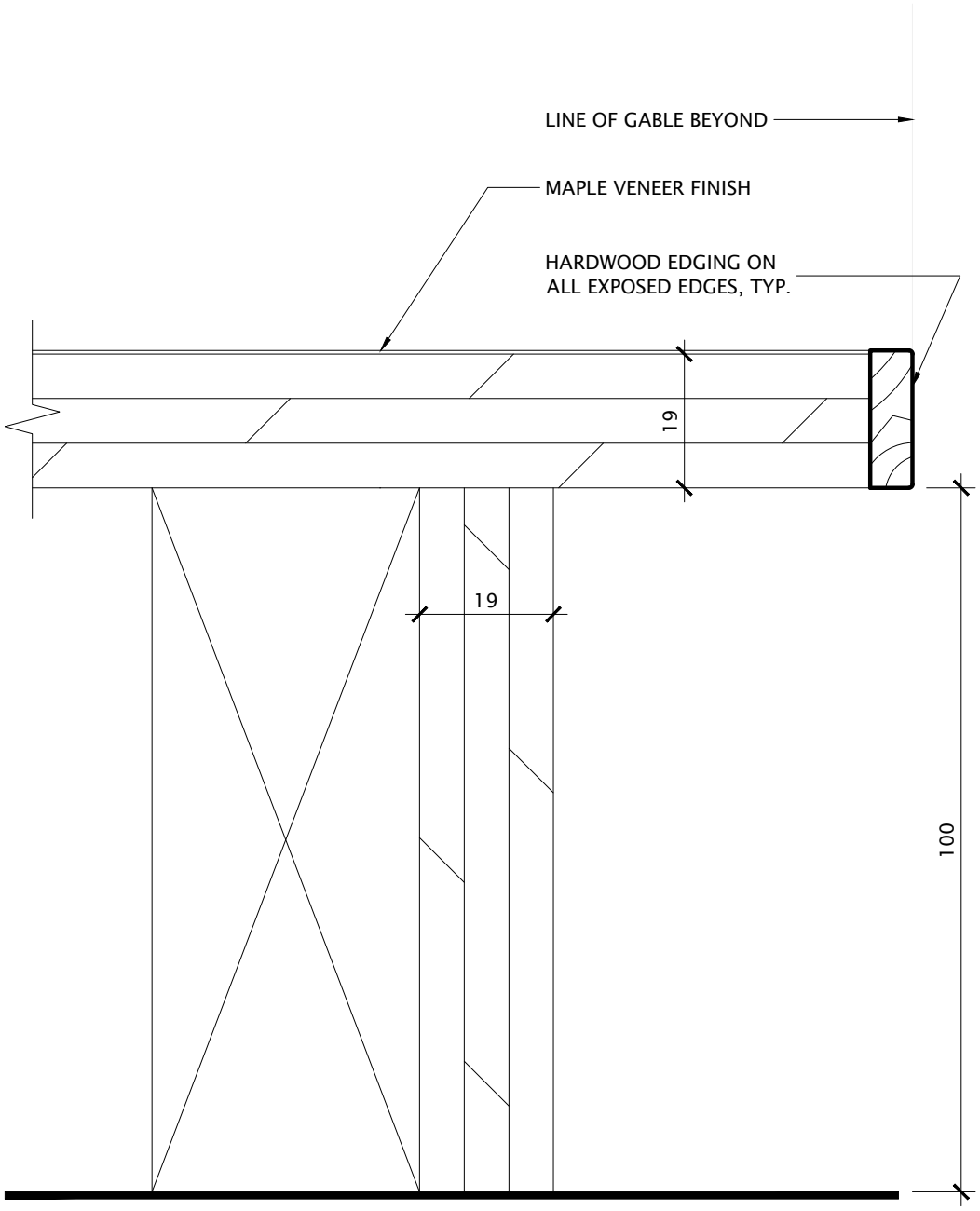
PROJECT NO: A22008

DWG NO: 6-002

REV.



Kingsland + ARCHITECTS INC.	ISSUED: ONTARIO ASSOCIATION ARCHITECTS COLIN J. KINGSLAND LICENCE 4549	DRAWING NAME: MILLWORK SECTION TYPICAL DETAIL	DATE: January 2023	SCALE: 1:1
			DRAWN: K+	PROJECT NO: A22008
KINGSLAND + ARCHITECTS INC 219 Dufferin Street , Suite 308b Toronto, Ontario M6K 3J1 ph 416.203.7799 fax 416.203.7763		PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition	CHECKED:	DWG NO: 6–004 / REV.



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LICENCE
4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN: K+

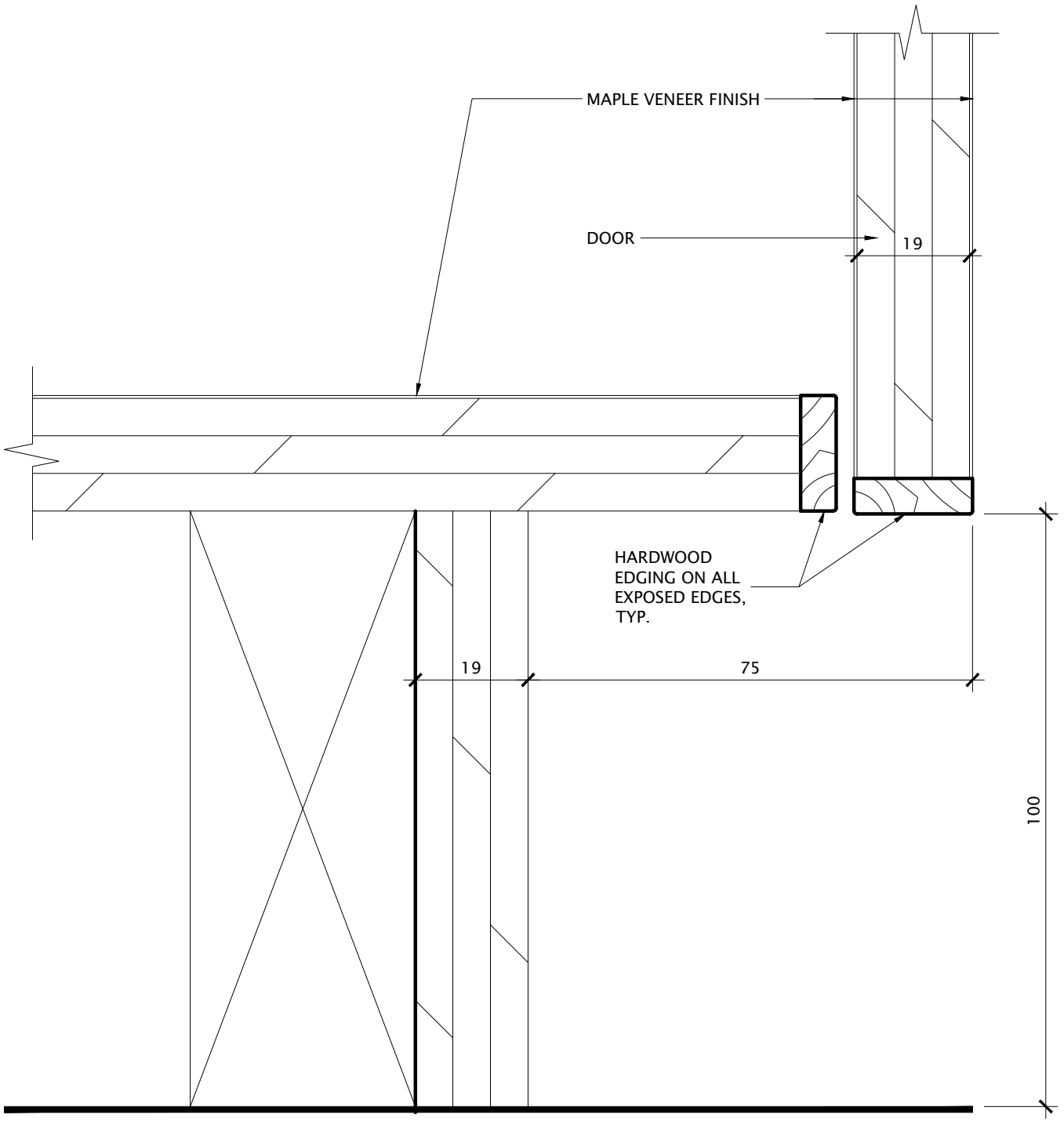
CHECKED:

SCALE: 1:1

PROJECT NO: A22008

DWG NO: 6-010

REV.



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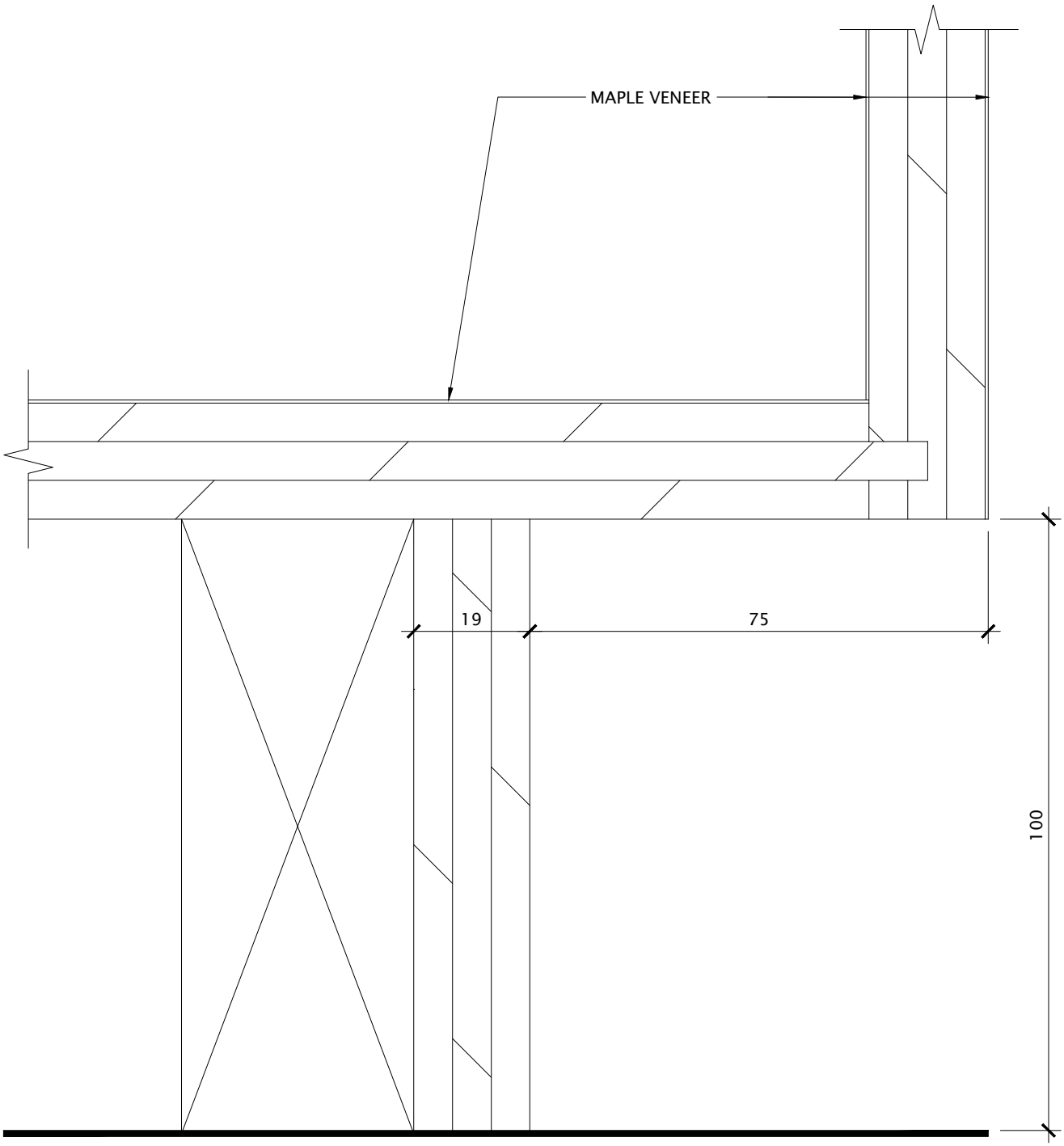
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-012
REV.



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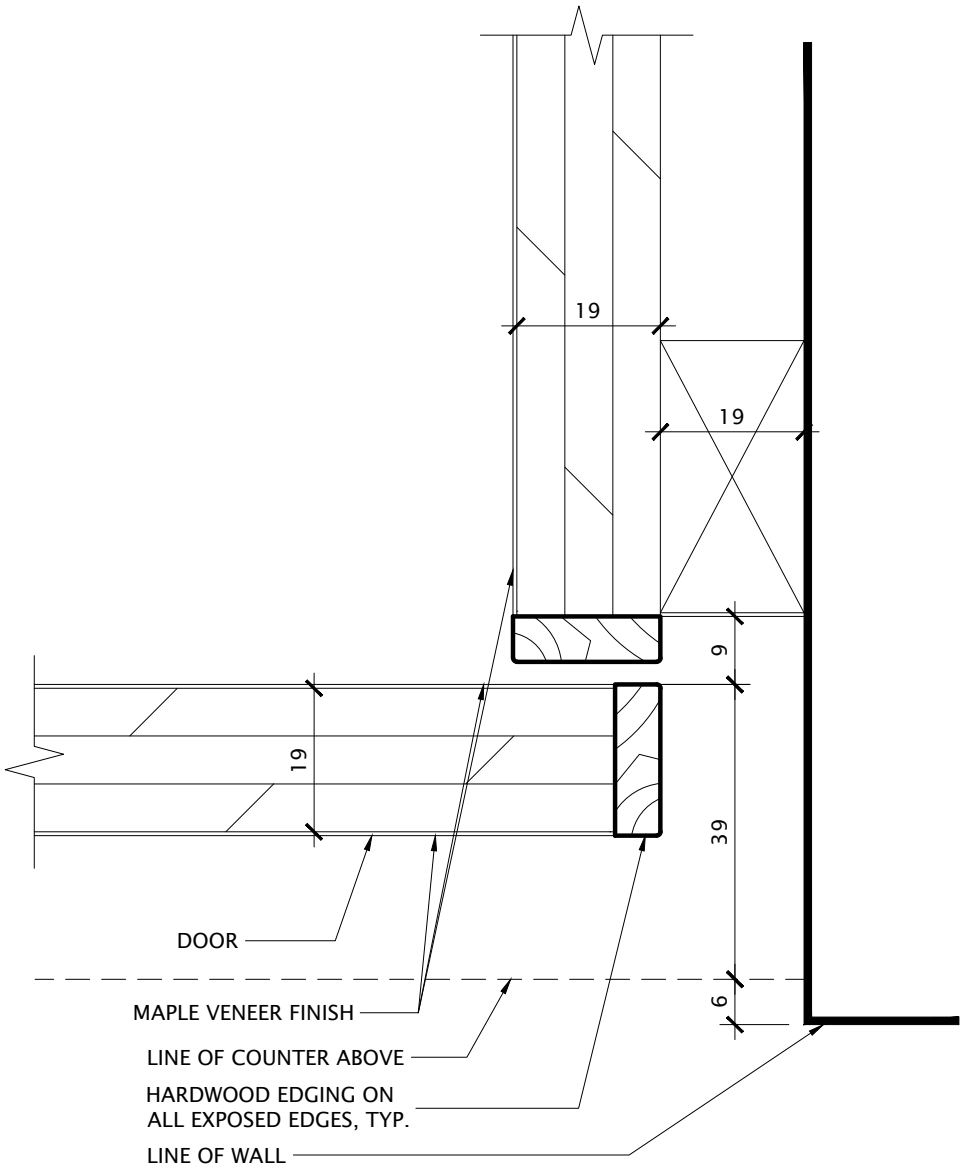
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-013
REV.



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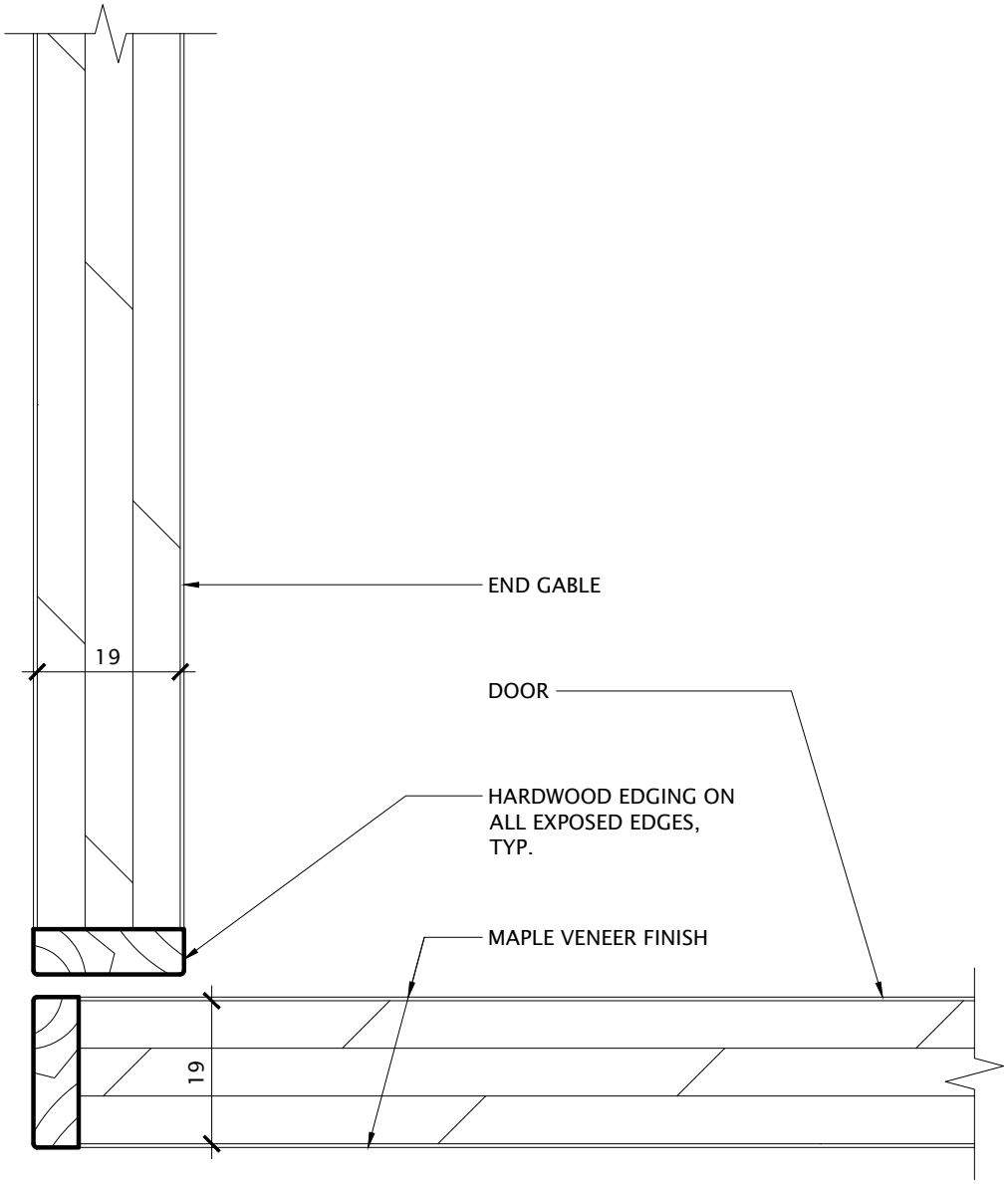
DRAWING NAME:
MILLWORK PLAN
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-016
REV.



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COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK PLAN
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN: K+

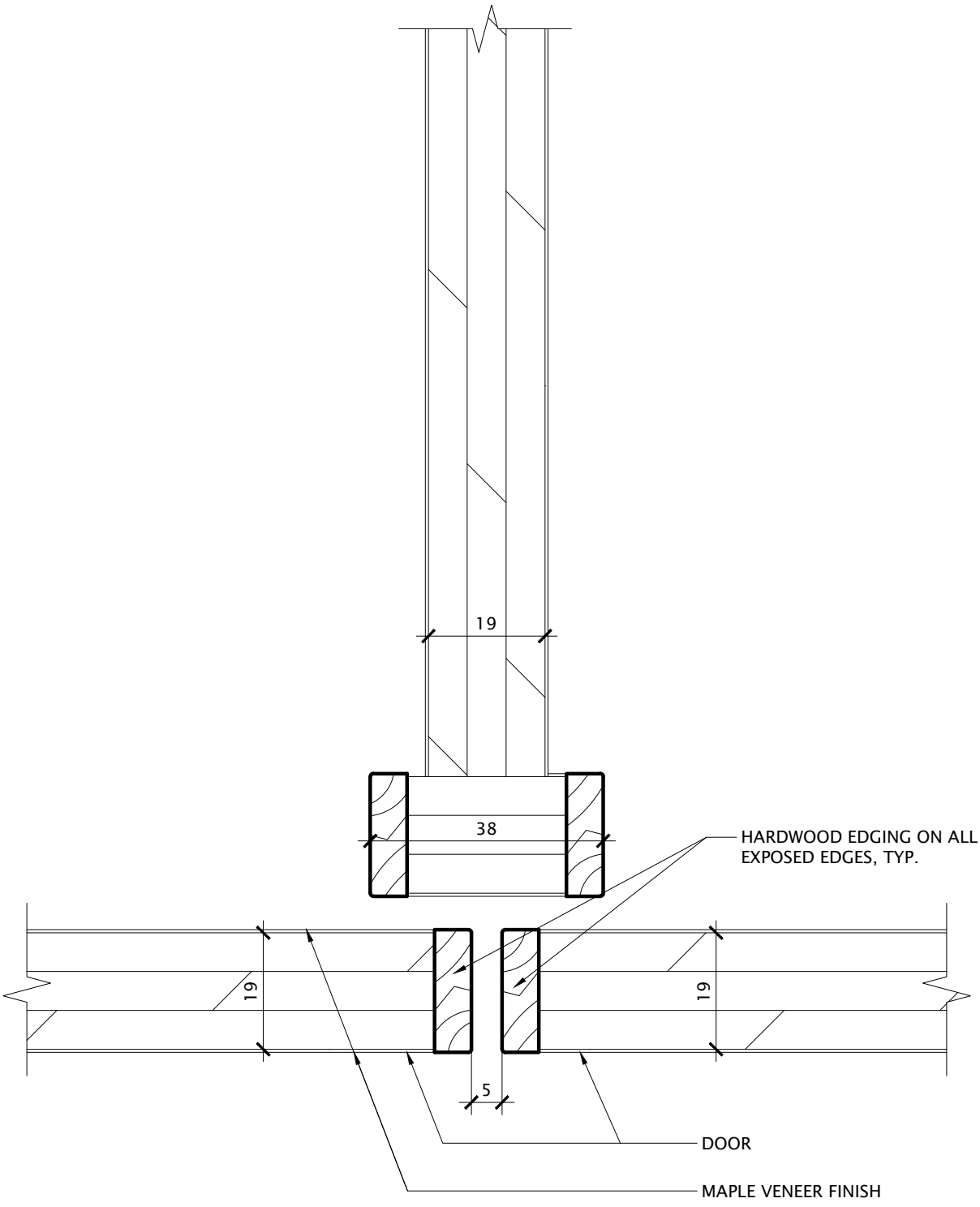
CHECKED:

SCALE: 1:1

PROJECT NO: A22008

DWG NO: 6-019

REV.



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fax 416.203.7763

ISSUED:

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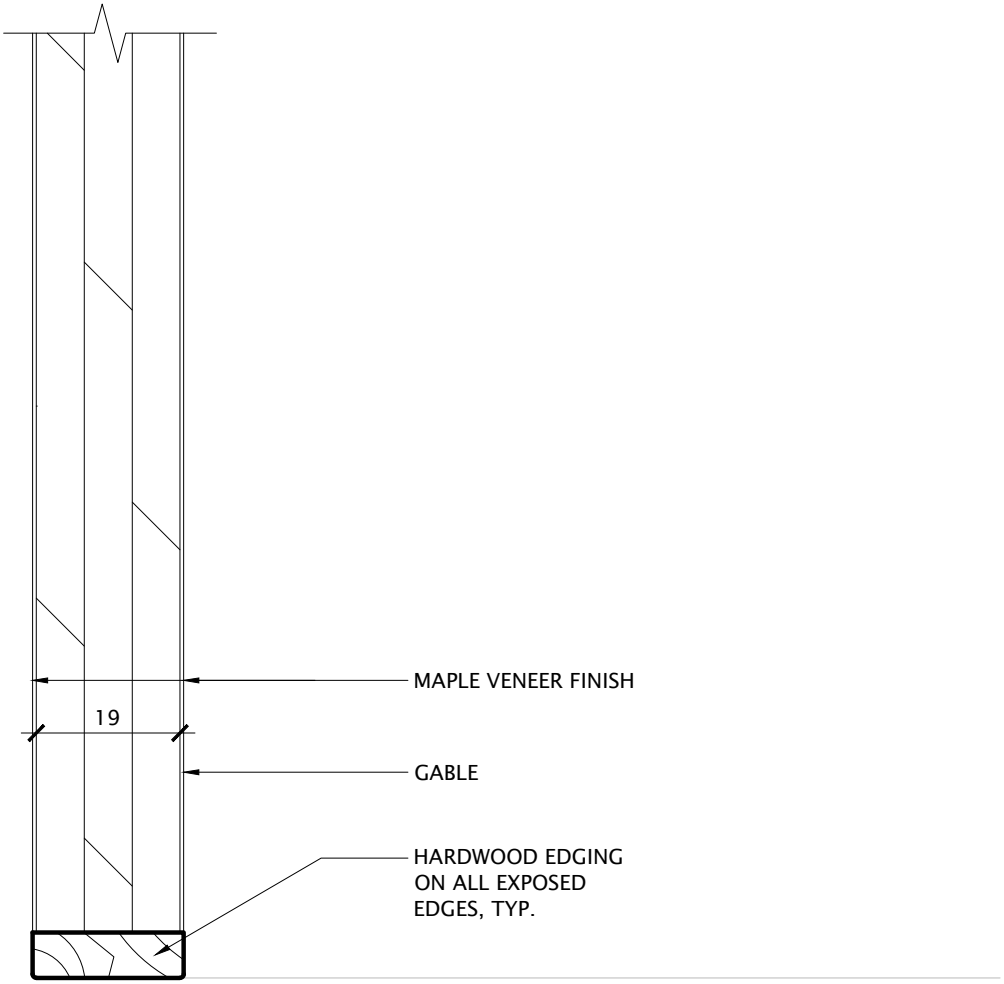
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK PLAN
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-021
REV.



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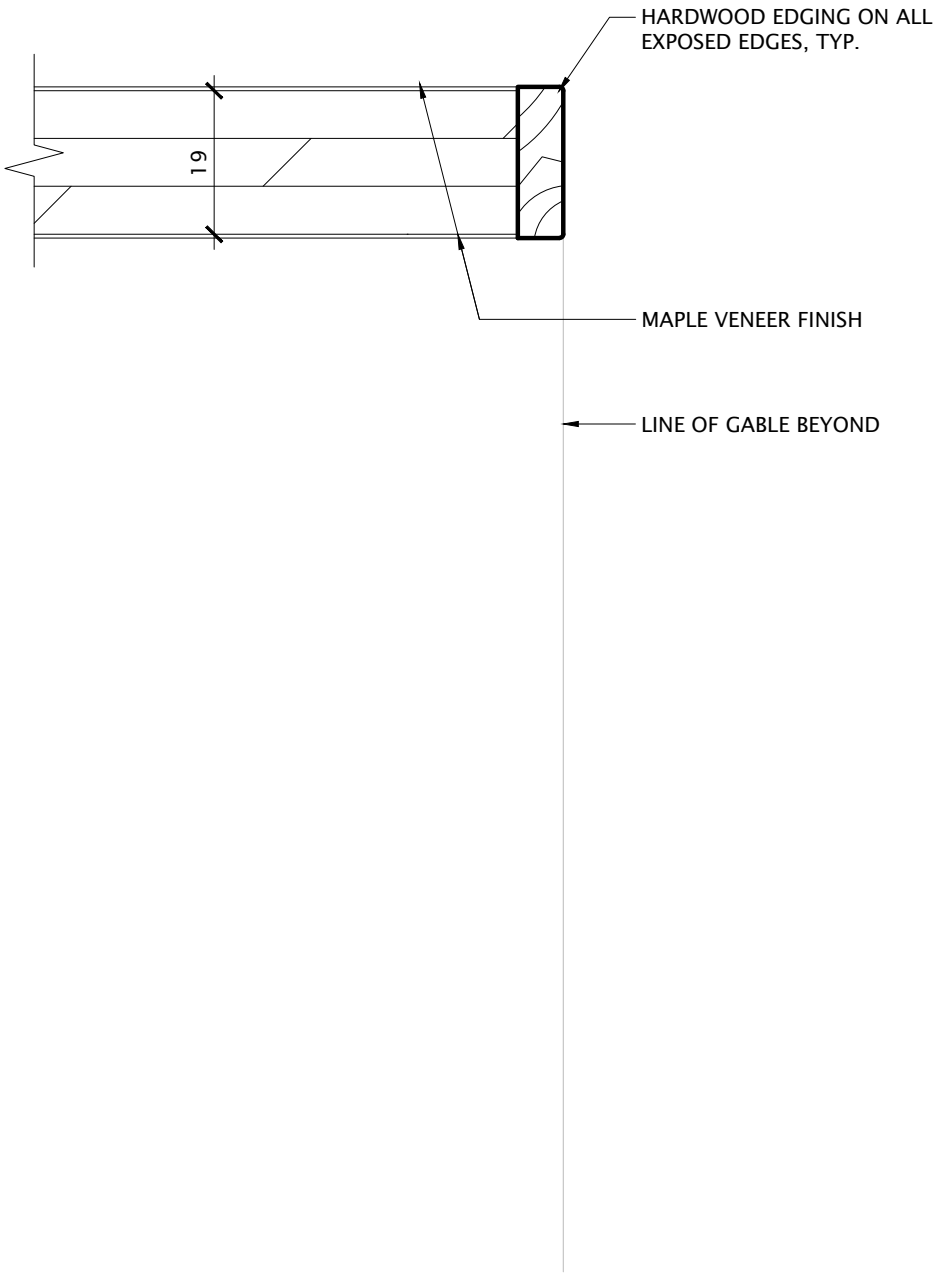
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK PLAN
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-023
REV.



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ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN: K+

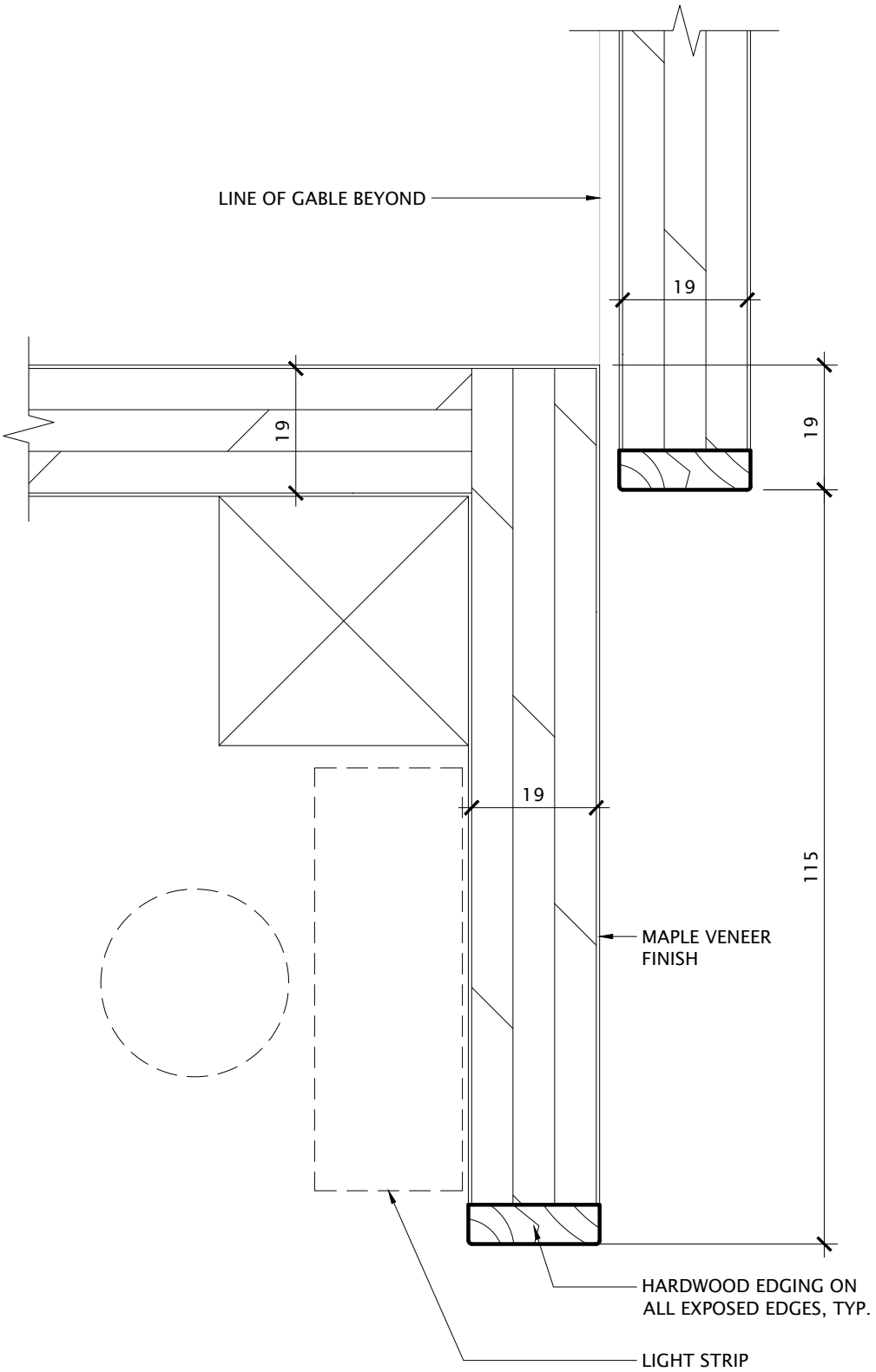
CHECKED:

SCALE: 1:1

PROJECT NO: A22008

DWG NO: 6-026

REV.



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COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN: K+

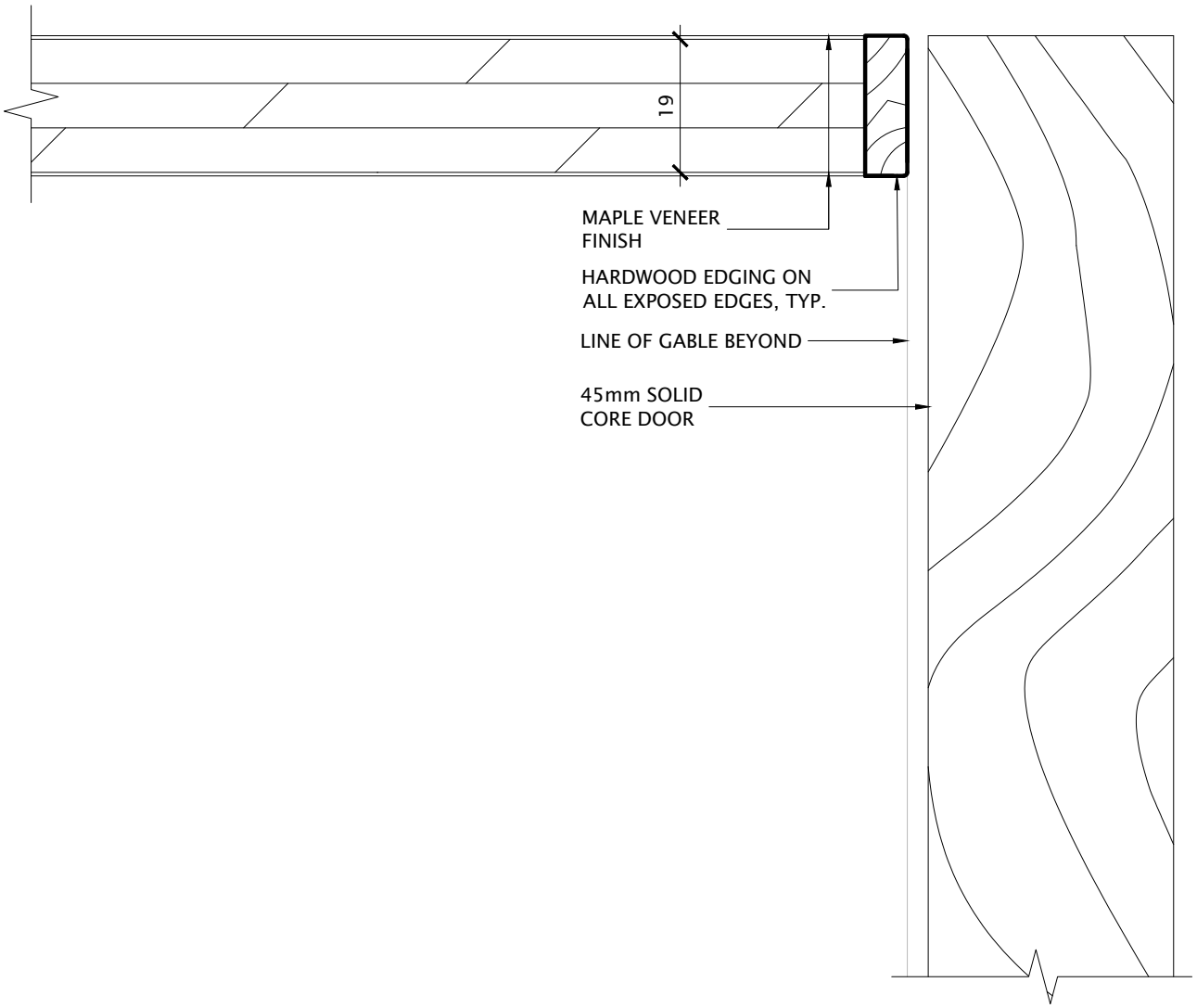
CHECKED:

SCALE: 1:1

PROJECT NO: A22008

DWG NO: 6-027

REV.



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ISSUED:

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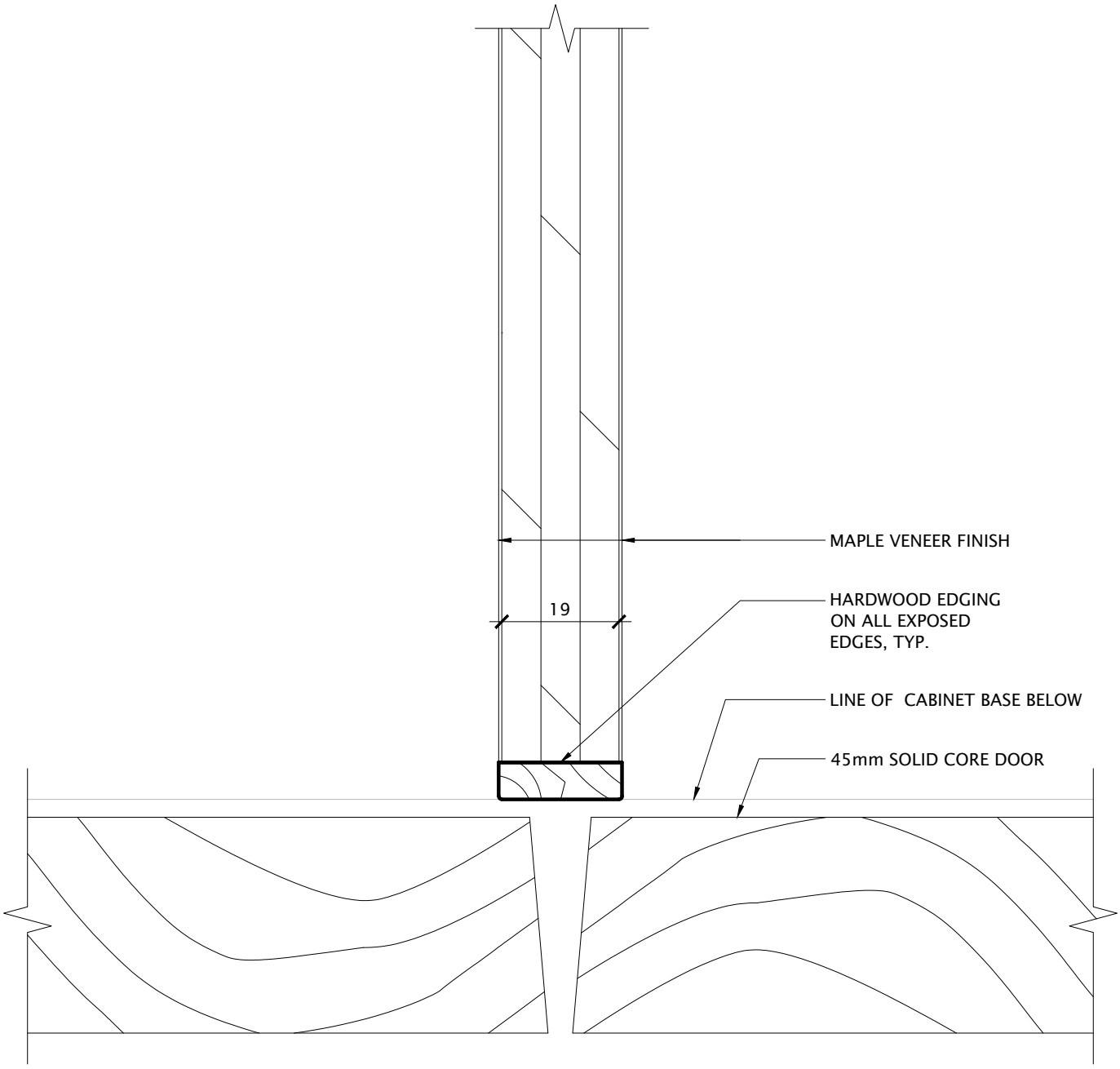
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:1
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 6-031
	REV.



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ISSUED:

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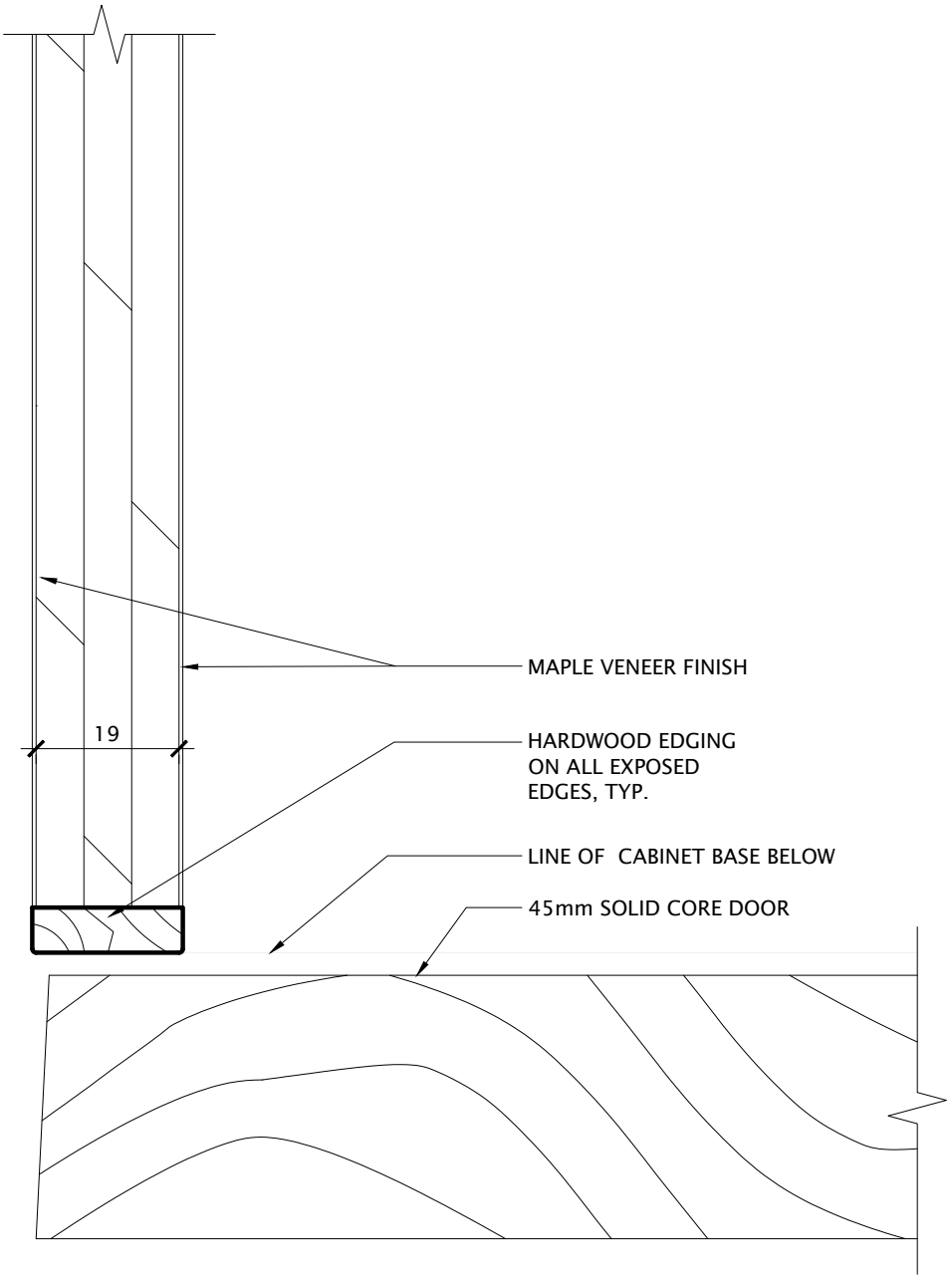
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
MILLWORK PLAN
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-032
REV.



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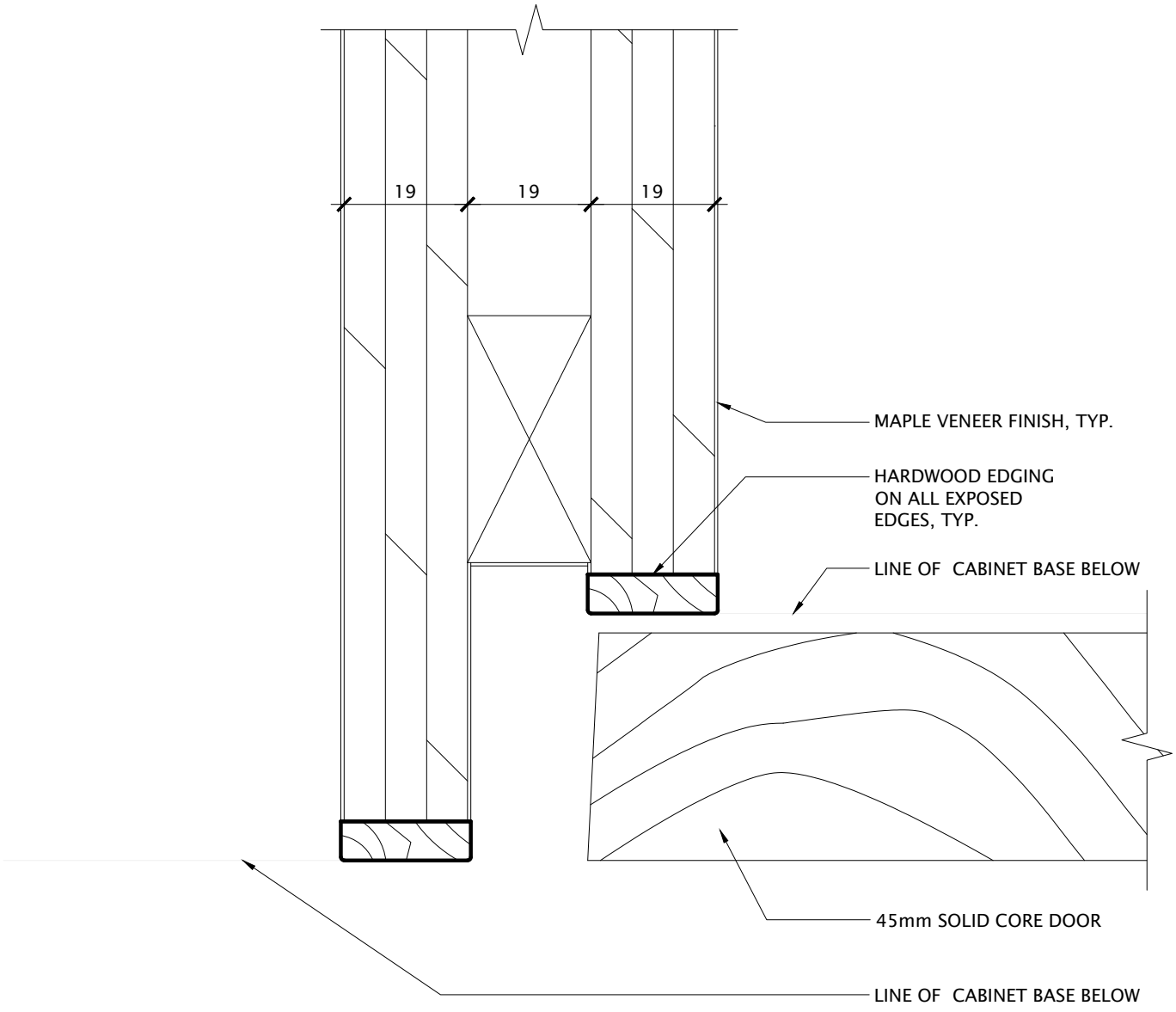
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
MILLWORK PLAN
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-033
REV.



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ISSUED:

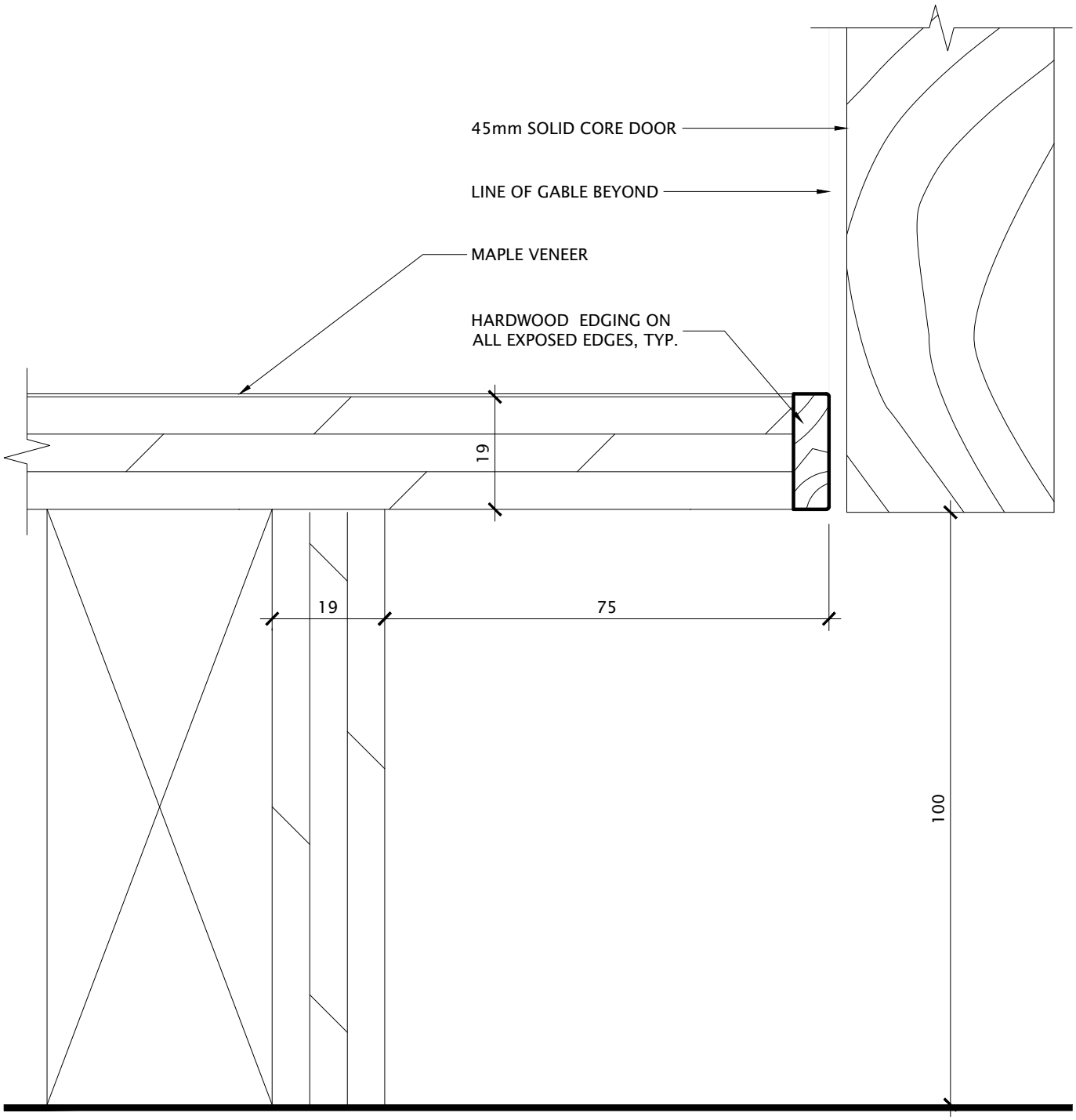
ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
MILLWORK PLAN
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:1
PROJECT NO: A22008
DWG NO: 6-034
REV.



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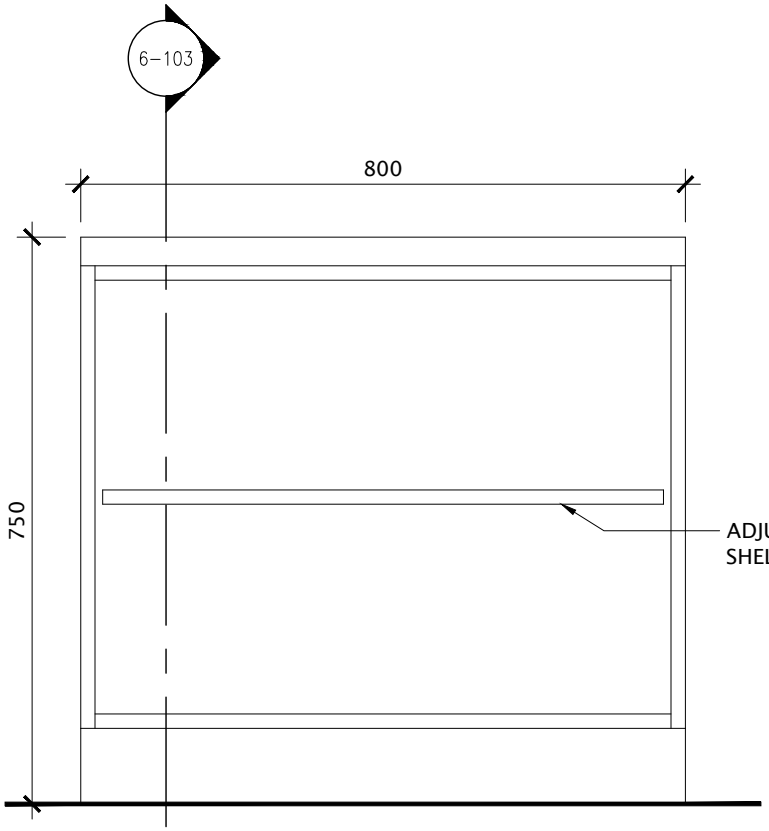
COLIN J. KINGSLAND LICENCE 4549

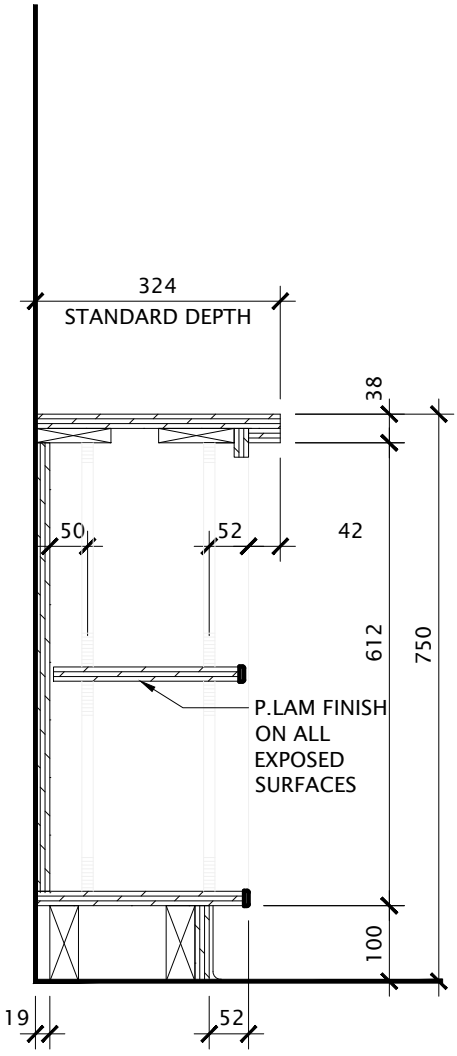
DRAWING NAME:
MILLWORK SECTION
TYPICAL DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:1
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 6-035
	REV.



ELEVATION



SECTION

NOTE: PROVIDE
STANDARD DEPTH
CABINETS UNLESS
NOTED OTHERWISE

Kingsland
ARCHITECTS INC.

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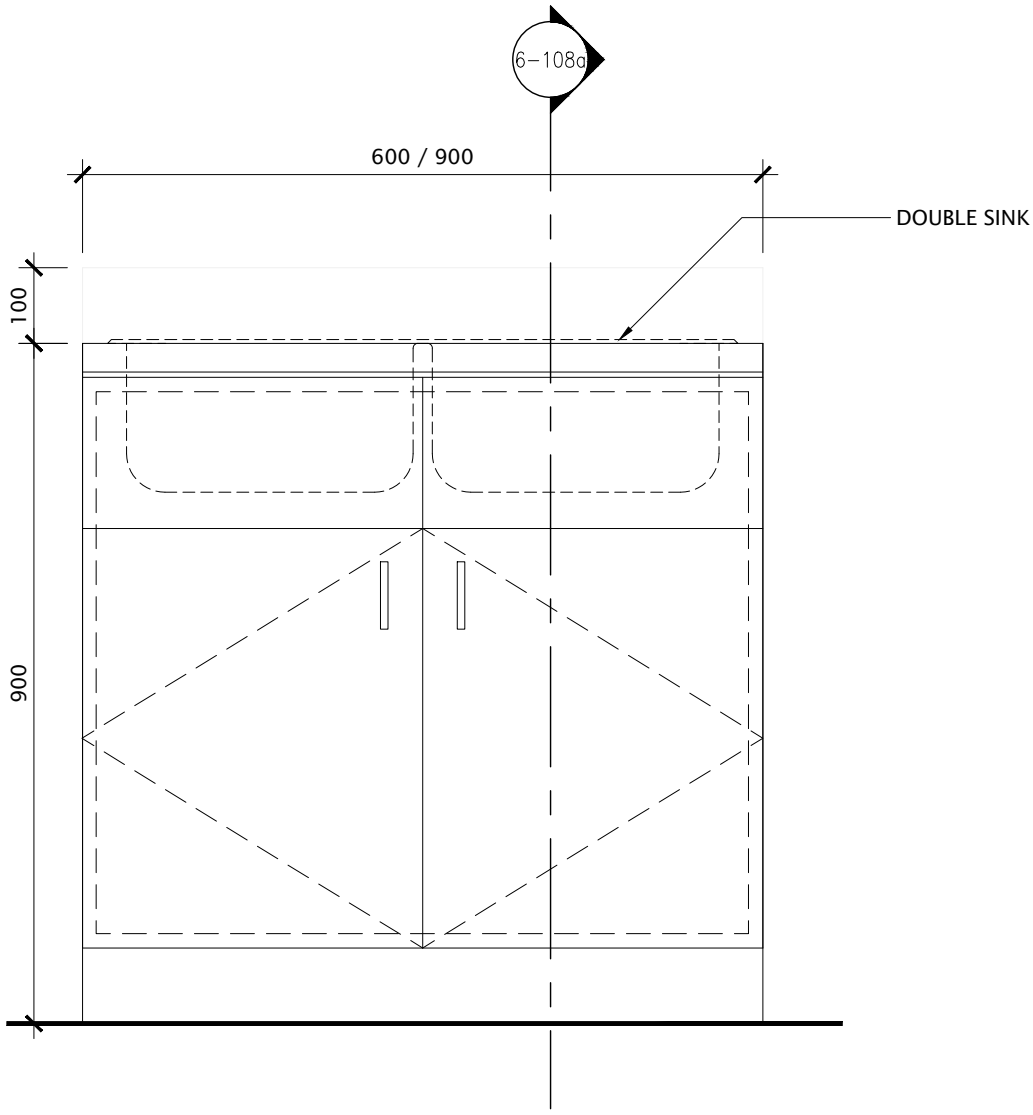
fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: OPEN SHELVING CABINET	DATE: January 2023	SCALE: 1:10	
	DRAWN: K+	PROJECT NO: A22008	
PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition	CHECKED:	DWG NO: 6-103	REV. 0



ELEVATION

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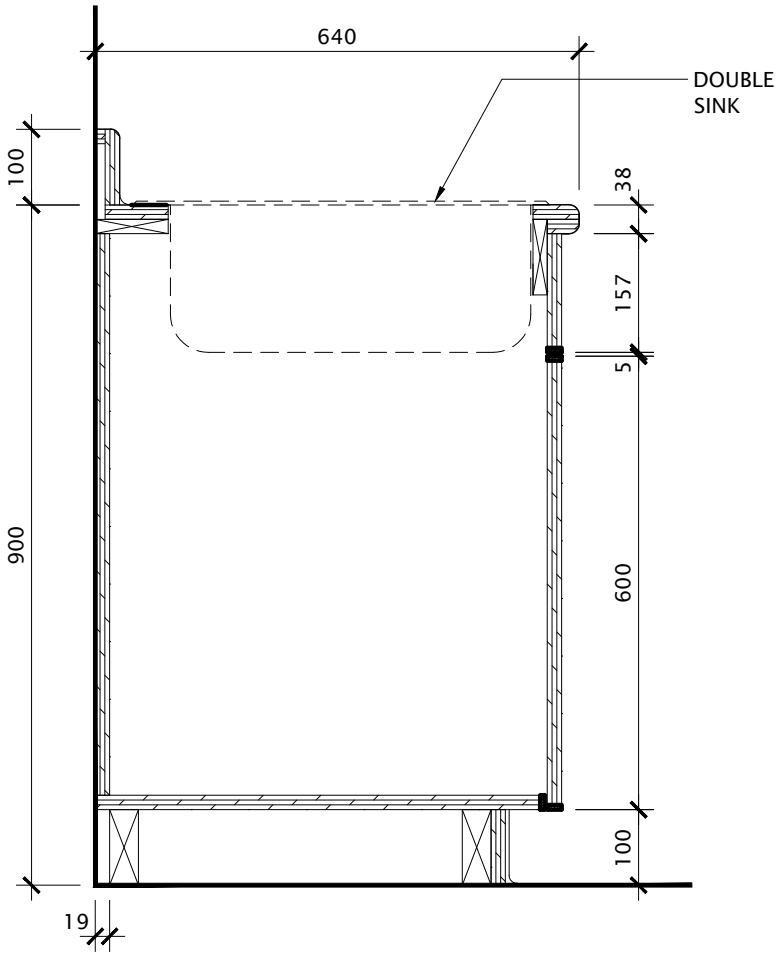
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: COUNTER WITH SINK	DATE: January 2023	SCALE: 1:10	
	DRAWN: K+	PROJECT NO: A22008	
PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition	CHECKED:	DWG NO: 6-108	REV. 0



SECTION

Kingsland
ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

ISSUED:

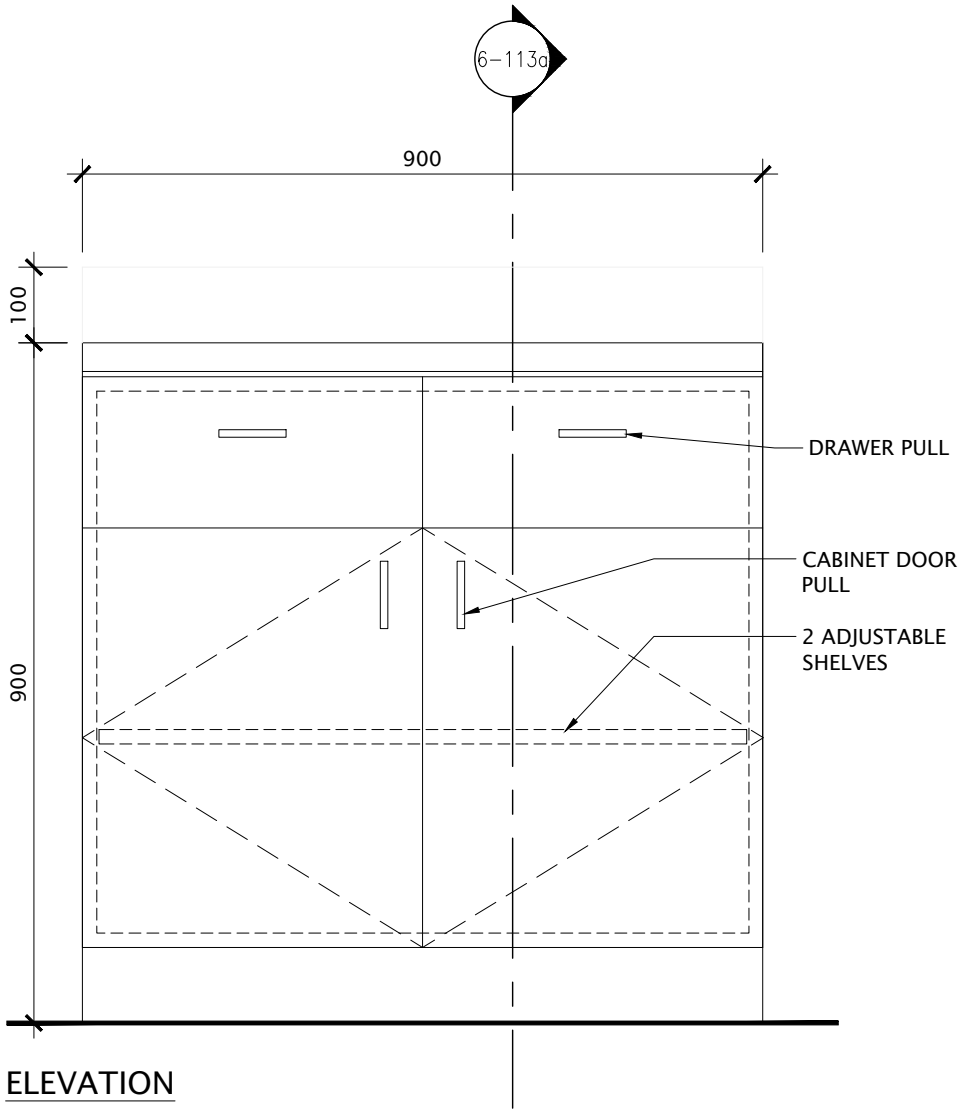
ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
COUNTER WITH SINK -
CABINET TYPE

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:10
PROJECT NO: A22008
DWG NO: 6-108a
REV. 0



ELEVATION

NOTE: FINISH ALL EXPOSED FACES. TYP.
ON CIRCULATION DESK AREA BACKSPLASH IS NOT NECESSARY

Kingsland + ARCHITECTS INC.

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219 Dufferin Street , Suite 308b
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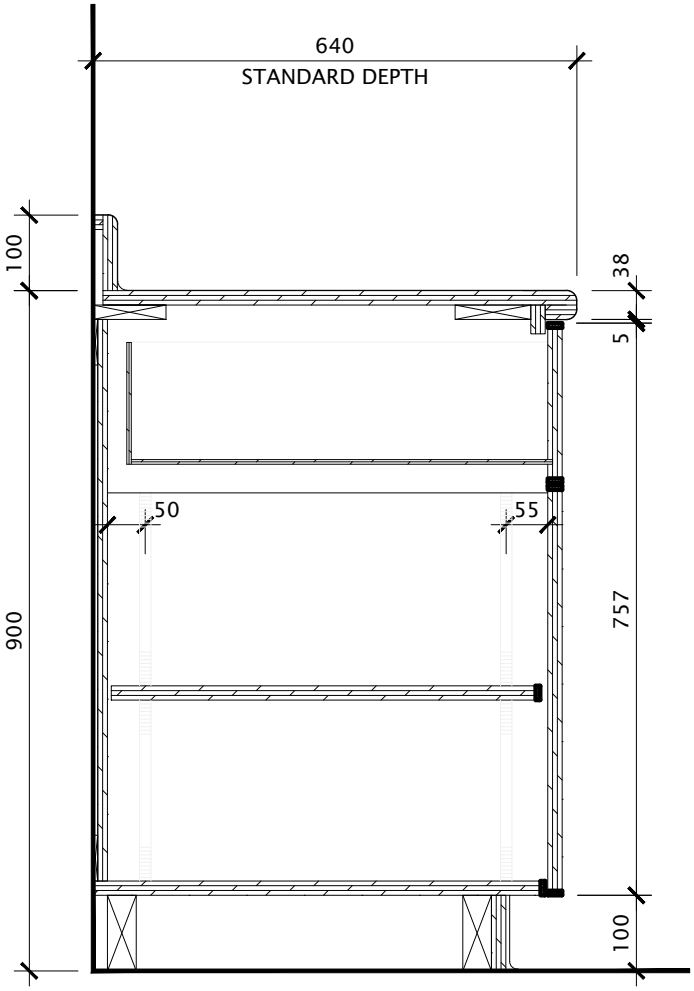
ph 416.203.7799
fax 416.203.7763

ISSUED:	DRAWING NAME: CABINET TYPES	DATE: JUNE 2022	SCALE: 1:10
		DRAWN: K+	PROJECT NO: A22007
	PROJECT NAME: ÉÉC SAINT-RENÉ-GOUPIL Classrooms Addition	CHECKED:	DWG NO: 6-113 / REV. 0



SECTION

NOTE: PROVIDE STANDARD DEPTH CABINETS UNLESS NOTED OTHERWISE
ON CIRCULATION DESK AREA BACKSPLASH IS NOT NECESSARY

Kingsland + ARCHITECTS INC.

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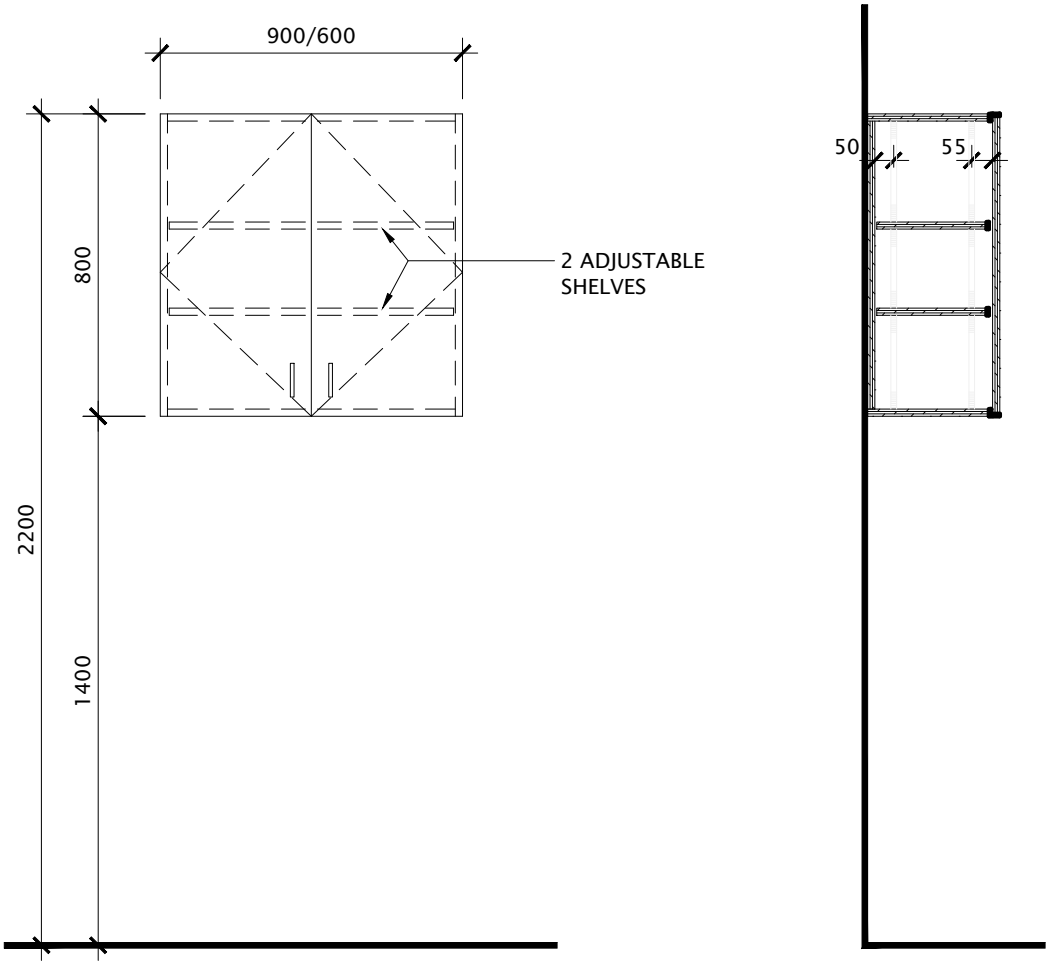
ph 416.203.7799
fax 416.203.7763

ISSUED:	DRAWING NAME: CABINET TYPES	DATE: JUNE 2022	SCALE: 1:10
		DRAWN: K+	PROJECT NO: A22007
	PROJECT NAME: **ÉÉC SAINT-RENÉ-GOUPIL** Classrooms Addition	CHECKED:	DWG NO: 6-113a / REV. 0



ELEVATION

SECTION

NOTE: FINISH ALL EXPOSED FACES. TYP.

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Toronto, Ontario M6K 3J1
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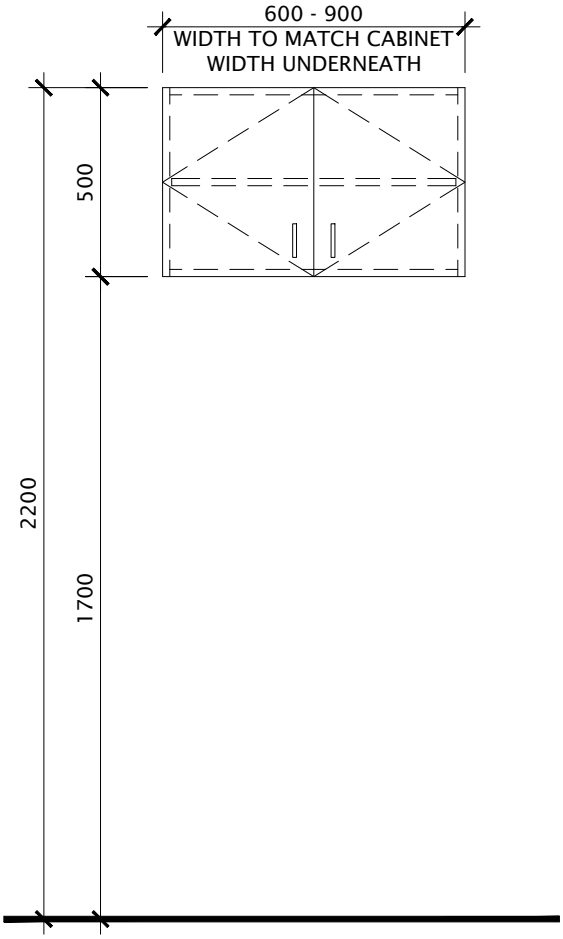
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: UPPER CABINET TYPES	DATE: January 2023	SCALE: 1:20	
	DRAWN: K+	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 6-201	REV. 0



ELEVATION

SECTION

Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
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ph 416.203.7799
fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: UPPER CABINETS

PROJECT NAME: **ÉÉC SAINT-MICHEL**
Classrooms Addition

DATE: January 2023

DRAWN: K+

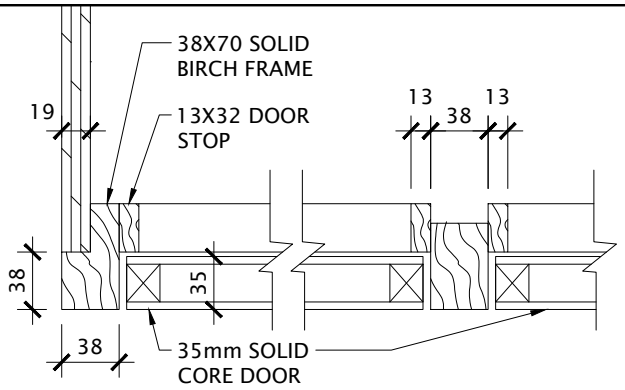
CHECKED:

SCALE: 1:20

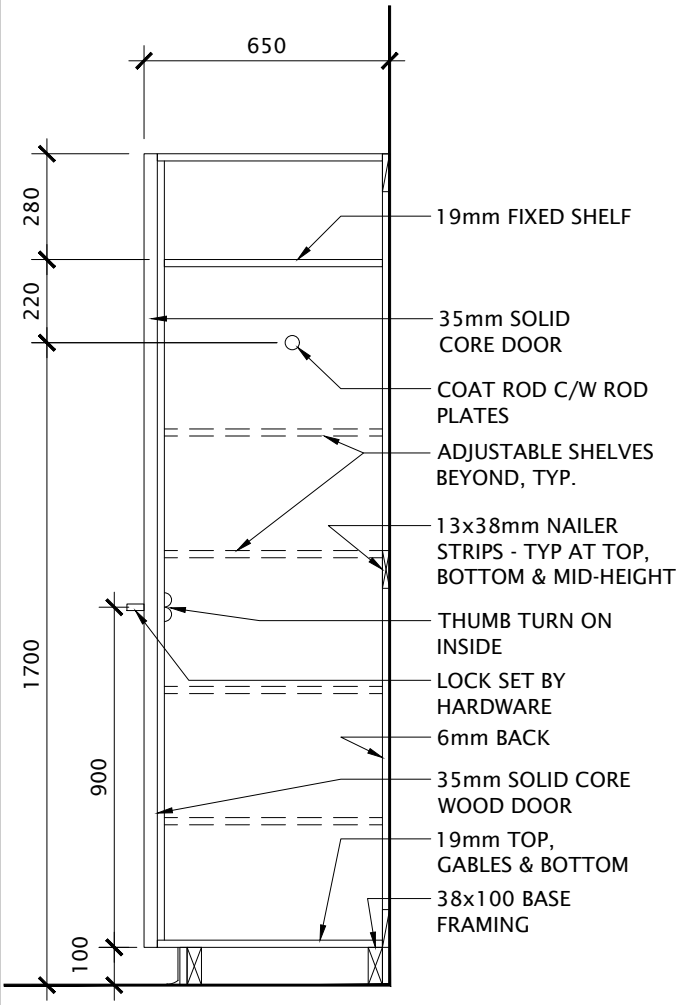
PROJECT NO: A22008

DWG NO: 6-206

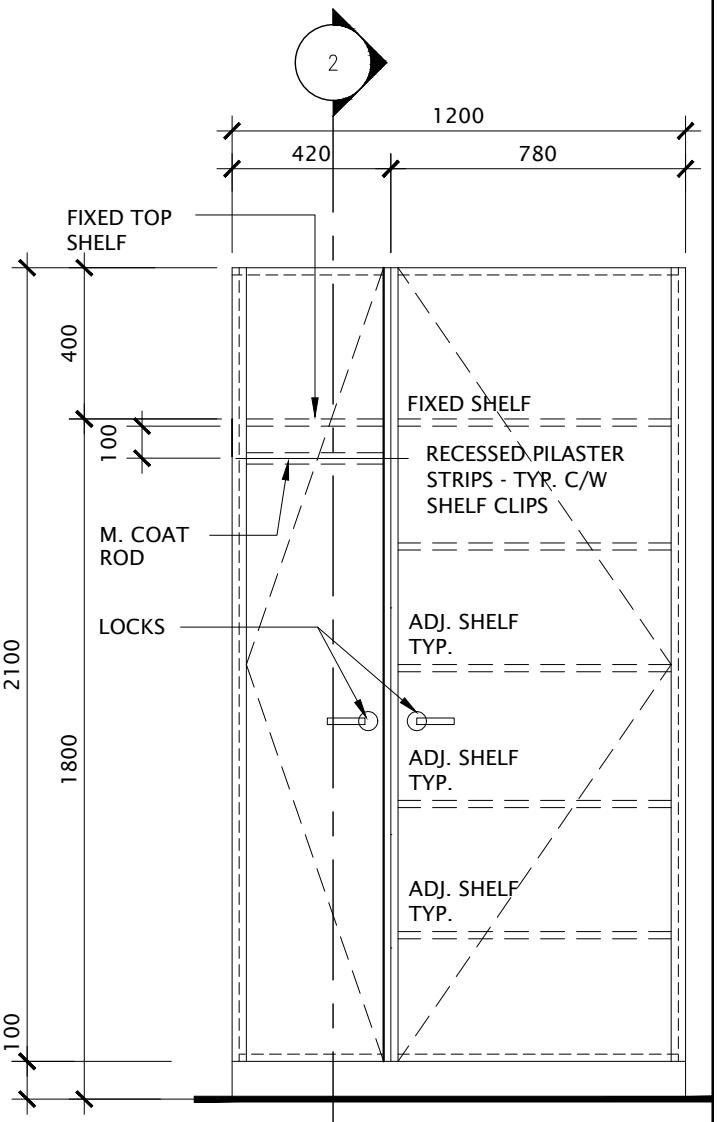
REV. 0



3 -SOLID FRAME PLAN DETAIL -
SCALE 1:5



2- SECTION



1- ELEVATION

Kingsland + ARCHITECTS INC.

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Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

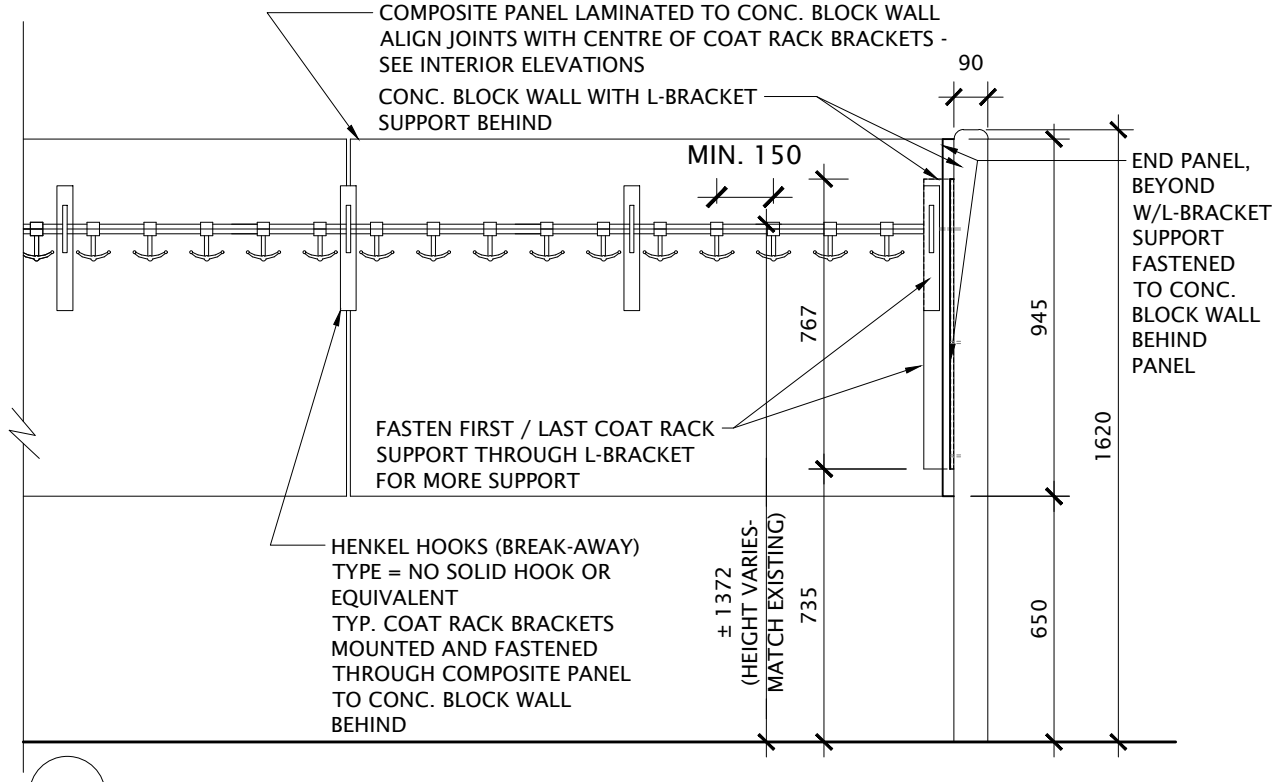
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

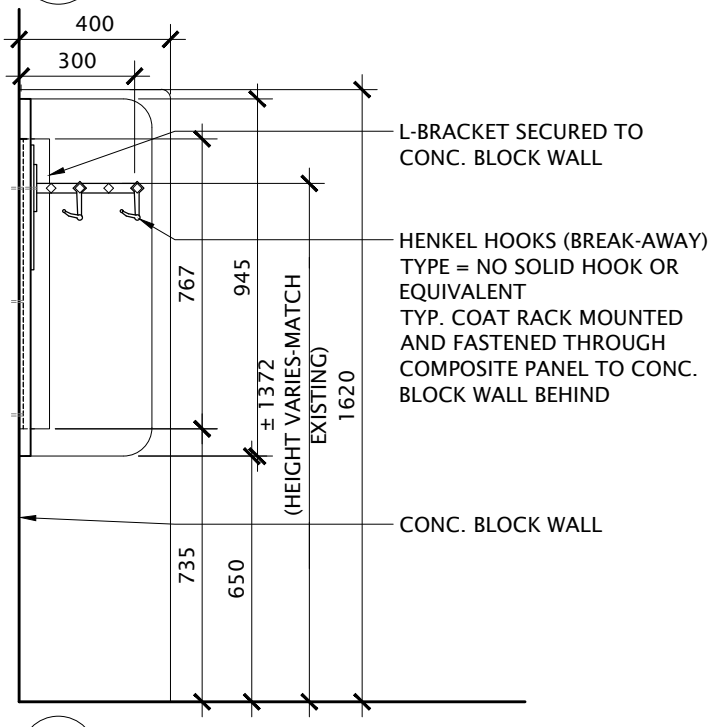
DRAWING NAME: TEACHER'S CLOSET

PROJECT NAME: **ÉÉC SAINT-MICHEL**
Classrooms Addition

DATE: January 2023	SCALE: 1:20
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 6-303 / REV. 0

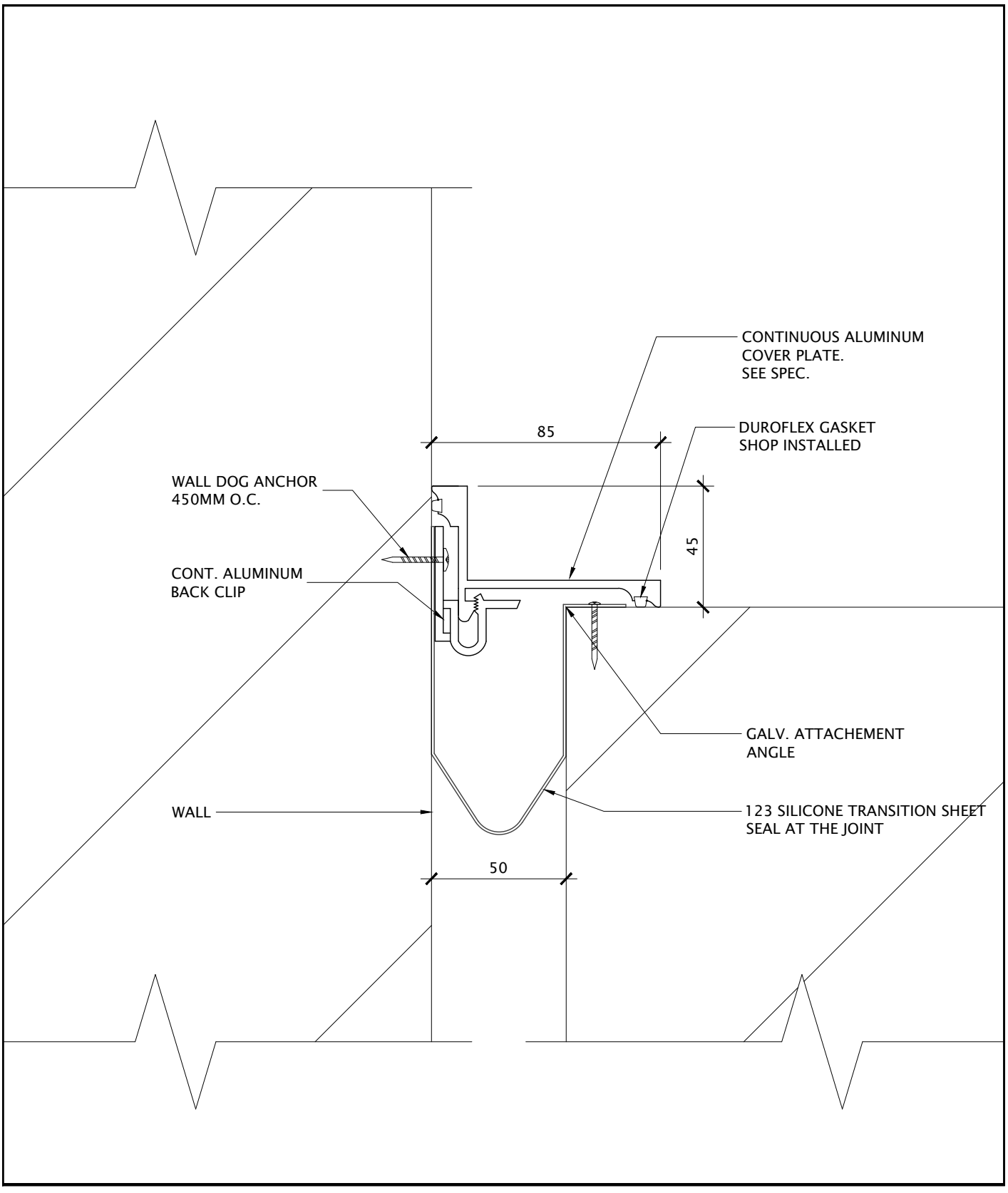


1 ELEVATION



2 SECTION

Kingsland ARCHITECTS INC.	ISSUED: ONTARIO ASSOCIATION OF ARCHITECTS COLIN J. KINGSLAND LICENCE 4549	DRAWING NAME: WALL PANEL DETAIL AT COAT RACKS	DATE: January 2023	SCALE: 1:20	
			DRAWN: K+	PROJECT NO: A22008	
KINGSLAND + ARCHITECTS INC 219 Dufferin Street , Suite 308b Toronto, Ontario M6K 3J1 ph 416.203.7799 fax 416.203.7763		PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 6-630	REV. 0



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Toronto, Ontario M6K 3J1
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fax 416.203.7763

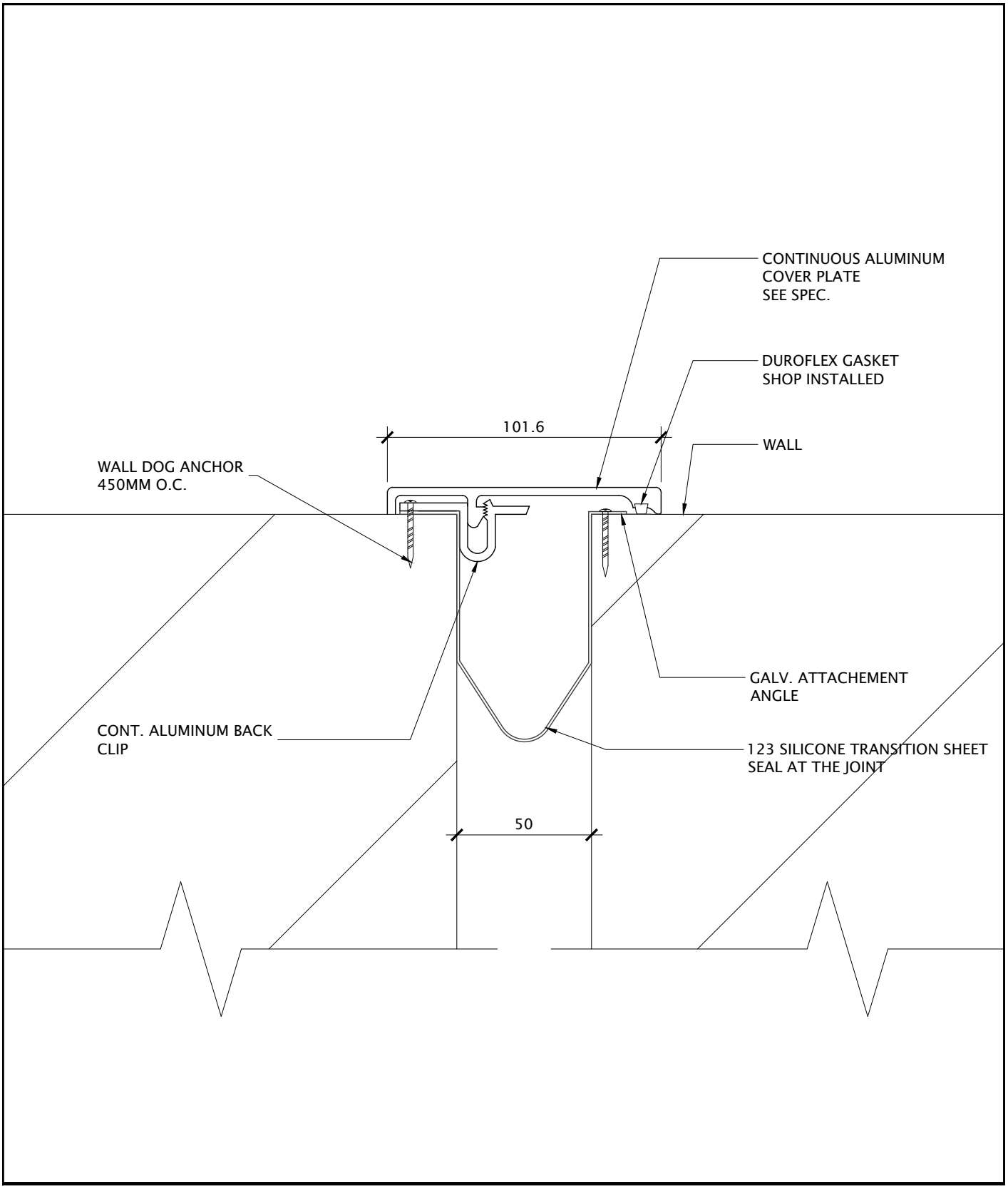
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
CORNER EXPANSION JOINT
COVER PLAN DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE:	SCALE:	
January 2023	1:2	
DRAWN: K+	PROJECT NO: A22008	
CHECKED:	DWG NO: 7-041	REV. 0



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Toronto, Ontario M6K 3J1
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ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
EXPANSION JOINT COVER
PLAN DETAIL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023

DRAWN: K+

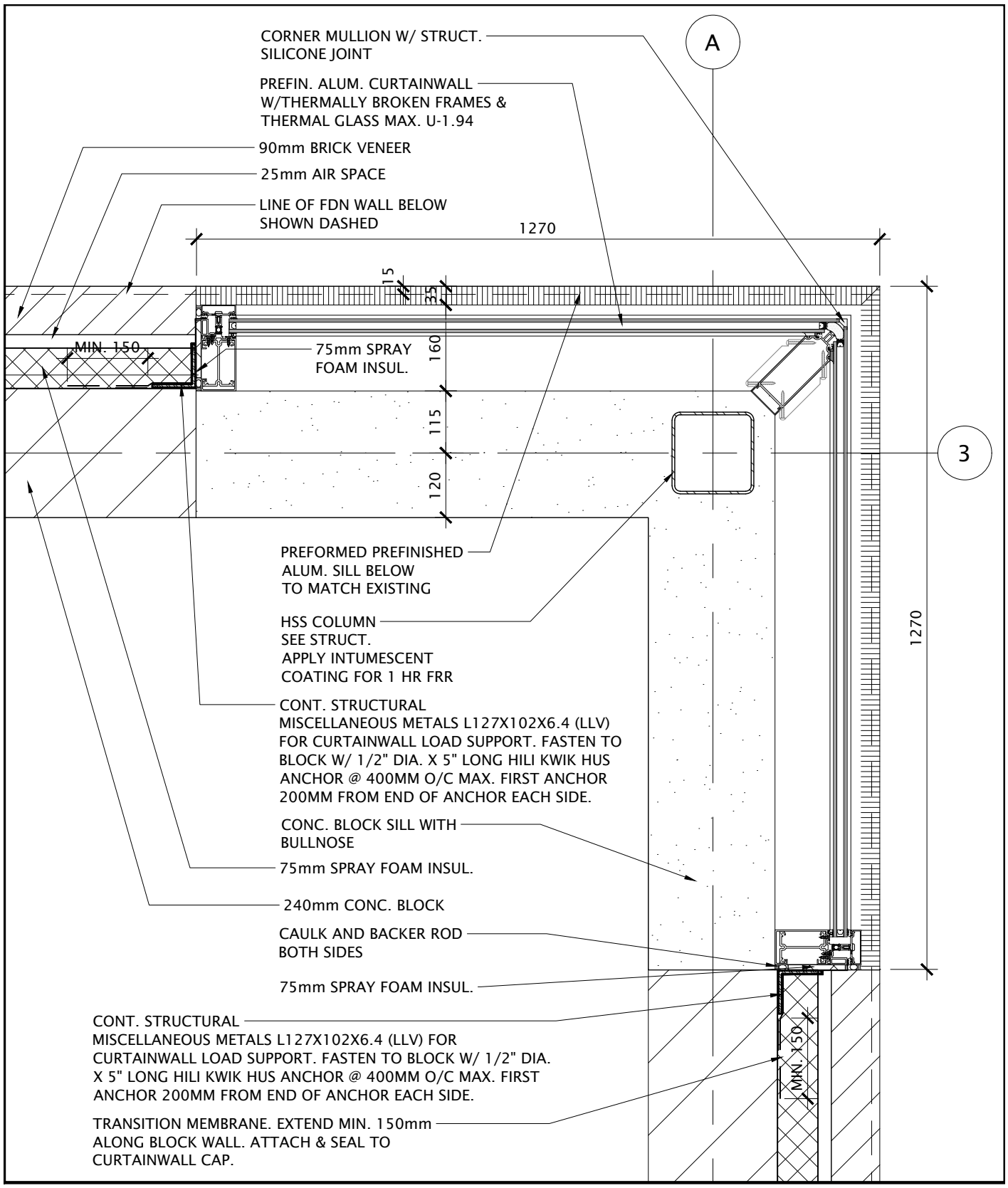
CHECKED:

SCALE: 1:2

PROJECT NO: A22008

DWG NO: 7-041b

REV. 0



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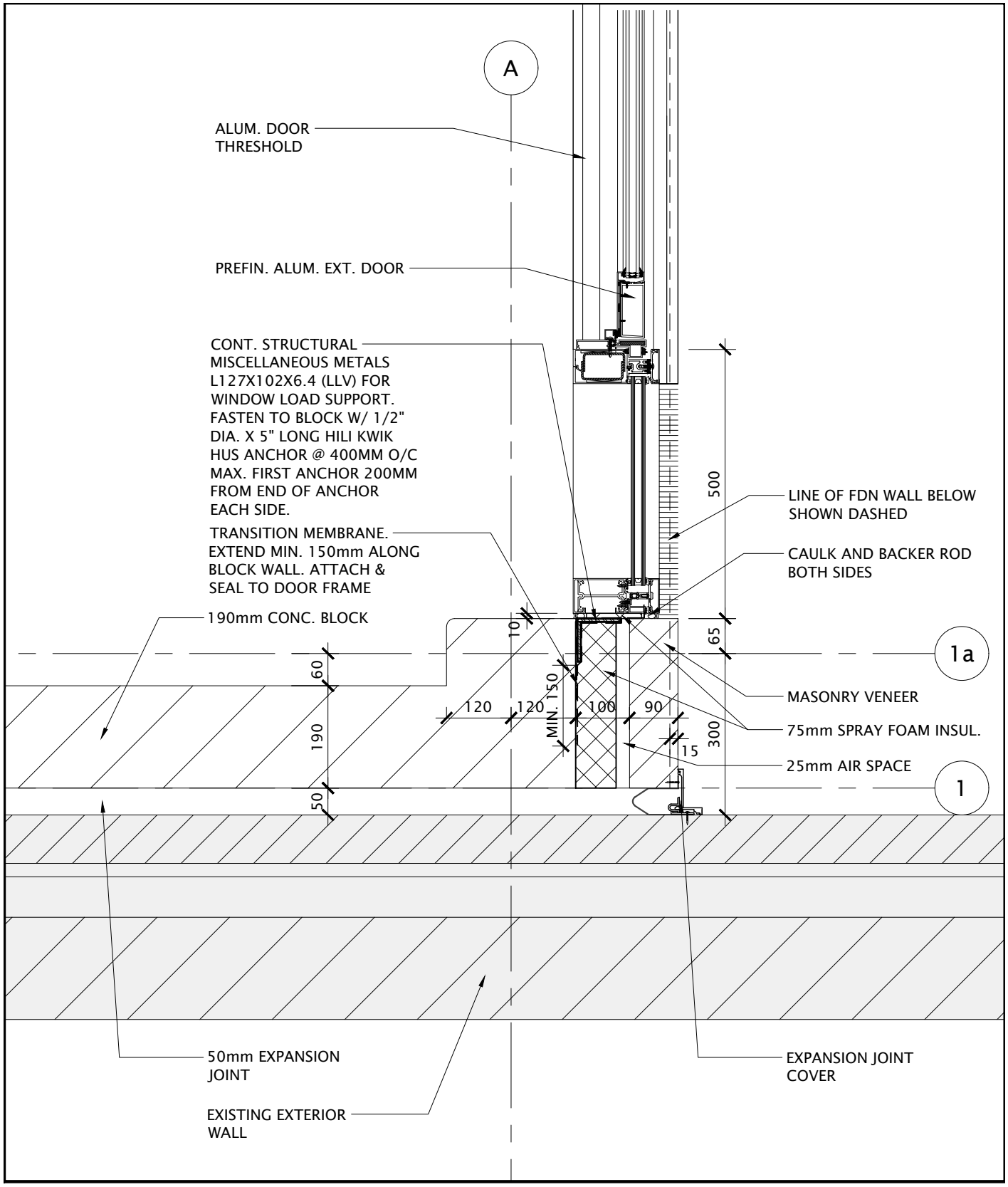
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
FIRST FLOOR PLAN DETAIL
GRID A/3

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE:	SCALE:
January 2023	1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-101 / REV. 0



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ph 416.203.7799
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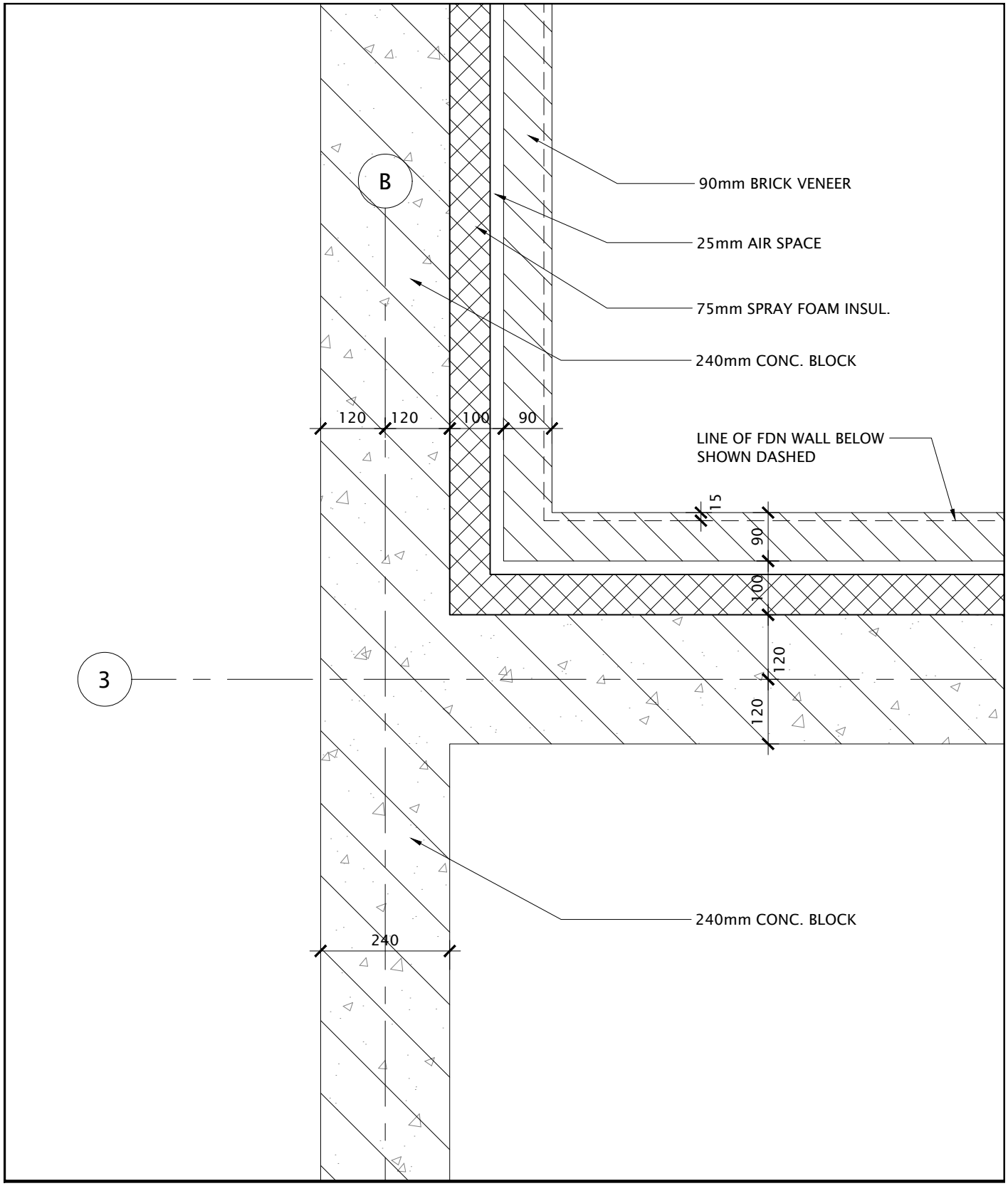
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
FIRST FLOOR PLAN DETAIL
GRID A/ 1a

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-102 / REV. 0



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Toronto, Ontario M6K 3J1
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fax 416.203.7763

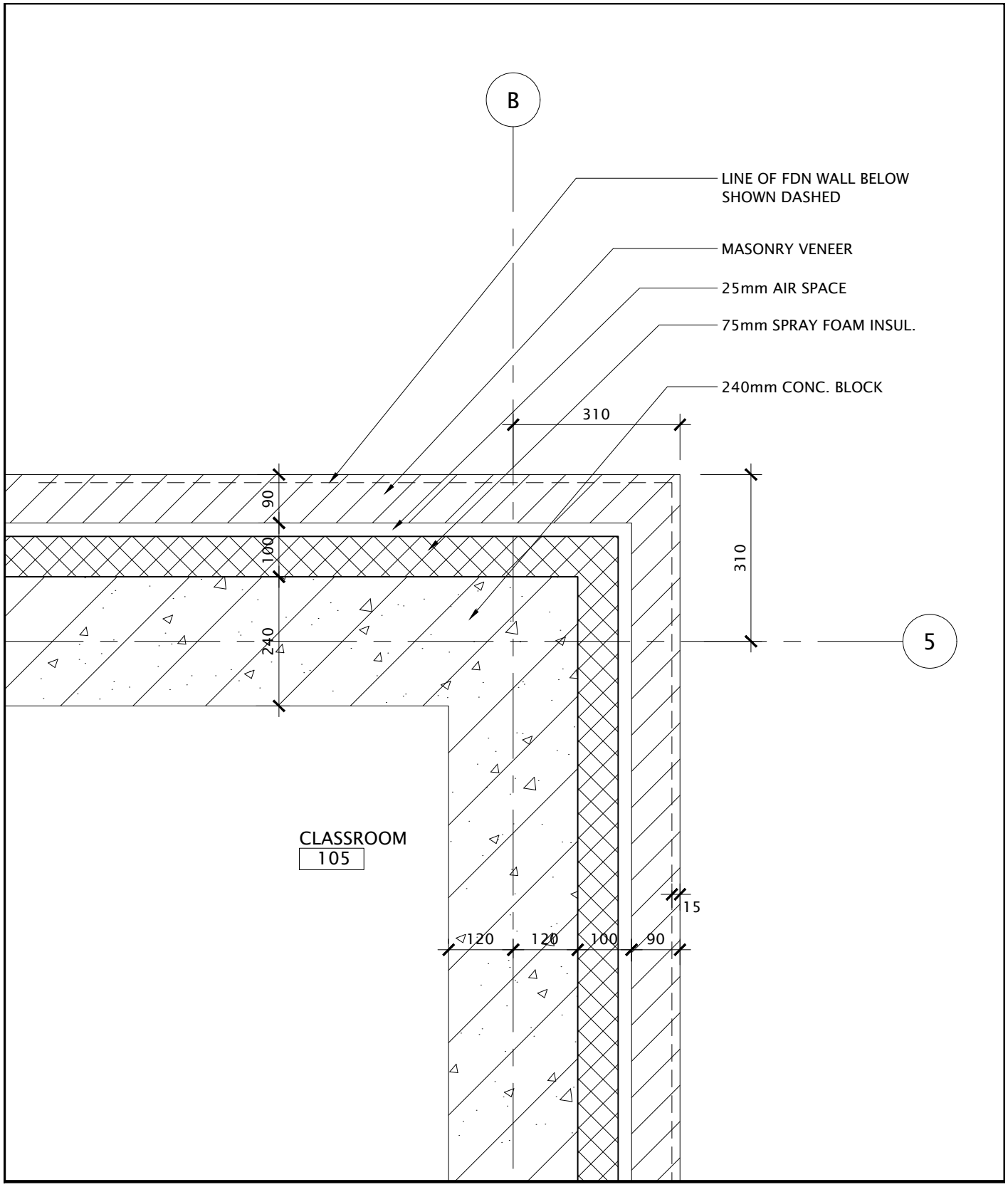
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
FIRST FLOOR PLAN DETAIL
GRID B/3

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-103 / REV. 0



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Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

ISSUED:

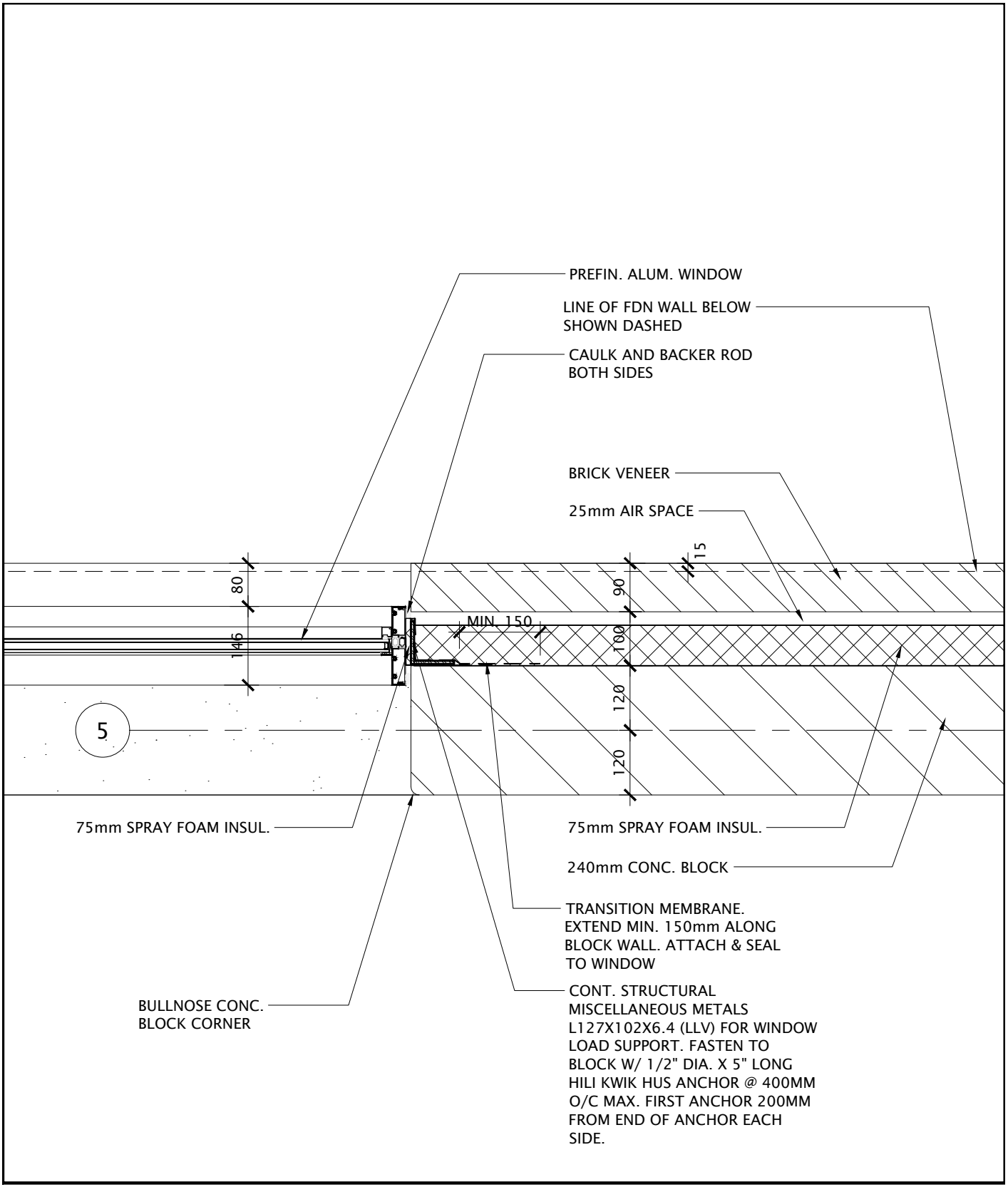
ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
FIRST FLOOR PLAN DETAIL
GRID B/5

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023
DRAWN: K+
CHECKED:

SCALE: 1:10
PROJECT NO: A22008
DWG NO: 7-104
REV. 0



Kingsland + ARCHITECTS INC.

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219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
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fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: FIRST FLOOR PLAN DETAIL GRID 5

PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition

DATE: January 2023

DRAWN: K+

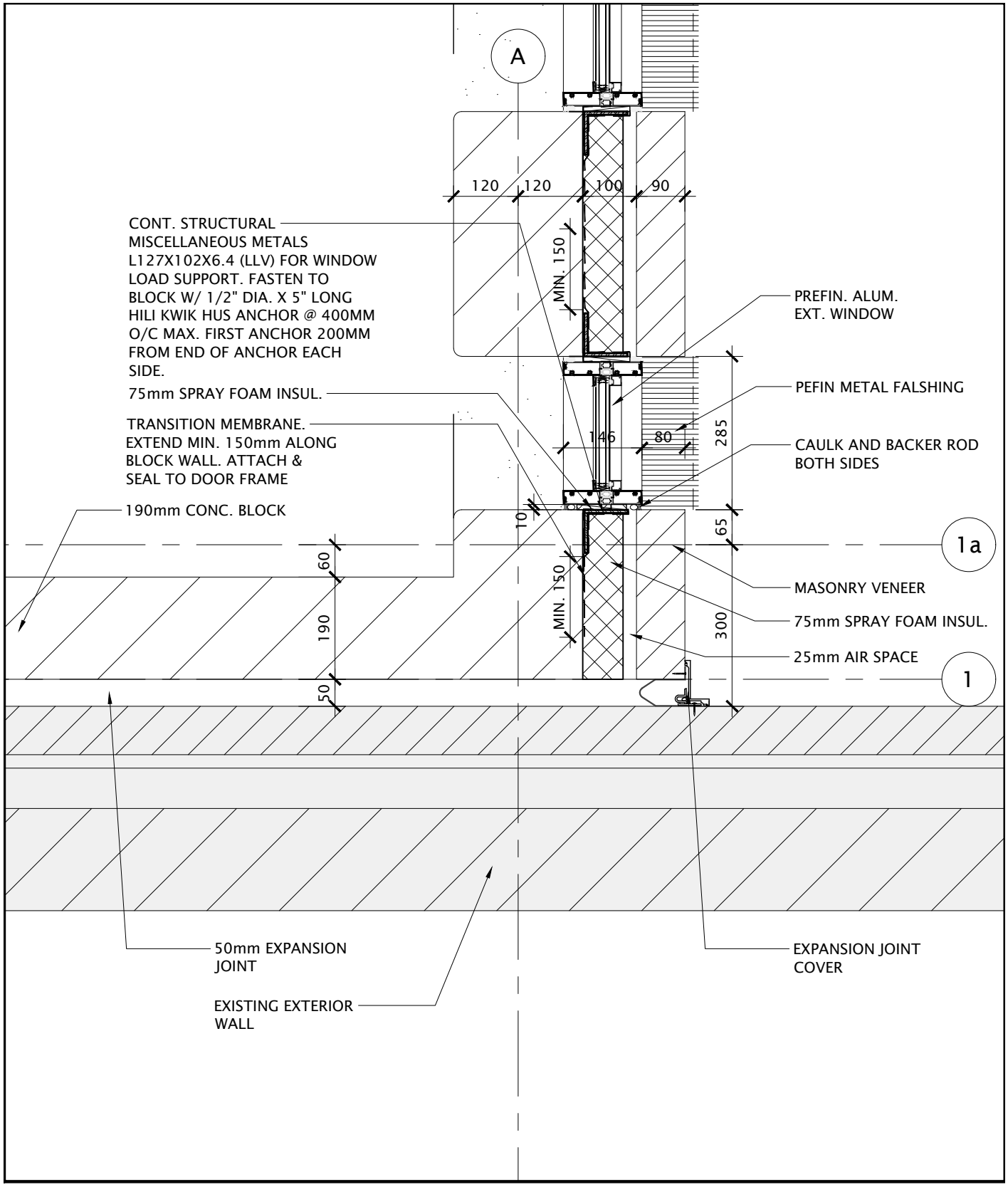
CHECKED:

SCALE: 1:10

PROJECT NO: A22008

DWG NO: 7-105

REV. 0



Kingsland ARCHITECTS INC.
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219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
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fax 416.203.7763

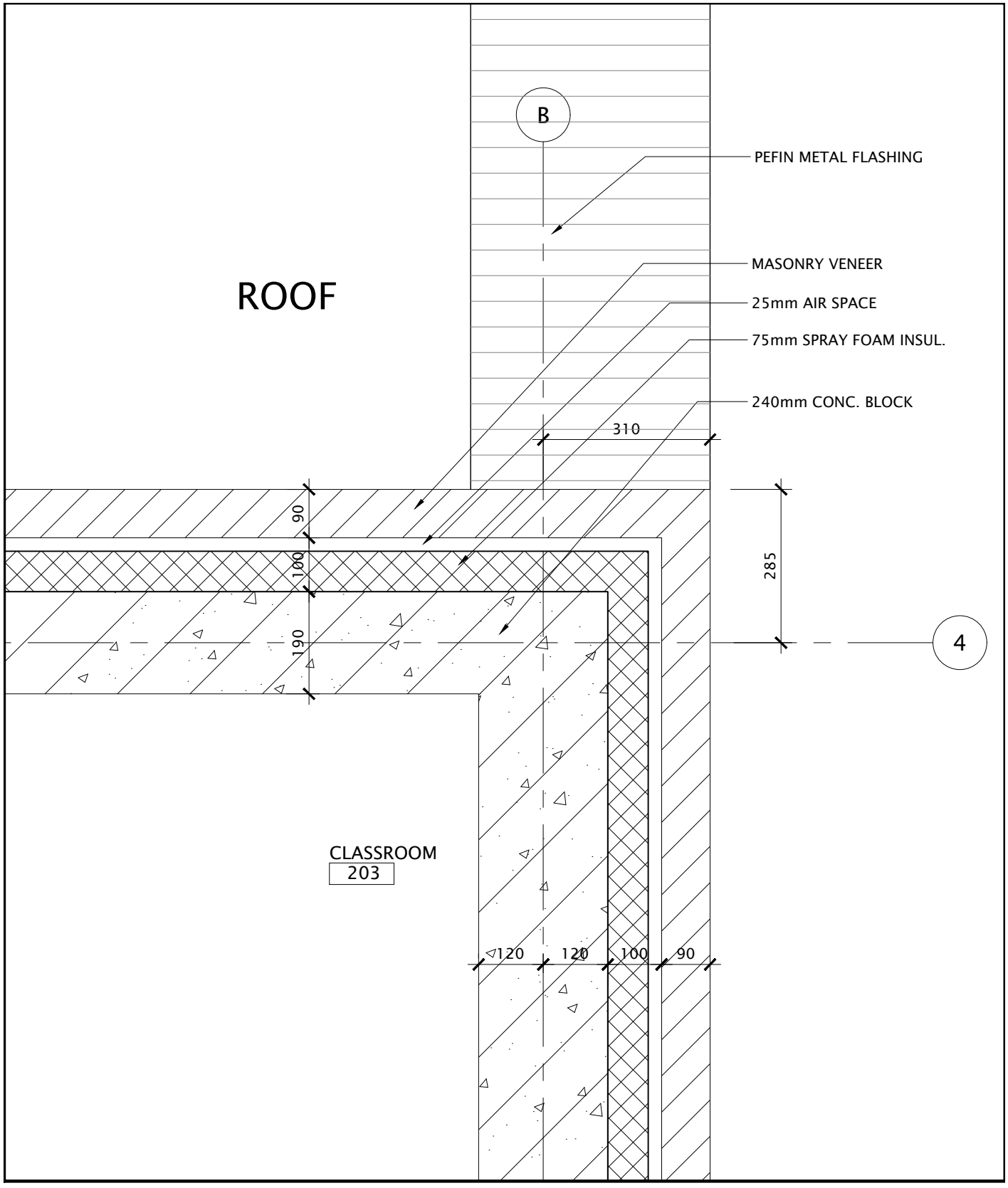
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: SECOND FLOOR PLAN DETAIL GRID A/1a

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-201 / REV. 0



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219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

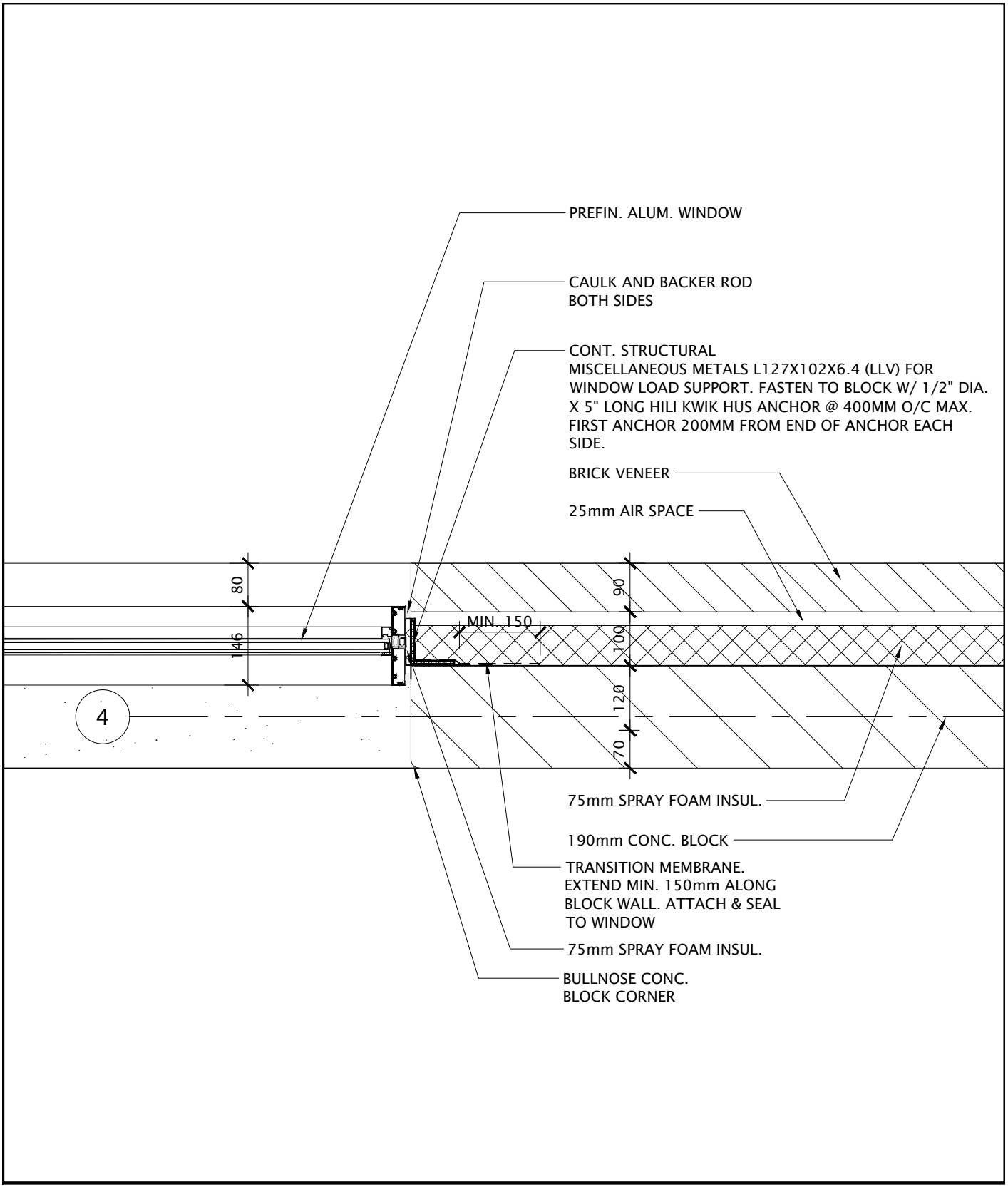
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
SECOND FLOOR PLAN DETAIL
GRID B/4

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 7–202 / REV. 0



Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
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Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

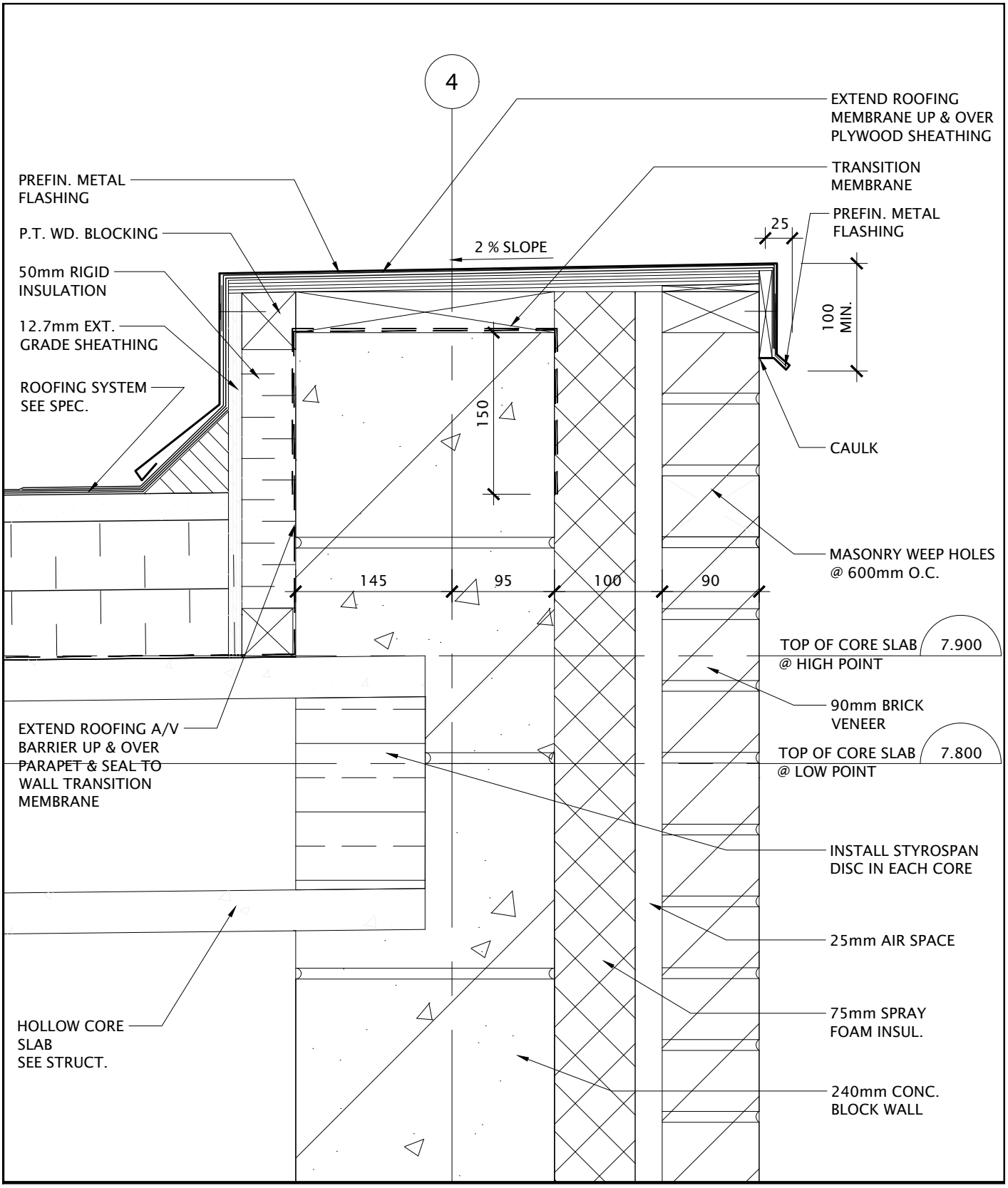
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
SECOND FLOOR PLAN DETAIL
GRID 4

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 7–203 / REV. 0



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219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

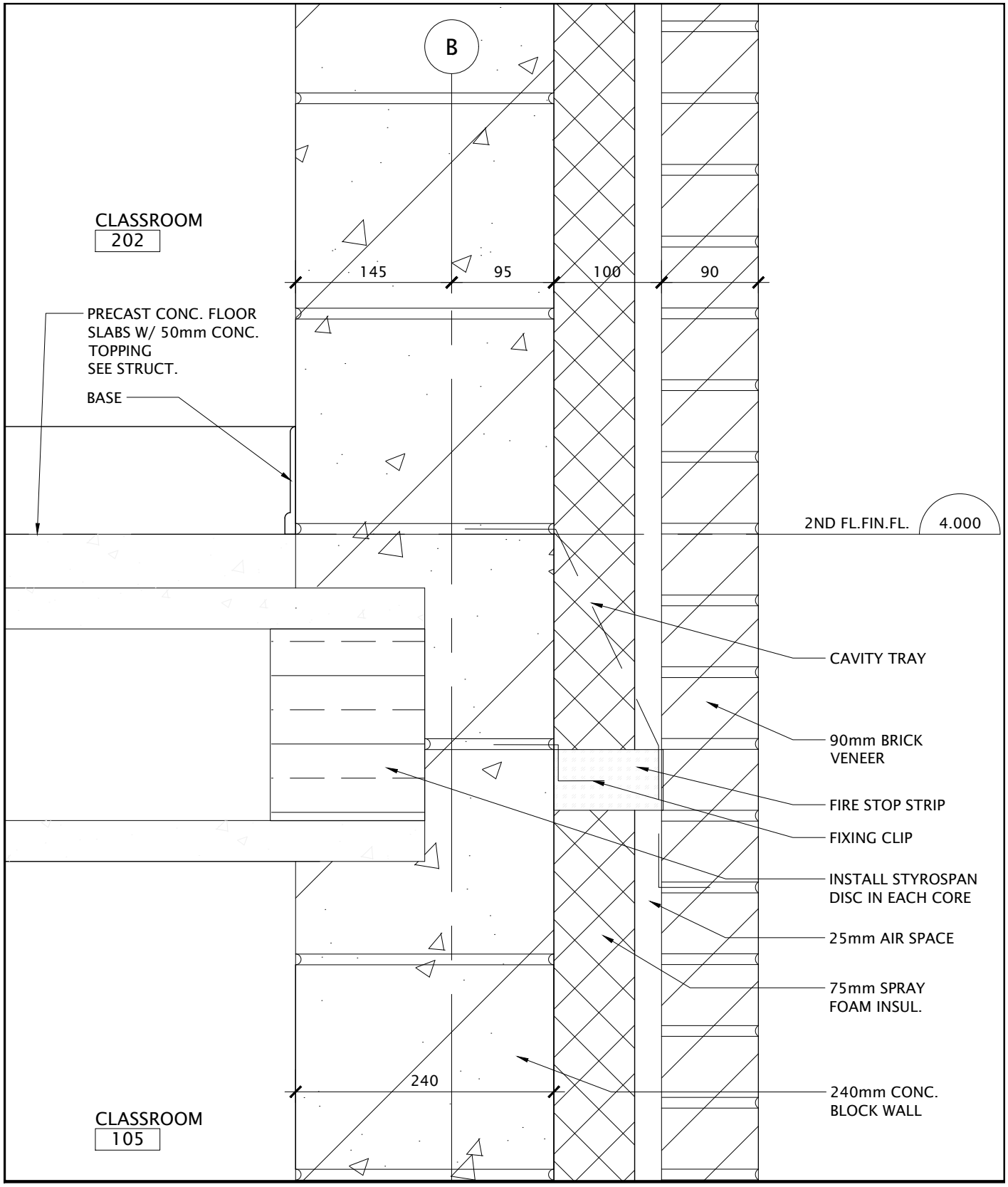
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
SECTION DETAIL @ ROOF PARAPET

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-501 / REV.



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219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

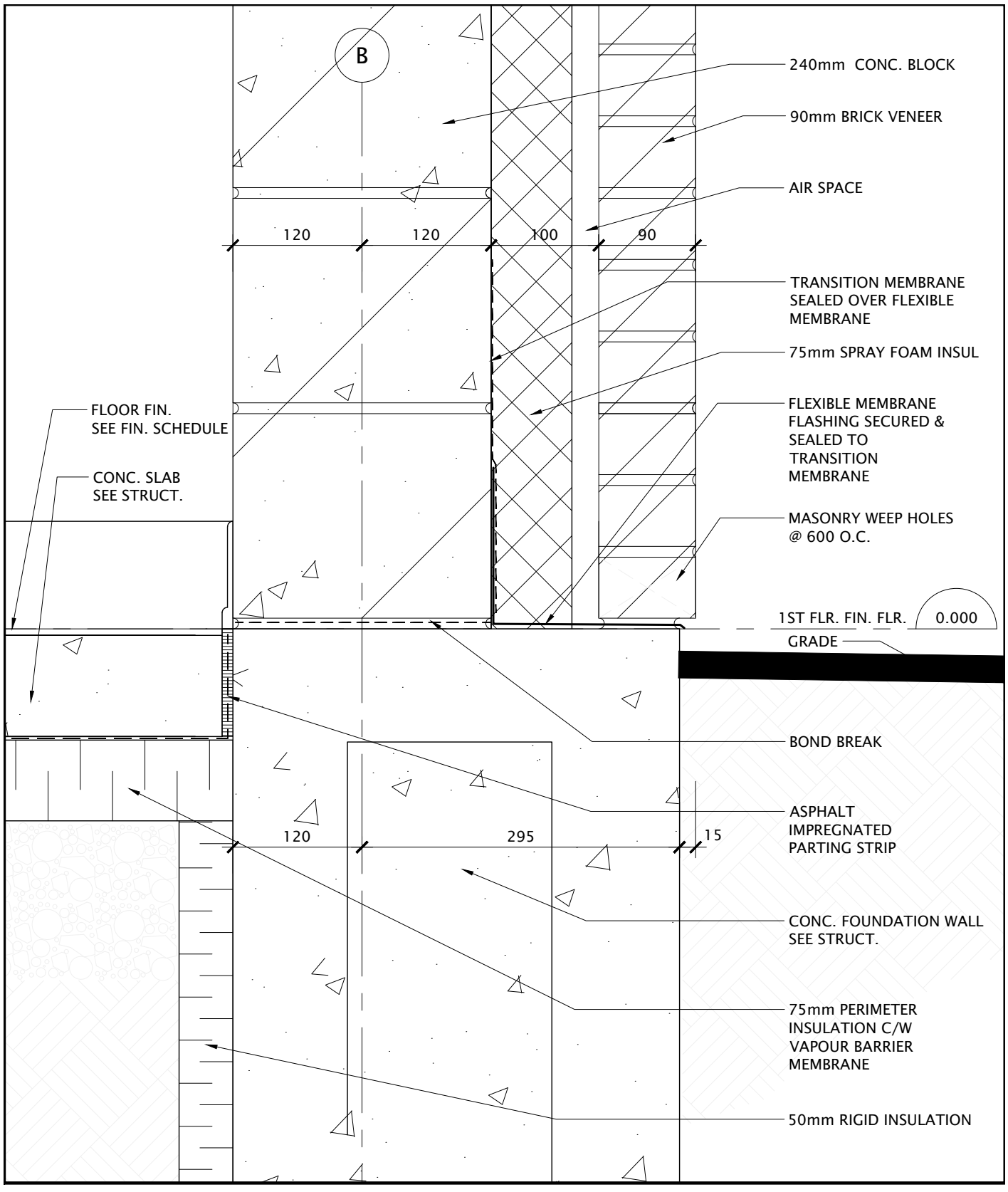
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: SECTION DETAIL @ 2ND FLOOR LEVEL

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-502
	REV.



Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

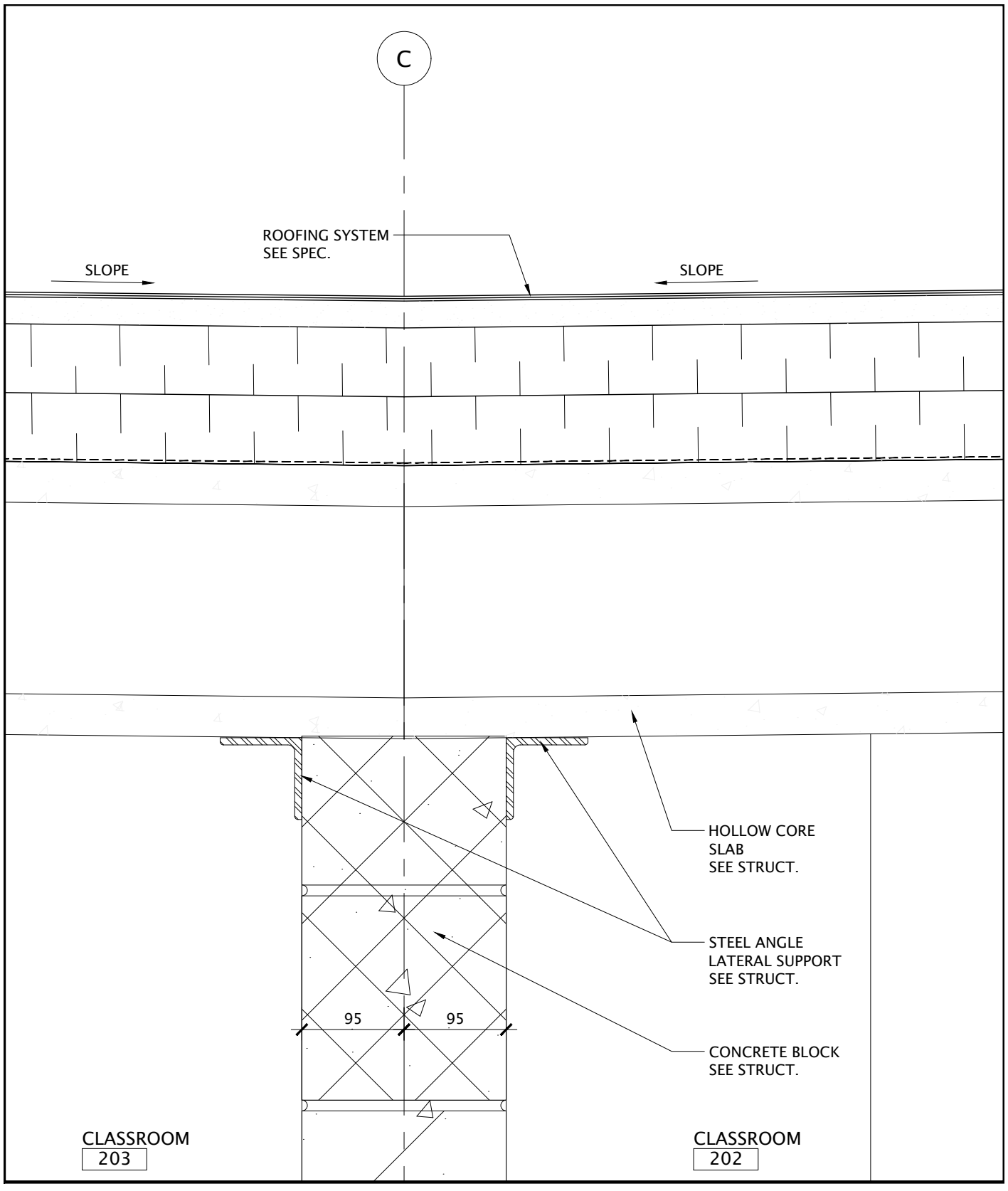
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
SECTION DETAIL @ FOUNDATION WALL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-503
	REV.



Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
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Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

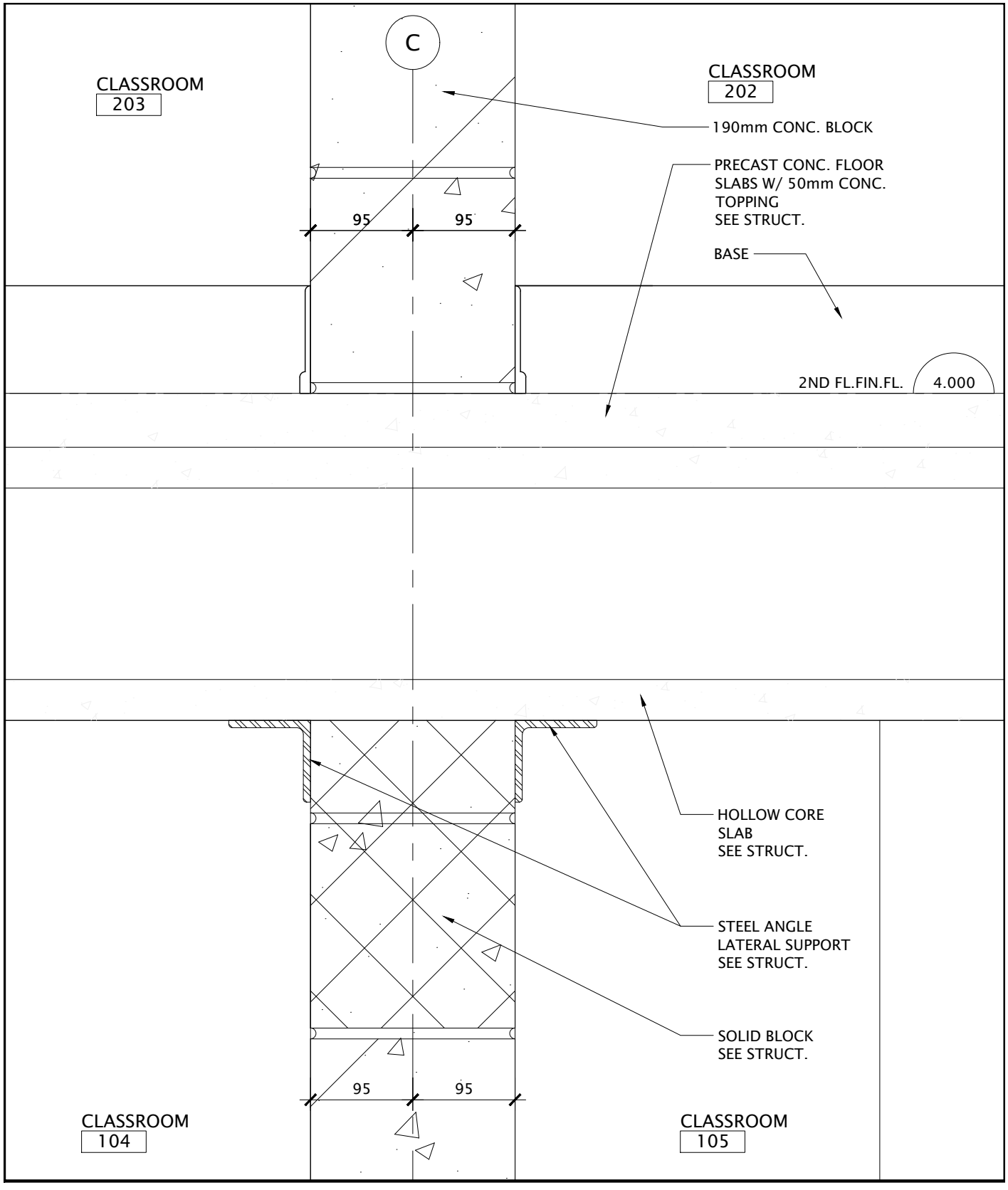
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
SECTION DETAIL @
ROOF LEVEL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-504
	REV.



Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
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Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

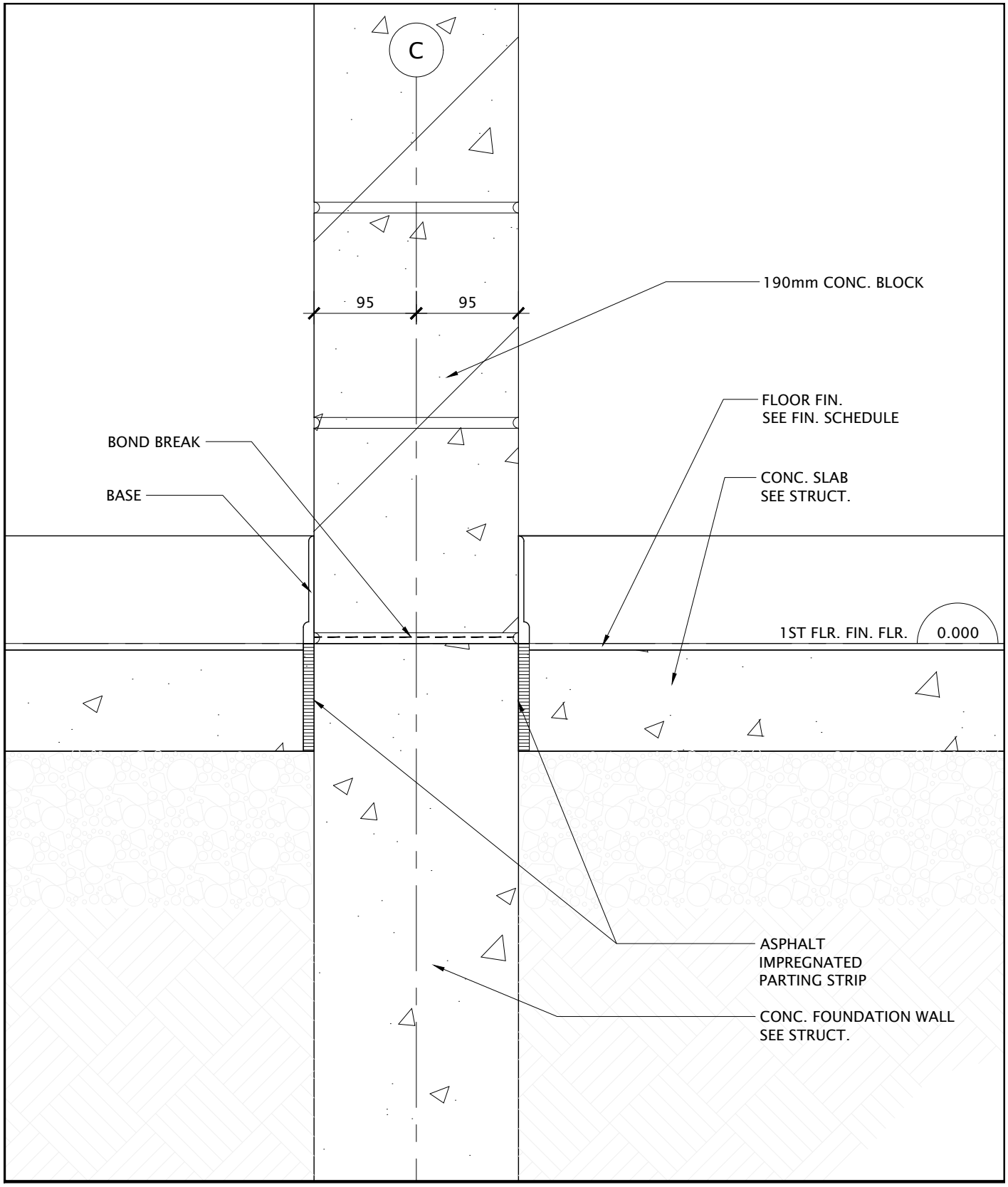
ISSUED:

ONTARIO ASSOCIATION OF ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
SECTION DETAIL @
2ND FLOOR LEVEL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-505
	REV.



Kingsland + ARCHITECTS INC.

KINGSLAND + ARCHITECTS INC
219 Dufferin Street , Suite 308b
Toronto, Ontario M6K 3J1
ph 416.203.7799
fax 416.203.7763

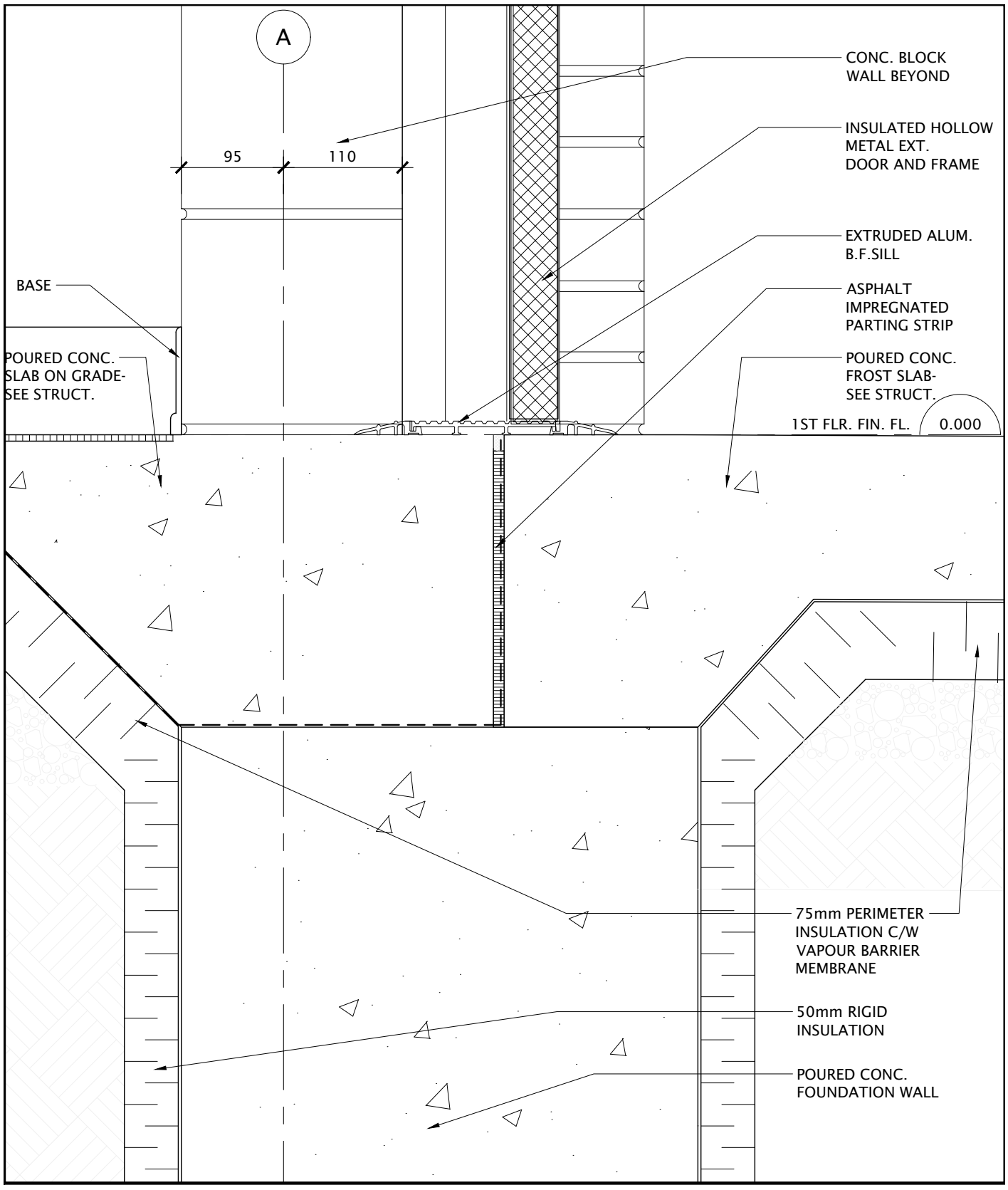
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
SECTION DETAIL @
FOUNDATION WALL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-506
	REV.



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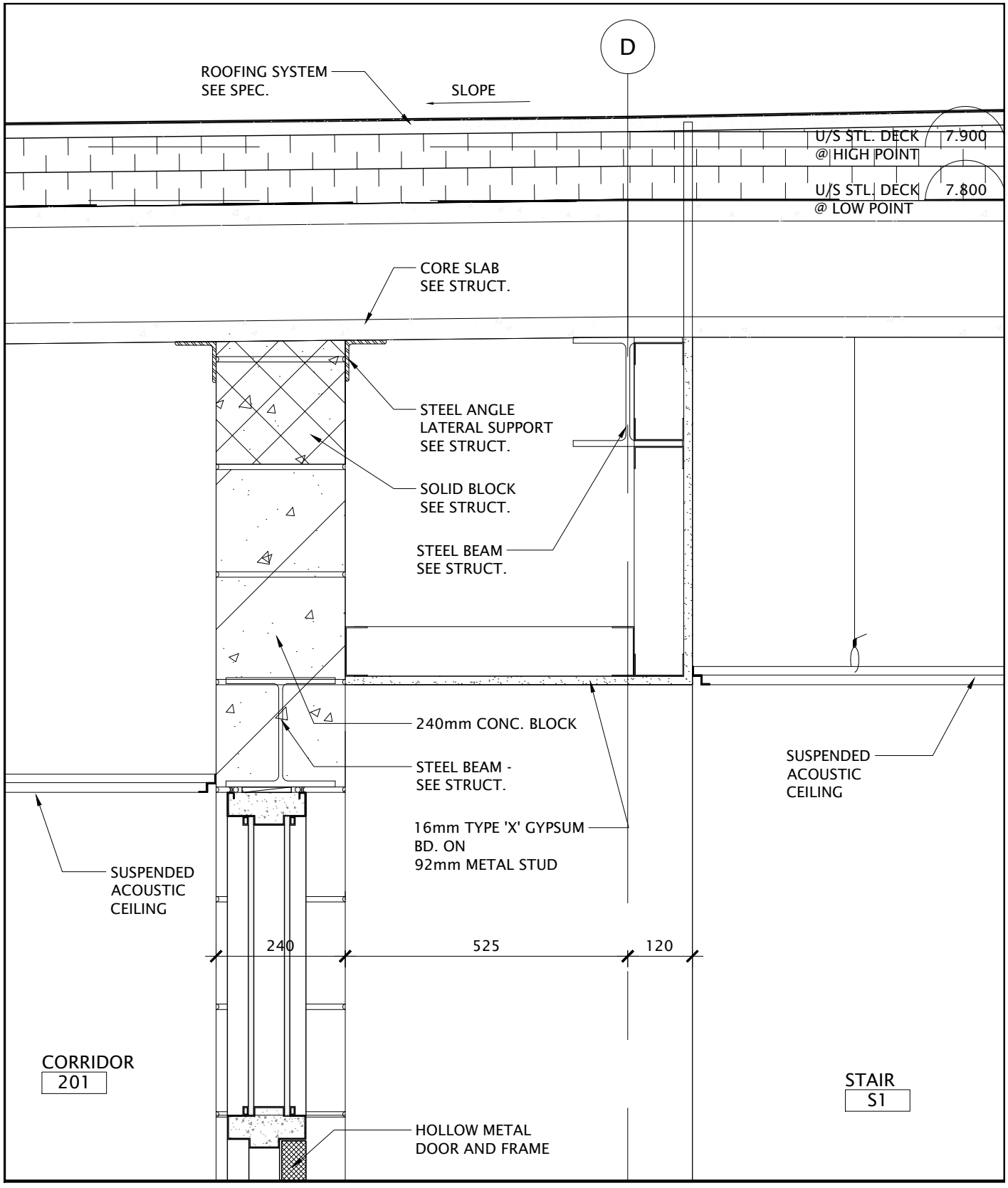
ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME: SECTION DETAIL @ DOOR SILL

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-507 / REV.



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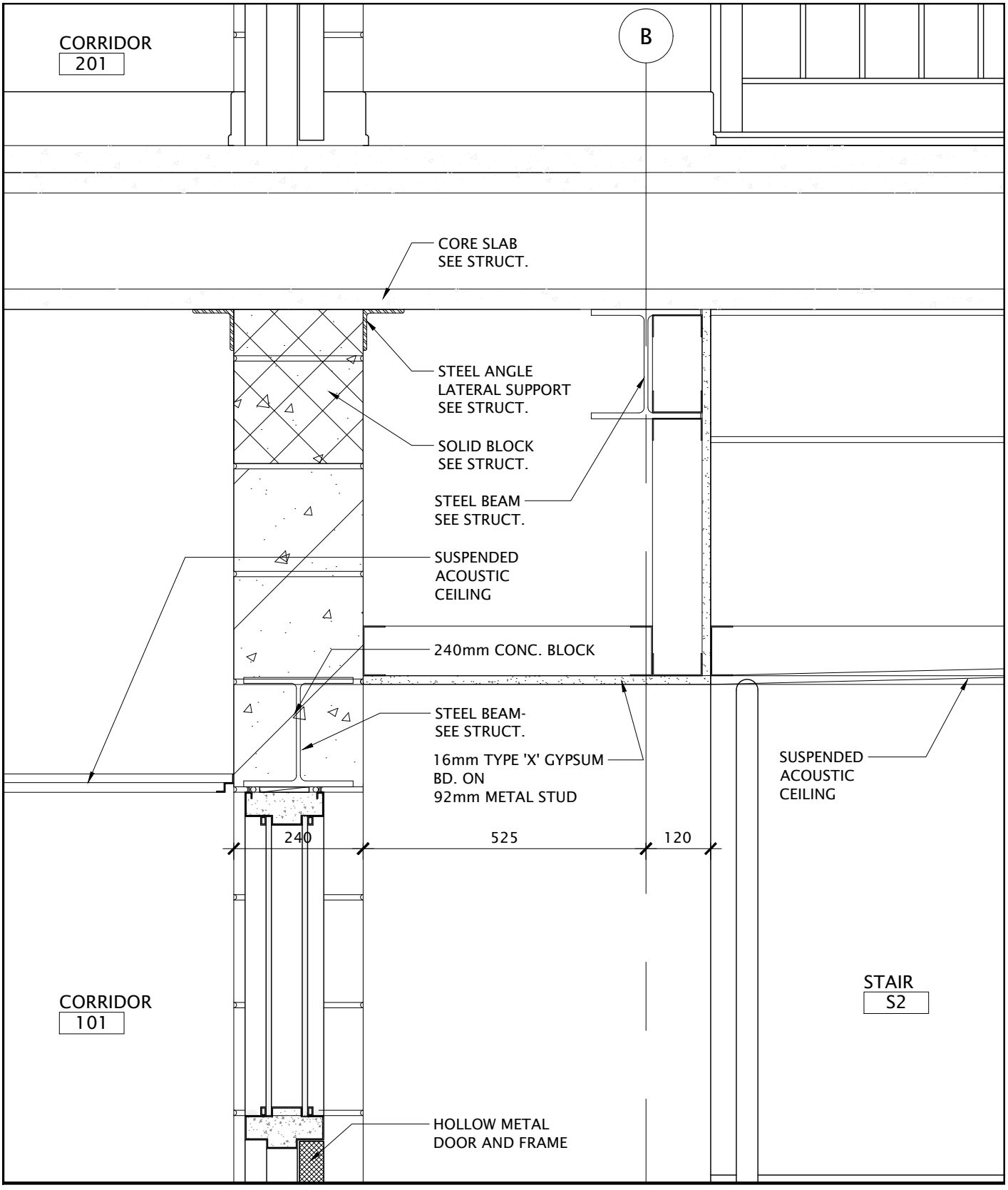
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME:
SECTION DETAIL @
DOOR HEAD

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE:	SCALE:
January 2023	1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-508 / REV.



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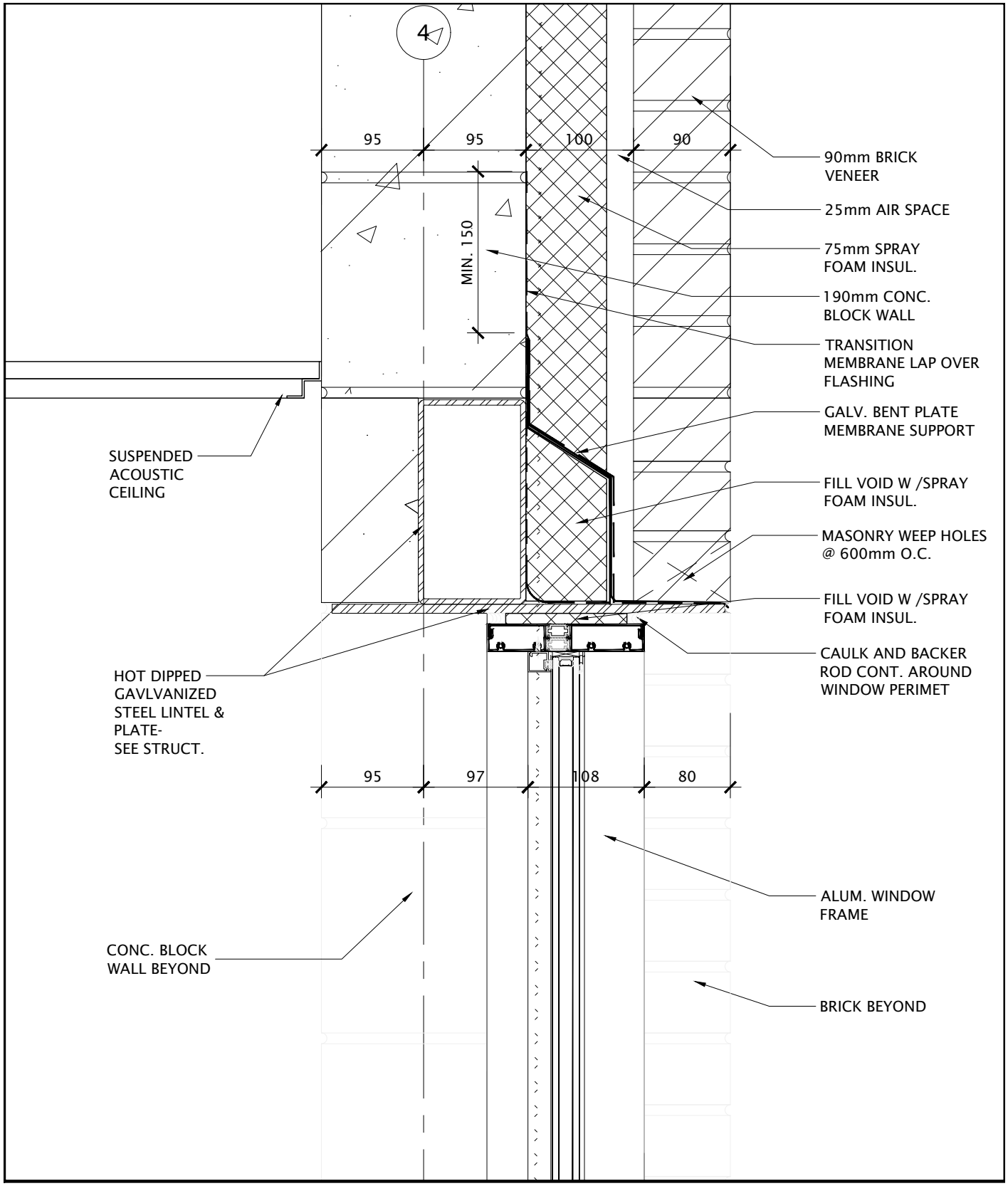
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: SECTION DETAIL @ DOOR HEAD	DATE: January 2023	SCALE: 1:10	
	DRAWN: K+	PROJECT NO: A22008	
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED: K+	DWG NO: 7-509	REV.



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COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
SECTION DETAIL AT WINDOW HEAD

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
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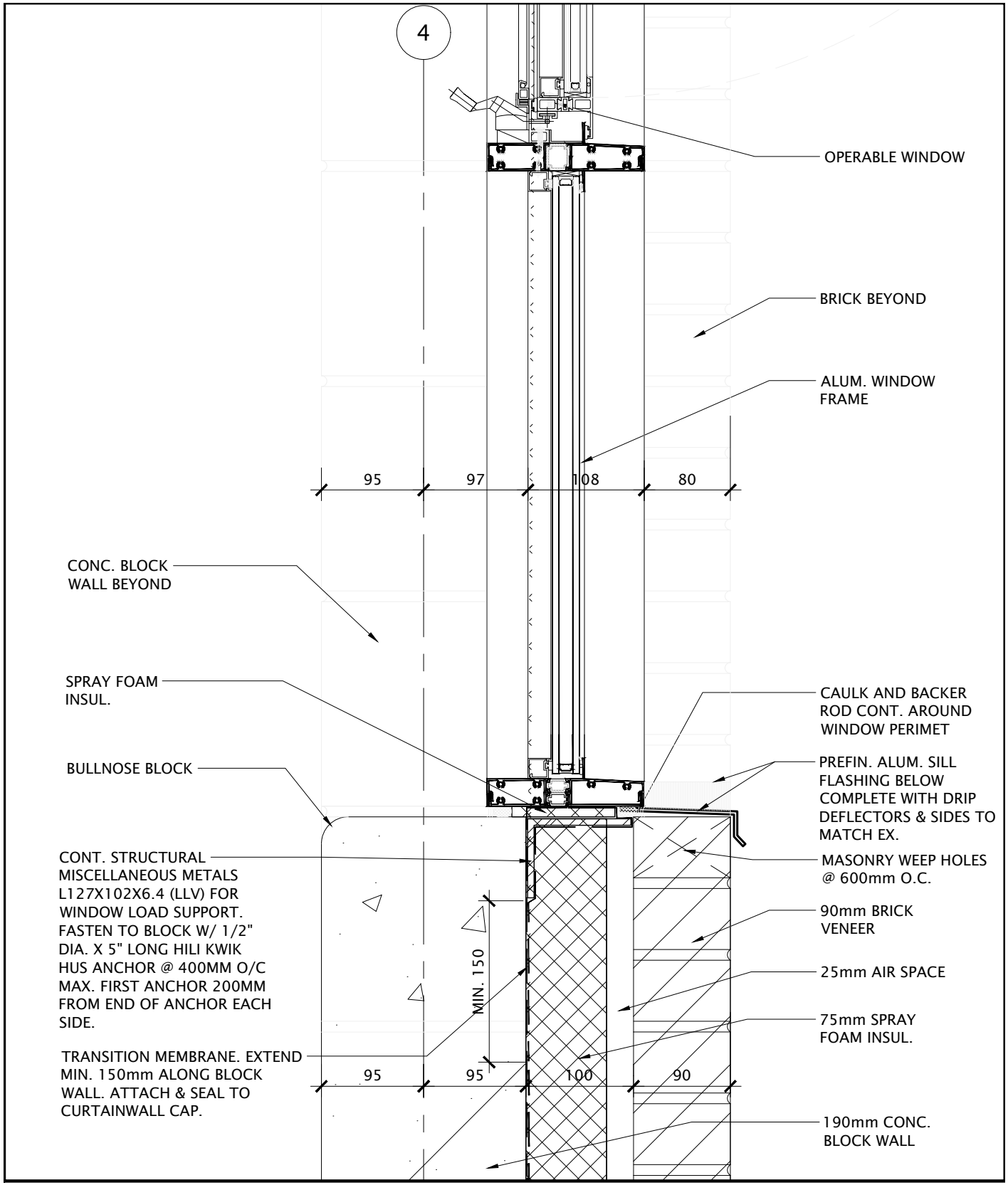

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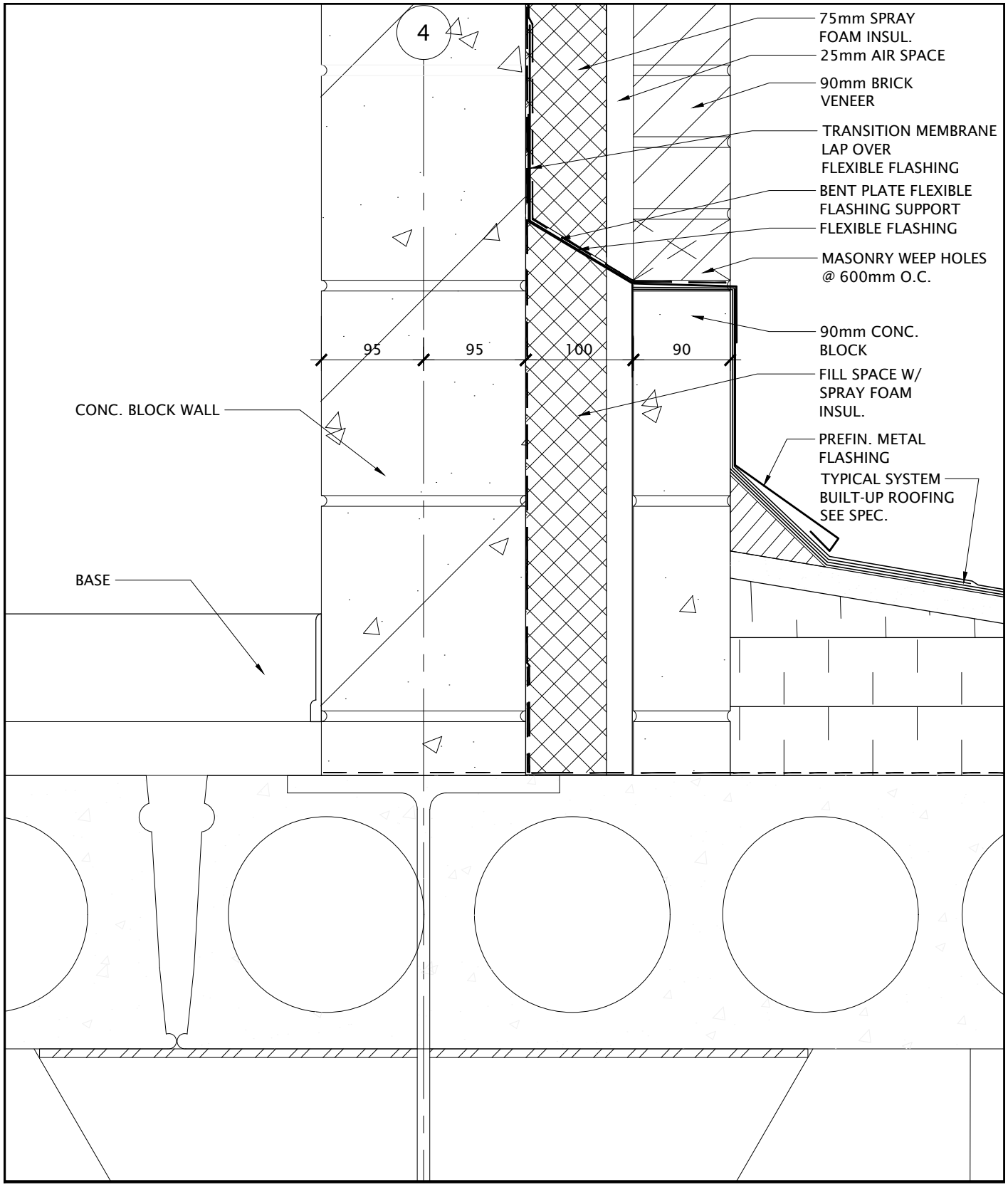
DRAWING NAME: SECTION DETAIL AT WINDOW HEAD

PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 7-512 / REV. 1



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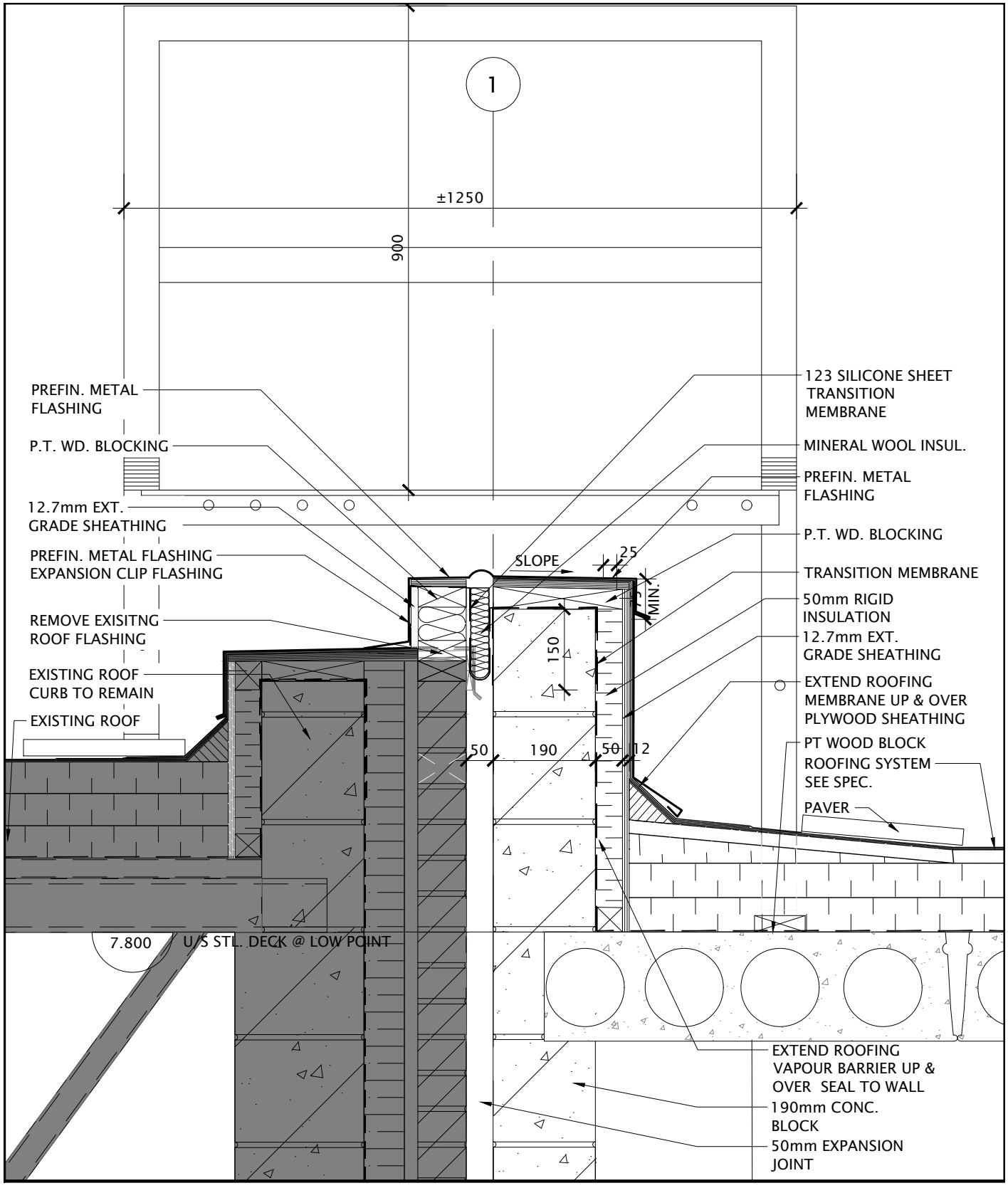
DRAWING NAME: SECTION DETAIL AT ROOF

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 7-513 / REV. 0



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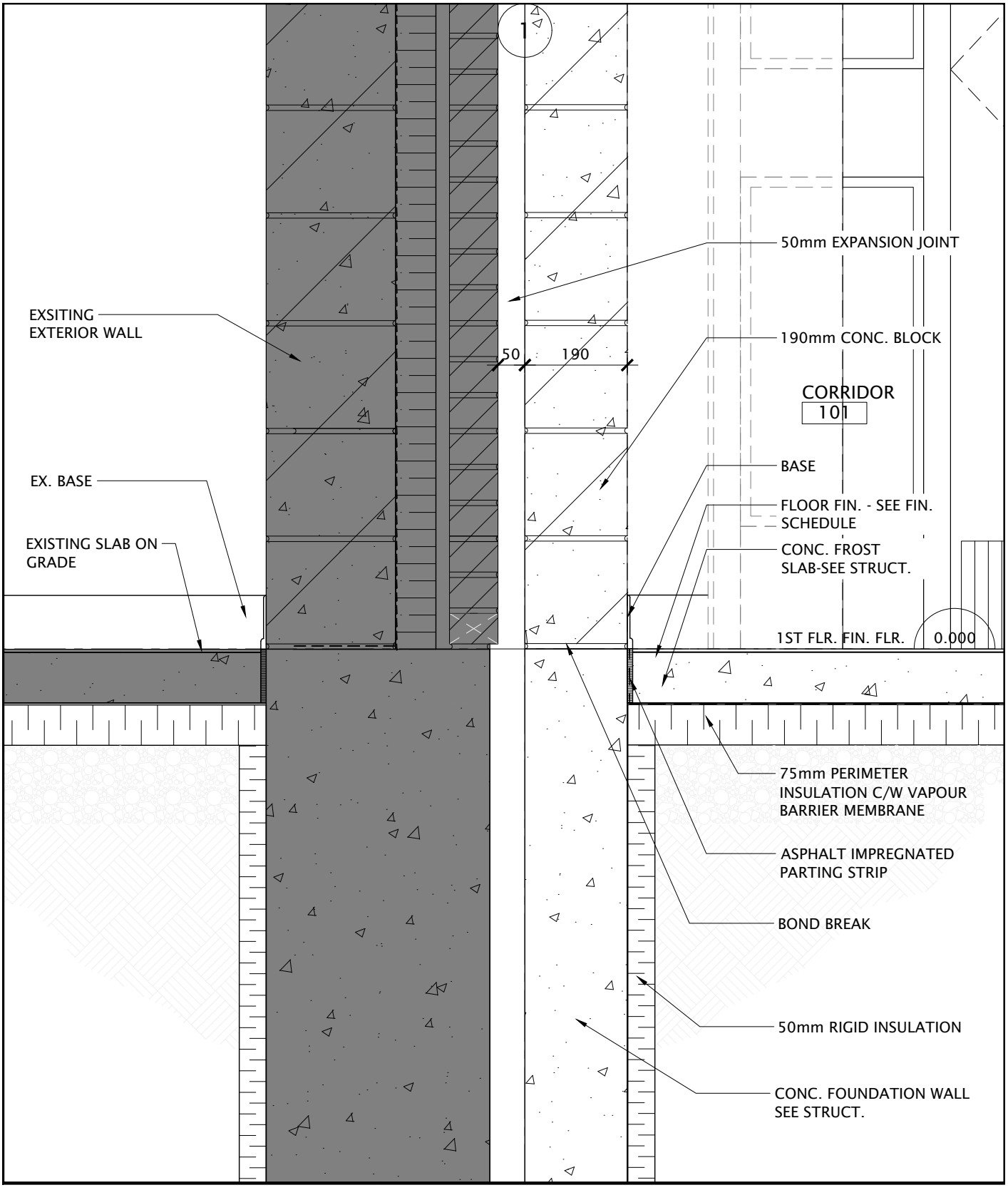
LICENCE
4549

DRAWING NAME:
SECTION DETAIL AT ROOF

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 7-514 / REV. 0



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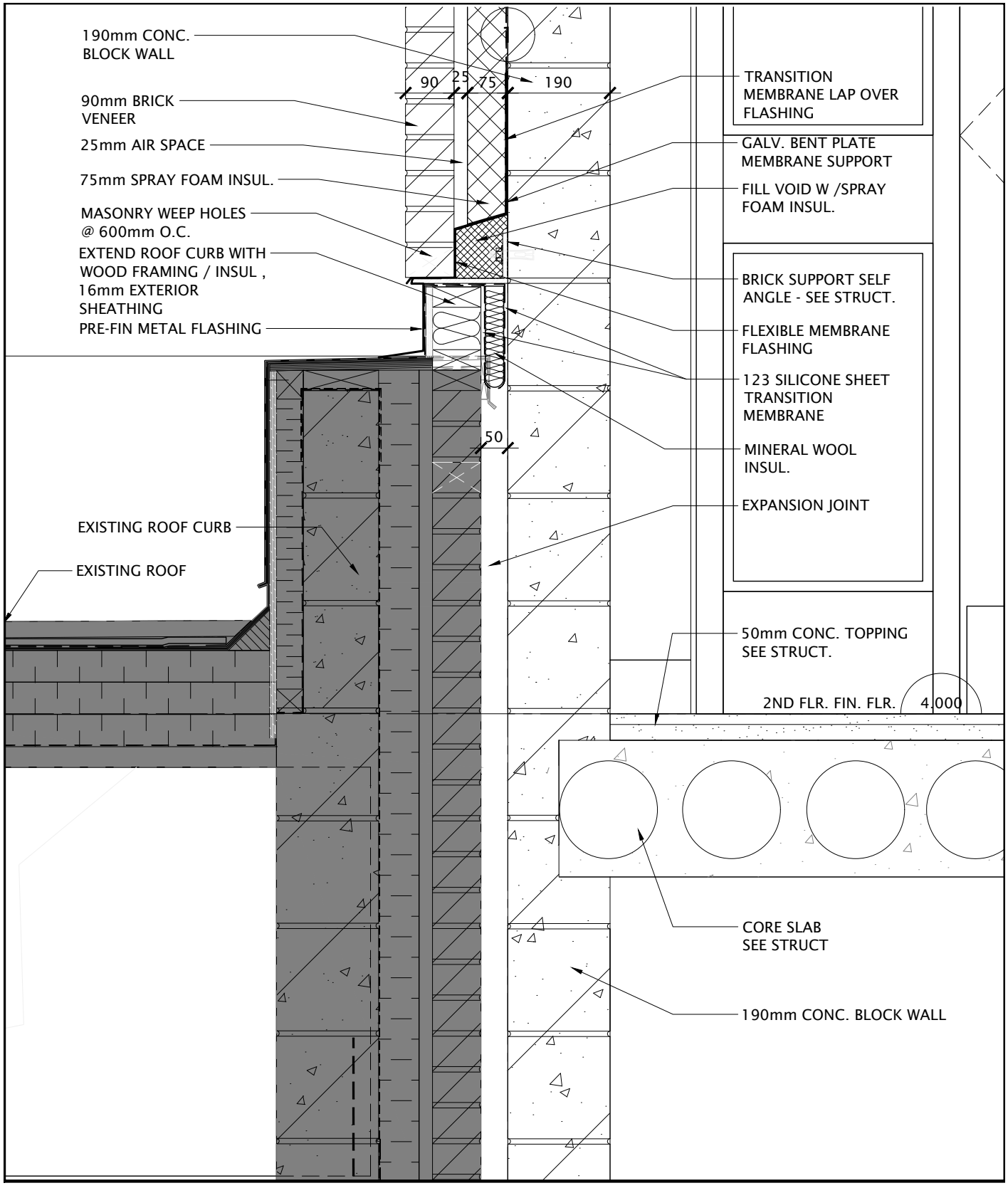
LICENCE
4549

DRAWING NAME:
SECTION DETAIL @
FOUNDATION WALL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7–515 / REV.



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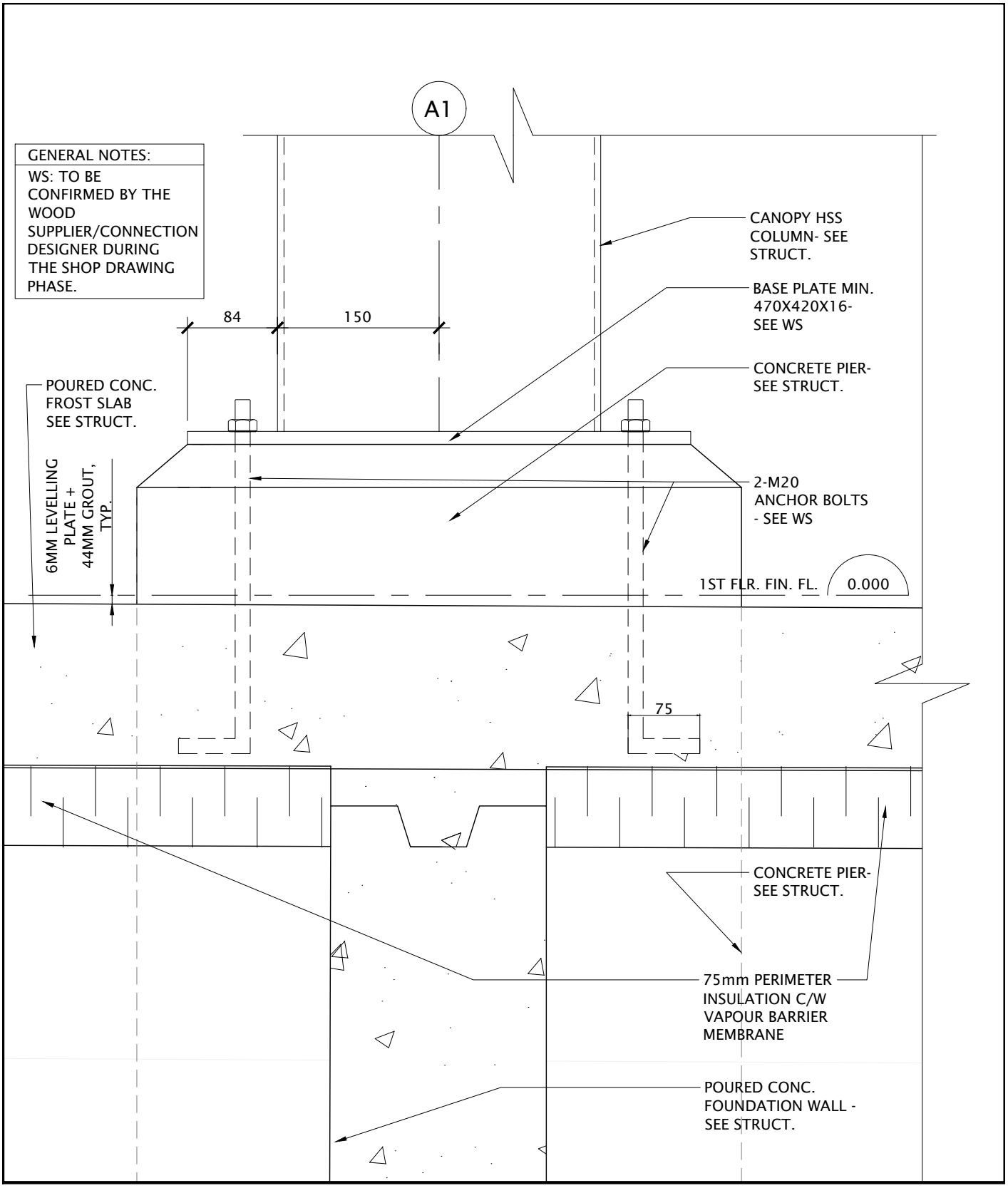
COLIN J. KINGSLAND LICENCE 4549

DRAWING NAME:
SECTION DETAIL @ FOUNDATION WALL

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE: January 2023	SCALE: 1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-516
	REV.



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DRAWING NAME: SECTION DETAIL @ CANOPY FOUNDATION

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-517
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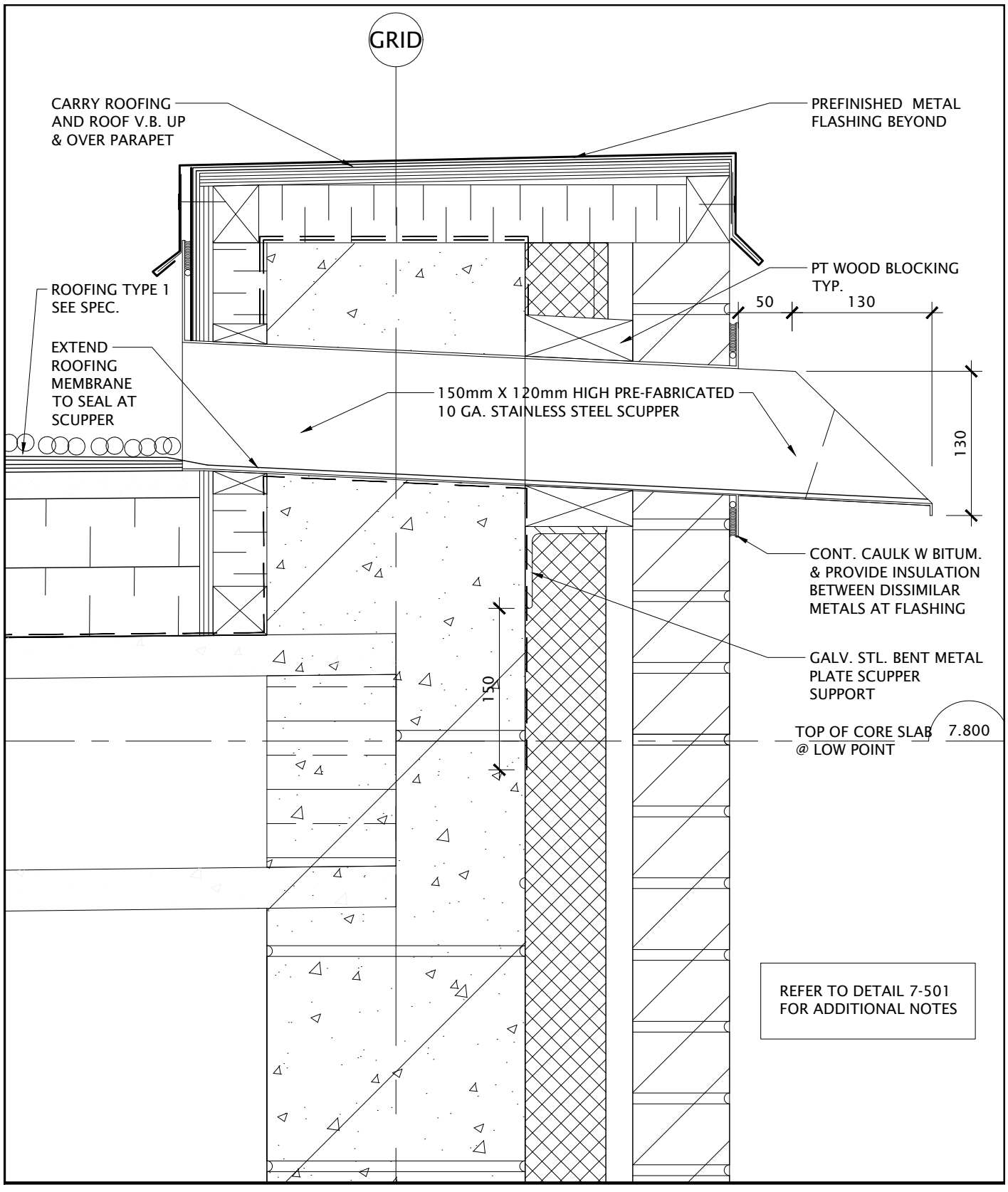

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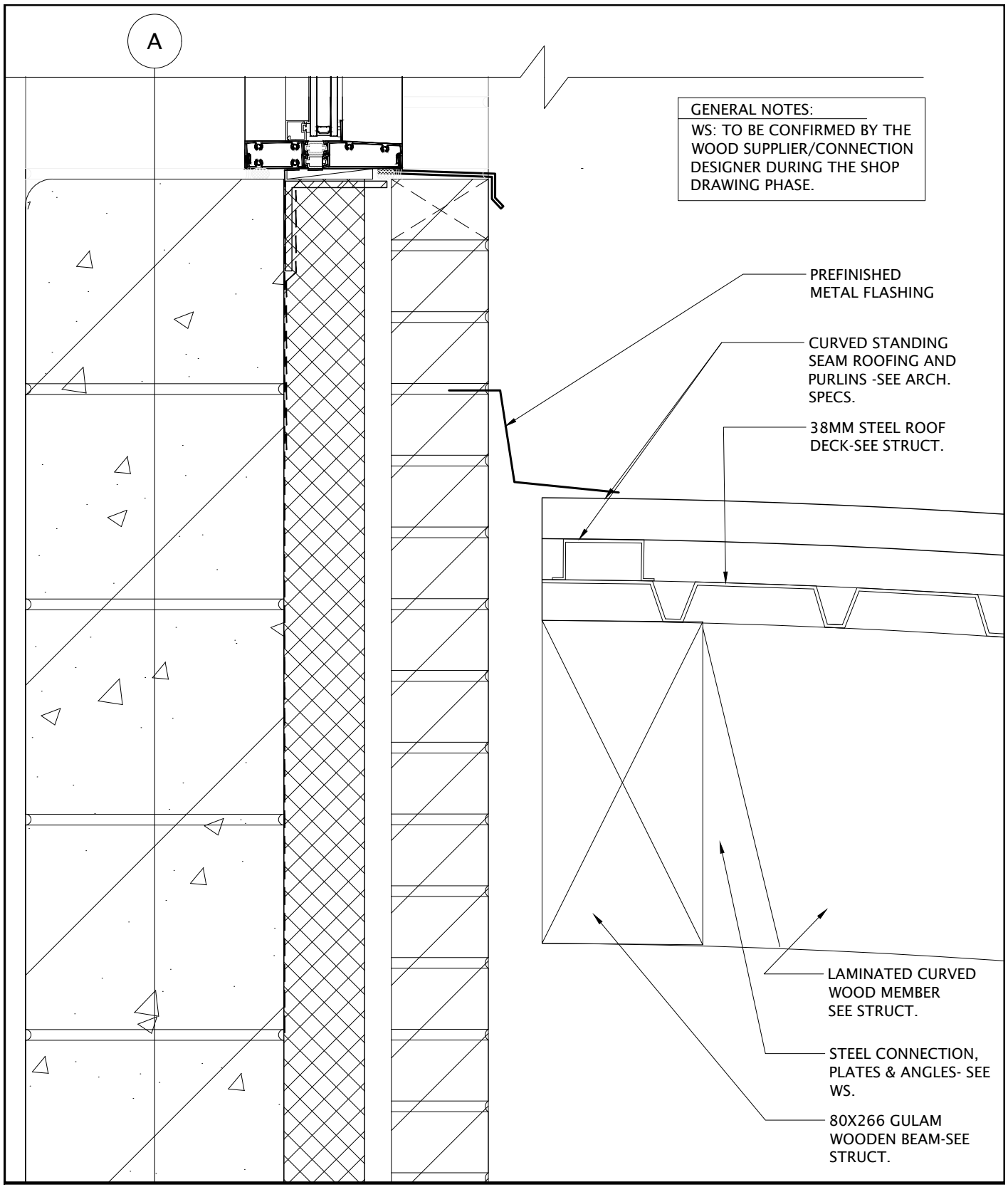
DRAWING NAME:
ROOF SCUPPER SECTION DETAIL AT MASONRY

PROJECT NAME:
ÉÉC SAINT-MICHEL
Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-518 / REV.



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DRAWING NAME: SECTION DETAIL @ CANOPY

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-542
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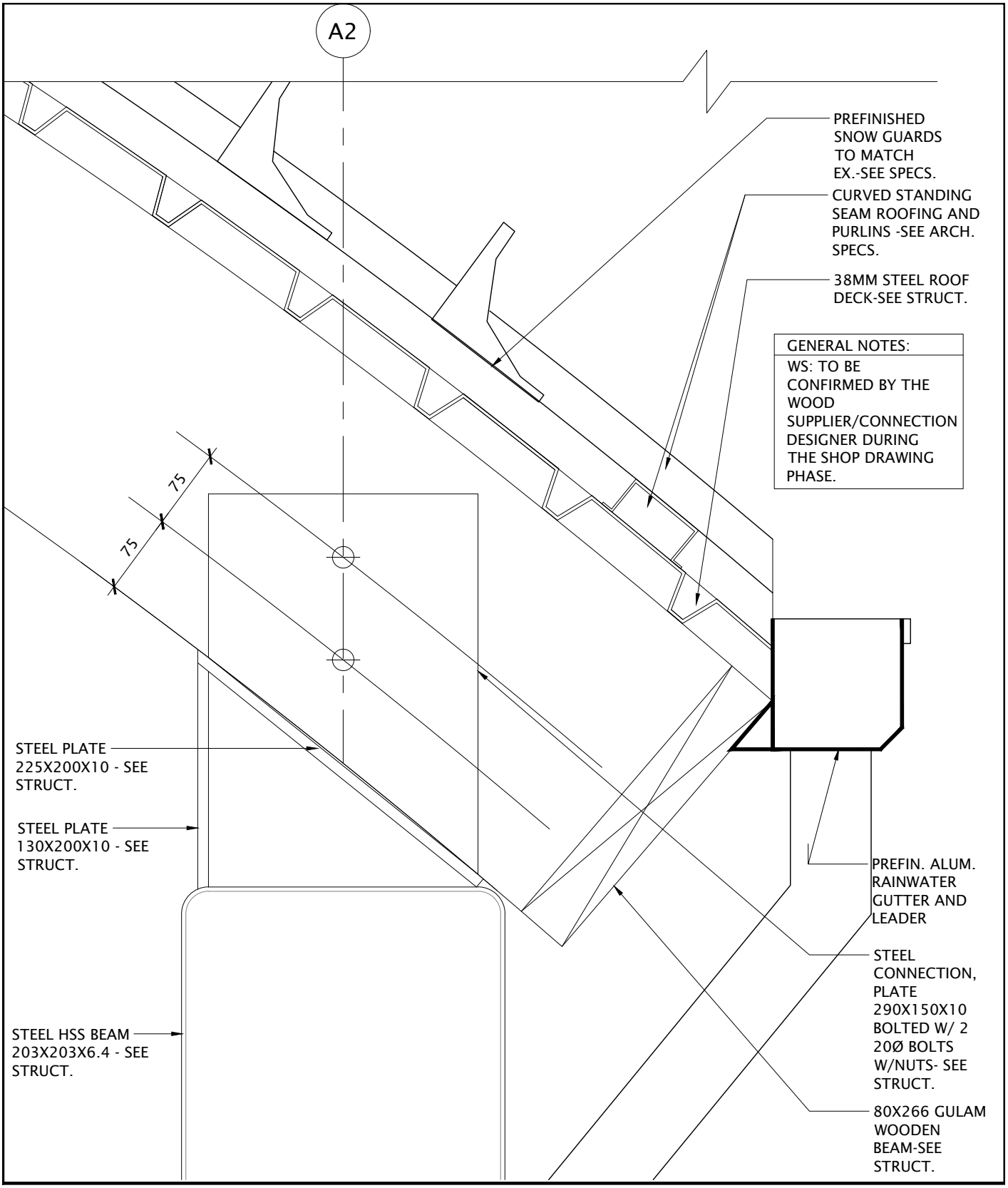

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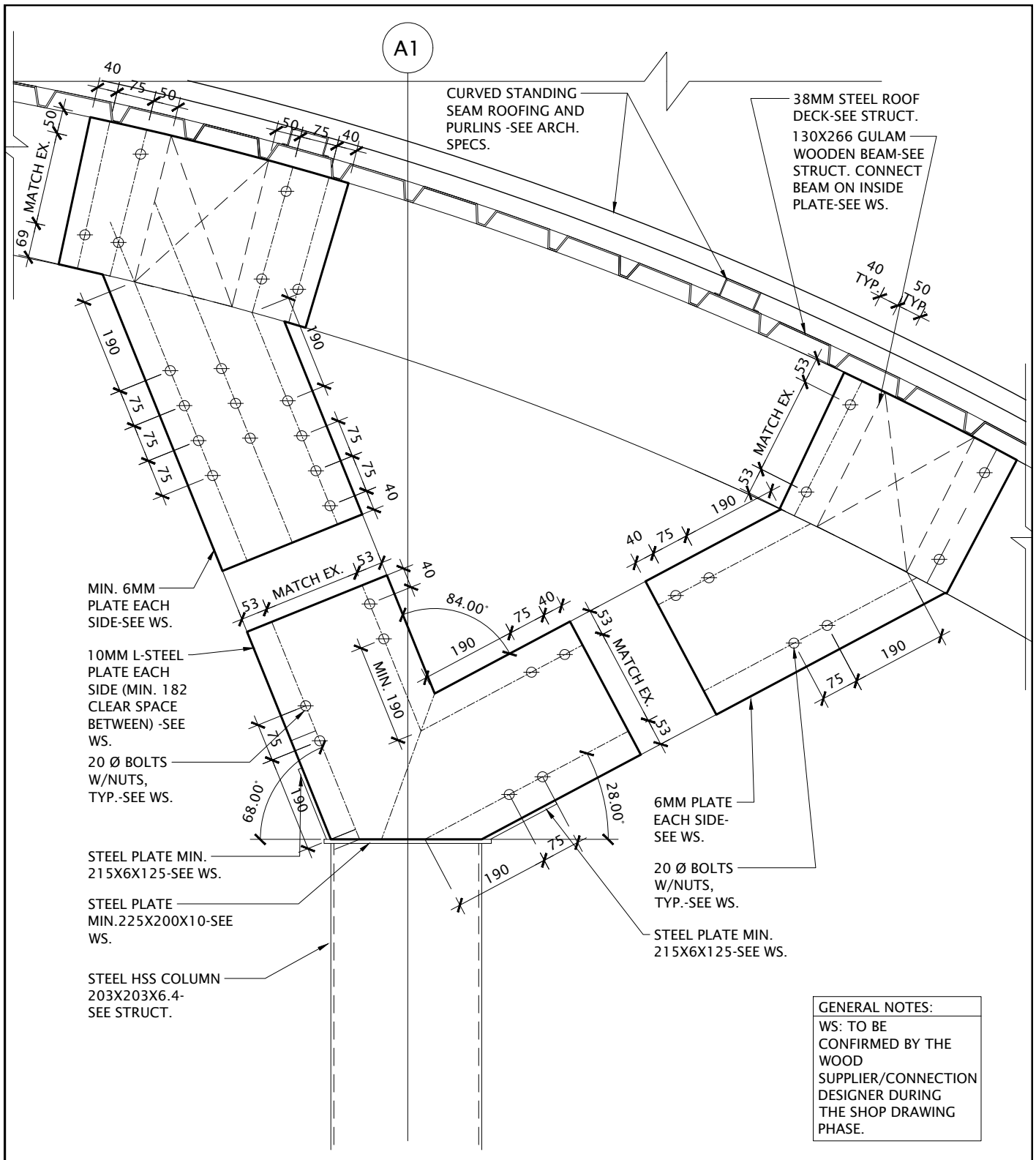
DRAWING NAME: SECTION DETAIL @ CANOPY

PROJECT NAME: **ÉÉC SAINT-MICHEL** Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-543 / REV.



GENERAL NOTES:

WS: TO BE CONFIRMED BY THE WOOD SUPPLIER/CONNECTION DESIGNER DURING THE SHOP DRAWING PHASE.

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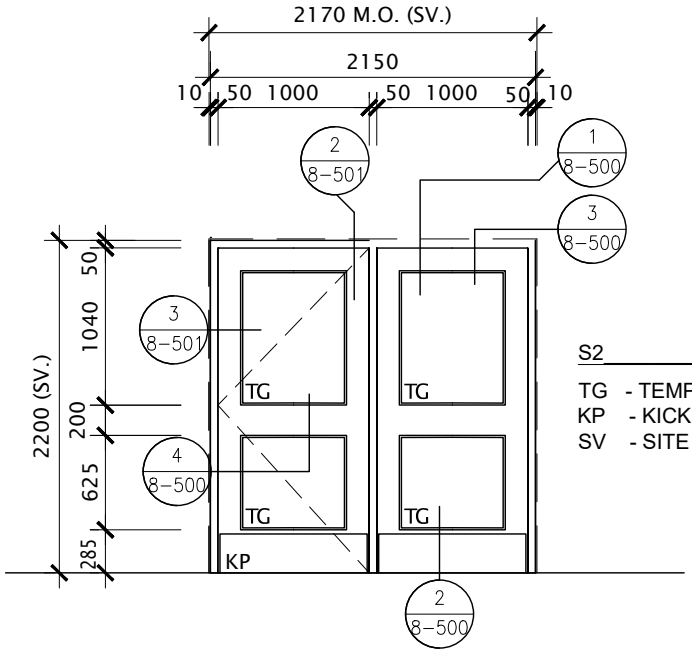
DRAWING NAME: SECTION DETAIL @ CANOPY

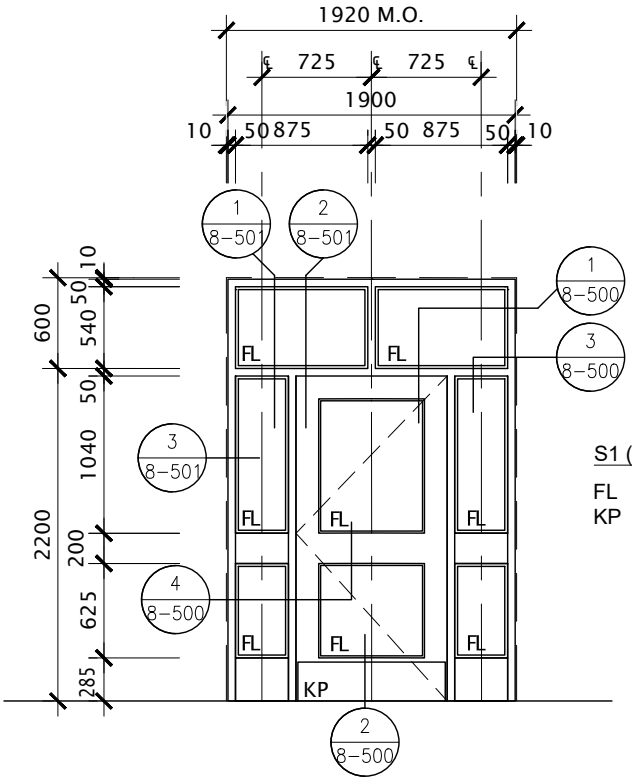
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:10
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 7-544 / REV.



S2

TG - TEMPERED GLASS
KP - KICKPLATE
SV - SITE VERIFY



S1 (45MIN. FRR-SEE DOOR SCHEDULE)

FL - FIRELITE TEMPERED GLASS
KP - KICKPLATE

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DRAWING NAME: H.M. SCREEN ELEVATIONS

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE: January 2023

DRAWN: T.E.

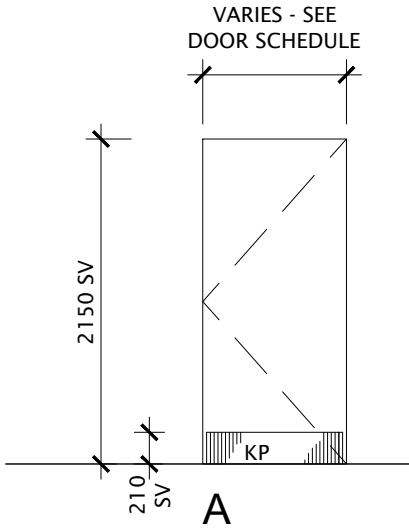
CHECKED:

SCALE: 1:50

PROJECT NO: A22008

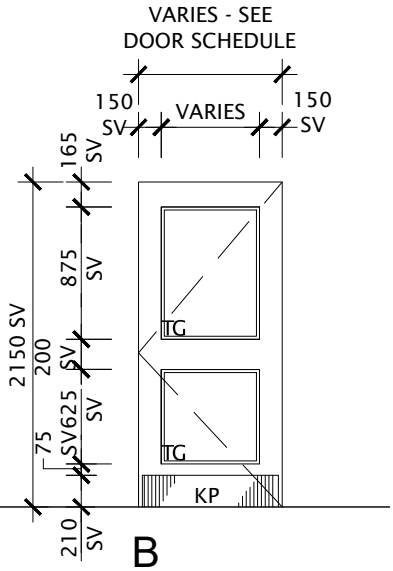
DWG NO: 8-400

REV. 1



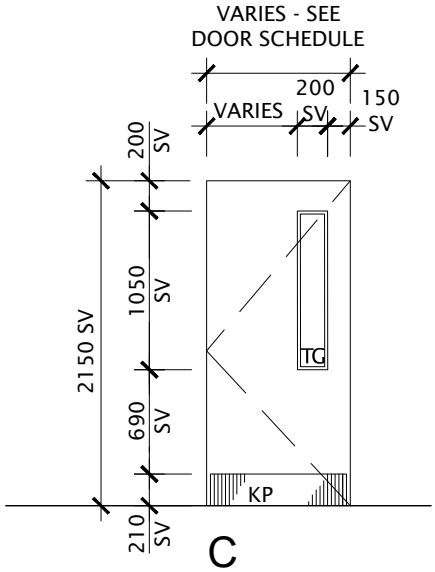
A

KP - KICK PLATE
SV - SITE VERIFY TO MATCH EXISTING



B

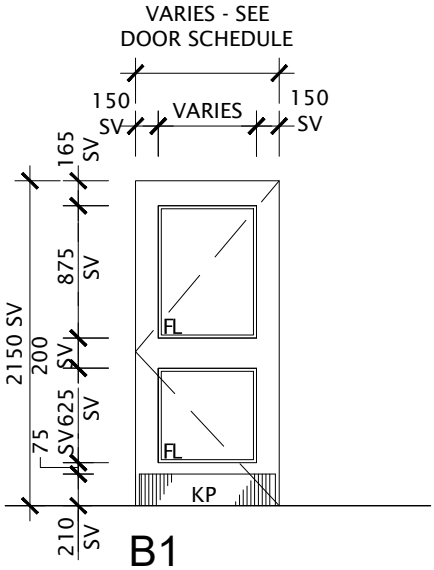
TG - TEMPERED GLASS
KP - KICK PLATE
SV - SITE VERIFY TO MATCH EXISTING



C

TG - TEMPERED GLASS
KP - KICK PLATE
SV - SITE VERIFY TO MATCH EXISTING

* FOR FIRE RATINGS OF DOORS - REFER TO DOOR SCHEDULE
* ALL NEW DOORS TYPES AND DIMENSIONS TO MATCH EXISTING



B1

FL - FIRELITE TEMPERED GLASS
KP - KICK PLATE
SV - SITE VERIFY TO MATCH EXISTING

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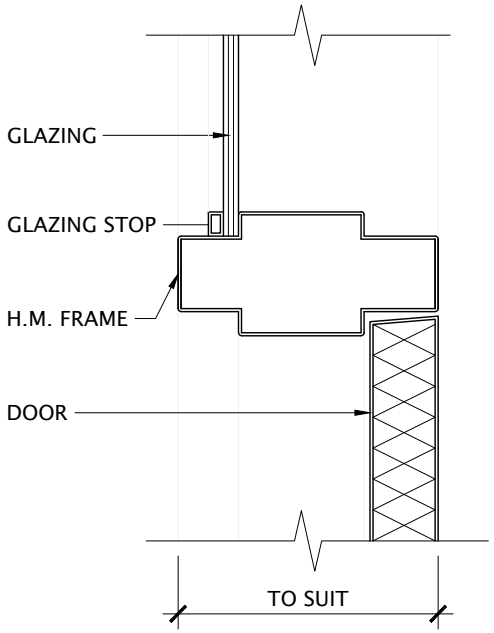
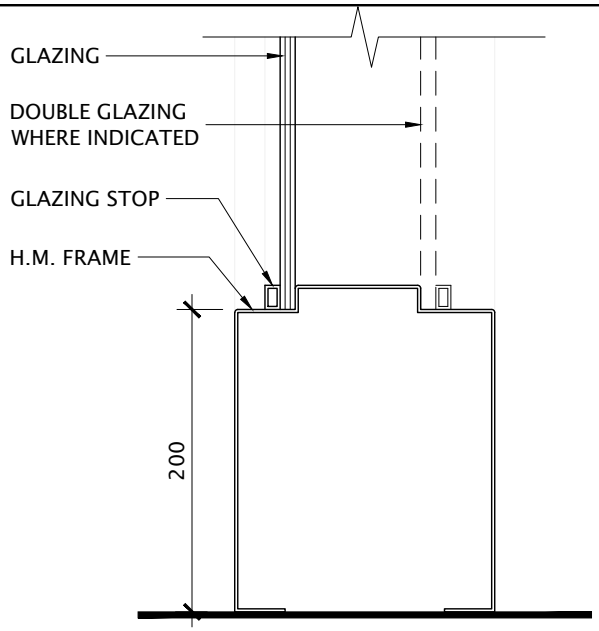
DRAWING NAME: DOOR TYPES

PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:50
DRAWN: K+	PROJECT NO: A22008
CHECKED: K+	DWG NO: 8-401 / REV. 0



1
8–500



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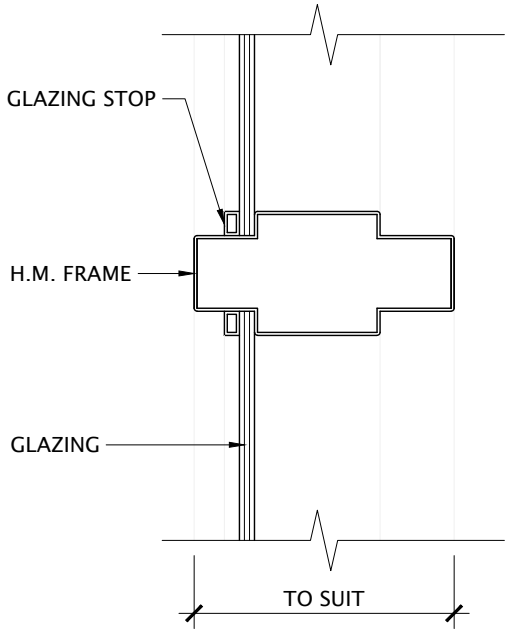
8–500



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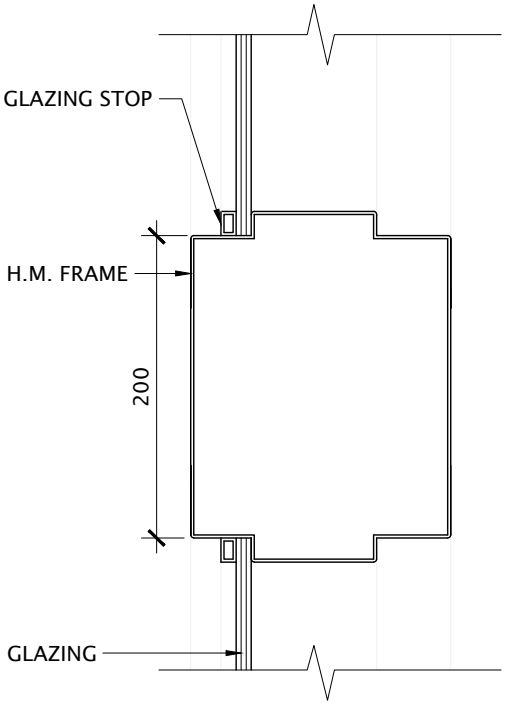

4
8–500

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ISSUED:

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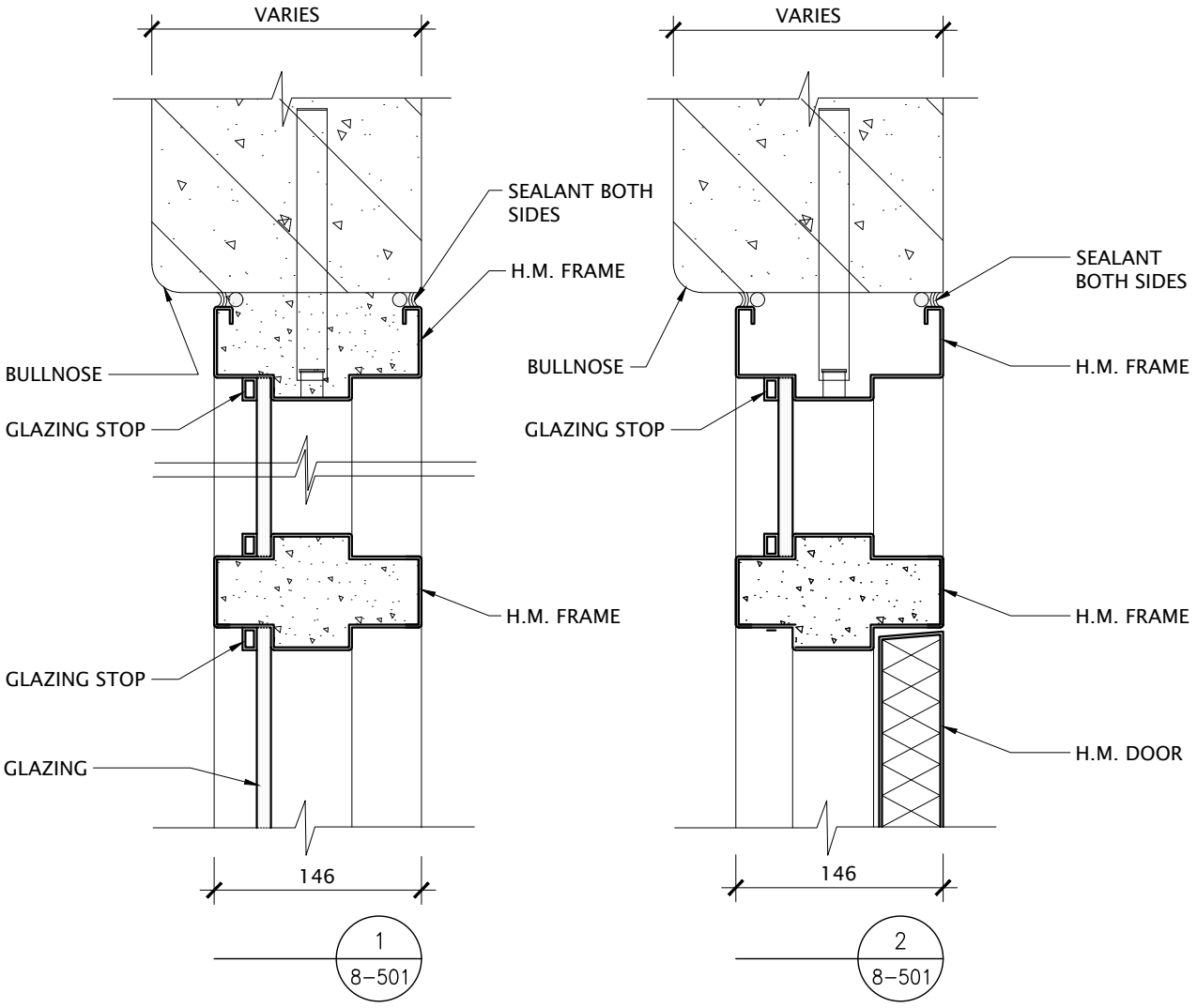
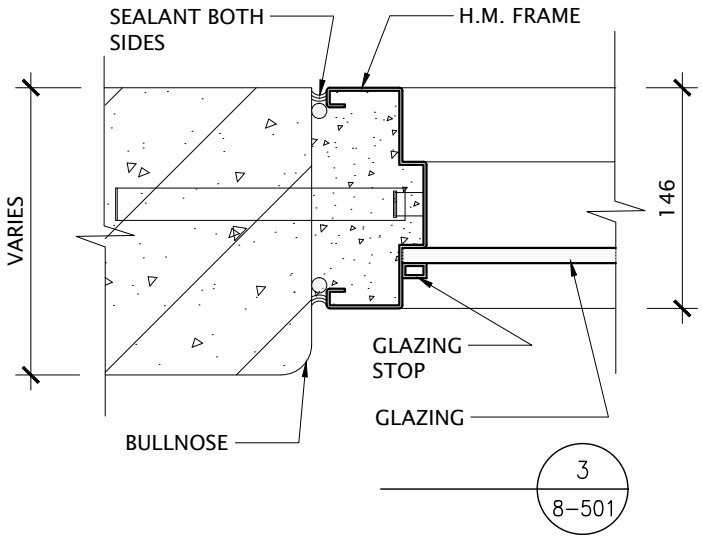
DRAWING NAME: HOLLOW METAL FRAME DETAILS

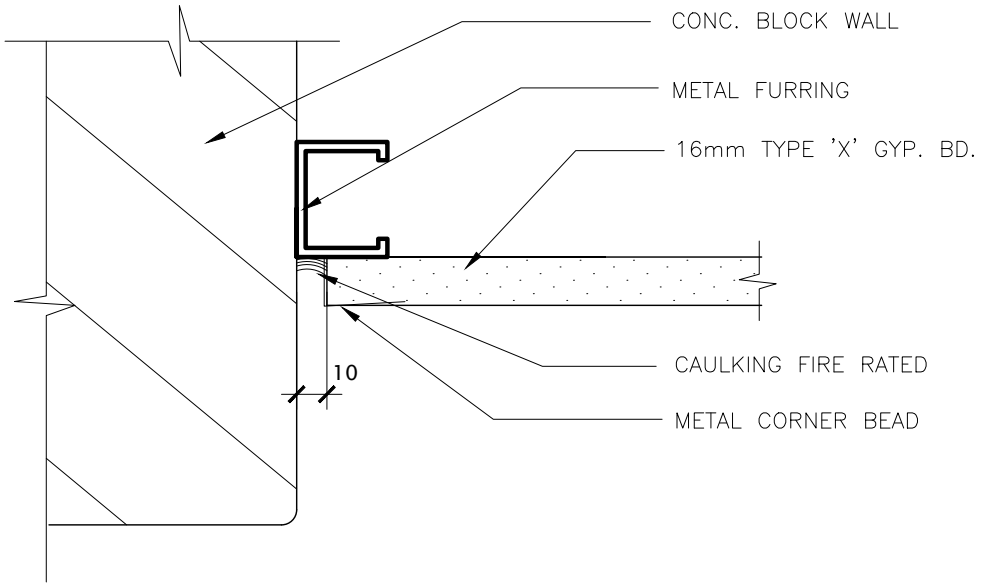
PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition

DATE:	SCALE:
January 2023	1:5
DRAWN: K+	PROJECT NO: A22008
CHECKED:	DWG NO: 8–500 / REV.





Kingsland ARCHITECTS INC.	ISSUED: ONTARIO ASSOCIATION OF ARCHITECTS COLIN J. KINGSLAND LICENCE 4549	DRAWING NAME: HOLLOW METAL FRAME DETAILS	DATE: January 2023	SCALE: 1:5
			DRAWN: K+	PROJECT NO: A22008
KINGSLAND + ARCHITECTS INC 219 Dufferin Street , Suite 308b Toronto, Ontario M6K 3J1 ph 416.203.7799 fax 416.203.7763		PROJECT NAME: ÉÉC SAINT-MICHEL Classrooms Addition	CHECKED:	DWG NO: 8-501 / REV.



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DRAWING NAME: CEILING DETAIL - TYP.

DATE: January 2023

SCALE: 1:5

DRAWN:

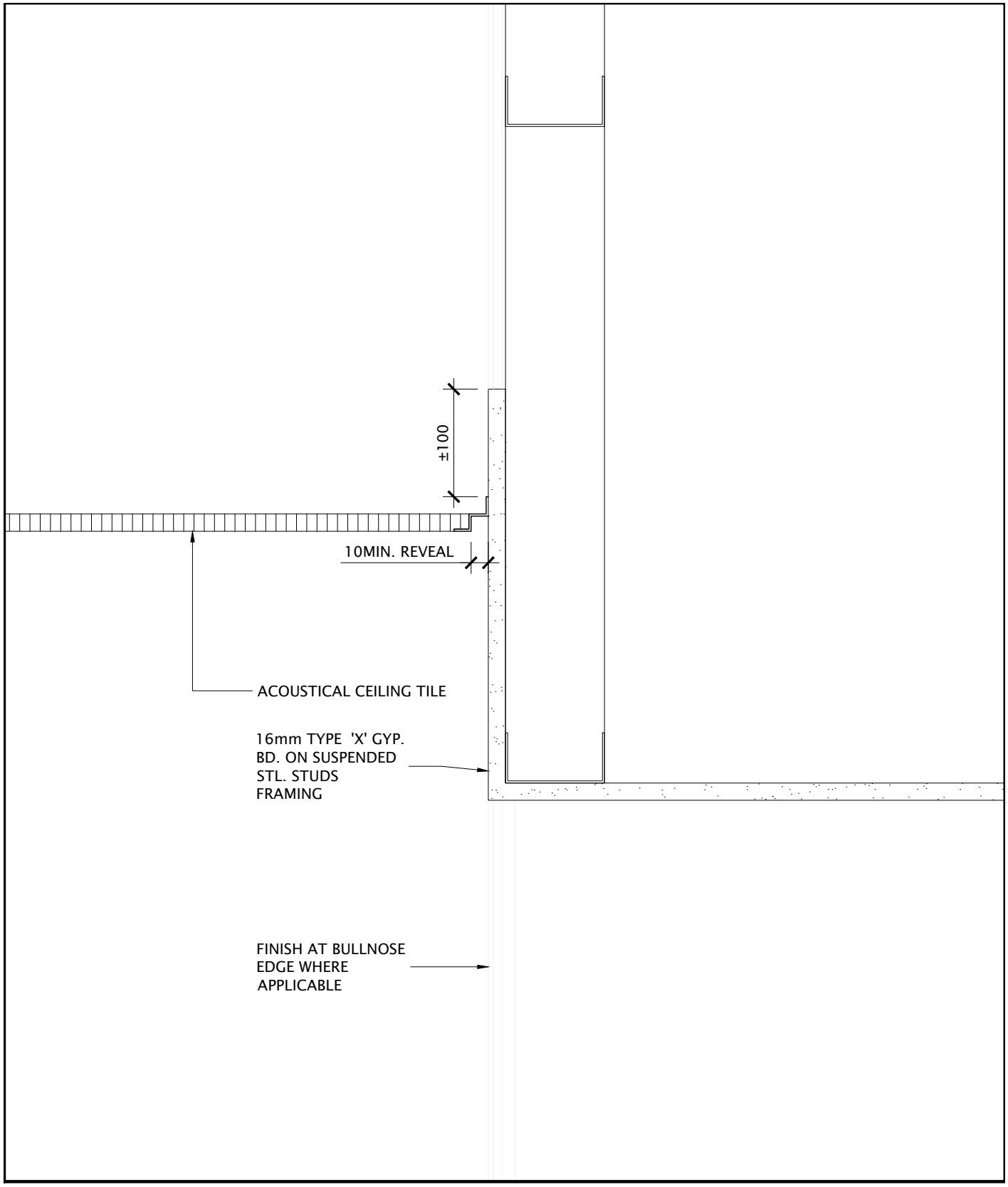
PROJECT NO: A22008

PROJECT NAME: **ÉÉC SAINT-MICHEL**
Classrooms Addition

CHECKED:

DWG NO: 9–108

REV.



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fax 416.203.7763

ISSUED:

ONTARIO ASSOCIATION ARCHITECTS
COLIN J. KINGSLAND
LICENCE
4549

DRAWING NAME: CEILING DETAIL - TYP.

DATE: January 2023

SCALE: 1:5

DRAWN:

PROJECT NO: A22008

PROJECT NAME: **ÉÉC SAINT-MICHEL**
Classrooms Addition

CHECKED:

DWG NO: 9–109

REV.

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of the Agreement.

.2 Division 1 requirements apply to all Sections of Work.

.3 In case of conflict between the Agreement and Division 1 requirements, the Agreement and the Special Provisions shall govern.

1.2 **Summary of Work**

.1 Provide all items, articles, materials, services and incidentals, whether or not expressly specified or shown on Drawings, to make finished work complete and fully operational, consistent with the intent of the Contract Documents.

1.3 **Examination**

.1 Contractor shall examine site and make themselves thoroughly acquainted with same, and obtain for themselves any and all information that may be necessary for proper carrying out of Contract.

Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection of the site prior to Tender closing.

.2 Ascertain nature and amount of materials to be removed or brought on site and demolition. Owner does not guarantee information furnished to Contractor regarding nature, amount and class of materials to be excavated, removed, or demolished.

.3 Prior to commencement of work, make careful examination of previously executed work, existing conditions, levels, dimensions and clearances. Promptly advise Consultant of unsatisfactory preparatory work and substrate conditions; commencement of work implies acceptance of conditions.

1.4 **Division of Work**

.1 Work specified in the Specifications has been divided into technical Sections for the purpose of ready reference. Division of work among Contractors and suppliers is solely the Contractor's responsibility and Consultant assumes no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of work.

1.5 **Coordination and Cooperation**

.1 Coordinate all sections of Work. Work required by Contract Documents or reasonably necessary to complete Work but not included in any specific section of specifications is hereby included in this section.

.2 Products specified in certain sections of specifications, e.g. specialties, etc., may or may not require installation by supplier. Allocate installation of items not normally installed by supplier.

1.5 **Coordination and Cooperation (Cont'd)**

.3 The Contractor shall:

.1 Coordinate work of their respective trades and cooperate with other tradesmen to facilitate continuous and expeditious progress of the entire work.

.2 Provide each other with all necessary, instructions and information required for proper execution of the work.

.3 Give each other reasonable opportunity for installation of their work.

.4 Provide all necessary inserts, anchors or other items which must be built in by other trades.

.5 Pay cost of extra work caused by and make up time lost resulting from failure to provide necessary cooperation, or information on items to be fixed to or built in, in adequate time.

1.6 **Metric Projects**

.1 This project is based on The International System of Units (SI), Measurements are expressed in metric (SI) units and depending on progress made in various sectors of industry, are either hard or soft converted units.

.2 Units specified shall be taken to be the minimum acceptable unless otherwise noted.

.3 It is the Contractor's responsibility to check and verify with manufacturers and suppliers on the availability of materials and products in either metric or imperial sizes.

.4 Where a material or product cannot be obtained in the metric size specified, provide the next larger imperial size available.

.5 Where both metric and imperial sizes or dimensions are shown, the metric size or dimension shall govern.

1.7 **Definitions**

.1 Where used, word 'supply' shall mean furnishing to site, in location required or directed, complete with necessary parts.

.2 Where used, word 'install' shall mean set in place and secured or affixed to building structure as noted or directed.

.3 Where used, word 'provide' shall mean supply and install as each is described above.

.4 Authorities: those having jurisdiction under law over Work or parts thereof.

.5 Make Good: See Item 1.21.

1.7 **Definitions (Cont'd)**

.6 Wherever words 'approved', 'selected', 'satisfactory', 'directed', 'permitted', 'inspected', 'instructed', 'required', 'submit', 'ordered', 'reviewed', 'reported to', or similar words or phrases are used in Contract Documents, it shall be understood, unless context provides otherwise, that words 'by Consultant' or 'to Consultants' follow.

.7 Words 'by others' when used in Specifications or on Drawings shall not mean by someone other than Contractor. Only means by which something shown or specified shall be indicated as not being in Contract is by initials 'NIC' or words 'not in Contract', 'by Owner', or 'by Contractor'.

.8 Exposed: visible at completion of Work, in useable areas as well as interior of closets, cabinets, drawers, storage and service rooms, stairwells and exterior surfaces.

1.8 **Organization of Work**

.1 Drawings are intended to convey scope of Work and indicate general and approximate location, arrangement and size of fixtures, equipment, ducts, piping, conduit and outlets. Obtain more accurate information about location, arrangement and size from study and coordination of drawings, and shop drawings, including architectural, structural, mechanical and electrical and become familiar with conditions and spaces affecting these matters before proceeding with Work. Where job conditions require reasonable changes from indicated location and arrangements, make changes at no extra cost to Owner.

.2 Manufactured items, shop fabricated items and items fabricated on or off site shall be fabricated to fit dimensions of building and site, as measured on site rather than to fit building as shown on Contract drawings.

1.9 **Labour**

.1 Employ only competent personnel on the work. When practicable use local labour.

.2 Foreperson must be able to understand the English language well enough to fully comprehend and carry out instructions issued and to work in complete coordination with other trades.

.3 Rates of wages paid may be subject to increase or adjustment at any time during the construction period, and all increases shall be borne by the Contractor without additional cost to the Owner

1.10 **Protection**

.1 Protect existing roads, ditches, culverts, sidewalks and trees. Adopt normal safety precautions for protection of workers and the public, including barricades, guard lights, etc., and assume all claims and actions taken against the Owner in the event of accident or injury to people or property as a result of the work.

1.10 **Protection (Cont'd)**

.2 Ensure no damage is caused to existing structures, buildings, foundations, pavement, fences, curbs, grounds, plants, property, utilities, services and finishes during progress of Work. Repair and make good any damage caused, at no extra cost to Owner, to the complete satisfaction of the respective property owners and authorities having jurisdiction. Do not proceed with repairs or remedial work without written permission from the Consultant. Only trades specifically capable of performing the work will be allowed to make remedial or repair work.

.3 Protect completed or adjacent work from damage due to the work of each Section. Damaged work shall be made good wherever possible by those performing work originally, but at the expense of those causing damage.

.4 Protect glass and other finishes against heat, slag and weld spatter by erecting sturdy plywood or other heavy shield.

.5 If tape or stripable coatings are used to protect glass or finished metal surfaces, do not allow them to become baked on or to thermoset.

.6 Adequately protect finished flooring from damage. Protect floors when moving heavy loads or equipment.

.7 Keep floors free from oils, grease, or other materials likely to cause damage discolouration or affect bond of applied finishes.

.8 Attach and fasten fixtures and fittings in place in safe sturdy, secure manner so they cannot work loose, fall or shift out of position during occupancy of building, as result of vibration or other causes in normal use of building. Refer to "Sleeves, Support and Fasteners" listed hereunder.

.9 Fire Protection

.1 Take necessary precautions to eliminate fire hazards and to prevent damage to Work, building materials, equipment and other property both public and private having to do with Work. Inspect Work weekly for this purpose.

.2 All combustible materials must be removed by the Contractor.

.3 Store and locate products and equipment packed in cardboard cartons, wood crates and other combustible containers in orderly and accessible manner.

.4 Tarpaulins shall be fire resistant.

.5 Maintain fire protection for Work. Store paints and volatile substances in a separate and controlled location and inspect frequently. Inspect temporary wiring, drop cords and extension cables for defective insulation or connections frequently. Remove combustible wastes frequently. Prohibit smoking on the job site.

1.10 **Protection (Cont'd)**

.6 Where gas welding or cutting is to be done within 3m or above combustible material, or above space that may be occupied by persons, interpose shields of noncombustible material. Tanks supplying gases for welding or cutting shall be placed at no greater distance from the work than is necessary and shall be securely fastened in an upright position. Such tanks shall be free from exposure to the sun or high temperature.

.10 Maintain life safety systems in good operating condition throughout the work.

.11 Should the Work be closed down for any cause, the Contractor will assume full responsibility for protection against water, wind, fire, vandalism, theft or other such damages during such period.

.12 Prevent sprayed materials from contaminating air beyond application area, by providing temporary enclosures.

.13 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

1.11 **Regulatory Documents**

1 Nothing contained in the Drawings and Specifications shall be so construed as to be in conflict with any law, by-law or regulation of the municipal, provincial or other authorities having jurisdiction. Work shall be performed in conformity with all such laws, by-laws and regulations.

.2 Contract forms, codes, specifications, standards, manuals, and installation, application and maintenance instructions referred to in these specifications are of the latest published editions at the date of signing the Contract.

.3 Carry out work in accordance with requirements of the Ontario Building Code, latest issue, including all amendments and revisions.

.4 Promptly submit written notice to Consultant of observed variance of Documents Contract Documents from requirements of Building Code and authorities having jurisdiction. Assume responsibility for work known to be contrary to such requirements and performed without notifying Consultant.

1.12 **Security**

.1 Be responsible for security of all areas affected by work of this Contract until taken over by Owner. Take steps to prevent entry to the Work by unauthorized persons and guard against theft, fire and damage by any cause.

.2 At the end of the day's work, secure all temporary enclosures and lock all exterior doors.

.3 The Contractor is responsible for the prevention of vandalism and theft of all tools, equipment and materials.

1.12	**Security (Cont'd)**	.4	A regular full time watchman is generally not required on site, but if in the opinion of the Consultant the work is not adequately protected by the Contractor, the Owner may demand a watchman be employed by the Contractor at no extra cost to the Contract.
1.13	**Safety**	.1	Be governed by pertinent safety requirements of Federal or Provincial Governments and of municipal bodies having authority, particularly the Ontario Construction Safety Act, The Occupational Health and Safety Act for Ontario, and regulations of Ontario Ministry of Labour, and work in conjunction with proper safety associations operating under the authority of Ontario Workers' Compensation Act. Protect Owner, Owner's employees, the public and those employed on the Work from bodily injury and to protect adjacent public and private property and Owner's property from damage. Furnish and maintain protection, such as warning signs, tarpaulins, guard rails, barriers, guard lights, night lights, railings around shafts, pits and stairwells, etc. as required. Remove temporary protective measures when no longer required.
		.2	In accordance with the General Conditions, temporary work requiring engineering proficiency for the design, erection, operation maintenance and removal shall be designed and bear stamp of the registered professional Engineer or Consultant. Detail drawings will be submitted to the Consultant for review prior to commencing any work.
		.3	Before temporary structure is used, person responsible for design, or their representative, shall inspect structure and certify it has been constructed according to their design.
1.14	**Use & Access of Site and Premises**	.1	Accept full responsibility for the site from the time of Contract award until Substantial Performance of the Work.
		.2	Check means of access and egress, rights and interests of the existing facility which may be interfered with. Do not block lanes, roadways, entrances or exits.
		.3	Maintain existing fire routes in a manner acceptable to the local authorities.
1.15	**Partial Occupancy Or Use**	.1	Owner shall have the right to enter and occupy the building in whole or in part for the purpose of placing fittings and equipment or for other use before completion of the Contract, if, in the opinion of the Consultant, such entry and occupancy does not prevent or interfere with the Contractor in performance of the Contract.
		.2	Such entry shall, in no way, be considered as an acceptance of the works.
1.16	**Services and Utility Systems**	.1	Information as to the location of existing services, if shown on the drawings does not relieve the Contractor of his responsibility to determine the exact number and location of existing services.

1.16 **Services and Utility Systems (Cont'd)**

.2 Operate and maintain all utility systems affected by work of this Contract, until the building or specific portions thereof have been accepted by the Owner.

.3 Report existing unknown services encounter to Consultant for instructions. Be responsible for the protection of all active services encountered and for repair of such service if damaged.

.4 Wherever inactive services are encountered, cap off and remove unwanted portion, with approval and in a manner acceptable with authorities and/or public utility concerned.

1.17 **Sleeves, Supports & Fasteners**

.1 The use of explosive power tools must be approved in writing by the Consultant. The use of explosive power tools will not be permitted under any circumstances unless equipped with a device which positively prevents free flight of the stud.

.2 Whenever expansion type fastening devices of any kind, which rely upon friction forces created by expansion of device in concrete or masonry, are to be used, submit following data to Consultant for review:

.1 load carrying capacity of device,
.2 nature and magnitude of force to be applied to device with supporting data;
.3 materials to which device is fastened;
.4 whether device is self drilling or, if not, size of bit to be used to drill hole to receive device;
.5 installation procedure to ensure that fastener is secure and reliable and that reinforcing bars are not damaged.

.3 If requested by Consultant conduct on site tests of installed fasteners using approved, independent testing laboratory with properly engineered and calibrated force measuring meters.

.4 Supply fastenings, anchors, and accessories required for fabrication and erection of Work. Where self drilling anchors are used, drive with impact hammer drill supported from floor in jig to hold drill steady. Do not damage reinforcing bars. If they are encountered relocate fastener. Anchors for exterior work and anchors occurring on or in an exterior wall or concrete shall be non-corrosive, hot dip galvanized steel or cadmium plated.

.5 Metal fastening shall be of same material as metal component they are anchoring or of metal which will not set up electrolysis which would cause corrosion of fastening or metal component under moist conditions.

.6 Exposed metal fastenings and accessories shall be of same texture, colour and finish as base metal on which they occur. Keep to minimum. Space evenly. Lay out neatly.

1.17 **Sleeves, Supports & Fasteners (Cont'd)**

.7 Fastenings shall be of such type and size and installed to provide positive permanent anchorage of unit to be secured. Wood plugs not acceptable. Install anchors at required spacing to provide required load bearing or shear capacity.

.8 Fastenings which cause spalling or cracking of material to which anchorage is being made are not permitted.

.9 Supply adequate instructions and templates and if necessary, supervise installation where fastenings or accessories are required to be built into work of other trades.

1.18 **Concealment**

.1 If doubt arises as to means of concealment, or intent of Contract Documents, request clarification from Consultant before proceeding with portion of work in question.

1.19 **Cutting and Patching**

.1 Do all cutting, patching and making good to leave in a finished condition and to make the several parts of the work come together properly. Coordinate work to keep cutting and patching to a minimum.

.2 Regardless of which Section of work is responsible for any portion of cutting and patching, in each case tradesmen qualified in work being cut and patched shall be employed to ensure it is correctly done.

.3 Omissions or untimely delivery of any portion of the work that results in costs shall be borne by the Contractor.

.4 Do not endanger any work by cutting, digging or otherwise altering, and do not cut nor alter any load bearing element without written authorization by Consultant. Provide bracing, shoring and temporary supports as required to keep construction safely supported at all times.

.5 The Contractors requiring cuts, holes or sleeves for their work shall locate them.

.6 Make cuts with clean, true, smooth edges. Fit unit to tolerance established by test standard practice for applicable work. Make patches invisible in final assembly.

.7 Cutting shall be done in a manner to keep patching to minimum. Obtain Consultant's approval of method to be used to conceal new mechanical and electrical services before beginning cutting. Chasing of concrete surfaces is not required.

.8 Complete and tightly fit all construction to pipes, ducts and conduits which pass through construction to completely prevent the passage of air.

.9 Patching and making good shall be done by trade specialists in material to be treated, and shall be made undetectable in finished work when viewed from distance of 1.5m under normal lighting.

.10 Cutting or coring of any structural concrete is to be reviewed and approved by the Consultant.

1.20 **Making Good**

.1 All damages to the work site and existing buildings, and areas adjacent to the work site due to the execution of this Contract, shall be 'Made Good'.

.2 'Make Good' requires patching or replacing damage in a manner equal to that specified for new construction.

.3 Where noted M.G.A.T. shall mean "make good all trades".

1.21 **Scaffolding**

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

1.22 **Ownership of Materials**

.1 All materials and equipment delivered to the site to form part of the Work shall be considered the property of the Owner and shall not be removed without the written consent of the Consultant. However, Contractor shall have the right to and shall remove surplus materials and equipment after Work has been completed. If so directed by the Consultant, remove such surplus materials and equipment at any time prior to the completion of the Work.

1.23 **Work Performed After Hours**

.1 Where it is necessary for work to be performed outside facility regular business hours and where such work requires the Contractor's workers to be admitted to the premises, the Contractor is to reimburse the Owner for the cost of maintaining personnel on the premises during the period of work, when in the opinion of the Owner such personnel are necessary and when such personnel would not be present as part of their normal duties.

1.24 **Location of Apparatus & Fixtures**

.1 Location of fixtures, apparatus, equipment fittings, outlets, conduits, pipes and ducts shown or specified, but not dimensioned, shall be considered approximate. Consult with Consultant to establish exact location. Relocation caused by Contractor's failure to consult with Consultant shall be done, by Contractor, as part of work. Where job conditions required reasonable changes in indicated locations and arrangements, make changes at no additional cost.

1.25 **Consultants' Construction Review**

.1 The Consultant's general review during construction and inspection and testing by independent inspection and testing agencies reporting to the Consultant are both undertaken to inform the Owner/Client of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

1.26 **Permits, Licences Fees**

.1 The Consultant will apply for the Building Permit on behalf of the Owner. The Owner will pay for and the Contractor shall pick up the Building Permit.

.2 Where permits, licences and inspection fees are required by authorities having jurisdiction for specific trade functions, they shall be obtained by particular substade responsible for the work.

.3 The Contractor shall apply and pay for all other permits required.

1.27 **Lines and Levels**

.1 Verify elevations, lines, levels and dimensions indicated and report errors, conflicts, or inconsistencies to the Consultant before commencing work or as soon as discovered.

.2 Accurately lay out work and establish lines and levels in accord with requirements of Contract Documents.

.3 Provide Contractors with, and be responsible for levels and dimensions which Contractors require to relate their work to work of Contractor, and Contractors. Notify Contractors that such lines, levels and dimensions must be obtained from Contractor.

1.28 **Dimensions**

.1 Check and verify dimensions wherever referring to work. Dimensions, when pertaining to work of another Section, shall be verified with Section concerned. Details and measurements of work which is to fit or conform with work installed shall be taken at site.

.2 Do not scale Drawings. If there is ambiguity, lack of information or inconsistency, immediately consult Consultant for directions. The Contractor shall be responsible for extra costs that result from the disregarding of this notice.

.3 Walls, partitions and screens shall be considered as extending from floor to underside of structural deck unless specifically indicated otherwise on Drawings.

.4 Give particular attention to finished dimensions and elevations of Work. Make finished work fit indicated spaces accurately. Make finished work flush, plumb, true to lines and levels and accurate in all respects.

1.29 **Extended Guarantee**

.1 Guarantee - Warranty

.2 Submit extended guarantees as part of "Operating and Maintenance Manuals" in accord with requirements of Section 01700.

.3 Arrange extended guarantees in systematic order matching Specification format, include a table of contents listing warranties in same order.

.4 Each guarantees must show:

.1 Name and address of project
.2 Name of Owner
.3 Section Number and Title

.5 Extended guarantees must be presented under Contractor's letterhead, seal and signature and must bear similar wording to that specified in Contract Documents.

.6 Refer to Division 2 to 16 inclusive for extended guarantees.

1.30 **Alteration & Addition to Existing Building**

.1 Perform work with least possible interference or disturbance to occupants, and normal use of existing building.

.2 Only corridors and stairways designated by the Consultant for Contractors use may be used for moving men and material within the building. Protect walls of stairways and corridors to approval of Consultant before use. Accept liability for damage, overloading of existing structure.

.3 Interruption of existing services may only occur at time designated by the building Owner. In no case interrupt essential services during hours when the building is occupied.

.4 Maintain at all times existing exits for use by building occupants.

.5 Provide temporary dust and sound screens, using metal studs and drywall and insulated with 6" batt insulation where construction or alteration work is adjacent to areas used by occupants.

End of Section

1. GENERAL

1.1 Allowances included herein are for items of Work which could not be fully quantified prior to Bidding.

1.2 Expend each allowance as directed by the Consultant in writing. Work covered by allowances shall be performed for such amounts and by such persons as directed by Consultant.

1.3 Funds will be expended by means of Cash Allowance allocations and contingency allowance allocations.

1.4 Progress payments for Work and Products authorized under allowances will be made in accordance with the payment terms set out in the Conditions of the Contract.

1.5 A schedule shall be prepared jointly by the Consultant and Contractor to show when items called for under allowances must be authorized by the Consultant for ordering purposes to that the progress of the Work will not be delayed.

1.6 Where a Cash Allowance is for work performed under a Subcontract, the Contractor shall bid the work involved and submit the Bids received, with the Contractor's recommendations, for approval.

2. CASH ALLOWANCES

2.1 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation where indicated, and other authorized expenses incurred in performing the Work. Cash allowances shall not be included by a subcontractor in the amount for their subcontract work.

2.2 Supply only allowances shall include:

.1 Net cost of Products.
.2 Delivery to Site.
.3 Applicable taxes and duties, excluding HST.

2.3 Supply and install allowances shall include:

.1 Net cost of Products.
.2 Delivery to Site.
.3 Unloading, storing, handling or products on site.
.4 Installation, finishing and commissioning of products.
.5 Applicable taxes and duties, excluding HST.

2.4 Inspection and testing allowances shall include:

.1 Net cost of inspection and testing services.
.2 Applicable taxes and duties, excluding HST.

2.5 Other costs related to work covered by cash allowances are not covered by the allowance, but shall be included in the Contract Price.

2.6 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.

2.7 Progress payments on accounts of work authorized under cash allowances shall be included in the monthly certificate for payment.

2.8 Submit, before application for final payment, copies of all invoices and statements from suppliers and subcontractors for work which has been paid from cash allowances.

2.9 Include in the Bid Price a total cash allowance as listed in the MonAvenir Invitation to Tender documents.

2.10 Include in the Bid Price a total cash allowance of **$120,000.00** to cover the following items:

1. Testing and Inspections (Inc. But Not Limited To: Soil, Concrete, Roofing, Mortar, Structural Steel)
2. PA, Data and Voice system extension.
3. Exterior and Interior Signage
4. Air and Water Balancing
5. Security System Installation and Wiring
6. CCTV System Equipment
7. Telephone System
8. Keying
9. Window Coverings
10. Fire Safety Plan
11. Designated Hazardous Substance Removal
12. Work Related To Unforeseen Municipal Requirements

3.0 CONTINGENCY ALLOWANCE

3.1 Do not include in the contract for a contingency allowance to be used upon Owner's written instruction via Change Order.

3.2 Do not include overhead and profit in the Contract Price on account of the contingency allowance

3.3 Expenditures under the contingency allowance will be authorized in accordance with the Conditions of the Contract.

3.4 Funds will be drawn from the Contingency Allowance only by Change Order.

3.5 At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

End of Section

PART 1 GENERAL

1.1 **Abbreviations** .1 When the following abbreviations are used in the Contract Documents, they shall have the meanings shown.

ABBREVIATION	MEANING
AA	THE ALUMINIUM ASSOCIATION
AAMA	ARCHITECTURAL ALUMINIUM MANUFACTURERS' ASSOCIATION
AASHO	AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
ACI	AMERICAN CONCRETE INSTITUTE
AGA	AMERICAN GAS ASSOCIATION
AIMA	ACOUSTICAL & INSULATING MATERIALS ASSOCIATION
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISI	AMERICAN IRON AND STEEL INSTITUTE
AMCA	AIR MOVING AND CONDITIONING ASSOCIATION INC.
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWI	ARCHITECTURAL WOODWORK INSTITUTE (USA)
AWMAC	ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA
AWPA	AMERICAN WOOD PRESERVERS ASSOCIATION
AWS	AMERICAN WELDING SOCIETY
BIA	BRICK INSTITUTE OF AMERICA
CCA	CANADIAN CONSTRUCTION ASSOCIATION
CCDC	CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE
CCRC	CANADIAN CODE FOR RESIDENTIAL CONSTRUCTION
CEC	CANADIAN ELECTRICAL CODE
CEMA	CANADIAN ELECTRICAL MANUFACTURERS' ASSOCIATION
CFUA	CANADIAN FIRE UNDERWRITERS' ASSOCIATION
CGA	CANADIAN GAS ASSOCIATION
CGSB	CANADIAN GENERAL STANDARDS BOARD
CIQS	CANADIAN INSTITUTE OF QUANTITY SURVEYORS
CISC	CANADIAN INSTITUTE OF STEEL CONSTRUCTION
CITC	CANADIAN INSTITUTE OF TIMBER CONSTRUCTION
CLA	CANADIAN LUMBERMEN'S ASSOCIATION
CMHC	CANADA MORTGAGE & HOUSING CORPORATION
COFI	COUNCIL OF FOREST INDUSTRIES OF BRITISH COLUMBIA
CPCI	CANADIAN PRESTRESSED CONCRETE INSTITUTE
CRCA	CANADIAN ROOFING CONTRACTORS ASSOCIATION
CSA	CANADIAN STANDARDS ASSOCIATION
CSC	CONSTRUCTION SPECIFICATIONS CANADA
CSI	CONSTRUCTION SPECIFICATIONS INSTITUTE (USA)
CSSBI	CANADIAN SHEET STEEL BUILDING INSTITUTE
CSPI	CORRUGATED STEEL PIPE INSTITUTE
CUA	CANADIAN UNDERWRITERS' ASSOCIATION
CWB	CANADIAN WELDING BUREAU
CWC	CANADIAN WOOD COUNCIL
DND	DEPARTMENT OF NATIONAL DEFENCE, CANADA
FM	FACTORY MUTUAL ENGINEERING CORPORATION
FS	FEDERAL SPECIFICATION (USA)
IES	ILLUMINATING ENGINEERING SOCIETY
IOS	INTERNATIONAL ORGANIZATION FOR STANDARDS
LTIC	LAMINATED TIMBER INSTITUTE OF CANADA
MIA	MARBLE INSTITUTE OF AMERICA
NAAMM	NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (USA)
NBFU	NATIONAL BOARD OF FIRE UNDERWRITERS
NBC	NATIONAL BUILDING CODE OF CANADA

1.1 **Abbreviations (Cont'd)**

ABBREVIATION	MEANING
NBS	NATIONAL BUREAU OF STANDARDS USDC
NEMA	NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NHLA	NATIONAL HARDWOOD LUMBER ASSOCIATION (USA)
NLGA	NATIONAL LUMBER GRADES AUTHORITY
NRCC	NATIONAL RESEARCH COUNCIL OF CANADA
PCA	PORTLAND CEMENT ASSOCIATION
PCI	PRESTRESSED CONCRETE INSTITUTE
RAIC	ROYAL ARCHITECTURAL INSTITUTE OF CANADA
SDI	STEEL DECK INSTITUTE
SSPC	STEEL STRUCTURES PAINTING COUNCIL
TTMAC	TERRAZZO, TILE & MARBLE ASSOCIATION OF CANADA
ULC	UNDERWRITERS' LABORATORIES OF CANADA
ULI	UNDERWRITERS' LABORATORIES, INC. (USA)
USAS	UNITED STATES OF AMERICA STANDARDS INSTITUTE
USDC	UNITED STATES DEPARTMENT OF COMMERCE

End of Section

PART 1 - GENERAL

1.1 **Pre-Construction Meeting**

.1 Immediately prior to construction, upon notification attend at location of Owner's choice, preconstruction meeting, along with authoritative representatives of certain key Contractors as specifically indicated in the conference notice.

.2 Purpose of meeting is as follows:

.1 Review project communications procedures.

.2 Review contract administration requirements including submittals, payment and change order procedures.

.3 Identify critical points on Construction Schedule for positive action.

.4 Identify product availability problems and substitution requests.

.5 Establish site arrangements and temporary facilities.

.6 Revise points which, in Owner's, Consultant's and Contractor's opinion, require clarification.

1.2 **Site Meetings**

.1 The Contractor will do the following:

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

.2 Organize site meetings. Ensure persons, whose presence is required, are present and relative information is available to allow meetings to be conducted efficiently.

.3 Post and forward copies of progress schedules for advice of Contractors, Owner and Consultant.

.4 Review approved progress schedule for rapid and efficient completion of Work according to Contract requirements, with Contractors, and suppliers of products.

.5 Take minutes of meetings and distribute copies to Owners and Consultant. The Contractor will then be responsible for further distribution to the Contractors, Inspectors and other interested parties within 2 working days after receipt of meeting minutes.

.6 Schedule additional meetings, to expedite progress, should work require it.

.7 Keep Owner and Consultant informed of progress, of delays and potential delays during all stages of Work. Do everything possible to

meet progress schedule.

1.3 **Supervision**

.1 Employ an experienced and qualified superintendent who shall devote his time exclusively to the Work of this Contract and who shall be in complete charge of the Work from commencement to completion. A working foreperson will not be acceptable. The superintendent shall not be changed after commencement of the Work without the Consultant's approval.

.2 Supervise, direct, manage and control the work of all forces, including Contractors and suppliers. Carry out daily inspections to ensure compliance with the Contract Documents and maintenance of quality standards. Ensure inspection staff includes personnel competent in supervising mechanical and electrical trades.

1.4 **Construction Schedule**

.1 Display a copy of the construction schedule in the site office from start of construction to completion. Superimpose actual progress of work on schedule at least once each week.

1.5 **Record Drawings**

.1 Maintain on site at all times a complete and separate set of Contact Documents for use as record documents. Make these documents available for review at all times.

.2 Note clearly, neatly, accurately and promptly, as the work progresses, all architectural, structural mechanical and electrical changes, revisions and additions to the Work and deviations from the Contract Documents.

.3 Accurate location, depth, position, size and type of concealed and underground services, both inside and outside shall be included as part of these record drawings.

.4 Refer to Section 01700 for requirements on submission of record drawings.

1.6 **Documents on Site**

.1 Contractor's field office shall at all times contain:

.1 Complete set of Contract Drawings

.2 Specifications

.3 All Addenda

.4 Site Instructions

.5 Reviewed Shop Drawings and Samples

.6 Change Orders and Contemplated Change Orders

.7 Record of Revisions

.8 Site Instructions and Sketches

.9 Colour schedule

1.6 **Documents on Site (Cont'd)**

.10 Hardware list

.11 Field Test Reports

.12 Approved Work Schedule

.13 Manufacturers' installation and application instructions

.14 Progress reports and meeting minutes

.15 Approved building permit drawings

.16 Copy of current Ontario Building Code

.17 CSA Standard, CGSB Specifications, ASTM Documents and other standards referred to in the Specifications.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Unless specified otherwise, make all submissions to the Consultant at their office.

.2 Make all submissions required by the Contract Documents with reasonable promptness and in orderly sequence to cause no delay in the Work.

1.2 **Related Sections**

.1 Submission of maintenance and record documents: Section 01700.

.2 Submission of maintenance materials: Section 01700.

1.3 **Construction Schedule**

.1 Within one week following the award of the Contract, submit a detailed, trade by trade progress schedule for the work in a bar chart form acceptable to the Consultant.

.2 Unless otherwise agreed provide schedule updates every month with request for Payment, for duration of Contract.

1.4 **Schedule of Values**

.1 Submit schedule of values in accordance with requirements of the General Conditions.

.2 Use specifications table of contents as basis for degree of breakdown required.

.3 Provide additional cost breakdown information if requested by Consultant to assist in certification of the Work.

1.5 **Shop Drawings**

.1 Submit shop drawings required by Contract Documents, in accordance with requirements of the General Conditions.

.2 Prepare shop drawings in metric measurements only. Shop drawings containing imperial measurements will be rejected.

.3 Term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, design calculations and other data which shall be provided by Contractor to illustrate details of portion of Work. Term "design team" means Consultant, and includes structural, mechanical, electrical, etc..

.4 Prior to submission to Consultant, review shop drawings. By this review Contractor represents that they have determined and verified field measurements, field construction criteria, materials, catalogue numbers, design calculations and similar data or will do so and that they have checked and coordinated each shop drawing with requirements of Work and of Contract Documents. Indicate review of each shop drawing by stamp, date and signature of responsible person of Contractor.

.5 Confirm and correlate dimensions at job site, for information that pertains solely to fabrication processes, quantities or to techniques of construction and installation and for coordination of sections of Work.

1.5 **Shop Drawings (Cont'd)**

.6 Shop drawings shall not contain substituted materials unless such substitutions have been requested in advance and approved by Consultant.

.7 Unless otherwise directed by the Consultant, submit all shop drawing's Electronically in PDF format.

.8 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before Consultant's final review.

.9 No work, requiring a shop drawing submission, shall be commenced until the submission has received Consultant's final review. Only shop drawings bearing Consultant's review stamp are to be sent and used on the job site.

.10 Signed shop drawings shall be returned to and retained by Contractor who is then responsible for distribution of copies of corrected shop drawing to appropriate Contractors for appropriate action and to municipal building department for their records of those subjects required by authorities.

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

1.6 **Samples**

.1 Submit samples required by Contract Documents and as directed by the Consultant.

.2 Unless indicated otherwise submit samples in Triplicate.

.3 Submit samples with identifying labels bearing material or component description, manufacturer's name and brand name, Contractor's name, project name, location in which material or component is to be used, and date.

.4 Prepay any shipping charges involved for delivering samples to destination point and returning to point of origin if required.

.5 Provide samples of special products, assemblies, or components when so specified.

.6 No work requiring a sample submission shall commence until submission has received Consultant's final review.

End of Section

PART 1 - GENERAL

1.1 **General Requirement**

.1 Provide all temporary facilities and controls required for proper execution of the Work.

.2 Location of temporary facilities shall be subject to Consultant's approval.

1.2 **Temporary Electricity & Lighting**

.1 Coordinate use of existing power with the School maintenance staff.

.2 Maintain temporary electrical service and systems in accordance with Construction Safety Association's "Temporary Wiring Standards on Construction Sites", the Ontario Electrical Code and other authorities having jurisdiction.

.3 Extension cords, lights, etc., required by various Contractors will be supplied and maintained by the party or parties requiring same.

1.3 **Temporary Ventilation**

.1 Provide minimum 1 air change per hour for enclosed areas receiving architectural finishes.

.2 Prior to commencement of work where hazardous or volatile adhesives, coatings or substances are used, install adequate mechanical ventilation.

.3 Do not allow excessive build-up of moisture inside building.

1.4 **Temporary Water**

.1 Potable water supply for use by all sections shall be coordinated with School maintenance staff.

.2 Hose extensions to be provided by Contractors requiring them.

1.5 **Temporary Sanitary Facilities**

.1 Provide enclosed, weatherproof temporary toilet/sanitary facilities in accordance with requirements of authorities having jurisdiction.

.2 Service temporary toilet/sanitary facilities as required by authorities but not less than weekly.

.3 After sanitary sewers and water become available, install used flush type toilets, at least one per floor.

.4 Keep toilet/sanitary facilities clean and sanitary and protect from freezing.

.5 Use of any permanent plumbing fixtures and facilities within the existing school is forbidden.

1.6 **Temporary Use of Permanent Service & Equipment**

.1 Electrical power and lighting systems can be used for construction provided damages are made good and all lamps that have been used for more than two months are replaced with new lamps.

.2 Do not use permanent service or equipment without Consultants written approval. Comply with Consultants instructions regarding use of permanent services and equipment.

.3 Inspect permanent services and equipment being used as temporary of facilities on a regular basis during use.

.4 Provide competent persons to operate and maintain permanent systems for duration of temporary use period.

.5 Perform required repairs and maintenance immediately after each inspection. Upon termination of temporary adjusted, filters replaced, balanced, cleaned and lubricated.

.6 Permanent services and equipment shall be turned over to Owner in new and perfect operating condition.

1.7 **Barriers and Hoarding**

.1 Provide fences, gates and locks, hoardings, guard rails, interior and exterior barriers as required and indicated for protection of public and of public and private property and as required by law and by authorities.

.2 Alter, remove and relocate or replace hoardings, barriers and entrances therein as required by authorities having jurisdiction and by the Work. Hazards requiring such protection shall be eliminated as soon as possible and protection devices removed.

.3 Provide temporary interior dust barriers where shown on drawings consisting of polyethylene sheet sealed at all edges to floor, walls and underside of structure to prevent the passage of dust into the existing building.

1.8 **Signs**

.1 Do not erect any signs unless approved by the Consultant.

.2 Erect signs relating to safety on the work and mandatory regulation notices.

1.9 **Removal of Temporary Facilities**

.1 Remove temporary facilities from site when directed by Consultant.

1.10 **Gasoline Driven Equipment**

.1 Gasoline driven equipment will not be permitted for work within the building and in areas where exhaust gases could enter occupied areas of the building.

End of Section

PART 1 - GENERAL

1.1 **Soils Reports** .1 The information contained in the referenced soil investigation report is supplied by the Owner and does not form part of the Contract Documents.

.2 The following soils investigation report records properties of the soils and recommendations for the design of foundations, prepared primarily for the use of the Consultant.

Report 1 - Geotechnical Report

PROPOSED ADDITION TO ÉCOLE ÉLÉMENTAIRE CATHOLIQUE
(ÉÉC) SAINT MICHEL
29 MEADOWVALE ROAD
TORONTO, ONTARIO

Report No. G6465-A
Dated: **August 22, 2022**
Prepared by: **Forward Engineering & Associates Inc**.

Report 2 - Soil Characterization Report No.1

PROPOSED ADDITION TO ÉCOLE ÉLÉMENTAIRE CATHOLIQUE
(ÉÉC) SAINT MICHEL
29 MEADOWVALE ROAD
TORONTO, ONTARIO

Report No. 6465-A
Dated: **February 08, 2024**
Prepared by: **Forward Engineering & Associates Inc**.

.3 Because the sub-surface conditions indicated by the borings are a sampling in relation to the entire construction area, the Owner, or the firm reporting the sub-surface conditions based on the borings, do not warrant the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site.

.4 Bidders using soil information described in this report shall accept full responsibility for its use in preparing bids and obtaining additional soil information which may be required for any bid.

.5 The report, by it's nature, cannot reveal all conditions that exist or can occur on the site. Should sub-surface conditions be found to vary substantially from the Soils Investigation Reports, changes in the design and construction of foundations will be made, with resulting credits or

expenditures to the Owner.

End of Section

FORWARD ENGINEERING

& ASSOCIATES INC.

Geotechnical, Environmental, Inspection & Material Testing Services

244 Brockport Drive, Unit 15, Toronto, Ontario, M9W 6X9, Tel: (416)798-3500, Fax:(416)798-8481

REPORT
GEOTECHNICAL INVESTIGATION

PROPOSED ADDITION TO ÉCOLE ÉLÉMENTAIRE CATHOLIQUE (ÉÉC) SAINT MICHEL
29 MEADOWVALE ROAD
TORONTO, ONTARIO

PREPARED FOR:
CONSEIL CATHOLIQUE MON AVENIR
110 Drewry Avenue
Toronto, ON
M2M 1C8

August 22, 2022
Ref. No. G6465-A

Distribution: 1 PDF Copy– CONSEIL CATHOLIQUE MON AVENIR
1 PDF Copy–FORWARD ENGINEERING & ASSOCIATES INC.

List of Contents

LIST OF ENCLOSURES:

BOREHOLE & TEST PIT LOCATION PLAN - DRAWING NO. 1

PERMENANT PERIMETER DRAINAGE – DRAWING NO. 2

LOG OF BOREHOLE SHEETS (BH-1 to BH-4) - APPENDIX A

TEST PIT OBSERVATION SHEET - APPENDIX B

INTRODUCTION

This report presents the results of the geotechnical investigation carried out by Forward Engineering & Associates Inc. for the proposed addition to École Élémentaire Catholique (ÉÉC) Saint Michel, located at 29 Meadowvale Road, in the City of Toronto, Ontario.

The locations of the proposed addition in relation to the existing building structure and site boundaries are shown on Drawing No. 1. The approximate locations of the boreholes and test pit conducted during this investigation are also presented on Drawing No. 1.

This investigation was authorized by Mr. Stéphane Gautier, Project Officer for the Conseil Catholique Mon Avenir.

PURPOSE AND SCOPE

The objectives (purpose) of this investigation were to determine the following:

- The extent, depth and properties of the predominant fill/soil strata as they affect the design and construction of the proposed addition.
- The dimensions and configurations of the existing foundation footings at select locations
- The short-term groundwater levels, if encountered.
- The appropriate geotechnical design criteria for building foundations, excavations, backfill, slab construction, utilities and pavement.

To achieve the above noted objectives, the field program of this investigation consisted of:

- Four [4] boreholes drilled to a depth ranging from 2.87 to 6.86 m below the **E**xisting **G**round **S**urface **L**evel (**EGSL**), and

- One [1] test pit, excavated to a maximum depth of about 1.30 m below the EGSL.

On completion of the field and laboratory work, an engineering analysis was carried out and this summary report was prepared.

PROPOSED DEVELOPMENT

We understand that the proposed design consists of a two-storey addition to the existing Saint Michel school building, to be located on the northeast part of the existing school building. The addition will be slab-on-grade with no basement.

The remainder of the intended work will consist of a new asphalt paving area.

FIELD AND LABORATORY TESTING

Field Works:

The field work for the borehole investigation consisted of four [4] boreholes (BH-1 to BH-4) drilled on August 02, 2022 under the supervision of a member of our staff.

The drilled boreholes were located at the approximate locations shown on Drawing No. 1 and extended to a depth ranging from 2.87 to 6.86 m below the EGSL.

Borehole BH-1 and BH-2 were located on pavement in the area of the proposed building addition and boreholes BH-3 and BH-4 were located on the flatter upper portion of an existing slope where future pavement is proposed. BH-3 was relocated in the field from originally intended/planned location due to existing landscape features, i.e., slope.

Soils were sampled in the boreholes following the Standard Penetration Test (SPT) method using a Dynamic Ram Sounder and Beaver combination. The samples were logged in the field and appropriately stored in plastic bags and re-examined in more detail in the laboratory. The samples will be stored for a period of three months and then discarded, unless we are instructed differently.

Groundwater observations were made in the open boreholes, during and upon completion of the drilling operation. The results are recorded on the Log of Borehole sheets.

Elevations referred to in this report are metric and geodetic. The ground level elevations at the borehole locations were interpolated from the Surveyor's Real Property Report conducted by J.H. Gelbloom Surveying Ltd., dated April 30, 2019, and provided to us by the client.

Test Pit Investigation

The field work for the test pit investigation consisted of one [1] test pit (TP-1) carried on August 17, 2022. The test pit was located at the approximate location shown on Drawing No. 1 and extended to a depth of about 1.30 m below the EGSL.

The test pit findings were documented, and results are summarized in the Sub Surface conditions section of this report and recorded in the Test Pit Observation sheet attached to Appendix B of this report.

Laboratory Testing:

Laboratory testing consisted of determination of the in-situ moisture content of the retrieved and representative soil samples.

SITE CONDITIONS

Surface Conditions

ÉÉC Saint Michel is located at 29 Meadowvale Road, in the City of Toronto, Ontario. Currently the school is operational.

The subject site (the area of the proposed addition), where the geotechnical investigation predominantly took place, is located on the east side of the existing school building.

The subject site conditions as observed during our site visit on August 02, 2022 are presented in the following table:

Table 1-Observed Site Conditions

East Boundaries:	Public park (Wanita Park).
North Boundaries:	Residential dwellings.
West Boundaries:	ÉÉC Saint Michel school building followed by residential dwellings.
South Boundaries:	Access road and parking lot to school followed by public park (Wanita Park).
Surface Coverage:	The surface coverage of the area of the subject site is generally asphalt pavement and landscaping.

Ground Level:	The area of the proposed building addition is relatively flat; however, the area of proposed asphalt pavement is located on a slope that grades down in the south-east direction.
Existing Structures:	One and two storey brick school.
Basement:	None in the proposed addition area.
Ditches:	None.
Berms:	None.
Stockpiles:	None.
Proposed/Intended Land Use:	Institutional (school building addition).

Subsurface Conditions

Borehole Investigation Findings:

The subsurface conditions encountered at the borehole locations are shown on the Log of Borehole sheets, presented in Appendix A, and can be summarized as follows:

Pavement	Asphalt layer with a thickness of about 125 mm, and granular fill base (crushed stones) with thicknesses of about 560 and 510 mm, was encountered at the surface of boreholes BH-1 and BH-2.
Topsoil/Organic Soil	A layer of topsoil/organic soil was encountered at the surface of boreholes BH-3 and BH-4 with a thickness of about 25 mm.
Fill/Disturbed Soil	A layer of fill/disturbed soil was encountered below the pavement and topsoil in all the boreholes and extended to depths ranging from about 1.60 to 2.80 m below the EGSL. This soil layer consisted of brown and moist to wet sandy and clayey silt with traces of rootlets and organics. The fill in boreholes BH-3 and BH-4, which are located on the upper portion of the existing slope, occasionally encountered gravel, asphalt and wood debris.

Silt Till **/Clayey Silt Till**	Silt Till/Clayey Silt Till stratum that was encountered below the fill/disturbed soil layer in boreholes BH-1 and BH-2 and extended to the maximum explored depth of this boreholes/investigation. This brown and grey till, which contained silt partings and sandy silt layer, was in very stiff to hard consistency and in very moist to wet state. In borehole BH-1, the lower zone of this stratum was observed in firm consistency.
Sandy Silt	Compact to dense, brown and very moist to wet Sandy Silt stratum was encountered below the fill/disturbed soil layer in boreholes BH-3 and BH-4. This stratum, which contained traces of gravel, extended to the maximum explored depth of this investigation.
Groundwater	Groundwater observations in the boreholes are outlined in the following Table:

Table 2-Groundwater and Cave-in Observations Upon Completion:

Borehole No.	Borehole Depth (m)	Cave-in Depth Below EGSL (m)	Groundwater Depth Below EGSL (m)
BH-1	6.86	3.8	1.7
BH-2	2.87	Open	Wet at bottom
BH-3	3.81	2.4	Dry
BH-4	3.05	Open	Dry

It should be noted, however, that the groundwater levels are subject to seasonal fluctuations. Consequently, definitive information on the long-term groundwater levels could not be obtained at the present time.

Test Pit Investigation Observations/Findings:

Findings of the test pit investigation are shown on the Test Pit Observation sheet, presented in Appendix B and can be summarized in the following table:

Table 3 – Test Pit Observation and Existing Footing Dimensions Measurements:

Test Pit No./Location	Depth from Existing Ground Surface to Top of Footing (mm)	Footing Thickness (mm)	Horizontal Footing Projection (mm)	Founding Soil Material	Test Pit Ground Surface Elevation (m)
TP-1	±990	±265	±115	Silt Till	98.02

- *The foundation system consisted of formed concrete footings and formed concrete foundation walls.*

- *Test pit remained open and dry during and upon completion of excavation.*

GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

Foundations

The proposed building addition will consist of a two-storey structure, with no basement. The Finished Floor Elevation (FFE) for the new addition is anticipated be the same as that of the existing building at Elevation 98.05 m.

The design loads are not known at this stage.

Conventional Strip/Spread Footings

The proposed addition structures can be supported on conventional spread/strip footings established, below the fill/disturbed soil layer, on the undisturbed, native silt till/clayey silt till stratum, at or below the depths/elevations presented in Table 3, shown below.

The size of the new strip/spread footings can be proportioned to the following bearing resistances:

Factored Bearing Resistance at Ultimate Limit State (ULS) = 225 kPa

Bearing Resistance at Serviceability Limit State (SLS) = 150 kPa

Table 4 - Foundation Depth and Elevation (at or below) for Strip/Spread Footing

Borehole No.	Borehole Ground Surface Elevation (m)	Founding Depth Below EGSL (m) (at/or Below)	Founding Elevation (m) (at/or Below)
BH-1	97.60	1.80	95.80
BH-2	97.54	2.30	95.24

Foundation Notes:

It shall be noted that the as-built vertical/horizontal alignment and conditions of existing underground services and buried structures shall be established prior to the design/construction stage.

In the areas of existing service trenches, the footings shall be established below the invert of the existing services, in the original undisturbed soils, or could potentially, if practical, be bridged over the trench backfill (subject to review by a structural engineer).

Excavation for new footings shall start from the face of the existing structure to expose the existing footings and to match the founding depth of the new footing with the depth of the adjacent existing footings.

Adjacent footings, founded at different elevations, shall be stepped at 10 to 7 (horizontal to vertical). If this condition cannot be met/complied with, underpinning of the existing footings will be required.

For frost protection requirements, all exterior footings, and footings in unheated areas, must have a minimum soil cover of 1.2 m.

Under no circumstances shall the footings be constructed over loose, soft, or frozen subgrade soil or within ponded water. During winter construction, the footings must be adequately protected against the effects of frost.

Concrete shall be placed without delay after excavation to avoid softening of the subgrade surface. Hand cleaning of footing bases shall be carried out as directed by the field inspector.

Total settlements of the footings designed and constructed in accordance with the above recommended resistances at SLS shall be less than the tolerable limits of 25 mm. The differential settlements are expected to be less than 19 mm.

Furthermore, the recommended bearing capacity and foundation elevations have been calculated from the limited borehole information and are intended for design purposes only.

More specific information, with respect to founding conditions between the boreholes will become available when the proposed construction is underway. Therefore, the encountered founding conditions must be verified in the field and all footings must be inspected by this office before placement of concrete.

Earthquake Considerations

For structural design seismic consideration, the seismic provisions of the Ontario Building Code (OBC 2012) outline the Classification of sites for Seismic Site Response in Table 4.1.8.4.A. of the Code, based on the average properties of the soil/rock ground profile for site under consideration.

According to Table 4.1.8.4.A. of the code and this investigation finding, the subject site Class is “D”.

Underground/Retaining Walls

Underground/retaining walls shall be designed to resist a pressure "p", at any depth, "h" below the surface, as given by the expression.

$$p = 0.45[\gamma h + q]$$

Where: **0.45** is the earth pressure coefficient considered applicable

γ = **21.0** kN/m^3 is the unit weight of backfill

q = an allowance for surcharge

The above equation assumes that perimeter drains will be provided and that the backfill against the subsurface walls would be a free draining granular material.

Excavation and Backfill

No major problems shall be encountered for the anticipated depth of excavation. The excavation shall be back-sloped at 45 degrees or flatter in accordance with the current Ontario Occupational Health and Safety Act (OHSA).

The anticipated water seepage, if any, into the excavations from the more permeable seams/lenses or surface run-off can be handled by conventional pumping methods.

The material to be used for backfilling under floor slab shall be suitable for compaction, i.e., free of organics and with natural moisture content, which is within 2 percent of the optimum moisture content and no pieces larger than 150mm in size. The backfill material shall be compacted to at least 98 percent of the Standard Proctor Maximum Dry Density (SPMDD).

Selected on site excavated fill and native soils can be used as backfill under the floor slab or in-service trenches, provided the excavated materials are not allowed to become wet. However, the excavated materials will be very sensitive to moisture content, and the use of Granular B/C is preferred.

The backfill against the subsurface walls, and confined spaces, shall be free draining granular fill, preferably conforming to the Ontario Provincial Standard Specification for granular base course, Granular B.

Slab Construction and Permanent Drainage

The floor slabs can be constructed following the standard slab-on-grade technique, provided that organic soils and fill/disturbed soil with organics, if encountered, are removed and the base is thoroughly proof-rolled. Any soft spots revealed during proof-rolling shall be sub-excavated, backfilled and adequately compacted.

Following the removal of any unsuitable soils, as per above, the ground surface shall be adequately compacted to densify the near surface disturbed and loose soil. New fill, if required to raise grades to design level, shall be placed in shallow lifts (not more than 200 mm thick) and thoroughly compacted to a minimum 98 % of its Standard Proctor Maximum Dry Density (SPMDD).

The floor slabs shall rest on a well compacted layer of "19 mm clear stone" at least 150 mm thick when compacted. The stone bed would act as a barrier and prevent capillary rise of moisture from the subgrade to the floor slab.

No perimeter drainage will be required, if the floor slab is at least 150 mm above the exterior grade, which slopes away from the building at an inclination of 1 to 2 percent, to prevent surface ponding of water close to exterior walls. If this condition cannot be complied with, then perimeter drainage as shown on Drawing No. 2 shall be provided.

Underground Utilities

The problem areas of pavement settlement largely occur adjacent to manholes, catch basins and service crossings. The on-site materials would generally be difficult to compact in these areas, and it is therefore recommended that a sand backfill be used in confined areas.

The upper 1.0 m of the trench backfill shall be compacted to 98 % SPMDD. Below this zone, a 95 % SPMDD compaction is considered acceptable.

Pavement Design

Within the proposed new parking lot pavement area, all topsoil/organic soil and/or fill with organics, if and where encountered, must be entirely removed, and the base shall be thoroughly proof-rolled. Any soft spots revealed during proof-rolling shall be sub-excavated and backfilled with suitable materials, compacted to at least 98 % SPMDD.

The subgrade soil is frost susceptible. The design of pavement is therefore mainly influenced by the need to minimize the effects of freezing and thawing. Consequently, the ground must not be unnecessarily disturbed.

The subgrade shall be sloped to facilitate drainage towards catch basins and the final subgrade shall be compacted before pavement is constructed. It shall be noted that the subgrade shall be dry and firm, not spongy, during compaction and during the construction of the [sub] base.

The subgrade will suffer strength regression if water is allowed to infiltrate into the mantle. Therefore, sub-drains shall be installed along the edge of all pavement areas to prevent surface water from infiltrating into the subgrade.

Within the parking lots, sub-drains radiating from the catch basins shall also be installed. These sub-drains shall be at least 3 m long in each direction and have inverts at least 0.75 m below the pavement surface.

Based on the engineering properties of the subgrade soil, climatic conditions and the anticipated use of the pavement, typical flexible asphaltic pavement designs for this development are as follows:

Table 5 - Typical Flexible Asphaltic Pavement Design

Pavement Components	Heavy Duty	Medium Duty	Light Duty
Asphaltic Concrete	40 mm HL3	40 mm HL3	50 mm HL3
	60 mm HL8	40 mm HL8	
19 mm Crushed Limestone	150 mm	150 mm	150 mm
Granular B Sub-base or 50 mm Crushed Limestone	300 mm	200 mm	200 mm

All granular materials used in the construction of pavement should be compacted to 98 % of Standard Proctor maximum dry density.

If the proposed pavements are to be constructed during wet seasons, the moisture content in the subgrade will probably be above the optimum, and this will render its shear strength inadequate to support paving equipment traffic. In this case, it is recommended that suitable filter fabric, such as Terratrack 200W or equivalent, be used at the interface of the native soil and the granular sub-base/base fill.

General Comments

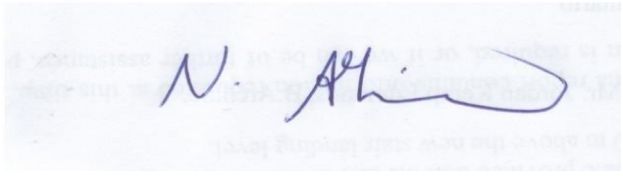
This geotechnical report is provided based on the terms of reference provided above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there is any change in the design features relevant to the geotechnical analyses, or if any questions arise regarding the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The comments given in this report are intended only for the guidance of design engineers. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to the classification of the fill/organic/topsoil cover and the potential reuse of these soils on/off site.

The prospective contractors must draw their own conclusions as to how the near surface and subsurface conditions may affect them.

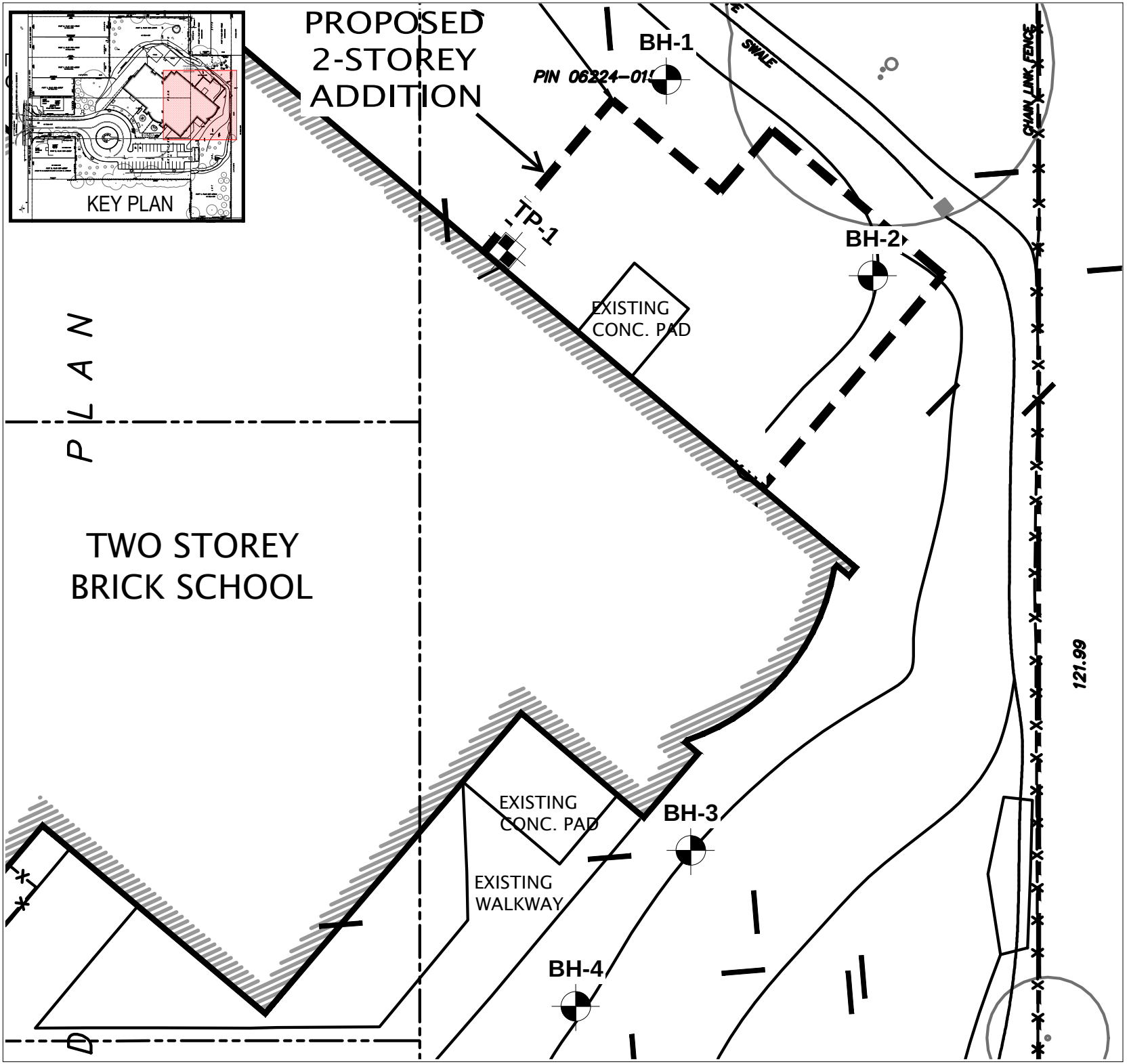
We trust this report contains information requested at this time. However, if any clarification is required, or if we can be of further assistance, please contact this office.

Yours truly,
Forward Engineering & Associates Inc.



Nasser Abdelghani, M.Sc., P.Eng.
Project Geotechnical Engineer

G. S. Semaan, M.Eng., P.Eng.
Principal



NOTES:

BH = BOREHOLE LOCATION

TP = TEST PIT LOCATION

N

DRAWING No. 1

BOREHOLE AND TEST PIT LOCATION PLAN

Rev.	DATE	REVISION / ISSUE
04		
03		
02		
01		

Project Name: PROPOSED ADDITION TO ÉÉC SAINT MICHEL

Address: 29 MEADOWVALE ROAD, TORONTO, ON.

PROJECT No.	:6465-A
DESIGN BY	:P.R.
DRAWING DATE	:AUG. 18, 2022
DRAWN BY: P.R.	PAGE 1 of 1
CHECKED BY: G.S.	

FORWARD ENGINEERING
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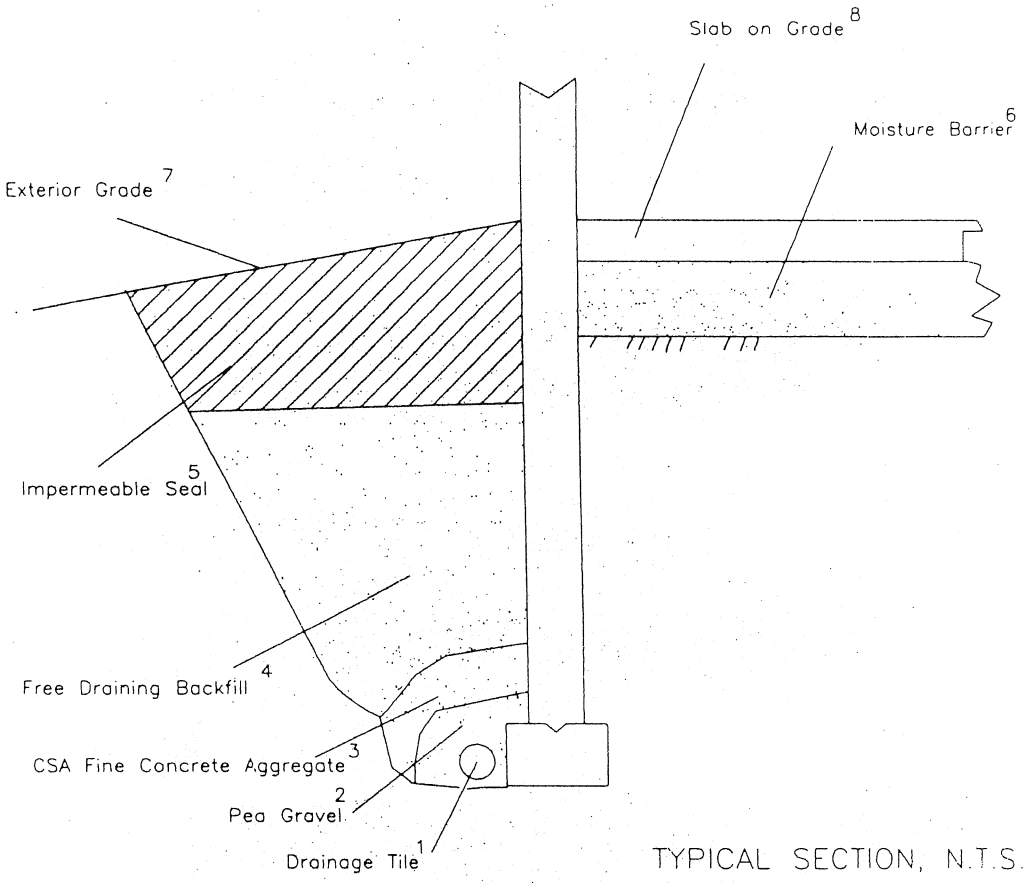
DRAINAGE AND BACKFILL RECOMMENDATIONS

(Not to Scale)



TYPICAL SECTION, N.T.S.

NOTES:

1. Drainage tile to consist of 100 (4") diam. Weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be minimum 150mm (6") below underside of floor slab.
2. Pea gravel 150mm (6") top and sides of drain. If drain is not on footing, 100 mm (4") of pea gravel below drain. Clear 20mm (3/4") crushed stone may be used provided it is covered by an approved porous membrane (Terrafix 270R or equivalent).
3. C.S.A. Fine aggregate to act as filter material. Minimum 300 mm (12") top and sides of tile drain. This may be replaced by an approved porous plastic membrane as indicated in 2.
4. Free draining backfill - Class B pit-run gravel or equivalent compacted to 93 – 95 % Standard Proctor Maximum Dry Density (SPMDD).
5. Impermeable backfill seal compacted clay, clay silt or equivalent. If original soil is free draining seal may be omitted.
6. Moisture barrier to consist of 20mm (3/4") compacted crushed stone. Layer to be 200mm (8") thick.
7. Exterior grade to slope away from wall.
8. Slab on grade should not be structurally connected to wall footing.
9. If the 20mm (3/4") stone requires surface blinding, use 6mm (1/4") stone chips.

DRAWING NO. 2

APPENDIX A

BOREHOLE LOG SHEETS
(1 – 4)

Project No: 6465-A

Log of Borehole BH-1

Project: PROPOSED ADDITION TO ÉÉC SAINT MICHEL

Client: CONSEIL CATHOLIQUE MON AVENIR

Enclosure: 2

Location: 29 MEADOWVALE ROAD, TORONTO, ON.

Depth (m)	Description of strata	Elevation (m)	No.	Type	Blows/ft	Recovery	Blows/ft (20 40 60 80)	Water Content % (10 20 30)	Monitoring Well
	Ground Surface	97.60							
0	PAVEMENT (±125 mm asphalt, ±560 mm granular)	0.00							
		96.91	1	SS	27		27	6.0	
1	FILL/DISTURBED SOIL brown and grey sandy and clayey silt with pockets to traces of organics, compact, very moist.	0.69	2	SS	10		10	17.0	
		96.00	3	SS	12		12	16.6	
2	SILT TILL/CLAYEY SILT TILL stiff to very stiff, brown, moist to very moist.	1.60	4	SS	28		28	14.2	
3	grading with occasional silt partings.		5	SS	11		11	24.3	
4	grading wet.		6	SS	20		20	10.3	
5	grading grey.		7	SS	11		11	7.8	
6			8	SS	18		18	11.6	
	grading firm.		9	SS	6		6	15.9	
7	End of Borehole	90.74 6.86							

Remarks: Upon completion of drilling, the borehole was open to 3.8 m and water level was measured at 1.7 m below EGSL.

Drill Method: RAM SOUNDER/BEAVER

Drill Date: 2 AUG. 2022

Datum: GEODETIC

FORWARD ENGINEERING & ASSOCIATES INC.
244 Brockport Drive, Unit 15, Toronto, Ontario, M9W 6X9

Engineer: G.R.

Checked by: G.S.

Sheet No. 1 of 1

Project No: 6465-A

Log of Borehole BH-2

Project: PROPOSED ADDITION TO ÉÉC SAINT MICHEL

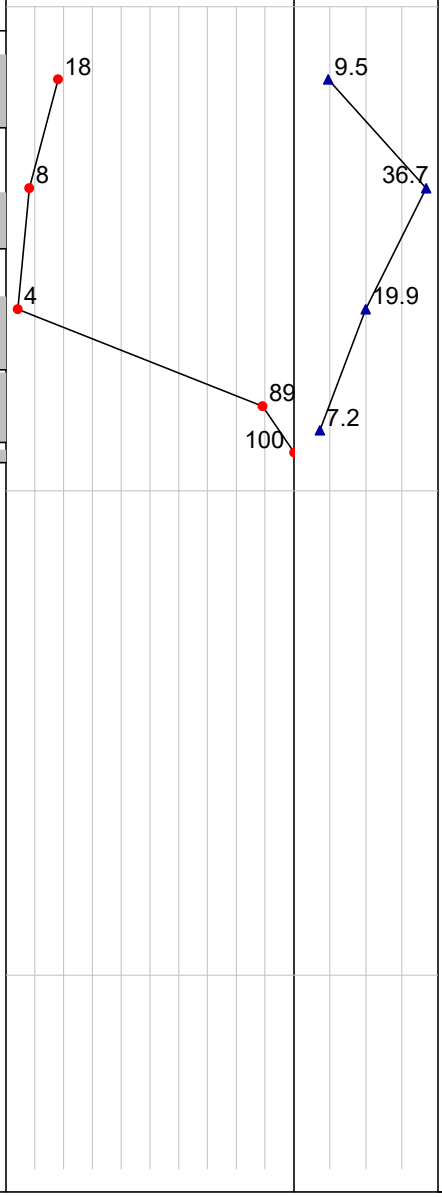
Client: CONSEIL CATHOLIQUE MON AVENIR

Enclosure: 3

Location: 29 MEADOWVALE ROAD, TORONTO, ON.

Depth (m)	Description of strata	Elevation (m)	Sample Details: No.	Type	Blows/ft	Recovery
0	Ground Surface	97.54				
	PAVEMENT (±125 mm asphalt, ±510 mm granular)	0.00				
	FILL/DISTURBED SOIL brown and dark brown sandy and clayey silt with traces of rootlets and organics, compact to very loose, very moist to wet.	96.90 0.63	1	SS	18	
1			2	SS	8	
	SILT TILL with wet sandy silt inclusions in the upper zone. soft to hard, brown, very moist to moist.	95.76 1.78	3	SS	4	
2	grading with occasional stone fragments, grey.		4	SS	89	
		94.66 2.87	5		100	
3	End of Borehole					
	Auger and Spoon Driving Refusal at ±9.5 ft					
4						
5						
6						
7						

Blows/ft: 20 40 60 80 — Water Content %: 10 20 30 — Monitoring Well



Remarks: Upon completion of drilling, the borehole was open and wet at the bottom.

Drill Method: RAM SOUNDER/BEAVER

Drill Date: 2 AUG. 2022

Datum: GEODETIC

FORWARD ENGINEERING & ASSOCIATES INC.
244 Brockport Drive, Unit 15, Toronto, Ontario, M9W 6X9

Engineer: G.R.

Checked by: G.S.

Sheet No. 1 of 1

Project No: 6465-A

Log of Borehole BH-3

Project: PROPOSED ADDITION TO ÉÉC SAINT MICHEL

Client: CONSEIL CATHOLIQUE MON AVENIR

Enclosure: 4

Location: 29 MEADOWVALE ROAD, TORONTO, ON.

Depth (m)	Description of strata	Elevation (m)	No.	Type	Blows/ft	Recovery	Blows/ft (20 40 60 80)	Water Content % (10 20 30)	Monitoring Well
	Ground Surface	98.00							
0	TOPSOIL/ORGANIC SOIL (±25 mm)	0.00							
	FILL/DISTURBED SOIL brown sandy silt with traces of rootlets and occasional gravel and asphalt debris, compact, moist.		1	SS	21		21	6.6	
1			2	SS	20		20	9.9	
	grading silty sand and gravel, very moist to wet.		3	SS	25		25	11.9	
2		95.71							
	SANDY SILT with traces of gravel. compact to dense, brown, very moist to wet.	2.29	4	SS	19		19	12.8	
3			5	SS	32		32	9.3	
		94.19							
4	End of Borehole	3.81							
5									
6									
7									

Remarks: Upon completion of drilling, the borehole was open to 2.4 m below EGSL and dry.

Drill Method: RAM SOUNDER/BEAVER

Drill Date: 2 AUG. 2022

Datum: GEODETIC

FORWARD ENGINEERING & ASSOCIATES INC.
244 Brockport Drive, Unit 15, Toronto, Ontario, M9W 6X9

Engineer: G.R.

Checked by: G.S.

Sheet No. 1 of 1

Project No: 6465-A

Log of Borehole BH-4

Project: PROPOSED ADDITION TO ÉÉC SAINT MICHEL

Client: CONSEIL CATHOLIQUE MON AVENIR

Enclosure: 5

Location: 29 MEADOWVALE ROAD, TORONTO, ON.

Depth (m)	Description of strata	Elevation (m)	Sample Details: No.	Type	Blows/ft	Recovery	Blows/ft (20 40 60 80)	Water Content % (10 20 30)	Monitoring Well
	Ground Surface	97.90							
0	TOPSOIL/ORGANIC SOIL (±25 mm)	0.00							
	FILL/DISTURBED SOIL		1	SS	4		4	10.2	
1	brown sandy silt with traces of gravel and occasional asphalt debris, loose to compact, moist.		2	SS	27		27	12.4	
	grading with traces of stone fragments and wood debris.								
2	grading clayey silt with traces of rootlets, very moist.		3	SS	13		13	11.9	
			4	SS	19		19	14.5	
3	SANDY SILT	95.10							
	compact, brown, very moist.	2.80							
	End of Borehole								
4									
5									
6									
7									

Remarks: Upon completion of drilling, the borehole was open and dry.

Drill Method: RAM SOUNDER/BEAVER

Drill Date: 2 AUG. 2022

Datum: GEODETIC

FORWARD ENGINEERING & ASSOCIATES INC.
244 Brockport Drive, Unit 15, Toronto, Ontario, M9W 6X9

Engineer: G.R.

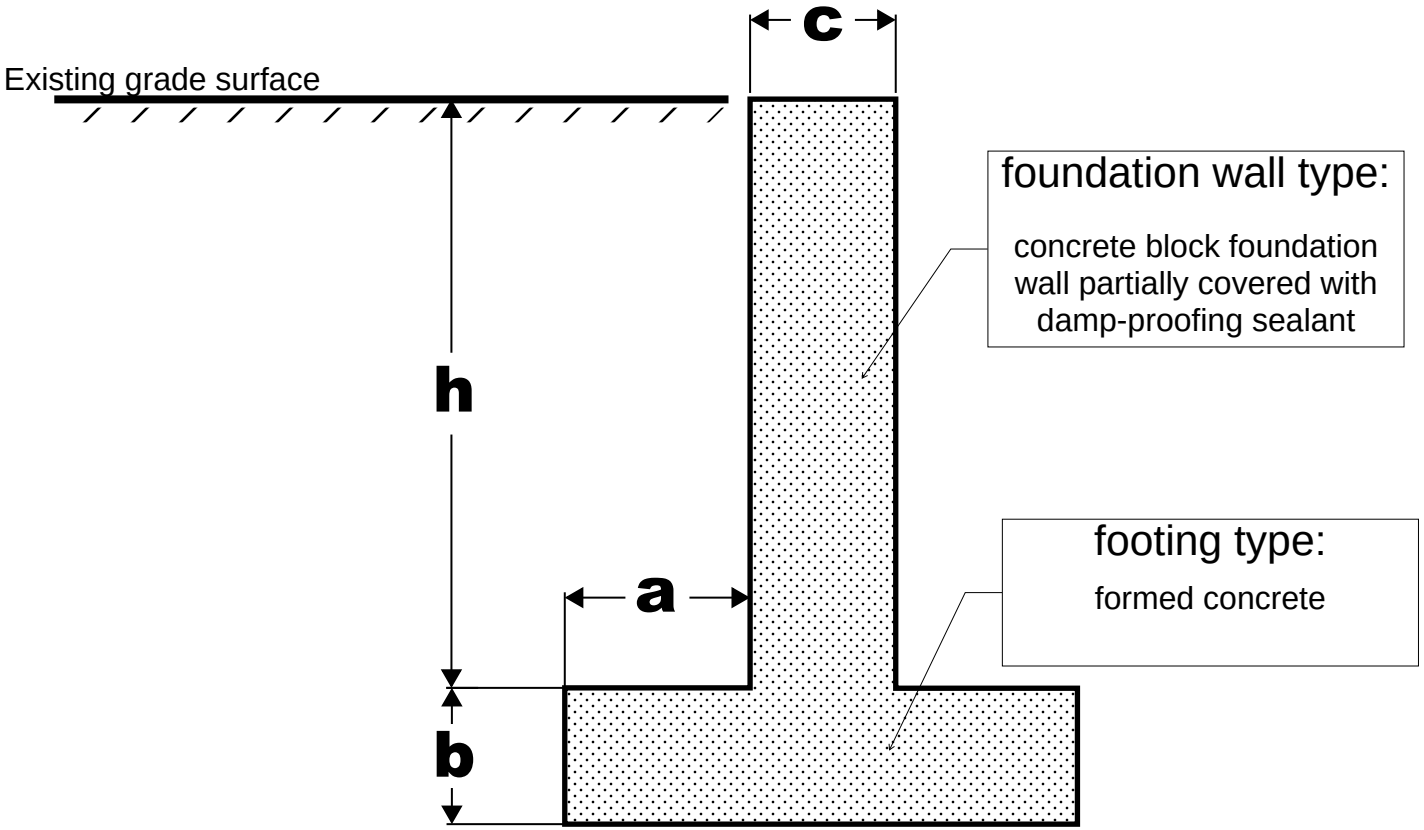
Checked by: G.S.

Sheet No. 1 of 1

APPENDIX B

TEST PIT OBSERVATION SHEET

Test Pit No.	a mm	b mm	c mm	h mm	founding material	water comments	test pit ground surface elevation (m)
1	115	265	N/A	990	Silt Till	Dry	98.02



FORWARD ENGINEERING
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Toronto, Ontario M9W 6X9
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TEST PIT OBSERVATIONS

Project Name: PROPOSED ADDITION - ÉÉC SAINT MICHEL

Address: 29 MEADOWVALE ROAD, TORONTO, ON.

PROJECT No. :6465-A
DRAWING DATE :AUG. 19, 2022
DRAWN BY: P.R. | PAGE 1 of 1
CHECKED BY: G.S.

NOTES:

6465-A

February 8, 2024

Kingsland + Architects Inc.
219 Dufferin Street, Suite 308b
Toronto, Ontario
M6K 3J1

Attention: Ms. Tereza George
Intern Architect I O.A.A.

Dear Mdm:

Re: Soil Characterization Report No. 1
ÉÉC Saint Michel
29 Meadowvale Road
Scarborough, Ontario

1.0 INTRODUCTION

Further to your request, Forward Engineering & Associates Inc. (**Forward)** conducted borehole drilling, sampling and testing of soils at the captioned property for their assessment for off-site re-use or disposal.

2.0 BACKGROUND

The subject property is the site of St. Michel French Catholic Elementary School reportedly built in 2013. A northeast building addition is proposed and an east extension to the paved parking lot, the construction of which will generate approximately 700 m^3 of excess soils which will be required to be transported off-site for re-use or disposal.

The purpose of this program was to sample and test soil materials in the northeast and east parts of the site which will shortly be excavated during the site grading activities.

Considering the property is relatively recently developed with institutional land uses, there are few associated Potential Contaminating Activities (PCAs) or Areas of Potential Environmental Concern (APECs).

Therefore, samples were collected proportionate to the quantity of these soils being excavated and tested for minimum parameters: Metals and Inorganics (M&I) and Petroleum Hydrocarbons (PHCs) including BTEX, as specified for re-use of excess soils under Ontario Regulation 406/19.

3.0 INVESTIGATION PROGRAM

3.1 SCOPE OF WORK

Based on the above, the scope of work consisted of the following:

1) Mobilizing, drilling, and logging of four [4] sampled boreholes, denoted as BH-1 through BH-4, to depths of 1.5 to 2.5 m below existing grade.

2) Screening of soil samples with an organic vapour monitor for volatile hydrocabons

3) Laboratory testing program to confirm or refute additional PHC contamination in the area investigated.

3.2 FIELDWORK

3.2.1 Borehole Drilling

On January 5, 2024, four [4] boreholes were advanced by a specialist drilling contractor at the locations shown on Drawing No. 1, enclosed in Appendix I.

Soil samples were collected from each borehole using a portable Pionjar with Split Spoon Samplers. To avoid cross contamination, the split spoon samplers were cleaned after obtaining each sample.

The boreholes extended to a depth of about 1.5 to 2.5 m below the Existing Ground Surface Level (EGSL).

All boreholes were backfilled and the surface was reinstated as needed.

All samples were later examined for visual and olfactory evidence of contamination and for soil characterization.

3.2.2 Combustible Vapor

A field instrument RKI Eagle organic vapor monitor (OVM) was used to screen the soil sample headspace for the presence of volatile hydrocarbon vapours and referenced to methane calibrant gas. The vapour readings are presented on the Log of Borehole sheets.

3.3 ANALYTICAL TESTING PROGRAM

Representative “worse-case” soil samples were selected for laboratory analyses based upon soil vapor measurements, visual or olfactory evidence of contamination, or the potential for contamination based upon depth and site history.

The samples were stored in pre-cleaned glass jars and kept cool until their delivery to the laboratory.

Selected samples collected during the investigation were submitted to Paracel Laboratories Ltd., Mississauga, Ontario, an independent laboratory certified by the Canadian Association of Environmental Analytical Laboratories (CAEAL).

3.3.1 Soil Testing

Five [5] representative soil samples were selected based on visual/olfactory evidence of contamination, or based on the highest vapour reading(s).

The samples were prepared, and submitted for laboratory analyses, as listed in the following table.

Laboratory Sample ID	Soil Sample No.	Tested Parameters
2402215-01	01 S1 (1/2B)	Metals and Inorganics, PHC's (F1-F4) + BTEX
2402215-02	02 S2 (2/2)	Metals and Inorganics, PHC's (F1-F4) + BTEX
2402215-03	03 S3 (3/3)	Metals and Inorganics, PHC's (F1-F4) + BTEX
2402215-04	04 S4 (4/2A)	Metals and Inorganics, PHC's (F1-F4) + BTEX
2402215-05	05 S5 (1/1B)	mSPLP Metals & VOCs

4.0 RESULTS

4.1 SUBSURFACE CONDITIONS

The subsurface conditions encountered at the borehole locations are shown on the Log of Borehole sheets, presented in Appendix B, and summarized as follows:

Pavement/Sod: Pavement layer, consisting of about 125 mm asphalt was found at the surface of borehole BH-1. Other boreholes had sod on the surface.

Fill: A layer of 1 to 2.3 m of fill materials comprising mostly reworked soils was encountered in all boreholes below the surfacing. It comprised brown clayey silt with traces to some organics and traces of gravel. In borehole BH-1 a layer of crushed gravel was part of the fill, while in borehole BH-4, the fill contained brick and asphalt fragments.

Clayey Silt Till: Native clayey silt till was encountered below the Fill layer in all the boreholes. It comprised light brown clayey silt with scattered gravel. This stratum extended to the maximum explored depth of investigation.

5.0 FINDINGS AND DISCUSSIONS

5.1 Analytical Testing Results

5.1.1 Analytical Results Compared to Ontario Excess Soil Quality Standards

The results, enclosed in Appendix C, were compared to the Table 2.1 Excess Soil Quality Standards (ESQS) of Ontario Regulation 406/19 for Residential/Institutional/Parkland (RPI) Land Uses.

The results showed general compliance with said standards, with the following exceptions:

- Electrical Conductivity (EC) in two samples, namely S2 (2/2) and S4 (4/2A), of 0.925 and 1.07 respectively, compared with the standard of 0.7;
- Sodium Adsorption Ratio (SAR) in one sample, namely S4 (4/2A), of 6.12 compared to the standard of 5; and
- Petroleum Hydrocarbon Fraction F3 in one sample, namely S4 (4/2A) of 264 ug/g vs. the standard of 240 ug/g.

The results of mSPLP analyses showed no exceedances of corresponding Table 2.1 leachate screening levels.

In comparison with Table 3.1 ESQS for Industrial/Commercial land uses, all the soils samples met said criteria.

Based on the foregoing findings, most of the excess soils can be dispatched to re-use sites accepting Table 2.1 or Table 3.1 RPI quality material with elevated EC and SAR, which could be reused in new roadway or paved parking areas, with the exception of soils from the vicinity of BH-4, which can only be accepted at Table 3.1 Commercial/Industrial sites. Additional testing could be undertaken to isolate the lower quality soils from around BH-4 for separate disposal during construction.

5.2 Summary

In conclusion, based on the foregoing findings, most of the excess soils from this construction project can be dispatched to re-use sites accepting O.Reg. 406/19 Table 2.1 or Table 3.1 RPI quality material with elevated EC and SAR, which could be reused in new roadway or paved parking areas, with the exception of soils from the vicinity of

BH-4, which can only be accepted at Table 3.1 Commercial/Industrial sites. This is subject to the receiving site's acceptance criteria.

Finally, additional testing could be undertaken to isolate the lower quality soils from around BH-4 for separate disposal during construction.

6.0 STATEMENT OF LIMITATIONS

This report is limited in scope to those items specifically referenced in the text. No testing or design calculations have been performed except as specifically reported. It should be understood that the data we have collated and opinions we have formed after reviewing this information should not be construed as a guarantee but only a guide to probable expectations. Conditions that exist but are not recorded herein were not apparent, given the level of study authorized.

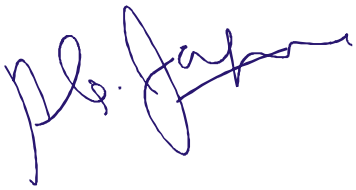
This report has been prepared for use of the client, along with their design consultants, their agents and solicitors, as well as any third parties noted in the report. It should not be relied upon for any other purpose. Unauthorized parties, who use this report, do so at their own risk.

It is recommended that Forward Engineering be contacted to provide assistance in the interpretation of the information contained in this report by anyone reviewing the report or anyone who intends to undertake work on or below the ground surface at this site, prior to this work being carried out.

We trust this report meets our terms of reference. However, if any clarification is required, or if we can be of further assistance, please contact this office.

Sincerely yours,

FORWARD ENGINEERING & ASSOCIATES INC.

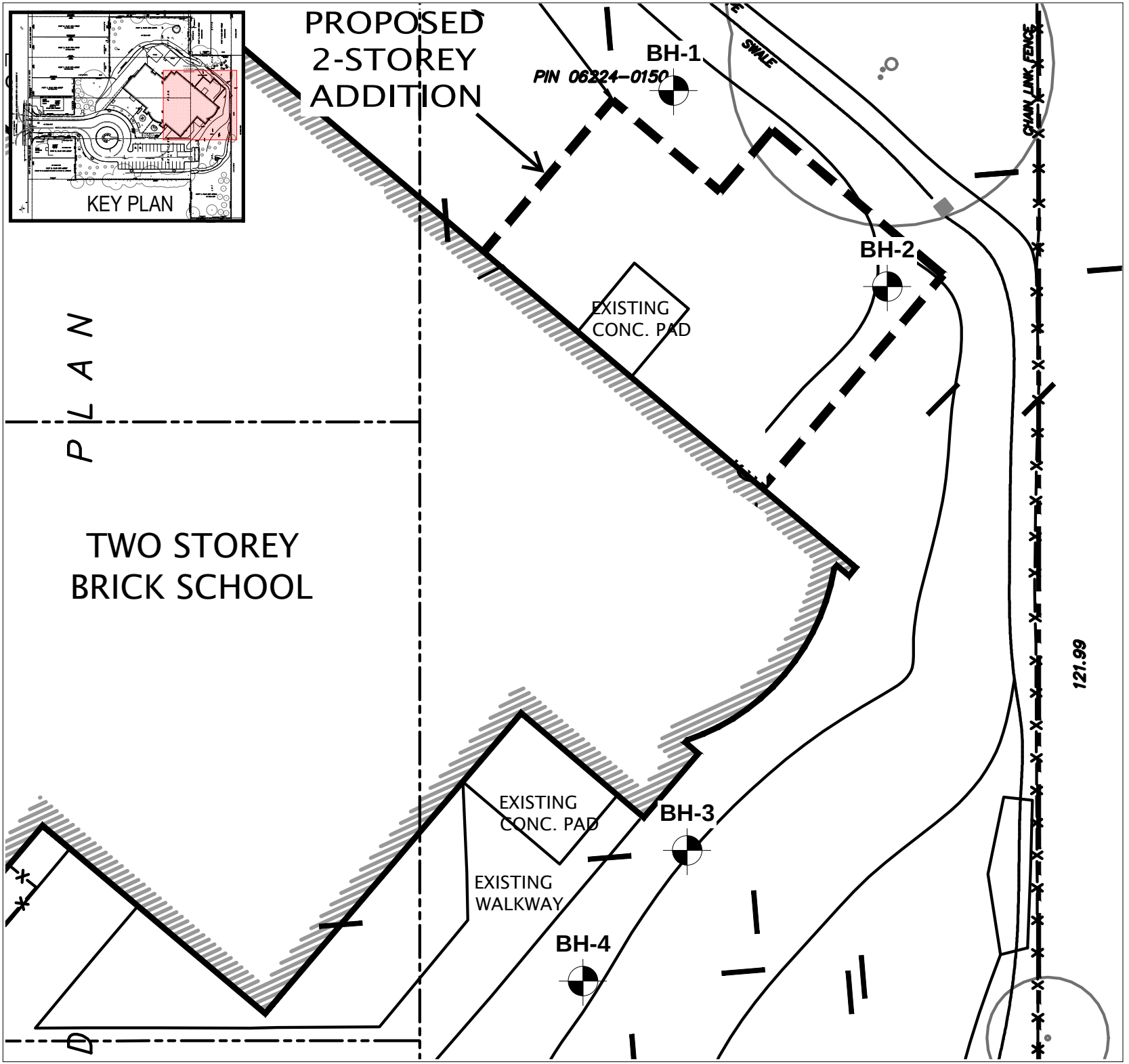


Juan Chahine, P. Eng.
Senior Project Manager

Mohamedarif M. Jagani, M.S., P.Eng., QP_{ESA}
Senior Environmental Consultant

Appendix A

Borehole Location Plan



NOTES:

BH = BOREHOLE LOCATION

N

DRAWING No. 1
BOREHOLE LOCATION PLAN

Rev.	DATE	REVISION / ISSUE
04		
03		
02		
01		

Project Name: PROPOSED ADDITION TO ÉÉC SAINT MICHEL

Address: 29 MEADOWVALE ROAD, TORONTO, ON.

PROJECT No.	:6465-A
DESIGN BY	:P.R.
DRAWING DATE	:Feb. 2, 2024
DRAWN BY: P.R.	PAGE 1 of 1
CHECKED BY: G.S.	

FORWARD ENGINEERING
& Associates Inc.

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244 Brockport Drive, Unit 15
Toronto, Ontario M9W 6X9
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www.forwardengineering.ca

Appendix B

Logs of Borehole Sheets

LOG OF BOREHOLE BH-1

Enclosure: 2

CLIENT KINGSLAND + ARCHITECTS INC. **PROJECT NAME** ÉÉC SAINT MICHEL

PROJECT NUMBER 6465-E **PROJECT LOCATION** 29 MEADOWVALE ROAD , SCARBOROUGH, ONTARIO

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation (m)	Sample TYPE NUMBER	Sample Recovery %	VOC Concentration (ppm) / LEL (%)	ENVIRONMENTAL DATA	WELL DIAGRAM
0.0			97.60					
		0.13 **ASPHALT** (±125 mm). 97.48						
		FILL crushed gravel.	97.50					
0.5				SS 1	75	NIL	mSPLP Leachate Metals & mSPLP Leachate VOCs	
		0.76 96.84	97.00					
		FILL/DISTURBED SOIL greyish brown clayey silt, wet. 0.96 96.64						
1.0		**CLAYEY SILT TILL** brown, moist.		SS 2	43	NIL	PHCs F1-F4 + BTEX, Metals & Inorganics	
			96.50					
1.5		1.52 96.08						

End of Borehole at 1.52 m.

Remarks: Upon completion of drilling, the borehole was open and dry.

DRILLING METHOD: PIONJAR

DRILLING DATE: January 05-2024

DATUM: GEODETIC

Forward Engineering & Associates Inc.
244 Brockport Drive, Unit15, Toronto, Ontario M9W 6X9

FIELD BY: P.R

CHECKED BY: P.R

SHEET NO. 1 of 1

LOG OF BOREHOLE BH-2

Enclosure: 3

CLIENT KINGSLAND + ARCHITECTS INC.

PROJECT NAME ÉÉC SAINT MICHEL

PROJECT NUMBER 6465-E

PROJECT LOCATION 29 MEADOWVALE ROAD , SCARBOROUGH, ONTARIO

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation (m)	Sample TYPE NUMBER	Sample Recovery %	VOC Concentration (ppm) / LEL (%)	ENVIRONMENTAL DATA	WELL DIAGRAM
0.0			97.54					
		FILL crushed gravel, wet.	97.50					
		0.33 / 97.21						
0.5		**FILL/DISTURBED SOIL** dark brown clayey silt with traces to some organics and traces of gravel, wet.	97.00	SS 1	100	NIL		
1.0			96.50	SS 2	84	NIL	**PHCs F1-F4 + BTEX, Metals & Inorganics**	
		with organic soil layer						
1.5		1.52 / 96.02						
		CLAYEY SILT TILL brown, wet.	96.00	SS 3	55	NIL		
		1.98 / 95.56						

End of Borehole at 1.98 m.

Remarks: Upon completion of drilling, the borehole was open and wet at the bottom.

DRILLING METHOD: PIONJAR

DRILLING DATE: January 05-2024

DATUM: GEODETIC

Forward Engineering & Associates Inc.
244 Brockport Drive, Unit15, Toronto, Ontario M9W 6X9

FIELD BY: P.R

CHECKED BY: P.R

SHEET NO. 1 of 1

LOG OF BOREHOLE BH-3

Enclosure: 4

CLIENT KINGSLAND + ARCHITECTS INC.

PROJECT NAME ÉÉC SAINT MICHEL

PROJECT NUMBER 6465-E

PROJECT LOCATION 29 MEADOWVALE ROAD , SCARBOROUGH, ONTARIO

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation (m)	Sample TYPE NUMBER	Sample Recovery %	VOC Concentration (ppm) 50 100 150 200 / LEL (%) 20 40 60 80	ENVIRONMENTAL DATA	WELL DIAGRAM
0.0		0.08 **TOPSOIL/ORGANIC SOIL** (±80 mm). 97.92	98.00					
		FILL/DISTURBED SOIL brown sandy silt with traces of clay and organics, moist.		SS 1	77	NIL		
0.5			97.50					
1.0			97.00	SS 2	67	NIL		
1.5			96.50					
2.0			96.00	SS 3	66	NIL	**PHCs F1-F4 + BTEX, Metals & Inorganics**	
		2.29 95.71 **CLAYEY SILT TILL** brown, moist.						
2.5		2.60 95.40	95.50	SS 4	25	NIL		

End of Borehole at 2.60 m.

Remarks: Upon completion of drilling, the borehole was open and dry.

DRILLING METHOD: PIONJAR

DRILLING DATE: January 05-2024

DATUM: GEODETIC

Forward Engineering & Associates Inc.
244 Brockport Drive, Unit15, Toronto, Ontario M9W 6X9

FIELD BY: P.R

CHECKED BY: P.R

SHEET NO. 1 of 1

LOG OF BOREHOLE BH-4

Enclosure: 5

CLIENT KINGSLAND + ARCHITECTS INC.

PROJECT NAME ÉÉC SAINT MICHEL

PROJECT NUMBER 6465-E

PROJECT LOCATION 29 MEADOWVALE ROAD , SCARBOROUGH, ONTARIO

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation (m)	Sample TYPE NUMBER	Sample Recovery %	VOC Concentration (ppm) 50 100 150 200 / LEL (%) 20 40 60 80	ENVIRONMENTAL DATA	WELL DIAGRAM
0.0		0.05 **TOPSOIL/ORGANIC SOIL** (±50 mm). 97.85	97.90					
0.5		**FILL/DISTURBED SOIL** brown clayey silt with traces of sand and gravel, moist.	97.50	SS 1	70	NIL		
		0.76 with minor brick and asphalt debris. 97.14						
1.0			97.00	SS 2	80	NIL	PHCs F1-F4 + BTEX, Metals & Inorganics	
		1.27 **CLAYEY SILT TILL** brown, moist. 96.63						
1.5		1.52 96.38	96.50					

End of Borehole at 1.52 m.

Remarks: Upon completion of drilling, the borehole was open and dry.

DRILLING METHOD: PIONJAR

DRILLING DATE: January 05-2024

DATUM: GEODETIC

Forward Engineering & Associates Inc.
244 Brockport Drive, Unit15, Toronto, Ontario M9W 6X9

FIELD BY: P.R

CHECKED BY: P.R

SHEET NO. 1 of 1

Appendix C

Laboratory Chemical Testing Results Compared to Applicable Criteria

TABLE 1		CLIENT: Forward Engineering & Associates Inc.						
PARACEL LABORATORIES LTD.		ATTENTION: George Semaan						
WORKORDER: 2402215		PROJECT: 6465-A						
REPORT DATE: 01/17/2024		REFERENCE: Standing Offer - ENV						
Parameter	**Units**	**MDL**	**Regulation**	**Sample**				
				S1 (1/2B) 2402215-01	**S2 (2/2) 2402215-02**	**S3 (3/3) 2402215-03**	**S4 (4/2A) 2402215-04**	**S5 (1/1B) 2402215-05**
Sample Date (m/d/y)			**Reg 406/19-Table 2.1 Residential/Parkland/Institutional**	**01/10/2024 11:00 AM**	**01/10/2024 11:00 AM**	**01/10/2024 11:00 AM**	**01/10/2024 11:00 AM**	**01/10/2024 11:00 AM**
Physical Characteristics								
% Solids	% by Wt.	0.1		84.0	83.3	89.3	90.9	90.7
mSPLP Leachate Metals								
Antimony	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Arsenic	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Barium	ug/L	1.0		N/A	N/A	N/A	N/A	7.5
Beryllium	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Boron	ug/L	10.0		N/A	N/A	N/A	N/A	16.2
Cadmium	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Chromium	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Cobalt	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Copper	ug/L	0.5		N/A	N/A	N/A	N/A	3.4
Lead	ug/L	0.2		N/A	N/A	N/A	N/A	0.7
Molybdenum	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Nickel	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Selenium	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Silver	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Thallium	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Uranium	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Vanadium	ug/L	0.5		N/A	N/A	N/A	N/A	13.0
Zinc	ug/L	5.0		N/A	N/A	N/A	N/A	<5
mSPLP Leachate VOCs								
Bromomethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Carbon Tetrachloride	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Chloroform	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichlorobenzene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Ethylene dibromide (dibromoethan	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
1,4-Dichlorobenzene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichloroethane	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
1,1-Dichloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1-Dichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
cis-1,2-Dichloroethylene	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
trans-1,2-Dichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichloropropane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
cis-1,3-Dichloropropylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
trans-1,3-Dichloropropylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,3-Dichloropropene, total	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,1,2-Tetrachloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,2,2-Tetrachloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Tetrachloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,2-Trichloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Trichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
General Inorganics								
SAR	N/A	0.01	5	3.13	4.03	1.00	6.12	N/A
Conductivity	mS/cm	0.005	0.7	0.584	0.925	0.188	1.07	N/A
Cyanide, free	ug/g dry	0.03	0.051	<0.03	<0.03	<0.03	<0.03	N/A
pH	pH Units	0.05	5	9.41	8.04	7.92	10.59	N/A
Metals								
Antimony	ug/g dry	1.0	7.5	<1	<1	<1	<1	N/A
Arsenic	ug/g dry	1.0	18	2.6	2.4	1.3	2.4	N/A
Barium	ug/g dry	1.0	390	53.3	41.7	13.5	39.2	N/A
Beryllium	ug/g dry	0.5	4	<0.5	<0.5	<0.5	<0.5	N/A
Boron, available	ug/g dry	0.5	1.5	<0.5	<0.5	<0.5	<0.5	N/A
Boron	ug/g dry	5.0	120	<5	<5	<5	5.2	N/A
Cadmium	ug/g dry	0.5	1.2	<0.5	<0.5	<0.5	<0.5	N/A
Chromium (VI)	ug/g dry	0.2	8	<0.2	<0.2	<0.2	0.2	N/A
Chromium	ug/g dry	5.0	160	14.1	14.0	6.0	11.4	N/A
Cobalt	ug/g dry	1.0	22	4.4	4.3	1.6	3.8	N/A
Copper	ug/g dry	5.0	140	9.5	8.2	<5	8.1	N/A
Lead	ug/g dry	1.0	120	9.4	8.9	2.3	8.0	N/A
Mercury	ug/g dry	0.1	0.27	<0.1	<0.1	<0.1	<0.1	N/A
Molybdenum	ug/g dry	1.0	6.9	<1	<1	<1	<1	N/A
Nickel	ug/g dry	5.0	100	9.7	8.7	<5	8.2	N/A
Selenium	ug/g dry	1.0	2.4	<1	<1	<1	<1	N/A
Silver	ug/g dry	0.3	20	<0.3	<0.3	<0.3	<0.3	N/A
Thallium	ug/g dry	1.0	1	<1	<1	<1	<1	N/A
Uranium	ug/g dry	1.0	23	<1	<1	<1	<1	N/A
Vanadium	ug/g dry	10.0	86	20.5	22.8	13.7	19.7	N/A
Zinc	ug/g dry	20.0	340	40.4	30.1	<20	25.4	N/A
Volatiles								
Benzene	ug/g dry	0.02	0.02	<0.02	<0.02	<0.02	<0.02	N/A
Ethylbenzene	ug/g dry	0.05	0.05	<0.05	<0.05	<0.05	<0.05	N/A
Toluene	ug/g dry	0.05	0.2	<0.05	<0.05	<0.05	<0.05	N/A
m/p-Xylene	ug/g dry	0.05		<0.05	<0.05	<0.05	<0.05	N/A
o-Xylene	ug/g dry	0.05		<0.05	<0.05	<0.05	<0.05	N/A
Xylenes, total	ug/g dry	0.05	0.091	<0.05	<0.05	<0.05	<0.05	N/A
Hydrocarbons								
F1 PHCs (C6-C10)	ug/g dry	7	25	<7	<7	<7	<7	N/A
F2 PHCs (C10-C16)	ug/g dry	4	10	<4	<4	<4	<4	N/A
F3 PHCs (C16-C34)	ug/g dry	8	240	54	50	15	264	N/A
F4 PHCs (C34-C50)	ug/g dry	6	2800	<6	<6	<6	904	N/A
F4G-sg PHCs (gravimetric)	ug/g dry	50	2800	N/A	N/A	N/A	2600	N/A

TABLE 1		CLIENT: Forward Engineering & Associates Inc.						
PARACEL LABORATORIES LTD.		ATTENTION: George Semaan						
WORKORDER: 2402215		PROJECT: 6465-A						
REPORT DATE: 01/17/2024		REFERENCE: Standing Offer - ENV						
Parameter	Units	MDL	Regulation	Sample				
				S1 (1/2B) 2402215-01	S2 (2/2) 2402215-02	S3 (3/3) 2402215-03	S4 (4/2A) 2402215-04	S5 (1/1B) 2402215-05
Sample Date (m/d/y)			Reg 406/19-Table 3.1 Residential/Parkland	01/10/2024 11:00 AM	01/10/2024 11:00 AM	01/10/2024 11:00 AM	01/10/2024 11:00 AM	01/10/2024 11:00 AM
Physical Characteristics								
% Solids	% by Wt.	0.1		84.0	83.3	89.3	90.9	90.7
mSPLP Leachate Metals								
Antimony	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Arsenic	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Barium	ug/L	1.0		N/A	N/A	N/A	N/A	7.5
Beryllium	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Boron	ug/L	10.0		N/A	N/A	N/A	N/A	16.2
Cadmium	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Chromium	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Cobalt	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Copper	ug/L	0.5		N/A	N/A	N/A	N/A	3.4
Lead	ug/L	0.2		N/A	N/A	N/A	N/A	0.7
Molybdenum	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Nickel	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Selenium	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Silver	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Thallium	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Uranium	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Vanadium	ug/L	0.5		N/A	N/A	N/A	N/A	13.0
Zinc	ug/L	5.0		N/A	N/A	N/A	N/A	<5
mSPLP Leachate VOCs								
Bromomethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Carbon Tetrachloride	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Chloroform	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichlorobenzene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Ethylene dibromide (dibromoethane	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
1,4-Dichlorobenzene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichloroethane	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
1,1-Dichloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1-Dichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
cis-1,2-Dichloroethylene	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
trans-1,2-Dichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichloropropane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
cis-1,3-Dichloropropylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
trans-1,3-Dichloropropylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,3-Dichloropropene, total	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,1,2-Tetrachloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,2,2-Tetrachloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Tetrachloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,2-Trichloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Trichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
General Inorganics								
SAR	N/A	0.01	5	3.13	4.03	1.00	6.12	N/A
Conductivity	mS/cm	0.005	0.7	0.584	0.925	0.188	1.07	N/A
Cyanide, free	ug/g dry	0.03	0.051	<0.03	<0.03	<0.03	<0.03	N/A
pH	pH Units	0.05	5	9.41	8.04	7.92	10.59	N/A
Metals								
Antimony	ug/g dry	1.0	7.5	<1	<1	<1	<1	N/A
Arsenic	ug/g dry	1.0	18	2.6	2.4	1.3	2.4	N/A
Barium	ug/g dry	1.0	390	53.3	41.7	13.5	39.2	N/A
Beryllium	ug/g dry	0.5	4	<0.5	<0.5	<0.5	<0.5	N/A
Boron, available	ug/g dry	0.5	1.5	<0.5	<0.5	<0.5	<0.5	N/A
Boron	ug/g dry	5.0	120	<5	<5	<5	5.2	N/A
Cadmium	ug/g dry	0.5	1.2	<0.5	<0.5	<0.5	<0.5	N/A
Chromium (VI)	ug/g dry	0.2	8	<0.2	<0.2	<0.2	0.2	N/A
Chromium	ug/g dry	5.0	160	14.1	14.0	6.0	11.4	N/A
Cobalt	ug/g dry	1.0	22	4.4	4.3	1.6	3.8	N/A
Copper	ug/g dry	5.0	140	9.5	8.2	<5	8.1	N/A
Lead	ug/g dry	1.0	120	9.4	8.9	2.3	8.0	N/A
Mercury	ug/g dry	0.1	0.27	<0.1	<0.1	<0.1	<0.1	N/A
Molybdenum	ug/g dry	1.0	6.9	<1	<1	<1	<1	N/A
Nickel	ug/g dry	5.0	100	9.7	8.7	<5	8.2	N/A
Selenium	ug/g dry	1.0	2.4	<1	<1	<1	<1	N/A
Silver	ug/g dry	0.3	20	<0.3	<0.3	<0.3	<0.3	N/A
Thallium	ug/g dry	1.0	1	<1	<1	<1	<1	N/A
Uranium	ug/g dry	1.0	23	<1	<1	<1	<1	N/A
Vanadium	ug/g dry	10.0	86	20.5	22.8	13.7	19.7	N/A
Zinc	ug/g dry	20.0	340	40.4	30.1	<20	25.4	N/A
Volatiles								
Benzene	ug/g dry	0.02	0.02	<0.02	<0.02	<0.02	<0.02	N/A
Ethylbenzene	ug/g dry	0.05	1.9	<0.05	<0.05	<0.05	<0.05	N/A
Toluene	ug/g dry	0.05	0.99	<0.05	<0.05	<0.05	<0.05	N/A
m/p-Xylene	ug/g dry	0.05		<0.05	<0.05	<0.05	<0.05	N/A
o-Xylene	ug/g dry	0.05		<0.05	<0.05	<0.05	<0.05	N/A
Xylenes, total	ug/g dry	0.05	0.9	<0.05	<0.05	<0.05	<0.05	N/A
Hydrocarbons								
F1 PHCs (C6-C10)	ug/g dry	7	25	<7	<7	<7	<7	N/A
F2 PHCs (C10-C16)	ug/g dry	4	10	<4	<4	<4	<4	N/A
F3 PHCs (C16-C34)	ug/g dry	8	300	54	50	15	264	N/A
F4 PHCs (C34-C50)	ug/g dry	6	2800	<6	<6	<6	904	N/A
F4G-sg PHCs (gravimetric)	ug/g dry	50	2800	N/A	N/A	N/A	2600	N/A

TABLE 1		CLIENT: Forward Engineering & Associates Inc.						
PARACEL LABORATORIES LTD.		ATTENTION: George Semaan						
WORKORDER: 2402215		PROJECT: 6465-A						
REPORT DATE: 01/17/2024		REFERENCE: Standing Offer - ENV						
Parameter	Units	MDL	Regulation	Sample				
				S1 (1/2B) 2402215-01	S2 (2/2) 2402215-02	S3 (3/3) 2402215-03	S4 (4/2A) 2402215-04	S5 (1/1B) 2402215-05
Sample Date (m/d/y)			Reg 406/19-Table 3.1 Industrial/Commercial	01/10/2024 11:00 AM	01/10/2024 11:00 AM	01/10/2024 11:00 AM	01/10/2024 11:00 AM	01/10/2024 11:00 AM
Physical Characteristics								
% Solids	% by Wt.	0.1		84.0	83.3	89.3	90.9	90.7
mSPLP Leachate Metals								
Antimony	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Arsenic	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Barium	ug/L	1.0		N/A	N/A	N/A	N/A	7.5
Beryllium	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Boron	ug/L	10.0		N/A	N/A	N/A	N/A	16.2
Cadmium	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Chromium	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Cobalt	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Copper	ug/L	0.5		N/A	N/A	N/A	N/A	3.4
Lead	ug/L	0.2		N/A	N/A	N/A	N/A	0.7
Molybdenum	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Nickel	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Selenium	ug/L	1.0		N/A	N/A	N/A	N/A	<1
Silver	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Thallium	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Uranium	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Vanadium	ug/L	0.5		N/A	N/A	N/A	N/A	13.0
Zinc	ug/L	5.0		N/A	N/A	N/A	N/A	<5
mSPLP Leachate VOCs								
Bromomethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Carbon Tetrachloride	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
Chloroform	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichlorobenzene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Ethylene dibromide (dibromoethane	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
1,4-Dichlorobenzene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichloroethane	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
1,1-Dichloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1-Dichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
cis-1,2-Dichloroethylene	ug/L	0.2		N/A	N/A	N/A	N/A	<0.2
trans-1,2-Dichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,2-Dichloropropane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
cis-1,3-Dichloropropylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
trans-1,3-Dichloropropylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,3-Dichloropropene, total	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,1,2-Tetrachloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,2,2-Tetrachloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Tetrachloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
1,1,2-Trichloroethane	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
Trichloroethylene	ug/L	0.5		N/A	N/A	N/A	N/A	<0.5
General Inorganics								
SAR	N/A	0.01	12	3.13	4.03	1.00	6.12	N/A
Conductivity	mS/cm	0.005	1.4	0.584	0.925	0.188	1.07	N/A
Cyanide, free	ug/g dry	0.03	0.051	<0.03	<0.03	<0.03	<0.03	N/A
pH	pH Units	0.05	5	9.41	8.04	7.92	10.59	N/A
Metals								
Antimony	ug/g dry	1.0	40	<1	<1	<1	<1	N/A
Arsenic	ug/g dry	1.0	18	2.6	2.4	1.3	2.4	N/A
Barium	ug/g dry	1.0	670	53.3	41.7	13.5	39.2	N/A
Beryllium	ug/g dry	0.5	8	<0.5	<0.5	<0.5	<0.5	N/A
Boron, available	ug/g dry	0.5	2	<0.5	<0.5	<0.5	<0.5	N/A
Boron	ug/g dry	5.0	120	<5	<5	<5	5.2	N/A
Cadmium	ug/g dry	0.5	1.9	<0.5	<0.5	<0.5	<0.5	N/A
Chromium (VI)	ug/g dry	0.2	8	<0.2	<0.2	<0.2	0.2	N/A
Chromium	ug/g dry	5.0	160	14.1	14.0	6.0	11.4	N/A
Cobalt	ug/g dry	1.0	80	4.4	4.3	1.6	3.8	N/A
Copper	ug/g dry	5.0	230	9.5	8.2	<5	8.1	N/A
Lead	ug/g dry	1.0	120	9.4	8.9	2.3	8.0	N/A
Mercury	ug/g dry	0.1	0.27	<0.1	<0.1	<0.1	<0.1	N/A
Molybdenum	ug/g dry	1.0	40	<1	<1	<1	<1	N/A
Nickel	ug/g dry	5.0	270	9.7	8.7	<5	8.2	N/A
Selenium	ug/g dry	1.0	5.5	<1	<1	<1	<1	N/A
Silver	ug/g dry	0.3	40	<0.3	<0.3	<0.3	<0.3	N/A
Thallium	ug/g dry	1.0	3.3	<1	<1	<1	<1	N/A
Uranium	ug/g dry	1.0	33	<1	<1	<1	<1	N/A
Vanadium	ug/g dry	10.0	86	20.5	22.8	13.7	19.7	N/A
Zinc	ug/g dry	20.0	340	40.4	30.1	<20	25.4	N/A
Volatiles								
Benzene	ug/g dry	0.02	0.034	<0.02	<0.02	<0.02	<0.02	N/A
Ethylbenzene	ug/g dry	0.05	1.9	<0.05	<0.05	<0.05	<0.05	N/A
Toluene	ug/g dry	0.05	7.8	<0.05	<0.05	<0.05	<0.05	N/A
m/p-Xylene	ug/g dry	0.05		<0.05	<0.05	<0.05	<0.05	N/A
o-Xylene	ug/g dry	0.05		<0.05	<0.05	<0.05	<0.05	N/A
Xylenes, total	ug/g dry	0.05	3	<0.05	<0.05	<0.05	<0.05	N/A
Hydrocarbons								
F1 PHCs (C6-C10)	ug/g dry	7	25	<7	<7	<7	<7	N/A
F2 PHCs (C10-C16)	ug/g dry	4	26	<4	<4	<4	<4	N/A
F3 PHCs (C16-C34)	ug/g dry	8	1700	54	50	15	264	N/A
F4 PHCs (C34-C50)	ug/g dry	6	3300	<6	<6	<6	904	N/A
F4G-sg PHCs (gravimetric)	ug/g dry	50	3300	N/A	N/A	N/A	2600	N/A

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Certificate of Analysis

Forward Engineering & Associates Inc.

244 Brockport Dr., Unit 15
Toronto, ON M9W 6X9
Attn: George Semaan

Client PO:
Project: 6465-A
Custody:

Report Date: 17-Jan-2024
Order Date: 10-Jan-2024

Order #: 2402215

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

Paracel ID	Client ID
2402215-01	S1 (1/2B)
2402215-02	S2 (2/2)
2402215-03	S3 (3/3)
2402215-04	S4 (4/2A)
2402215-05	S5 (1/1B)

Approved By:

Milan Ralitsch, PhD
Senior Technical Manager

Certificate of Analysis

Report Date: 17-Jan-2024

Client: Forward Engineering & Associates Inc.

Order Date: 10-Jan-2024

Client PO:

Project Description: 6465-A

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.8 - ICP-MS	17-Jan-24	17-Jan-24
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	12-Jan-24	15-Jan-24
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	15-Jan-24	15-Jan-24
Conductivity	MOE E3138 - probe @25 °C, water ext	17-Jan-24	17-Jan-24
Cyanide, free	MOE E3015 - Auto Colour, water extraction	12-Jan-24	12-Jan-24
Mercury by CVAA	EPA 7471B - CVAA, digestion	16-Jan-24	16-Jan-24
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	15-Jan-24	16-Jan-24
PHC F1	CWS Tier 1 - P&T GC-FID	12-Jan-24	15-Jan-24
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	15-Jan-24	16-Jan-24
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	17-Jan-24	17-Jan-24
REG 153: PHC F4(g)	CWS Tier 1 - Extraction Gravimetric	16-Jan-24	16-Jan-24
REG 406: Leachate - Metals by ICP-MS	mSPLP EPA 6020 - Digestion - ICP-MS	15-Jan-24	15-Jan-24
REG 406: Leachate - VOCs	mSPLP EPA 624 - P&T GC-MS	15-Jan-24	16-Jan-24
SAR	Calculated	17-Jan-24	17-Jan-24
Solids, %	CWS Tier 1 - Gravimetric	15-Jan-24	16-Jan-24

Certificate of Analysis

Report Date: 17-Jan-2024

Client: **Forward Engineering & Associates Inc.**

Order Date: 10-Jan-2024

Client PO:

Project Description: 6465-A

	Client ID:	S1 (1/2B)	S2 (2/2)	S3 (3/3)	S4 (4/2A)
	Sample Date:	10-Jan-24 11:00	10-Jan-24 11:00	10-Jan-24 11:00	10-Jan-24 11:00
	Sample ID:	2402215-01	2402215-02	2402215-03	2402215-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	84.0	83.3	89.3	90.9
General Inorganics					
SAR	0.01 N/A	3.13	4.03	1.00	6.12
Conductivity	0.005 mS/cm	0.584	0.925	0.188	1.07
Cyanide, free	0.03 ug/g dry	<0.03	<0.03	<0.03	<0.03
pH	0.05 pH Units	9.41	8.04	7.92	10.59
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	2.6	2.4	1.3	2.4
Barium	1.0 ug/g dry	53.3	41.7	13.5	39.2
Beryllium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Boron	5.0 ug/g dry	<5.0	<5.0	<5.0	5.2
Boron, available	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	5.0 ug/g dry	14.1	14.0	6.0	11.4
Chromium (VI)	0.2 ug/g dry	<0.2	<0.2	<0.2	0.2
Cobalt	1.0 ug/g dry	4.4	4.3	1.6	3.8
Copper	5.0 ug/g dry	9.5	8.2	<5.0	8.1
Lead	1.0 ug/g dry	9.4	8.9	2.3	8.0
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Molybdenum	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Nickel	5.0 ug/g dry	9.7	8.7	<5.0	8.2
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.3 ug/g dry	<0.3	<0.3	<0.3	<0.3
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	10.0 ug/g dry	20.5	22.8	13.7	19.7
Zinc	20.0 ug/g dry	40.4	30.1	<20.0	25.4
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Toluene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
o-Xylene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05

Certificate of Analysis

Report Date: 17-Jan-2024

Client: **Forward Engineering & Associates Inc.**

Order Date: 10-Jan-2024

Client PO:

Project Description: 6465-A

	Client ID:	S1 (1/2B)	S2 (2/2)	S3 (3/3)	S4 (4/2A)
	Sample Date:	10-Jan-24 11:00	10-Jan-24 11:00	10-Jan-24 11:00	10-Jan-24 11:00
	Sample ID:	2402215-01	2402215-02	2402215-03	2402215-04
	MDL/Units	Soil	Soil	Soil	Soil
Toluene-d8	Surrogate	111%	111%	110%	109%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	54	50	15	264
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	904
F4G-sg PHCs (gravimetric)	50 ug/g dry	-	-	-	2600

Certificate of Analysis

Client: **Forward Engineering & Associates Inc.**

Client PO:

Report Date: 17-Jan-2024

Order Date: 10-Jan-2024

Project Description: 6465-A

	Client ID:	S5 (1/1B)	-	-	-
	Sample Date:	10-Jan-24 11:00	-	-	-
	Sample ID:	2402215-05	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	90.7	-	-	-
mSPLP Leachate Metals					
Antimony	0.5 ug/L	<0.5	-	-	-
Arsenic	1.0 ug/L	<1.0	-	-	-
Barium	1.0 ug/L	7.5	-	-	-
Beryllium	0.5 ug/L	<0.5	-	-	-
Boron	10.0 ug/L	16.2	-	-	-
Cadmium	0.2 ug/L	<0.2	-	-	-
Chromium	1.0 ug/L	<1.0	-	-	-
Cobalt	0.5 ug/L	<0.5	-	-	-
Copper	0.5 ug/L	3.4	-	-	-
Lead	0.2 ug/L	0.7	-	-	-
Molybdenum	0.5 ug/L	<0.5	-	-	-
Nickel	1.0 ug/L	<1.0	-	-	-
Selenium	1.0 ug/L	<1.0	-	-	-
Silver	0.2 ug/L	<0.2	-	-	-
Thallium	0.5 ug/L	<0.5	-	-	-
Uranium	0.2 ug/L	<0.2	-	-	-
Vanadium	0.5 ug/L	13.0	-	-	-
Zinc	5.0 ug/L	<5.0	-	-	-
mSPLP Leachate VOCs					
Bromomethane	0.5 ug/L	<0.5	-	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	-	-	-
Chloroform	0.5 ug/L	<0.5	-	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
Ethylene dibromide (dibromoethane, 1	0.2 ug/L	<0.2	-	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethane	0.2 ug/L	<0.2	-	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
cis-1,2-Dichloroethylene	0.2 ug/L	<0.2	-	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-

Certificate of Analysis

Client: Forward Engineering & Associates Inc.

Client PO:

Report Date: 17-Jan-2024

Order Date: 10-Jan-2024

Project Description: 6465-A

	Client ID:	S5 (1/1B)	-	-	-
	Sample Date:	10-Jan-24 11:00	-	-	-
	Sample ID:	2402215-05	-	-	-
	MDL/Units	Soil	-	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	-	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	-	-
Trichloroethylene	0.5 ug/L	<0.5	-	-	-
4-Bromofluorobenzene	Surrogate	88.8%	-	-	-
Dibromofluoromethane	Surrogate	67.6%	-	-	-
Toluene-d8	Surrogate	114%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
SAR	ND	0.01	N/A						
Conductivity	ND	0.005	mS/cm						
Cyanide, free	ND	0.03	ug/g						
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
F4G-sg PHCs (gravimetric)	ND	50	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
mSPLP Leachate Metals									
Antimony	ND	0.5	ug/L						
Arsenic	ND	1.0	ug/L						
Barium	ND	1.0	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10.0	ug/L						
Cadmium	ND	0.2	ug/L						
Chromium	ND	1.0	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.2	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1.0	ug/L						
Selenium	ND	1.0	ug/L						
Silver	ND	0.2	ug/L						
Thallium	ND	0.5	ug/L						
Uranium	ND	0.2	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5.0	ug/L						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: Toluene-d8	*8.54*		*ug/g*		*106*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
SAR	3.94	0.01	N/A	4.03			2.3	30	
Conductivity	0.906	0.005	mS/cm	0.925			2.0	5	
Cyanide, free	ND	0.03	ug/g	ND			NC	35	
pH	9.45	0.05	pH Units	9.41			0.4	10	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g	ND			NC	30	
F4 PHCs (C34-C50)	23	6	ug/g	ND			NC	30	
F4G-sg PHCs (gravimetric)	1210	50	ug/g	1190			1.8	30	
Metals									
Antimony	ND	1.0	ug/g	ND			NC	30	
Arsenic	3.1	1.0	ug/g	2.6			18.3	30	
Barium	67.2	1.0	ug/g	53.3			23.2	30	
Beryllium	ND	0.5	ug/g	ND			NC	30	
Boron, available	ND	0.5	ug/g	ND			NC	35	
Boron	5.5	5.0	ug/g	ND			NC	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium (VI)	ND	0.2	ug/g	ND			NC	35	
Chromium	16.8	5.0	ug/g	14.1			18.0	30	
Cobalt	5.2	1.0	ug/g	4.4			16.0	30	
Copper	11.6	5.0	ug/g	9.5			19.9	30	
Lead	12.3	1.0	ug/g	9.4			26.8	30	
Mercury	ND	0.1	ug/g	ND			NC	30	
Molybdenum	ND	1.0	ug/g	ND			NC	30	
Nickel	11.5	5.0	ug/g	9.7			17.8	30	
Selenium	ND	1.0	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1.0	ug/g	ND			NC	30	
Uranium	ND	1.0	ug/g	ND			NC	30	
Vanadium	24.0	10.0	ug/g	20.5			15.8	30	
Zinc	48.8	20.0	ug/g	40.4			18.8	30	
mSPLP Leachate Metals									
Antimony	ND	0.5	ug/L	ND			NC	50	
Arsenic	ND	1.0	ug/L	ND			NC	50	
Barium	2.60	1.0	ug/L	2.62			0.8	50	
Beryllium	ND	0.5	ug/L	ND			NC	50	
Boron	ND	10.0	ug/L	ND			NC	50	
Cadmium	ND	0.2	ug/L	ND			NC	50	
Chromium	ND	1.0	ug/L	ND			NC	50	
Cobalt	ND	0.5	ug/L	ND			NC	50	
Copper	0.67	0.5	ug/L	0.69			4.1	50	
Lead	ND	0.2	ug/L	ND			NC	50	
Molybdenum	5.24	0.5	ug/L	5.63			7.3	50	
Nickel	ND	1.0	ug/L	ND			NC	50	
Selenium	ND	1.0	ug/L	ND			NC	50	
Silver	ND	0.2	ug/L	ND			NC	50	
Thallium	ND	0.5	ug/L	ND			NC	50	
Uranium	ND	0.2	ug/L	ND			NC	50	
Vanadium	0.91	0.5	ug/L	1.01			9.8	50	
Zinc	ND	5.0	ug/L	ND			NC	50	
Physical Characteristics									
% Solids	94.2	0.1	% by Wt.	93.8			0.4	25	
Volatiles									
Benzene	ND	0.02	ug/g	ND			NC	50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: Toluene-d8	*8.57*		*ug/g*		*109*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Cyanide, free	0.349	0.03	ug/g	ND	97.8	70-130			
Hydrocarbons									
F1 PHCs (C6-C10)	62	7	ug/g	ND	87.8	80-120			
F2 PHCs (C10-C16)	108	4	ug/g	ND	118	60-140			
F3 PHCs (C16-C34)	264	8	ug/g	ND	129	60-140			
F4 PHCs (C34-C50)	186	6	ug/g	ND	126	60-140			
F4G-sg PHCs (gravimetric)	1140	50	ug/g	ND	114	80-120			
Metals									
Antimony	43.9	1.0	ug/g	ND	87.5	70-130			
Arsenic	50.2	1.0	ug/g	1.0	98.4	70-130			
Barium	64.7	1.0	ug/g	21.3	86.8	70-130			
Beryllium	46.3	0.5	ug/g	ND	92.3	70-130			
Boron, available	4.73	0.5	ug/g	ND	94.6	70-122			
Boron	44.2	5.0	ug/g	ND	85.1	70-130			
Cadmium	44.4	0.5	ug/g	ND	88.6	70-130			
Chromium (VI)	5.2	0.2	ug/g	ND	87.5	70-130			
Chromium	54.7	5.0	ug/g	5.6	98.1	70-130			
Cobalt	50.4	1.0	ug/g	1.8	97.2	70-130			
Copper	50.9	5.0	ug/g	ND	94.3	70-130			
Lead	53.3	1.0	ug/g	3.7	99.0	70-130			
Mercury	1.60	0.1	ug/g	ND	107	70-130			
Molybdenum	48.3	1.0	ug/g	ND	96.4	70-130			
Nickel	53.5	5.0	ug/g	ND	99.3	70-130			
Selenium	47.4	1.0	ug/g	ND	94.6	70-130			
Silver	42.5	0.3	ug/g	ND	84.9	70-130			
Thallium	48.9	1.0	ug/g	ND	97.7	70-130			
Uranium	48.7	1.0	ug/g	ND	97.1	70-130			
Vanadium	56.5	10.0	ug/g	ND	96.5	70-130			
Zinc	63.9	20.0	ug/g	ND	95.5	70-130			
mSPLP Leachate Metals									
Antimony	62.6	0.5	ug/L	ND	125	70-130			
Arsenic	52.4	1.0	ug/L	ND	104	70-130			
Barium	54.9	1.0	ug/L	2.62	105	70-130			
Beryllium	51.9	0.5	ug/L	ND	104	70-130			
Boron	64.8	10.0	ug/L	ND	110	70-130			
Cadmium	51.6	0.2	ug/L	ND	103	70-130			
Chromium	52.3	1.0	ug/L	ND	103	70-130			
Cobalt	50.9	0.5	ug/L	ND	102	70-130			
Copper	53.2	0.5	ug/L	0.69	105	70-130			
Lead	49.3	0.2	ug/L	ND	98.4	70-130			
Molybdenum	62.1	0.5	ug/L	5.63	113	70-130			
Nickel	52.1	1.0	ug/L	ND	104	70-130			
Selenium	53.9	1.0	ug/L	ND	107	70-130			
Silver	47.2	0.2	ug/L	ND	94.4	70-130			
Thallium	50.9	0.5	ug/L	ND	102	70-130			
Uranium	53.7	0.2	ug/L	ND	107	70-130			
Vanadium	53.1	0.5	ug/L	1.01	104	70-130			
Zinc	52.8	5.0	ug/L	ND	100	70-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
mSPLP Leachate VOCs									
Bromomethane	36.5	0.5	ug/L	ND	90.8	50-140			
Carbon Tetrachloride	38.7	0.2	ug/L	ND	96.2	50-140			
Chloroform	42.3	0.5	ug/L	ND	105	50-140			
1,2-Dichlorobenzene	40.6	0.5	ug/L	ND	101	50-140			
Ethylene dibromide (dibromoethane, 1,2	38.5	0.2	ug/L	ND	95.7	50-140			
1,4-Dichlorobenzene	38.4	0.5	ug/L	ND	95.0	50-140			
1,2-Dichloroethane	39.6	0.2	ug/L	ND	97.9	50-140			
1,1-Dichloroethane	39.5	0.5	ug/L	ND	98.4	50-140			
1,1-Dichloroethylene	37.9	0.5	ug/L	ND	94.4	50-140			
cis-1,2-Dichloroethylene	38.3	0.2	ug/L	ND	95.7	50-140			
trans-1,2-Dichloroethylene	36.8	0.5	ug/L	ND	91.5	50-140			
1,2-Dichloropropane	39.7	0.5	ug/L	ND	98.3	50-140			
cis-1,3-Dichloropropylene	37.7	0.5	ug/L	ND	93.8	50-140			
trans-1,3-Dichloropropylene	40.1	0.5	ug/L	ND	99.8	50-140			
1,1,1,2-Tetrachloroethane	38.5	0.5	ug/L	ND	95.8	50-140			
1,1,2,2-Tetrachloroethane	30.2	0.5	ug/L	ND	75.2	50-140			
Tetrachloroethylene	39.5	0.5	ug/L	ND	98.2	50-140			
1,1,2-Trichloroethane	40.3	0.5	ug/L	ND	100	50-140			
Trichloroethylene	44.7	0.5	ug/L	ND	111	50-140			
Surrogate: 4-Bromofluorobenzene	*81.4*		*ug/L*		*101*	*50-140*			
Surrogate: Dibromofluoromethane	*92.6*		*ug/L*		*115*	*50-140*			
Surrogate: Toluene-d8	*80.9*		*ug/L*		*101*	*50-140*			
Volatiles									
Benzene	3.82	0.02	ug/g	ND	95.1	60-130			
Ethylbenzene	3.74	0.05	ug/g	ND	93.2	60-130			
Toluene	3.71	0.05	ug/g	ND	92.8	60-130			
m,p-Xylenes	7.34	0.05	ug/g	ND	91.5	60-130			
o-Xylene	3.81	0.05	ug/g	ND	94.8	60-130			
Surrogate: Toluene-d8	*7.93*		*ug/g*		*98.7*	*50-140*			

Qualifier Notes:

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL

Paracel ID: 2402215

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2402215	

Client Name: Forward Engineering & Associates Inc.	Project Ref: 6465 - A
Contact Name: George Semaan	Quote #:
Address: 244 Brockport Dr., Unit 15, Toronto ON M9W 6X9	PO #:
Telephone: (416) 798-3500	E-mail: george@forwardengineering.ca

Page 1 of 1

Turnaround Time

☐ 1 day ☐ 3 day ☐ 2 day ☑ Regular

Date Required:

☐ REG 153/04 ☑ REG 406/19

Other Regulation: ☐ REG 558 ☐ PWQO ☐ CCME ☐ MISA ☐ SU - Sani ☐ SU - Storm ☐ Mun: ☐ Other:

☐ Table 1 ☐ Res/Park ☐ Med/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ Table

For RSC: ☐ Yes ☐ No

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	Metals & Inorganics	Leachate (on SPLP) Metals	Leachate (on SPLP) VOCs		
1	S1 (1/2B)	S		2	JAN 10/2024	11 AM	✓							✓				
2	S2 (2/2)	S		2	"	"	✓							✓				
3	S3 (3/3)	S		2	"	"	✓							✓				
4	S4 (4/2A)	S		2	"	"	✓							✓				
5	S5 [redacted] (1/1B)	S		1	"	"									✓	✓		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Rabbex

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab: C-Ply	Verified By: C-Ply
Relinquished By (Print): PABLO RIOS	Date/Time: 10-JAN-24, 15:05	Date/Time: 01/11/24 12:50	Date/Time: 01/11/24 14:00
Date/Time: JAN. 10/2024 12pm	Temperature: 12.4 °C	Temperature: 8.8	pH Verified: ☐ By:

PART 1 - GENERAL

1.1 **Product Quality**

.1 Products supplied for work shall be new.

.2 Materials used for temporary facilities are not required to be new, provided they are structurally sound and in suitable and safe operating condition.

1.2 **Standards**

.1 Where a standard has been adopted by these Specifications, incorporate minimum requirements of such standard into the Work. Where requirements of Specifications are more stringent than those of the standard, follow more stringent requirements.

1.3 **Certification**

.1 Building materials, components and elements specified without the use of trade or proprietary names shall meet requirements specified.

.2 If requested by Consultant, submit evidence of meeting requirements specified. Evidence shall consist of certification based on tests carried out by an independent testing agency.

.3 Certification based on previous tests for same materials, components or elements is acceptable. Certification shall be in form of written test reports prepared by testing agency.

1.4 **Availability & Substitutions**

.1 Products which are specified by their proprietary names or by part or catalogue number form the basis for Contract. No substitutes for these may be used without Consultant's approval in writing.

.2 Where it is found that specified materials have become unavailable for incorporating into work, notify Consultant in writing immediately of proposed substitution.

.3 Proposed substitution will be top quality products considered by Consultant to be of equal quality and value to that specified, and suitable for purpose intended.

.4 Products proposed as substitutions, and which are considered by Consultant to be suitable for purpose intended, but which are in his opinion of lesser value and quality than those specified shall only be accepted as substitution if reasonable credits are allowed for their use.

.5 In order to substantiate equivalency of proposed materials, products or processes, submit samples, printed product descriptions, test data, installation instructions, standards, certification, sample, guarantee/warranty forms, list of successful projects incorporating such proposals, and similar information requested by Consultant.

.6 Whenever a substitute is proposed, any change to contract price as a result of acceptance of proposed product shall include adjustments to adjacent structure or space in order to accept minor differences in size or weight between proposed items and corresponding specified items.

1.4 **Availability & Substitutions (Cont'd)**

.7 Prevent substitution or request for substitution from delaying construction progress.

.8 Requests for substitution resulting from failure to place orders in time will not be entertained. Be responsible for ordering products in time to ensure prompt delivery; bear all costs for failure to comply with these requirements.

.9 Upon Consultant's request submit copies of material and equipment purchase orders.

.10 Substitutions during the bidding period will not be permitted.

1.5 **Product Delivery, Handling & Storage**

.1 Suitably pack, crate and protect products during transportation to site to preserve their quality and fitness for the purpose intended.

.2 Store products in original, undamaged condition with manufacturer's labels and seals intact until they are being incorporated into completed work.

.3 Handle and store materials in accordance with manufacturer's and supplier's recommendations to ensure preservation of quality, appearance and fitness for work.

.4 Protect materials from damage by extreme temperatures or exposure to the weather.

.5 Arrange materials so as to facilitate prompt inspection, and remove faulty, damaged or rejected materials immediately from site.

1.6 **Trademarks & Labels**

.1 Trademarks and labels shall not be visible in finished work except in mechanical, electrical, communications equipment and elevator machine rooms, to identify equipment, for maintenance and replacement.

.2 Outside of such areas, exposed lettering, numerals and graphic symbols on equipment, fittings, fixtures, components and accessories, shall be subject to Consultant's specific direction and approval regarding placement size, style, colour and other design features. Remove and replace such lettering etc., for which such direction, etc. has not been obtained.

.3 Except as provided in paragraph 1.6.1, locate trademarks and labels on concealed or inconspicuous surfaces or remove by grinding if necessary or paint out where surface painted, if located conspicuously.

1.7 **Product Delivery Schedule**

.1 Contractor is responsible to ensure suppliers or distributors of materials specified or alternatives accepted, which he intends to use, have materials on site when required. Contractor shall obtain confirmed delivery dates from the suppliers.

.2 Contractor shall contact Consultant immediately upon receipt of information indicating materials or items, will not be available on time, in

accordance with original schedule, and similarly it shall be the responsibility of all Contractors and suppliers to so inform the Consultant.

1.7 **Product Delivery Schedule (Cont'd)**

.3 Consultant reserves the right to receive from the Contractor, upon request, copies of actual purchase or work orders of any materials or products to be supplied for the Work.

.4 If materials and products have not been placed on order, the Consultant may instruct that such materials and products be placed on order, if direct communication, in writing, from the manufacturer or prime suppliers is available indicating delivery of said materials and products will not be made in sufficient time for the orderly completion of the Work.

.5 The above, in no way releases the Contractor and suppliers of their responsibility for ensuring timely ordering of materials and items required, including the necessary expediting, to complete the Work as scheduled in accordance with the Contract Documents.

1.8 **Workmanship**

.1 All work shall be carried out in accordance with the best trade practice, by mechanics skilled in the type of work concerned.

.2 Products, materials, systems and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the applicable manufacturer's printed directions.

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

End of Section

PART 1 – GENERAL

1.1 **Take-Over Procedures**

.1 Take over procedures shall be in accordance with **Conseil Scolaire Catholique MonAvenir** procedures.

.2 Contractors shall familiarize themselves with this document and follow it when handing over the building to the Owner.

1.2 **Operating & Maintenance Manuals**

.1 Provide three copies of operating and maintenance data, prepared in Portable Document Format (PDF) format, and on 215 x 280mm sheets in printed or typewritten form, contained in 3-ring binders with soft vinyl covers for materials and equipment which require special maintenance or operating procedures.

.2 Include the following material in each manual:

.1 Title sheet labelled "Operating and Maintenance Data" and listing project name, date, volume number, if applicable and names and addresses of Contractor, mechanical and electrical Contractors, and Consultant.

.2 List of contents. If more than one volume is required, provide a cross-reference contents page at front of each volume.

.3 Complete list of Contractors and suppliers, their addresses and telephone numbers. Provide 24 hour emergency telephone number for such Contractors as Plumbing, Electrical, Heating etc.

.4 Copy of finish hardware list, complete with all amendments and revisions and lock manufacturer's descriptive and service literature.

.5 Schedule of paints and coatings. Include sufficient explanation to fully identify each surface with the applicable paint or coating used. Enclose copy of colour schedule.

.6 Maintenance instructions for finished surfaces.

.7 Brochures, cuts of equipment and fixtures.

.8 Operating and maintenance instructions for equipment.

.9 Submit copies of letters from manufacturers of equipment and systems indicating their technical representatives have inspected and tested systems and are satisfied with methods of installation, connection and operations.

.10 These letters shall state names of persons present at testing, methods used and list of functions performed.

1.2 **Operating & Maintenance Manuals (Cont'd**

.11 Complete set of reviewed shop drawings of architectural, structural, mechanical, electrical, Civil and Landscape items, folded to 215 x 280mm size, contained in heavy duty manila envelopes, numbered and labelled. Follow specification format with no more than one Section per envelope.

.12 Electronic copy, in PDF format, of all documentation listed above saved to a computer disk (CD).

1.3 **Substantial Performance**

1 Prior to requesting a Substantial Performance deficiency inspection submit 3 copies of Operating and Maintenance Manuals for Consultants approval.

.2 Advise Consultant in writing, when project has been substantially completed. If Consultant agrees this stage has been reached, prepare a complete list of deficiencies and submit five copies of this list to Consultant.

.3 On receipt of the deficiency list in a satisfactory form, the Consultant, the Contractor and his project superintendent, the mechanical and electrical Contractor and their project superintendents, and the Owner if deemed desirable, will carry out an inspection of the Work.

.4 Add to the deficiency list, in accordance with Consultant's directions, additional deficiencies which are identified during inspection and reissue updated deficiency list to all concerned.

1.4 **Payment of Basic Holdback**

.1 Prior to the release of lien holdback provide one copy of the following by the Contractor.

.1 Statutory Declaration or Declaration of Last Supply.
.2 Worker's Compensation Board "Certificate of Clearance".

.2 Arrange and pay for services of service engineers and other manufacturers representatives required for instruction.

1.5 **Maintenance Materials**

.1 Deliver to site, unload and store where directed, maintenance materials as required elsewhere in these Specifications. Obtain receipt from Owner for delivered materials and submit copy of receipt.

.2 Package materials so that they are protected from damage and loss of essential properties.

.3 Label packaged materials for proper identification of content.

1.6 **Record Drawings**

.1 Upon completion of the work, prior to Total Performance, obtain an electronic computer disk copy of the drawings from the Consultant and record all AS-BUILT information compiled during construction on the electronic files. (AutoCAD Version 2006 is required)
Note: Electronic computer disk will be provided by Consultant at no additional cost to the General Contractor or the Owner.

.2 Quality of electronic information shall match that of original drawings.

.3 Submit one set of completed AS-BUILT documents to the Consultant for review. Documents will be returned to contractor with Consultant's comments. Revise content of documents as required prior to final submittal.

.4 Resubmit final electronic computer disk to the Consultant for inclusion in Owner's Operating and Maintenance manual.

1.7 **Total Performance**

.1 Prior to requesting a final inspection do the following:

.1 Submit maintenance materials.

.2 Submit a final request for payment incorporating all approved changes to the contract price.

.3 Upon completion of all items noted on the deficiency list, clean all areas, surfaces, and components affected by corrections and completion of deficient items.

.4 Ensure services, equipment and apparatus are properly tested and adjusted.

.2 After deficiencies have been corrected, submit a written request to the Consultant for a final inspection. This inspection will be carried out by the same parties involved in the Substantial Performance deficiency inspection.

3 If all deficiencies have not been corrected, in the opinion the Consultant, a final deficiency list will be prepared in the same manner as specified herein for Substantial Performance Deficiency Inspection and inspection procedure repeated until all items have been completed to the satisfaction of the Consultant and or Owner.

1.8 **Partial Occupancy**

.1 Refer to Supplementary Conditions. In the event portions of the Work may be completed and occupied by the Owner prior to completion of the entire project, the inspection procedures set out above will be followed for these parts of the Work, and on final acceptance the Consultant will issue a written confirmation of acceptance. However, final certificates as such, and release of holdback monies, pertaining to such areas of the work, will not be issued but will be incorporated in the completion procedures for the entire project.

.2 The Owner also reserves the right to install furnishings and equipment in areas of the building that are substantially completed prior to the date of Substantial Performance providing it does not in the opinion of the Consultant interfere with the work of the Contract.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Be responsible for cleanliness of site and structures to satisfaction of Consultant. Maintain work in neat and orderly condition at all times.

.2 Periodically, or when directed by the Consultant, remove from site and legally dispose of rubbish and waste materials.

.3 Upon completion of work of each trade, each trade shall thoroughly clean their work and leave their work in a suitable condition acceptable to Consultant and to other trades requiring suitable condition.

.4 Burning or burying of rubbish and waste materials on site is not permitted.

.5 Use only cleaning materials recommended by manufacturer of surface to be cleaned.

.6 Use cleaning material only on surfaces recommended by cleaning material manufacturer.

1.2 **Cleaning During Construction**

.1 Remove debris, packaging and waste materials daily.

.2 Keep dust and dirt to an acceptable level, as directed.

.3 Remove oily rags, waste and other hazardous substances from premises at close of each day, or more often if required.

.4 Provide on site containers located within designated work site as required for collection of waste materials.

.5 Vacuum clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as needed basis until building is ready for Substantial Performance or Occupancy.

.6 Schedule cleaning operations so resulting dust and other contaminants will not fall on wet, newly painted surfaces.

1.3 **Final Cleaning**

.1 Prior to Substantial Performance, thoroughly clean all surfaces and components. Provide professional cleaning of all areas and surfaces to allow Owner to occupy without further cleaning.

.2 Remove grease, dust, dirt, stains, labels, fingerprints, smudges, and other foreign materials, from sight-exposed interior and exterior finished surfaces including glass and other polished surfaces.

.3 Clean glass, remove stickers and paint; leave glass in spotless, polished condition; use cleaning liquids only. Clean glass in exterior windows including the faces between the exterior glass and the interior glass in sull-sash double glazing.

.4 Clean and polish hardware.

1.3 **Final Cleaning (Cont'd)**

.5 Just prior to substantial performance, inspect floor drain to determine if they are clean, clear and functioning properly.

.6 Upon completion of project, prior to total performance, remove from site waste and surplus materials.

End of Section

1. GENERAL

1.1 Warranties shall be in accordance with General Conditions, as amended, and as follows:

.1 Warranties shall commence at date of Substantial Performance of the Work.

.2 Submit warranties for applicable items, signed by the applicable company responsible for each warranty.

.3 Submit warranties on form approved by Owner including, but not limited to, the following information:
- .1 Name and address of Project.
- .2 Warranty commencement date (date of Substantial Performance of the Work).
- .3 Duration of warranty.
- .4 Clear indication of what is being warranted and what remedial action will be taken under warranty.
- .5 Authorized signature and seal of company providing each warranty.

.4 Owner shall be named in manufacturer's Product warranties. Submit on relevant Product manufacturer's standard warranty or guarantee form.

2. EXTENDED OR SPECIAL WARRANTIES

2.1 Provide in writing, extended warranties having warranty periods greater than 2 year in duration.

2.2 Provide extended warranties for the stipulated Work and for duration's specified in each trade Section.

2.3 Wherever equipment manufacturers make available extended warranties/guarantees on parts and components of equipment, the Contractor shall be responsible for obtaining product extended warranties/guarantees on behalf of the Boards from the manufacturers.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1 Excavating, Backfilling and Grading: Section 02200

1.3 **Existing Conditions**

.1 Before commencing clearing, ensure by examination of site all possible factors concerning clearing are investigated, and the following are know in particular:

- .1 Methods and means available for material handling, disposal, storage and transportation.
- .2 Conformation and condition of ground surfaces.
- .3 Location and elevation of existing services to remain.
- .4 Location and/or limit of existing fences, pavement, trees and shrubs to remain.
- .5 Character, quality and quantity of growth on site.

1.4 **Protection**

.1 Protect public and private property adjacent to clearing performed by this Section. Make good and return property to original condition if damaged by clearing performed by this Section.

.2 Do not damage root systems of existing trees, plants, and shrubs which are to remain, and future landscaped areas, by piling of surplus soil or debris over them, or by cutting when clearing.

.3 Ensure locations of overhead and underground utility and other services have been established by an investigation conducted together with the utilities and maintenance staff of services concerned. Perform no clearing until locations of services have been verified and protective measures taken are satisfactory to all concerned.

.4 Perform relocation, removal, protection and plugging of existing utility services only by the responsible utility, and of other services by licensed mechanics.

.5 Immediately repair damage to trees, structures, buried and above ground services, benchmarks, and survey monuments should it occur as a result of clearing performed by this Section. Completely cover wounds of over 25.5mm diameter suffered by trees and shrubs with wound paint.

.6 Protect and maintain established survey markers. If these markers are disturbed except where service connections have to be installed, the Contractor shall bear the cost to have them re-established by an Ontario Land Surveyor.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Wound Paint: Bituminous paint specially prepared for use on trees and shrubs.

.2 Cleared and grubbed materials become property of Contractor, unless noted otherwise.

PART 3 - EXECUTION

3.1 **Clearing**

.1 Clear site within limits of the Work site boundary and/or limit of works indicated on drawings, except for items specifically noted on drawings.

.2 Remove all pavements, concrete curb and walks, fences, surface debris, trees and shrubs to depth specified under 3.2 Grubbing.

.3 Remove trees, saplings, shrubs, bushes, vines and undergrowth to the following heights:

.1 150mm for trees over 150mm diameter.
.2 75mm for shrubs, saplings, bushes and trees under 150mm diameter.
.3 50mm for vines and undergrowth.
.4 Treat stumps over 100mm diameter below grubbing depth specified with herbicide applied in accordance with manufacturer's specifications to prevent regrowth.

3.2 **Grubbing**

.1 Perform grubbing within the limits of the area cleared.

.2 Grub out and remove all stumps, roots over 100mm diameter and matted roots to the following depths:

.1 Remove completely under footings, walks, roads, parking areas, slab on grade or other constructions.
.2 200mm under lawns
.3 300mm under planting

.3 Use of explosives is not acceptable.

.4 Leave root systems intact in areas where erosion may occur.

3.3 **Disposal**

.1 Disposal:

.1 Remove and dispose of debris legally away from site daily, as it accumulates, materials and debris resulting from clearing performed by this Section, unless it has been specified for salvage. Do not accumulate materials on site from clearing performed outside of normal working hours for longer than 48 hours.

.2 Do not burn materials or debris at the site.

3.4 **Finished Surface**

.1 Leave ground surface in a condition suitable for immediate grading operations.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Site Clearing	Section 02110
.2	Topsoil and Finish Grading	Section 02212
.3	Erosion and Sedimentation Control	Section 02270
.4	Asphalt Paving	Section 02513
.5	Concrete Curbs and Paving	Section 02525
.6	Sodding	Section 02938
.7	Excavation and partial backfilling for mechanical underground services	Division 15
.8	Excavation and partial backfilling for electrical underground services	Division 16

1.3 **Reference Standards**

.1 Testing of Aggregate:

: ASTM C117-90, Test Method for Material Finer Than 0.075 mm sieve in mineral aggregates by washing.

: ASTM C136-84a, Method for Sieve Analysis of Fine and Coarse Aggregates.

: ASTM D698-78, Test Methods for Moisture-Density Relations of Soils, and Soil Aggregate Mixture, Using 2.5 kg Rammer and 304.8 mm Drop.

: ASTM D1557-78, Test Methods for Moisture-Density Relation of Soils, Using 4.5 kg Rammer and 457 mm Drop.

.2 Sieve Size Designations: CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Products:

: ASTM Specification C33, Concrete Aggregates.

: CAN3-A23.1-M77, Concrete Materials and Methods of Concrete Construction.

: CSA Standard B182.1-M77, Plastic Drain and Sewer Pipe and Pipe Fittings.

1.4 **Guarantee**

.1 Replacement of Defective Work:

.1 Correct and make good areas where settlement has occurred during the warranty period of contract.

1.5 **Submittals**

.1 Samples

.1 Submit samples of fill as specified in Section 01400, Quality Control.

1.6 **Inspection and Testing**

.1 The Owner has appointed and will pay for, out of the Allowance specified in Division 1, an independent Inspection Company to conduct tests as directed by the Consultant.

.2 Testing agency may do any or all of the following as directed by the Consultant in accordance with requirements of Section 01400:

.1 Determine at what depth existing soil is capable of supporting fill, concrete slabs and superimposed loads without deleterious settlement.
.2 Carry out grain size analysis on samples of each type of granular fill to ensure proper materials are being placed.
.3 Determine quantity of water to be added to, or removed from, each type of fill to attain correct moisture content for compaction and maximum density.
.4 Determine on-site density and moisture content of compacted fills.

.3 Submit Inspection Reports as specified under Section 01400, Quality Control.

.4 It is the Contractor's responsibility to contact the Inspection Agency at least 48 hours in advance of the need for inspection.

1.7 **Examinations**

.1 Visit and examine the site and note all characteristics and features affecting the work of this Section. No allowance will be made for difficulties encountered or expense incurred resulting from conditions known or visible at the time of tendering.

.2 Ensure in examination of site, all possible factors concerning earth work are investigated, and the following are known in particular.

.1 Methods and means available for material handling, disposal, storage and transportation.
.2 Physical conditions of site, including ground water table and drainage courses.
.3 Conformation and condition of ground surfaces, including extent of clearing, grading, filling and lawn work.
.4 Character, quality, and quantity of surface and sub-surface materials. Remove unsuitable materials or import suitable materials as required at no expense to the Owner.

.3 Starting work implies acceptance of all conditions, and no consideration for extra compensation will be allowed at a later date if found that actual site conditions and the drawings do not agree.

1.8 **Existing Conditions**

.1 Geoenvironmental and geotechnical Investigations have been previously carried out for this site, as indicated in the instructions to Bidders, and a report and letter is bound into these Specifications.

.2 Follow the recommendations made in these reports except where specifically indicated otherwise in Contract Documents.

1.8 **Existing Conditions (Cont'd)**

.3 The information given in these reports is furnished in good faith for guidance and in no way relieves responsibility for properly ascertaining the nature of conditions on site. No responsibility is accepted by the Owner or the Consultants for its correctness, nor shall its accuracy affect the provisions of the Contract.

.4 Ensure locations of buried utility and other services to remain have been established by an investigation conducted together with maintenance staff and utilities of services concerned. Do not excavate or grade until locations of services to remain have been verified and protective measures taken are satisfactory to all concerned.

.5 A tolerance of plus or minus three centimetres variation from design levels for grading outside the building is the maximum acceptable.

.6 No extra compensation will be allowed for removing rock or other materials encountered during excavation work, site work or laying utility lines.

.7 A cut and fill balance has not been made. The Contractor must establish what additional fill is to be imported or excess to be hauled away. No additional compensation will be made for cut and fill.

1.9 **Environmental Requirements**

.1 If excavation reveals unexpected subsurface conditions, advise Consultant immediately.

.2 Do not place fill material when temperature is at or below 0 degree C, nor while either fill material or subgrade is frozen.

.3 Stockpile each type of fill material separately to prevent integration. Stockpile granular materials so as to prevent segregation.

.4 Effect approved measures to minimize dust as a result of this work.

.5 Do not stockpile excavated material to interfere with site operation or drainage.

1.10 **Protection**

.1 Protect excavations in accordance with applicable regulations. Provide and maintain in safe condition lining, bracing and shoring required. Protect bottoms and sides from exposure to wet weather, snow and frost, and from drying out; prevent softening or weathering of bearing surfaces. Take special care when excavating for footings.

.2 Prevent damage to existing structures and buried services. Make good any damage caused.

.3 Provide adequate protection around bench markers, layout markers, survey markers, and geodetic monuments.

1.11 **Basis of Elevation**

.1 Estimate excavation using excavation levels specified and shown on Drawings as a basis.

.2 If, upon excavation, load bearing conditions are fulfilled at levels different

from those shown on Drawings, excavation levels will be adjusted as required. Consultant will decide whether adjustment in level is required.

1.11 **Basis of Elevation (Cont'd)**

.3 Additional excavation and backfill work authorized by Consultant will be reimbursed as an extra to the contract.

.4 Extras will be allowed if upon excavating to elevations shown, it is found conditions do not meet specified requirements excluding damage to excavation for such reasons as action of ground water, weather, construction activity or the presence of nearby electrical or mechanical service.

PART 2 - PRODUCTS

2.1 **Materials**

.1 **Fill Type 1:** Conforming to Class 'A' granular material OPSS 1010 clean, angular crusher run natural stone, free from silt, clay, friable materials, roots and vegetable matter and graded within following limits.

Sieve Size (MTC)	Per Cent Passing
37.5 mm	100
16 mm	62 - 100
9.5 mm	48 - 73
4.75 mm	33 - 55
1.18 mm	15 - 45
0.3 mm	5 - 22
0.075 mm	0 - 8

.2 **Fill Type 2:** Conforming to Class 'B' granular material OPSS 1010 clean, natural sand and gravel material free from silt, clay, loam friable or soluble materials and vegetable matter and graded within following limits.

Sieve Size (MTC)	Per Cent Passing
106 mm	100
22.4 mm	57 - 100
4.75 mm	25 - 100
1.18 mm	10 - 85
0.300 mm	5 - 40
0.075 mm	0 - 8

.3 **Fill Type 3:** Conforming to Class 'C' granular material OPSS 1010, clean, washed, coarse sand free from clay, shale and organic matter.

.4 **Fill Type 4:** Excavated soil either on site or imported, free from roots, rocks larger than 75 mm and building debris capable of being compacted to a density of 98% Standard Proctor. Excavated material shall be approved by Consultant before being used as fill.

.5 **Fill Type 5:** 19 mm clear, crushed limestone.

.6 **Vapour Barrier:** 15 mil polyethylene membrane meeting or exceeding all requirements of ASTM E1745 Classes A, B, & C.
Seam Tape: High Density Polyethylene Tape with pressure sensitive

adhesive. Minimum width 100 m.

PART 3 - EXECUTION

3.1 **Topsoil**

.1 Remove topsoil completely from area of new building and paving and areas being regraded. Store good topsoil, acceptable for reuse in stockpile(s) in locations approved by the Consultant, and provide measured quantity of stockpiled material immediately after stripping.

3.2 **Grading**

.1 Cut or fill the site area to extent shown on drawings and to levels below finish elevations which will allow for specified surface treatments.

.2 Conform to grades and contours indicated on Drawings. Uniformly slope grade between elevations shown unless otherwise indicated.

.3 Smoothly slope top and toe of slopes and banks.

.4 Proofroll, with a heavy roller, existing subgrade below paved areas after excavation. Sub-excavate loose, soft and excessively wet areas and areas containing organic material, and fill with suitable specified fill capable of being compacted to required density.

.5 Fill, where required, in accordance with requirements for Backfilling, and Fill Types and Compaction as specified in this section.

.6 Do not exceed slopes of 1:4 unless indicated otherwise, and ensure sub-grade is sloped to drain water away from building.

.7 Leave no debris boulders, roots, plant material or other foreign materials showing at graded surfaces.

3.3 **Excavation**

.1 Prior to proceeding with excavation, determine accurately the actual founding elevation of any existing footings and report findings to the Consultant.

.2 Excavate to extent, elevation and depth required for construction of the building site work and grading including pits and building sub-drainage systems, and for a sufficient distance beyond to permit proper construction, shoring, curing and inspection of work.

.3 Excavate for footings to undisturbed soil capable of sustaining super-imposed loads, and carry exterior footings down to a minimum depth of 1200 mm below the finished grade, or deeper where shown.

.4 Excavate to well-defined lines to minimize quantity of fill material required.

.5 Keep a record of founding elevations of footings. This record must be approved by the Consultant before claims for extras will be considered.

.6 Earth bottoms of excavations to be dry undisturbed soil, level, free from loose or organic matter.

.7 Excavation must not interfere with normal 45^{o} splay of bearing from bottom

of any footing.

.8 When complete, have Consultant inspect excavations to verify depths and dimension of footings before pouring.

3.3 **Excavation (Cont'd)**

.9 If additional excavation to satisfactory bearing is requested, payment will be made as an extra to the contract. Where such extra excavation is due to the error or misinterpretation by the Contractor no extra payment shall be made.

.10 If bottom corners of excavation for mechanical or electrical services pits or the like encroach upon a 7 in 10 slope between corners of footings at elevations shown, lower footings as not to encroach upon the permitted slope at no extra cost to the Owner.

.11 Correct unauthorized excavation at no extra cost as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings. Do not refill over excavated area.

.2 Fill under other areas with Fill Type 2 compacted to 100% Standard Proctor Density.

.12 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.

.13 Excavate for footings in a particular area commencing from the lowest footing and proceeding to the higher elevations.

.14 Use hand methods to carry out final trimming and accurate levelling of footing beds prior to placement of footings. Remove water, disturbed soil and foreign matter from footing excavations before placing reinforcement or concrete. Do not permit the soil at founding elevations to soften due to the presence of water in the excavations or construction activity.

.15 During cold weather, prevent soil adjacent to and beneath footings from freezing. If soil at specified founding elevations is frozen or was frozen and thawed, remove effected material and found footings on unaffected soil with the required characteristics at no extra cost to the Owner.

.16 Where footings are to be poured without forms, trench sides must be sharp and true. Approval from the Consultant in writing must be obtained before deleting forms.

.17 Remove and legally dispose off site, excess fill and existing fill material containing topsoil, organic and debris not capable of meeting specification for Fill Type 4.

.18 Observe the rules and regulations governing the respective utilities during excavation. Report existing unlocated services encountered, and do not continue with excavation without directions. Repair damages to services should they occur.

.19 Cap off unused services such as drains, sewers, field tile and service pipes uncovered by excavation. Report in writing to the Consultant the discovery

of these service.

.20 Blasting is prohibited.

3.4 **Excavation For Underground Service Trenches**

.1 Trenches for mechanical underground services will be excavated by Division 15. Excavation, will be performed in accordance with this Section.

.2 Trenches for electrical underground services will be excavated by Division 16. Excavation will be performed in accordance with this Section.

.3 Excavate trenches for underground services shown on drawings. Grade bottom of trenches accurately to suit required service elevations. Trench to width required for specified bedding and backfilling. Ensure that trenches do not drain water into building.

3.5 **Dewatering**

.1 Establish and maintain a positive outfall to control surface water. Bail, pump out or divert water from excavations, from whatever cause, as it accumulates, and until the time foundations are completed.

.2 Establish drainage ditches at perimeter of excavation and provide sump areas at locations which are not adjacent to foundations and distributed to ensure excess water is collected. Refer to soils report.

.3 Provide and operate pumps of sufficient number and capacity, including standby units, and necessary accessories, to keep excavations free of water at all times.

.4 Ensure soil is not removed in suspension in the pumped water in sufficient quantity to cause settlement of adjacent soil.

3.6 **Backfilling**

.1 Backfill areas below building and at building perimeter.

.2 Do not place backfilling until bearing surfaces, subgrades and work to be covered has been inspected and approved by the Consultant.

.3 Remove debris, rubbish and temporary shoring before commencing backfilling.

.4 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground. Backfill materials will not be frozen or contain ice, snow or debris. Do not place backfill in freezing weather without written permission of Consultant.

.5 Prior to placing fill under slabs on grade, compact existing subgrade to obtain same compaction as specified for fill. Remove "soft" material and fill with approved materials.

.6 Do not commence backfilling until perimeter insulation is installed and inspected and pipe and conduit joints tested and approved by Consultant.

.7 Backfill simultaneously each side of walls and other structures to equalize soil pressure.

3.6 **Backfilling (Cont'd)**

.8 Take care to avoid damage to or displacement of walls, weeping tiles, waterproofing, dampproofing and other work. Whenever temporary unbalanced earth pressures are liable to develop in walls, provide and place the necessary shoring and bracing to counteract the imbalance, and leave shoring/bracing members in place until their removal is approved by the Consultant. Make good, at no cost to the Owner, any damages caused due to inadequate bracing.

.9 Place fill materials in layers not exceeding 200 mm compacted depth. Backfill to the level required and as indicated on the Drawings.

.10 Compact areas to be backfilled, by mechanical tamping or rolling, to a minimum 98% STANDARD PROCTOR DRY DENSITY, unless noted otherwise.

.11 Remove and replace fill until compaction test reports by the independent inspection agency are satisfactory to the Consultant.

3.7 **Backfilling for Underground Service Trenches**

.1 Do not proceed with trench backfilling operations until Consultant has inspected and approved installation.

.2 Within building area: Backfill trenches for underground mechanical and electrical services to a level 300mm above service. Backfill below this level is the responsibility of Division 15 and 16.

.3 Outside building area:

.1 Backfill trenches for underground mechanical and electrical trenches to underside of subgrade level. Backfilling below subgrade level is the responsibility of Division 15 and 16. Supply of fill, placing of fill and compacting will be performed in accordance with this section.

.4 Backfilling around installations:

.1 Place bedding and surround materials specified elsewhere.
.2 Do not backfill around over cast-in-place concrete within 24 hours of placement.
.3 Place layers simultaneously on both sides of installed work to equalize loading.
.4 Place material by hand under, around and over installations until 300mm of cover is provided. Dumping backfill material directly on installations will not be permitted.

.5 Pipe Crossings:

.1 Where pipes cross, backfill full width of trenches, between and around pipes, with bedding material.

.6 Electrical Trenches Exterior to Building:

.1 Place plastic 'Buried Cable' warning tape 100 mm wide, 150 mm below finished grade over buried electrical service.

3.7 **Backfilling for Underground Service Trenches (Cont'd)**

.7 Shoring, Sheeting and Bracing:

.1 Unless otherwise indicated, or directed by Consultant, remove sheeting and shoring from trench during backfilling operations.

.2 When sheeting is to remain in place, cut off tops at elevations directed.

3.8 **Fill Types & Compaction**

.1 Dimensions specified in following paragraph are minimum dimension of fill after compaction.

.2 Exterior side of perimeter walls: Use Fill type 2 to subgrade level. Compact to 98% Standard Proctor Density.

.3 Within building area: Use Fill Type 2 to underside of base course for floor slabs. Compact to 100% Standard Proctor Density.

.4 Under concrete floor slab: Provide minimum 200 mm base course of Fill Type 1 to underside of slab. Compact base course to 100% Standard Proctor Density.

.5 Backside of retaining walls: Use Fill Type 2 to subgrade level on high side for minimum 500 mm from wall. Compact to 95% Standard Proctor Density.

.6 Service trenches within building area: After protective cover over service has been installed, fill remainder of trenches with Fill Type 2 to underside of base course for floor slab. Compact to 100% Standard Proctor Density.

.7 Service trenches outside building area: After protective cover over service has been installed, fill remainder of trench as follows.

.1 In non pavement area use Fill Type 4 to subgrade level. Compact to a density at least equal to density of adjacent, undisturbed soil, but not less than 95% Standard Proctor Density.

.2 In pavement areas use Fill Type 2 to subgrade level. Compact to 98% Standard Proctor Density.

.8 Raise subgrade:

.1 Where required raise subgrade to rough grade levels with Fill Type 4. Compact to 98% Standard Proctor Density.

.2 In pavement areas where undisturbed soil surface is low bring level up to subgrade with Fill Type 2. Compact to 98% Standard Proctor Density.

.9 Unless otherwise indicated, use Fill Type 2 in areas requiring backfill.

3.9 **Vapour Barrier**

.1 Install vapour barrier over compacted fill directly under concrete floor slabs on grade. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.

.2 Unroll vapour barrier with the longest dimension parallel with the direction of the pour. Lap vapor barrier over footings and seal to foundation walls.

.3 Overlap joints 150 mm and seal with manufacturer's seam tape.

.4 Seal all penetrations (including pipes) with manufacturer's pipe boot.

.5 No penetration of the vapour barrier is allowed except for reinforcing steel and permanent utilities.

.6 Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 150 mm and taping all four sides with seam tape.

3.10 **Completion**

.1 Upon completion, remove and dispose of legally off site, surplus topsoil, excavated and graded materials and leave site clean and tidy. Disposal charges are the Contractor's responsibility.

End of Section

ART 1 - GENERAL

1.1	***General Requirements***	.1	Comply with requirements of Division 1.	
1.2	***Related Sections***	.1	Scheduling of work:	Division 1.
		.2	Submittals:	Division 1.
		.3	Temporary facilities:	Division 1.
1.3	***Qualifications***	.1	CSA S350-M1980 (R1998), Code of Practice for Safety in Demolition of Structures.	
1.4	***Submittals***	.1	Where required by authorities having jurisdiction and by other sections of this specification, submit for approval, drawings, diagrams, details and supporting data clearly showing sequence of demolition & removal work of building designed by a registered professional structural engineer licensed to practice in Ontario.	
1.5	***Protection***	.1	Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.	
		.2	Cease operations and notify Project Manager if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with Project manager.	
		.3	Cease operations and notify the Project Manager immediately for special protective and disposal instructions when asbestos materials or other hazardous materials [, other than those identified,] are uncovered during the work of this project.	
		.4	NA	
		.5	Prevent debris from blocking surface drainage inlets and mechanical and electrical systems which remain in operation.	
		.6	Temporarily suspended work that is without continuous supervision, shall be closed to prevent entrance of unauthorized persons.	
1.6	***Examination***	.1	Visit the site and the existing building so as to fully understand all existing conditions and extent of work required. No increase in cost or extension of performance time will be considered for failure to know conditions.	
1.7	***Components Removed by Owner***	.1	All components not removed by the Owner shall become the property of the Contractor and shall be removed from the site by the Contractor.	
		.2	Existing millwork and countertops noted to be removed are to be turned over to school.	

PART 2 - PRODUCTS

2.1 ***Materials & Equipment***

.1 Provide materials and equipment as required to perform work of this section.

PART 3 - EXECUTION

3.1 ***Preparation***

.1 Ensure that affected building areas are unoccupied and discontinued in use prior to start of demolition work.

.2 Verify that existing services in areas affected by demolition work are disconnected, capped or removed, prior to start of work.

3.2 ***Existing Services***

.1 Disconnect all electrical and telephone service lines in the areas to be demolished in accordance with rules and regulations of authorities having jurisdiction. Post warning signs on all electrical lines and equipment that must remain energized to serve other areas during period of demolition.

.2 Disconnect and cap mechanical services in accordance with requirements of local authority having jurisdiction.

.1 Natural gas supply lines to be removed by qualified tradesman in accordance with gas company instructions.

.2 Remove sewer and water lines and cap to prevent leakage.

.3 Remove and cap other underground services.

.4 In each case notify the affected utility company in advance and obtain approval where required, before commencing with the work on main services.

.3 Do not disrupt active or energized utilities designated to remain undisturbed.

3.3 ***Demolition***

.1 Carry out demolition work in accordance with CSA S350, unless otherwise specified.

.2 Remove from the site all materials indicated to be removed.

.3 Carry out demolition in a manner to minimize inconvenience to adjacent occupied space.

.4 Demolish work in a safe and systematic manner, from top to bottom.

.5 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated runoff or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.6 Lower waste materials in a controlled manner; do not drop or throw materials from heights. Use chutes, conveyors, or hoisting equipment to lower materials.

3.3 ***Demolition (Cont'd)***

.7 Burning of materials on site is not permitted.

.8 Demolish masonry and concrete elements in small sections. Carefully remove and lower structural framing and other heavy and large objects.

.9 At end of each work period, leave work in a safe condition, so that no part is in danger of toppling or falling.

3.4 ***Clean-Up***

.1 For clean-up during demolition and for final cleaning, comply with requirements of Division 1.

End of Section

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1	Site Grading	Section 02311
.2	Aggregates	Section 02701

1.3 REFERENCES

.1 ASTM D4791-89, Test Method for Flat or Elongated Particles in Coarse Aggregate.

.2 Ontario Provincial Standard Specification 1001.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01300.

.2 Allow continual sampling by Consultant during production.

.3 Provide Consultant with access to source and processed material for sampling.

.4 Install sampling facilities at discharge end of production conveyor, to allow Consultant to obtain representative samples of items being produced. Stop conveyor belt when requested by Consultant to permit full cross section sampling.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Clear stone for mud mat and along bottom of silt control fencing:

.1 50 mm clear stone in accordance with OPSS 1001.

.2 150mm clear stone in accordance with OPSS 1001.

.3 Geotextile for siltation control fence, catch basin protection and under mud mat shall be Class I non-woven geotextile fabric in accordance with OPSS 1860.

2.2 SOURCE QUALITY CONTROL

.1 Inform Consultant of proposed source of aggregates and provide access for sampling at least four weeks prior to commencing production.

.2 If, in opinion of Consultant, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.3 Advise Consultant four weeks in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Mud Mat Installation:

.1 Place clear stone to the dimensions indicated on the contract drawings to a depth of 450 mm.

.2 Remove and replace top layers of clear stone when they become ladened with mud and the mud mat becomes ineffective in removing mud from equipment exiting the site.

.3 The mud mat installation does not alleviate the contractor's responsibility to clean mud from adjacent roadways as a result of the construction.

.2 Silt Control Fence:

.1 Install silt control fence along construction site perimeter, including tee bars, geotextile filter fabric, clear stone along the upstream side of the fence in the instance the ground is frozen.

.3 Catch Basin Protection:

.1 Install catch basin protection on adjacent catch basins or as requested by Consultant to prevent silt from entering catch basin inlets, before any other works proceed on the site.

.4 Ditch Inlet Catch Basin Protection:

.1 Install ditch inlet catch basin protection on indicated inlet or as requested by Consultant to prevent silt from entering ditch inlet catch basin, before any other works proceed on the site. Protection to include straw bales and stakes as shown on drawing. Alternatively a coir coil of equal dimension may be used.

.5 Interceptor Ditches:

.1 Install interceptor ditch as shown or as directed by Consultant, to intercept runoff and direct the flow to settling area and to the storm inlets in a controlled manner.

.2 Install check dams to slow waters and encourage settlement of silt by runoff.

3.2 MAINTENANCE

1. Maintain the mud mat and replace clear stone as required during the construction period as required to maintain the function of the mud mat.

2. Maintain silt control fencing for the duration of the construction and replace as required until the site is stabilized.

3. Replace geotextile on catch basin protection as required during the construction period as required to maintain the function of the protection until the site is stabilized.

.4 Remove sediment accumulation in interceptor ditches and by check dams as the sediment reach half the available depth.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2 SCOPE OF WORK

.1 Provide all labour, materials, tools and equipment necessary for all excavation and backfill to the full extent of work shown on the plans and this specification, including but not limited to the following:

.1 Grading (cutting and filling) to subgrade elevations including compaction and fine grading of existing earth materials to +/- 25 mm of design subgrade elevations (not uniformly high or low) in accordance with OPSS 206.

.2 Proof rolling of subgrade with Geotechnical consultant present.

.3 Excavation and disposal of all excess unsuitable materials off site.

.4 Supply and installation of earth borrow material as required to establish design subgrade elevations.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1	Excavating, Trenching and Backfilling	Section 02315
.2	Aggregates	Section 02701

1.4 SITE CONDITIONS

.1 Protection:

.1 Provide protection (i.e. shoring, cribbing, bracing and planking) to ensure no damage occurs to existing facilities and equipment situated on site. In certain areas only hand tools may be used.

.2 Provide adequate protection around bench marks, layout markers, survey markers, and geodetic monuments.

.3 Protect bottom of excavations from freezing.

.4 Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with lean concrete. Keep bottoms of excavations dry at all times.

.5 Direct discharge from pumps, when draining excavations, so that damage to site and adjacent property does not occur.

.6 Do not stockpile excavated material to interfere with site operation or drainage.

.7 Effect approved measures to minimize dust as a result of all grading work and all other construction activities related to this Contract.

.8 Protect legal iron bars, bench marks, surface or underground utility lines which are to remain. If damaged, restore to original or better condition unless directed otherwise.

.9 Ensure sufficient quantities of wood sheeting, timbers, steel members and other materials are available at all times in order to support, brace or protect utilities structure and properties near to or occurring within excavations.

.2 The Contractor shall take all the necessary precautions to protect all utilities against damage. The Contractor shall carry out his work in a safe manner with due regard for roadway traffic to the satisfaction of the Consultant, and any authority having jurisdiction.

.3 The Contractor shall have full and sole responsibility for the safety of all excavation performed under this Contract until final acceptance of the work.

.4 Utility Lines:

.1 Before beginning work, establish location and extent of underground utility lines in area of excavation. Notify Consultant of all existing located services encountered, and do not continue with excavation without the Consultant's instructions. Repair and pay for damages to existing utility lines resulting from the work.

.2 Relocate existing lines in area of excavation which must remain active as indicated on the drawings.

.3 Remove abandoned utility lines, if any, to distance of 2 m from foundations. Cap lines at cut-off points.

.4 Record locations, if any, of maintained, re-routed and abandoned underground utility lines.

.5 Repair and pay for damage to existing underground lines as may result from this work.

.5 Examination:

.1 Ensure in examination of the site that all possible factors concerning earthwork are investigated and that the following are known in particular:

.1 Methods and means available for material handling, disposal, storage, and transportation.

.2 Physical conditions of site; including ground water table and drainage course, extent of removals and grading completed under a previous work on the site.

.2 Unsatisfactory Soil Conditions:

.1 Any unsatisfactory or questionable soil conditions revealed during excavation shall be reported immediately to the Owner's Consultant and Geotechnical Engineer.

.2 All foundation and sub-structural work shall cease until the condition has been examined and approval to proceed has been issued.

.6 Material Unsuitable for Backfill:

.1 The Contractor shall be responsible for all costs associated with the excavation and removal, off site, of all materials unsuitable for backfill or re-use.

.7 Water:

.1 Keep excavation free from water at all times. Provide drainage trenches and sumps as necessary and pump water well away from excavation. Do not discharge water onto private property.

.8 Inspection and Testing:

.1 Testing of materials and compaction will be carried out by testing laboratory designated by the Consultant.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Protect and repair exposed excavations where required to prevent adverse effects of rain, freezing weather and other weather conditions on subgrade of subsequent work.

.2 Suspend construction operation at times when satisfactory results cannot be obtained on account of rain, snow, freezing weather or other unsatisfactory conditions.

.3 Do not carry out filling or backfilling in freezing weather unless authorized by Consultant. Do not use frozen material nor place material where the material in place is already frozen.

.4 Dispose of excess or unsuitable earth materials generated from the site grading in accordance with Ontario Reg. 558. The items in the Form of Tender include all costs for disposal of excess or unsuitable material off the site and the Contractor shall make the arrangements for the disposal of the materials removed in accordance with MOE Reg. 558.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Earth Borrow:

.1 Earth borrow shall be earth material obtained from outside the project limits that meets the requirements of Ontario Provincial Standard Specification 212.

.2 Backfill:

.1 Site or imported material containing no organic or foreign matter and which the subcontractor can demonstrate is compactable to a density of 98% SPMDD.

2.2 STOCKPILING

.1 Fill Materials:

.1 Temporarily stockpile fill materials in areas designated by Consultant. Stockpile granular materials to prevent segregation.

.2 Protection:

.2 Protect fill materials from contamination and freezing.

PART 3 - EXECUTION

3.1. STRIPPING OF TOPSOIL

.1 Do stripping of topsoil in accordance with this Section and Geotechnical Consultant requirements.

.2 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Consultant.

.3 Commence topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses and removed from site.

.4 Strip all topsoil. Avoid mixing topsoil with subsoil.

.5 Stockpile sufficient topsoil for restoration of all grassed areas impacted by the construction.

.6 Remove and dispose of surplus topsoil, off site.

.7 All silt fence and erosion control measures to be in place before start of topsoil stripping operation.

3.2. EXCAVATION/GRADING

.1 All excavation shall be in open cut and shall comply with the requirements of the Occupational Health and Safety Act.

.2 Grade to subgrade levels (to a tolerance +/- 25 mm but not consistently high or low) allowing for surface treatment as indicated.

.3 Do not place material which is frozen nor place material on frozen surfaces.

.4 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.

.5 Excavation, placing and compacting of fill materials are to be carried out in accordance with Ontario Provincial Standard Specification (OPSS) 206.

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

.7 If any soft areas are detected during the proof rolling process, and with the Consultant's direction, sub-excavate as per Geotechnical Consultant's recommendations. Sub-excavated areas are to be backfilled with suitable native material, or imported approved granular material.

3.3. PROOF ROLLING

.1 Proof rolling shall be carried out on completed subgrade prior to installing granular sub-base materials.

.2 Proof rolling shall be carried out using a roller with a minimum static weight of 5 tonnes, and shall consist of a minimum of four passes per unit area. Wet areas or deleterious materials identified during proof rolling shall be sub-excavated and be replaced with engineered fill, consisting of Granular B, Type I as per OPSS 1010 or select native material, compacted to 98% SPMDD in maximum 200 mm lifts.

3.4. FIELD QUALITY CONTROL

.1 Inspection and testing of materials and compaction will be carried out by the Geotechnical Consultant engaged by the Owner for this project. Costs of tests will be paid by Owner.

.2 Sieve Analysis:

.1 Proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.

.3 Reinstatement:

.1 All disturbed areas must be reinstated to Consultant's and Owner's satisfaction.

END OF SECTION

PART 1 - GENERAL

1.1 **General Requirements**
.1 Comply with requirements of Division 1.

1.2 **Related Sections**
.1 Excavation, Trenching and Backfill Section 02200
.2 Concrete Curbs and Paving Section 02525

1.3 **Reference Standards**
.1 **Bituminous Concrete Paving**
.1 Conform to Ontario Provincial Standard Specifications (O.P.SS) as specified herein.
.2 **Paint**
.1 CGSB 1-GP-74M, Alkyd Traffic Paint
.2 CGSB 1-GP-12C-68, Standard Paint Colours
.3 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thinner
.4 MTO Manual of Uniform Traffic Control Devices. (Metric Edition) - latest edition

1.4 **Qualifications**
.1 The work of this section is to be done by a paving contractor of recognized standing who has personnel experienced in this type of work and who has the necessary equipment to complete the work.

1.5 **Guarantee**
.1 Provide the following Guarantee in accordance with the General Conditions of the Contract, not withstanding the time provisions therein.
.1 **Two years on materials and labour**

1.6 **Inspection & Testing**
.1 Comply with the requirements of Section 01400 Quality Control.
.2 The Owner may appoint and will pay for, out of the Allowances specified in Division 1 an independent inspection agency to conduct any or all of the following as directed by the Consultant.
.1 Carry out grain size analysis.
.2 Determine minimum and maximum moisture content of densities of granular fill.
.3 Determine on-site density, thickness and moisture content of compacted fills.
.4 Check properties of asphalt mixes, including aggregate gradation of asphalt content.
.5. Check suitability of equipment used.

1.7 **Environmental Requirements**
.1 Lay granular base courses and asphalt paving courses when weather is dry and only on dry bases.
.2 Place granular bases courses only when ambient temperature is above 0°C. Do not place granular materials while either material or subgrade is frozen.
.3 Place asphalt paving courses only when ambient temperature is 7°C or above.

1.8 **Protection**

.1 Prevent damage to buildings, landscaping, curbs, sidewalks, trees, and adjacent property.

.2 Provide access to building at all times. Arrange paving schedule so as not to interfere with normal use of premises.

.3 Make special provisions to minimize deterioration of subgrade, particularly when operating during unfavourable weather conditions or when working in wet soil. Use special designated traffic lanes, build temporary roads, reduce traffic to half-loads or take other suitable measures.

.4 Do not permit vehicular traffic on finished asphalt pavement until it has cooled and hardened and in no case sooner than 12 hours after completion.

.5 Provide barricades and warning devices to protect pavement.

PART 2 - PRODUCTS

2.1 **Materials**

.1 **Granular Base:** Conforming to Class 'A' granular material OPSS 1010 clean, angular crusher run natural stone, free from silt, clay, friable materials, roots and vegetable matter and graded within following limits.

Sieve Size (MTC)		Per Cent Passing
37.5	mm	100
16	mm	62 - 100
9.5	mm	48 - 73
4.75	mm	33 - 55
1.18	mm	15 - 45
0.3	mm	5 - 22
0.075	mm	0 - 8

.2 **Granular Subbase:** Conforming to Class 'B' granular material OPSS 1010 clean, natural sand and gravel material free from silt, clay, loan friable or soluble materials and vegetable matter and graded within following limits.

Sieve Size (MTC)		Per Cent Passing
106	mm	100
22.4	mm	57 - 100
4.75	mm	25 - 100
1.18	mm	10 - 85
0.300	mm	5 - 40
0.075	mm	0 - 8

.3 **Asphalt:**

.1 Asphalt cement shall be penetration grade 85-100 and conform with OP.SS Specification Form 1101 and aggregates shall conform with OP.SS Form 1003.

.2 Asphalt base and surface course, as shown on the drawings shall conform to OP.SS Specification Form 310.

.3 Asphalt emulsions shall conform with OP.SS Specifications Form 1102.

.4 Tack coat between base and wearing course shall be SS-1 asphalt emulsion diluted with an equal volume of water.

.4 **Paint:**

.1 **Traffic Marking Paint:**

.1 **Paint:** to CGSB 1-GP-74M, alkyd traffic paint
Colour: to CGSB 1 GP-12C
.1 White 513-301
.2 Yellow 33538

.2 **Thinner:** to CAN/CGSB-1.5

.3 All paint to conform to OPSS #1712

PART 3 - EXECUTION

3.1 **Ex. Asphalt Paving Removal**

.1 Remove existing asphalt paving, including 150 mm depth of existing granular base (for full depth) where shown and noted on drawings for existing asphalt paving to be removed and replaced.

.2 Dispose of all surplus materials off site at an approved and authorized registered dumpsite licensed to receive these materials

.3 Proof roll and compact existing sub-base to remain and proceed with replacement of granular base and asphalt paving as specified in this section for new asphalt paving.

3.2 **Preparation of Subgrade**

.1 Examine rough graded subgrade over which asphalt paving system is to be installed to ensure it is suitable for installation. Start of work shall imply acceptance of conditions.

.2 Fine grade subgrade as required to bring it to required levels and slopes. Meet compaction densities and fill material requirements specified in Section 02200. Slope fine graded subgrade to permit drainage.

.3 Thoroughly compact subgrade to minimum 98% Standard Proctor Density for at least the uppermost 300 mm. Sub-excavate soft spots that develop during compaction and bring to proper grade by the addition of fill material and then thoroughly compact until satisfactory, adding more fill material as required.

.4 In the event subgrade cannot be made stable or be compacted with a roller the Consultant will decide if local soft spots are to be excavated and backfilled with 50 mm crusher limestone.

3.3 **Granular Base & Subbase**

.1 Over compacted subgrade place granular base and subbase in layers not exceeding 150 mm thickness. Compact each layer to 100% Standard Proctor Density unless otherwise indicated.

.2 Compact granular base and subbase by rolling with power rollers capable of reversing without backlash. Use hand tamping or mechanical hand compaction equipment in areas inaccessible to rollers.

.3 Add water as required to obtain optimum density and to control dust.

3.4 **Paving**

.1 Obtain approval of granular base and subbase, by Consultant, prior to installing asphalt paving. Lay asphalt as soon as base is approved.

.2 The Contractor shall inform the Consultant at least 48 hours prior to commencing asphalting operations or resuming same after a delay of more than one week, in order that the Consultant may inspect the base before asphalt is applied.

.3 No asphalt shall be laid on a surface which is wet, or covered by snow or ice, or if the temperature of the air is below 7ºC, or if the ground is frozen.

.4 Slope paving away from building minimum 1%. Slope paving minimum 1% for drainage in all locations unless specifically indicated otherwise on Drawings. Bumps or "bird baths" will not be accepted.

.5 Finish surface true to grade and free from deviations exceeding 1:1000 when measured with a 3m straight edge.

.6 In all cases where asphalt base course layer has been in place for a period of two or more months, tack coat shall be placed prior to the placing of asphalt top course layer or at the discretion of the Consultant.

.7 Minimum asphalt mixture temperature when spread, 118°C.

.8 Maximum asphalt mixture temperature at anytime, 149°C.

.9 Compact each course layer with roller when it can support roller mass without undue cracking or displacement, until all roller marks are eliminated.

.10 Compact each asphalt paving course to 97% Marshall density to ASTM D1559-76.

.11 Keep roller speed slow enough to avoid mixture displacement.

.12 Moisten roller wheels to prevent mixture adhesion.

.13 Compact mixture with hot tampers in areas inaccessible to roller and all exposed edges.

3.5 **Joints**

.1 Transverse and longitudinal joints in successive courses shall be offset at least 300 mm from each other.

.2 All joints shall be coated with tack coat prior to placement of adjacent asphalt if the previous section has been in place for more than two hours.

.3 Transverse joints shall be cut back at least 300 mm and painted with tact coat before paving proceeds.

.4 Where tack coat has been applied, it shall be allowed to dry to a tacky texture before new asphalt is laid against it.

3.6 **Repairs**

.1 Where repairs are required, include repairs under warranty, cut asphalt to its full depth making straight neat cuts.

.2 Compact granular base and subbase in accordance with requirements for new asphalt.

.3 Coat exposed cut edges with a tack coat. Place hot asphalt mixture and compact to thickness required in accordance with requirements for new asphalt.

3.7 **Pavement Marking**

.1 Provide all painted pavement markings shown on drawings including, but not limited to parking stalls, barrier free symbol, painted medians, cross walks, games lines.

.2 Premark lines in an approved manner and as indicated on drawings.

.3 Apply paint with an approved pressure type distributor that will ensure uniform application and a positive means to shut-off.

.4 Evenly apply paint at the rate of 4.5L/10m^2.

.5 Barrier free symbol shall be painted in stalls as indicated on drawings.

.6 **Schedule:**

.1 **Parking Stalls:** 100 mm wide painted lines
Colour: white

.2 **Painted Medians:** 100mm wide angular painted lines spaced 300 mm apart
Colour: yellow

.3 **Barrier Free Symbols:** to MTO Manual of Uniform Traffic Devices

3.8 **Pavement Schedule**

.1 Provide heavy duty asphalt paving at driveways where noted on drawings.

.1 **Heavy Duty Asphalt Pavement and Base Construction:**

.1	Granular Sub-base:	300 mm Granular 'B'
.2	Granular Base:	150 mm Granular 'A'
.3	Asphalt Base Course:	60 mm of HL-8 base course asphalt.
.4	Asphalt Top Course:	40 mm of HL-3a top course asphalt.

.2 Provide heavy duty asphalt paving where indicated for existing asphalt paving to be removed and replaced.

.1 **Heavy Duty Asphalt Pavement and Base Construction:**

.1	Granular Sub-base:	Existing Granular 'B' to remain.
.2	Granular Base:	150 mm Granular 'A'
.3	Asphalt Base Course:	60 mm of HL-8 base course asphalt.
.4	Asphalt Top Course:	40 mm of HL-3a top course asphalt.

.3 Provide light duty asphalt paving for pedestrian walkways and where noted.

.1 **Light Duty Asphalt Paving and Base Construction:**

.1	Granular Subbase:	200 mm of Granular 'B'
.2	Granular Base:	150 mm of Granular 'A'
.3	Asphalt Top Course	50 mm of HL3A Top Course Asphalt

End of Section

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2 RELATED WORK

.1	Submissions	Section 01300
.2	Site Grading	Section 02311
.3	Excavation, Trenching and Backfilling	Section 02315
.4	Granular Base	Section 02721
.5	Granular Sub-Base	Section 02723
.6	Asphalt Paving	Section 02741

1.3 REFERENCES

.1 ASTM D4791-89, Test Method for Flat or Elongated Particles in Coarse Aggregate.

.2 Ontario Provincial Standard Specification 1001.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01300.

.2 Allow continual sampling by Consultant during production.

.3 Provide Consultant with access to source and processed material for sampling.

.4 Install sampling facilities at discharge end of production conveyor, to allow Consultant to obtain representative samples of items being produced. Stop conveyor belt when requested by Consultant to permit full cross section sampling.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed five times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following.

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders or gravel.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of the following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

2.2 SOURCE QUALITY CONTROL

.1 Inform Consultant of proposed source of aggregates and provide access for sampling at least four weeks prior to commencing production.

.2 If, in opinion of Consultant, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.3 Advise Consultant four weeks in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Aggregate source preparation:

.1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Consultant.

.2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.

.3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

.4 When excavation is completed, dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

.5 Trim and dress slopes and leave site in neat condition.

.2 Processing

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Consultant.

.3 Wash aggregates to meet specifications. Use only approved equipment.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

.3 Handling:

.1 Handle aggregates to avoid segregation, contamination and degradation.

.4 Stockpiling:

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Consultant. Do not stockpile on completed surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Consultant within 48 hr of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Max. 1.5 m for coarse aggregate and base course materials.

.2 Max. 1.5 m for fine aggregate and sub-base materials.

.3 Max. 1.5 m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained conditions, free of standing surface water.

.2 Leave any unused aggregates in neat stockpiles as directed by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2 RELATED WORK

.1	Site Grading	Section 02311
.2	Excavation, Trenching and Backfilling	Section 02315
.3	Aggregates	Section 02701
.4	Granular Sub-base	Section 02723

1.3 REFERENCES

.1 ASTM C 117-90, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C 131-89, Test method for Resistance to Degradation of Small-Size Coarse aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C 136-92, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D 698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-1bf/ft3) (600 kN-m/m^3).

.5 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.

.6 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

.7 Ontario Provincial Standard Specification 1010.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 02701 – Aggregates.

.2 Do not deliver or place soil in frozen, wet, or muddy conditions. Material shall be delivered at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698). Do not deliver or place materials in an excessively moist condition (beyond 2 percent above optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698).

.3 Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content

1.5 SAMPLES AND SUBMITTALS

.1 At least 4 weeks prior to ordering materials, the Contractor shall submit to the Consultant samples, certificates, manufacturers' literature and certified tests for materials requested. No materials shall be ordered until the required samples, certificates, manufacturer's literature and test results have been reviewed and approved by the Consultant. Delivered

materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Consultant reserves the right to reject, on or after delivery, any material that does not meet these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular base material: Granular 'A' OPSS 1010, Section 02701 and following requirements:

.1 Crushed pit-run or screened stone, gravel or sand consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits of specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	% Passing
26.5 mm	100
19 mm	85 – 100
13.2 mm	65 – 90
9.5 mm	50 – 73
4.75 mm	35 – 55
1.18 mm	15 – 40
0.300 mm	5 – 22
0.150 mm	–
0.075 mm	2 – 8

.3 Plasticity Index: ASTM D4318-840.

.4 Los Angeles Abrasion ASTM C131-81 (1987) Gradation 'A' Max. % loss by weight: 60.

.5 Crushed particles: at least 50% of particles by mass within each of following sieve designation ranges to have at least 10 freshly fractured face. Material to be divided into ranges using methods of ASTM C136-84a.

Passing	Retained On
19 mm	26.5 mm
4.75 mm	19 mm

.6 Petrographic number MTO LS 69, Maximum 250.

.7 Soaked CBR: AASHTO T193-72 when compacted to 100% of AASHTO T180-774 Method D, Min 80 for use under Portland cement and Min 100 for use under asphalt concrete.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

.1 Place granular base after finished sub-base surface or subgrade is inspected and approved by Geotechnical Consultant.

.2 Placing

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Place material using methods which do not lead to segregation or degradation of aggregate.

.5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.7 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Consultant before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Compacting in accordance with ASTM D 698 and ASTM D 1557.

.1 Compaction of Pavement Base: Compact to density of not less than 100% SPMDD.

.2 Compaction of Concrete Slab on Grade or Concrete Sidewalks Base: Compact to density of not less than 100% of SPMDD.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.4 Apply water as necessary during compacting to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROOF ROLLING

.1 For proof rolling use roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 915 mm maximum.

.2 Consultant may authorize use of other acceptable proof rolling equipment.

.3 Proof roll top of base upon completion of fine grading and compaction.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals defective areas:

.1 Remove base, sub-base and subgrade material to depth and extent directed by Consultant.

.2 Backfill excavated subgrade with sub-base material and compact in accordance with Section 02315.

.3 Replace sub-base material and compact in accordance with Sections 02315 and 02723.

.4 Replace base material and compact in accordance with this Section.

3.4 INSPECTION AND TESTING

.1 Testing of materials and compaction will be carried out under Cash Allowance by testing laboratory designated by Consultant. Frequency of tests will be determined by Consultant.

3.5 PROTECTION

.1 Maintain finished base in condition conforming to this section until succeeding material is applied or until acceptance by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1	Site Grading	Section 02311
.2	Excavation, Trenching and Backfilling	Section 02315
.3	Aggregates: General	Section 02701
.4	Granular Base	Section 02721

1.3 REFERENCES

.1 ASTM C 117-90, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C 131-89, Test method for Resistance to Degradation of Small-Size Coarse aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C 136-92, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D 422-63 (1990), Method for Particle-Size Analysis of Soils.

.5 ASTM D 698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-1bf/ft3) (600 kN-m/m^3).

.6 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.

.7 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

.8 Ontario Provincial Standard Specification 1010.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 02701 – Aggregates.

.2 Do not deliver or place soil in frozen, wet, or muddy conditions. Material shall be delivered at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698). Do not deliver or place materials in an excessively moist condition (beyond 2 percent above optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698).

.3 Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content

1.5 SAMPLES AND SUBMITTALS

.1 At least 4 weeks prior to ordering materials, the Contractor shall submit to the Consultant samples, certificates, manufacturers' literature and certified tests for materials requested.

No materials shall be ordered until the required samples, certificates, manufacturer's literature and test results have been reviewed and approved by the Consultant. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Consultant reserves the right to reject, on or after delivery, any material that does not meet these specifications.

PART 2 - PRODUCTS

2.1. Materials

.1 Granular sub-base material: Granular 'B', Type I, OPSS 1010, Section 02701 and following requirements.

.1 Crushed, pit run or screened stone, gravel or sand consisting of hard durable angular particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	% Passing
150 mm	100
26.5 mm	50 – 100
4.75 mm	20 – 100
1.18 mm	10 – 100
0.300 mm	5 – 22
0.150 mm	2 – 65
0.075 mm	0 – 8

.2 Other Properties as follows:

.1 Plasticity Index: ASTM D4318-84.0.

.2 Crushed particles: at least 100% of particles by mass within each of the following sieve designation ranges to have at least 1 freshly fractured face for Type II. Not applicable for Type I material to be divided into ranges using methods of ASTM C135-84a.

.3 Petrographic Number: to MTO LS609 Maximum 250.

Passing	Retained On
26.5 mm	4.75 mm

.4 Particles smaller than 0.02 mm AASHTO T88-78 maximum 3%.

.5 Soaked CBR AASHTO T193-72 Min 40 when compacted to 100% of AASHTO T180.74 Method D.

PART 3 - EXECUTION

3.1 PLACING

.1 Compact subgrade to 95% of SPMDD. Excavate all weak and soft spots as required and replace with granular sub-base compacted uniformly to 100% of SPMDD.

.2 Place granular sub-base after subgrade is inspected and approved by Geotechnical Consultant.

.3 Construct granular sub-base to depth and grade in areas indicated.

.4 Ensure no frozen material is placed.

.5 Place material only on clean unfrozen surface, free from snow or ice.

.6 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.7 For spreading and shaping materials, use spreader boxes having adjustable templates or screens which will place material in uniform layers of required thickness.

.8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.10 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Consultant before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Compaction in accordance with ASTM D698 and ASTM D1577.

.1 Pavement Sub-base: Compact to density of not less than 100% SPMDD.

.2 Backfill of subgrade weak or soft spots: Compact to density of not less than 98% of SPMDD.

.5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.6 Apply water as necessary during compaction to obtain specified density.

.7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.

.8 Correct surface irregularities by loosening and adding or removing material unit surface is within specified tolerance.

3.3 SITE TOLERANCES

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.4 INSPECTION AND TESTING

.1 Testing of materials and compaction will be carried out by testing laboratory designated by Owner. Frequency of tests will be determined by Consultant.

.2 Owner will pay costs for inspection and testing.

3.5 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to the requirements stated in the General Conditions, Supplementary General Conditions and General Requirements of this Specification and all addenda.

1.2 RELATED WORK

.1	Site Grading	Section 02311
.2	Aggregates	Section 02701
.3	Granular Base	Section 02721
.4	Granular Sub-Base	Section 02723
.5	Pavement Markings	Section 02761

1.3 QUALITY ASSURANCE

.1 Plant requirements: facilities for production and transportation or asphaltic mixture shall conform to OPSS Form 310.

.2 Equipment Requirements: self-powered mechanical pavers conforming to OPSS Form 310.

.3 Rollers: conforming to OPSS Form 310.

1.4 INSPECTION

.1 Examine areas to receive the work of this Section and do not proceed until unsatisfactory conditions are corrected.

.2 Notify the Consultant at least 48 hours prior to commencing work.

.3 Do not commence work until the Geotechnical Consultant has inspected and approved surfaces to receive asphalt paving.

1.5 CONDITION OF SURFACES

.1 Prior to delivery of mixture, base surface shall be dry and free of all loose and foreign material.

1.6 TEMPERATURE REQUIREMENTS

.1 Prior to placing asphalt, air temperature at the base surface shall be a minimum of 7° C and rising.

.2 Temperature of mixture shall not be less than 118° C immediately after spreading prior to initial rolling.

.3 The asphalt cement shall be heated at the mixing plant only to the temperature required for satisfactory mixing and shall not exceed 162° C.

1.7 PROTECTION

.1 Conduct work without damaging other work. If other work is damaged, it shall be corrected to the approval of the Consultant without cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Asphalt cement: conform to OPSS Form 1101.

.2 Aggregates: conform to OPSS Form 1000 and 310.

.3 Emulsified Asphalt: SS-1 emulsion conforming to OPSS Form 1103.

2.2 ASPHALT MIXES

.1 Asphalt Binding Course: HL8 conforming to OPSS Form 310.

.2 Asphalt Surface Course: HL3 conforming to OPSS Form 310.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Clean surfaces of all loose and foreign materials.

.2 Paint cold contact surfaces with emulsified asphalt.

3.2 INSTALLATION

.1 Place asphalt paving in accordance with OPSS Form 310.

.2 Compact asphalt to a minimum of 92% Maximum Theoretical Relative Density (MTRD).

.3 Place asphalt to the following thicknesses:

Pavement	**Heavy Duty**	**Medium Duty**	**Light Duty**
Application	Fire Route as shown architectural plan	Parking Areas outside of fire routes	Hard surface play areas and walkways (not generally subject to automotive traffic).
Asphaltic Concrete	40 mm HL3 65 mm HL8	40 mm HL3 50 mm HL8	50 mm HL3
Base Course: 19 mm Crushed Limestone	150 mm	150 mm	200 mm
Sub-Base: Granular B or 50 mm Crushed Limestone	300 mm	200 mm	--

.4 Rolling shall continue until all roller marks are eliminated and no further compression is possible.

.5 Hand tamp the asphalt with vibrating compactors adjacent to buildings, manhole covers and concrete curbs.

.6 At the end of each day's work, or prolonged stoppage of asphalt paving, joints hall be formed by laying the asphalt and rolling it against a horizontal edge board of the proper thickness, placed across the entire width of the pavement.

.7 Finished asphalt surfaces shall be straight and true to established levels, free from cracks, undrained areas or depressions exceeding 3 mm as measured with a 3 m straight edge in any direction. Asphalt thickness specified shall be maintained as minimum at any point.

.8 Edges shall be neat and straight or properly curved as indicated, without broken, disintegrated or loose edges.

3.3 CLEANING

.1 Remove asphalt stains from adjacent finished surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2 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-71-83, Method of Testing Paints and Pigments.

.4 CGSB 1-GP-74M-79, Paint, Traffic, Alkyd.

.5 ASTM D4505-85 - Preformed Plastic Pavement Marking Tape for Extended Service Life

.6 MTO Manual of Uniform Traffic Control Devices (Metric Edition) – latest edition.

1.3 SAMPLES AND SUBMITTALS

.1 Submit to Consultant, upon request, the following material sample quantities at least four weeks prior to commencing work.

.1 Two 1 L samples of each type of paint.

.2 Sampling to CGSB 1-GP-71.

.2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation and batch number.

.3 For Asphalt Primer submit the following, upon request:

.1 Manufactures printed data sheets and test reports.

.2 Certificates of Analysis for performance properties.

.3 MSDS – Material Safety Data Sheets.

1.4 AMBIENT CONDITIONS FOR ASPHALT PRIMER

.1 Air temperature to be above 10 degrees Celsius for 24 hours.

.2 Do not apply if conditions will not permit complete cure before rain, dew or freezing temperatures occur.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Traffic Marking Paint:

.1 To CGSB 1-GP-74M, alkyd traffic paint.

.1 Colour: to CGSB 1-GP-12C:

.1 white 513-301.

.2 yellow 33538.

.2 Thinner: to CAN/CGSB-1.5

.2 All paint to confirm to OPSS #1712 and be supplied by one of the following suppliers.

Supplier	White Paint Code
Niagara Paint and Chemical Co. Ltd.	#87932
Ibis Products Ltd.	#40-2478
CIL	#7612-26992
Sherwin Williams	#C97WG129
Sico Paints	#3007649W

.2 Plastic Marking Tape:

.1 The material as supplied, shall be free of cracks, and have edges true, straight and unbroken conforming to ASTM D4505. Preformed plastic pavement marking tape of all types shall have a uniform width and thickness.

.2 The material used in the manufacture of thermal plastic pavement marking tape shall be of high quality so that the appearance will not change in service to impair the colour or the visibility of the delineation.

.3 Shall meet the requirements of OPSS 1713 – Thermoplastic Pavement Markings.

.3 Asphalt Paint:

.1 Epoxy modified, acrylic, waterborne coating designed for application on asphalt pavements containing properties that ensure good adhesion and movement on flexible pavement, while providing good durability. Durable in dry and wet environments. To meet the following properties:

.1 Physical Properties:

.1 Solids by Volume, ASTM D-2697, 55%.

.2 Solids by Weight, ASTM D-2369, 68.9%.

.3 Density, ASTM D-1475, 13.34 lbs/gal (1.599 kg/l).

.2 Performance Properties:

.1 Dry time (to re-coat), ASTM D-5895 23°C; 37% RH, 35 min.

.2 Taber Wear Abrasion Dry H-10 wheel, ASTM D-4060 1 day cure, 0.98 g/1000 cycles.

.3 Taber Wear Abrasion Wet H-10 wheel, ASTM D-4060 7 days cure, 3.4 g/1000 cycles.

.4 QUV E Accel., ASTM G-154 Delta, 0.53.

.5 Weathering environment, E 1,500 hours.

.6 Hydrophobicity Water absorption, ASTM D-570, 8.3% (9 days immersion).

.7 Shore hardness, ASTM D-2240, 63 Type D.

.8 Mandrel Bend, ASTM D522-93A, 1/4" @ 21° C.

.9 Permanence, ASTM D1653, 3.45 g/m²/hr (52 mils).

.10 VOC, Per MSDS, 23 g/l.

.11 Adhesion to Asphalt ASTM D-4541 Substrate Failure

.12 FrictionWet, ASTM E-303 British Pendulum Tester,

.1 WP* coated 64 (test conducted on asphalt pavement in wheel path)

.2 WP* uncoated 57 (test conducted on asphalt pavement in wheel path)

.3 AC** coated 73 (test conducted on asphalt pavement adjacent to curb)

.4 AC** uncoated 60 (test conducted on asphalt pavement adjacent to curb)

PART 3 - EXECUTION

3.1 EQUIPMENT REQUIREMENTS

.1 Paint applicator to be an approved pressure type 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.

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 OF TRAFFIC MARKING PAINT

.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 60 km/h and no rain is forecast within next 4 hr.

.3 Apply traffic paint evenly at rate of 2.42 m²/L.

.4 Do not thin paint unless approved by Consultant.

.5 Symbols and letters to conform to MTO Manual of Uniform Traffic Control Devices.

.6 Paint lines to be of uniform colour and density with sharp edges. Painted lines for islands and crosswalks shall be 200mm in width.

.7 Apply Thermoplastic pavement marking to manufacturer's instruction for pedestrian crossings as per drawings.

.8 Thoroughly clean distributor tank before refilling with paint of different colour.

3.4 APPLICATION OF ASPHALT PRIMER

.1 Surface Preparation:

.1 Clean surfaces ensuring they are free of dirt, oil, grease, soapy films, surface chemicals or other foreign contaminants.

.2 Exiting asphalt must be cleaned using a biodegradable chemical cleaner and water using a mechanical scrubber. Rinse with fresh water removing all traces of chemical cleaner.

.2 Mixing:

.1 Stir primer before application.

.3 Application:

.1 Applied by brush, roller or spray. A low pressure sprayer can be used to apply primer to surface followed by back rolling. For large projects airless spray is the preferred method. Any airless spray equipment capable of 1,000 psi and 1.9l/minute delivery can be used. A reversible, self-cleaning spray tip with an orifice size of .4 mm to .7 mm and minimum 40 degree fan angle is recommended. Before spraying, flush equipment with clean water to prevent contamination.

.2 Do not allow the product to puddle or glaze over the top of the substrate. Allow to dry properly before applying colour coating. Failure to do so can result in coating failure. Surface may be slightly tacky but must not transfer residue to hand. Primer must be top coated within 48 hours for optimum bonding results. In warm conditions with direct sun light allow 2-4 hours to dry. In cool shaded conditions allow to dry for 24 hours.

3.5 APPLICATION OF ASPHALT PAINT

.1 Equipment:

.1 Coating Sprayer: capable of applying coatings to the asphalt pavement surface in a thin, controlled film optimizing drying and curing time of coating.

.2 Mixer: motorized mixing device designed to ensure efficient and thorough blending of components.

.2 Preparation:

.1 Ensure surface is dry and free of foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue.

.2 Clean surface with a broom and blower. In severe situations use a power washer.

.3 Ensure substrate is dry before applying coating.

.4 Ambient and surface temperatures must be 50^0F (10^0C) and raising before coating application.

.5 All existing painting to be removed before new asphalt painting is started.

.6 Layouts for areas to be painted are to the responsibility of the Contractor or Subcontractor.

.3 Application of Colour Coating:

.1 Use coating sprayer. Spray apply first layer then broom to work into pavement surface. Subsequent applications shall be sprayed then broomed or rolled. Ensure each coating application is dry to the touch before applying next layer.

.2 Recommended coating coverage and thickness is:

.

# of Layers	Coverage (Approx.)		Thickness (Approx.)	
	Textured (Offset Brick sf/pail)	Non-Textured (sf/pail)	Wet mm (mil)	Dry mm (mil)
Coats 3	200	225	0.65 (25.7)	0.36 (14.1)
4	150	175	0.87 (34.3)	0.48 (18.9)

.3 Coverage may be affected by the texture of the asphalt pavement substrate. There will be less coverage with the first layer and higher coverage with subsequent layers.

.4 Protection

.1 Protect coated surfaces from traffic until completely dry. Drying time will be affected by ambient temperatures. Check with manufacturer for coating drying times.

3.6 TOLERANCE

.1 Paint markings to be within plus or minus 12 mm of dimensions indicated.

.2 Remove incorrect markings and clean asphalt surface to satisfaction of Consultant prior to re-painting markings.

3.7 PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until dry.

3.8 PROJECT COMPLETION

.1 Clean all surfaces and apply a second coat to all markings and symbols at total completion of project.

END OF SECTION

PART 1 - GENERAL

1.1 **Related Sections** .1 Division 2

1.2 **Definitions** .1 COMPOST: A mixture of soil and decomposing organic matter used as a fertilizer, mulch, or soil conditioner. Compost is processed organic matter containing 40% or more organic matter as determined by the Walkley-Black or LOI test. Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminates. Composted bio-solids must meet the requirements of the Guidelines for Compost Quality, Category (A) produced by the Canadian Council of the Ministers of the Environment (CCME).

PART 2 - PRODUCTS

2.1 **Topsoil** .1 Topsoil for sodded and seeded areas and ground-level planting beds: mixture of 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 45 % sand, 15 % clay, 40% silt, and contain 4 to 10 % organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials.

.3 Finished surface 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.

.4 Consistence: friable when moist.

.5 Fertility: major soil nutrients present in following amounts:

.6 Nitrogen (N): 20 to 40micrograms of available N per gram of topsoil.

.7 Phosphorus (P): 40 to 50micrograms of phosphate per gram of topsoil.

.8 Potassium (K): 75 to 110micrograms of potassium per gram of topsoil.

.9 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.

.10 Ph value: 6.5 to 8.0.

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 Organic matter: compost Category A, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.4 Limestone:

.1 Ground agricultural limestone.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.5 Fertilizer: organic, industry accepted standard medium containing nitrogen, phosphorous, potassium and any other micro-nutrients suitable to the specific plant species or application or defined by the soil test.

2.3 Source Quality Control

.1 Advise Consultant of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to supply topsoil as specified.

.3 Soil testing by recognized testing facility for pH, N, P and K, and organic matter and other test components as designated by Consultant. Coordinate with Consultant prior to arranging for testing.

.4 Testing of topsoil will be carried out by testing laboratory designated by Consultant. Soil sampling, testing and analysis to be in accordance with Provincial standards. Cost of tests will be paid by cash allowance.

PART 3 - EXECUTION

3.1 **Stripping of Topsoil**

.1 Commence topsoil stripping of areas as directed by Consultant after area has been cleared of weeds and grasses and removed from site.

.2 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.3 Stockpile in locations as directed by Consultant. Stockpile height not to exceed 2 m.

3.1 **Stripping of**

.4 Disposal of unused topsoil is to be in an environmentally responsible manner

Topsoil (Cont'd)

but not used as landfill.

.5 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 50mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 50 mm above surface. Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to minimum 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.

.3 For sodded areas keep topsoil 15 mm below finished grade.

.4 Spread topsoil as indicated to following minimum depths after settlement.

.1 150 mm for seeded areas.

.2 135 mm for sodded areas.

.3 600 mm for shrub and perennial 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 into full specified depth of topsoil.

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. 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.

3.7 **Surplus Material**

.1 Dispose of materials except topsoil not required off site.

End of Section

PART 1 - GENERAL

1.1 **Related Sections** .1 Section 02911 Topsoil and Finish Grading

1.2 **Samples** .1 Submit samples in accordance with Section 01300 – Submittals.

.2 Submit:

.1 Sod for each type specified.

.1 Install approved samples in one square metre mock-ups and maintain in accordance with maintenance requirements during establishment period.

.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 when frost is not present in ground.

1.4 **Maintenance Period** .1 Maintain sod from date of installation until Substantial Performance, or a 90 day period after sodding, whichever is longer. If Substantial Performance, or the 90 day period after sodding, ends after end of growing season, extend maintenance period until June 30 of the following growing season. Maintain sod layed at end of growing season until August 31 of following season.

PART 2 - PRODUCTS

2.1 **Materials** .1 Number One Turfgrass Nursery Sod: Sod that has been especially sown and cultivated in nursery fields as turfgrass crop.

.1 Turfgrass Nursery Sod types:

.1 Turf-Type Perennial Ryegrass Sod – containing mixture of 70% perennial Ryegrass and 30% Kentucky Bluegrass.

.2 Fine-Leafed Fescue Sod – containing mixture of 70% Fine-Leafed Fescue and 30% Kentucky Bluegrass.

.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 from height of 1500 mm when mown to height of 50 mm.

.3 Mowing height limit: 35 to 65 mm.

.4 Soil portion of sod: 6 to 15 mm in thickness.

2.1 **Materials (Cont'd)**

.2 Sod establishment support:

.1 Wooden pegs: 17 x 8 x 200 mm.

.2 Biodegradable starch pegs: 17 x 8 x 200 mm.

.3 Water:

.1 Supplied by Owner at designated source.

.4 Fertilizer:

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

.2 Complete, natural, organic, slow release with 65 % of nitrogen content in water-insoluble form.

2.2 **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.

PART 3 - EXECUTION

3.1 **Preparation**

.1 Verify that grades are correct and prepared in accordance with Section 02911 - 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 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 8mm, for Turfgrass Nursery 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.

3.2 **Sod Placement**

.1 Lay sod within 24 hours of being lifted if air temperature exceeds 20°C.

.2 Lay sod sections in rows, 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.

3.3 **Sod Placement on Slopes and Pegging**

.1 Start laying sod at bottom of slopes.

.2 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:

.1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.

.2 Not less than 3-6 pegs per square metre.

.3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Consultant.

.4 Drive pegs to 20 mm above soil surface of sod sections.

3.4 **Fertilizing Program**

.1 Fertilize during establishment and warranty periods to following program:

Date	Rate
May 1 to May 31 (first application)	12 kg / 100 cu.m
July 1 to July 31 (second application)	6 kg / 100 cu.m
September 1 to September 15 (third application)	12 kg / 100 cu.m

.2 The fertilizer requirements noted above have been included for tendering purposes only. Adjust requirements and rates to conform to soil testing report and subsequent recommendations. Make such adjustments at no extra cost to the contract.

3.5 **Maintenance During Establishment Period**

.1 Perform following operations from time of installation until acceptance at end of maintenance period.

.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 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas as directed by Consultant.

.4 Maintain sodded areas weed free 95%.

.5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.6 **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.

.3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.

.4 Sodded areas have been cut minimum 2 times prior to acceptance.

3.6 **Acceptance (Cont'd)**

.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.

3.7 **Maintenance During Warranty Period**

.1 Maintenance during Warranty Period will be the responsibility of the Owner.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1 Section 03302 Concrete Formwork
.2 Section 03302 Concrete Floor Finishing.
.3 Section 05510 Metal Stairs and Railings.
.4 Section 10999 Manufactured Specialties.

1.3 **Quality Assurance**

.1 The precast concrete stairs shall be designed and fabricated by a fully experienced and recognized manufacturer of precast concrete stairs whose manufacturing plant and facilities are equipped for this type of work.

.2 Manufacturer of precast stairs and landings shall be a member of the National Precast Concrete Association (NPCA).

.3 Manufacturer of precast stairs and landings shall be certified by CSA, meeting requirements of CSA A23.4-00 for appropriate class of work.

1.4 **Submittals**

.1 Prepare and submit fully detailed Shop Drawings, containing all pertinent information in regard to the fabrication and erection of the precast concrete stairs and landings including:

.1 Shop drawings to be sealed by professional engineer licensed to practice in jurisdiction of project.
.2 Location of each unit in the completed structure and identifying marks for each unit.
.3 Size and dimensions of each stair complete with connection details.
.4 Reinforcing details, grade of reinforcement, concrete strength and admixtures.
.5 Locations and details for lifting hooks and handling points.
.6 Sequence of erection and any special instructions that may be required in handling, setting and temporary bracing.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Concrete Compressive Strength (28 Days): 30 MPa, CSA A23.1-00.

.2 Cement: Portland Cement, Gray, Conforming to the requirements of CAN 3-A23.4-00 or CAN/CSA-A5-98, of same type, brand and source.

.3 Aggregates: Conforming to the requirements of CAN 3-A23.4-00 or CAN 3-A23.1-00.

.4 Reinforcements: Conforming to the requirements of CAN/CSA A-G30.18-M92 or CAN 3-A23.1-00. Grade 60. All reinforcing steel to be weldable.

.5 Tolerances: Fabricated precast concrete units shall be straight and true to dimensions as approved in Shop Drawings, conforming to CSA A23.4-00.

.6 Formwork: All forms shall be steel, accurately constructed, well braced and stiffened to avoid deformations under pressure of wet concrete and vibrators. The quality of forms shall be such that all dimensional tolerances and exposed concrete quality can be consistently maintained.

2.2 **Fabrication**

.1 Stair tread finish application required for this project:

1. Finish Type 1
The steel forms shall be manufactured to produce finish suitable for exposed finish complete with radiused nosing and raised non-slip parallel ridges at tread nosing.

.2 The underside of all precast stairs shall have a smooth trowel finish. Screed finish is not acceptable.

.3 Accurately set reinforcing steel. Vibrate continuously during casting of concrete.

.4 Bearing areas shall be reinforced against diagonal tension, splitting, rupture and flexure. Extra ties, stirrups and reinforcing bars shall be placed at support points.

.5 Support precast stair units uniformly while curing. Keep a daily check to detect any development of warpage or other distortion. Rearrange supports as required to compensate for warpage or distortion.

.6 Cast in lifting devices required for erection of the precast concrete stair units. Ensure that lifting devices used externally or cast into units are capable of supporting the precast units in all positions that the units may be in during course of manufacture, transportation and installation. Ultimate capacity of lifting devices shall be sufficient to resist forces obtained by applying load factor of 4:1.

.7 Cast in weld plates on stringer face for attachment of steel guard/balustrade.

PART 3 - EXECUTION

3.1 **Storage, Delivery, Handling & Protection**

.1 Proper lifting devices for the stair units shall be incorporated to ensure that they will be safely and efficiently handled and not produce distortion, cracking or deflection nor strain or adversely affect the units.

.2 Precast stair units shall be handled and adequately protected during fabrication, curing, storage and transport by methods that will prevent damage, warping, cracking, breakage, chipping, staining or other disfigurement. Units shall not be permitted to contact the earth or other staining influences.

.3 Repair chipped, checked, cracked, blemished or defective units.

.4 Precast stair units shall be delivered to the site clearly marked in an acceptable manner as indicated on the Shop Drawings. Markings shall not be visible once stair unit is installed.

3.2 **Erection**

.1 Erection of the precast stairs and landings, at the site, shall be by the contractor.

.2 All work shall be executed using workers skilled in the trade of precast erection.

.3 All stair and landing units shall be set plumb, true and square, with joints parallel and uniform, all in accordance with approved Shop Drawings.

		.4	Units shall be anchored securely and rigidly to supporting work.
3.2	**Erection (Cont'd)**	.5	Provide all anchors, fixing devices, supports, and misc. installation hardware necessary.
		.6	Grout joints at supports with non-shrink grout.
		.7	Patch holes at lifting hook locations, to match adjacent surfaces.
3.3	**Schedule**	.1	Provide finish types in Stairs according to the following schedule: **Finish Type 1:** Stair 901
3.4	**Cleaning**	.1	Clean soiled precast concrete surfaces by approved means to satisfaction of consultant.
		.2	Repair units that have minor visual defects to the satisfaction of consultant.
3.5	**Inspection and Testing**	.1	All inspection and testing as directed by consultant. Costs incurred for inspection and testing will be applied against allowances specified in Section 01020.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**
.1 Comply with requirements of Division 1.

1.2 **Related Sections**
.1 Concrete fill for block lintels: Section 03302
.2 Masonry, including mortar joint workmanship: Section 04200

1.3 **Reference Standards**
.1 Quality Standards: meet requirements of CSA A179-94, Mortar and Grout for Unit Masonry.

1.4 **Source Quality Control**
.1 Source of Materials: for mortar to remain exposed in finished project, brands of cementitious materials and source of supply of sand, shall remain the same for duration of work.

1.5 **Delivery & Storage**
.1 Store cementiitous materials so as to prevent moisture absorption from any source. Do not use material affected by moisture.

.2 Store mortar and aggregate materials to prevent contamination. Do not use contaminated materials.

PART 2 - PRODUCTS

2.1 **Materials**
.1 Water: potable and non-staining.

.2 Aggregate - Sand: CSA A82.56M

.3 Portland cement: CAN/CSA-A5-93, Type 10.

.4 Masonry cement: CAN/CSA-A8-93, Type H.

.5 Waterproofer: Master Builders "Omnicron"

.6 Lime: Hydrated lime 'S' Type to ASTM C207.

PART 3 - EXECUTION

3.1 **Proportioning & Mixing**
.1 Mix mortar in accordance with table 2 of CSA A179-94 and the recommended procedures of the Brick Institute of America Manual MI except as specified herein.

.2 Mix mortar to proportions indicated in Mortar Schedule.

.3 An experienced competent tradesman must supervise mortar mixing.

.4 Mix mortar in watertight mechanical mixers. Measure ingredients accurately by volume. Bring mortar to required elasticity. Continue mixing mortar until materials are blended to uniform colour, but not less than 3 minutes, or more than 5 minutes. Do not mix longer than 10 minutes.

3.1 **Proportioning & Mixing (Cont'd)**

.5 Do not use admixtures of any kind in mixes except where specified otherwise.

.6 Prehydrate pointing mortar by mixing ingredients dry then mix again adding just enough water to provide a damp workable mix that will retain its form when pressed into a ball. Allow to stand for not less than two hours then remix with sufficient water to produce mortar of the proper consistency for pointing.

3.2 **Time Limits & Retempering**

.1 Use and place mortar in final position within the following time limits after mixing:

.1 Air Temp. above 25 degrees C - 12 hours.
.2 Air Temp. below 25 degrees C - 2.5 hours.

.2 Standard mortar that has stiffened within above time limits because of evaporation of water may be retempered by adding water as frequently as needed to restore required consistency. Discard mortar not used within above time limits.

3.3 **Mortar Schedule**

.1 Bearing walls: Type S mortar.

.2 Non bearing walls: Type N mortar consisting of 1 part Masonry Cement, 3 parts aggregate.

.3 Where cement mortar is called for on Structural Drawings: Type S mortar.

.4 At solid bearing courses and foundation walls: type S mortar.

.5 Exterior brick and block veneer: Type N mortar.

End of Section

PART 1 - GENERAL

1.1	**General Requirements**	.1	Comply with requirements of Division 1.	
1.2	**Related Sections**	.1	Supply of reinforcing steel and concrete for block lintels:	Section 03302
		.2	Installation of dovetail anchor slots at concrete elements:	Section 03302
		.3	Mortar	Section 04100
		.4	Supply of loose steel lintels	Section 05123
		.5	Metal Fabrications	Section 05500
		.6	Air Barrier	Section 07196
		.7	Foamed Cavity Wall Insulation	Section 07219
		.8	Caulking:	Section 07900
		.9	Supply of steel door frames	Section 08100
		.10	Supply of access doors for mechanical and electrical Work.	Division 15 & 16
1.3	**Work Installed But Supplied By Others**	.1	Build into masonry elements inserts, anchors, bolts, sleeves and other items supplied by other Sections and which are required for installation and performance of work of other Sections.	
		.2	Install loose steel lintels.	
		.3	Coordinate installation of lateral supports required for final support of masonry partitions with Section 05500.	
		.4	Install steel window and door frames and access doors occurring in masonry elements.	
		.5	Install reinforcing steel and concrete fill into block lintels.	
1.4	**Reference Standards**	.1	Confirm to requirements of CSA A370.94, CSA A371.94 and CSA S304.1.94.	
1.5	**Qualifications**	.1	The work of this section is to be done by a masonry contractor of recognized standing having personnel with experience in this type of work and who has the necessary equipment to carry out the work.	
		.2	Ensure that work is executed under the continuous supervision and direction of a competent foreman.	
1.6	**Submittals**	.1	Before ordering any materials submit two samples of all materials for approval.	
		.2	Submit additional materials as required for testing to a Testing Company approved by the Consultant and provide results of standard tests on the actual production run of exterior brick including compression, absorption and saturation coefficient and 50 cycle freeze thaw resistance test.	
		.3	Submit shop drawings in accordance with the General Conditions of all special masonry units.	

1.7	**Inspection & Testing**	.1	The Consultant may at his discretion call for tests of mortar or other masonry materials to be made by an independent inspection company.
		.2	A Cash Allowance for these tests will be carried by the General Contractor in accordance with the General Conditions.
1.8	**Site Mock-Up**	.1	Construct sample panel of an exterior cavity wall including: masonry veneer, block, reinforcement, insulation, flashings and weep and vent holes, minimum 1.6 m x 2.5 m in size. Build sample panel in stepped-back fashion to expose each material used (brick, insulation, air barrier, block) to a minimum height of 400 mm each. Locate panel where directed by consultant. Panel may be located to allow incorporation into finished work if approved by the Consultant.
		.2	Construct a sample panel with regular lightweight block, minimum 1.5 m x 2.5 m in size. Locate panel where directed by Consultant. Panel may be located to allow incorporation into finished work if approved by the Consultant.
		.3	Construct panels to meet project requirements. Select masonry units to represent maximum texture and colour variations. Employ specified mortar, bond, reinforcement, ties, jointing, coursing and workmanship.
		.4	Obtain Consultant's approval of mock-up panels prior to starting masonry work.
		.5	Approved sample shall remain in place for comparison until completion of masonry work and the Consultant has reviewed the work.
1.9	**Source Quality Control**	.1	Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with Specification requirements.
		.2	For clay units, in addition to requirements set out in referenced Standards include data indicating initial rate of absorption for units proposed for use.
1.10	**Product Handing & Storage**	.1	Handle masonry units so as to prevent soiling and chipping and deliver to the job site in dry condition.
		.2	Store masonry units above and off ground on level platforms which permit air circulation under stacks.
		.3	During storage, protect masonry units against moisture absorption, damage, staining and freezing.
		.4	Keep materials dry until use.
1.11	**Environmental Conditions**	.1	In cold weather, construct and protect masonry elements in accordance with Clause 5.15.2 and 5.15.3 of CAN3-A71-M84. Maintain temperature of mortar between 5 degrees C and 50 degrees C until used.

1.12 **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. Anchor securely in position.

.2 In hot weather, protect freshly laid masonry from drying too rapidly by means of waterproof, non-staining coverings.

.3 Protect sills, projections and exposed edges so that finished work will not be damaged or defaced.

.4 Protect face work from splashing or marking. Protect interior block walls which are to be painted or left unfinished from staining and other damage.

.5 Protect all work installed by other trades from splashing and marking and other damage.

.6 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

PART 2 - PRODUCTS

2.1 **Materials**

.1 **Face Brick**

.1 Hard burned clay brick to CSA A82.1-M87.

.2 **Type 'A':**

Size:	Metric Modular (to match existing)
Series:	Butternut Velour | Glen-Gery
Colour:	Field Colour
Distributer:	Brampton Brick
Contact:	Andrew Bim
	abimm@bramptonbrick.com

Website**:** https://www.glengery.com/brick-catalog/butternut
https://www.glengery.com/sites/default/files/2024-01/2024TDS Urban Creme Velour.pdf

.3 **Type 'B':**

Size:	Metric Modular (to match existing)
Series:	Red Velour
Colour:	Accent Colour
Distributer:	Brampton Brick
Contact:	Andrew Bim
	abimm@bramptonbrick.com

Website: https://bramptonbrick.com/sites/default/files/resource_file/Architectural_Series_Product_Tech_Sheet_Eng.pdf

.2 **Concrete Block**: Metric size and autoclaved.

.1 Lightweight block: Ultra Lite to CSA Standard A-165.1M

.2 Standard weight block: to CAN3-A165.1M85.

.3 Units must be cured for at least 28 days before delivery and shall have a moisture content of not more than 30% of total absorption.

.4 Size: unless indicated otherwise 190 x 390 mm x thickness as shown on drawings.

.5 Exposed block units shall be uniform in size, free of perceptible warp or twist, without chipped, ragged or broken edges; have a uniform surface texture, free of cracks, blemishes or defects detrimental to appearance or performance.

.6 Where indicated on Drawings and/or Specifications, provide solid or semi-solid units.

.7 Provide manufacturer's catalogued special units such as bullnose corner, lintel block and 45° corner blocks.

2.1 **Materials (Cont'd)**

.4 **Metal Reinforcement and Anchors**

.1 Material: high tensile strength steel wire meeting ASTM A82, by Bloklok or Durowall.

.2 Finish: hot dip galvanized after fabrication to ASTM A153, Class B.

.3 Provide prefabricated assemblies for corners and intersections.

.4 Horizontal Reinforcement:

.1 Single wythe and solid walls: truss type with minimum 3.66 mm thick side and cross rods unless otherwise indicated; width 50 mm less than wall thickness: BLOK-TRUS BL30.

.2 Cavity walls at walls with concrete block back-up: Refer to Structural drawings. Ferro Slotted Block Tie (type i) consisting of 1.6 mm thick steel connector plate of length to suit insulation and concrete block thickness, steel wire V-tie, 4.8 mm diameter. Refer to structural drawings.

.3 Cavity walls at walls with structural steel backup: Ferro Rap Tie consisting of slotted connector plate of length to suit insulation thickness, anchored with predrilled anchors, and steel wire V-tie. Refer to structural drawings.

.5 Anchors and Ties:

.1 Non-bearing walls and partitions to bearing walls: corrugated wall ties minimum 0.7 mm thick, 21 x 175 mm BLOK-LOK BLT7A.

.2 Masonry walls, partitions and veneer to concrete elements: Flexible wire tie, 4.76 mm thick, length to suit wall condition, and dovetail anchor slot: BLOK-LOK BLT8, or POS-1-TIE NWTC-TAPCON screw anchors by National Wire Products Industries Inc.

.3 Masonry to structural steel: flexible triangular 4.76 mm thick ties and weld on anchor straps: BLOK-LOK FLEX-O-LOK BLT9 or POS-1-TIE NWDI-DRIL-IT screw anchors by

National Wire Products Industries Inc.

.4 Masonry veneer to exterior wall steel stud: M.A.S.S. Assembly by A.C. Wild Inc., consisting of reinforce stainless steel angle clip, screws fastened to steel stud with co-polymer coated, self drilling screws (with EPDM Gasket) spring steel washer, stainless steel washer, stainless steel insulation retainer, stainless steel wire tie.

.5 Strap anchors: galvanized, 2 mm thick, crimped, 50 mm x 150 mm.

2.1 **Materials (Cont'd)**

.5 **Cavity Wall Insulation:**

.1 Insulation: Foamed in place insulation by Section 07219.

.6 **Membrane Flashing/Dampproof Course:** Minimum 0.5 mm thick flexible membrane: Bakor Blueskin TWF (self adhering SBS Modified Flashing Membrane) or F20 by Lexsuco or Rodoply (20 mils) by Sternson.

.7 **Membrane Flashing Back-up:** minimum 0.9 mm thick hot dipped galvanized sheet steel meeting Z275 zinc coating designation

.8 **Weep Holes, Vent Holes**: Weep Hole Ventilator by BLOK-LOK Ltd. or Goodco Plastic Brick Vent.

.9 **Nailing Inserts:** 0.6 mm purpose made galvanized steel inserts for setting in mortar joints.

.10 **Premoulded Joint Filler** - Closed cell vinyl foam, compressed 25% when in joint, one of the following:

.1 Unifoam R 1009 - Flexible by Goodco Ltd
.2 Rodofoam PR by Sternson Ltd.

.11 **Fire stop:** ULC labelled, firebarrier mineral wool by Double A/D Distributors Ltd., Fire-Bloc by M.W. McGill and Associates. Use Bakelite 910-10 Adhesive.

.12 **Dovetail anchor slots**: 26 ga. galvanized steel, glass fibre filled. Supply to Section 03300 for installation.

.13 **Preformed Control Joint Key:** Titewall BL.A Rubber Preformed Joint Key by BLOK-LOK.

.14 **Bond Break**: 0.1 mm thick polyethylene.

.15 **Compressible Filler:** Rockwool Insulation

.16 **Asphalt Impregnated Board**: 12 mm thick asphalt impregnated fibre boards.

.17 **Mortar Drainage System**

.1 Products: "Mortar Net" manufactured by Mortar Net USA Ltd., supplied by JV Building Supply, 905-851-3744.

PART 3 - EXECUTION

3.1 **Erection**
General

.1 Build masonry work true to line, plumb, square and level, with vertical joints in proper alignment.

.2 Assume complete responsibility for dimensions, plumbness and levels of this work and constantly check same with graduated rod.

.3 Masonry courses to be of uniform height, and both vertical and horizontal joints to be of equal and uniform thickness.

3.1 **Erection**
General
(Cont'd)

.4 Extend all non-bearing partitions to within 25 mm of underside of floor or roof construction above and pack joint with a compressible filler of fire stop mineral wool, leave no voids.

.5 Carry wall up in uniform manner, no one portion being raised more than 750 mm above another at any time. Build no more than 1500 mm of wall measured vertically in any one day.

.6 Buttering corners of units, throwing mortar into joints, deep or excessive furrowing of bed joints not permitted. Do not shift or tap units after mortar has taken initial set. Where adjustments must be made after mortar has started to set, remove mortar and replace with fresh supply.

.7 Isolate masonry from vertical structural framing in exterior walls using 12 mm thick asphalt impregnated rigid board cemented to columns.

.8 Cut exposed masonry units with power driven masonry saw only. Ragged or chipped edges will not be permitted.

.9 Consult with other sections to avoid cutting and patching. Co-operate in setting and aligning built-in items. Build in conduit and piping so that they are not exposed. Do not break masonry bond to accommodate concealed built-in items.

.10 Install access doors occurring in masonry elements, required by Division 15 and 16. Install access doors, level, plumb properly aligned and securely anchored, in locations directed by Division 15 and 16.

.11 Grout solid with mortar all spaces around built-in items.

.12 Build in metal nailing plugs, grounds, inserts, anchor bolts, bearing plates, loose and miscellaneous items of steel and iron, isolated beams, lintels and shelf angles, sleeves, blocking and items furnished by other Sections.

3.2 **Blockwork**

.1 Lay all block in running bond, except where noted to be stack bond, with thicker end of face shell upward. Coursing to be modular 200 mm for one block and one joint.

.2 Do not wet blocks before laying.

.3 Lay units with webs aligning one over the other in full bed of mortar over entire laying surface including webs. Vertical joints shall be fully filled with mortar on both faces and squeezed tight.

.4 Exposed faces shall be full units laid out to minimize cutting with not less than 100 mm at any vertical edge or corner.

.5 Top course of block walls shall be laid with semi-solid blocks at door and window sills, at wall changes to brick and where shown on Drawings.

.6 Use solid block for at least two courses under all point bearing loads.

3.2 **Blockwork (Cont'd)**

.7 Use special shaped units where indicated, specified or required. Use bull nosed units for exposed external corners, window jambs, door jambs and as detailed. Exposed open cells not permitted.

.8 Use square cornered block for first course at floor at locations with exposed external bullnose corners. Grind square corner above top of base to match bullnose of blocks above as detailed.

.9 Where resilient base is indicated, tool the joints to within 100 mm of the floor. Cut joints flush behind the base.

.10 Provide minimum 400 mm solid or grouted block for jambs of openings and at ends of walls.

.11 Cope or cut with power saw exposed units to accommodate flush mounted electrical outlets, grilles and other components. Leave maximum 5 mm clearance. Cover plates and flanges must cover cut edges.

.12 Take special care to prevent mortar or other substances from staining exposed block faces. Replace stained blocks as directed by the Consultant at no extra cost to Contract.

.13 Tie intersecting non-bearing walls together with masonry reinforcing every second course.

.14 Concrete block to receive thinset ceramic tile installation shall be laid plumb with maximum variation of 3 mm in 2 M with joints finished flush.

.15 Provide continuous 0.1 mm thick polyethylene bond breaker at base of partitions and walls which bear on concrete slabs.

.16 Use lightweight blocks for all interior block walls and partitions.

3.3 **Face Brick**

.1 Lay face brick in common running bond except where specifically shown otherwise. Provide special band courses, where indicated.

.2 Completed brickwork shall appear uniform and well blended, free of contrasting areas. Replace at no cost to contract, brickwork which does not meet this requirement.

.3 Brick with an absorption rate of over 1g/min./100 sq.mm when tested in accordance with ASTM C67 shall be dampened before laying.

.4 Tops of walls which have been left exposed for any period of time shall be dampened before work is commenced again, if required.

.5 Brickwork at different levels shall be stepped in regular proportions between levels.

.6 Brickwork shall be laid up with the shave joint method in full bed of mortar with vertical and horizontal joints filled flush. Slushing mortar into joints after brick is laid, is not permitted.

.7 All joints in brickwork, including bed and collar joints, shall be filled full as each course is laid. Pull down and rebuild walls/partitions which do not meet this requirement as directed by consultant and at no extra cost to Contract.

.8 Variations in size of brick shall be evenly distributed in wall so that mortar joints are uniform throughout.

3.3 **Face Brick (Cont'd)**

.9 At first brick course over steel lintels place brick directly on membrane flashing without mortar.

3.4 **Cavity Walls**

.1 Discuss all aspects of cavity wall construction with Consultant before proceeding to ensure that the cavity wall is constructed in accordance with the best masonry practice and recommendations of the Ontario Masons' Relations Council (O.M.R.C.).

.2 Keep the cavity completely clean and free from mortar droppings or projection. Bevel the "cavity" edge of the mortar bed immediately after "stringing" the mortar. Following the setting of the masonry unit, spread any mortar which protrudes into the cavity over the back of the unit using the back of the trowel.

.3 Bond inner and outer wythes of cavity wall with cavity wall reinforcement system at 400 mm vertically. Provide additional reinforcement at openings as specified hereinafter.

.4 Ensure that sheet air barrier and foamed insulation is complete and has been inspected and accepted by Consultant prior to installation of face brick

.5 Provide, unless otherwise indicated, mineral wool fire stops to block off concealed spaces within a cavity wall.
a) at every floor level;
b) so that the maximum horizontal dimension is not more than 20 m and the maximum vertical dimension is not more than 3 m.

.6 Provide continuous mortar drainage system at bottom of cavity and at all areas where cavity is interrupted with thru wall flashings.

3.5 **Mortar & Pointing**

.1 Make all joints uniform in thickness, straight, in line, with mortar compressed to form concave joints.

.2 After joints have been tooled rub walls with burlap.

.3 Strike joints flush where walls are to receive insulation, ceramic tile or similar finishes.

3.6 **Building-In**

.1 Build in door and window frames, steel lintels, sleeves, anchor bolts, anchors, nailing strips and other items to be built into masonry.

.2 Do not distort metal frames. Bed anchors of frames in mortar and fill frame voids with mortar or grout as wall is erected.

3.7 **Bearings**

.1 Fill concrete block solid with 20 mPa concrete for two courses below

bearing points of structural members, and where indicated.

.2 Install building paper and wire mesh reinforcing in the bed below second block course from top.

.3 Use 100% solid concrete blocks where indicated.

.4 Build masonry neatly around beam and lintel bearings.

.5 Complete fill voids beneath steel bases bearing on masonry with an approved non-shrink grout having a compressive strength at 28 days of at least 35MPa. Where grout is exposed to view or weather, use no-ferrous expansion agents.

3.8 **Membrane Flashings/ Dampproof Course**

.1 Install dampproof course on top of foundation walls above grade.

.2 Install membrane flashing at bottom of cavity walls, at door and window heads, immediately above horizontal interruptions with exterior walls and elsewhere where shown on drawings.

.3 Lap membrane flashing minimum 100 mm at joints./ Seal lap with adhesive.

.4 Extend membrane flashing 13 mm beyond face of wall or outside edge of steel lintels. Trim as required to Consultants later instructions.

.5 Carry membrane flashing up behind exterior wythe masonry minimum 300 mm and coordinate with Sections 07196 and 07219.

.6 At wall/ low roof junctions coordinate with Section 07513. DO NOT INSTALL VENEER UNTIL COMPLETED MEMBRANE FLASHING INSTALLATION HAS BEEN WATER TESTED AND INSPECTED BY CONSULTANT.

3.9 **Control Joints**

.1 Provide continuous vertical control joints in concrete block partitions and walls at locations indicated and at heads of all doors and openings over 300 mm wide. Provide continuous vertical control joints maximum 10 M apart and at all corners and intersections.

.2 Form control joints as detailed. Stop masonry reinforcing each side of joints and provide continuous preformed rubber joint key.

3.10 **Construction Joints**

.1 Where fresh masonry joins partially or totally set masonry, clean exposed surfaces of set masonry and remove loose mortar and foreign material prior to laying fresh masonry.

.2 If necessary to stop off a horizontal run of masonry, rack back one-half masonry length in each course. Toothing will not be permitted unless approved by the Consultant.

3.11 **Expansion Joints**

.1 Construct expansion joints where indicated, as detailed.

3.12 **Chases, Openings**

.1 Chases and openings shall be built in during erection of masonry work, and purpose-made chased units shall be built into proper position.

& Holes

.2 Openings in masonry work exceeding 200 mm opening width shall be provided with lintels in accordance with lintel schedule.

.3 No horizontal or diagonal chasing of completed walls or formation of holes shall only be carried out with Consultant's prior approval, and then only with a tool designed to cleanly cut masonry units.

.4 Chases shall be plumb and shall be minimum of one unit length from jambs of openings.

3.13 **Anchoring, Bonding & Reinforcement**

.1 Anchor or bond walls and partitions at points where they intersect.

.2 Anchor masonry walls and partitions to concrete elements with anchors spaces at 400 mm vertically.

.3 Unless otherwise indicated reinforce all walls and partitions with continuous horizontal metal reinforcement, installed at 400 mm o.c. vertically.

.4 At all wall openings place continuous reinforcement in first and second mortar joints above and below openings. Additional reinforcement at openings shall extend 610 mm beyond both sides of openings.

.5 Install prefabricated corner assemblies at outside corners.

.6 Lap continuous reinforcement 150 mm at splices. Cut reinforcement at control joints.

3.14 **Cutting Masonry**

.1 Cutting of masonry units exposed in finished work shall be done with approved type power saw. Where electrical conduit outlet or switch boxes occur, grind and cut units before services installed.

.2 Obtain Consultant's approval before cutting any part or area which may impair appearance or strength of work.

.3 Patching of masonry not permitted.

3.15 **Reinforced Lintels**

.1 Install reinforced concrete block lintels at openings where steel lintels are not indicated.

.2 Support masonry units of reinforced block lintels built in place. Provide a level platform, true to the proper elevation and of sufficient strength to support the load without visible deflection. Maintain supports in place for a minimum of 7 days and for a period sufficient to permit the concrete to cure and gain sufficient strength to safely support all loads.

.3 Cast and cure lintels on a plank. Set special channel lintel blocks using specified mortar. Place wood stops at each end of lintel to prevent movement.

.4 Place 25 mm of 20 mPa concrete in voids, lay in reinforcing bars as indicated on drawings and place concrete to level of block sides. Rod and tamp concrete well without disturbing reinforcing. Allow lintels to cure 7 days before moving.

.5 Minimum bearing shall be 200 mm each side.

.6 Provide building paper in joint at bearings and at vertical joint at ends of block lintels to break bond.

3.16 **Reglets &**

.1 Form continuous reglets and recesses in masonry elements as shown on

Recesses

Drawings and as required to accommodate work of other Sections.

.2 Rake out mortar joints and make sawcuts in masonry elements as shown on Drawings and as required to accommodate work of other Sections.

.3 Make reglets 25 mm deep, unless otherwise shown.

3.17 **Steel Door Frames**

.1 Install steel frames in masonry walls. Build in frames rigid, true and plumb. Fill voids between frames and masonry with mortar grout.

.2 Brace frames solidly in position while being built in. Provide temporary horizontal wood spreader at mid-height of frames to ensure maintenance of required frame width until masonry work is completed. For frames over 1200 mm width provide temporary vertical support at centre of head.

.3 Comply with installation requirements specified under Section 08100.

3.18 **Weep & Vent Holes**

.1 Form weep holes by inserting weep hole inserts into brick mortar joint immediately above all membrane flashings and where shown on Drawings; space weep holes at 600 mm o.c. horizontally.

.2 Form vent holes by placing inserts near top of cavity compartments and where indicated on drawings. Space inserts at 600 mm o.c.

.3 Keep face of inserts back from face of brick minimum 6 mm. Keep weep/vent holes free of mortar.

3.19 **Patching & Cleaning**

.1 At completion of work, holes and other defects in masonry joints shall be repaired, and masonry surfaces shall be thoroughly cleaned.

.2 Holes in masonry joints shall be filled with mortar and suitably tooled. Cut out and repoint defective joints.

.3 Dry brush masonry surfaces at end of each day's work and after all final pointing.

.4 Remove mortar smears and droppings from concrete block masonry surfaces after such smears and droppings have dried. When mortar joints are dry and hard, clean masonry surfaces by rubbing down with abrasive blocks and stiff fibre brushes.

.5 Remove large particles from brickwork and with wood paddles without damaging surface. Do not use wire brushes. Saturate masonry with clean water and flush off loose mortar and dirt. 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. Repeat cleaning process as often as necessary to remove mortar and other stains.

.6 Remove efflorescence from masonry surfaces by wet cleaning in accordance with manufacturer's recommendations.

.7 Upon completion of work, clean blockwork by brushing and washing. In

extreme cases a 5% solution of muriatic acid may be used preceded and followed by a copius bath of clean water. Clean blockwork to be painted to suit requirements of Section 09900.

End of Section

PART 1 - GENERAL

1.1	**General Requirements**	.1	Comply with requirements of Division 1.	
1.2	**Related Sections**	.1	Structural Steel:	Section 05120
		.2	Metal Deck:	Section 05300
		.3	Metal Stairs and Railings	Section 05510
		.3	Metal Doors and Frames	Section 08100
		.4	Painting:	Section 09900
1.3	**Reference Standards**	.1	Do welding work to C.S.A. W59-1984 unless specified otherwise.	
		.2	Comply with the Ontario Building Code latest edition.	
1.4	**Submittals**	.1	Submit shop drawings in accordance with the General Conditions. Clearly indicate such items as design calculations, materials, thickness, construction, connections, joints, anchorage, supports, reinforcements, and other relevant details.	
		.2	Shop drawings for ladders and pit covers shall bear stamp of a professional engineer registered in Ontario.	
1.5	**Work Supplied To Other Trades**	.1	Supply the following items for installation under other Sections of work: Anchor bolts, bearing plates, sleeves and other inserts to be built into concrete and masonry elements and required for anchorage and support of work of this section.	
		.2	Supply other Sections with instructions, and if required, templates, necessary for accurate setting of inserts and components.	
1.6	**Product Delivery & Storage**	.1	Deliver, handle and store fabricated components to prevent permanent distortion, corrosion and damage.	

PART 2 - PRODUCTS

2.1	**Materials**	.1	Material to be free from defects impairing strength durability or appearance and be of best commercial quality for purposes specified.
		.2	Steel sections and plates: To C.S.A. GRO.21-M1978. Type (300W).
		.3	Steel Pipe: To CSA B63-1966 (R1971) standard weight, extra strong, double extra strong, black, galvanized finish.
		.4	Square steel tube: CAN3-G40.21-M81, Grade 350W, Class H.
		.5	Sheet steel: Hot dip galvanized, cold rolled, with stretcher level degree of flatness to ASTM A526; zinc coating designation Z275.
		.6	Stainless steel: To C.S.A. G110.6-1968 Type 302, exposed surfaces to have No. 4 polished finish.
		.7	Welding materials: To C.S.A. W59-1984.

2.1 **Materials (Cont'd)**

.8 Bolts and anchor bolts: To ASTM A307-76B.

.9 Galvanizing: Hot dipped galvanizing with minimum zinc coating of 600 g/m^2 to CSA G164-1965 (1972).

.10 Chromium plating: Chrome on steel with plating sequence of 9 micrometres thickness of copper, 10 micrometres thickness of nickel and 2.5 micrometres thickness of chromium.

.11 Galvanized primer: Zinc rich, ready mix to CGSB 1-GP-181M.

.12 Cast Iron: Soft grey iron.

.13 Wrought Iron: Best quality, strong homogeneous, ductile forged iron to CSA standards latest edition for wrought iron.

.14 Shop primer: CGSB 1-GP-40M.

.15 Zinc rich paint: CGSB 1-GP-181M.

.16 Bituminous enamel: Alkali resistant asphaltic coating.

.17 Non-shrink grout: Por-Rok by Hallemite Products Ltd., or SET 15 Minute Anchoring Cement by SET Products Ltd.

2.2 **Fabrication**

.1 Fabricate components in the shop in largest size practicable to minimize field jointing.

.2 Fabricate components square, straight, true, free from warpage and other defects. Accurately cut, machine file and fit joints, corners, copes and mitres.

.3 Fabricate items from steel unless otherwise noted.

.4 Reinforce fabricated components to safely withstand expected loads.

.5 Make joints in built-up sections with hairline joints in least conspicuous locations and manner.

.6 Make allowance for thermal expansion and contraction when fabricating exterior work.

.7 Joints shall be welded unless otherwise indicated and unless details of construction do not permit welding. Exposed welds shall be continuous and shall be ground smooth.

.8 Close exposed open ends of tubular members with welded on steel plugs.

.9 Curved work to be made true radii.

.10 Use self-tapping shake-proof countersunk flat headed screws on items required to be assembled by screws or as indicated.

2.2 **Fabrication (Cont'd)**

.11 Where work of other Sections is to be attached to work of this Section,

prepare work by drilling and tapping holes, as required to facilitate installation of such other work.

.12 Work of this Section, supplied for installation under other Sections, shall be prepared as required ready for installation by drilling, countersinking and tapping holes, forming shapes and cutting to required sizes.

.13 Grind off mill stampings and fill recessed markings on steel components left exposed to view.

2.3 **Connections**

.1 All exposed fastenings to be of same material, colour and finish as the metal to which it is applied.

.2 Connections and accessories must be adequate to sustain safely and withstand stresses and strains to which normally subjected.

.3 Shop and field connections to be riveted or welded and where indicated or required, blind riveted. Rivets, screws and fastenings to be countersunk into exposed work and finished flush.

.4 Connect all members to form a homogeneous structure. Connections to develop the full strength in the member connected before failure.

2.4 **Finishes**

.1 Thoroughly clean steel of loose scale, rust, oil, dirt and other foreign matter. Suitably prepare steel surfaces by power tool cleaning to receive specified finishes.

.2 Grind smooth sharp projections.

.3 Remove oil and grease by solvent cleaning.

.4 Apply coatings in the shop and before assembly. Where size permits, galvanize components after assembly.

.5 Shop apply coat of primer to interior components after fabrication except where galvanized or zinc rich paint finish is required.

.6 Do not paint surface to be field welded.

.7 Dip bolts that are to remain permanently in the structure, in oxide paint before placing in position.

.8 Hot dip galvanize all exterior components and, where so indicated, interior components, after fabrication.

.9 Apply coat of bituminous enamel to surfaces of metal components in contact with cementitious materials and dissimilar metals.

PART 3 - EXECUTION

3.1 **Installation**

.1 Erect metal work square, plumb, straight and true, accurately fitted, with tight joints and intersections. Drill, cut and fit as necessary to attach this work to adjoining work.

3.1 **Installation (Cont'd)**

.2 Provide suitable and acceptable means of anchorage such as dowels

anchor clips, bar anchors, expansion bolts and shields, toggles.

.3 Make field connections with high tensile bolts, or weld to CSA S16-1969 and CSA S16S1-1975.

.4 Provide temporary supports and bracing required to position components until they are permanently anchored in place.

.5 Securely anchor components in place; unless otherwise indicated, anchor components as follows:

.1 To concrete and solid masonry with expansion type anchor bolts.
.2 To hollow construction with toggle bolts.
.3 To thin metal with screws or bolts.
.4 To thick metal with bolts or by welding.
.5 To wood with bolts or lag screws.
.6 Fill space between railing members and sleeves with non-shrink grout.

.6 Hand items to be cast into concrete or built into masonry over to appropriate trades together with setting templates.

.7 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection.

.8 Touch-up galvanized surfaces with zinc primer where burned by field welding.

.9 Dissimilar metals and metals in contact with cementitious elements shall have contact surfaces coated with bituminous paint or be isolated by other means as approved by Consultant.

3.2 **Schedule of Components**

.1 **Elevator Pit Ladder**

.1 Not required.

.2 **Millwork Accessories**

.1 Examine millwork detail drawings and Section 06200 and Section 06400 and supply welded tubular frames, angle and channel supports and other miscellaneous metal items required for but not specified as part of Section 06200 or Section 06400.

.3 **Hollow Metal Frame Supports**

.1 Provide supplementary steel supports for hollow metal frames as detailed.

.4 **Miscellaneous Steel Items**

.1 Miscellaneous steel angles, plates and lintels indicated on

3.2 **Schedule of Components (Cont'd)**

Architectural Drawings, but not included on Structural Drawings.

.2 Other metal fabrications shown on Drawings and not specifically covered in other Sections. All steel components indicated on Structural Drawings will be provided by Section 05123.

.5 **Elevator Rail Supports**

.1 Supply appropriate steel plates for support of elevator rails for casting into concrete at each floor level. Co-ordinate size and number required with Section 14200.

.6 **Roof Access Ladders**

.1 Provide hot dipped galvanized exterior roof access ladders as detailed.

.2 Fabricate ladders from 19 mm diameter rungs welded to 10 mm x 65 mm stringers 450 mm apart. Space rungs 300 mm o.c. Set ladder 150 mm clear of wall on bracket supports set into wall.

.3 Fabricate parapet step from 19 mm diameter steel bars 75 mm o.c. welded to 65 x 10 steel angle stringers.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**
.1 Comply with Requirements of Division 1.

1.2 **Related Sections**
.1 Installation of anchors in concrete and masonry. Section 03302 & Section 04200
.2 Precast Concrete Stairs Section 03480

1.3 **Reference Standards**
.1 Do welding work to CSA W59-1984 unless specified otherwise.
.2 Comply with the Ontario Building Code latest edition.

1.4 **Submittals**
.1 Submit shop drawings in accordance with the General Conditions. Clearly indicate such items as design calculations, materials, thickness construction, connections, joints, anchorage, supports, reinforcements, and other relevant details.
.2 Shop drawings shall bear stamp of a professional engineer registered in Ontario.

1.5 **Work Supplied To Other Trades**
.1 Supply the following items for installation under other Sections of work: Anchor bolts, bearing plates, sleeves and other inserts to be built into concrete and masonry elements and required for anchorage and support of metal fabrications.
.2 Supply other Sections with instructions, and if required, templates, necessary for accurate setting of insets and components.

1.6 **Product Delivery**
.1 Protect materials from damage and rusting during delivery and storage.
.2 Store materials under waterproof cover on pallets or plank platforms held off the ground by means of planks or timber skids.
.3 Coat all items which have not been shop primed with a generous layer of grease. Clean grease off prior to installing and/or painting.

1.7 **Protection**
.1 Protect steel stairs from damage after installation.
.2 If primer is scraped off steel stairs prior to finishes being applied, grind smooth and paint with primer.

1.8 **Cooperation**
.1 Cooperate with all trades on the job. Supply all articles to be built in by others when required. Provide information to other trades as to proper location of openings, articles and anchors.
.2 In the event of failure to provide such articles or information in time, have all cutting and patching done at no cost to the Owner.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Steel sections To CSA G40.21-M1978, Type 300W.

.2 Steel plate To CSA G40.21-M1978, Type 260W.

.3 Steel pipe To CSA B63-1966 (R1971). Type E. Grade A. Standard Weight. Schedule 40. Seamless Black.

.4 Welding Materials: To C.S.A. W59-1984.

.5 High strength bolts: To ASTM A325-76C.

.6 Shop coat primer: To CGSB 1-GP-40d.

.7 Non-shrink grout: Por-rok by Hallermite Products or SET 15 min. Anchoring Cement by SET Products Ltd.

.8 Galvanizing: Hot dipped galvanizing with minimum zinc coating of 600 g/m^2 to CSA G164-1965 (1972).

.9 Stainless Steel: To CSA G110-6 Type 302, exposed surfaces to have No. 4 polished finish.

2.2 **Fabrication**

.1 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.

.2 Accurately form connections with exposed faces flush; mitres and joints tight. Make all risers in one run of stairs of equal height.

.3 Grind or file exposed welds and steel sections smooth.

.4 Shop fabricate stairs in sections as large and complete as practicable.

.5 Grind off mill stampings and fill recessed markings on steel components left exposed to view.

2.3 **Interior Handrails**

.1 Handrails shall be 38 mm diameter stainless steel. Provide full rounded end caps. Assemble handrails with factory fabricated corners and transitions.

.2 Wall brackets to be 12 mm diameter solid bent stainless-steel rod welded to 100 mm diameter x 10 mm stainless steel wall plate.

2.4 **Interior Stair Balustrades**

.1 All welded construction made up of the following:

.1 Stair 1
38 mm diameter stainless steel handrails.
12 mm diameter solid steel bar pickets.
38 mm x 38 mm steel newel and intermediate posts.
13 mm x 38 mm steel bottom rail

.2 Stair 2
38 mm diameter stainless steel handrails.

12 mm diameter solid steel bar pickets.
38 mm x 38 mm steel newel and intermediate posts.
13 mm x 38 mm steel bottom rail

.2 Provide full rounded end caps. Assemble handrails with factory fabricated corners and transitions.

.3 At corners, angles and intersections of steel balustrades cope or mitre, weld and grind smooth.

2.4 **Utility Stairs & Platform**

.1 Form stringers from 250 mm x 38 mm x 4.76 kg Junior Steel Channels.

.2 Treads and landings to be welded grating stair treads, type W/B complete with checkered plate nosing and end plates as manufactured by Borden Welded Gratings.

.3 Shop assemble components to minimize field welding.

.4 Finish: Hot dipped galvanized.

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2.5 **Exterior Railings & Balustrades**

.1 38 mm O.D. stainless steel pipe 3.2 mm wall thickness top rail with. continuous smooth welded connections and full rounded end caps.

.2 38 mm diameter stainless steel newel posts inserted into cored concrete openings.

.3 12 mm diameter solid stainless steel pickets and 38 mm diameter bottom rail.

.4 Finish Stainless Steel - No. 4 polished.

2.6 **Shop Painting**

.1 Clean all surfaces in accordance with Steel Structures Painting Council SSPC-SP2-63.

.2 Apply one coat of shop primer. Apply two coats of primer in different colours to parts inaccessible after final assembly.

.3 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is below 7° C.

.4 Do not paint surfaces to be field-welded.

PART 3 - EXECUTION

3.1 **Installation**

.1 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

.2 Touch up welds and burned or scratched surfaces at completion of erection.

.3 Exposed welds to be ground smooth.

.4 Extend handrails and balustrades around landing as required.

.5 Shop assemble components prior to galvanizing to minimize field welding.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Work Supplied to Other Trades**

.1 Supply following items for installation under other Sections of work: Anchor bolts, bearing plates, sleeves and other inserts to be built into concrete and masonry elements and required for anchorage and support the work of this section.

.2 Supply other Sections with instructions, and if required, templates, necessary for accurate setting of inserts and components.

1.3 **Source Quality Control**

.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.

1.4 **Product Delivery & Storage**

.1 Store material on site on skids off the ground and covered for protection from rain.

.2 Take adequate measures to prevent moisture gain of kiln dried materials.

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 3-086-M84
.2 CSA 0141-1970
.3 NLGA Standard Grading Rules for Canadian Lumber, 1980 edition revised according to Supplement No. 1, 1981.

.2 Furring, blocking, railing strips, grounds, rough bucks, curbs.

USE	SPECIES	GRADE
Blocking	Spruce	2
Studs	Spruce	1
Plates	Spruce	1
Other	Spruce	1
Cants	Douglas Fir	2
Wood Fascia	Douglas Fir	1

2.2 **Plywood**

.1 Douglas Fir to CSA 0121-M1978 Unsanded Sheathing Grade.

2.3 **Fasteners**

.1 Nails: to CSA B111-1974, hot dip galvanized steel for exterior work

including components located in exterior walls and roofs; bright finish steel in all other locations. Unless otherwise indicated use common spiral flathead nails.

.2 Bolts, nuts, washers: ASTM A307, hot dip galvanized steel.

.3 Connectors, anchors, brackets, spikes: hot dip galvanized structural quality steel.

.4 Plugs for masonry walls: 4.5 mm galvanized sheet steel wall plugs by Drummond & Reeves, approx. 75 mm deep and 57 mm wide.

.5 Screws: to CSA B35.4-1972 zinc, cadmium or chrome plated.

.6 Nailing discs: flat caps, minimum 1" diameter, maximum 16 ga thick sheet metal, formed to prevent dishing. Bell or cup shapes not acceptable.

2.4 **Wood Treatment**

.1 Preservative pressure treated components: to CSA, using alkaline copper quatemary (ACQ).

.2 Surface, cut, bore and trim components to sizes required as much as possible prior to pressure treatment.

PART 3 - EXECUTION

3.1 **General**

.1 Erect work plumb, level, square and to required lines, Ensure that materials are rigidly and securely attached to each other and to adjacent building elements and will not be loosened by work of other trades.

.2 Where other materials and components are to be applied directly over wood members recess heads of fastening devices below wood surfaces.

.3 Where work remains exposed to view, fasteners shall be uniformly and evenly spaced and neatly installed.

3.2 **Nailers, Blocking Copings Grounds**

.1 Provide wood nailers, blocking, copings, strapping, bucks, grounds and other rough carpentry components to sizes and in locations required for satisfactory supply of fabricated items and other work.

.2 Unless otherwise indicated, provide minimum 38 mm thick material. Grounds may be 21 mm thick material unless otherwise indicated.

.3 Install wood members plumb, level, straight, true to line and solidly anchored to adjacent building elements.

.4 Provide rough bucks where indicated or required for windows, doors lockers and other elements.

3.3 **Anchors & Fasteners**

.1 Provide rough hardware including nails, screws, bolts, washers, brackets, hangers, and fastening devices of all types.

.2 Unless otherwise indicated, attach wood members at maximum 600 mm . o.c. as follows:

.1 To concrete and solid masonry with expansion type anchor bolts.

.2 To hollow masonry with toggle bolts.

.3 To heavy gauge metal with bolts.

.4 To light gauge metal with screws or bolts.

.5 To wood with nails, screws or bolts as required to ensure stability.

.3 Bucks and plates shall be anchored to masonry walls with 13 mm galvanized steel bolts 450 mm long.

.4 Fasten wood copings to supporting masonry elements with 13 mm galvanized steel bolts min. 450 mm long spaced max. 600 mm o.c. Where width of coping plate exceeds 100 mm, stagger bolts off centre.

3.4 **Pressure Treated Components**

.1 Use preservative pressure treated lumber and Treated plywood within exterior wall and roof systems and other locations indicated on drawings.

.2 Where it is necessary to cut, bore or otherwise alter pressure treated components in the field, treat cut surfaces with heavy coat of wood preservative.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**
.1 Comply with requirements of Division 1.

1.2 **Related Sections**
.1 Finished Hardware: Section 08710
.2 Electrical Outlets to be built into Cabinet Work: Division 16

1.3 **Reference Standards**
.1 Standards referred to herein are based on the published standards of the Architectural Woodwork Manufacturer's Association of Canada (AWMAC).

.2 Subcontractors shall make themselves thoroughly familiar with these standards prior to submitting their tender.

1.4 **Qualifications**
. 1 The work of this section is to be done by a Millwork Contractor of recognized standing having personnel with experience in this type of work and who has the necessary equipment to carry out the work.

1.5 **Guarantee**
.1 Provide the following guarantee in accordance with the General Conditions, not withstanding the time provisions therein.
Five (5) year guarantee against defects in workmanship and materials including warpage and delamination.

.2 Make good or replace work showing defect in this period at no expense to the Owner

1.6 **Submittals**
.1 Submit shop drawings electronically in accordance with the General Conditions of the contract. Clearly indicate methods of construction, profiles, jointing, fastening and other related details. Make shop drawings complete with details and sections

.3 Submit samples in accordance with Section 01300

.4 Verification Samples: Duplicate samples of the following:
.1 Hardwood Panel: 300 x 300 mm illustrating full panel sheet, edge trim, joint trim and shop applied finish.
.2 Hardwood Trim: 300 mm long illustrating profile size and shape, quality of wood grain and shop applied finish.

1.7 **Product Delivery & Storage**
.1 Do not deliver materials until suitable heated dry storage space is available and portion of building in which it is to be installed is completely ready. Deliver materials with protective coverings and maintain in undamaged condition.

.2 Store materials on site in such a way as to prevent deterioration or loss or impairment of essential properties. Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22oC.

.3 Cover finished plastic laminate surfaces with heavy kraft paper or put in cartons during shipment. Protect installed plastic laminate surfaces by approved means. Do not remove until immediately before final inspection.

PART 2 - PRODUCTS

2.1 **Materials** .1 **Casework Hardware**

.1 Cabinet Hardware:

.1 **Hinges:**
19 mm cupboard door Blum Model 170BL91-653 with Blum mounting plate BL175.810. or
Hafela Aximat hinges, self-closing 270 degree where noted on drawings

.2 **Pulls:**
Cupboard door - Canadian Building Hardware CBH 255 xC26D

.3 **Catches:**
19 mm cupboard door- Elbow Catch Richelieu #BP3675-2G

.4 **Door Bumper:** Richelieu AMP 5312-11

.5 **Pilaster Strip:** 16mm wide X 4 mm deep perforated metal strip, zinc plated, Model 2332GXX by Richelieu.

.6 **Pilaster Clip:** Richelieu CP2392G. heavy duty, zinc plated

.7 **Cupboard and Drawer Lock:** National disc tumbler cylinder cam lock C8080 Series, chrome finish, keyed to Owner's master keying system.

.8 **Continuous Hinge:** stainless steel, heavy duty, length to suite door height; Hager Roton 790-900, US32D finish.

.10 **Cable Grommet:** plastic counter top fitting for computer /telephone/ power cables; two-part cable set with spring closure top, 50 mm OD, black colour; Model 600910140 by Richelieu.

.11 **Closet Rod:** 32 mm OD, 2mm thick stainless steel tube, C32D satin finish CW matching closet rod flange; CBH 762 with 752 closed end flanges

.2 Teacher's Closet Hardware:

.1 **Hinge:** 1-1/2 pair per leaf; 75 x 75 mm size, 5 knuckle ball bearing standard weight full mortise butt hinges with brushed chrome finish; FBB 179 by Stanley.

.2 **Slide Bolt for Inactive Leaf:** 60 mm long barrel bolt nickel plated.

.3 **Lockset:** supplied by Section 08710, installed by this section. Provide strike plate.

2.1 **Materials (Cont'd)**

.2 **Solid Wood**

.1 **Hardwood Lumber:** to National Hardwood Lumber Association (NHLA) requirements, moisture content of maximum 7%, maple species to AWMAC premium grade capable of receiving high quality transparent finish

.2 **Softwood Lumber:** to CSA 0141-1970, dressed all sides used in concealed locations.

.3 All wood materials shall be new, straight and clean, free of sap, knots, pitch, and other defects, except as permitted by applicable grading rules.

.3 **Casework Plywood:**

.1 **Hardwood Plywood:** Multicore plywood to ANSI/HOVA HP-1 Architectural G2S, minimum 9 plies, of thickness indicated good two sides grade where exposed or semi-exposed, good one side sound one side grade where one side is permanently concealed.
Maple veneer, Face Grade A, plain sliced; of clear book matched grain capable of receiving high quality transparent finish

.4 **Douglas Fir Plywood:** To CSA 0121-M1978 good one side. Select high density overlaid grade.

.5 **Particleboard:**

To ANSI A208.1, Grade M-2 minimum 635 kg/m³ density; 6 percent maximum moisture content; no added urea formaldehyde; certified EPP by composite Panel Association; sanded faces, 19 mm thickness.

.6 **Hardwood Edging /Trim:** 6 mm thick clear maple species hardwood, clear grain suitable for receiving clear transparent finish.

.7 **Fasteners & Adhesives:**

.1 Nails and Staples: to CSA B111-1974 galvanized for exterior work, interior highly humid areas and for treated lumber, plain finish elsewhere.

.2 Screws: zinc cadmium or chrome plated steel. Stainless steel for high moisture areas.

.3 Wire: stainless steel 16 gauge.
.4 Adhesives: Resorcinol resin adhesive to CSA 0112.7-M1977.

.8 **Stainless Steel:** Type 304. .9 Plastic Laminate: From full range of products by Formica, Arborite, Wilsonart, Pionite and Nevamar as selected by Consultant.

.9 **Plastic Laminate for Flat Work:** To CAN3-A172-M79. Grade; General Purpose Standard Duty 1.27 mm thick, Gloss and suede finish.

2.1 **Materials (Cont'd)**

.10 **Plastic Laminate Backing Sheet:** Supplied by same manufacturer as facing sheet, same thickness and colour as face laminate.

.11 **Laminated plastic for post forming work:** To CSA A172 1974 type 2b, 1.6 mm thick, gloss and suede finish.

.12 **Plywood Core:** Douglas Fir to CSA 0121-M1978 solid two sides 19 mm thick, exterior grade for high moisture areas.

.13 **Plastic Laminate Adhesive**: As recommended by manufacturer to suit application.

2.2 **Fabrication**

.1 **General Requirements**

.1 Fabricate all casework to AWMAC NAAWS 3.1, custom grade standards.

.2 Unless noted otherwise all casework construction shall be flush overlay.

.3 Shop install all cabinet hardware.

.4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures to accommodate work of other sections.

.5 Use poplar plywood only in locations where wood is concealed.

.6 Inconspicuously locate mechanical fasteners. Wherever possible concealed fastenings.

.7 Countersink nail heads, apply stained wood filler, and smooth to receive finish.

.8 Where exposed to view, countersink screw and bolt heads and fill holes with matching wood plugs.

.2 **Fabrication of Casework:**

.1 All cabinet work is to be constructed with hardwood plywood with solid hardwood edging. Fabricate casework components as follows:

.1 **Gables:** 19 mm hardwood plywood complete with Douglas Fir plywood kick.

.2 **Case bottoms:** 19 mm Hardwood plywood

.3 **Case backs:** 13 mm hardwood plywood.

.4 **Backs on Freestanding cabinets:** 19 mm hardwood plywood

.5 **Base:** 19 mm Fir plywood where covered with rubber base

2.2 **Fabrication (Cont)**

.6 **Shelving:**
Under 915 mm long: 19 mm hardwood plywood with hardwood edging on all sides.
Over 915 mm long: 19 mm hardwood plywood with front edge return of 50 mm hardwood. Hardwood edging on all sides.

.7 **Cabinet doors up to 1200 mm high:** 19 mm hardwood plywood.

.2 Shelving in cabinetwork to be adjustable. All sides of adjustable shelving to be edge banded with 6 mm hardwood.

.3 Provide all finishing hardware unless noted otherwise.

.4 Install hardware in accordance with the hardware manufactures printed instructions.

3 **Fabrication of Teachers Cabinet Doors:**

.1 **Doors: s**olid core flush wood doors to ANSI/WDMA 1I.S. 1A heavy duty 44 mm thick; 5-ply construction, as follows:
.1 Perimeter construction: solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
.2 Core: AWMAC Particleboard Core Type: 448 kg/m³ solid particleboard core to ANSI A208.1.
.3 Face Assembly Adhesive: Type I-Waterproof.
.4 Core Assembly Adhesive: Type II -Water-resistant.
.5 Cross Banding: 1.6 mm thick hardwood veneer.
.6 Edges: to AWMAC NAAWS 3.1, Type D – Solid hardwood.
.7 Door Faces: AWMAC Custom Grade; Maple veneer, Face Grade A, Plain-sliced with book matched grain, capable of receiving a high quality transparent finish.

.4 **Plastic Laminate:**

.1 All countertops to be post formed plastic laminate with integral 100 mm high splashback. Comply with CSA A172 - 1974, Appendix "A".

.2 Obtain governing dimensions before fabrication 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 cutouts.

.5 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.

2.2 **Fabrication (Cont**

.6 Use straight self edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 deg. Do not mitre laminate work.

.7 Apply laminate backing sheet to reverse side of core of plastic laminate work.

.8 Apply laminated plastic liner sheet where indicated.

PART 3 -- EXECUTION

3.1 **Workmanship**

.1 All work to be performed by skilled mechanics. Tool marks on finished work will not be acceptable. Set nails on all finished work.

.2 Do as much handwork as is required for first quality results.

.3 Obtain accurate dimensions on the job for all work of this Section. No extra will be allowed for making good precut material which does not fit the job condition.

.4 This subcontractor must machine assemble and completely finish all materials in his plant before shipment. Units and countertops, etc. are to be shipped prefinished for assembly and installation by his own forces.

.5 Assembled units shall be of such size as will not present difficulties of entry into the building and rooms where required.

3.2 **Co-ordination**

.1 Carefully examine Mechanical and Electrical drawings and specifications for water, gas, drainage and air piping, faucets, traps, ventilation ducts, sinks, electric receptacles fixtures and wiring specified under the Mechanical and Electrical Sections. Co-ordinate the work with these trades and make provision in the construction of the fitments to accommodate this work. Methods of construction shall be such as to permit Mechanical and Electrical work being concealed in the fitments, cut and frame accordingly, provide removable access panels in the units to provide proper access for installation and repairs.

3.3 **Measurement**

.1 This Contractor shall take, at the site, all measurements of space and conditions to which his work must conform. Measurements shall be taken prior to the fabrication of his work and in ample time to avoid delays in the work.

3.4 **Owner's Equipment**

.1 Throughout the job, spaces have been provided for Owner's equipment. Obtain the exact size of these units and modify, if necessary, all millwork to suit this equipment.

3.5 **Installation**

.1 Provide rough hardware, nails, expansion shields, screws, brackets, furring and strapping and incidentals required to assemble and install the fitments in their proper location. Units to be adequately fastened and secured in place with concealed fixings wherever possible.

.2 Do all framing in accordance with best standard practice.

3.5 **Installation (Cont)**

.3 Fitments shall be installed level, plumb and true and complete in all respects.

.4 Where permitted, nail with small headed finishing nails. Countersink nail heads with nail setter.

.5 Install components using concealed fastening devices.

.6 Where components are fastened with screws or bolts countersink screw and bolt heads and provide wood plugs matching surrounding wood.

.7 Where cabinetwork abuts other building elements provide wood trim matching cabinetwork except where otherwise detailed.

.8 Protect the work from damage during storage, handling, installation and until the building is turned over to the Owners. Make good all damages and loss without expense to the Owner.

.9 Check operation of all movable parts and, if necessary, adjust to ensure proper and smooth functioning.

.10 Upon completion of installation inspect work of this Section and touch up, where required, minor or damaged surface finish to restore it to original condition. Replace damaged components which in the opinion of the Consultant, cannot be satisfactorily repaired.

3.6 **Hardware Installation**

.1 Locate hinges in accordance with manufacturer of hinge and with best standard practice. Set knobs, locks, and cylinders square with doors and escutcheons plumb. Apply accurately and neatly, to operate quietly and smoothly. Knobs shall turn easily, bolts slide freely and smoothly.

.2 All keys shall be labelled as to their lock location and shall be turned over to the Owner. All locks, slide bolts, etc. shall be supplied with the appropriate strikes and screws.

.3 At completion of the work, moving parts shall be gone over, made to work easily, smoothly and efficiently. Work carefully cleaned down and left in complete and finished condition satisfactory to Architect.

3.7 **Plastic Laminate**

.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 to counter top joints. Maximum spacing 450 mm o.c., 75 mm from edge. Make flush hairline joints.

.4 Provide cutouts for inserts, grilles, appliances, outlet boxes, etc. 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 or shop 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 indicated or approved. Slightly bevel arises.

.7 For site application, offset joints in plastic laminate facing from joints in core.

3.8 **Finishes** .1 Shop finish hardwood products to AWMAC NAAWS 3.1, System 12 Polyurethane Water Based, Custom Grade for Transparent finish; colour and sheen selected by consultant.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Masonry:	Section 04200
.2	Thermal Insulation:	Section 07200
.3	Built-up Roofing:	Section 07513
.4	Metal Flashings:	Section 07620
.5	Aluminum Entrances and Curtain Wall:	Section 08900

1.3 **Qualifications**

.1 All air barrier materials shall be applied by an independent company that specializes in the installation of air barriers and currently approved by W.R. Grace & Co. of Canada. Installation by the mason will not be accepted. Provide written evidence of approval from manufacturer prior to commencement of the work.

1.4 **Guarantee**

.1 Provide the following guarantee in accordance with the General Conditions notwithstanding the time provision therein.

.1 Five (5) years against all air tightness defects.
.2 Ten (10) years manufacturers warranty.

1.5 **Submittals**

.1 Submit duplicate 200 mm x 300 mm samples of air barrier material to the Consultant for approval prior to ordering materials.

.2 Submit original copy of test data from certified independent testing laboratory confirming performance requirements of air barrier membrane as specified.

1.6 **Inspection and Testing**

.1 Owner will appoint and pay, out of allowance carried in Division I, for independent inspection agency to inspect work of this Section as directed by the Consultant.

.2 Scaffolding must be provided by this contractor for the use of the Inspection Company, Consultant and School Board.

1.7 **Description of System**

.1 The air barrier system specified herein is based on Perma Barrier Membrane system by W.R. Grace & Co. The following manufacturers will also be acceptable, subject to the Consultant's detailed review and acceptance:

.1 Soprema Waterproofing Inc.
.2 Bakelite Thermosets Ltd.

1.8 **Product Delivery & Storage**

.1 Deliver materials in original unopened containers.

.2 Containers are to be labelled with manufacturer's name, brand name, installation instructions and identification of various items.

.3 All materials must be stored between 10°C and 26°C. If exposed to lower temperature, restore materials to 15°C minimum temperature before using.

1.8 **Product Delivery & Storage (Cont'd)**

.4 All materials must be stored in a dry area and protected from water and direct sunlight. Replace damaged materials at no extra cost.

.5 Store membrane rolls off ground, flat, protected from moisture and well ventilated.

.6 Store solvent base liquids away from excessive heat and open flame.

1.9 **Job Conditions**

.1 Prior to the use of any product consult the manufacturer's safety data bulletin for applicable cautions and warnings.

.2 Substrates which are to receive air barrier materials shall be sound and dry.

.3 Apply materials only within application limitations specified by respective product manufacturers.

1.10 **Protection**

.1 Make good damage to building and to work of Other Contractors and Subcontractors arising from this Section of Work to the satisfaction of the of the Consultant.

1.11 **Compatibility**

.1 Assure that all components are compatible with each other.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Membrane: Perm-A Barrier Membrane minimum 1.02mm composite sheet, dark grey, supplied in widths to suit reinforcing. Membrane shall incorporate 6mm edge bead of rubberized asphalt on all side laps.

Properties
p

Property	Value	Test Method
Colour	Dark Grey	N/A
Pliability 180° bendover 25mm mandril at 32°C.	Unaffected	ASTM D146
Tensile Strength - membrane	1.7 MPa min.	ASTM D412 (Die C) modified
Elongation Ultimate failure of rubberized asphalt (%)	300 min.	ASTM D412
Cycling over crack at - 26°C	No effect 100 cycles	
Cycling over 25mm joint at	No effect 1000 cycles	

2.1	**Materials (Cont'd)**	Peel adhesion (N/mm width) 28 days wet (submerged aging)	0.822 min.	
		Puncture resistance (N) (stretched by blunt object)	178 min.	ASTM E154
		Puncture resistance polyethylene film (mm N tear) (compact from sharp object)	1,746.23 min.	ASTM D781
		Air Permeance of "In Place" System (Pressure difference of 75 Pa)	less than .01 litre sq.m.	ASTM E283-83
		Resistance to 2 kPa Air Pressure Difference	No increase	ASTM E283-83 in equivalent
		Permeance	0.517 metric perms	ASTM E96
		Water Absorption 72 hours (% weight)	0.25 max.	ASTM D1228

.2 Mastic: Bituthene EM3000 Mastic - Rubber based mastic.

.3 Liquid Membrane: Liquid Membrane LM3000 - two component liquid membrane with 100% solids content.

.4 Primer: Bituthene Primer - P3100 - rubber based solvent used to condition all substrates.

.5 Insulation Attachments

.1 Type "N" sticklip and type "S" adhesive as manufactured by ECKEL Industries Ltd., or an approved alternative.
.2 Wedge fasteners type "WEDGE-LOK", as manufactured by BLOK-LOK, or an approved alternative for board insulation.

.6 Flexible Flashings - Perm-A-Barrier wall flashing, thickness 1mm.

PART 3 - EXECUTION

3.1 **Preparation**

.1 Examine all surfaces to receive air barrier for conformance to recommended surface conditions.

.2 Do not proceed with air barrier installation until all defects are repaired.

.3 Acceptable surfaces include cast-in-place concrete, masonry gypsum board, and plywood.

.4 All surfaces to receive air barrier must be smooth, clean, dry and in good condition. All moisture, grease, machine oil or other foreign material shall be

removed.

3.1 **Preparation (Cont'd)**

.5 Concrete must be smooth, monolithic, free from voids, spalled areas, loose aggregates or sharp protrusions.

.6 Concrete must be cured minimum (7) days and dry before air barrier is applied. Cure concrete with clear resin-based curing compounds containing no oil, wax or pigment.

.7 Allow concrete to dry following rain.

.8 Repair defects such as spalled or poorly consolidated areas. Remove sharp protrusions and form match lines.

.9 If walls are rough use a well adhered parge coat to achieve a smooth finish.

.10 Concrete Blocks:

.1 Unevenness between blocks shall not exceed 2mm.
.2 Holes and openings must be patched.
.3 Excess mortar shall be removed.

.11 Cast-In-Place Concrete:

.1 Reliefs at framework joints shall not exceed 5mm.
.2 Concrete lumps shall be removed.
.3 Tie holes shall be filled.
.4 All surfaces shall be clean, dry, free from oil, etc.

3.2 **Primer Application**

.1 Apply primer with lambs wool roller 6 to 8 sq. metres per litre and allow allow 30 minutes for drying to a tacky surface. Prime only the area to be covered in a working day. Areas not covered with membrane in 24 hours must be reprimed.

3.3 **Membrane Installation**

.1 Apply Perm-A Barrier to primed structured substrates, in accordance with the manufacturer's recommendations.

.2 All side laps shall be 64mm minimum and all end laps shall be 150mm.

.3 At top and bottom terminations heavy pressure should be applied to membrane with the back of utility knife to assure positive adhesive at the edge.

.4 The membrane shall be rolled, firmly and completely immediately after each sheet is applied. An extrusion handled counter top roller shall be used.

.5 Apply a trowelled bead of EM3000 Mastic to all terminations of membrane at the end of the day's work.

.6 Inspect membrane thoroughly before covering and make any corrections immediately.

.7 Misaligned or inadequately lapped seams, punctures or other damage shall be repaired with a patch of Perm-A-Barrier extending 150mm in all

directions from the edge of the damaged area. Seal all edges of patch with EM3000 Mastic.

3.3 **Membrane Installation (Cont'd)**

.8 Perm-A-Barrier shall be covered immediately to protect the air barrier from other trades.

.9 Fit membrane tightly around all penetrations through it and seal using EM 3000 Mastic.

.10 At all detail areas take extra care to ensure continuity of the air barrier.

.11 Provide flexible flashings around the perimeter of all openings including window and door frames. Mechanically secure flashings to frames. Reinforce all inside and outside corners.

.12 All gaps or joints wider than 6mm shall be filled with LM3000 or a foam backer rod and reinforced with a 300mm piece of membrane prior to application of field membrane.

.13 Liquid Membrane LM3000 shall be used at all protrusions which do not allow for easy installation of sheet membrane. LM3000 shall be placed over or under Perm-A-Barrier with at least a 64mm overlap required.

.14 Provide flexible flashings at the base of the cavity wall, at the head of windows and doors, at horizontal interruptions in exterior walls, and where shown on drawings.

.15 In all cases extend flexible flashings 13mm beyond outside face of wall or outside edge of steel lintel. Trim as required to Consultants later instruction.

.16 Unless otherwise indicated carry flexible flashing up behind brick masonry units minimum 200mm and adhere to air barrier membrane with adhesive in accordance with manufacturers recommendations.

3.4 **Roof/Wall Junctions**

.1 Coordinate proper construction of roof/wall junction with roofing contractor so as to maintain continuity of air barrier from wall to roof.

.2 Ensure compatibility of air barrier with roofing membrane and flashing.

3.5 **Inspection**

.1 Inspect completed air barrier for punctures, tears and discontinuous seams. Apply additional layer of membrane over punctures and tears, extending min. 50 mm (2 in.) beyond damaged area in all directions.

3.6 **Clean-Up**

.1 Promptly as the work proceeds and on completion, clean up and remove from the premises all rubbish and surplus materials.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Air Barrier System	Section 07196
.2	Masonry	Section 04200
.3	Built-up Roofing	Section 07513
.4	Aluminium Entrances and Curtain Wall	Section 08900
.5	Gypsum Board	Section 09250
.6	Duct and pipe insulation	Division 15

1.3 **Product Delivery & Storage**

.1 Deliver insulation to site in sealed Storage and wrappings bearing manufacturer's name, product name and RSI or KSI value.

.2 Store materials in a dry area protected from the elements.

1.4 **Protection**

.1 Temporarily protect installed insulation from damage and action of the elements until it is permanently concealed or protected.

.2 Protect polystyrene insulation from sunlight.

PART 2 - PRODUCTS

2.1 **Insulation**

.1 Fibrous batt insulation: mineral fibre, batt or roll type: CSA A101-M1983, friction fit for steel studs.

.2 Perimeter insulation and Underfloor Insulation: extruded, expanded polystyrene with shiplapped edges: CGSB 51.20-M87, Type 4: Styrofoam SM by Dow or Pro-Tec by Esso Building Products or Celfort 300 by Celfortec.

.3 Rigid fibrous insulation: thermosetting resin bonded boards, AF530 by Fiberglas Canada Inc.

.4 Foam Sealant: One component poyurethane foam sealant "Insta Seal" by Insta-Foam.

2.2 **Fasteners & Adhesives**

.1 Insulation adhesive: as recommended by insulation manufacturer.

.2 Impaling clips: zinc coated Stic-Klip type N and cadmium plated speed washer by Eckle Industries of Canada Ltd.

.3 Impaling clip adhesive: as recommended by impaling clip manufacturer.

PART 3 - EXECUTION

3.1 **Preparation**

.1 Substrate to receive rigid board insulation shall be sound, dry and free of dirt, oil grease and other foreign substances.

.2 Clean substrate as required. Remove concrete surface ridges and deposits.

3.2	**Installation** **General**	.1	Provide under this Section all thermal insulation required except where it is specified to be part of other Sections.
		.2	Where insulation is interrupted by construction elements, neatly fit insulation around such elements and pack spaces around elements with same insulation.
		.3	Moderately butt insulation boards against each other so that there are no gaps.
		.4	Stagger joints at multiple layer installations.
3.3	**Perimeter** **Insulation**	.1	Provide rigid board perimeter insulation at inside or outside of foundation walls, as indicated, to minimum 1200 mm vertically below finished grade or lower where shown on Drawings and 600 mm horizontally below floor slab. Unless otherwise indicated provide 50 mm thick insulation bonded to substrate with spot adhesive application.
3.4	**Foamed** **Sealant**	.1	Provide foamed sealant where indicated on the Drawings.
		.2	Coordinate the installation of this work with the work of other sections.
3.5	**Fibrous Batt** **Insulation**	.1	Provide fibrous batt insulation where indicated on Drawings.
		.2	Completely fill spaces between furring and framing members with insulation, leaving no gaps or voids. Do not pack insulation tighter than manufactured density of materials.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**
.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Masonry	Section 04200
.2	Air Barrier	Section 07196

1.3 **Qualifications**
.1 Applicator: Company specializing and licensed to perform the work of this section under the guidelines of CAN/ULC S705.2 and in accordance with the manufacturers written instructions.

1.4 **Submittals**
.1 Provide data on material characteristics, performance characteristics, limitations and independent R value, recycled content and water vapour transmission test data.

1.5 **Mock up**
.1 Provide mock-up of materials.

.2 Construct typical exterior wall sample panel. Locate where directed by consultant.

.3 Mock-up may remain as part of the work.

. .4 Allow [24] hr for inspection of mock-up by Consultant before proceeding with work of this section.

1.6 **Pre-Installation Meeting**
.1 Prior to commencing work of this section convene a pre-installation meeting to review conditions of installation, installation procedures, and coordination with related work. Establish manufacturer's requirements for approval of substrate.

.2 Ensure attendance of representatives from inspection company, manufacturer and applicator, and parties directly affecting the work of this section.

PART 2 - PRODUCTS

2.1 **Insulation Air Barrier System**
.1 Closed cell, spray applied polyurethane foam, medium density, ccSPF meeting the requirements of CAN / ULC-S705.1-15 and using only HFO blowing agents. Certified by EcoLogo as containing a minimum of 5% recycled content by mass of finished product. ULE/GREENGUARD Indoor Air Quality Certified® by the ULE/GREENGUARD Environmental Institute under the GREENGUARD for Children & Schools℠. Having an R value of R5.25/ inch @ 2 inches, R5.53/inch @ 4 inches.

.1 **WALLTITE** CM01 or XL01 by BASF as represented by Building Resource Inc. installed at a Minimum Field Density (Core) (ASTM D1622): 29 kg/m^3 (1.8lb/ft^3)

.2 **Heatlock Soya HFO** two component closed cell spray applied rigid polyurethane foam system standard by Huntsman. installed at a Minimum Field Density (Core) (ASTM D1622): 35.49 kg/m^3 (2.21lb/ft^3).

2.1 **Insulation Air Barrier System (Cont'd)**

.2 Transition Membrane Self Adhering: SBS modified bitumen, self adhering sheet membrane complete with a cross-laminated polyethylene film. Acceptable material: Tremco ExoAir 110, Blueskin SA as manufactured by Bakor or other material as accepted by BASF.

.3 Through-wall flashing membrane (Self-Adhering): SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film. Acceptable material: Tremco TWF, Bakor Blueskin TWF or other material as accepted by BASF.

.4 Through-wall flashing and dampproof coursing mastic: Synthetic rubber base compound. Compatible with air/vapour barrier membrane, substrate and insulation materials, Acceptable material: Air-Bloc 21 or 230-21 Adhesive as manufactured by Bakor.

.5 Primer for self-adhering membranes: Synthetic rubber based adhesive type, quick setting. Acceptable material: Blueskin® Primer as manufactured by Bakor.

PART 3 - EXECUTION

3.1 **Examination**

.1 Verify that surfaces and condition are suitable prior to commencing work of this section.

.2 Ensure that:

.1 Surfaces are sound, dry, even and free of oil, grease, dirt, excess mortar or other contaminants.

.2 Concrete surfaces are cured and dry, smooth and without large voids, spalled areas or sharp protrusions.

.3 Masonry joints are flush and completely filled with mortar.

.4 Verify that all penetrations, sleeves, etc. are properly placed and secure.

3.2 **Preparation**

.1 Substrate to receive foamed in place insulation shall be sound, dry and free of dirt, oil grease and other foreign substances.

.2 Clean substrate as required. Remove concrete surface ridges and deposits.

.3 All excessively wide joints should be covered or filled before applying the polyurethane foam.

.4 Install transition membranes in all places recommended in section 3 of BASF's technical product documentation including at the intersection of dissimilar materials, at connection to roof membranes, at all openings (doors and windows), at moving joints (control, construction and expansion), and around through wall penetrations as required.

.5 Install though wall flashings at all shelf angles and as shown on the drawings.

3.2	**Preparation (Cont'd)**	.6	Polyurethane foam should be sprayed with a tolerance of ±6mm (±¼") in relation to the specified thickness.
		.7	Avoid the formation of sub-layer air pockets when applying.
		.8	Avoid spraying the foam on any surfaces other than those indicated. Use drop sheets or masking tape to protect other surfaces.
		.9	Once the foam has hardened, remove all overspray from non-prescribed surfaces .
		.10	Do not allow polyurethane foam, once applied, to be damaged during work by the other trades.
		.11	Spray the polyurethane foam in overlapping layers, so as to obtain a smooth, uniform surface.
		.12	Do not spray polyurethane foam any closer than 75 mm (3") from chimneys, heating vents, steam pipes, recessed lighting fixtures, and other heat sources. Do not spray the insides of any exit openings or electrical junction boxes (refer to the BASF manual).
		.13	In temperatures below +10°C (+50°F) use transition membranes specifically formulated for low temperature application. If required mechanically fasten transition membranes to achieve the required pull strength.
3.3	**Installation**	.1	Apply insulation in accordance with manufacturer's instructions. Ensure full bond of insulation to substrate.
		.2	Apply insulation within recommended application temperature ranges. Consult manufacturer when insulation cannot be applied within these temperature ranges.
		.3	Using airless spray equipment having a minimum pressure of 20 684 kPa (3000 psi), apply insulation in multiple, uniform passes to provide seamless, monolithic cured thickness as indicated on drawings.
		.4	Ensure water tight seal at items penetrating insulation and ensure continuity of building envelope air barrier.
3.4	**Field Quality Control**	.1	An independent inspection and testing company appointed and paid for by the owner under Cash Allowance specified in Section 01020 will carry out inspection and testing in accordance with the General Conditions.
3.5	**Cleaning**	.1	Clean work in accordance with Section 01710.
		.2	Clean to the Consultant's approval, soiled surfaces, spatters, and damage caused by work of this Section.

End of Section

PART 1 – GENERAL

1.1 **SECTION INCLUDES**

.1 Built-up membrane roofing, hot applied rubberized method

1.2 **RELATED SECTIONS**

.1 Section 05310 - Steel Decking: Structural metal roof deck.

.2 Section 06100 - Rough Carpentry: cants, blocking and curbs.

.3 Section 07196 - Air Barriers: Connection of wall air barrier system to roofing system.

.4 Section 07620 - Sheet Metal Flashing and Trim.

.5 Section 010999 - Roof Accessories: Manufactured hatches

.6 Division 15 - Roof drains.

1.3 **REFERENCES**

.1 ASTM C931/931M-01: Standard Specification for Exterior Gypsum Soffit Board.

.2 ASTM D4601-98: Standard Specification for Asphalt-Coated Glass Fibre Base Sheet Used In Roofing.

.3 CSA A123.4-M1979: Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

.4 CGSB 37-GP-9Ma: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.5 CGSB 37-GP-52M: Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric.

.6 CAN/CGSB-51.33-M89: Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.7 CAN/ULC-S704-2001: Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.8 CAN/ULC-S706-02: Standard for Wood Fibre Thermal Insulation for Buildings.

1.4 **PERFORMANCE REQUIREMENTS**

Hot Applied Roof Membrane:

.1 Roofing System: three ply hot-applied built-up roofing system with thermal barrier underlay board (where required), self adhered vapour retarder, rigid board insulation, composite ply plus fiberglass roofing membrane roofing felts and aggregate surfacing.

.2 Provide Products that are compatible with one another under field conditions, as demonstrated by roofing manufacturer.

.3 Provide watertight roofing system capable of resisting specified uplift pressures, thermally induced movement and exposure to weather without failing during the specified warranty period.

.4 Shop Drawings for Sloped Insulation: Ensure positive drainage to roof drains. If roof deck is structurally tapered, provide drawings for crickets and roof drain sumps as required.

1.5 **CERTIFICATES**

.1 Manufacturer Certificates: Signed by roofing manufacturer verifying that installer is approved, authorized or licensed by manufacturer to install specified Products.

.2 Installer Certificates: Signed by installer verifying that they have the specified qualifications described below.

.3 Copy of Manufacturer's 20 Year Warranty

1.6 **TEST REPORTS**

.1 Submit test reports as specified in Section 01300

.2 Product Test Reports: based on the evaluation of comprehensive tests conducted by an independent testing agency of the specified roofing Products.

.3 Manufacturer Field Inspection Reports: manufacturer's written acceptance of roofing installation based on daily inspections.

1.7 **QUALITY ASSURANCE**

.1 Manufacturer: qualified manufacturer having roofing systems listed by UL and approved for use by Factory Mutual.

.2 Installer: a company and persons specializing in the application of protected elastomeric roofing, with minimum 5 years documented experience and approved to apply roofing system by manufacturer.

.3 Conform to CRCA Roofing Specifications and roofing membrane manufacturer's instructions.

.4 Is an approved vendor of the Waterloo Catholic District School Board.

1.8 **PRE-INSTALLATION MEETINGS**

.1 Conduct pre-installation meeting.

.2 Meeting: prior to commencement of deck installation, review and document methods and procedures related to roof deck and roofing system construction, including the following:

.1 Participants: authorized representatives of the Contractor, Consultant, Owner, roofing Subcontractor, roofing manufacturer, and installers of roof accessories and roof-mounted equipment.
.2 Review methods and procedures related to roofing installation, including manufacturer's written installation instructions.
.3 Review construction schedule and confirm availability of Products, Subcontractor personnel, equipment and facilities.
.4 Review deck installation criteria and finishes for conformance with roofing system criteria, including issues of flatness and fastening.
.5 Review structural loading conditions and limitations of roof deck both during and after roofing application.
.6 Review flashing details, special roofing details, roof drainage, roof penetrations, equipment curbs, and other conditions affecting roofing installation.

.7 Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
.8 Review safety requirements, including temporary fall-arrest measures.
.9 Review field quality control procedures.

1.8 **DELIVERY, STORAGE AND HANDLING**

.1 Deliver and store Products undamaged in original containers with manufacturer's labels and seals intact.

.2 Store Products in designated areas elevated off the ground and protected from ultra-violet radiation, inclement weather and construction activities.

.3 Store solvent-based liquids away from excessive heat and open flame.

.4 Store adhesives and sealants at temperature above -5 degrees Celsius.

.5 Store membrane rolls on end, dry, and protected from moisture and damage. Cover rolls, insulation and other moisture-sensitive Products with tarpaulins.

.6 Store Products on roof deck in a manner to prevent overloading the structure and properly secured to prevent movement due to wind or other forces

1.9 **SITE CONDITIONS**

.1 Protect adjacent properties from damage as a result of contract operations.

.2 Protect the Work and the Owner's property from damage as a result of contract operations.

.3 Confine equipment, material storage, and operations of workers to limits indicated by laws, ordinances, permits, and prior arrangements with the Owner.

.4 Do not interrupt or hamper occupant operations without prior written approval.

.5 Remove progressively all debris created by the execution of the Work and dispose of same at appropriate disposal sites.

.6 Alert the Owner to the expected presence of odours, fumes, or dust and co-ordinate the shielding of ventilation equipment or scheduling of process to achieve acceptable abatement.

.7 Upon completion of the work, leave premises in original order and condition.

1.10 **ENVIRONMENTAL REQUIREMENTS**

.1 Do not install roofing during weather that might adversely affect the performance of the system.

.2 Do not install roofing over surfaces that are wet, icy, dirty or otherwise unacceptable to the system being installed.

.3 Secure the Work in a safe and watertight fashion before the onset of inclement weather and at the end of each day's work.

1.11 **WARRANTY**

.1 Submit extended warranties in accordance with the General Conditions of the Contract.

.2 Installer's Extended Warranty: standard 2 year warranty, commencing from the date of Substantial Performance of the Work.

.3 Manufacturer's Extended Warranty: a written guarantee that the manufacturer will replace, at no cost to the Owner, any portion of the roofing membrane which experiences actual leaks resulting from defects in the manufacture of the membrane for a period of 20 years, commencing from the date of Substantial Performance of the Work.

1.12 **MAINTENANCE**

.1 The Manufacturer shall issue a non-prorated warranty for a period of Twenty Years. All components from the vapour retarder up shall be covered under this warranty.

.2 Warranty shall include inspections in years 2 and 5, 10 & 15 of the warranty. The following duties shall be carried out at no extra cost to the Owner as required, by the Manufacturer.

- sealing of flashing seams
- filling of pitch pockets
- repairs to blisters and ridges
- caulking at metal details as required
- written inspection report
- removal of light debris from the roof and premises
- cleaning of drain screens.

.3 Documentation shall be provided that the manufacturer has personnel to carry out above noted warranty requirements and has a history of providing these for a minimum of 5 years.

.4 Upon satisfactory completion, the warranty and all construction information regarding the roof installation shall be placed on an Online Roof Management Program at no additional cost to the Owner.

.5 Prior to the 2 year expiration of the contractor's warranty, the manufacturer shall carry out an Infra-Red Scan of the roof areas completed under this contract.

Part 2 – Products

The the School Board will not consider more than one bid from a bidder under the same or different names.

MANUFACTURERS

.1 Manufacturers of Multi Ply built-up asphalt roofing systems having Products considered acceptable for use:
.1 Tremco Canada and/or approved equal.

.2 Substitution Procedures: Only 3 ply ballasted systems shall be taken under consideration for substitution. Substitute system must have a ten year history in the roofing industry and must have been installed on a minimum of 5 projects within an 80 kilometer radius of the project.

.3 Confirmation that substitution is equal to specified system must be provided as determined by an independent Engineering testing agency.

2.1 **MATERIALS**

.1 Verify all materials are compatible before proceeding with the work.

.2 Base sheet: Composite Trilaminate Felts (Burmastic) or approved equal.

.3 Saturated glass fibre roofing felts; to ASTM D2178-88a, Type 4.

.4 Asphalt primer: to CGSB 37-GP-9Ma-83.

.5 Asphalt: rubberized hot melt to CAN/CGSB 37.50-M89. Tremco Thermastic 80 or approved equal.

.6 Plastic cement: asphalt, to CGSB 37-GP-5Ma-89.

.7 Sealing compound: to CGSB 37-GP-29Ma-89, rubber asphalt type.

.8 Insulation:

.2 .1 Top layer - 2" (50mm) TopRock DD Plus Mineral Wool Insulation by Rockwool. Base and intermediate layers: 2 layers of 2.5" (64mm) Trisotech Polyisocyanurate or approved equal. Crickets and all tapered accessories as per drawings; ModulR or Posi Slope.

.9 Flexible elastomeric flashing: use reinforced EPDM/SBR rubber sheet as supplied by Tremco.

.10 Self-Adhering Sheet Vapour Retarder**:** 1.0 mm- (40 mil-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 6 ng/Pa x s x sq. m (0.1 perm); cold- applied, with slip-resisting surface and release-paper backing. Provide primer when recommended by vapour-retarder manufacturer.

.11 Cant strips: to be wood by Rough Carpentry.

.12 Thermal Barrier Underlay Board: Securock 5/8" mechanically secured.

.13 Gravel: to ASTM D1863-66.

.14 Roof vents: Alumi-Flash by Portals Plus or approved alternate.

.15 Pipe pass through. Portals Plus.

.16 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 Nails: to CSA B111-1974.
.3 Flat caps or discs: flat metal 32 mm diameter not less than 0.25 mm thick.
.4 Mechanical fasteners; as approved by ULC or Factory Mutual, length to suit application, c/w plastic or metal disks.
.5 Insulation joint tape: asphalt treated kraft paper, fibre reinforced, 100 to 150 mm wide, self- adhering.
.6 Sealing compound: to CAN/CGSB-19.24-M80.
.7 Polyethylene back-up rope: extruded close cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa, compatible with primers and sealants, oversized 30 to 50%.
.8 Slip Sheet: 0.15 mm thick polyethylene sheet, to CAN/CGSB-51.34-M.
.9 Altra Metal Specialties – Model ABD-CR-X-SS: Aluminum Body Roof Drain complete with clamping ring.

Part 3 - Execution

3.1 **EXAMINATION**

.1 Inspect existing conditions to ensure they are suitable for roofing work to begin. Do not proceed until unacceptable conditions are corrected.

.2 Ensure substrate is solid, clean, dry and free of any contaminants prior to commencing any roofing work.

.3 Ensure Products are dry prior to installation. Replace damaged Products.

3.2 **PREPARATION**

.1 Protect existing roofing from damage with minimum 13 mm thick plywood runways.

.2 Remove all existing roof membrane components down to the deck and remove from the roof surface.

.3 Prime metal and concrete surfaces designated to be covered with asphaltic Products.

.4 Apply primer at an average rate of 4.3 m^2/litre. Allow to cure.

.5 Ensure primer does not enter building through cracks and other openings.

3.3 **THERMAL BARRIER UNDERLAY BOARD** (as indicated on drawings/existing roof tie-in)

.1 Mechanically secure thermal barrier underlay board to roof deck with screws and plates using one fastener per 0.27 m^2. Stagger boards 300 mm. Drive fasteners flush to top surface.

3.4 **VAPOUR RETARDER**

.1 Prime underlay board and adhere roof vapour retarder over thermal barrier underlay.

.2 Overlap vapour retarder minimum 100 mm for side laps and 150 mm for end laps.

.3 Extend vapour retarder under cant strips and blocking. Extend to perimeter and deck protrusions.

.4 Seal roof vapour retarder to wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building air/vapour barrier envelope.

3.5 **INSULATION AND OVERLAY BOARD**

.1 Install insulation boards to maintain continuity of thermal envelope, as specified in Section 07196.

.2 Adhere the first layer of insulation to the vapour retarder using Low Rise Foam Adhesive.

.3 Adhere second layer of insulation to succeeding layer of roof insulation using Kettle Modified Rubberized Asphalt.

.4 Adhere top layer/overlay board of roof insulation to succeeding layer of roof insulation with Kettle Modified Rubberized Asphalt.

.5 Adhere roof insulation crickets and sumps where indicated and in accordance with approved Shop Drawings.

.6 Fit insulation tight to roof penetrations.

.7 Firmly butt insulation boards. Do not jam or deform boards.

.8 Minimize lipping between adjacent boards.

.9 Stagger joints minimum 300 mm.

.10 Stagger overlay board seams with insulation board seams.

3.6 **CANT STRIPS**

.1 Install cant strips at intersections of roofing and vertical surfaces.

.2 Embed in a continuous bed of approved adhesive applied to overlay boards.

.3 Lay true to line, level and with flush, butt joints and accurately mitred corners.

3.7 **ROOF MEMBRANE**

.1 Install 1 ply of base ply in shingle fashion, starting at roof low point. Apply membrane perpendicular to overlay board joints. Conform to manufacturer's recommended method

.2 Install two plies of Type IV felts in shingle fashion, starting at roof low point. Apply membrane perpendicular to overlay board joints. Conform to manufacturer's recommended method.

.3 Overlap starter strips 510 mm with first ply, then overlap each succeeding ply 485 mm.

.4 Place ply sheets to ensure water will flow over or parallel to, but not against, exposed edges.

.5 Shingle in direction to shed water. Extend ply membranes over and terminate beyond cants and cut evenly.

.6 Embed plies in bitumen, at a minimum rate of 1.2 L/m^2, and solidly coating each ply for full width.

.7 Ensure complete and continuous seal and contact between bitumen and ply membranes, including ends, edges and laps without wrinkles, fish mouths or blisters.

.8 Do not step or walk on felts during or immediately after application until bitumen has set.

.9 Install each ply so that it shall be firmly and uniformly set, without voids, into bitumen. Thoroughly and effectively broom or roll each membrane application to ensure full adhesion.

.10 Lap ply membrane ends 150 mm. Stagger end laps 1.0 metres minimum.

.11 Overlap previous day's work 600 mm, as required.

.12 Terminate all ply layers to outer edge of roof perimeter.

3.8 **ELASTOMERIC FLASHINGS**

.1 Provide membrane flashings as specified and in accordance with manufacturer’s written installation guidelines.

.2 Install flashings to ensure the roof is watertight at the end of each Working Day.

.3 Extend flashing membrane minimum 150 mm over roof membrane.

.4 Extend flashing membranes minimum 200 mm up vertical surfaces.

.5 Secure flashings at 200 mm OC. Secure vertical flashings through termination bar.

.6 Overcoat lap edges with end lap stripping adhesive and membrane.

.7 Tie-in leading edge of elastomeric sheet flashing with stripping ply membrane embedded between alternate courses of stripping ply adhesive.

.8 Canted Eave:
- .1 Extend reinforced elastomeric sheeting over outside face of cant and extend minimum 25 mm below blocking. Mechanically fasten with 38 mm common roofing nails, 200 mm OC.
- .2 Extend reinforced elastomeric sheeting down over cant strip and embed in flashing adhesive from top of cant to at least 150 mm beyond toe of cant onto roof.
- .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.

.9 Canted Eave with Fascia
- .1 Extend reinforced elastomeric sheeting over outside face of cant and fascia and secure to underside of fascia. Mechanically fasten with 38 mm common roofing nails, 200 mm OC.
- .2 Extend reinforced elastomeric sheeting down over cant strip and embed in flashing adhesive onto roof surface a minimum of 150 mm.
- .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.

.10 Low Parapet Wall Flashing
- .1 Seal exposed joint between the wall and roof deck for airtight seal.
- .2 Adhere elastomeric sheeting completely to flashing surface, cant, and roofing with flashing adhesive.
- .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .4 Extend elastomeric sheeting up and over parapet at least 38 mm and face nail with 38 mm common roofing nails, 200 mm OC.

.11 Gravel Stop
- .1 Prior to setting and nailing horizontal flanges of edge flashings, uniformly trowel a 1.5 mm thick layer of cold flashing adhesive to roofing surface designated to receive metal flange.
- .2 Install metal gravel stop with formed drip edge, incorporating lock-type joints to allow expansion and contraction. Set flange in cold flashing adhesive.
- .3 Nail interior portion of flange to wood blocking 75 mm OC, staggered.
- .4 Prime metal flange with asphaltic primer.
- .5 Fully adhere a sufficiently wide strip of elastomeric sheeting to flashing with flashing adhesive. Ensure complete bond and continuity without wrinkles or voids lap sheeting ends 100 mm and adhere with flashing adhesive. Elastomeric sheeting to cover gravel stop completely and overlapping onto adjacent roof minimum 150 mm.
- .6 Seal edge of flashing membrane at metal upturn.

.12 Flashing at Edges and Gutters
- .1 Fabricate and install new one-piece edges, gutter with downspouts. Slope gutter to downspouts.
- .2 Prior to setting and nailing horizontal flanges of gutter, uniformly trowel a 1.5 mm thick layer of cold flashing adhesive to roofing surface designated to receive metal flange.
- .3 Nail flange to wood blocking 75 mm OC, staggered.
- .4 Prime metal flange with asphaltic primer.
- .5 Adhere sufficiently wide strip of elastomeric sheeting completely to flashing surface with flashing adhesive. Ensure complete bond and continuity without wrinkles or voids lap sheeting ends 100 mm and adhere with flashing adhesive. Elastomeric sheeting to cover gravel stop completely and overlap onto adjacent roof a minimum of 150 mm.
- .6 Seal edge of flashing membrane at metal upturn.

.13 Wall Flashing
- .1 Seal exposed joint between the wall and roof deck for airtight seal.
- .2 Adhere elastomeric sheeting completely to flashing surface, cant and roofing with flashing adhesive.
- .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .4 Elastomeric sheeting width: sufficient to extend at least 150 mm beyond toe of cant onto roof surface and 200 mm above the roof surface.
- .5 Secure top of elastomeric sheeting to vertical plane with termination bar. Mechanically fasten 300 mm OC. Overcoat bar with end lap stripping adhesive and membrane.

.14 Building Expansion Joints
- .1 Fill joint with loose insulation.
- .2 Provide 13 mm thick plywood to top of wood blocking, secured one side only.
- .3 Apply foam rubber or 25 mm thick mineral fibre insulation to top of plywood.
- .4 Install elastomeric sheeting centred over expansion joint.
- .5 Fully adhere sheeting to horizontal and vertical blocking surfaces with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
- .6 Elastomeric Sheeting Width: Sufficient to extend onto adjacent roofing minimum 150 mm.
- .7 Lap sheeting ends 100 mm and adhere with flashing adhesive.

.15 Expansion Joint at Wall
- .1 Extend vapour retarder from deck level up wall sufficiently and secure to wall.
- .2 Fill joint with loose insulation.
- .3 Install blocking, sheathing and compressible insulation as detailed on drawings.
- .4 Adhere elastomeric sheeting completely to flashing surface, cant and roofing with flashing adhesive.
- .5 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm and adhere with flashing adhesive.
- .6 Elastomeric Sheeting Width: sufficient to extend at least 150 mm beyond toe of cant onto roof surface and 200 mm above the roof surface.
- .7 Secure top of elastomeric sheeting to vertical plane with a termination bar. Mechanically fasten 300 mm OC. Overcoat bar with end lap stripping adhesive and membrane.

.16 Area Divider
- .1 Install elastomeric sheeting centered over area divider extending onto roof membrane a minimum of 150 mm beyond toe of cant on either side.
- .2 Fully adhere sheeting with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
- .3 Lap sheeting ends 100 mm and adhere with flashing adhesive.

.17 Control Joint
- .1 Install elastomeric sheeting centered over joint.
- .2 Fully adhere sheeting to horizontal and vertical blocking surfaces with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
- .3 Flashing Width: Sufficient to extend onto adjacent roofing minimum 150 mm.
- .4 Lap sheeting ends 100 mm and adhere with flashing adhesive.

.18 Curb Flashing
- .1 Fully adhere sheeting to horizontal and vertical blocking surfaces with flashing adhesive. Press sheeting into adhesive. Ensure complete bond and continuity without wrinkles or voids.
- .2 Elastomeric Sheeting Width: Sufficient to extend from top of curb down onto adjacent

roofing minimum 150 mm. Mechanically fasten sheeting on top face of curb.
.3 Lap sheeting ends 100 mm and adhere with flashing adhesive.
.4 If membrane does not completely cover sleeper, secure top edge with a termination bar.
.3 Mechanically fasten 300 mm OC. Overcoat bar with end lap stripping adhesive and membrane.

.19 Projection Flashing
.1 Apply flashing adhesive to prepared area and Provide aluminium base over pipe and set into the flashing adhesive.
.2 Select proper step of rubber cap and cut off above index ring.
.3 Install cap onto base collar and press edge to ensure proper seal.
.4 Provide clamp around pipe and rubber cap. Prime flange.
.5 Install elastomeric sheeting with stripping ply adhesive and membrane.
.6 Cover flange completely. Extend flashing minimum 100 mm onto adjacent roofing. Remove wrinkles and voids. Lap flashing ply ends 100 mm.

.20 Lead Plumbing Vents
.1 Provide lead plumbing vent flashing.
.2 Flange: minimum 100 mm wide; extend completely around periphery of vent flashing. Set flange into flashing adhesive. Neatly dress flange with wood blocking.
.3 Prime lead flange with asphaltic primer.
.4 Pipe Greater Than 50 Mm OD: Bend lead inside pipe minimum 25 mm; replace cracked lead.
.5 Pipe 50 mm OD or Less: Cut lead at vent top. Provide integral lead cap.

.21 Cartwheel and Collar: Provide cartwheel and collar flashing around projection using elastomeric sheeting and flashing adhesive.

.22 Coping
.1 Test mortar bond of coping units. Remove loose mortar from bell joint and clean surfaces.
.2 Pack flashing adhesive into bell joint and extend up onto bell approximately 75 mm and down onto shank of adjoining unit a similar distance.
.3 Cut proper lengths of 150 mm wide reinforcement membrane and dry trowel membrane into flashing adhesive; tight and wrinkle-free.
.4 Overcoat reinforcing membrane with flashing adhesive.

.23 Equipment Stands (Pipe) Portals Plus
.1 Provide 200 mm high sleeve flashing with 100 mm wide flange. Flange to extend completely around flashing periphery. Solder joints. Double solder vertical joints.
.2 Nail flange to wood blocking minimum 75 mm OC; staggered.
.3 Prime flange with asphaltic primer.
.4 Install elastomeric sheeting to stand and roofing with continuous 1.5 mm thick application of flashing adhesive.
.5 Sandwich top edge of sheeting between two layers flashing tape.
.6 Secure top of sheeting with stainless steel drawband. Seal top of drawband and sheeting-to-pipe interface. Provide watershed and tool neatly.
.7 Fabricate umbrella and install drawband; cover sleeve flashing minimum 75 mm. Install immediately above sleeve flashing. Tighten drawband.
.8 Wipe clean top of umbrella and projection with metal cleaner. Prime surface with metal primer.
.9 Seal projection-to-sheet metal interface. Provide watershed and tool neatly.

.24 Piping Through Roof Boxes Portals Plus
.1 Install pre-manufactured Portal Plus as per manufacturers written recommendations.
.2 Set flange in mastic, nail flange to wood blocking at 75 mm OC. Prime flange.
.3 Fill box interior with mineral fibre insulation.
.4 Fasten top and closure detail to bottom.
.5 Clean surfaces of box and piping with metal cleaner and then prime. Seal joint between box

and piping.
.6 Install elastomeric sheeting with flashing adhesive and membrane.

.25 Roof Drain
.1 Install drain assembly in accordance with manufacturer's written installation guidelines.
.2 Plug and seal drain to prevent water entry until service connection is completed.
.3 Provide 600 x 600 mm size elastomeric sheeting reinforcement, centered over drain; and fully adhered with flashing adhesive. Remove wrinkles and entrapped air.
.4 Apply mastic to exposed edge of membrane inside the drain opening.
.5 Reclamp flashing collar to drain in bed of flashing adhesive.
.6 Trim excess sheeting within drain.

.26 Roof Drain Insert
.1 Cut 225 mm OD opening through membrane and insulation; coinciding with existing drain opening.
.2 Install roof drain insert into existing drain pipe in accordance with drain insert manufacturer's written installation guidelines.
.3 Adhere drain flange to membrane with flashing adhesive.
.4 Provide 900 x 900 mm size elastomeric sheeting reinforcement, centered over drain; and fully adhere sheeting with flashing adhesive. Remove wrinkles and entrapped air.
.5 Trim excess sheeting within drain.
.6 Seal leading edge of sheet with reinforcing membrane embedded between alternate continuous courses of flashing adhesive.

3.8 SURFACING

.1 Install concrete pavers on pedestals where indicated on Drawings.

.2 Flood coat roof surface with Kettle Modified Rubberized Asphalt adhesive, applied at a rate of 2.4 L/m^2.

.3 Immediately broadcast aggregate ballast into Kettle Modified Rubberized Asphalt at a rate of 20 kg/m^2, covering flood coat completely.

.4 Rake out aggregate to a neat, even surface.

3.9 FIELD QUALITY CONTROL

.1 Contractor Inspection: Prior to application aggregate surfacing, inspect completed membrane and flashing for punctures, tears, and discontinuously sealed seams.

.2 Apply additional layer of membrane over punctures and tears, extending minimum 50 mm beyond damaged area in all directions, and seal seams.

.3 Manufacturer's Field Service: arrange for manufacturer's technical representative to regularly inspect the roofing application daily and confirm that the roofing system installation is in strict accordance with manufacturer's recommendations.

3.10 CLEANING

.1 Clean drains, gutters and downspouts of debris, ensuring free drainage.

.2 Clean adjacent roof surfaces, levels and ground level areas of debris and excess Products.

3.11 PROTECTION

.1 Adequately protect Products and work from damage by weather, traffic and other causes.

.2 At the end of each Working Day, seal exposed edges of roofing membrane to be watertight.

.3 Protect adjacent Work from damage. Repair damage.

END OF SECTION

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Work**

.1	Rough Carpentry	Section 06100
.2	Metal flashings except as specified herein	Section 07620
.3	Structural Timber	

1.3 **Quality Assurance**

.1 Reference Standards: comply with applicable requirements of Technical Bulletins Nos. 5, 6 and 7, and Metric Standards of CSSBI, except where specified otherwise herein.

.2 Manufacturer and installer shall have experience in fabrication and installation of metal roofing of similar scope and complexity. Installers shall be manufacturer's forces or forces approved by manufacturer.

1.4 **System Description**

.1 Provide the following metal roofing system:

.1 Roofing system to match existing curved standing seam prefinished steel roofing system in finish, profile and colour.

.2 The work of this section shall include the design, fabrication supply and erection of the following:

.1 Curved prefinished steel roofing panels.

.2 All metal flashings and trim required in connection with the above installation.

.3 Galvanized steel structural purlins.

.4 Prefinished eaves trough (gutter), downspouts(RWLs) and snow guards matching existing

.5 Flexible membrane to seal to roofing system.

.6 Sealants for joints between panels and between panels and adjoining construction.

1.5 **Design Performance Requirements**

.1 Appearance: no exposed fasteners; exposed surfaces free of distortion, twist, waves and buckles.

.2 Structural loads: resist positive and negative wind pressures expected in this geographical area with a maximum allowable deflection of 1/180 of span. Components shall not vibrate when subjected to the effects of wind.

.3 Thermal movement: accommodate expansion and contraction of component parts without causing buckling, failure of joint seals, undue stress on fasteners and other detrimental effects.

.4 Structural movement: accommodate movement between metal roofing and building structure caused by structure movement, without permanent distortion, racking of joints, breakage of seals or water penetration.

1.6 **Submittals**

.1 Submit duplicate minimum 50 x 100mm size samples of metal roofing material for approval of colour.

.2 Submit detailed shop drawings. Indicate dimensions, metal roofing profiles, attachment methods, types and locations of supports, trim and closure pieces and all components related to the work.

1.7 **Warranty**

.1 At no cost to Owner, remedy any defects in this and other Section due to faults in materials and design provided under this Section, for a period of **five years from date of Substantial Performance.** Provide Owner with a written warranty to this effect.

PART 2 - PRODUCTS

2.1 **Materials**

.1 **Prepainted Sheet Steel**

.1 Meet requirements of CSSBI Technical Bulletin No. 7, proven colour.

.2 Base metal: 0.71 mm galvanized sheet steel meeting requirements of ASTM A653M, Grade 230, zinc coating designation Z275.

.3 Finish: Duranar XL two coat system matching existing

.2 **Subgirts, Clips, Spacers:** minimum 1.2mm thick formed galvanized steel: ASTM A653M, Grade 230, zinc coating designation Z275.

.3 **Fastening Devices:** stainless, cadmium plated or galvanized steel.

.4 **Flashings Gutters and Downspouts:** same material and colour as metal roofing sheet.

.5 **Metal Closures:** as required and where indicated on the drawings.

2.2 **Fabrication**

.1 Unless otherwise indicated use minimum 0.711mm core thickness sheet metal, tension levelled.

.2 **Spacer or Girt System:** galvanized steel girt anchor or clip system designed to meet performance requirements specified.

.3 Finished exposed surfaces shall be prepainted steel, smooth and plain.

.4 **Flashings, Trim, Closures:** fabricated to profiles indicated and as required to meet design and performance requirements. Use preformed corner pieces only. Use same material as exterior skin where exposed. Double back exposed edges.

.5 **Snow Guards:** designed and placed as required to meet existing area historical snow loading data. Match existing colour and profile.

PART 3 - EXECUTION

3.1 **Preparation**

.1 Prior to start of erection, examine existing work and report to Consultant any unsatisfactory conditions.

3.2 **Erection**

.1 Install preformed curved standing seam metal roofing system to structural timber framing as detailed and in accordance with manufacturer's directions.

.2 Install purlins screw fastened to structural timber. Space and design structural purlins as required to support roofing.

.3 Install metal roofing skin with joints accurately aligned and tight fitting and in such a manner that horizontal lines are true and level and vertical lines are plumb.

.4 For standing seam metal roofing, ensure sheet side-lap is mechanically seamed for full length of roof.

.5 Provide flashings, closures, covers and trim as indicated and required to render work complete. Provide flashings between metal roofing elements and between metal roofing and building structure. Provide segmented eave and parapet flashings.

.6 Install companion flashings, gutters and downspouts as shown on reviewed shop drawings.

.7 Leave metal roofing system in clean and neat condition.

.8 Touch up all minor scratches, etc. to exterior finish as approved by the Consultant.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Masonry	Section 04200
.2	Rough Carpentry	Section 06100
.3	Built-up Asphalt Roofing:	Section 07513
.4	Aluminum Entrances and Curtain Wall	Section 08900
.5	Air Barrier	Section 07196

1.3 **Guarantee**

.1 Provide the following guarantee in accordance with the General Conditions, notwithstanding the time provision therein:

Two (2) years materials and labour.
Twenty (20) years manufacturers warranty

1.4 **Samples**

.1 Submit two 2 sets of samples of manufacturer's full range of precoated metal finishes, or custom colours as specified.

1.5 **Design and Performance Criteria**

.1 Appearance: neatly and evenly lay out and install components. Exposed fastening devices not permitted.

.2 Effects of wind: resist positive and negative wind pressures without detrimental effects.

.3 Water control: prevent passage of water.

.4 Thermal movement: Accommodate expansion and contraction of component parts without buckling, failure of joints, undue stress on fasteners and other detrimental effects.

.5 Compatibility: Components shall be compatible with dissimilar metals and materials with which they are in contact or fastened to so as to prevent corrosion, staining and other detrimental effects. If required, treat or separate contact surfaces with inert and non-staining insulation material to achieve compatibility.

1.6 **Job Conditions**

.1 Schedule and coordinate installation of metal flashing components with work of other Sections where it is integral or contiguous therewith.

.2 Install metal counter and cap flashings immediately after installation and inspection of roofing membrane base flashings.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Precoated Sheet Steel

.1 Meet requirements of CSSBI Technical Bulletin No. 7, Proven Colour.

.2 Base metal: galvanized sheet steel meeting requirements of ASTM A446, Grade A, zinc coating designation Z275, 24 ga.

.3 Colour: Stelco or Dofasco 8000 Series: Colour to be selected by Consultant from full range of colours.

2.1 **Materials (Cont'd)**

.2 Galvanized Sheet Steel: Hot dip galvanized, cold rolled with stretcher level degree of flatness to ASTM A 526; zinc coating designation Z275.

.3 Cleats and Edge Strips: Non-corrosive metal compatible with sheet metal, thickness as required to provide rigid support and positive securement for metal flashings.

.4 Mechanical Fastening Devices: Non-corrosive metal compatible with sheet metal.

.5 Sealant: One of the following:
.1 Two-part polysulphide to CGSB 19-GP-24M.
.2 One part low modulus silicone to CGSB 19-GP-28M.
.3 Dymeric by Tremco.

.6 Asphaltic Paint: Alkali resistant asphalt based enamel: CGSB 1-GP-108M.

2.2 **Fabrication General**

.1 Shop fabricate metal flashing components to profiles indicated. Where flashings are required but not detailed follow applicable requirements of SMACNA Architectural Manual. Provide minimum 24 ga. material for all components unless otherwise indicated.

.2 Provide components free from distortion, waves, twists, buckles and other defects detrimental to performance and appearance. Form sections square, true and accurate to size.

.3 Double back exposed edges at least 12 mm.

.4 Seams: space seams uniformly at maximum 3 m o.c. Unless otherwise indicated, use flat locked seams, lapped 25 mm. Make horizontal seams in directions of water flow. Mitre and seal corners. Make allowance for expansion.

.5 Unless otherwise indicated, counter flashings shall completely cover base flashings.

.6 Furnish everything necessary for complete metal flashing installation, including clips and fastening devices.

.7 Back paint metal flashings with asphaltic paint.

2.3 **Sleeve Flashing System**

.1 Aluminum 1.5 mm thick 3-part flashing system by Thaler Roofing Specialities Products. Conduit flashing – MEF-1A, vandal proof stack flashing SJ -31

.2 Fabricate sleeve flashings square or circular and of size to suit components being flashed. Unless otherwise indicated, fabricate sleeves 450 mm high.

.3 System shall consist of bitumen protection cup, sleeve with flange and rain collar.

.4 Inside of jacket base flange and all sides of protection cup still be coated with bituminous paint.

.5 Size sleeves to allow minimum 25 mm thick insulation between component

and sleeve.

PART 3 - EXECUTION

3.1 **Installation**

.1 Provide all metal flashings required to render roof and wall systems watertight, whether specifically shown on Drawings or not.

.2 Provide under this Section, concealed sheet metal components forming part of air and vapour barrier system, located within building envelope and not provided under work of other Sections. Unless otherwise detailed provide galvanized sheet steel, minimum 0.7 mm thick.

.3 Clean surfaces to be covered with metal flashings of dirt and other foreign matter. Drive projecting nails flush with substrate. Do not apply metal flashings over substrates likely to cause rupture.

.4 Provide underlay of resin sized paper under metal flashings installed over masonry, concrete or wood. Lay underlay dry as sheet metal work is installed. Secure in place and lap joints 100 mm.

.5 Provide sheet metal flashing at roof curbs, copings, penetrations, at junction of roof to wall, and where shown on Drawings.

.6 Protect all membrane flashings with metal counter flashings.

.7 Wherever possible, secure flashings to supporting building elements with concealed continuous edge strips; avoid exposed surface fasteners.

.8 Fill and seal seams with sealant; rivet corners.

.9 Where flashing is punctured by bolts, provide sheet lead or neoprene washers, 6 mm larger than bolt hole.

.10 Where flashing is installed around circular components and upper flashing edge is exposed, provide draw band around upper edge of flashing collar.

.11 At reglets in masonry walls, secure metal flashings to reglet with mechanical fasteners at maximum 610 mm o.c.

.12 Except where premoulded pipe flashings are provided by Section 07513 install sleeve flashing systems at penetrations through roof membrane. Install systems in accordance with manufacturer's directions. Insulate between penetrating elements and sleeve with 25 mm thick fibrous insulation. Sweat solder or weld on rain collar.

.13 Imperfections in metal flashing work such as holes, dents, creases, or oil-canning will not be accepted.

End of Section

PART 1 - GENERAL

1.1	**General Requirements**	.1	Comply with requirements of Division 1.
1.2	**Related Sections**	.1	Section 01020 – Allowances
		.2	Section 05123 - Structural Steel
		.3	Section 07200 - Insulation
		.4	Section 07270 - Firestopping and Smoke Seals
		.5	Section 09900 – Painting
1.3	**Work Included**	.1	Provide all labour, materials, equipment and services necessary for, and incidental to, the complete and proper installation of all spray-applied fire resistive materials and related work as shown on the drawings or where specified herein, and in accordance with all applicable requirements of the Contract Documents.
		.2	The material and installation shall conform to the applicable building code requirements and the requirements of all authorities having jurisdiction.
1.4	**Quality Assurance**	.1	Work shall be performed by a firm with expertise in the installation of fire protection or similar materials. This firm shall be licensed or otherwise approved by the spray-applied fire resistive material manufacturer.
		.2	Before proceeding with the fire protection work, approval of the proposed material thicknesses and densities shall be obtained from the architect and other applicable authorities.
1.5	**Reference Standards**	.1	ASTM E84 - Surface Burning Characteristics of Building Materials.
		.2	ASTM E119 - Fire Tests of Building Construction and Materials.
		.3	ASTM E136 - (Noncombustibility) Behavior of Materials in a Vertical Tube Furnace at 750°C.
		.4	ASTM E605 - Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.
		.5	ASTM E736 - Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
		.6	ASTM E759 - Effect of Deflection of Sprayed Fire-Resistive Materials Applied to Structural Members.
		.7	ASTM E760 - Effect of Impact on the Bonding of Sprayed Fire-Resistive Materials Applied to Structural Members.
		.8	ASTM E761 - Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

1.5 **Reference Standards (Cont'd)**

.9 ASTM E859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.

.10 ASTM E937 - Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.

.11 ULC/CAN S101 Standard Methods of Fire Tests of Building Construction and Materials.

.12 ULC/CAN S102 Steiner Tunnel Test.

.13 ULC/CAN 4 - S114 Standard Test Method for Determination of Non-combustibility in Building Materials.

.14 Underwriters Laboratories of Canada (ULC) List of Equipment and Materials.

.15 Uniform Building Code Standard No. 7-6 (current edition): Thickness and Density Determination for Spray-Applied Fire Protection.

.16 AWCI Publication: Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials. Technical Manual 12-A; an annotated guide.

1.6 **Submittals**

.1 Manufacturer's Data: Submit manufacturer's specifications, including certification as may be required to show material compliance with Contract Documents.

.2 Test Data: Independent laboratory test results shall be submitted for all specified performance criteria.

1.7 **Delivery, Storage and Handling**

.1 Deliver materials to the project in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data. Packaging shall bear the UL and ULC labels for fire hazard and fire-resistance classifications.

.2 Store materials above ground, in a dry location, protected from weather, moisture and areas of high humidity. Damaged packages found unsuitable for use should be rejected and removed from the project.

1.8 **Project Conditions**

.1 When the prevailing outdoor temperature at the building is less than 40° F (4° C), a minimum substrate and ambient temperature of 40° F (4° C) shall be maintained prior to, during and a minimum of 24 hours after application of the spray-applied fire resistive material. If necessary for job progress, General Contractor shall provide enclosures with heat to maintain temperatures.

.2 General Contractor shall provide ventilation to allow proper drying of the spray-applied fire resistive material during and subsequent to its application.

.3 Ventilation shall not be less than 4 complete air exchanges per hour until

the SFRM is fully cured. When spraying in enclosed areas such as basements, stairwells, shafts and small rooms, additional air exchanges may be necessary.

1.9 **Sequencing/ Scheduling**

.1 All fire protection work on a floor shall be completed before proceeding to the next floor.

.2 The Contractor shall cooperate in the coordination and scheduling of fire protection work to avoid delays in job progress.

PART 2 - PRODUCTS

2.1 **Acceptable Manufacturers**

The spray-applied fire resistive material shall be manufactured by:

ISOLATEK INTERNATIONAL or
W. R. GRACE CONSTRUCTION PRODUCTS

2.2 **Acceptable Materials**

CAFCO® BLAZE-SHIELD® II, Isolatek International
CAFCO® 300, Isolatek International or
Monokote® MK-6, W. R. Grace

.1 Materials shall be applied to conform to the drawings, specifications and following test criteria:

.1 Deflection: When tested in accordance with ASTM E759, the material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical centerload resulting in a downward deflection of 1/120th of the span.

.2 Bond Impact: When tested in accordance with ASTM E760, the material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.

.3 Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 150 psf (7.2 kPa).

.4 Air Erosion: When tested in accordance with ASTM E859, the material shall not be subject to losses from the finished application greater than 0.025 grams per sq. ft. (0.27 grams per square meter).

.5 Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 750 psf (35.9 kPa).

.6 Corrosion Resistance: When tested in accordance with ASTM E937, the material shall not promote corrosion of steel.

.7 Noncombustibility: When tested in accordance with ASTM E136 or CAN4-S114, the material shall be noncombustible.

.8 Surface Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following

surface burning characteristics:

Flame Spread.....0
Smoke Developed.....0

2.2 **Acceptable Materials (Cont'd)**

.9 Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL/ULC design or as required by the authority having jurisdiction, or shall have a minimum average of 15 pcf (240 kg/m3).

.2 The material shall have been tested and reported by Underwriters Laboratories, Inc. (UL) or Underwriters Laboratories of Canada (ULC) in accordance with the procedures of UL 263 (ASTM E119) or CAN4-S101.

.3 The material shall have been evaluated and reported by International Code Council Evaluation Services (ICC-ES). A valid Evaluation Services Report Number shall be provided ensuring code compliance.

.4 Spray-applied fire resistive materials shall be applied at the required thickness and density to achieve the following ratings:

Floor assemblies 1 hr.
Roof assemblies 1 hr.
Beams + Channels 1 hr.

.5 Potable water shall be used for the application of spray-applied fire resistive materials.

.6 Spray-applied fire resistive materials shall be free of all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Material manufacturer shall provide certification of such upon request.

PART 3 - EXECUTION

3.1 **Preparation**

.1 All surfaces to receive fire protection shall be free of oil, grease, loose mill scale, dirt, paints/primers (other than those listed and tested) or other foreign materials, which would impair satisfactory bonding to the surface. Manufacturer shall be contacted for procedures on handling primed/painted steel. Any cleaning of surfaces to receive sprayed fire protection shall be the responsibility of the General Contractor or Steel Erector, as outlined in the structural steel or steel deck section.

.2 Clips, hangers, supports, sleeves and other attachments to the substrate are to be placed by others prior to the application of spray-applied fire resistive materials.

.3 The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of sprayed fire protection is complete in an area.

.4 The spray-applied fire resistive material shall only be applied to steel

deck which has been fabricated and erected in accordance with the criteria set forth by the Steel Deck Institute.

.5 When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

3.2 **Application**

.1 Equipment, mixing and application shall be in accordance with the manufacturer's written application instructions.

.2 The application of spray-applied fire resistive material shall not commence until certification has been received by the General Contractor that surfaces to receive sprayed fire protection have been inspected by the applicator and are acceptable to receive sprayed fire protection.

.3 All unsuitable substrates must be identified and made known to the General Contractor and corrected prior to the application of the spray-applied fire resistive material.

.4 Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.

.5 The application of spray-applied fire resistive material to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased.

.6 Proper temperature and ventilation shall be maintained as specified in 1.7.1, 1.7.2 and 1.7.2.1.

.7 Provide masking, drop cloths or other suitable coverings to prevent overspray from coming in contact with surfaces not intended to be sprayed.

.8 Bonding materials (adhesives, catch coats, metal lath, mesh, stud pins, etc.) shall be applied as per the appropriate UL/ULC fire resistance design and manufacturer's written recommendations.

.9 Topcoat material, if any, shall be the type recommended and approved by the manufacturer of each spray-applied fire resistive material required for the applications indicated.

3.3 **Repairing and Cleaning**

.1 All patching of and repair to sprayed fire protection, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage.

.2 After the completion of the work in this section, equipment shall be removed and all surfaces not to be sprayed shall be cleaned to the extent previously agreed to by applicator and General Contractor.

3.4 **Inspection and Testing**

.1 The spray-applied fire resistive material shall be tested for thickness and density in accordance with one of the following procedures:

ASTM E605 - Standard Test Method for Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.

AWCI - Inspection Procedure for Field-Applied Sprayed Fire-Resistive Materials, Technical Manual 12-A; an annotated guide.

UBC Standard No. 7-6 - Thickness and Density Determination for Spray-Applied Fire Protection.

3.4 **Inspection and Testing (Cont'd)** .2 Inspection will be contracted to independent inspection company by Owner.

A cash allowance will be carried by the general contractor in accordance with the General Conditions.

3.5 **Schedule** .1 Provide spray applied fire resistive material to the following:

.1 All structural steel beams and columns above the ceiling line (not exposed to view) supporting the second floor structure.

End of Section

PART 1 - GENERAL

1.1	**General Requirements**	.1	Comply with requirements of Division 1.
1.2	**Related Sections**	.1	Section 01020 – Allowances
		.2	Section 05i23 – Structural Steel
		.3	Section 07270 – Firestopping and Smoke Seals
		.4	Section 07811 – Spray-Applied Fire Resistive Material
		.5	Section 09900 – Painting
1.3	**Scope**	.1	This specification covers labor, materials, equipment, and application necessary for, and incidental to, the complete and proper installation of intumescent fire protection for application to steel structures and supports in accordance with all applicable requirements of contract documents.
		.2	This specification shall be supplemented by the applicable requirements of building codes, insurance rating organizations and all other authorities having jurisdiction.
1.4	**Quality Assurance**	.1	Manufacturer - Company specializing in manufacturing fire protection products.
		.2	The intumescent fire resistive material shall be manufactured under the Follow-Up Service program of UL or ULC and bear the UL and/or ULC label (mark).
		.3	Applicator - A firm with expertise in the installation of fire resistive or similar materials.
1.5	**Reference Standards**	.1	Underwriters Laboratories Inc. (UL) Fire Resistance Directory.
		.2	Underwriters Laboratories of Canada (ULC) - List of Equipment and Materials.
		.3	ICC Evaluation Services – ES Report (ESR-1092)
		.4	UL 263 (ASTM E119) - Fire Tests of Building Construction and Materials.
		.5	CAN/ULC-S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.
		.6	ASTM E84 (UL723, CAN/ULC-S102) - Surface Burning Characteristics of Building Materials. Class A Rating Required; Flame Spread Maximum: 10 and Smoke Developed Maximum: 50.
		.7	ASTM D2240 – Durometer Hardness (Shore D Only). Minimum: 84 Shore D.
		.8	ASTM D2794 – Impact Resistance. Intrusion minimum: 56 inch-lb.

(0.65 kg-m).

1.5 **Reference Standards (Cont'd)**

.9 ASTM D4060 – Abrasion Resistance. Maximum 0.2850 grams/1000 cycles.

.10 ASTM D4541 – Bond Strength. Minimum: 280 psi. (1931 k Pa.)

.11 Steel Structures Painting Council (SSPC) Surface Preparation Standards.

.12 Material manufacturer's current published information including, but not limited to, application guide.

.13 AWCI Technical Manual 12-B "Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide", Latest Edition.

1.6 **System Description**

.1 The intumescent fire protection materials shall be applied at the required thickness to provide 1 hour fire resistive rating in accordance with ULC Design.

1.7 **Submittals**

.1 Manufacturer's Data: Submit manufacturer's specifications, including certification as may be required to show material compliance with contract documents.

1.8 **Delivery, Storage and Handling**

.1 Deliver materials to the project in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data. Packaged materials shall bear the appropriate labels, seals and UL label (mark) for fire resistive ratings and shall be stored at temperatures between 50º F (10º C) and 100º F (38º C), in a dry interior location away from direct sunlight.
DO NOT FREEZE.

1.9 **Project Conditions**

.1 When the temperature at the job site is less than 50º F (10º C), a minimum substrate and ambient temperature of 50º F (10º C) shall be maintained prior to, during, and a minimum of 72 hours after application. If necessary for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.

.2 In enclosed areas, ventilation shall not be less than 4 complete air exchanges per hour until the material is dry.

.3 Relative humidity shall not exceed 75% throughout the total period of application and drying for the intumescent fire resistive material, and must not exceed 75% throughout the application and drying for the protective decorative topcoat.

1.10 **Sequencing & Scheduling**

.1 Applicator shall cooperate in the coordination and scheduling of fire protection work to avoid delays in job progress.

.2 The installation of piping, ducts, conduit or other suspended equipment shall not commence until the application of the thin-film fire resistive material is complete in that area.

PART 2 - PRODUCTS

2.1 **Compatible Metal Primer**

.1 Primer shall be approved by manufacturer and applied in full accordance with the primer manufacturer's written instructions.

2.2 **Intumescent Fire Protection System**

.1 The intumescent fire resistive material shall be CAFCO SprayFilm -WB 3 as supplied by Isolatek International or CAFCO Industries or A/D Firefilm III as supplied by AD Fire Protection Systems.

.2 Intumescent fire resistive material shall be applied in accordance with drawings and/or specifications, and shall have been tested in accordance with the procedures of UL 263 or ASTM E119 or CAN/ULC-S101, and reported by Underwriters Laboratories, Inc. or Underwriters Laboratories of Canada only.

.3 Thin-Film Fire-Resistive Intumescent Mastic Coating: Factory-mixed formulation.

- .1 Water-Based Formulation: Approved by manufacturer and authorities having jurisdiction for indicated use.
- .2 Verify with manufacturer that products selected are suitable for use indicated.
- .3 UL Fire Tested Designs Only based on UL 263 (ASTM-E119).
- .4 Minimum Shore D Hardness of 80 before the finish coat is applied.
- .5 Meet UL Interior General Purpose Classification Requirements without any Topcoat.
- .6 To assure an acceptable Architectural finish, no mesh is allowed.
- .7 A representative mock-up sprayed Architectural finish sample must be submitted, reviewed, and accepted by the architect in advance.
- .8 Materials shall be evaluated up to 3 bar blast overpressure exposure.
- .9 IBC/ICC ES Report required.

2.3 **Decorative Topcoating**

.1 Topcoat material shall be A/D colour coat interior general purpose, silicone alkyd paint applied to a minimum dry thickness of 2 to 4 mils. Colour to be selected by Consultant.

PART 3 - EXECUTION

3.1 **Preparation**

.1 All surfaces to receive thin-film fire resistive material shall be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other materials which would impair bond of the thin-film fire resistive material to the surface. Any cleaning of the surfaces to receive fire resistive material shall be the responsibility of the General Contractor or steel erector, as outlined in the structural steel section.

.2 Confirm compatibility of surfaces to receive thin-film fire resistive material. Steel surfaces shall be primed with a compatible primer approved by the thin-film fire resistive material manufacturer.

.3 Provide masking, drop cloths or other suitable coverings to prevent

overspray onto surfaces not intended to be coated with intumescent coating.

3.2 **Application** .1 The thin-film fire resistive material shall be applied at the required dry film thickness per the following ULC designs:

.1 A/D Fire Film III – ULC – Z 611
.2 CAFCO Spray Film – ULC – Z 607.

3.3 **Mock Up** .1 Before proceeding with the work, the applicator shall apply the thin-film fire resistive material to a section witnessed by the architect's or owner's representative. The application shall be subject to their approval and shall be used as a guide for texture and thickness of the finished work.

3.4 **Clean Up and Repair** .1 Upon completion of installation, all excess material, overspray and debris shall be cleared and removed from the job site.

.2 All patching of and repair to thin-film fire resistive material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by an applicator with expertise in the installation of fire resistive or similar materials.

3.5 **Inspection and Testing** .1 In addition to continuous Wet Film Thickness checks performed by applicator during application, the installed intumescent material shall be inspected by a qualified independent testing laboratory for thickness in accordance with the AWCI Technical Manual 12-B "Standard Practice For The Testing and Inspection Of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide", Latest Edition, before application of the topcoat.

.2 The results of the above tests shall be made available to all parties at the completion of each area and approved prior to the application of topcoat.

3.6 **Schedule** .1 Provide Intumescent Fire Resistive material to the following:

.1 All exposed (exposed to view) structural steel supporting the second floor structure.

End of Section

PART 1 GENERAL

1.1 RELATED WORK

.1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) and at mechanical and electrical penetrations are specified in Division 15 and 16 respectively.

.2 Coordinate work of this section with other sections as required to properly execute the work and as necessary maintain satisfactory progress of the work of other sections.

1.2 RELATED SECTIONS

.1 Section 01300 – Submittals

.2 Section 01400 – Quality Control.

.3 Divisions 15 and 16.

1.3 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)

.1 CAN-S115, Fire Tests of Firestop Systems.

1.4 SUBMITTALS

.1 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

.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 engineering judgement identification number and drawing details when no ULC or cUL system is available. Engineering judgement must include both project name and contractor's name who will install firestop system as described in drawing.

.4 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. Include manufacturer's specifications, training letter, and technical data for each material including the composition and limitations, documentation of ULC or CUL firestop systems to be used.

.5 Submit material safety data sheets provided with product delivered to job site.

1.5 MOCK-UP

.1 Construct mock-up in accordance with Section 01400 – Quality Control.

.2 Construct mock-up showing service penetrations, fire separation and floor assemblies. Mock-up may be part of finished work.

.3 Allow 48h for inspection of mock-up by Consulatnt before proceeding with membrane work.

1.6 MANUFACTURER'S REPRESENTATIVE

.1 A manufacturer's representative is to be on site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures and at commissioning stage to certify acceptance completed installation. Training will be done as per manufacturer's written recommendations published in their literature and drawing details.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire-rating involved for each separate instance.

.2 Fire stopping and smoke seal systems: in accordance with CAN-S115.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN-S115 and not to exceed opening sizes for which they are intended.

.2 Firestop system rating: as indicated on drawings.

.3 Service penetration assemblies: certified and tested by ULC or cUL in accordance with CAN-S115.

.4 Service penetration firestop components: certified and tested by ULC or cUL in accordance with CAN-S115.

.5 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.6 Non-curing, re-penetrable intumescent sealants, caulking or putty material for use with flexible cables or cable bundles.

.7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal. Consult with Consultant and damper manufacturer prior to installation ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

.8 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe. No silicone based firestop are allowed to be applied on plastic pipes.

.9 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.10 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.11 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.

.12 Sealants for vertical joints: non-sagging.

PART 3 EXECUTION

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

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

3.2 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification or UL Products Certified for Canada (CUL) and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

.1 Firestop and smoke seal at:

.1 Penetrations through all fire-resistance rated masonry, concrete, and gypsum board partitions and walls including walls required to provide a fire separation but having no required fire resistive rating .

.2 Edge of floor slabs at curtain wall and precast concrete panels.

.3 Top of fire-resistance rated masonry and gypsum board partitions.

.4 Intersection of fire-resistance rated masonry and gypsum board partitions.

.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

PART 1 - GENERAL

1.1 **General Requirements** .1 Comply with requirements of Division 1.

1.2 **Related Sections** .1 Ceramic Tile Section 09310

1.3 **Definition** .1 Caulking = Sealant.

1.4 **Qualifications** .1 Work of this section is to be done by Contractor of recognized standing having personnel with minimum of five years experience in this type of work and who have the necessary equipment to carry out the work.

.2 Use only sealants which are proven to be compatible with materials they are in contact with. Notify Consultant prior to start of work should any sealant specified be considered unsuitable for the purpose intended.

1.5 **Guarantee** .1 Provide the following guarantee in accordance with the General Conditions, notwithstanding the time provisions therein, that the caulking work will not leak, crack, crumble, melt, shrink, run, loose adhesive or colour or stain adjacent materials for the following period.

.1 **Two years on material and labour for interior work**.

1.6 **Product Delivery & Storage** .1 Deliver sealants to site in sealed containers bearing manufacturer's name, brand name of sealant and reference standard to which sealant complies.

.2 Store materials in a dry area having an ambient temperature within limitations recommended by material manufacturer.

1.7 **Job Conditions** .1 Unless otherwise specified, apply sealants when air temperature is between 10 degrees C and 25 degrees C. when air temperature is above 25 degrees C or below 10 degrees C follow sealant manufacturer's recommendations regarding application.

2. Prior to start of work review installation procedures with Consultant, where caulking is located adjacent to painted surfaces.

PART 2 - PRODUCTS

2.1 **Materials** .1 Sealants

.1 Class A Sealant: Dymeric by Tremco or approved alternate Meeting CGSB 19.24

.2 Class C Sealant: Acrylic Latex by Tremco or approved alternate Meeting CGSB 19-GP-17M

.3 Class E Sealant: Proglaze by Tremco or approved alternate Meeting CGSB 19-GP-9Ma

.4 Materials shall be standard colours as selected by the Consultant, free from ingredients which will stain masonry.

2.1 **Materials (Cont'd)**

.2 Primers, thinners, cleaners: As recommended by sealant manufacturer, non-staining type.

.3 Premoulded backup for sealant: Round, closed cell polyethylene of size to suit joint, causing 30% compression of backing when in place. Dow Ethafoam or approved equal.

.4 Bond breaker: Closed cell polyethylene or vinyl foam tape, self-adhering one side.

PART 3 - EXECUTION

3.1 **Examination**

.1 Before any caulking is done, a representative of the sealant manufacturer and the caulking Contractor must inspect all joints or rebates to receive sealant. The work of others must be examined insofar as it affects the work of this section.

.2 Ensure that joints and rebates are of sufficient width and depth for sealant installation.

.3 Do not commence installation of sealants until conditions are acceptable.

.4 Commencement of the work implies that the Contractor accepts full responsibility that the caulking will perform without failure for the full period of the guarantee.

3.2 **Inspection**

.1 The sealant manufacturers' representative must carry out periodic inspections during application and submit a written report to the Consultant immediately after each inspection.

.2 The caulking Contractor shall notify the Consultant when the work is completed for inspection. Do not cover work until approved. Take out and recaulk all defective work.

3.3 **Preparation**

.1 Clean and prepare joints to be caulked to produce clean sound surfaces for sealant adhesion.

.2 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.

.3 Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.4 Remove oil, grease and other coatings from non-ferrous metals with joint cleaner.

.5 Prepare concrete, masonry, glazed and vitreous surfaces to sealant manufacturer's instructions.

.6 Examine joint sizes and correct to achieve depth ratio one half of joint width with minimum width and depth of 6 mm maximum width 25 mm.

.7 Install joint filler to achieve correct joint depth.

3.3 **Preparation (Cont'd)**

.8 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.9 Apply bond breaker tape where required to manufacturer's instruction.

.10 Prime side of joints to sealant manufacturer's instructions immediately prior to caulking.

.11 Seal joints in surfaces to be painted before surfaces are painted. Where surfaces to be sealed are primed in shop before sealing, check to make sure prime paint and sealant are compatible. If they are incompatible inform Consultant and change sealant to compatible type approved by Consultant.

.12 Check form release agent used on cast in place concrete for compatibility with sealant and primer. If they are incompatible inform Consultant and change sealant to compatible type approved by Consultant or clean concrete to Consultant's approval.

.13 Install bond breaker tape and back up joint where joint backing is not required or cannot be installed (so that sealant will adhere only to sides of joint).

3.4 **Application**

.1 Apply sealant using gun fitted with suitable nozzle. Use sufficient pressure to fill voids and joint solid. Superficial pointing with skin bead is not acceptable.

.2 Tool surface of sealant smooth, concave, free from ridges, wrinkles, sags, air pockets and embedded foreign matter.

.3 Apply sealants in accordance with following table:

Joint Width	Sealant Depth
5 mm	5 mm
10 mm	7 mm
15 mm	10 mm
20 mm	12 mm
25 mm	15 mm

.4 Where recommended by sealant manufacturer, vent exterior joints in accordance with such recommendation.

3.5 **Cleaning**

.1 As work progresses, remove sealant smears and stains from adjacent surfaces. Use cleaning method recommended by sealant manufacturer.

.2 Leave adjacent surfaces in neat and clean condition.

3.6 **Schedule**

.1 Apply sealant at the following exterior locations:

.1 Between dissimilar materials in exposed locations except where specifically indicated otherwise.

.2 All exterior control joints, door thresholds, perimeter of metal louvres with Class A sealant.

3.6 **Schedule (Cont'd)**

.3 Joints around perimeter of exterior hollow metal door frames and screens and steel frames of overhead doors with Class A sealant.

.4 Around perimeter of devices (H.B., Siamese, etc.) protruding through exterior wall face with Class A sealant.

.5 Caulk exterior railing brackets steel sleeves recessed into concrete walls with Class A sealant.

.6 Where indicated on Drawings with Class A sealant.

.7 Mitred outside corners of artificial stone - Class A sealant.

.8 At penetrations through exterior building elements - Class A sealant.

.2 Apply sealant at the following interior locations:

.1 Between dissimilar materials in exposed locations except where specifically indicated otherwise with Class A sealant.

.2 Concealed air/vapour barrier joints except those sealed under work of other Sections with sealant compatible with surfaces being caulked.

.3 Perimeter of door, window, louvre and screen frames with Class C sealant.

.4 Control joints in masonry elements with Class A sealant.

.5 Perimeter of firehose cabinets, access panels, and control panels with Class A sealant.

.6 Between walls and drinking fountains, hand basins, wash fountains, urinals with Class E sealant.

.7 Between floors and WC's with Class E sealant.

.8 Between counter tops and wall with Class E sealant.

.9 Between top of partitions and underside of floor or roof structures above, where no ceiling is specified.

.10 Where shown on Drawings.

End of Section

PART 1 - GENERAL

1.1	**General Requirements**	.1	Comply with requirements of Division 1.	
1.2	**Related Sections**	.1	Caulking at frame perimeters:	Section 07900
		.2	Finish Hardware:	Section 08710
		.3	Glazing:	Section 08800
		.4	Painting:	Section 09900
1.3	**Qualifications**	.1	Acceptable manufacturers: Member of The Canadian Steel Door & Frame Manufacturers' Association.	
		.2	Reference standards: Unless otherwise specified, meet requirements of "Canadian Manufacturing Specification for Steel Doors and Frames" published by the Canadian Steel Door & Frame Manufacturers' Association.	
		.3	Fire protection requirements: fire rated doors, frames and screens shall bear ULC labels.	
		.4	One manufacturer is to provide doors and frames unless specified otherwise.	
1.4	**Guarantee**	.1	Provide the following guarantee in accordance with the General Conditions, not withstanding the time provision therein.	
			.1 **Three years on materials and labour.**	
1.5	**Submittals**	.1	Submit shop drawings in accordance with Section 01300.	
		.2	Clearly indicate each type of frame, door, material, core thickness reinforcements, glazing stops, location of anchors, exposed fastenings and finishes.	
1.6	**Work Supplied to Other Trades**	.1	Supply frames and anchors to other Sections where it is necessary to build frames into work of other Sections.	
		.2	Supply instructions required for accurate positioning and proper installation of components supplied to other Sections.	
1.7	**Design Requirements of Doors & Frames**	.1	Exclusion of water.	
		.2	Prevent air infiltration in excess of 0.5 cubic feet/minute/linear foot.	
		.3	U factor of 0.56 or less	
		.4	S.T.C. 20.	

PART 2 - PRODUCTS

2.1 **Materials**

.1 Sheet Steel: Cold rolled steel with stretcher level degree of flatness, meeting requirements of ASTM A366 Class 1.

Finish:

.1 W25 wipe coated zinc finish to ASTM A526.

.2 Hot dipped galvanized zinc to ASTM A526M for all doors and frames where indicated.

.2 Core Material:

.1 Fire rated doors: in accordance with fire test requirements.

.2 Exterior doors: semi-rigid glass fibre insulation minimum density of 24 kg/m^2.

.3 Interior doors, except fire rated doors: honeycomb core of rigid pre-expanded resin impregnated Kraft paper having maximum 20mm hexagonal shaped cells.

.3 Finishing Materials:

.1 Touch up paint: zinc rich paint CGSB 1-GP-181M.

.2 Metal filler: two component epoxy type.

.3 Shop primer: zinc or lead chromate type.

.4 Door Bumpers: Gray neoprene double stud.

2.2 **Reinforcement & Hardware Preparation**

.1 Templated hardware: prepare work in accordance with templates supplied by Section 08710. ANSI Standards will not necessarily be used. Drill and tap doors for templated hardware. Provide door latch guide.

.2 Blank, reinforce, drill and tap doors and frames for concealed, mortised and surface mounted hardware and concealed magnetic contacts. Provide door closer reinforcement at all steel doors and frames whether closer is required by hardware list or not.

.3 Hardware reinforcements shall be minimum 3.4mm thick.

.4 Guard boxes: 0.9 mm (20 ga.) steel welded to back of frame at hardware cutouts where mortar or other materials could obstruct hardware operation.

.5 Provide steel angle high frequency top hinge reinforcing in doors and frames. Weld both legs of angle to adjoining surfaces.

2.3 **Doors**

.1 Construct fire rated doors in accordance with fire test requirements.

.2 Provide all doors of seamless construction with no visible seams or joints on faces and vertical edges. Render joints invisible by grinding, filling and dressing smooth.

.3 Exterior doors: *1.6 mm (16 ga.) thick base sheet steel of urethane core construction. Fully weld vertical seams for full height of door and grind smooth.*

.4 Interior doors: *1.2 mm (18 ga.) thick base sheet steel of honeycomb core construction. Mechanically interlock, with adhesive, face sheets at vertical edge to form a tight straight joint. Tack weld every 6" for full height of door. Fill all seams with epoxy and grind smooth.*

.5 Provide condensation weep holes at bottom edge of exterior doors.

.6 Provide flush end steel closures at top edge of all exterior doors and where required for attachment of hardware, weather stripping and concealed magnetic switches.

.7 Prepare doors as required for louvres, glazing and between glass blinds where indicated. Surround openings in flush doors with minimum 1.2mm thick steel edge channels, welded to both face sheets. Where prepared openings in doors exceed 35% of the total door area, face sheets at vertical edges must be continuously welded.

.8 Provide 0.9 mm thick removable glazing stops of zinc coated steel channels mitred at corners, accurately fitted into position and fastened with countersunk Phillips, flathead sheet metal screws.

.9 Glazing stops at outside of exterior doors shall be rendered non-removable.

.10 Doors to be square and true. Maximum twist 3mm measured on the diagonal of the door.

.11 Construct rail and stile doors in same manner as flush doors.

.12 Undercut doors where shown or required to suit floor finish.

2.4 **Frames**

.1 Provide welded frames of 1.6 mm thick sheet steel to profiles shown on Drawings.

.2 Shop assemble components with accurately cut joints. Mitre outside corner joints of frames. Weld joints on inside of profile; grind welds, flush and sand to smooth uniform surface.

.3 Glazing stops shall be minimum 0.9 mm thck steel, drilled and secured with oval headed screws.

2.4 **Frames (Cont'd)**

.4 Drill interior door frames for double stud rubber bumpers. Drill strike jamb of each single frame for 3 bumpers. Drill head member of double door frames for 2 bumpers.

.5 Provide full height 3.4 mm thick steel reinforcement at hinge side of all frames.

.6 Provide steel channel head reinforcement for door frames wider than 915 mm.

.7 Tack weld two removable 1.2 mm thick steel spreader channels to inside faces of door frames at base.

.8 Provide adjustable base clips for anchorage to floor at bottom of each door jamb.

.9 Provide 0.9 mm guard boxes at all strike and hinge reinforcements.

.10 Provide welded on drip at head of exterior door frames.

.11 For screens with between the glass blinds, prepare frame to accept tilt control knob assembly.

.12 Prepare frames as required to accommodate wiring to electrical hardware devices.

.13 Provide removable mullions where indicated.

.14 Provide 1.2 mm thick continuous steel closer panels at all exposed backs of head and jamb frame conditions.

.15 Prepare frames as required to accommodate supplementary steel supports provided by Section 05500.

.16 Provide 1.6 mm thick anchors for frames.

2.5 **Transom Panels**

.1 Provide insulated metal transom panels at head of doors where shown on drawings.

.2 Construct panels in manner specified for hollow metal doors.

.3 Secure panels to frame with concealed fastenings.

PART 3 - EXECUTION

3.1 **Frame & Screen Installation**

.1 Set frames plumb, square, level and at correct elevation.

.2 Allowable limit of distortion shall be 1.5mm out of plumb at each jamb, measured on face of frame, resulting in maximum twist of frame of 3mm measured from upper corner to lower diagonal corner.

3.1 **Frame & Screen Installation (Cont'd)**

.3 Generally anchorage of frames shall be by means of standard anchors. Where standard anchors cannot be used, provide special anchors to ensure proper installation. Method of anchorage shall not be visible when frames are installed.

.4 Provide minimum 3 anchors at each jamb. At frames exceeding 2150 mm in height provide one additional anchor for each additional 610mm or part thereof.

.5 Anchor intermediate vertical frame members to structure above as required to ensure stability. Where required, provide steel frame extensions. Provide flexible connection at structure to allow for deflection.

.6 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 950mm wide. Remove temporary spreaders after frames are built-in.

.7 Remove spreader channels only after frames are securely anchored in place.

3.2 **Doors**

.1 Install doors after wet finishes are completed.

.2 Doors must be square and true within frame. Maintain approximately 3mm between perimeter outside edge of sides and head of door and inside edge of frame.

.3 Exterior doors and fire doors must seal tight against weatherstrip and smoke gaskets.

.4 Install transom panels where indicated on drawings.

.5 Install hardware in accordance with hardware supplier's instructions.

.6 Adjust operable parts to ensure proper operation.

3.3 **Touch-up**

.1 Patch damaged shop primer. Remove rust, sand damaged and abraded surfaces and touch-up with prime paint matching original finish.

.2 Touch-up damaged zinc coating with zinc rich paint prior to application of shop primer.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Installation of finish hardware	Sections 06200, 08100 & 08900
.2	Hardware for cabinetwork:	Section 06400
.3	Hardware for aluminum windows:	Section 08900

1.3 **Scope of Work**

.1 Supply only of

.1 Finishing Hardware
.2 Aluminum Door Hardware

1.4 **Quality Assurance**

.1 The products listed in the finishing hardware schedule establish the minimum quality standards for this project. Deviations are not permitted.

.2 Companies tendering this project shall retain a qualified Architectural Hardware Consultant (A.H.C.) who will assume responsibility relative to their profession.

.3 Finishing Hardware companies tendering on this project shall BID only those products specified, or for the purpose of tendering products listed here in as equivalents. Alternates will be allowed only as outlined in Section 2.1.

.4 The Architect's Consultant will be provided with a copy of the approved hardware schedule and all approved change notices to complete a quality assurance inspection at completion of the project. It will be the hardware supplier's responsibility to correct any hardware found to be improperly supplied, including installation, painting and reworking of doors and/or frames.

1.5 **Handling, Delivery and Storage**

.1 Package finishing hardware for each opening, identified shall correspond with hardware schedule.

.2 Copy of finishing hardware schedule shall accompany hardware shipments.

.3 Deliver all hardware to job site and obtain signed receipt.

.4 The general contractor shall provide on site an adequate, enclosed, lockable, clean and dry storage area. Access to locked storage area will be the responsibility of the general contractor.

.5 All hardware shall be checked in jointly by representatives of the general contractor and hardware supplier to avoid discrepancies.

.6 The general contractor shall protect the finish and function of the installed hardware from the other trades (paint, plaster, cleaners, etc.) during the construction period.

1.6 **Warranty**

.1 Submit a written warranty covering finish hardware against defects in materials and workmanship. The warranty period shall be two years generally and five years for closers. Warranty commences on date of Substantial Completion.

.2 Hardware products found defective within warranty period shall be removed by the general contractor or owner and returned to the distributor for evaluation.

1.7 **Submittals**

.1 Submit templates when requested to contractor for use by installers and fabricators as required for proper location and installation of hardware.

.2 Submit 4 (four) copies of the hardware schedule complete with a list and legend of abbreviations used. It is the Suppliers responsibility to thoroughly check the Hardware Schedule and working drawings to ensure, all handlings are correct, product will function as listed and that there are no errors or omissions before submitting for approval.

.3 Upon request submit physical samples of each type of hardware for the project. Samples which may be required shall be tagged for their intended use and shall be incorporated into the supply of finishing hardware.

.4 Supply wiring schematics and product information for all electronic hardware supplied under this section.

1.8 **Codes and Regulations**

.1 All hardware listed or furnished shall meet requirements of Federal, Provincial and Local Codes having jurisdiction over this installation.

PART 2 - PRODUCTS

2.1 **Manufacturers**

.1 The following is a list of acceptable manufacturers for work under this contract. The listed acceptable alternative manufacturers must provide products which are of equal quality of better than the specified manufacturers products.

	Manufacturer As Specified	**Acceptable Alternative Manufacturer**
Hinges	Stanley	Hager
Locks	Schlage	No substitution
Exit Devices	Sargent	Von Duprin (Full stainless steel)
Closers	LCN4041 Cush	Sargent 351 PS
Kickplates	Gallery	Hager/CBH
Push/Pulls	Gallery	Hager/CBH
Overhead Stops	Sargent Glynn Johnson	
Weatherstrip	Hager	KN Crowder National Guard

PART 3 - EXECUTION

3.1 **Execution**

.1 The contractor installing the hardware shall carefully follow manufacturer's instructions for installation of all finish hardware.

.2 The finish hardware installer shall be experienced in the installation of architectural hardware and have general knowledge of the functions of the various types of hardware.

.3 Thru bolts for door pulls are to be counter sunk and concealed by push plates where push plates are listed.

.4 Manufacturer's fasteners supplied are to be used. It is the installers responsibility to ensure fasteners are not over tightened or stripped by use of screw guns, etc.

.5 Provide finished hardware for all display cases. Refer to Architectural drawings for locations.

3.2 **Keying**

.1 All locks shall be interchangeable core and to be keyed to a factory registered master key system.

.2 Furnish the following quantities of keys:

2	Grand master keys
3	Master keys per level
2	Change keys per lock
10	Construction keys

.3 All permanent Cores and Keys are to be delivered to the end user.

3.3 **Adjusting**

.1 It is the hardware installer's responsibility to adjust the hardware as per the manufacturer's specifications. Final adjustments to closers shall be made at final completion of products.

3.4 **Documentation**

.1 The finish hardware supplier shall include copies of the as-built finishing hardware schedule, and maintenance manuals to the owner on completion of this project.

3.5 **Finishes**

.1

Standard N.B.H.A. Code	**BHMA Base Material & Description Code**
32D	630 Stainless Steel, Satin
EN	689 Silver Enamel
CH	Charcoal Grey

3.6 **Schedule**

.1 Refer to Finishing Hardware Schedule dated February 22, 2024 prepared by Commercial door and Hardware included within this section

Finishing Hardware schedule

EEC Saint Michel Class Rm. Add. 2023

29 Meadowvale Rd , Scarborough

Job No. A22008

Architect
Kingsland Architects Inc.

Detailer: **Riley Rykhoff**
Consultant: **Ross Ruprecht B.A., A.H.C.**

Submittal Date: **Jan 27/23, Mar 28/23, MAY 19/23, JAN 25/24, FEB 22/24**

Manufacturers & Finishes

Manufacturers

Baron Metal
Camden
Canadian Builders Hdw
CBH
Glynn-Johnson
GYROTECH
Ives
K.N. Crowder
LCN
MEDECO
MISC
Schlage
Schlage E.S.
UNK
Von Duprin

Finishes

626 - Satin chromium plated over nickel
627 - Satin aluminum, clear coated
628 - Satin aluminum, clear anodized
630 - Satin stainless steel
652 - Satin chromium plated over nickel
689 - Aluminum painted
US32D - Satin stainless steel

Openings Schedule

Opening Number(s)	Qty	Type	Door Catalog	Location 1	To/ From	Location 2	Label	Nominal Width	Nominal Height	Door Thickness	Hand	Degree of Opening	Hardware Group	Heading Num.	Remarks
A1-101A	1	Pair		CORR	To/From	CORR		1000, 1000	2150	45	L-LHR		DBL EGRESS NO LABEL	1	
A1-104	1	Single		CORR	TO	CLASS RM		950	2150	45	RH	90°	CLASS RM WS	2	
A1-105	1	Single		CORR	TO	CLASS RM		950	2150	45	LH	90°	CLASS RM WS	2	
A1-901A	1	Single	<Aluminum>	EXTERIOR	FROM	STAIR		1000	2150	57	RHR	100°	EXT SGL ADO	3	ADO, EXIT ,
A1-901B	1	Single		CORR	From	STAIR	45 min	1000	2150	45	RHR	90°	VEST SGL ADO	4	ADO
A1-902A	1	Single	<Aluminum>	EXTERIOR	FROM	STAIR		1000	2150	57	LHR	100°	EXT SGL ADO	3	ADO, EXIT ,
A1-902B	1	Single		CORR	From	STAIR	45 min	1000	2150	45	LHR	90°	VEST SGL ADO	4	ADO
A1-202	1	Single		CORR	TO	CLASS RM		950	2150	45	RH	90°	CLASS RM WS	2	
A1-203	1	Single		CORR	TO	CLASS RM		950	2150	45	LH	90°	CLASS RM WS	2	
A1-901C	1	Single		CORR	From	STAIR	45 min	1000	2150	45	RHR	140°	VEST SGL ULC	5	
A1-902C	1	Single		CORR	From	STAIR	45 min	1000	2150	45	LHR	140°	VEST SGL ULC	5	

GENERAL COMMENTS.

-TYPICAL FOR ALL AUTO DOOR OPERATORS.
HARDWARE SUPPLIER DIV 08710 TO SUPPLY AND INSTALL OPERATORS.
HARDWARE SUPPLIER TO PROVIDE WIRING DIAGRAMS .
ELECTRICAL CONTRCTOR TO PROVIDE 120VAC TO HEAD OF FRAME & TO POWER SUPPLY LISTED.
ELECTRICAL CONTRACTOR TO S & I ALL LVW IN CONDUIT TO ALL ACTUATORS , ES , CR AND ALL ELECTRICAL COMPONEBTS LISTED . REFER TO WIRING DIAGRAM.

Hardware Schedule

Heading #1 (Group: DBL EGRESS NO LABEL)

Item #1 — 1 Pair of doors A1-101A, CORR To/From CORR — L-LHR

1000, 1000 x 2150 x 45 - HM DR x HM FR

6	Standard Hinge	Ives 5BB1HW 5 X 4.5 652	652
2	Push Plate	Canadian Builders Hdw CBH 923 101 X 500	630
2	Surface Closer	LCN 4040XP EDA 689 45	689
2	Kick Plate	Canadian Builders Hdw CBH 903 200 X 950 C32D	630
2	Overhead Door Stop	Glynn-Johnson 105S	630
1	Weatherstripping	K.N. Crowder W-22-BL x 25'	BL
2	Weatherstripping	K.N. Crowder W-24S x 42"	628
1	Weatherstripping	K.N. Crowder W-25 x 2150mm	

Heading #2 (Group: CLASS RM WS)

Item #2 — 1 Single door A1-104, CORR TO CLASS RM — 90° RH

Item #3 — 1 Single door A1-105, CORR TO CLASS RM — 90° LH

Item #4 — 1 Single door A1-202, CORR TO CLASS RM — 90° RH

Item #5 — 1 Single door A1-203, CORR TO CLASS RM — 90° LH

950 x 2150 x 45 - HM DR x HM FR

12	Standard Hinge	Ives 5BB1 4 1/2" x 4" 652	652
4	Lockset	Schlage ND75 P6 ATH 626	626
4	Kick Plate	Canadian Builders Hdw CBH 903 200 X 900 C32D	630
4	Wall Door Holder	Ives WS401CVX	626

Heading #3 (Group: EXT SGL ADO)

Item #6	1 Single door A1-901A, EXTERIOR FROM STAIR	100° RHR
Item #7	1 Single door A1-902A, EXTERIOR FROM STAIR	100° LHR

1000 x 2150 x 57 - AL DR x AL FR

2	Continuous Hinge	Ives 112XY X 83" 628	628
1	Exit Device	Von Duprin 35A-NL-OP 626-1000 LHR RHR LEAF	626/626
1	Exit Device	Von Duprin 35A-NL-OP 626-1000 RHR RHR LEAF	626/626
2	Cylinder	MEDECO MEDECO RIM CYLINDER SUPPLIED BY OWNER	
2	Cylinder	Schlage MORT 20-001 CMK GMK	626
2	Cylinder	Schlage RIM 20-021 USE FOR CONSTRUCTION USE	626
2	Electric Strike	Von Duprin 6300-630 ACT LEAF RHR	630
2	Door Pull	CBH CBH 7008-1 No. 1 C32D	US32D
2	Electronic Closer	GYROTECH AUTO OPERATOR GT8710 X DR WIDTH HEADER 628 ACT LEAF RHR	
2	Overhead Door Stop	Glynn-Johnson 104S ADJ RHR LEAF	630
2	Threshold	K.N. Crowder CT-46 X 48" AL	627
2	Weatherstripping	K.N. Crowder W-24S x 42"	628
2	Miscellaneous Item	Schlage E.S. 679-05HM BY SCURITY CONTRACTOR	BLK
2	Miscellaneous Item	LCN 8310-802	PLA
2	Miscellaneous Hardware	UNK CARD READER/INTERCOM BY OTHERS	
2	Miscellaneous Hardware	Camden CM-1110-7224 WALL OR JAMB MTD	
2	Miscellaneous Hardware	Camden CM-160/21 INSTALL IN ADO HEADER	
4	Miscellaneous Hardware	Camden CM-60/4	
4	Miscellaneous Hardware	Camden CM-89S	
2	Miscellaneous Hardware	Camden CX-33	
2	Miscellaneous Hardware	MISC WEATHERSTRIP BY ALUM DR/FR SUPPLIER	
2	Miscellaneous Hardware	MISC WIRING DIAGRAM	

HARDWARE SUPPLIER SECTION 08710 TO SUPPLY & INSTALL ADO.

ELECTRICAL CONTRACTOR TO PROVIDE 120VAC TO FRAME HEADER AND PROVIDE ALL LVW IN CONDUIT TO ALL ELECTRICAL COMPONENTS LISTED.
REFER TO HARDWARE SUPPLIERS WIRING DIAGRAM.

Heading #4 (Group: VEST SGL ADO)

Item #8	1 Single door A1-901B, CORR From STAIR	90° RHR
Item #9	1 Single door A1-902B, CORR From STAIR	90° LHR

1000 x 2150 x 45 - HM DR x HM FR - 45 min

6	Standard Hinge	Ives 5BB1HW 5 X 4.5 652	652
1	Exit Device	Von Duprin 98-L-BE-F -07 US26D LHR 1000	626/626
1	Exit Device	Von Duprin 98-L-BE-F -07 US26D RHR 1000	626/626
2	Electric Strike	Von Duprin 6300-630	630
2	Electronic Closer	GYROTECH AUTO OPERATOR GT8710 X DR WIDTH HEADER 628	
2	Kick Plate	Canadian Builders Hdw CBH 903 200 X 950 C32D	630
2	Overhead Door Stop	Glynn-Johnson 105S	630
2	Weatherstripping	K.N. Crowder W-24S x 48"	628
2	Gasketing	K.N. Crowder W-22 X18'	BLK
4	Miscellaneous Hardware	Camden CM-60/4	
4	Miscellaneous Hardware	Camden CM-89S	
2	Miscellaneous Hardware	Camden CX-33	
2	Miscellaneous Hardware	MISC WIRING DIAGRAM	

HARDWARE SUPPLIER SECTION 08710 TO SUPPLY & INSTALL ADO.

ELECTRICAL CONTRACTOR TO PROVIDE 120VAC TO FRAME HEADER AND PROVIDE ALL LVW IN CONDUIT TO ALL ELECTRICAL COMPONENTS LISTED.
REFER TO HARDWARE SUPPLIERS WIRING DIAGRAM.

Heading #5 (Group: VEST SGL ULC)

Item #10	1 Single door A1-901C, CORR From STAIR	140° RHR
Item #11	1 Single door A1-902C, CORR From STAIR	140° LHR

1000 x 2150 x 45 - HM DR x HM FR - 45 min

6	Standard Hinge	Ives 5BB1HW 5 X 4.5 652	652
1	Exit Device	Von Duprin 98-L-BE-F -07 US26D LHR 1000	626/626
1	Exit Device	Von Duprin 98-L-BE-F -07 US26D RHR 1000	626/626
2	Surface Closer	LCN 4040XP EDA 689 45	689
2	Kick Plate	Canadian Builders Hdw CBH 903 200 X 950 C32D	630
2	Overhead Door Stop	Glynn-Johnson 105S	630
2	Weatherstripping	K.N. Crowder W-24S x 48"	628
2	Gasketing	K.N. Crowder W-22 X18'	BLK

5BB1 5 Knuckle, ball bearing full mortise hinge

- Recommended for medium weight doors (<150 lbs)
- Recommended for medium frequency usage (<400 cycles per day)
- Made with two ball bearing assemblies
- Recommended for use with a door closer
- Packed with fasteners for hollow metal and wood doors
  12-24 x 1/2 UFPHMS, 12 x 1 1/4 FPHWS
  10-24 x 1/2 UFPHMS, 10 x 1 FPHWS (3.5x3.5 hinge size only)

Certifications

- Certified to ANSI/BHMA A156.1 for performance standards
- Meets ANSI/BHMA 156.7 for template hinge dimensions
- UL Classified for windstorm rated assemblies - R37965
- UL Listed, 3 hour fire doors

Material substrate

- Made from brass, 1040 steel, or 304 series stainless steel

Options

- NRP.....Non-removable pin
- HT.....Hospital tip
- SH.....Security stud - comes standard with NRP
- RC-1/4, RC-5/8...Rounded corners
- SEC .....Security fasteners - pin-in-socket
- TW4 .....Four wire
- TW4M .....Four wire with monitor
- TW8 .....Eight wire
- TW8M*.....Eight wire with monitor
- TW12.....Twelve wire
- MON*.....Monitor (not available on 4X4)

Dimensions

Height x Width	Size (mm)	Gauge
3.5 x 3.5	89 x 89	0.123
4 x 4	102 x 102	0.130
4.5 x 4	114 x 102	0.134
4.5 x 4.5	114 x 114	0.134
5 x 4.5	127 x 114	0.146
5 x 5	127 x 127	0.146

Refer to General Hinge Information page to determine proper hinge for application

5BB1 Finishes

BHMA	Description	Substrate	Finish
600	Primer paint	Steel	USP
605	Bright brass	Brass	US3
606	Satin brass	Brass	US4
612	Satin bronze	Brass	US10
613	Oil rubbed bronze	Brass	US10B
614	Oxidized bronze	Brass	US10A
616	Blackened bronze	Brass	US11
619	Satin nickel	Brass	US15
622	Matte black	Brass	B-BLK
625	Bright chrome	Brass	US26
626	Satin chrome	Brass	US26D
643e/716	Aged bronze	Brass	B-643e/716
629	Bright stainless	Stainless steel	US32
630	Satin stainless	Stainless steel	US32D
631	Matte black	Steel	F-BLK
632	Bright brass	Steel	US3
633	Satin brass	Steel	US4
639	Satin bronze	Steel	US10
640	Oil rubbed bronze	Steel	US10B
641	Oxidized bronze	Steel	US10A
643	Blackened bronze	Steel	US11
646	Satin nickel	Steel	US15
651	Bright chrome	Steel	US26
652	Satin chrome	Steel	US26D
643e/716	Aged bronze	Steel	F-643e/716

For other colors, consult factory.

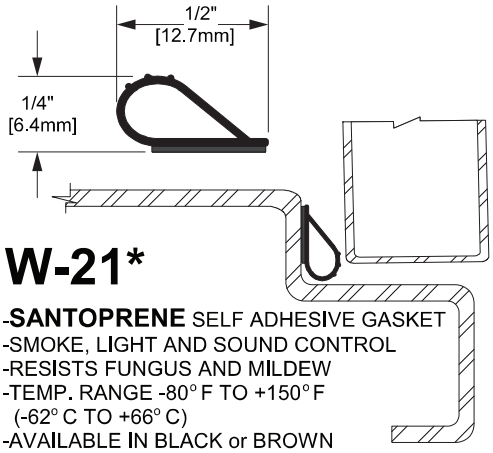
*TW and MON options are not available on 3.5X3.5.

CDH
COMMERCIAL DOORS & HARDWARE LTD.
2150 WINSTON PARK DR
UNIT 16
OAKVILLE , ON., ross@cdh.ca

EEC Saint Michel Class Rm. Add. 2023
29 Meadowvale Rd , Scarborough
Job No. A22008

Submittal Date: Jan 27/23, Mar 28/23, MAY

SELF ADHESIVE WEATHERSTRIP

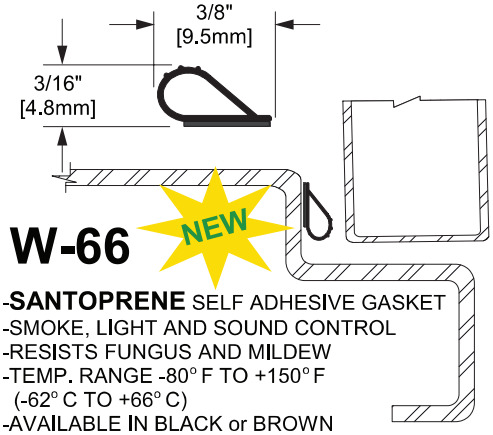


W-21*

-**SANTOPRENE** SELF ADHESIVE GASKET
-SMOKE, LIGHT AND SOUND CONTROL
-RESISTS FUNGUS AND MILDEW
-TEMP. RANGE -80° F TO +150° F
(-62° C TO +66° C)
-AVAILABLE IN BLACK or BROWN

W-22 NEW

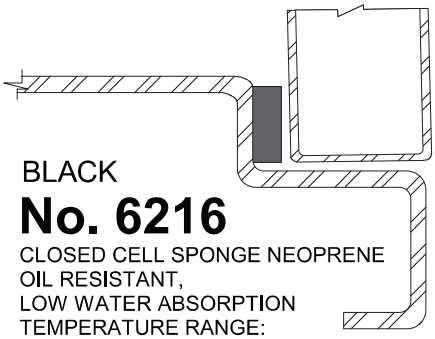
-**SILICONE** SELF ADHESIVE GASKET
-SMOKE, LIGHT AND SOUND CONTROL
-UNAFFECTED BY FUNGUS AND MILDEW
-TEMP. RANGE -110° F TO +400° F
(-80° C TO +204° C)
-AVAILABLE IN BLACK or BROWN



W-66 NEW

-**SANTOPRENE** SELF ADHESIVE GASKET
-SMOKE, LIGHT AND SOUND CONTROL
-RESISTS FUNGUS AND MILDEW
-TEMP. RANGE -80° F TO +150° F
(-62° C TO +66° C)
-AVAILABLE IN BLACK or BROWN

* W-21 is approved for use with 90 minute rated mineral core wood, plastic lamfaced fire doors & wood veneered steel frames.



BLACK

No. 6216

CLOSED CELL SPONGE NEOPRENE
OIL RESISTANT,
LOW WATER ABSORPTION
TEMPERATURE RANGE:
-70° TO +250° F (-57° C TO +121° C)

ADHESIVE BACKED NEOPRENE WEATHERSTRIP

1/16" x 3/8"	3/16" X 1/4"	3/8" X 1/2"
1/16" x 1/2"	3/16" X 3/8"	3/8" X 3/4"
1/8" x 1/4"	3/16" X 1/2"	1/2" X 1/2"
1/8" x 3/8"	1/4" X 3/8"	1/2" X 3/4"
1/8" x 1/2"	1/4" X 1/2"	
	1/4" X 3/4"	

OTHER SIZES/COLOURS, SPECIAL ORDER: CONTACT OFFICE

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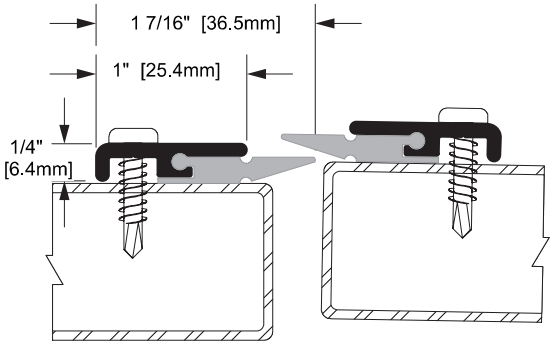
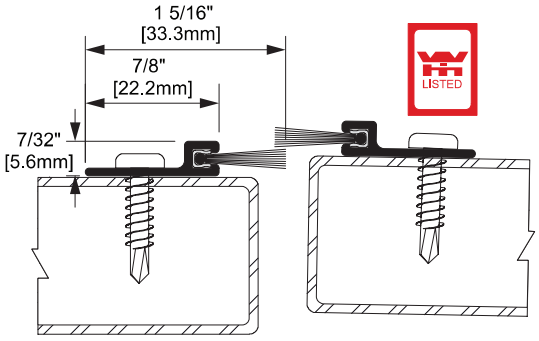
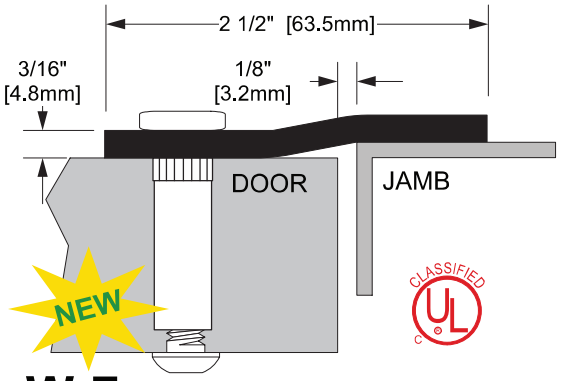
ASTRAGALS



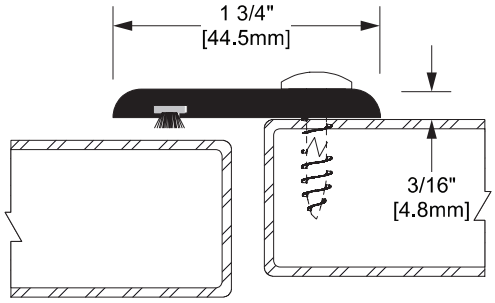
W-5 CLEAR ANODIZED ALUMINUM AND VINYL



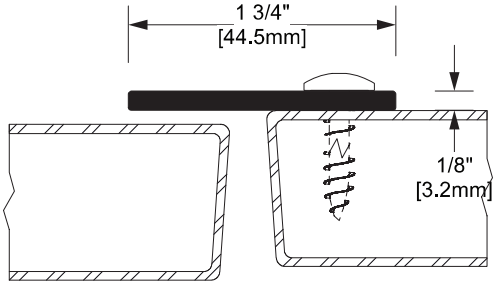
W-25 CLEAR ANODIZED ALUMINUM AND NYLON BRUSH



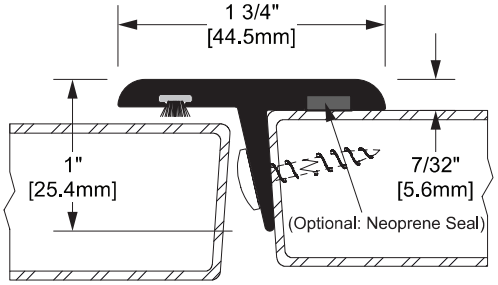
W-7 SECURITY ASTRAGAL
PRIMED C.R. STEEL c/w SECURITY SLEEVE



W-8 EXTRUDED ALUMINUM
W-8P EXTRUDED ALUMINUM WITH PILE
W-8SL EXTRUDED ALUMINUM WITH SILICONE



W-8S C.R. STEEL WITH CONDITIONED EDGES
W-8SP AS ABOVE, PRIMED FINISH
W-8SS STAINLESS STEEL, SEE PG. 20



W-9 EXTRUDED ALUMINUM WITH PILE
W-9S EXTRUDED ALUMINUM WITH SILICONE

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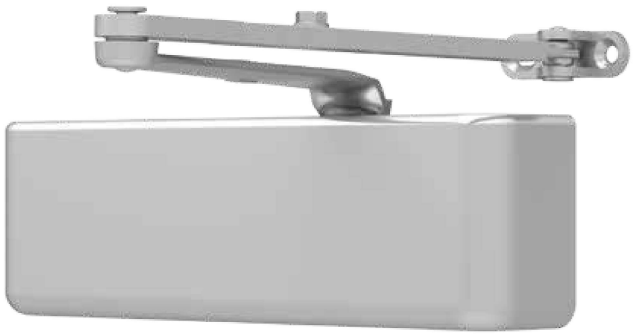
Submittal Date: Jan 27/23, Mar 28/23, MAY

4040XP Series

Features

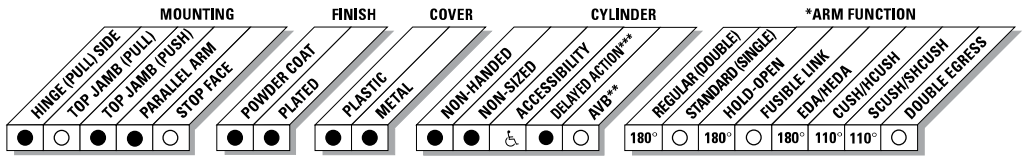


The 4040XP is LCN's most durable and flexible heavy duty closer designed for institutional and other demanding high traffic applications.

Certifications	Grade 1 - ANSI A156.4, UL 10C, ADA, 100 Hour Salt Spray, Meets BAA - Buy American Act
Body Construction	■ Cast Iron Body ■ Full Complement Bearings ■ 1-1/2″ Diameter Piston ■ 3/4″ Diameter Double Heat Treated Pinion Journal
Fluid	All Weather Liquid X Fluid
Handing	Non-Handed
Templating	Peel-n-Stick templates - 2-1/4″ x 5″ Mounting Hole Pattern
Size	Adjustable Spring Size 1-6, includes Patented Green Dial
Warranty	30 years

Cover	■ Plastic, Standard ■ Metal, Optional
Fasteners	Self Reaming and Tapping Screws (SRT)
Mounting	Hinge (Pull Side), Top Jamb (Push Side), Parallel Arm (Push Side)
Arms	Regular Arm
Finishes/Colors/ Powder Coat	■ Aluminum (689) ■ Statuary Bronze (690) ■ Light Bronze (691) ■ Black (693) ■ Dark Bronze (695) ■ Brass (696) ■ Custom colors optional
	■ Optional SRI primer - powder coat only ■ Optional plated finishes

Special Templates | Customized installation templates or products may be available to solve unusual applications. Contact LCN Product Support for assistance.



● AVAILABLE
○ NOT AVAILABLE

♿ *Closer available with less than 5.0 lbs. opening force on 36″ door.*
* *Maximum opening/hold-open point with standard template.*
** *Advanced Variable Backcheck.*
*** *Delay feature incorporates standard 4040 cylinder (not XP).*

Arms

4040XP-3077
Regular Arm

- Non-handed
- Mounts pull side or top jamb with shallow reveal P4041 closer includes PA SHOE, 4040XP-62PA required for parallel arm mounting

4040XP-3077L
Long Arm

- Non-handed
- Includes LONG ROD AND SHOE, 4040XP-79LR for top jamb mount
- Optional

4040XP-3077ELR
Extra Long Arm

- Non-handed
- Includes EXTRA LONG ROD AND SHOE, 4040XP-79ELR for top jamb mount with deep reveal
- Optional

4040XP-3049
Hold-Open Arm

- Non-handed
- Mounts pull side or top jamb with shallow reveal, hold-open adjustable shoe
- 4040XP closer includes 4040XP-62PA shoe required for parallel arm mounting
- Optional

4040XP-3049L
Long Hold-Open Arm

- Non-handed
- Includes LONG HEAD AND TUBE, 4040XP-3048L for top jamb mount
- Optional

4040XP-3077EDA
Extra Duty Arm

- Non-handed
- Features forged, solid steel main and forearm for potentially abusive installations
- Optional

4040XP-3049EDA
Hold-Open Extra Duty Arm

- Handed
- Parallel arm features forged, solid steel main and forearm for potentially abusive installations
- Hold-open function is adjusted at the shoe
- Optional

4040XP-3077EDA/62G
Extra Duty Arm with 62G

- Non-handed
- Features forged, solid steel main and forearm for potentially abusive installations
- 62G shoe provides additional blade stop clearance
- Optional

4040XP-3049EDA/62G
Hold-Open Extra Duty Arm with 62G

- Handed
- Features forged, solid steel main and forearm for potentially abusive installations
- 62G shoe provides additional blade stop clearance. Hold-open function is adjusted at the shoe
- Optional

4040XP-3077CNS
Cush-N-Stop® Arm

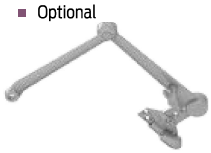
- Non-handed
- Features solid forged steel main arm and forearm with stop in soffit shoe.
- Optional

4040XP-3049CNS
HCUSH Arm

- Non-handed
- Hold-open function with templated stop/hold-open points
- Handle controls hold-open function
- Optional

4040XP-3077SCNS
Spring CUSH Arm

- Non-handed
- For abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe
- Optional



4040XP-3049SCNS
Spring HCUSH Arm

- Non-handed
- For abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe
- Handle controls hold-open function
- Optional

ALLEGION

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OAKVILLE , ON., ross@cdh.ca

EEC Saint Michel Class Rm. Add. 2023
29 Meadowvale Rd , Scarborough
Job No. A22008

Submittal Date: Jan 27/23, Mar 28/23, MAY

ND mechanical

Applications

The Schlage ND is extremely versatile and is regularly used in healthcare, education, government, office, retail and other commercial applications.

With 31 mechanical functions, the ND's range spans from the simple (non-locking passage) to complex (double-cylinder security) to specialized (school time-out lock).

Because the ND uses an ANSI 161 door prep, commonly used across cylindrical locks, it is ideal for both new construction and retrofit applications.

Key features

- Significantly exceeds ANSI/BHMA A156.2 requirements for Grade 1 cylindrical locks
- 31 mechanical functions (see adjacent columns for wired electrified and electronic options)
- Nine lever designs, two rose designs
- 10 available finishes
- Supports standard, SFIC and FSIC cylinder formats
- Multiple key systems available – open, patented, restricted, geographic exclusive, UL437
- Support for 10 non-Schlage cores (see cylinder section)

ND wired electrified

Applications

Wired electrified locks complement the mechanical offering and are typically incorporated into a wired access control system or used independently with a remote access switch (e.g. switch behind a receptionist desk).

The electrified ND is ideally used in:

- high traffic areas, where line power ensures continuous operation
- new construction, where electrified door prep, hinges and wiring can easily be incorporated into the building

Key features

All mechanical features plus:

- auto-detecting 12-24VDC input
- selectable EL/EU operation
- low 0.23 amp max current draw that allows multiple locks on a single power supply
- low 0.010 amp holding current that eliminates "hot levers" in electrically locked applications
- modular Request to Exit (RX) that can be added at any time
- inventory friendly—one lock supports 12-24V, EL or EU, with or without RX
- six electrified functions for application flexibility

NDE wireless electronic

Applications

Wireless electronic locks complete the offering by delivering all of the access control system hardware components required at the door in a single integrated design.

NDE wireless lock applications include:

- retrofit applications where electronic credentials can be used for improved visibility and control
- new construction to expand the scope of access control to interior openings
- low to medium traffic areas, where battery power delivers long life

Key features

All mechanical features[1] plus:

- Fits standard ANSI 161L mechanical door prep
- Installs in minutes with only a Phillips screwdriver
- Integrated card reader, door position sensor and Request to Exit (RX) switch
- Built-in Bluetooth® enables wireless configuration from smart phones and tablets
- Built-in Wi-Fi enables automatic updates to access rights
- Capable of networked real-time communication[2]
- Up to 2 years of battery life (4 AA)

1 NDE wireless electronic lock available in seven lever designs, one rose design, and nine finishes only.
2 Requires ENGAGE™ Gateway and alliance access control software.

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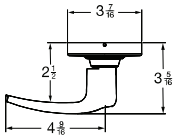
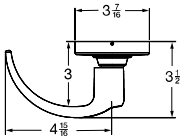
Lever designs and finishes

Athens (ATH)[2]



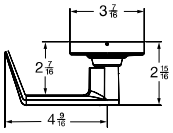
Mechanical | Wired electrified | Wireless electronic

Sparta (SPA)[1, 2]



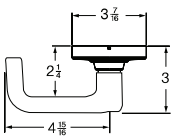
Mechanical | Wired electrified | Wireless electronic

Rhodes (RHO)[1, 2]



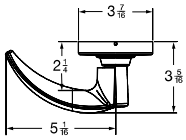
Mechanical | Wired electrified | NDE wireless electronic

Tubular (TLR)[1, 2]



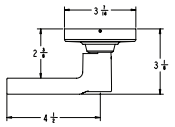
Mechanical | Wired electrified | Wireless electronic

Omega (OME)[1]



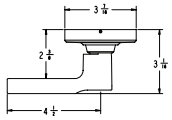
Mechanical | Wired electrified | Wireless electronic

Latitude (LAT)



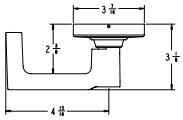
Mechanical | Wired electrified | Wireless electronic

Broadway (BRW)



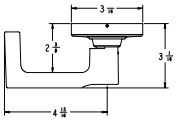
Mechanical | Wired electrified | Wireless electronic

Longitude (LON)



Mechanical | Wired electrified | Wireless electronic

Boardwalk (BWK)



Mechanical | Wired electrified | Wireless electronic

All levers comply with the Americans with Disabilities Act (ADA).

1 Boardwalk, Longitude, Omega, Rhodes, Sparta and Tubular levers comply with California State code for return within 1/2" of door face.

2 Athens, Rhodes, Sparta and Tubular levers support cylinders from other manufacturers, see cylinder section on page 24 for details.

Finish options									
Color	Bright brass	Satin brass	Satin bronze	Oil rubbed bronze	Satin nickel	Matte black	Bright chrome	Satin chrome	Aged bronze
ANSI/BHMA number	605	606	612	613	619	622	625	626/626AM	643e
US number	US3	US4	US10	US10B	US15	US19	US26	US26D	US11
Mechanical	■	■	■	■	■	■	■	■	■
Wired electrified	■	■	■	■	■	■	■	■	■
Wireless electronic	■	■	■	—	■	■	■	■	■

Product information and specifications contained in this catalog are subject to change without notice. Please consult the factory.

ND Series mechanical lock
Keyed function list

Schlage ANSI

ND50PD F82

Entrance/office lock

- Push-button locking.
- Push-button locks outside lever until it is unlocked with key or by turning inside lever.
- Inside lever always free for immediate egress.

Outside Inside

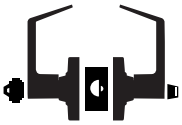
Schlage ANSI

ND53PD F109

Entrance lock

- Turn/push-button locking: Pushing and turning the button locks the outside lever, requiring use of a key until the button is manually unlocked.
- Push-button locking: Pushing button locks outside lever until unlocked by key or by turning the inside lever.
- Inside lever always free for immediate egress.

Outside Inside



Schlage ANSI

ND60PD F88

Vestibule lock

- Latch retracted by key from outside when outside lever is locked by key in inside lever.
- Inside lever always free for immediate egress.

Outside Inside

Schlage ANSI

ND66PD F91

Store lock†

- Key in either lever locks or unlocks both levers.

Outside Inside

Schlage ANSI

ND70PD F84

Classroom lock

- Outside lever locked and unlocked by key.
- Inside lever always free for immediate egress.

Outside Inside

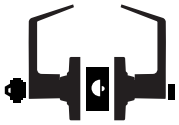
Schlage ANSI

ND73PD F90

Corridor lock

- Locked or unlocked by key from outside.
- Push-button locking from inside.
- Turn inside lever or close door to release button.
- When outside lever is locked by key it can only be unlocked by key.
- Inside lever always free for immediate egress.

Outside Inside



Schlage ANSI

ND75PD -

Classroom security lock

- Key in either lever locks or unlocks outside lever.
- Inside lever always free for immediate egress.

Outside Inside

Schlage ANSI

ND80PD F86

Storeroom lock

- Outside lever is fixed.
- Entrance by key only.
- Inside lever always free for immediate egress.

Outside Inside

Available with RX

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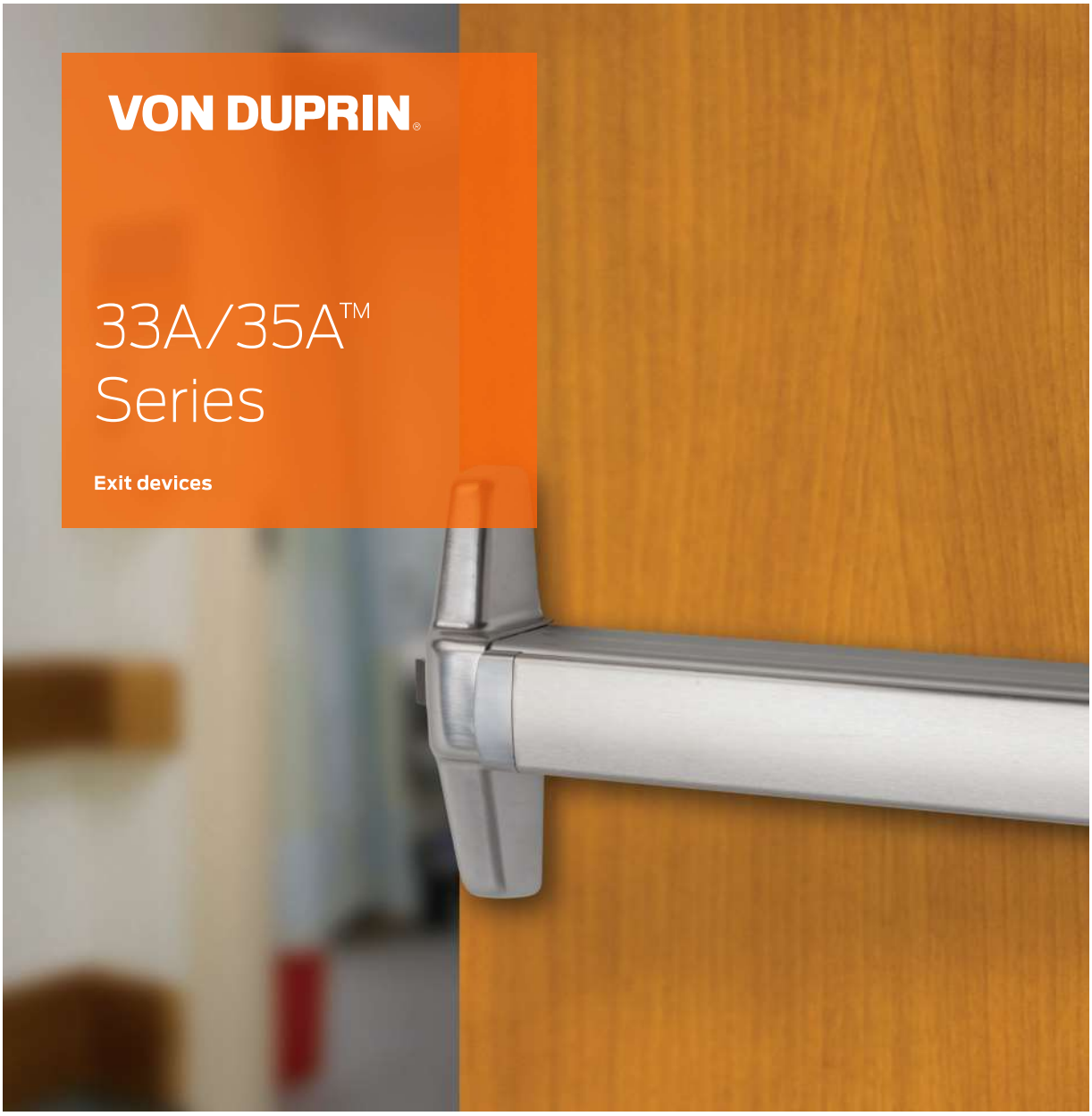
ALLEGION



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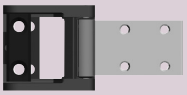
33A/35A Rim device



1439 Roller ships standard, optional strikes available

299 Strike needs to be specified for Hollow Metal Frames

33A and 35A for all types of single and double doors with mullion, UL listed for panic exit hardware. Devices are ANSI A156.3 – 2014 Grade 1. The 35A has a smooth mechanism case and the 33A has grooved case. The rim device is non-handed except when the SS (signal switch) option is used. See opposite page for available outside trim and device functions.

33A/35A fits door stiles as narrow as 1 3/4" (44mm). Newly designed device has a one piece center case cover.

Finishes – US3, US4, US10, US15 (35A Only) US26, US26D, US26D-AM,US28, 313 and 315.

Specifications

Device lengths	**3'** 2' 4" to 3' (711mm to 914 mm) Door size **4'** 2'10" to 4' (864 mm to 1219 mm) Door size
Device centerline from finished floor	39 13/16" (1011 mm) 39 11/16" (1008 mm) with Mullion
Center case dimensions	8 3/16" x 1 9/16" x 2 13/32" (208mm x 40mm x 62mm)
Mechanism case dimensions	2 1/4" x 2 1/4" (57mm x 57mm)
Projection	Pushbar Neutral – 3 13/16" (97 mm) Pushbar Depressed – 3 1/16" (78 mm)
Latch bolt	Deadlocking, 3/4" (19mm) throw
Fasteners & sex bolts (SNB)	Includes 1 3/4" (44mm) – 2 1/4" (57mm) wood & metal doors #425 SNB furnished standard for end case #325 SNB furnished standard for EO (exit only device)
Electric options	**ALK** Alarm kit **CX** Chexit delayed exit **EL** Electric latch retraction **HD-EL** Electric latch retraction with hex dogging **QEL** Quiet electric latch retraction **RX** Request to exit, WP-RX waterproof option **LX** Latchbolt monitoring **LX-RX** Request to exit / latchbolt monitoring **RX-LC, LX-LC, LX-RX-LC** Low current option for RX, LX, LX-RX **SS** Signal switch **CON** Allegion Connect
Mechanical options	**AX** Accessible device
Miscellaneous options	**GBK** Glass bead kit **PN** Pneumatic **SG** Safety glow **SEC** Security screws **SNB** Sex bolts
Dogging feature	**Hex Dogging standard** **CD** Cylinder dogging **LD** Less dogging
Strikes	**1439** – Dull black **Optional strikes**

QEL
Quiet electric latch retraction
- Bolt retraction via switch
- Converts exit door to push-pull operation

AX
Accessible device
- UL certified to meet new 5 lb. maximum operating force requirement
- Exceeds ANSI/BHMA requirements

CX
Chexit delayed exit
- Meets NFPA 101 requirements
- Self-contained controls, locking, alarm

ALK
Alarm exit kit
- Unauthorized opening triggers 85-decibel horn
- Set in armed or disarmed mode by key

EL
Electric latch retraction
- Enables remote unlatching
- Alternative to manual dogging

RX
Pushpad monitor switch
- Signals use of an opening
- SPDT switch to monitor pushpad

E (E360L)
Electric lever trim
- Electrified remote locking/unlocking
- Fail safe & fail secure options available
- No key override

CON
Allegion Connectors
- Common connectors to connect various door hardware all the way to the power supply

PN
Pneumatic latch retraction
- For areas where electrical devices banned
- Special linkage for mechanical or pneumatic dogging

CD
Cylinder dogging
- Replaces hex key dogging
- Requires standard 1 1/4" mortise cylinder

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Standard trim

	EO	DT	NL	NL-OP
	No outside trim Exit only	 **Dummy trim** Pull when dogged	 **Night latch** Key retracts latchbolt	 **Night latch** Key retracts latchbolt optional pull required
Product description	33A-EO 35A-EO	33A-DT 35A-DT	33A-NL 35A-NL	33A-NL-OP 35A-NL-OP
Trim description	—	386DT	386NL	388
Base size	—	7 15/32" x 1 5/8" (190x41mm)	7 15/32" x 1 5/8" (190x41mm)	7 1/2" x 1 11/16" (190x43mm)
Grip size	—	8 1/2" x 4 5/16" (216x110mm)	8 1/2" x 4 5/16" (216x110mm)	—
Projection	—	2 7/16" (62mm)	2 7/16" (62mm)	1" (25mm)
ANSI function	01	02	03	03
Cylinder type	—	—	Rim	Rim
Handing	—	—	Handed	—
Optional trim	—	x360L-DT x550DT x IVES 8190	—	x550DT x IVES 8190 10"

	L	L-BE	T	T-BE
	 **Lever** Key Locks and Unlocks	 **Lever Blank Escutcheon** Always Operable (No Cylinder)	 **Thumbturn** Key Locks and Unlocks	 **Thumbturn** Always Operable (No Cylinder)
Product description	33A-L 35A-L	33A-L-BE 35A-L-BE	33A-T 35A-T	33A-T-BE 35A-T-BE
Trim description	360L	360L-BE	360T	360T-BE
Base size	7 1/2" x 1 11/16" x 7/8" (190x43x22mm)	7 1/2" x 1 11/16" x 7/8" (190x43x22mm)	7 1/2" x 1 11/16" x 7/8" (190x43x22mm)	7 1/2" x 1 11/16" x 7/8" (190x43x22mm)
Grip size	—	—	—	—
Projection	3" (76mm)	3" (76mm)	1 13/16" (46mm)	1 13/16" (46mm)
ANSI function	08 or 09 field selectable	—	11 or 12 field selectable	—
Cylinder type	1 1/4" Mortise	—	1 1/4" Mortise	—
Handing	Handed/Reversible	Handed/Reversible	—	—
Optional trim	—	E360L-BE	—	E360T-BE

Note: 360L & 360T used on wood door require the 33A-WDA cover plate

Notes

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98-F/99-F Rim exit device

98-F and 99-F Rim fire exit devices are certified to ANSI/BHMA A156.3 2014, Grade 1 and UL listed for fire exit hardware. See page 67 for detailed information on UL fire exit hardware label and door opening size information. The 98-F device has a smooth mechanism case and the 99-F device has a grooved case. The rim device is non-handed except when the following device options are used: -2 (double cylinder) or SS (signal switch).

Specifications

Device functions	Device ships EO/DT/N; Field selectable; For TP, K or L remove NL drive screw from device
Device lengths	3' 2'4" to 3' (711mm to 914mm) Door size 4' 2'10" to 4' (864mm to 1219mm) Door size
Device centerline from finished floor	39 13/16" (1011mm) 39 11/16" (1008mm) with mullion
Center case	8" x 2 3/4" x2 3/8" (203mm x 70mm x 60mm)
Mechanism case	2 1/4" x 2 1/4" (57mm x 57mm)
Projection	Pushbar neutral – 3 13/16" (97mm) Pushbar depressed – 3 1/16" (78mm)
Latch bolt	Deadlocking, 3/4" (19mm) throw
Finishes	605, 606, 612, 626/626AM, 628, 710, 711 and 643e (619 and 630 available with 98 Series only)
Fasteners and sex bolts (SNB)	Includes screw pack for 1 3/4" (44mm) and 2 1/4" (57mm) thick metal or wood doors; Optional 425 SNB available for metal doors; 425 and 825 SNB required on wood doors without SLM blocking (See page 64 for quantities)

Accessories

299F Strike
Ships standard, optional strikes available

499F Strike
With 9854/9954 mullion

Features and options

Electrified options

LX	Latch bolt monitor switch
RX	Request to exit
RX2	Double request to exit
E	Electric locking and unlocking trim
EL	Electric latch retraction
ESL	Emergency secure lockdown
QEL	Quiet electric latch retraction
SS	Signal switch
CX	Chexit delayed exit
ALK	Alarm exit kit
WP-RX	Waterproof request to exit
CON	Allegion Connect

Mechanical options

-2	Double cylinder
-2SI	Double cylinder with security indicator
AX	Accessible device
GBK	Glass bead kit
PN	Pneumatic latch retraction
QM	Quiet mechanical
SNB	Sex bolts
SEC	Security screws
SLM	Special laminate material blocking
WH	Weep holes
XP	Extra protection

Dogging option
No mechanical dogging;
QEL options available

Strikes
299F – Dull black, 499F with mullions

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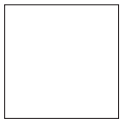
Trim functions

Von Duprin protects your investment by empowering you to adapt with flexible solutions and modular options. The 98/99 Series features numerous trim options to serve your different needs. Designed with flexibility in mind, our solutions offer ease of adding new options as they are developed.

With Von Duprin, you can be confident that as the needs of your facility change, our products can be upgraded easily to meet your needs, especially as the mechanical and electronic technology converge. Von Duprin's versatile design enables you to add functionality to existing devices in a cost-effective way, protecting your investment well into the future.

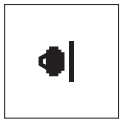
A variety of device trim lock type functions such as key lock and unlock, latch bolt retraction with key and no cylinder designs for an "always operable" function are available in levers, knobs, latches, thumbpiece and thumbturn designs.



EO **No outside trim**
- Exit only

DT **Dummy trim**
- Pull when dogged (not recommended for fire device)

NL **Night latch**
- Key retracts latchbolt
- Rim and 1 ¼" mortise cylinder



NLOP **Night latch**
- Key retracts latchbolt, pull required

TP **Thumbpiece**
- Key locks and unlocks
- Rim and 1 ¼" mortise cylinder

TPBE **Thumbpiece, blank escutcheon**
- Blank escutcheon always operable (no cylinder, use with DT trim)

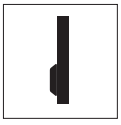
L **Lever**
K **Knob**
- Key locks and unlocks
- Rim and 1 ¼" mortise cylinder
- Handed, reversible lever
- Electrified lever operation available

LDT **Lever, dummy trim**
KDT **Knob, dummy trim**
- Pull when dogged

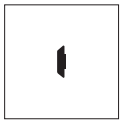
LNL **Lever, night latch**
KNL **Knob, night latch**
- Key retracts latchbolt
- Rim and 1 ¼" mortise cylinder
- Handed, reversible lever

LBE[1] **Lever, blank escutcheon**
KBE **Knob, blank escutcheon**
- Always operable (no cylinder)

TL **Turn lever**
- Key locks and unlocks (use with DT trim)
- 1 ¼" mortise cylinder



TLBE **Turn lever, blank escutcheon**
- Blank escutcheon always operable (no cylinder, use with DT trim)



TLOP **Turn lever, optional pull**

HL **Hospital latch**
- Key locks and unlocks
- 1 ¼" mortise cylinder

Trim options

996 trim

Trim description					
Nomenclature	996EO	996L*	996L-NL*	996L-BE*	996L-DT
Trim function	Exit only plate	Lever	Lever-night latch	Lever-blank escutcheon	Lever-dummy trim
Function description	Exit only plate	Key locks and unlocks	Key retracts latch bolt	Always operable, no cylinder	Pull when dogged
ANSI function	01	08	03	14	02
Device compatibility					
98/99 Rim/Rim-F	■	■	■	■	■
XP98/XP99 Rim/Rim-F	■	■	■	■	■
98/9927/27-F	■	■	■	■	■
98/9947/47-F	■	■	■	■	■
98/9947WDC/WDC-F	■	■	■	■	■
98/9948/48-F	■	■	■	■	■
98/9949/49-F	■	■	■	■	■
98/9950WDC/50WDC-F	■	■	■	■	■
98/9952†	†	†	†	†	†
98/9957/57-F	■	■	■	■	■
98/9975/75-F	■	■	■	■	■
Dimensions					
Escutcheon plate size	2 3/4" x 10 3/4" x 27/32" (70 x 273 x 21mm)				
Pull center to center	—	—	—	—	—
Projection	—	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)
Handing					
	—	Handed/reversible	Handed/reversible	Handed/reversible	Handed/reversible
Cylinder type					
Rim or vertical device	—	Rim	Rim	—	—
Mortise lock device	—	1 1/4" mortise	1 1/4" mortise	—	—

* Specify R/V if used for rim and vertical devices, M for mortise device. Example, 996L-R/V or 996L-M.

† Default trim is 252L /L-BE. Must be ordered as EO when paired with other trims (ordered separately).

CDH
COMMERCIAL DOORS & HARDWARE LTD.
2150 WINSTON PARK DR
UNIT 16
OAKVILLE , ON., ross@cdh.ca

EEC Saint Michel Class Rm. Add. 2023
29 Meadowvale Rd , Scarborough
Job No. A22008

Submittal Date: Jan 27/23, Mar 28/23, MAY

Additional information

Lever styles and finishes

Decorative levers


M51 [2]


M52 [2]


M53


M54


M55


M56


M57 [1]


M61 [3]


M62 [1,3]


M63 [3]


M81 [2]


M82


M83


M84


M85 [3]


ME1 [3,4]


ME2 [3,4]


ME3 [3]

1. Available in stainless steel substrate ONLY.
2. Knurling available.
3. Handed.
4. Designed with Gensler as product design consultant.

Standard levers


01


02 [2]


03 [1,2]


05


06[1] (Default lever)


07


12 [3]


16 - Omega


17 [1,2]


18


ACC - Accent [3]


AST - Asti [3]


MER - Merano [3]


LAT [1] - Latitude


LON [1] - Longitude

1. Available in Stainless Steel - specify SS when ordering.
2. Knurling available.
3. Handed.

Finish options*						
Color	Bright Brass	Satin Brass	Satin Bronze	Satin Nickel	Matte Black/ Anodized	Bright Chrome
ANSI/BHMA number	605	606	612	619	622/711	625

Finish options*						
Color	Satin Chrome	Aluminum, anodized	Satin Stainless	Aged Bronze	Black Paint	Dark Brown, Anodized
ANSI/BHMA number	626/626AM†	628	630/630AM†	643e	693	710

* Durable powder coated finishes available at special request. Please contact factory.
† AM = Antimicrobial

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6300 Series surface mounted strike for rim exit devices

Overview
Von Duprin electric strikes are known for their reliability, durability and security. The 6300 Series is designed to withstand abuse. Its heavy-duty stainless steel construction is fully UL1034 and UL10C Listed.

6300 Series electric strikes are designed for use with a variety of rim devices. It interfaces with the latch mechanism of the exit device. The movable lip (keeper) allows a door to open even when the latch bolt is extended. This feature, called remote release, provides added benefits such as increased convenience and efficiency. The 6300 Series also provides added security and traffic control.

6300 Series electric strikes are ideal for aftermarket applications. It is easy to install without modifying or altering the door frame. To assure the proper selection of an electric strike on new applications, lockset compatibility charts are shown on the next page. When using a lockset not listed or when retrofitting a strike to an existing application, please contact Von Duprin technical support for application assistance.

The 6300 is fail-secure (FSE) only to achieve compliance with UL10C for fire-rated openings. In a fail-secure application, the door is normally locked. To unlock the door, power must be applied. The 6300 strike can be used with either 12VDC or 24VDC. There are 2 connectors that ship with it and the appropriate connector for either 12VDC or 24VDC will be used, based upon the available voltage at the opening.

Features and benefits

- Non-handed design provides greater flexibility
- Requires no alteration or cutting to existing frame
- UL1034 burglary-resistant and
- UL10C electric strike for fire door
- Stainless steel (satin) finish
- Durable stainless steel construction
- Field selectable voltage 12VDC or 24VDC
- Dynamic strength 70 ft-lbs
- Endurance 2,000,000 cycles

6300 Series power requirements

Model	Voltage	Current	Duty	Amps	Ohms
6300	12V	DC	Continuous	0.50	22
6300	24V	DC	Continuous	0.24	89

Rim exit device compatibility 6300 strikes

Manufacturer	Model Number
Von Duprin	VD 22/22-F Rim
Von Duprin	VD 33A/35A Rim*
Von Duprin	VD 55 Rim
Von Duprin	VD 88 Rim
Von Duprin	VD 98/99 and 98/99-F Rim
Falcon	Falcon 24/24-F Rim*
Falcon	Falcon 25/25-F Rim
Falcon	Falcon 19/19-F Rim
Falcon Doromatic	Falcon Doromatic 1590*
Falcon Doromatic	Falcon Doromatic 1790*
Falcon Doromatic	Falcon Doromatic 2090*

* Stile and frame condition may affect compatibility.

Model specifications

Model number	6300
Retrofits model	N/A
Latchbolt throw	3/4"
Face plate length	9"
Projection	3/4"
Lockset	Rim exit device
Number of doors	Single or pair with mullion
Door/frame type	Hollow metal, aluminum and wood
EB (entry buzzer)	Optional
Certifications	UL1034, UL10C, UL 294, CSFM
Application notes	Surface mounted electric strike ideal for aftermarket applications. Strike designed for use with Von Duprin 98/99, however it can be used with most rim exit devices.

GT710/8710

Low-Energy
ADA Swing Door Operator

Where SOLUTIONS are AUTOMATIC

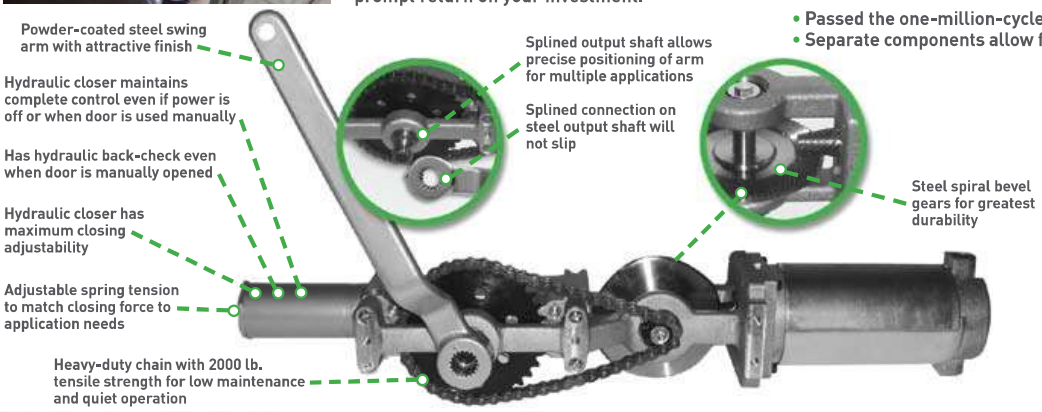
Product Features and Benefits

- Hydraulic design offers **proven reliability**
- Adjustable closing speeds to **enhance energy savings**
- Manual mode requires very little pressure to open **promoting ease of operation**
- Approved on fire door assemblies rated up to 3 hours, **maintaining security and safety**
- Hydraulic back-check during windy conditions **protects the door and operator from damage**

GT710/8710 Low-Energy ADA Swing Door Operator

The NABCO GT710/8710 Low-Energy Operator is engineered for interior and exterior use, and designed to automate essentially any new or existing door frame. The GT710/8710 operates in both automatic and manual modes with a hydraulic back-check that protects the door and mechanical operator from damage when forced open in windy conditions or when manually operated. The GT710/8710 Operator has been approved for use on fire door assemblies rated up to 3 hours. The low-energy performance, combined with the adjustable opening and closing speeds, reduces energy consumed, which offers a prompt return on your investment.

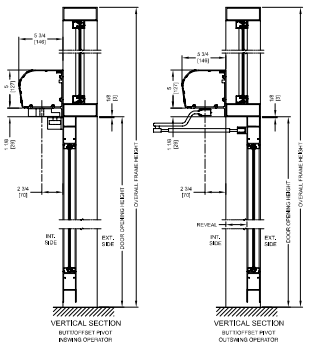
- Passed the one-million-cycle endurance test
- Separate components allow for lower repair costs



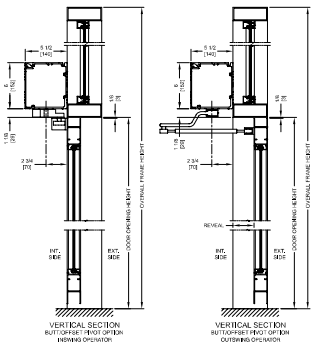
PRODUCT INFORMATION

Header dimensions	Side load - 5" H X 5 3/4" D (GT710) curved header Side load - 6" H X 5 1/2" D (GT8710)
Standard finish	Clear and dark bronze anodized
Optional finishes	Painted, clad, special anodized
Mounting	Surface applied or overhead concealed
Installation types	Push or pull
Operating voltage	120 VAC @ <5 amps
Auxiliary power output	12VDC 750mA
Operator drive	Electro-hydraulic
Motor voltage	Pulse width modulated
Motor type	1/8th HP @ peak
Control type	Microprocessor
Door panel weight	300 lbs.
Adjustable open	Force and speed
Adjustable close	Force and speed
Closing method	Spring/hydraulic (with selectable power assist)
Adjustable opening angle	Up to 145°
Power boost close	Selectable
Basic features	Low-energy operation Push and go Obstacle detection in opening and closing cycles Sequential or timer mode operation LCD display for programming and diagnostics Open- or closed-circuit safety inputs Momentary or maintained activation
Switch modes	On, off, hold-open
Opening and closing speed	Adjustable
Hold-open time	Adjustable (0-30 seconds)
Code compliances	ANSI A156.19/ANSI A117.1
Approvals	UL, ULC

GT710 Operator



GT8710 Operator



CONFIGURATIONS:
The GT710/8710 is available for multiple configurations, such as single doors, simultaneous pairs, and dual-egress, as well as the Opman configuration, which is a single continuous header for a pair of doors containing a manual closer on one side and an automatic operator on the other.

NABCO Service and Specifications

Along with the NABCO factory branches, NABCO has the largest independently owned network of automatic door distributors in North America. Their friendly, qualified installers and technicians always strive to exceed your expectations from install to after-sales service. NABCO's factory branches and independent distributors provide AAADM-certified technicians to ensure your doors meet all ANSI A156.10/A156.19 standards.

Complete three-part specifications and CAD drawings are available on the NABCO website.

NABCO
Member of the Nabtesco Group

Member AAADM

NABCO ENTRANCES INC.
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PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Cabinet Work	Section 06400
.2	Metal Doors and Frames	Section 08100
.3	Aluminum Entrances and Curtain Wall	Section 08900
.4	Finishing Hardware	Section 08710

1.3 **Qualification**

.1 Work of this Section is to be done by Contractors of recognized standing having personnel with a minimum of five years experience in this type of work and who have the necessary equipment to carry out the work. Manufacturers and Contractors are to comply to the Standards of the "Insulated Glass Manufacturers of Canada Ltd." latest edition.

.2 Approved Manufacturers of Sealants, Glazing Tapes, Splines etc. are as follows:

.1 Tremco Canada Ltd.

1.4 **Guarantee**

.1 Provide the following guarantee in accordance with the General Conditions, notwithstanding the time provision therein, as follows.

.1 **Five years material and labour should defects in mirror silvering occur.**

.2 **Five years material and labour should defects in factory sealed insulating units such as, but not limited to, obstruction of vision due to dust or film forming on inner glass surfaces occur.**

1.5 **Product Delivery & Storage**

.1 Deliver materials to site only as required.

.2 All units are to be crated and stored upright, covered, ventilated in a dry and safe location.

.3 Leave all materials in their original cartons or wrapping until required.

.4 Identify all glass delivered to job with Manufacturer's labels which are to remain in place until final cleaning.

1.6 **Protection**

.1 Protect work of other trades from damage resulting from work of this Section.

.2 Identify glazed openings immediately following glass installation. Do not apply tapes directly to glass.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Setting Blocks: neoprene, Shore 'A' duro-meter hardness of 70 to 90 points; spacer shims, 40 to 50 points, as recommended by glass manufacturer.

.2 Glazing Compound: non-hardening modified oil type meeting requirements to CGSB 19-GP-2M.

.3 Glazing Sealant: one part polysulphide to CAN2-19.13-M82 or one part silicone to CGSB 19-GP-18M.

.4 Glazing Tape: Polyshim 2 Tape by Tremco

.5 Glazing Gasket: E.P.D.M. Glazing Gasket by Tremco

.6 Float Glass: Clear float glass to CAN2-12.3 Glazing Quality. Unless otherwise indicated provide 6 mm thick glass for panes up to 2.25 m^2, 6 mm thick glass for panes up to 4 m^2 and 8 mm thick glass for panes in excess of 4 m^2.

.7 Tempered Glass: 6 mm and 10 mm thick fully tempered float glass to CAN2-12.1. Tempered glass identification must be sandblasted into glass and shall be visible after installation.

.8 Fire Rated Glass: 8 mm thick polished, clear ceramic laminated glass. Each lite shall bear permanent non-removable label certifying it for use in tested fire rate assemblies in accordance with ASTM E2074-00, ULC standards,CAN4 S-104 and CAN4 S-106.
Impact safety resistance to ANSI Z97.1 and CPSC 16CFR1201.

.9 Insulating Glass: 6 mm thick PPG Industries Inc. Solarban 60 Low-E high performance glass, clear shading coefficient 0.44

.10 Exterior Glass: 6mm thick PPG Industries Solexia, green tint

.11 Mirror Glass: 6 mm thick, clear polished plate or float glass, silvered mirror glazing quality to CAN2-12.5-M76. All edges polished.

.12 Mirror Adhesive: Compatible with mirror backing, as recommended by mirror glass manufacturer.

.13 Transparent Mirror Glass: (one-way) to CAN2-12-6-M76 6mm thick float glass "Mirropane".

.14 Laminated Glass: 6 mm and 10 mm thick to CAN2-12-1-M79. Laminated glass identification must be sandblasted into glass and shall be visible after installation.

.15 Spandral Glass: PPG Industries Inc. Tempered High Performance Glass, with Hi-Performance colour coating. Two colours to be selected by Consultant.

.16 Safety Film: 100 microns thick, clear polyester film with pressure sensitive adhesive; Scotchtint Shatter Resistant Window Film by 3M.

2.2 **Fabrication** .1 **Double Glazed Exterior Insulated glass units**

.1 **Type 1- Insulating Vision Glass:**
Outer Light - Tinted Tempered Exterior Glass
Air Gap - 13 mm Argon gas filled air space
Inner Light - Insulating Glass, tempered, with Low-E coating.

.2 Provide tempered glass in all lights and sidelights of exterior doors, both on exterior and interior glazing.

PART 3 - EXECUTION

3.1 **Glass Installation General**

.1 Do not glaze when ambient or surface temperature is less than 5° C. Ensure that glazing rabbets, stops and glass are dry, free of frost, grease, oil, dust, rust and other substances detrimental to adhesion of compounds and sealants.

.2 Carefully remove glazing stops and reinstall after glazing.

.3 Provide clearance at perimeter edge of glass on all four sides, minimum equal to glass thickness. Accurately size glass to fit openings, allowing for expansion in accord with glass manufacturer's recommendations.

.4 Site cutting of glass is prohibited unless approved by the Consultant.

.5 Provide sealer space between face of glass and glazing stops of minimum 3 mm.

.6 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing tapes, gaskets and compounds. Use solvents and cleaning agents recommended by manufacturer of sealing materials.

.7 Install glazing tapes uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.

.8 Set glass on setting blocks, spaced as recommended by glass manufacturer. Provide at least one setting block at quarter points from each corner.

.9 Centre glass in glazing rabbet to maintain specified clearances at perimeter on all four sides. Maintain centred position of glass in rabbet and provide the required sealer thickness on both sides of glass.

.10 Use spacers and shims in accordance with glass manufacturer's recommendations.

.11 Mark each pane of glass with approved means to indicate presence of glass.

3.2 **Interior** .1 Unless otherwise indicated glaze interior openings as follows:

Glazing

.1 Apply glazing tape to permanent stop; centre glass in opening and set glass on setting blocks, align edges and press home.

.2 Apply glazing tape to removable stops and install stops. Trim tape for neat appearance.

3.3 **Exterior Glazing**

.1 Unless otherwise indicated glaze exterior openings as follows:

.1 Apply glazing tape to permanent stop; butt tape joints and weld together; do not overlap joints; daub tape corners with sealant.

.2 Set glass on setting blocks, align edges and press home to ensure adhesion at all points.

.3 Apply heel bead of sealant around perimeter of glass, maintaining 5 mm bite to glass and positive bond to frame. Completely seal void around glass edges. Sealant shall partially fill channel between glass and removable stop.

.4 Install removable stops; insert spacer shims between glass and stops at approximately 610 mm o.c. not less than 6 mm below sight lines. Fill remaining void with glazing compound or sealant to sight line and trim to clean line leaving no voids or depressions.

.5 Glazing gaskets may be installed in lieu of backfilling with sealant or glazing compound after setting removable stops.

3.8 **Completion**

.1 Tighten all stops and ensure they are properly secured.

.2 Remove dirt, scum, plaster, paint spatter, and other harmful and deleterious matter from glass promptly and completely, before they establish tight adhesion.

.3 Avoid using abrasive, steel wool, razor blades, solvents, alkaline or other harsh cleaning agents.

.4 Remove excess sealant using solvents as recommended by sealant manufacturer.

.5 Remove glazing compound droppings promptly from all surfaces as the work progresses.

.6 Replace scratched or otherwise damaged glass.

.7 After inspection by Consultant remove all labels and polish glass.

.8 Wash down exposed surfaces with a mild solution of tri-sodium phosphate in warm water and dry with soft, clean wiping cloths, polish all glass.

3.9 **Schedule**

.1 Provide glazing for the following elements and components:

.1 Metal Doors Frames and Screens
.2 Wood Doors
.3 Cabinet Work
.4 Other glazing shown on Drawings and not covered in other Sections.

.2 Provide the following glass Types:

.1 Fire Rated Glass: all interior fire rated screens and doors.

.2 Insulating Units: all exterior glazed elements and where indicated on documents.

.3 Float Glass: where no specific type of glass is called for.

.4 Tempered Glass: doors and sidelights at entrances and exits, interior non-fire rated screens and doors, all cabinet work, exterior glazed elements and other location where indicated on drawings.

.5 Laminated glass: exterior glazed elements where indicated on documents.

End of Section

PART 1 - GENERAL

1.1	**General Requirements**	.1	Comply with requirements of Division 1	
1.2	**Related Sections**	.1	Cast in Place Concrete	Section 03300
		.2	Masonry	Section 04200
		.3	Structural Steel	Section 05123
		.4	Wood Blocking	Section 06100
		.5	Air Barrier	Section 07196
		.6	Insulation	Section 07200
		.7	Sealant	Section 07900
		.8	Metal Doors & Frames	Section 08100
		.9	Finishing Hardware	Section 08710
		.10	Glazing	Section 08800

1.3 **Reference Standard**

.1 Do sealant work in accordance with Section 07900, unless otherwise specified herein.

.2 Do glazing work in accordance with Section 08800, unless otherwise specified herein.

1.4 **Qualifications**

.1 Work of this section is to be done by Manufacturers of recognized standing, having personnel with experience in this type of work and who have the necessary equipment to carry out the work.

1.5 **Guarantee**

.1 Provide the following Guarantee in accordance with the General Conditions of the Contract, notwithstanding the time provisions therein. **Ten years material and labour to cover the following**:

.1 Replace any window unit whose finish shows any defects such as but not limited to delamination, blistering or excessive fading.

.2 Replace or repair any window unit with air and water leakage, defects and malfunctions under normal usage.

1.6 **Submittals**

.1 Shop Drawings

.1 Submit shop drawings in accordance with the General Conditions.

.2 Clearly indicate materials and large-scale details for head, jamb and sill, profiles of components, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes and fasteners.

.3 All shop drawings for curtain wall systems must bear the stamp of a professional engineer.

3 Maintenance Data

.1 Submit maintenance data for cleaning and maintenance of aluminum windows for incorporation into maintenance manual.

1.7 **Inspection & Testing**

.1 The Owner may appoint and pay, out of the allowances carried in Section 01020, for an independent inspection agency to inspect and test the work of this section as directed by the Consultant.

1.8 **Work Supplied to Other Trades**

.1 Supply to other Sections anchors, inserts and items required to be built into work of other Sections.

.2 Ensure accurate setting of built-in items; where necessary provide templates, diagrams or other suitable means of instruction.

1.9 **Design Criteria**

.1 Design curtain wall systems to withstand, without any detrimental effects to appearance and performance, wind loads, and temperature range expected in geographical area of this project (OBC climatic information, 30 year probability), unless specified otherwise.

.2 Design Requirements

.1	Air leakage through curtain wall	ASTM E 283-84
.2	Structural performance of curtain wall	ASTM E 330-90
.3	Water penetration through curtain wall	ASTM E 331-86
.4	Water absorption	ASTM C 272-53 (80)
.5	Linear thermal coefficient	ASTM D 696-79 (88)
.6	Thermal conductivity	ASTM C 177-85
.7	Permeability	ASTM E 96-90, procedure E
.8	Resistance to permanent set	ASTM A 395M-88. method B
.9	Elongation	ASTM D 412-87
.10	Ozone resistance	ASTM D 1149-86
.11	Tensile strength	ASTM D 412-87
.12	Hardness Shore A	ASTM D 2240-86

1.10 **Acceptable Manufacturer**

.1 Product Qualifications: the specifications and drawings are based on products as manufactured by Kawneer Company Inc.

Acceptable Alternate Manufacturers: Sherwood Windows Group, Aerloc Industries or Alumicor Ltd. with similar profiles, materials performance specifications and finishes that meet the standards established by this Specification. The manufacturer will be responsible for the supply, installation, and guarantee of this Section.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Curtain Wall and Window Systems:

.1 Curtain Wall Systems: Kawneer 1600 UT System 1 or Sherwood Windows TB 1500 or Alumicor Thermawall 2600 Series or Aerloc 1600 Series.

.2 Window Systems: Kawneer Trifab 451 UT (thermal) Storefront System complete with Kawneer DUAL IsoLock® Thermal Break with two (2) 1/4" (6.4 mm) separations consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.

.1 Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

.2 Alternate Window Systems: (Providing the product meets the required performance specifications as outlined in the base spec.) Sherwood Windows TB 502D or Aerloc 2200/4200 Series or Windspec.

.2 Aluminum Window Extrusions: Extruded alloy AA 6063-T54 mechanically straightened and free of marks and be of size and shape as specified and detailed. Minimum extrusion wall thickness of 2.5 mm.

.3 Aluminum Plate and Sheet: AA 1100 alloy.

.4 Steel Sections and Plates: to CSA GRO 21-M1978 Type 300W. Hot dip galvanized with minimum zinc coating of 600 g/M^2.

.5 Bolts and Anchor Bolts: to ASTM A307-7613, hot dip galvanized with minimum zinc coating of 600 g/M^2 to CSA G16a-1972.

2.1 **Materials (Cont'd)**

.6 Steel Reinforcing: For screens to CSA G40.2, Class H.

.7 Flashings: 2 mm aluminum finished to match windows and entrances.

.8 Glass and Glazing Materials: Conform to the requirements of Section 08800 Glazing.

.9 Insulated Aluminum Panels:

.1 Where exposed to view on interior of building: Fabricate panels from **100 mm** thick rigid styrofoam insulation with 0.7 mm thick aluminum sheet laminated to both interior and exterior faces. Finish of both faces of panel to match frames.

.2 Where concealed to view on interior of building: Fabricate panels from **100 mm** thick rigid styrofoam insulation with 0.7 mm thick galvanized steel sheet laminated to interior face and aluminum sheet on exterior face.

.10 Caulking Materials

.1 Sealant: two part polytremdyne terpolymer to CAN/CGSB-19.24-M80; acceptable product: Tremco Dymeric; Colour selected by Consultant.

.2 Primer: As recommended by sealant manufacturer.

.3 Joint backing: foamed, closed cell polyethylene rope, minimum 12 mm wider than joint, compressed when installed.

.11 Foam Sealant: One component polyurethane foam sealant "Insta Seal" by Insta-Foam.

.12 Sills: 3 mm formed or extruded aluminum shapes of proper size and fastening type to suit wall conditions and as detailed, complete with joint covers and drip deflectors.

.13 Operable Venting Hardware: Top hinged open-out vents to have extruded aluminum hinges with stainless steel pins, clear anodized aluminum under screen roto operators with rotating disk handle.

.14 Vent Screens

.1 Standard top hinge open out bug screen configuration.

.15 Miscellaneous Materials

.1 Flexible Flashings: 1 mm thick Perm-A-Barrier flexible flashing by W.R. Grace & Co. of Canada.

.2 Bituminous paint: alkali resistant asphaltic enamel.

.3 Bedding compound: non-hardening and non-skinning.

.4 Assembly Screws: Stainless steel.

.5 Anchor Screws and Bolts: Stainless steel.

.6 Gaskets: E.P.D.M.

.7 Thermal Break: 13mm extruded, rigid polyvinyl chloride keyed into aluminum members.

2.1 **Materials (Cont'd)**

.15 Miscellaneous Materials (Cont')

.8 Aluminum Closures: Closures, caps, flashings and panels as detailed fabricated from 14-gauge aluminum laminated to 19 mm fir plywood backing. Finish to match frame.

.16 Entrance Doors

.1 Aluminum entrance doors to be Kawneer wide stile heavy duty aluminum doors.

.2 Aluminum frames for aluminum doors to match window frame profile. Provide continuous 13 mm thickness solid aluminum bar reinforcing at jambs and head.

2.2 **Fabrication General**

.1 Aluminum components shall be extruded Section and shapes unless otherwise specified.

.2 Framing shall consist of closed tubular aluminum sections reinforced if necessary, thermally broken.

.3 Open channel profiles are not acceptable.

.4 Make allowances for deflection of structure. Ensure that structured loads are not transmitted to windows.

.5 Design work so that it will not be distorted, nor fasteners overstressed from expansion and contraction of metal.

.6 Internally reinforce framing members where fastening for work of other sections is required and to withstand loads and deflection within allowable limits.

.7 Fastenings shall be concealed where possible. Where concealed fasteners cannot be used, use countersunk flathead screws with finish to match base metal on which they occur.

.8 Manufacturer's name plates on windows and doors are not permitted.

.9 Allow for vertical expansion and contraction of curtain wall framing.

.10 Ensure any moisture entering or forming inside systems drains to the exterior.

.11 Fabricate aluminum sills to profiles indicated to suit wall conditions. Provide drip deflectors at sill ends and at abutting vertical surfaces. Open ends of sills shall be fitted with neatly applied closure plates. Unless otherwise detailed provide flush slip joint at intermediate sill joints.

.12 Stools, cap flashings, closures, covers and trim shall be extruded or formed to profiles shown and unless otherwise shown, minimum 3 mm thick.

2.3 **Ventilator** .1 Ventilator frames shall consist of inner and outer aluminum frame sections

Units

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 **Entrance Doors**

.1 Doors shall be 50mm thick and shall have 190 mm head, stiles and centre rail and 250mm bottom.

.2 Provide polyurethane insulation to completely fill all door sections.

.3 Provide insulated aluminum panels in lower portion where shown or noted.

.4 Provide continuous steel reinforcing in frames at jambs and head.

.5 Prepare for and install finishing hardware. Provide cutouts, recesses, mortising as required for installation of finish and operating hardware.

.6 Make provision for recess magnetic door switches

2.5 **Finishes**

.1 Aluminum curtain wall, doors and vents: clear anodized finish.

2.6 **Display Case**

.1 As shown on drawings, supply and install aluminum display case framing as detailed.

.2 Provide cylinder lock for each operable door

PART 3 - EXECUTION

3.1 **Framing**

.1 Erect and secure framing systems and window units' plumb, square and level, free from warp, twist and superimposed loads.

.2 Anchor framing systems to supporting building elements; provide brackets, anchors and clips as required. All devises for anchoring shall have sufficient adjustment to permit correct and accurate alignment. After alignment rivet, weld or otherwise positively lock anchoring devices to prevent movement other than that required to accommodate expansion, contraction and deflection.

.3 Anchor immediate vertical frame members to structure above as required. Where support for intermediate vertical frame members is not available directly above head, provide frame extensions to structure above. Provide flexible connection at structure to allow for movement.

.4 Anchor window jamb members to adjacent building elements near top and bottom and at maximum 600 mm in between.

.5 Provide necessary inserts to be built into work of other Sections as required for anchorage of framing.

.6 Set frame members in bedding compound to ensure watertight assembly.

.7 Metal to metal joints between abutting components shall be sealed weathertight.

.8 Use concealed fastenings where possible; where not possible, use flathead screws in countersunk holes. Match exposed fastenings with base metal on which they occur.

3.2 **Insulated Panels**

.1 At glass spandrel panel locations, install insulated back-up panel into framing and seal airtight.

3.3 **Glazing**

.1 Glaze openings in accordance with window and glass manufacturer's recommendation and Glazing Section 08800 so as to achieve weathertight installation.

3.4 **Sealants**

.1 Seal joints in accordance with window and sealant manufacturer's recommendations and in accordance with Sealants Section 07900.

.2 Provide caulking between framing members and adjoining work and where required to render work of this Section weathertight.

.3 Provide for continuity of air and vapour barrier in all locations; join up with air/vapour barrier components of adjacent systems.

.4 Install polyurethane foam sealant in all voids between framing and surrounding building elements.

.5 Where indicated provide membrane flashing located within or abutting framing systems. Secure membrane flashings to frames and to adjacent work mechanically or with adhesive lap membrane flashings at joints minimum 100 mm and seal.

.6 Where indicated, and where required to maintain continuity of air barrier, install galvanized sheet metal closures at terminations of framing systems and effectively seal to adjacent building elements.

3.5 **Sill Installation**

.1 Install metal sills with uniform wash to exterior level in overall length, straight in alignment with plumb upstands and faces. Use maximum lengths possible allowing for expansion.

.2 Secure sills in place with anchoring devices locate at ends and at 600 mm o.c. in between.

.3 Fasten drip deflectors with self tapping stainless steel screws.

3.6 **Covers, Closures & Trim**

.1 Provide stools, covers, closures and trim as indicated and as required to provide complete and finished installation.

3.7 **Final Cleaning and Adjustment**

.1 When instructed by Consultant and after the Substantial Completion of the project, perform the following work:

.1 Remove any protective coatings or tapes from windows.
.2 Wash all interior and exterior work installed under this section with a mild solution of tri-sodium phosphate and water.
.3 Rinse all surfaces and polish with a soft dry cloth.
.4 Reset and tighten all glazing studs.
.5 Adjust all operating vents.
.6 Touch up any scratches and abrasions on frames.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Rough Carpentry:	Section 06100
.2	Sealants:	Section 07900
.3	Metal Doors and Frames:	Section 08100
.4	Painting:	Section 09900
.5	Mechanical Access Panels:	Division 15
.6	Electrical Access Panels	Division 16

1.3 **References Standards**

.1 CAN/CSA-A82.27-M91 - Gypsum Board.

.2 CGSB 19-GP-21M - Sealant.

.3 CAN/CSA-S102-Latest Edition - Building materials and assemblies, standard method of test for surface burning characteristics.

.4 CAN/CSA-A82.30-Latest Edition - Metal framing and furring (Substitute words "Lath and Plaster" in standard with "Gypsum Board").

1.4 **Qualifications**

.1 Work to be performed by a qualified contractor of recognized standing, who has personnel with 5 years experience of successful work on similar projects and who has the necessary equipment to complete the work.

.2 This specification is based on materials manufactured by C.G.C. Donn Canada. Alternate materials are acceptable provided they meet the specifications.

1.5 **Submittals**

.1 Samples

.1 Prior to ordering materials submit, for Consultants' review, duplicate 150x150mm sample of each board material and 300mm long sample of each corner bead, casing, trim, and moulding.

1.6 **Site Mock-up**

.1 Prior to commencing work, review all details and provide mock-ups for Consultants' review.

1.7 **Definitions**

.1 Drywall - Gypsum Board.

1.8 **Source Quality Control**

.1 Give complete cooperation to trades erecting framing and furring over which this work is applied. Coordinate finished joint location with framing. Notify carpentry trades when framing, blocking, and furring are inadequate by CSA Standards.

1.9 **Product Delivery & Storage**

.1 Do not deliver or install materials on site until building has been enclosed and heated.

.2 Deliver materials to site in original unopened containers, store safely in dry protected area free of moisture. Take precautions so no foreign matter contaminates materials.

1.9 **Product Delivery & Storage (Cont'd)**

.3 Corner beads, casing beads, mouldings and trim to be shipped in rigid

packages. Bent, rusted, or deformed material will not be accepted.

.4 Allow materials to come to room temperature (18°C - 22°C) for 24 hours prior to installing.

1.10 **Environmental Conditions**

.1 Install and finish gypsum board when ambient temperature is between 14°C and 22°C. Maintain this temperature range in areas to receive gypsum board for 24 hours prior to and during application, and until joint cement and adhesives are fully cured.

.2 Do not start work in an area until bucks, anchors, blocking, electrical and mechanical work and other work which is to be installed in or concealed by this work, has been installed, tested and approved.

1.11 **Protection**

.1 Provide adequate protection of materials and work from damage by weather and other causes. Protect work of other trades from damage resulting from work of this trade.

PART 2 - PRODUCTS

2.1 **Framing, Furring & Trim**

.1 Unless otherwise specified provide framing, and frame members of minimum 0.91 mm (20 ga.) core thickness, hot dip galvanized to ASTM A525.

.2 Studs: channel shaped screw-on type: 41mm, 67mm, 92mm , 152mm depth to suit conditions; with knurled supporting flanges at least 34mm wide; with service pass-through holes in web at 610mm o.c.

.3 Top and bottom runners: channel sections, depth to suit studs, with 35mm legs and service pass-through holes at 610mm o.c.

.4 Rough furring members: 13x13x1.2mm and 19x13.1.2mm galvanized steel channels.

.5 Furring and strapping members to receive gypsum board: channel shaped, 19mm deep; with outstanding flanges and 35mm wide knurled supporting face.

.6 Corner beads: CGC #200B trim "L" shaped.

.7 Casing beads: CGS #200-A trim "J" shaped, one piece length per location. Exposed J-mould is unacceptable.

.8 Metal control joints: CGC #093.

.9 Ceiling and Soffit Furring and Framing

.1 Tie Wire: CGC Tie Wire, 1.2mm min., soft annealed galvanized steel wire.

.2 Hangers: CGC Wire Rod and Pencil Rod, 3.7mm min., galvanized steel rod.

.3 Main Runners: Sheet steel 1.6mm thick; 38mm deep x 13mm wide; linear density 0.7 kg/m min.

2.1 **Framing Furring & Trim (Cont'd)**

.4 Cross Furring: Screwable, 19mm deep (flange to flange), 0.55mm

thick or deeper and heavier where required by loads.

.5 Furring Clips: Not less than 3.5mm galvanized.

.10 Reveal Channel, other Furring and Framing: Sheet metal of sizes and thickness as required.

.11 Anchors: Self-drilling tie wire anchors, Red Head T32. Phillips Drill Co. of ITT Ind.

.12 Resilient Channels: RSI resilient channels.

2.2 **Board Materials**

.1 Gypsum Board: CSA A82.27-M1977, tapered edge, minimum 16mm thick, 1200mm wide x most practical length. Use backing board in unexposed locations.

.2 Abuse Resistant Gypsum Fibre Board: CGC Fiberock Brand Panels Type VHI abuse - resistant 16 mm thickness**. No alternate manufacturers will be accepted**.

.3 Fire Rated Gypsum Board: Type 'X' board CSA A82.27-M1977.

.4 Cementitious Backer Board: CGC Fiberglass reinforced, light weight concrete board, 13mm thick.

.5 Moisture/Abuse Resistant Gypsum Fibre Board: CGC Fiberock AQUA-Tough panels - 16 mm thickness. No alternate manufacturers will be accepted.

.6 Shaftwall: In accordance with UL Design No. U415 System A -1 Hr.

.7 Exterior Sheathing: Glass-Mat Gypsum Sheathing Board:
ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
Basis-of-Design Product: 5/8" Type X Georgia-Pacific Gypsum; "DensGlass Sheathing".
Acceptable alternate is CGC Securerock Glass Mat Sheathing.

2.3 **Fastening & Finishing Materials**

.1 Gypsum Board

.1 Screws: to CAN/CAS A82-031, self-drilling, self-tapping, case hardened, as recommended by Gypsum Board Manufacturer.

.2 Laminating Adhesive: CGC Durabond 90 compound.

.3 Joint Tape: 50mm wide, CGC sheetrock joint tape.

.4 Joint Filler: as recommended by Manufacturer.

.2 Cementitious Backer Board

.1 Fasteners: Self-tapping galvanized or coated bugle head gypsum board screws, length to suit manufacturer's specification for board thickness.

2.3 **Fastening & Finishing Materials (Cont'd)**

.2 Joint Tape: 50 mm wide Durock, Alkali resistant fiberglass open weave, type AP≅ tape.

.3 Joint Filler: Thin-set mortar as recommended by manufacturer.

.4 Latex Additive: As recommended by manufacturer.

.3 Insulation Strip: Rubberized, moisture resistant 3mm cork strip, 12mm wide, with self sticking adhesive on one face, lengths as required.

2.4 **Acoustical Materials**

.1 Acoustic Insulation: CGC Therma fiber, sound attenuation fire blanket thickness and width to suit cavity.

.2 Caulking: CGC Acoustical Sealant.

PART 3 - EXECUTION

3.1 **General**

.1 Do work in accordance with CAN/CSA A82-31 except where specified otherwise.

.2 Framing and furring indicated on Drawings is schematic and shall not be considered exact or complete. Location and spacing of members, bracing, supports and securement shall be in accord with referenced standards as required to provide complete and finished work.

.3 Provide additional framing, supports and stiffeners to support recessed, built-in or surface mounted cases, shelving, fixtures and equipment.

.4 Coordinate with other trades to determine opening and access requirements.

3.2 **Framing Erection**

.1 Partitions

.1 Unless specified otherwise extend partitions assembly and individual studs framing each side of openings to underside of structure above. Provide for deflection of structure.

.2 Furr duct shafts, beams, columns, pipe spaces, exposed services and around built-in equipment or openings on all sides.

.3 Install runner channels at top and bottom of partitions and secure to supporting building elements at maximum 610mm o.c.

.4 At partition corners extend one runner channel to end of corner and butt other runner channel; allow clearance for gypsum board thickness; do not mitre runner channels.

.5 Install studs vertically; fix studs to runner channels by screwing on both sides.

.6 Install additional studs as detailed and required at partition intersections, openings and terminations at dissimilar materials. Place studs not more than 50mm from abutting walls, openings and each side of corners.

3.2 **Framing Erection (Cont'd)**

.7 Stiffen partitions over 2400mm in height at maximum 1500mm with at least one 19mm horizontal bracing channel extending full length of partition.

.8 Where studs extend over 3600mm in height, provide continuous girt bracing spaced approximately at mid height and double studs each side of door frames and other openings. In addition, carry studs through to structure above. Use 90mm studs spaced 400mm o.c. unless indicated otherwise. Conform to manufacturer's limiting height restriction. Brace diagonally to structure above, on approximately 45° angle, both sides of partitions, 2400mm o.c. maximum. Carry bracing down as close to ceiling as possible. Where studs have to be joined or spliced to achieve required height, nest one stud completely within other for distance of 600mm minimum.

.9 Provide for deflection under structure to avoid transfer of structural load to partition.

.10 In glazed partitions install horizontal runner at top and bottom of rough opening.

.11 Shim furring members for wall furring to present true, plumb line and plane face for application of wallboard.

.12 Locate furring members not more than 50mm away from openings, interior corners, intersections, frames, and control joints.

.13 Install miscellaneous furring using studs or furring runners as best suited for location.

.14 Install nested stud girts at proper locations to provide fastening anchorage for accessories, and equipment requiring special support. Check Division 10, Specialties and Division 15, Mechanical for anchors supplied by them.

.15 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.16 Provide horizontal framing and reinforcing sufficiently strong, stiff and sturdy to take load of wall hung cases, shelving, and equipment. Mark gypsum board to show where supports are located. Coordinate number and height of horizontal elements with drawings and related subcontractors. Screw continuous 150mm wide fastener reinforcement to metal studs before installing gypsum board.

.2 Ceilings and Soffits

.1 Erect hangers and runner channels in accordance with CAN/CSA-A82.31 except where specified otherwise.

.2 Erect suspension system to support ceiling assemblies, rigid secure and level to a tolerance of ∀ 3mm over 3000mm with a maximum deflection of L/360 where L represents the unsupported

span.

3.2 **Framing Erection (Cont'd)**

.3 Hangers for suspended ceilings will support suspension system independent of walls, columns, pipes and ducts. Space hangers at maximum 1220mm o.c. along rough furring members and not more than 150mm from ends.

.4 Cut hangers to required length. Ensure hangers are free from kinks, bends, twist or other deformations, except those required for fastening. Double saddle tie main runners to hangers. If hangers bend around or through runners and buck on themselves, they shall be twisted around themselves a minimum of 2 twists.

.5 Where hanger is suspended from concrete slab provide self drilling anchor only. Impact driven anchors are not acceptable.

.6 Provide additional hangers within 150mm of corners to support weight of lighting fixtures, diffusers, grilles and other built-in items occurring in ceiling. Provide additional hangers of 600mm o.c. around perimeter of items over 1m in length.

.7 Where duct work, piping and other elements within ceiling spaces interfere with direct suspensions of ceiling from structure, or where hanger spacing must exceed 1200mm install additional framing securely fastened to main structure to accommodate proper hanging of ceiling.

.8 Securely saddle tie main runners to hangers and level. Do not level by crimping hangers. Locate hangers not more than 150mm from ends of main runners and framing channels and not more than 1200mm o.c. both ways to accommodate placement of main runners and framing channels and to support weight of ceiling and superimposed loads such as lighting fixtures, diffusers and grilles.

.9 Locate main runners not more than 150mm from walls which are parallel to them or from other ceiling interruptions and not more than 1200mm o.c., and to suit ceiling layouts; and to frame and support superimposed weight of items intersecting ceilings.

.10 Space furring channels at right angles to main runners and framing channels at not more than 600mm o.c. Attach furring channels by means of clips or double strand of tie wire.

.11 Furr with furring channels, perimeter of openings for access panels, grilles, diffusers and lighting fixtures. Coordinate with other trades for proper location.

.12 Screw 300mm wide continuous fastener reinforcement at head of all exterior windows and screens before installing gypsum board. Install fastener reinforcement for full length of window wall.

.13 At exterior soffits install furring members at maximum 400mm o.c. Suspend soffit framing with metal studs and brace system to withstand positive and negative wind pressures without detrimental effects. Fasten furring members to surrounding walls.

3.2 **Framing Erection (Cont'd)**

.3 Bulkheads, Coves

.1 Frame to profiles shown, rigid, square, true to line and securely fastened to supporting building elements.

.2 Space furring members to receive gypsum board at 450mm o.c.

.3 Provide rough framing and bracing members as required to ensure stability and accuracy of work.

.4 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.5 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

3.3 **Installation**

.1 Gypsum Boards:

.1 Do not install gypsum board tight to floor surface. Leave a gap of 13 mm minimum between floor surface and underside of panel.

.2 Apply gypsum board to framing with screw fasteners. Position all edges or ends over supporting members. Use maximum practical sizes and install vertically or horizontally to minimize end joints.

.3 Fit end and edge joints closely, but not forced together. Stagger joints on opposite sides of partition and locate inconspicuously.

.4 Where joints cannot terminate on support member terminate between supports, stagger and back block them for joint treatment to minimize irregular joint appearance in side light.

.5 Apply screw fasteners, for non-rated assemblies, at the following spacings (apply screw fasteners in rated assemblies in accordance with ULC standards).

.1 For single layer space screws 300mm o.c. in field of panels and along edges or end joints.

For double layer screw attachment, space screws 400mm o.c. for both layers. Apply both layers of gypsum panels parallel to studs with joints in face layer offset from base layer joints. Use 25mm screws for base layer and 41mm screws for face layer.

.6 Adhesive bonded gypsum board; apply 13x13mm ribbons of laminating adhesive to back side of board, parallel to long dimension; space adhesive ribbons at maximum 150mm o.c. temporarily brace boards until complete adhesive bond develops.

.7 Provide moulding at perimeter of gypsum board ceilings and around window openings as detailed.

3.3 **Installation (Cont'd)**

.8 Provide casing beads where gypsum board butts dissimilar materials, against surfaces having no trim concealing junction and at openings.

.9 Provide corner beads at external corners.

.10 Provide insulating strips where gypsum board butts frames of exterior doors and windows or exposed masonry and concrete walls. Adhere strips to casing beads and compress 50%.

.11 In areas requiring gypsum board ceiling, gypsum board shall extend over the whole ceiling area including furred and pipe spaces.

.12 Where space above ceiling is congested with services, making installation difficult, contractor may use alternate system, with Consultant's approval, provided fire rating of assembly is maintained and no additional cost to Owner is incurred.

.2 Abuse Resistant Gypsum Fibre Board Installation

.1 Provide abuse resistant gypsum fibre board in the following areas.

.1 **All interior wall locations shown, detailed or noted to have gypsum board finish surface.**

.2 Install abuse resistant gypsum board to height of 2400 above finished floor and where noted or detailed. Install regular gypsum board from 2400 height to U/S of structure.

.3 Cementitious Board Installation

.1 Provide cementitious board in the following areas.
.1 All exterior soffits

.2 Leave gap of 3mm, at edge, between adjacent panel and or dissimilar materials. Anchor panel with specified fasteners at 150mm o.c. Fill gaps with thin set mortar with latex additive, and finish with fiberglass tape as recommended by manufacturer.

.4 Moisture/Abuse Resistant Gypsum Fibre Board

.1 Provide moisture resistant board in the following areas:
- Barrier free WR/Shower
- Washrooms

.5 Shaftwall

.1 Provide Shaftwall where noted on drawings.

3.4 **Gypsum Board Finishing**

.1 Tape and conceal exposed joints, fastener heads, edges and corners to produce a smooth level surface, free of defects, ready to receive finish.

.2 Finish panel joints and internal angles using 3 coat joint system consisting of the following:

- Thin layer of joint compound and embedded joint tape.
- Skim coat of compound over joint tape and allow to dry.
- 2 additional coats of compound feathered out onto panel face 200mm.

.3 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.

.4 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.

.5 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

3.5 **Gypsum and Relief Joints**

.1 Control Joints

.1 Provide control joints where shown on Drawings and as follows:
.1 Partitions: maximum 7.5m o.c.
.2 Ceilings: maximum 10m o.c.

.2 Relief Joints

.1 Provide relief joints where shown on Drawings and where gypsum board assemblies abut dissimilar construction.

.2 Stop gypsum board 6mm from abutting construction at dissimilar building elements.

.3 Where reglet pattern is required in gypsum board panel cut gypsum board and install appropriate trim.

3.6 **Expansion Joints**

.1 Provide expansion joints where indicated and at change of substrate construction and building expansion joint locations.

.2 Construct joints of 2 back to back casing beads set in gypsum board and supported independently at both sides. Break continuity of gypsum board and framing at joint.

.3 Provide continuous polyethylene dust barrier behind and across joints.

.4 Fill joint with sealant.

3.7 **Sound Control**

.1 Acoustical Insulation

.1 Provide acoustical insulation in gypsum board partitions and ceilings as indicated on Drawings. Unless otherwise noted provide

50mm thick insulation for full height of all partitions.

3.7 **Sound Control (Cont'd)**

.2 Acoustical Sealant

.1 Where sealant is to be installed, keep bottom of panel 13 mm above floor.

.2 Provide acoustical sealant around periphery of each partition and ceiling scheduled to receive acoustic insulation, to seal gypsum board/structure junction. Seal full perimeter of cut-outs, services and other penetrations.

.3 Provide 2 bead sealant system around horizontal and vertical perimeters of partitions. Apply continuous sealant beads at each side of horizontal runner tracks and vertical end studs, between gypsum board and adjacent construction.

3.8 **Associated Elements**

.1 Access doors and plaster rings for access to mechanical and electrical equipment and fixtures to be supplied by Mechanical and Electrical Division for installation by this Section.

.2 Build doors and rings into gypsum board elements flush and parallel to walls. Rigidly secure frames to framing or framing systems.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1 Finishing of Concrete Slabs: Section 03302

.2 Sealants Section 07900

1.3 **Reference Standards**

.1 Do tile work in accordance with installation manual 200-1979 (Revised 1989), 'Ceramic Tile', by Terrazzo Tile and Marble Association of Canada and CSC Architectural Specification Study 09300 on Ceramic Tile.

.2 American National Standards Institute (ANSI) / Ceramic Tile Institute (CTI)

.1 ANSI A108.1, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1)

.3 American Society for Testing and Materials (ASTM)

.1 ASTM C144, Specification for Aggregate for Masonry Mortar.

.2 ASTM C207, Specification for Hydrated Lime for Masonry Purposes.

.4 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-22M, Adhesive, Organic, for Installation of Ceramic Wall Tile

.2 CAN/CGSB-75.1, Tile Ceramic

.5 Canadian Standards Association (CSA)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5, A8, A23.5, A362, A363, A456.1, A456.2, A456.3)

1.4 **Qualifications**

.1 Installer: Work to be performed by a qualified Contractor and who has personnel with experience of successful work on similar projects, and who has the necessary equipment to complete the work.

1.5 **Guarantee**

.1 Provide the following guarantees in accordance with the General Conditions, not withstanding the time provisions therein, including but not limited to such defects as cracks and delamination, except where proven the defect is a direct result of structural failure.

.2 Provide certificate of quality compliance from tile manufacturer.

.3 Provide certificate of quality compliance from tile installer upon satisfactory completion of installation.

.1 **General Tile Work - 2 years**

1.6 **Submittals**

.1 Samples:

.1 Prior to ordering materials submit, for Consultant's review, duplicate samples of each tile, trim, fitting and base, mounted on panels complete with grout and mortar joints. Also submit samples of mitre cut base (if indicated on Finishes Drawings and Colour Schedule) and field tiles.

.2 Maintenance Data:

.1 Submit manufacturer's maintenance data for inclusion into the maintenance manuals specified in Division 1. Also submit manufacturer's specification sheets for mortar and grout systems installed.

.3 Maintenance Materials:

.1 Supply a minimum 2%, but not less than 2 boxes, of each tile specified, for maintenance purposes after all deficiencies have been completed. Store material where directed by Consultant.

.2 Maintenance materials to be of same run as materials installed.

1.7 **Site Mock-Up**

.1 Prior to commencing work, review all details and provide mock-up for Consultants review. Mock-up will remain in place throughout installation as a representation of finish work standard and may become part of the finished work if approved by Consultant.

.2 Review tile patterns and layout with Consultant, on site, prior to commencing work.

1.8 **Product Delivery & Storage**

.1 Deliver materials to site in original unopened containers. Store in safe dry protected area free of moisture. Take precautions so no foreign matter contaminates materials.

1.9 **Environmental Conditions**

.1 Do not install tiles when ambient air temperature and substrate temperature is less than 12°C.

.2 Maintain a temperature of between 12°C to 20°C in areas of work for 24 hours prior to and during installation and for duration of curing time.

.3 Inspect areas to receive work and certify surfaces are acceptable for installation. Do not commence installation until improper conditions have been corrected.

1.10 **Protection**

.1 Exclude construction traffic from areas to receive tile, during installation and for duration of curing time.

PART 2 - PRODUCTS

2.1 **Tile General**

.1 Specifications for tile and supporting accessories is based on materials manufactured and/or distributed by Olympia Tile International Inc., at 1-800-268-1613 or 416-785-6666.

.2 Tile: CAN2-75T-M77, except that no blisters or chips will be allowed; colours and patterns selected by Consultant.

2.2 **Ceramic & Porcelain Tile**

.1 Colour to be selected by Consultant.

2.3 **Mortar/ Adhesives & Grout**

.1 All interior wall tile to use Ultra/Mastic 1.

.2 All floor tiles to use Karalastic/Karabond.

.3 Colour to be selected by Consultant.

.4 Provide “Grout Boost” Stain resistant grout additive by Specialty Construction Brands Inc, to grout for all porcelain floor tile applications.

.5 Unless otherwise indicated all grout lines on walls to line up with grout lines on floors in all directions.

2.4 **Transition Strips**

.1 Provide Schluter Schiene or Quadec transition strips in satin anodized aluminum at the top edge and exposed side edges of porcelain tiles.

.2 Transitions strips are required to clean up edge of tiles where different thicknesses of tiles are specified and vertical edges.

.3 Provide Schluter Quadec in brushed stainless steel at outside corners where tile meets tile.

.4 Grind all sharp edges smooth. Careful attention to corner conditions to ensure smooth finish to touch.

.5 Use full length strips where possible. All connecting transition strips to have a seamless appearance and smooth to the touch.

2.5 **General Materials**

.1 Water: Potable and non-staining

.2 Portland Cement: CAN3-A5-M83.

.3 Sand: CSA A82.56-M1976.

.4 Control Joint Sealant: Urethane sealant equal to Vulkem 245 self leveling sealant manufactured by Mameco Canada Ltd. Colour to match grout. Architect to make final colour selection.

PART 3 - EXECUTION

3.1 **Inspection**

.1 Examine floors for defects that are detrimental to installation and bonding of tile.

.2 Examine drywall surfaces for adequate fixing, plumb, joint filling and freedom from waves.

.3 Examine masonry and concrete surfaces for soundness, excessive moisture, efflorescence and variation tolerance.

3.2 **Preparation**

.1 Substrates to be clean and free of foreign matter and minimum 10° C.

.2 Clean substrates as required to produce acceptable surface.

.3 Where substrate conditions require it, apply leveling coat and allow to cure.

3.3 **Tile / Stone General**

.1 Finished work shall be level, plumb, or sloped as shown, true, square and free of defective, chipped, broken, discoloured or blemished tiles. Maximum allowable finished surface variation is 3 mm in 3 m when measured, in any direction, with a 3 m straightedge.

.2 Lay out tile patterns symmetrically within each area using full tiles where possible, and to patterns shown. Unless otherwise indicated provide stacked pattern. Review with architect/interior designer on site prior to installation of any and all tiles.

.3 Joints shall be parallel, uniform, neat, straight, square and completely filled.

.4 Fit tile or stone accurately against and around interruptions, penetrations and abutting dissimilar surfaces. Wherever possible, drill holes for penetrating elements to ensure neat fitting.

.5 After setting, sound tiles and replace hollow backed tiles.

.6 Provide tile manufacturer's standard trim pieces at changes in direction and at terminations. Unless otherwise indicated provide the following corner and edge conditions.

.1 Internal horizontal corners: coved.
.2 External vertical and horizontal corners and edges: bullnose.
.3 Internal vertical corners and unexposed edges: square butt joint.
.4 Top of base: curved surface cap.

3.4 **Floor Tile Installation**

.1 At floors shown to be sloped install setting bed to slopes indicated screed and tamp firmly, minimum 20 mm thick, with reinforcing mesh embedded approximately in centre of setting bed. Lap mesh 50 mm at joints.

.2 Over setting bed trowel or brush on bond coat approximately 1.5 mm thick, or apply evenly over back of tiles. Set tiles onto setting bed and beat firmly and evenly in place so as to achieve true, uniform and properly bonded installation but without causing damage to tiles.

.3 Provide minimum 1% slope to floor drains.

.4 Floor tiles at floors without slopes, and base tiles may be installed with the thin set method using dry set mortar.

.5 Unless otherwise indicated provide 3 mm wide joints.

.6 Provided caulked control joints at 6 m on centres.

3.5 **Grouting**

.1 Remove mortar and adhesive from tile face as work progresses with CLEAN water.

.2 Commence grouting not earlier than 24 hours after setting tiles unless otherwise directed by grout manufacturer.

3.5	**Grouting (Cont'd)**	.3	Force maximum grout into joint so as to fill them flush, leaving no voids.
		.4	Promptly as work progresses remove excess grout from adjacent tile surfaces with CLEAN water before grout establishes tight permanent adhesion.
		.5	Cure grout in accordance with manufacturer's directions, minimum of 10 days.
		.6	Use MORE™ Surface Acidic Cleaner - to remove grout haze from the surface. Product supplied by Olympia Tile & Stone.
		.7	Seal all polished tiles with manufacturer's recommended sealer prior to grouting. Review and consult architect prior to tile installation and grouting.
3.6	**Control Joints**	.1	Provide control joints at substrate control joint locations, at abutting dissimilar materials.
		.2	Unless otherwise detailed provide control joints 10 mm wide, and fill with control joint sealant.
3.7	**Cleaning**	.1	Thoroughly clean tiles in accordance with manufacturers' instructions rinse with clean water and polish with clean dry cloths.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Related Sections**

.1	Gypsum Board:	Section 09250
.2	Painting:	Section 09900
.3	Mechanical Fixtures:	Division 15
.4	Electrical Fixtures:	Division 16

1.3 **Reference Standards**

.1 CAN/CGSB -92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

.2 CAN/ULC-S102-M88, Surface Burning Characteristics of Building Materials.

1.4 **Qualifications**

.1 Work to be performed by a qualified Contractor of recognized standing, who has personnel with experience of successful work on similar projects, and who has the necessary equipment to complete the work.

1.5 **Submittals**

.1 Samples

.1 Prior to ordering materials submit, for Consultants' review, duplicate 300x300mm tile samples and duplicate samples of suspension system components.

.2 Maintenance Data

.1 Submit manufacturer's maintenance data for inclusion into the maintenance manuals specified in Division 1.

.3 Maintenance Materials

.1 Supply three boxes of each tile specified, for maintenance use. Comply with the requirements of Section 01700.

.2 Maintenance materials to be of same run as materials installed.

.4 Certificates

.1 Submit certificate, attested by professional engineer registered in Province of Ontario, signed and sealed by attesting engineer, affirming ceiling system has been designed, fabricated and installed to safely support light fixtures installed in it, to satisfy requirements of electrical inspection department of Ontario.

.2 Have representative of tile manufacturer inspect the site, and certify moisture levels are at an acceptable level for installation of tile.

1.6 **Site Mock-up**

.1 Prior to commencing work, review all details and provide a mock-up for Consultants' review. Mock-up will remain in place throughout installation as a representation of finish work standard and may become part of finished work if approved by the Consultant.

1.7 **Design Criteria**

.1 Maximum deflection: 1/360th of span to ASTM C635-76 deflection test.

.2 Level: suspension system to be erected to a maximum tolerance of 3mm over 3m length.

1.8 **Product Delivery & Storage**

.1 Deliver materials to site in original sealed wrapping and containers. Store material in dry area free from dampness. Take precautions so no foreign matter contaminate materials.

.2 Store materials in work area 48 hours prior to commencing work.

1.9 **Environmental Conditions**

.1 Install ceiling systems after building is completely enclosed and before cementitious building elements are complete and cured and humidity levels are acceptable to the tile manufacturer.

.2 Maintain uniform minimum temperature of 15ºC and humidity of 20-40% before and during installation.

.3 Ensure work to be concealed by ceiling systems has been installed, tested, inspected and approved before starting work.

.4 Coordinate with Division 15 and 16 for work to be built into work of this Section.

PART 2 - MATERIALS

2.1 **General Requirements**

.1 Fabricate and install ceiling systems to ASTM C636-76.

2.2 **Suspension System**

.1 All components formed from commercial quality cold-rolled zinc coated steel. Exposed finish: baked enamel, low gloss, white.

.2 Suspension System: Donn CE by CGC by Donn Canada Ltd. Or Equivalent by Bailey Metal Products or Armstrong.

Type AC,1
Exposed Tee System with override cross tee to main tee connection.

Main Tee	38 x 38 mm Bulb Section
Length	3600 x 38
Cross Tee	38 mm wide
Length	1220 mm

.3 Hanger Wire: Galvanized, soft annealed steel 3.6mm thick.

.4 Tie Wire: 1.5mm soft annealed galvanized steel, double strand.

.5 Anchors: Self drilling tie wire anchor, Red Head T32, Phillips Drill Co. of ITT Ltd.

.6 Carrying Channels: Minimum 1.2mm thick cold rolled galvanized steel channels 38x13mm.

.7 Accessories: Splicers, fasteners, clips, outside corners, retainers as required to provide complete and finished work: manufacturer's standard types.

2.3 **Acoustical Boards** .1

Mineral Fibre:	**Type AC.1**
Size:	610mmx1220mm
Thickness:	16mm
Flame Spread:	Fire Resistive
NRC:	0.50
STC:	35-39
Manufacturer:	Armstrong
Type:	Dune
Pattern:	Dune, square edge, lay-in No. 1851
Finish:	Factory applied vinyl latex – white

***** Prior to ordering consult with client regarding confirmation of specific acoustic ceiling and manufacturer used at this school.**

PART 3 - EXECUTION

3.1 **General Requirements**

.1 Cooperate with other ceiling installers where acoustic ceilings and other ceiling types or bulkheads are installed as part of same ceiling system.

.2 Lay out ceilings in accordance with reflected ceiling plans and symmetrical within each area to obtain uniform borders at perimeter of room. Where layout is not shown install ceilings as directed by Consultant.

.3 Finished work shall be plumb, level and square with adjoining work.

.4 Cooperate with mechanical and electrical subcontractors and other trades. Assist in preparation of interference Drawings so services, fixtures and other penetrations are properly located in relation to the ceiling. Cut, fit and trim around services, fixtures and other penetrations.

.5 Where recessed light fixtures are covered with canopies, ventilate canopies.

3.2 **Preparation**

.1 Locate hangers in accordance with specification careful not to interfere with services cast in concrete slabs.

.2 Percussion activated type anchors are not permitted.

3.3 **Suspension System Installation**

.1 Install hangers to required length. Hangers shall be free from kinks, bends, twists and crimps, except those required for fastening. Saddle tie main runners to bent hangers. If hangers bend around or through runners and back on themselves, they shall be twisted around themselves at least twice.

.2 Suspend ceilings directly from structural members or from carrying supported from structural members. Do not fasten hangers to steel deck.

.3 Hangers shall support grillage independently of walls, columns, pipes and ducts. Space hangers at maximum 1220mm o.c. along supporting grillage and not more than 150mm from ends.

.4 Make provisions for carrying fixtures occurring on and in suspended ceilings. Install additional hangers and reinforcing to ensure loads being carried do not compromise integrity of system. Frame around fixtures openings and changes in elevation as required.

3.3 **Suspension System Installation (Cont'd)**

.5 At light fixtures occurring on and in suspended ceilings, provide suspension hanger at each corner of fixture.

.6 Where ductwork, piping and other elements interfere with direct suspension of ceiling from structure, install additional framing securely fastened to main structure to accommodate proper hanging of ceiling.

.7 Install main tees in accordance with module size.

.8 Install cross tees perpendicular to main tees in accordance with module size. Interlock with main tees.

.9 Exposed members to be longest length possible to minimize joints. Distribute joints to prevent clustering in one area. Joints to be square, tight and flush so exposed faces of intersecting members are on same plane.

.10 Use no stabilizer bars. Securely, positively and mechanically interlock cross member to main runner so grid is adequately and stiffly braced and stabilized, yet members can be removed easily and adequate provision is made for expansion and contraction.

.11 Mechanically fasten border trim to suspension system or walls. Do not adhere with glue or adhesive. Maximum spacing of fasteners not to exceed 450mm o.c.

3.4 **Acoustical Board Installation**

.1 Commence installation when all anchors, blocking, sound or fire barriers and mechanical and electrical work above ceiling has been inspected and approved by Consultant.

.2 Install acoustic units in true, level plane, on surface, recessed or concealed grid as indicated and scheduled.

.3 Install acoustic units with directional pattern running in same direction.

.4 Scribe acoustic units to suit ceiling layout, services, fixture and to fit adjacent work. Butt joints tight, terminate edges with moulding or trim as required.

.5 Install edge moulding at junction of ceiling and other materials around entire length of joint. Secure to construction. Butt joints neatly, square and true in alignment.

.6 Install services and fixtures on center of panels unless otherwise indicated.

.7 Identify panels below valves, controls and equipment requiring servicing, in ceiling space, with coloured upholstery tacks acceptable to Consultant.

3.5 **Cleaning**

.1 Touch up scratches and abrasion. Replace damaged or improperly installed acoustic units or suspended grid.

End of Section

PART 1 - GENERAL

1.1 **Reference** .1 Comply with requirements of Division 1.

1.2 **Related Sections** .1 Concrete Floor Finishing Section 03302

1.3 **Qualifications** .1 Flooring Contractor(s) shall be established firms, experienced in the field, and appointed as a distributer by the manufacturer of the flooring product specified.

1.4 **Submittals** .1 Samples:

.1 Submit duplicate tiles/planks/or sheet sample pieces of each colour specified for approval.

.2 Direction of veining or marbleization in the floor tile will be in accordance with instructions issued by the Consultant when colour selection is made. Refer to Finishes Drawings.

.2 Maintenance Data:

.1 Furnish the Owner with three copies of manufacturers printed maintenance instruction for inclusion in the maintenance manuals.

.3 Maintenance Materials:

.1 Deliver 25 tiles and/or planks and/or 1 box of sheet flooring of each colour pattern and type flooring material required for this project for maintenance use. Store where directed. Clearly identify each box.

.2 Furnish to the Owner additional materials containing a total of at least 1% of each different colour or design of the indoor resilient athletic surface used on the project.

.3 Delivery 10 m length rubber base. Store where directed.

.4 Maintenance materials to be same production run as installed materials.

1.5 **Delivery and Storage** .1 Deliver materials to the job in sealed, original, labeled containers.

.2 Store flooring materials in areas of application for at least 48 hours prior to installation.

1.6 **Environmental Requirements** .1 Maintain minimum 20°C air temperature at flooring installation area for 3 days before, during and for 48 hours after installation.

PART 2 – PRODUCTS

2.1 **Materials**

.1 Mastic Fill (latex underlayment): Bakelite Co. latex underlayment power/liquid or other approved manufacturer.

.2 **RUB** – Rubber Base: to meet the performance requirements of ASTM F-1861, Type TP and TV, Group 1 (Solid), Standard Specification for Resilient Wall Base.

.1 TighLock Carpet wall base is a wedge-shaped toeless base specifically designed to be installed prior to traditional, direct, or double glue down carpet installations.

.2 Tightlock Resilient Topset wall base is specifically designed for resilient installations where there is a transition from resilient flooring to carpet.

.3 6.35mm (1/4") thick – wedge design, ± 100mm (4") high, complete with inside/outside corners.

.4 Should not crack, break, or show any signs of fatigue when bent around a (6.4mm (1/4") diameter cylinder.

.5 Product Performance and Technical Data
ASTM F 1515 (Resistance to Light)…….... ΔE<8
ASTM F 925 (Chemical Resistance)…….. Pass
5% acetic acid
70% isopropyl alcohol, mineral oil
5% sodium hydroxide solution
5% hydrochloric acid solution
5% sulfuric acid solution
5% household ammonia solution
5.25% household bleach solution

Rubber Wall Base:
ASTM E 84/ NFPA 255 (Flame/Smoke)…… Class B, <450
ASTM E 648/ NFPA 253 (Critical Radiant Flux)…….. Class I

Rubber Wall Base:
ASTM E 84/ NFPA 255 (Flame/Smoke)…… Class A, <450
ASTM E 648/ NFPA 253 (Critical Radiant Flux)…….. Class I

Acceptable rubber base manufacturers: Johnsonite, Nora, Roppe, Armstrong, Mannington.

Refer to Section 00865 Colour Schedule for colour selection(s).

.3 Metal Edge Strips: aluminum extruded, smooth mill finish with lip to extend under floor finish, shoulder flush with adjacent floor finish.

.4 Vinyl Reducing Strips: Minimum 25 mm wide x thickness of flooring on one side, tapered on the other side, minimum 915 mm long.

2.1 **Materials (Cont'd)**

.5 **VCT -** Vinyl Composite Tile: to ASTM F-1066, Class 2, Through Patter, ISO 10595, Type II, Composed of 85% North American Limestone. (12" x 12") 305 mm x 305 mm, (1/8") 3.2 mm gauge.

.1 Armstrong Commercial Vinyl Composition Tile is coated with the Fast Start Factory Finish (not to be stripped upon installation).

.2 Installation: Full spread adhesives – S-515 high moisture, S-521 high-moisture, S-700 thin spread, S-750 Premium.

Refer to Section 00865 Colour Schedule for colour and material selection(s).

.6 **Floor Sealer:** S-495 Commercial Floor Sealer as supplied by Armstrong.

.7 **Rubber Sheet Flooring (RSF):** Size - 1m x 2.7m (3'-0" x 9'-0') 3.0mm to 4.0mm nominal guage, 1900mm wide sheets meeting ASTM F 1913, Smoke 450 or less. MicroTone Palette by Tarkett/ Johnsonite.

.1 Rubber Stair Treads with integrated risers.
.2 Rubber Stingers & Risers.
.3 Provide contrasting grit nosing strips.
.4 Provide weld rod to all seam lines.

Characteristics	**Standard**	**Unit**	**Req'ts**
Hardness	ISO 7619	Shore A	≥ 75
	ASTM D 2240		
Residual Indentation	EN 433	mm	≤ 0,20
Abrasion Resistance	ISO 4649	mm^3	≤ 250
Dimensional Stability	EN 434	%	± 0,40 max
Flexibility	EN 435	-	No fissuring
Colour Fastness	ISO 105-B02	degree	≥ 6 blue ≥ 3 grey
Fire Behaviour	EN 13501-1	class	-
	ASTM E 648		
Slip Resistance	EN 13893	class	≥ 0,30 (DS)
Resistance to Stains	EN423	-	-
Ramp Slip Resistance	DIN 51130	°	BGR 181
Thermal Resistance	DIN 52612	m^2 K/W	-
Electrical Resistance	EN 1081	ohm	-
Electrostatic Charge	EN 1815	kV	-
Reduction to Sound Due to Treading	ISO 10140-3	dB	-
Caster Chairs	EN 425	-	-
VOC Emisions	CA Section 01350	-	various

Performance Criteria	**Test Method**
Modulus at 10% Elongation	ASTM D412
Coefficient of Friction	ASTM D 2047
Hardness Shore A	ASTM D 2240
Taber Abrasion (H18 wheel, 1000g, 1000 cycles)	ASTM D 3389

2.1 **Materials (Cont'd)**

Critical Radiant Flux	ASTM E 648
Optical Density of Smoke	ASTM E 662
Chemical Resistance	ASTM F 925
Static Loading	ASTM F 970
Resistance to Heat	ASTM F 1514
Colour Light Stability	ASTM 1515
Fungal Resistance Test	ASTM G21
GREENGUARD	Certification
GREENGUARD	Gold

Refer to Colour Schedule for colour selection(s).

.8 **TSWI-2** – Tactile Surface Warning Indicators: Eon Tiles by Kinesik Manufactured from a homogeneous composition of 100% synthetic rubber, high quality additives, and colourants to meet ASTM F 1344, Class 1-A and 1-B Standards for Rubber Floor Tile.

Meets Canadian Standards Association (CSA) B651-12, current ISO/FDIS 23599 Assistive Products for The Blind and Vision-Impaired Persons – Tactile Walking Surface Indicators, Division A of Ontario Regulation 332/12, and Accessibility for Ontarians with Disabilities Act (AODA).

Product Features and Specifications:
- Abrasion Resistance (ASTM D 3389): <1.0 gm weight loss
- Hardness (ASTM D 2240): Not less than 85 Shore A
- Slip Resistance (ASTM D 2047): Meets or exceeds a static coefficient of friction of 0.8
- Colour Heat Stability (ASTM F 1514): <8.0 ΔE
- Static Load Limit (ASTM F 970): Passes at 250 psi
- Fire Resistance (ASTME 684 – Critical Radiant Flux): Class 1
- Smoke Development (ASTM 3 662): <450
- Chemical Resistance (ASTM F 925): Passes

Test	Description	Requirements
Antimicrobial Test	ASTM E2180	Pass
Fungi Test	ASTM G21	Pass
Tensile Strength	ASTM D412	0.17 MPa
Tensile Elongation	ASTM D412	700%
Tensile Stress	ASTM D412	6.9 MPa
Hardness (Shore A)	ASTM 2240	> 85
Shrinkage	ASTM D955	0.9 – 1.5%
Melt Temperature		190 – 210°C
Moisture Content		0.05%

Refer to Colour Schedule for colour selection(s).

PART 3 - EXECUTION

3.1 **Inspection** .1 Ensure concrete floors are dry by using test methods recommended by tile resilient flooring manufacturers, and exhibit negative alkalinity, carbonization for dusting. Follow current ASTM F710 guidelines for the preparation of concrete slabs to receive resilient flooring.

3.2 **Subfloor Treatment**

.1 Remove subfloor rides and bumps. Fill low spots, cracks, joints, holes and other defects with subfloor filler.

.2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured.

.3 Apply filler as necessary where resilient flooring terminates at adjacent thicker flooring materials to insure top of finished flooring materials are flush Feather filler sufficiently to eliminate abrupt changes in elevation.

.4 Prime concrete to floor manufacturer's recommendations.

3.3 **General Application**

.1 All flooring materials are to be installed wall to wall over entire floor areas prior to the installation of any cabinet work.

3.4 **Resilient Flooring Application**

.1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.2 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.

.3 Install flooring to square grid pattern with all joints aligned.

.4 Cut tile and fit neatly around fixed objects.

.5 Install flooring in pan type floor access covers. Maintain floor pattern.

.6 Terminate flooring at centerline of door in openings where adjacent floor finish, material or colour is dissimilar.

.7 Provide reducer strip fully bonded to floor where floor covering terminates exposing edge of floor.

3.5 **Resilient Base Application**

.1 Set base in adhesive tightly against wall and floor surfaces.
Use lengths as long as practicable and not less than 600 mm long.

.2 Install straight and level to variation of 1:1000.

.3 Scribe and fit to door frames and other obstructions.

.4 Wrap base around exterior corners as recommended by base manufacturer. Miter internal corners.

.5 Apply base to all millwork surfaces in contract with the floor unless otherwise detailed.

3.6 **Resilient Sheet Installation**

.1 Install in accordance with manufacturer’s recommendations.

.2 Heat weld all seams to create a monolithic and impermeable surface.

.3 Install resilient sheet flooring minimizing cross seams. Provide seam

3.6	**Resilient Sheet Installation (Cont'd)**		diagram during submittal process for approval prior to installation.
		.4	Install the indoor resilient athletic surfacing in strict accordance with the indoor resilient athletic surfacing manufacturer's written instructions.
		.5	Install the indoor resilient athletic surfacing minimizing cross seams. Provide a seam diagram during the submittal process for approval prior to installation.
3.7	**Tactile Surface Warning Indicator Application**	.1	Apply adhesive uniformly using recommended trowel in accordance with product manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
		.2	Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
		.3	Cut tile and fit neatly around fixed objects.
		.4	Provide reducer strip fully bonded to floor where floor covering terminates exposing edge of floor.
3.8	**Protection and Cleaning**	.1	Protect all adjacent surfaces from damage resulting from the work of this scope. Make good all damage.
		.2	Prior to final completion, inspect the work and do all necessary replacement or repair. Replace or repair floor covering which has not seated in a level plane with surrounding material. Replace all damaged rubber base.
		.3	Promptly as the work proceeds and on completion, clean-up and remove from the premises all rubbish and surplus material resulting from the work of this Section.
		.4	Promptly remove adhesive from surface of resilient materials as work progresses.
		.5	Leave resilient floors broom clean, free of building materials, rubbish, paint, adhesives, stains and spills.

End of Section

PART 1 - GENERAL

1.1 **General Requirements** .1 Comply with requirements of Division 1.

1.2 **Scope**

1.1.1 Work includes painting of:

- All new hollow metal doors and frames, inside and out, provided under this contract
- Adjacent painted surfaces damaged as a result of the work of this contract. Patch and make good all surfaces to accept new paint finish.

1.1.2 Contractor shall visit the site to review locations, verify dimensions and determine quantities.

1.1.3 Quality Assurance- Paint work shall meet or exceed standards set out in CGSB-85.100-93.

1.1.4 Delivery, storage and handling

1.1.4.1 Deliver material to site in their original containers with labels intact and store in space directed by School Board.
1.1.4.2 Paint shall be stored at a minimum ambient temperature of 7ºC in a well ventilated and heated space.
1.1.4.3 Keep stored materials covered at all times and take all necessary precaution against fire. Provide CO_2 fire extinguisher of minimum 20 Lbs (9kg) capacity in storage area.

1.3 **Qualifications** .1 **Qualifications of Contractor**

.1 Work of this Section is to be done by Contractor of recognized standing having personnel with a minimum five years experience in this type of work and who have the necessary equipment to carry out the work.

.2 **Qualifications of Manufacturer**

.1 Unless otherwise specified, materials shall be manufactured and supplied by one of the following:

.1 Dulux Paints
.2 Benjamin Moore and Co. Ltd.
.3 Zinsser
.4 Sherwin Williams
.5 Glidden
.6 ICI Paints
.7 PPG Industries
.8 Coronado Industrial Coatings
.9 C2 Paint
.10 Dominion Sure Seal Ltd.

1.2 **ENVIRONMENTAL CONDITIONS**

1.2.1 Do not paint or finish in unclean or improperly ventilated areas. Do not paint when temperatures are lower than 50ºF (10ºC) or varnish when temperatures are lower than 65º F (18º C).

1.2.2 Do not apply paint finish in areas where dust is being generated.

1.3 PROTECTION

1.3.1 Provide metal pans or adequate tarpaulin to protect floors in areas assigned for the storage and mixing of paints.

1.3.2 Use sufficient drop cloths and protective coverings for the full protection of floors, furnishings and work not being painted.

1.3.3 Leave above areas clean and free from evidence of occupancy upon completion of painting.

1.3.4 Protect paint materials from fire and freezing.

1.3.5 Keep waste rags in metal drums containing water and remove from building at the end of each working shift.

1.3.6 Drop clothes shall be provided to prevent paint materials from falling on or marring any adjacent surface not to be painted. If a contractor will be spraying then all adjacent surfaces must be protected. Any damage resulting from the neglect of this provision will be corrected at the expense of the contractor. If there is a pre-existing condition of paint marring an adjacent surface the contractor must bring the condition to the attention of the Consultant prior to commencing work.

PART 2 – PRODUCTS

2.1 MATERIALS - for block walls, hollow metal doors and door frames

Primer:

a. Rust-Oleum - Zinsser Bulls Eye Odourless – SKU - 248263
b. Coronado Industrial Coatings – Coropoxy WB Amine Adduct 1142 Line
c. Sherwin-Williams primer
d. Dulux Lifemaster primer
e. Glidden primer
f. Equivalent primer approved by the Board

Paints and Coatings:

a. PPG Aquapon WB 98-1 Series – Water Base Epoxy – Semi Gloss
b. Sherwin-Williams
(**e.g.** *2 part water based catalyzed epoxy B70W211*
0 Voc semigloss acrylic latex B31WQ2651
0 VOC eggshell acrylic latex B20WQ2651)
c. Dulux Lifemaster finish paint
d. Glidden finish paint
e. Coronado Industrial Coatings – Coropoxy WB Amine Adduct 1142 Line
f. Dominion Sure Seal Ltd. - Premium rubberized Rocker Guard. Location: Undercoat all door frames and sidelights minimum 610mm (2'-0"), and also undercoat doors.
g. Equivalent paint products approved by the Board.

2.2 **MATERIALS -** for drywall, plaster, and cement board:

Primer:

1. Sherwin-Williams primer
2. Dulux Lifemaster primer
3. Glidden primer
4. ICI Paints Canada. – Gripper
5. C2 Paint – C1000 – C2One Interior/Exterior Acrylic Primer/Sealer,
6. Equivalent primer approved by the Board

Paints:

1. Sherwin-Williams finish paint
2. Dulux Lifemaster finish paint
3. Glidden finish paint
4. ICI Paints Canada
5. C2Paint products
6. Equivalent paint products approved by the Board.

2.2.1 Materials shall be "top line quality" products and shall be supplied by a single manufacturer except for specialty products not available from paint manufacturer.

2.2.2 Materials wherever possible shall be low odor products, free of or low in VOC content.

2.2.3 Paints shall be factory mixed unless otherwise specified, except any coating in paste or powder form.

2.2.4 Primers shall be as specified by manufacturer and fully compatible with finish coats.

2.2.5 Thinners, cleaners: as recommended by paint manufacturer.

2.2.6 Before ordering materials, submit written request form acceptable to the Consultant for approval of paint materials. List each of the materials proposed and surfaces to be covered. State manufacturer's name, brand name of materials and provide color name and code.

2.2.7 List of materials shall be endorsed by manufacturer as being the best material for the applicable condition.

2.2.8 Do not order material or commence work until list of materials is approved by the Consultant.

2.2.9 Any exception or variation must be requested by the contractor in writing to the Consultant stating the reason for requesting a change for approval.

2.2.10 All paint shall be delivered to the site in manufacturer's unbroken, sealed containers bearing its original label.

2.2.11 All materials shall be applied in strict accordance with manufacturer's directions as printed on the container and any thinning required shall be done in the manner prescribed; and exclusively with the type of reducer recommended by the manufacturer.

2.2.12 Colors for all finish coats of paint selected to be submitted to the Consultant for review, with duplicate drawdowns supplied to the contractor.

2.2.13 The Contractor shall provide the Material Safety Data Sheets for all materials proposed for use. Provide a separate attachment sheet indicating the protective equipment proposed for use with the materials indicated.

2.2.14 The Board reserves the right to take representative samples of any material the painting contractor brings on the job site and have it tested by an approved laboratory to verify the materials conform to the specifications. Cost of tests, if required, shall be paid for by the Contractor.

2.2.15 Provide block fillers, primers, and finish coat materials that are compatible with each other and with the substrates indicated.

2.2.16 Provide manufacturer's factory formulated paint material of the various coating types specified that are recommended by manufacturer for application indicated. Paint containers must display manufacturer's product identification.

2.2.17 Paint colour for walls to be: Dulux – Ghost Writer # DLX 1007-3

PART 3 – EXECUTION

3.1 PRE-CONSTRUCTION MEETING AND DOCUMENTATION

3.1.1 Prior to commencement of work, the Contractor shall meet with the Board Representative and Consultant to discuss paint colors, review the work area and to discuss the proposed schedule.

3.1.2 The proposed schedule shall include shifts to be worked, proposed work force, starting date, and completion date.

3.1.3 The Contractor shall provide the Material Safety Data Sheets for all materials proposed for use. Provide a separate attachment sheet indicating the protective equipment proposed for use with the material indicated.

3.1.4 Where work area is adjacent to occupied areas, install enclosure using 6 mil clear polyethylene sheeting sealed with tape.

3.1.5 Post warning signs that read "CAUTION – PAINTING IN PROGRESS – AUTHORIZED PERSONNEL ONLY".

3.1.6 **Each stage of work must be signed off by Consultant before starting the next stage:**

Stage 1. - Area/Surface to be cleaned and properly prepared for priming.
Stage 2. - Area/Surface to be primed.
Stage 3. - Area/Surface to be painted –first finish/coat.
Stage 4. - Area/Surface to be painted – second finish/coat.
Stage 5 – third coat if necessary.

The contractor must provide 24 hour notice to Consultant for review of each stage.

3.2 CONDITION OF SURFACES

3.2.1 Measure all surfaces with electric moisture meter and do not proceed if reading is higher than 12-15 without written permission from the Board Representative.

3.2.2 Proceed with work only when surfaces and conditions are satisfactory for production of a first class job.

3.2.3 Remove dust, grease, rust and extraneous matter from all surfaces (except that rust occurring on items specified to be primed under other sections shall be removed and work re-primed under these sections).

3.2.4 The commencing of work in a specific area shall be construed as acceptance of the surfaces, and thereafter the contractor shall be fully responsible for satisfactory work as required herein.

3.3 PREPARATION

3.3.1 Refer to Canadian standard CAN/CGSB 85.100 or Master Painter's Institute Architectural Specification Manual. Paint application shall not be started when the surfaces to be painted have not been properly prepared. All surfaces must be dry, clean, and free from dust, dirt, grease, oil, rust, mortar spatters, salts and any other foreign matter likely to affect the adhesion and the appearance of paint finishes.

3.3.2 Surfaces to be painted or to receive a transparent finish shall be dry and free from tool or sandpaper marks, dust, glue, any type tape, rust, insects, grease and any other foreign matter liable to impair finished work, Touch up where necessary.

3.3.3 No finish or paint shall be applied to wet or rusty materials. Prepare such defective surfaces as necessary to obtain a satisfactory painting surface.

3.3.4 All previously painted wood, plaster and other surfaces which will be repainted shall be properly prepared by sanding, cutting, tilling and patching to give a smooth, true surface.

3.3.5 All existing painted metal surfaces to be repainted shall be similarly prepared with all rust removed by wire brushing; under no circumstances shall any paint be applied over rust. Rust inhibiting primer shall be used prior to application of finish coat.

3.3.6 Cracked and deteriorated mortar joints in concrete block shall be repainted.

3.3.7 Cracks in block walls shall be caulked using paintable caulking.

3.3.8 The vendor shall remove and afterwards replace all removable furniture, mirrors, towel and/or toilet tissue dispensers and all other removable items mounted on the surfaces to be painted.

3.4 PRIMING SURFACES

3.4.1 All exposed block, wood or painted metal surfaces shall be primed before applying finish.

3.5 APPLICATION

3.5.1 All primed areas to have two finishing coats applied. Finishes and number of coats specified in the schedule are intended to cover surfaces perfectly. If they do not cover the surface, apply further coats until perfect coverage is achieved as required.

3.5.2 Mask and cover all surrounding surfaces to provide neat, clean, true juncture lines and to keep paint from adjacent surfaces. All glass to be left free from paint.

3.5.3 Finishes shall be applied to flat surfaces by brush or roller. Windows, trims, piping and metal surfaces by brush only. Spray painting will NOT be permitted unless previously approved in writing by the Plant Department.

3.5.4 All finishes shall be applied by skilled labour over clean and dry surfaces only. All material shall be applied according to the manufacturer's directions.

3.5.5 Before applying any material to any surface, clean off all rust and loose materials, soiling and grease, using wire brushes and abrasive on metal only. On wood, use only sand paper, any other means of cleaning is not acceptable.

3.5.6 All coats of paint, varnish or enamel shall be perfectly dry and hard before the next coat is applied and the surfaces of trim sanded between coats.

3.5.7 All previously stained or varnished surfaces shall be varnished unless otherwise specified.

3.5.8 When refinishing metal surfaces, care must be taken to ensure a complete bonding of the finishing paint to the surface to be painted.

3.5.9 Any areas exhibiting incomplete or unsatisfactory coverage shall have the entire plane painted. Patching will not be acceptable.

3.5.10 Where two coats of the same paint are to be applied, the first coat shall be the same color as the finish coat.

3.5.11 Spray painting will not be permitted unless specifically approved by the Plant Department. Plant Department may withdraw approval at any time and prohibit spray painting for reasons such as carelessness, poor masking or protection measures, drifting paint fog, disturbance to other Trades or failure to obtain a dense, even, opaque finish. Spray painting shall be full double coat, i.e. at least two passes for each coat. Do not use spray or roller on wood or metal surfaces (brush only) unless approved in writing by Plant Department. Arrange to have traffic barred from completed areas wherever possible. Apply materials in strict accordance with manufacturer's directions and specifications and be familiar with these directions and specifications.

3.5.12 Apply two coats minimum of Premium Rubberized Rocker Guard undercoating by Dominion Sure Seal Ltd. or approved equal, to inside of all metal door frames and sidelights. Undercoat minimum 600mm (2'-0") from underside / bottom surface. Undercoat doors. Apply additional coatings as requested by Plant Department.

3.5.13 At completion, clean entire area of surplus materials and equipment.

3.5.14 Cracks occurring in walls or ceilings requiring patching during "warranty period" shall be repainted in such a way that the patch is not visible at a distance of 5'-0" (1500 mm). If patch painting is not acceptable, repaint entire wall or ceiling surface.

3.5.15 "Warranty period" is two (2) years. The contractor shall ensure that the newly applied primer and finish coats bond with the existing painted surface for a period of two (2) years. Excluding vandalism.

3.6 MAINTENANCE MATERIAL

3.6.1 Provided four sealed cans, one liter capacity, of each product in each color used in the Work for Owner's use in maintenance work.
3.6.2 Container to be new fully labeled with manufacturer's name, type of paint, and color.

3.7 COMPLETION

3.7.1 At the end of each workday, remove empty cans, rags, rubbish, and other discarded materials from project site and shall not be permitted to accumulate. Materials such as rags used with

certain products may begin to self combust. After use, put rags in water or lay flat to dry, and then discard.

3.7.2 Upon completion of the work of this section, remove surplus materials, tools, equipment and debris and leave the site in a clean and tidy condition to the complete satisfaction of the Board Representative.

3.8 WORKMANSHIP AND REQUIREMENTS

3.8.1 All materials shall be applied and cut in neatly so as to dry uniformly to the color and sheen specified, free from runs, sags, wrinkles, shiners, streaks, and brush marks.

3.8.2 Do not paint over architectural numbers or fire rating labels on door frames.

3.8.3 During the actual application and drying of the paint and until normal occupancy of the building occurs a minimum temperature of 15 °C shall be maintained. This temperature shall be held as constant as possible to prevent condensation. Enamel undercoats shall be sanded smooth prior to re-coating.

3.8.4 Door edges shall be finished in the same manner as the remainder of the door surfaces.

3.8.5 No exterior painting shall be undertaken at temperatures under 10 °C or immediately following rain, frost, or dew.

3.8.6 Safe levels for painting shall be determined by use of an electronic moisture meter.

3.8.7 The areas in which the contractor has been conducting his work shall be left in a clean and orderly condition, with all paint spots, rags, and discarded equipment removed.

3.8.8 All coats of paint shall be thoroughly dry before applying succeeding coats. All primer and intermediate coats of paint shall be sanded lightly and dusted before succeeding coats of paint are applied. All finished surfaces blemished with dust particles shall be sanded smooth and refinished.

3.8.9 Where damage to or patching of any kind occurs on any newly finished surface, the entire plane shall be refinished terminating only at a definite break or change in direction of the plane surface. No spot touch-ups will be permitted.

3.8.10 Where the specification calls for one coat of primer and only one coat of finish, the primer is to be shaded to the approximate shade of the finish coat.

3.8.11 Any work which does not meet the approval of the Board shall be immediately corrected. If the work is not corrected, the Board reserves the right to deduct from the amount due the contractor under his written contract.

3.8.12 Paint shall be applied so that one-inch strip of the proceeding coat is discernible at the base of walls.

3.8.13 No paint or finishing to be done in any area unless area is **broom clean**.

3.8.14 All surfaces, with the exception of walls, shall be tipped with a brush if a roller has been used to apply the finish. Roller marks will not be accepted on doors, frames, etc.

End of Section

PART 1 - GENERAL

1.1 **General Requirements** .1 Comply with requirements of Division 1.

1.2 **Qualifications** .1 The following manufacturers are acceptable:

.1 Architectural School Products - Mississauga
.2 CVET1 Products Ltd.
.3 Martack Specialties Ltd.
.4 Forbo
.5 Global School Products

1.3 **Guarantee** .1 Provide the following guarantee in accordance with the General Conditions, notwithstanding the time provisions therein to replace whiteboards showing any manufacturing defects which impair proper use of board.

Ten years material and labour.

1.4 **Submittals** .1 Shop Drawings

.1 Provide shop drawings in accordance with the General Conditions. Show dimensional layouts together with fabrication and installation details based on site conditions.

.2 Samples

.1 Submit samples to the Consultant, if requested, for perusal and approval of all materials to be utilized in this installation.

1.5 **Inspecting** .1 Inspect all surfaces for irregularities, trueness, and rigidity and projections and notify the General Contractor for correction.

.2 On completion of the installation all materials and workmanship to be inspected for proper operation, rigidity and appearance, and any defective materials to be replaced with the materials prior to final inspection.

1.6 **Product Delivery & Storage** .1 Deliver whiteboards and tackboards to site in properly packed crates. Store material in dry area within building held off floor on 50 mm x 100 mm blocking.

1.7 **Protection** .1 During installation utmost care is to be taken by workmen to ensure the protection of the work from damage by other trades until the building is ready for occupation and handed over to the owner.

.2 Protection of all materials during the painting operation shall be carried out using polyethylene covering which shall be the responsibility of the painting contractor.

PART 2 - PRODUCTS

2.1 **Whiteboard** .1 12.7 mm thick porcelain enamelled board with minimum 0.75 mm thick steel writing surface laminated to 11 mm impregnated fibreboard core and 0.48 mm thick stretcher levelled zinc coated steel back sheet.

.2 Porcelain enamel finish shall meet requirements of the Porcelain Enamel Institute Standard S104. Acceptable finish: Duracite.

2.2 **Tackboards** .1 6 mm thick natural cork, fine grain, factory laminated to 6 mm thick particleboard, to maximum size of 1.22 x 2.44 m. Tackboards to meet all requirements of O.B.C. for flame spread ratings.

2.3 **Trim** .1 Whiteboard and Tackboards:

.1 Material: Extruded aluminum sections, 6063-T5 alloy.

.2 Design: Series 200 by Architectural School Products (A.S.P.).

.3 Perimeter trim: A.S.P. #207 and #207 divider

.4 Maprail above each whiteboard and tackboard: Kwickgrip display rail.

.5 Rail below each whiteboard: A.S.P. #212.

2.4 **Finishes** .1 Whiteboards: White.

.2 Trim: Clear etched and anodized.

2.5 **Fabrication** .1 Pre-assemble, as far as possible, whiteboards and tackboards in factory.

.2 Trim joints shall be hairline type, neat and tight, mitre corners.

.3 Affix a label to upper right-hand corner of each whiteboard unit, stating manufacturer's recommended care and maintenance instructions.

PART 3 - EXECUTION

3.1 **Installation** .1 Erection of materials to be carried out by competent craftsmen supervised by a foreman with at least two years experience in this specialized field.

.2 Overhead work such as ceiling girds, plumbing, electrical services, communications systems, painting, etc., to be in an advanced stage of completion in order not to impede this sub-contractor. Millwork units forming integral part of the whiteboard/tackboard installation to be located and affixed to the walls before commencing whiteboard/tackboard installation.

.3 Install Whiteboards and tackboards in accordance with manufacturer's printed instructions.

.4 Install whiteboards and tackboards plumb, square, in true plane and fasten securely to substrate.

.5 All fastenings shall be concealed.

. .6 Ensure that where boards are joined the joint is uniform, neat and tight, and the boards are properly aligned.

.7 Field measure masonry recess for gymnasium whiteboard. Custom fit to allow a maximum of 12 mm space between trim and block.

3.1	**Installation (Cont'd)**	.8	Tackboards to be adhered to wall surface by the use of an adhesive as recommended by the supplier applied in egg-size blobs at approximately 200 mm centres. Tackboards to be pressed firmly into this adhesive to ensure proper adhesion.
		.9	Whiteboards to be joined together by the use of a 14-gauge x 25.4 mm wide steel spline and an extruded polyvinyl slotted insert to ensure a flush butt joint with a hairline appearance.
		.10	All writing boards are to be whiteboards.
3.2	**Cleaning**	.1	Upon completion of all work clean down, remove all stains, loose dirt and excessive adhesive, and leave all elements in a first-class condition at the point of handing over to the owner.

End of Section

PART 1 - GENERAL

1.1 **General Requirements**

.1 Comply with requirements of Division 1.

1.2 **Submittals**

.1 Submit shop drawings for all items specified in this section in accordance with the General Conditions.

.2 Clearly indicate fabrication details, plans, elevations, hardware and installation details.

1.3 **Product Handling**

.1 Protect all items from damage.

.2 Store items in heated weatherproof area.

.3 Do not remove protective coverings from items until immediately prior to final inspection by Owner.

PART 2 - PRODUCTS

2.1 **Fabrication**

.1 Fabricate items true to dimensions, square, plumb, and level.

.2 Joints and intersecting members shall be accurately fitted with adequate fastenings.

.3 Finished work shall be free from distortion and defects detrimental to appearance and performance.

.4 Fit and assemble work in shop where possible. Execute according to details and approved shop drawings. Where shop fabrication is not practical, make trial assembly in shop.

.5 Nonferrous metals shall not be primed nor painted unless otherwise shown.

2.2 **Continuous Coat Rack**

.1 Provide Architectural School Products Series STL 1001 wall mounted aluminum tube rack.

.2 Provide two rows of double prong hooks spaced 150 mm apart.
Colours – refer to spec section 00865 Colour Schedule.

.3 Provide continuous racks in corridors as indicated.

2.3 **Expansion Joints**

.1 Provide the following extruded aluminum expansion joint assemblies as manufactured by C/S Construction Specialties Ltd.:
Wall/Ceiling: Model ASMC-100X -25mm.

PART 3 - EXECUTION

3.1 **Preparation**

.1 Report to the Contractor, in writing, defects of work prepared by other trades and unsatisfactory site conditions.

.2 Verify all dimensions on the site.

3.2 **Installation General**

.1 Install items in accordance with Manufacturer's printed directions.

.2 Give actual dimensions of item to the General Contractor so that sufficient

space is allowed for installation.

.3 Use sufficient fastenings and anchors to provide a rigid installation to withstand expected usage.

End of Section

CONTENTS

END OF SECTION

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION

.1 Refer to drawings for detailed demolition scope of work.

.2 All existing building services not affected by this work shall be maintained in operation during and after the demolition work is complete. Any accidental interruption of existing building services not required by this project will be promptly repaired at no additional cost to the Board.

.3 Prior to removing any piping, ensure the system is completely isolated and is not live.

.4 Complete all work impacting existing Building Operations after hours only.

1.2 QUALIFICATIONS

.1 Work of this section shall be executed by trades personnel having a minimum of five years' experience in the demolition field and capable to deploy adequate equipment to complete the work in an efficient and orderly manner.

1.3 EXAMINATION

.1 Examine existing property. Determine the nature of materials to be removed.

1.4 SALVAGE

.1 The Board Representative will review the Site prior to commencement of demolition and instruct the Contractor, in writing, as to the items to be retained for re-use or be turned over to the Board. In the absence of such specific instructions, materials from demolition shall become property of Mechanical Contractor who shall promptly remove all salvageable material and debris from Site.

.2 Remove and store indicated items for future use by the Board. Remove, handle and transport such items to storage area designated by the Board Representative. Perform such work carefully and with diligence to prevent any damage to the items during removal and in storage. Store material to be salvaged, neatly on wooden pallets, where directed by Board.

1.5 MAINTAINING TRAFFIC

.1 Maintain and preserve Board's access requirements within, to and from existing building in areas where demolition and removal work is being carried out.

.2 Do not close, obstruct, place or store material in Board's driveways and passageways. Conduct operations with minimum interference with roads, streets, driveways, user traffic and passageways.

1.6 HAULING OPERATIONS

.1 Maintain roadways and paving in the hauling areas clean on a daily basis and as required by Municipal Authorities.

1.7 INTERRUPTIONS TO BOARD'S OPERATIONS

.1 There will be absolutely no interruptions to the School schedule during demolition work. Therefore, it is imperative that operations and machine and equipment movements, deliveries and removals are executed at time or times that will permit uninterrupted Board's operations in and around the school, including parking, receiving areas, deliveries and site and access and egress.

.2 Where interruptions of domestic cold and hot water are necessary, coordinate with the School Representatives the timing and duration of such interruptions.

1.8 SAFETY REQUIREMENTS

.1 Coordinate posting of danger signs conspicuously around property. Close doorways and thoroughfares giving access to area of demolition with barricades.

.2 Provide a competent, experienced supervisor in charge of the Work and on Site while work is in progress.

.3 Should any suspect designated substance not already identified, be encountered, cease work in the immediate area and immediately report, to the Board. Board is responsible for removal of designated substances.

1.9 PROTECTION

.1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, parts of existing building to remain. Make good any collateral damage caused by demolition.

.2 Take precautions to support affected structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify Board.

.3 Prevent debris from blocking drainage systems (floor drains) or other mechanical and electrical systems that must remain in operation.

.4 Protect building floors against damage from demolition work. Use ½" plywood covers over floor where lifting, moving, rolling of removed equipment is anticipated. Be responsible for repairing any damage to flooring caused by the work defined in this section. Execute repairs to the satisfaction of the Board at no cost to the Board.

PART2 - PRODUCTS

Not applicable

PART3 – EXECUTION

3.1 DEMOLITION

.1 At the end of each day's work, leave site in a safe condition and erect safety barriers and lights as required. Ensure that no parts of the existing building are in danger of collapsing.

.2 Review the requirements of new equipment to be installed. Perform all demolition work required to allow for the new equipment to be installed, whether shown on the drawings or not.

.3 Control dust and dirt produced during demolition.

.4 Provide any additional labour, materials and services not specifically indicated on the drawings but required to complete the work.

.5 Dispose of demolished materials in accordance with the requirements of Authorities Having Jurisdiction.

.6 At the end of demolition work, leave site in broom-clean condition. Clean existing surfaces specified to receive new applied finishes to ensure proper adherence.

.7 Do not disturb adjacent structures or equipment designated to remain in place.

.8 Confine operations and workers to those parts of the building which are defined on the drawings and exercise great care not to damage existing construction beyond that necessary for the carrying out of new work. Make good any such damage in every respect, to the satisfaction of the Board.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section of the specification is an integral part of the Contract Documents and shall be read accordingly.

.2 Where applicable, all portions of the Mechanical Supplementary Tender Form shall be submitted by bidders.

1.2 DUTIES OF MECHANICAL CONTRACTOR

.1 The mechanical contractor shall assume the responsibilities and duties including but not limited to the ones described below:

.2 Superintendence

.1 Provide full time on-site superintendent personnel and supporting staff with proven experience in project of similar value and complexity.

.2 Site superintendent shall have over-all authority to speak for and represent the mechanical contractor.

.3 Coordination

.1 Coordinate the work with all the sub-trades involved to ensure that the work will be carried out on schedule and in proper sequence.

.2 Take complete responsibility for all remedial work that results from failure to coordinate any aspect of the mechanical work prior to its fabrication and/or installation.

.3 Take responsibility for the delivery of equipment necessary to complete the work in accordance with the approved schedule.

.4 Staffing and Scheduling

.1 Within seven days after the award of the contract, the Mechanical Contractor shall provide to the Owner’s representative the following information:

1 Appointment of official representatives in the project.
2 Schedule of work.
3 Delivery schedule for specified equipment.
4 Requirements for temporary facilities, site signs, storage, etc.

.5 Work Completion Meeting

.1 Prior to application for Substantial Performance of the Work, the mechanical contractor shall participate in the take-over meeting. Agenda to include the following:

1 Review of outstanding deficiencies.
2 Submission of maintenance manuals, warranties and as-built drawings.
3 Results of performance tests and described further in this section.
4 Scheduling of training to Owner's personnel.

1.3 INTENT

.1 Bidders for this work shall include for all labor, material, equipment and all other related cost including all applicable taxes (except HST) and fees to provide the work as indicated on the drawings.

.2 Misinterpretation of any requirement of the drawings and specifications will not relieve the Mechanical Contractor of responsibility. If in any doubt, the Mechanical Contractor shall contact the Consultant for written clarification prior to submitting a bid for the Work.

.3 Supplementary to definitions established are:

1. "Concealed" means hidden from normal sign in furred spaces, shafts, ceiling spaces, walls, or partitions.

2. "Exposed" means work normally visible, including work in equipment rooms, tunnels, and similar spaces.

3. "Provide" (and all tenses) means supply and install for a complete, operational, and code-compliant system, including all devices, equipment, materials, accessories and/or components as specified or as otherwise required for a complete, operational, and code-compliant installation.

4. "Install" (and all tenses) means secure in position, connect as specified, test, and verify.

5. "Supply" means to supply all devices, equipment, materials, accessories and/or components to the responsible trade.

6. "Remove" means to isolate, disconnect, disassemble, remove, and dispose of all devices, equipment, materials, accessories and/or components. Patch and make good all surfaces affected by the removal. Remove and dispose of all redundant material off site.

.4 Where used, wordings such as "approved, to approval, as directed, permitted, permission, accepted, acceptance", shall mean: approved, directed, permitted, accepted, by authorized representative of the Owner.

1.4 INTERFERENCES

.1 The mechanical drawings do not show all the architectural and structural details, and any information involving accurate measuring of the building shall be taken from the building drawings or at the building. Make without additional change, any necessary changes or additions to the runs of drains, pipes, ducts, etc., to accommodate the above conditions. The

location of equipment may be altered without charge providing the change is made before installation and does not necessitate major additional material.

.2 Wherever differences occur between specifications, riser diagrams or schematics and drawings, the maximum conditions shall govern and the bid shall be based on whichever information indicates the greater cost.

.3 Field verifications of dimensions on plans shall be made since actual locations, distances, and levels will be governed by actual field conditions.

.4 Discrepancies between different plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Consultant for a decision.

.5 Install all mechanical services including but not exclusive to drains, pipes, and ducts, to conserve headroom and interfere as little as possible with the free use of the space through which they pass. Install as high as possible, unless otherwise directed by the Consultant All drains, pipes, ducts, etc., particularly those which may interfere with the inside treatment of the building, or conflicting with other trades, shall be installed only after the locations have been approved by the Consultant. Special care shall be taken in the installation of all mechanical services including, but not exclusive to drains, pipes, and ducts, which are to be concealed, to see that they come within the finished lines of floors, walls, and ceilings. Where such drains, pipes, ducts, etc., have been installed in such a manner as to cause interference, they shall be removed and re-installed in suitable locations without extra cost to the Owner.

.6 Before commencing work, check and verify all grade and invert elevations, stacks, levels, and dimensions, to ensure proper and correct installation of the work.

.7 In every place where there is space indicated as reserved for future or other equipment, leave such space clear, install blank offs, shut off valves with blind flanges and other work so that the necessary connections can be made without any stoppages to the system. Consult with the consultant whenever necessary for this purpose.

.8 In addition to the work specifically mentioned in the Specifications and shown on the drawings, provide all other items that are obviously necessary to make a complete working installation, including those required by the Authorities Having Jurisdiction over the work.

.9 The mechanical plans show approximate locations for wall mounted devices. Obtain Consultant's approval of mounting heights and locations before commencement of work.

.10 Prepare and submit complete interference drawings (in PDF format) to avoid and/or resolve conflict of trades and to coordinate the work of the Mechanical Division with that of all other Trades. Submission of interference drawings shall be done no later than 10 business days after the Project has officially begun. The cost of producing the interference drawings shall be included for in the Base Tender Price.

.11 Include costs (in the Base Tender Price) for the services of a third-party to 3D scan the entire area of construction upon completion of demolition. System shall be Matterport or similar. The

intent to is capture and submit to the Consultant a full 3D perspective of the space. This model shall be used to identify any potential conflicts ahead of installation and ordering of equipment to allow for quick resolution of site conflicts. 3D Model shall capture all architectural, structural, mechanical and electrical conditions on site and all such conditions shall be part of the model. The model, along with site verifications, shall be used as the basis for interference drawings.

1.5 EXAMINE SITE

.1 Examine the site and the local conditions affecting the work. Examine carefully all drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Consultant.

1.6 SUBCONTRACTOR'S SHOP

.1 Provide Job site office, work-shop, tools, scaffolds, material storage, etc., as required to complete the work.

1.7 CLEANING

.1 During the performance of the work and on the completion, remove from the place of the work all debris, rubbish and waste materials caused by the performance of the work. Remove all tools and surplus materials after completion and acceptance of the work.

.2 All equipment shall be thoroughly vacuumed out at the time of final acceptance of the work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Protection of Equipment:

.1 Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.

.2 Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Consultant. Such repair or replacement shall be at no additional cost to the Owner.

.3 Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

.4 Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

.2 Cleanliness of Piping and Equipment Systems:

.1 Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.

.2 Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

.3 Clean interior of all tanks prior to delivery for beneficial use by the Owner.

.4 Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.9 INSTALLATION OF WORK

.1 Be responsible for:

.1 The layout of the work shown on the drawings and specified herein, and for any damage caused to the Owner by improper location or carrying out of this work.

.2 The prompt installation of the work in advance of concrete pouring or similar work.

.3 The condition of all material and equipment supplied and for the protection and maintenance of work completed.

.2 Coordinate with other trades and schedule all work to suit the date for the substantial performance established in the construction contract.

.3 Furnish items to be "built-up" in ample time and give necessary information and assistance in connection with the building in of the same.

.4 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule.

.5 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Owner within the time limit stipulated.

.6 Furnish promptly information required for the construction schedule.

.7 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.

.8 All new ductwork and piping shall be supported from a secondary structure site supplied and installed by the Contractor consisting of unistruct (or alternate as necessary) structure fastened to the building OWSJ structure. No supporting of piping, conduits ductwork or equipment from the roof deck will be permitted.

1.10 CODES, PERMITS, FEES AND CONNECTIONS

.1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance

with requirements of By-Laws and Regulations in force in area where the building is to be erected.

.2 Apply for, obtain, and pay for all permits, fees and service connections for the work and the inspections required by Authorities Having Jurisdiction in the area where the building is to be erected.

.3 In particular, coordinate with and pay for the local gas supply company to adjust/modify/replace the existing gas meter assembly and PRV as required to ensure that the available gas pressure is adequate for all gas fired equipment to operate simultaneously at maximum capacity. The minimum gas pressure at the boiler shall not be less than 8" w.g. under simultaneous maximum operating condition of all gas-fired equipment.

.4 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.

.5 When part of equipment does not bear the required CSA label, the contractor shall obtain from CSA or Hydro Electric Power Commission, when that part of the equipment is an electric component, a special approval and pay the applicable fees.

.6 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.

1.11 MATERIALS

.1 Where materials, equipment, apparatus, or other products are specified by the manufacturer, brand name, type or catalogue number, such designation is to establish standards of desired quality style or dimensions and shall be the basis of the Bid. Materials so specified shall be furnished under this Contract, unless changed by mutual agreement. Where two or more designations are listed, the Contractor shall base the submitted Tender Price based on the base specified equipment; any approved alternate will only be entertained after Notification of Award.

1.12 BASE BID SPECIFIED EQUIPENT& SUBSTITUTIONS WITH APPROVED ALTERNATES

.1 Requests for substitutions will not be accepted prior to the Notification of Award. Substitutions will be considered:

1) The proposed substitutions have been investigated and complete data are submitted which clearly includes highlighting all aspects that meet the specifications. Consultant will only review data submitted. Incomplete data will be grounds for non-acceptance.

2) Data relating to changes in the Contract Schedule, if any, and relation to other Work have been submitted.

3) Same warranty is given for the substitution as for the original Product specified.

4) All claims are waived for additional costs related to the substitution which may subsequently arise.

5) Installation of the accepted substitution is co-ordinated into the Work and that full responsibility is assumed when substitutions affect other work. Make any necessary changes required to complete the Work. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.

1.13 MATERIAL SUBSTITUTIONS

.1 After execution of the Contract, requests for substitution of materials of makes other than those specifically named in the Contract Documents may be approved by the Consultant, subject to owner's review and acceptance of the financial credits involved.

.2 In the absence of such express approval by the Consultant, the Mechanical Contractor will be held to furnish specified items under the base bid.

1.14 SHOP DRAWINGS AND SAMPLES

.1 Submit to the Consultant detailed dimension shop drawings and installation wiring diagrams for all mechanical equipment. Further details and special requirements called for in these specifications shall be shown on the shop drawings.

.2 Ensure that copies of all reviewed shop drawings are available on the job site for reference.

.3 Provide samples of mechanical equipment as requested in the specification at the same time as the shop drawing submission.

.4 **The Mechanical Contractor is responsible for consolidating all Mechanical Shop Drawings and submitted them in no more than three (3) packages as per the following:**

1. HVAC Equipment and Material.
2. Plumbing Equipment, Fixtures and Material.
3. Fire Protection Equipment, Fixtures and Material.

Individual shop drawings not consolidated will not be accepted.

1.15 AS-BUILT DRAWINGS

.1 Maintain up to date "as built" drawings on site.

.2 At the conclusion of the project, the Consultant will forward to the Contractor a set of electronic files of the project. The Contractor shall modify the files as required, to reflect the as-built conditions, mark them conspicuously in the title block as "as-built drawings" and submit the modified files to the Consultant for review. Completion of the As-Built Drawings in AutoCAD will be the responsibility of the Mechanical Contractor at no extra cost to the project. The

Mechanical Contractor is responsible for updating all Architectural Plans based on the Architectural As-Builts while producing the Mechanical As-Builts

.3 Put a digital copy of the as-built files (in AutoCAD 2017 format) as part of the Operations and Maintenance manuals.

.4 Any subsequent changes found by the Consultant shall remain the responsibility of the Contractor at no charge to the Owner.

1.16 TEMPORARY AND TRIAL USAGE

.1 After any part of the work has been completed, the Consultant will make an inspection, and performance tests of such parts shall be carried out under the direction of the Consultant. If deficiencies are found, they shall be immediately rectified to the satisfaction of the Consultant. After such deficiencies have been rectified, the work shall be placed in service at such time and in such order as the Consultant may direct. If, in placing a portion of the equipment in service, it is necessary to make temporary connections in the wiring in order to obtain proper operation, such connections shall be provided to the extent and in the manner required by the Consultant.

.2 Temporary or trial usage of any mechanical devices, machinery, apparatus, equipment or materials shall not be construed as evidence of the acceptance of same.

.3 No claims for damage will be considered for injury to, or the breaking of any parts of such work which may be used.

1.17 CONSULTANT'S INSTRUCTIONS

.1 During construction the Consultant will issue such instructions as may be necessary for verification and corrections of the work. These instructions shall be binding as part of the specification.

1.18 ADDITIONAL WORK AND CHANGES

.1 Unless a written order, reviewed by the Consultant and countersigned or otherwise approved by the Owner Representative, no additional work shall be undertaken by the Contractor.

1.19 WARRANTY

.1 The Mechanical Contractor shall guarantee all work and apparatus installed under his contract against all defects of workmanship and material for a period of one (1) year after the Substantial Performance of the Work , unless otherwise mentioned in the Specifications, and shall make good any and all defects developing during such time without expense to the Owner. Any materials shall be further guaranteed as may be called for in these specifications. Where warranties on equipment extend beyond one (1) year the Mechanical Contractor shall honor the extended warranty.

1.20 SCHEDULING OF WORK

.1 For all work to be performed under this contract, adhere to Construction Schedule agreed upon with the Owner Representative.

1.21 ENERGY CONSUMPTION

.1 The Consultant may reject equipment submitted for approval on basis of performance or energy consumed or demanded.

.2 All equipment installed on the project shall conform to the requirements outlined in ASHRAE 90.1 latest edition.

1.22 ELECTRIC MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install an acceptable motor for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 All motors shall be manufactured and installed in accordance with CSA requirements.

.4 Motor speed shall be 1750 rpm unless otherwise specified.

.5 All motors shall be "T" frame CEMA Standard Design "B" with Class "B" insulation, 40□C ambient, standard drip-proof with a 1.15 service factor, or as otherwise specified. Motors in air stream or exposed shall be TEFC type.

.6 Motors shall be of adequate size to operate associated equipment and drive mechanisms under all conditions of load and service and to bring equipment up to operating speed within 13 seconds without overloading, and be not less than the nameplate HP specified or indicated on the Drawings.

.7 Integral HP motor sizes ½ HP and above shall be squirrel cage induction motors rated 575 volt or 230volt, 3 phase, 60 hertz, unless noted otherwise.

.8 Fractional HP motors up to but not including ½ HP shall be rated 120 volt, single phase, 60 hertz and will be capacitor start, induction motors, with adequate thrust capacity when used with direct mounted equipment, and shall be provided with integral overload and overheating protection. Shaded pole starting devices will not be accepted.

.9 Multi-speed motors and associated switching devices shall be circuited to protect the motor at each speed.

.10 All motors, 1 HP and up shall comply with the Ontario Hydro EnerMark Motor Efficiency Level as tested either CSA 390 M 1985, or IEEE 112B, and be approved under the Canadian Electrical Safety Code.

.11 All starter panels shall be lockable and supplied with locks.

.12 Special Requirements:

.1 Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Owner.

.2 Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.

.13 Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:

.1 Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.

.2 Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.

.3 Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

.14 Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

.15 Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

.16 Insulation Resistance: Not less than one half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

1.23 EQUIPMENT REQUIREMENTS AND INSTALLATION

.1 Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping and duct systems and without interference from building structure or other equipment.

.2 Provide accessible means for lubricating equipment including permanent lubricated bearings.

.3 For all base mounted boilers, pumps, compressors, air handling units, fans and other rotating equipment, provide chamfered edge housekeeping pads a minimum of 4" high and 4" larger than equipment dimensions all around. Work shall be performed by the trades specializing in this work.

.4 Pipe drain lines, overflows and safety relief vents to drains. If the horizontal drains present a tripping hazard, use aluminum checkered plate covers.

.5 Line-up equipment, rectangular cleanouts and similar items with building walls wherever possible.

1.24 LIFTING ATTACHMENTS

.1 Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

1.25 THERMOMETERS AND PRESSURE GAUGES

.1 General:

.1 Locate direct reading thermometers and gauges for reading from floor or platform.

.2 Provide remote reading thermometers and gauges where direct reading instruments cannot be satisfactorily located.

.3 Locate engraved lamacoid nameplate as specified in Section Identification, identifying medium adjacent to thermometers and gauges.

.2 Thermometers:

.1 Industrial, 9" adjustable angle cast aluminum case, CGSB standard CAN/CGSB-14.4-M88 red reading mercury, lens front tube, white scale black embossed figures, clear glass or acrylic window, tapered aluminum stem.

.2 Scale shall be suitable for 2 times the temperature range of service. Scale shall be combined Celsius and Fahrenheit.

.3 Standard of Acceptance: Weiss, Ashcroft, Trerice.

.3 Pressure Gauges:

.1 5" dial, solid front blow out back, fibreglass reinforced polypropylene case, phosphor bronze bourdon tube and brass 1/4" N.P.T. socket, bottom connection, stainless steel rotary type movement, gauge to be registered with the Provincial Boiler and Pressure Vessel Safety Branch with a registration number and conform to ANSI B40.1. Accuracy to be grade "A".

.2 On pumps liquid filled gauges shall be utilized.

.3 Standard of Acceptance: Weiss, Ashcroft, Trerice.

.4 Provide bronze stop cock, bronze bar stock 1/4" N.P.T. bronze porous core pressure snubber for pulsating operation and diaphragm for corrosive service.

.5 Use materials compatible with system requirements.

.6 Gauges shall have combined kilopascal and psi scales.

1.26 PIPE HANGERS AND SUPPORTS

.1 General

.1 Pipe Supports: Comply with MSS SP 58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP 69.

.2 Attachment to Concrete Building Construction:

.1 Concrete insert: MSS SP-58, Type 18.

.2 Self drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Consultant for each job condition.

.3 Power driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.

.3 Attachment to Steel Building Construction:

.1 Welded attachment: MSS SP 58, Type 22.

.2 Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C clamp may be used for individual copper tubing up to 23mm (7/8 inch) outside diameter.

.4 Attachment to Metal Pan or Deck:

.1 As required for materials specified Steel Decking section of the specification.

.5 Attachment to Wood Construction:

.1 Wood screws or lag bolts.

.6 Hanger Rods

.1 Hot rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP 58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn buckles shall provide 38 mm (1 1/2 inches) minimum of adjustment and incorporate locknuts. All thread rods are acceptable.

.7 Hangers Supporting Multiple Pipes (Trapeze Hangers):

.1 Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1 5/8 inches by 1 5/8 inches), 2.7 mm (No. 12 gage), designed to accept special

spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.

.2 Allowable hanger load: Manufacturers rating less 91kg (200 pounds).

.3 Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

.8 Supports for Piping Systems:

.1 Select hangers sized to encircle insulation on insulated piping.To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.

.9 Piping Systems (MSS SP 58):

.1 Standard clevis hanger: Type 1; provide locknut.
.2 Riser clamps: Type 8.
.3 Wall brackets: Types 31, 32 or 33.
.4 Roller supports: Type 41, 43, 44 and 46.
.5 Saddle support: Type 36, 37 or 38.
.6 Turnbuckle: Types 13 or 15. Preinsulate.
.7 U bolt clamp: Type 24.
.8 Copper Tube:

1 Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.

2 For vertical runs use epoxy painted or plastic coated riser clamps.

3 For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.

.9 Insulated Lines:

1 Provide pre-insulated calcium silicate shields sized for copper tube.

.10 Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

.10 Piping with Vertical Expansion and Contraction:

.1 Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.

.2 Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral

adjusting nut, turn buckle and travel position indicator. //

.11 Heat Exchanger and Expansion Tank Hangers:

.1 May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.

1.27 PIPE PENETRATIONS

.1 Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

.2 To prevent accidental liquid spills from passing to a lower level, provide the following:

.1 For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.

.2 For blocked out floor openings: Provide 40 mm (1 1/2 inch) angle set in silicone adhesive around opening.

.3 For drilled penetrations: Provide 40 mm (1 1/2 inch) angle ring or square set in silicone adhesive around penetration.

.3 Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Consultant.

.4 Sheet Metal: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

.5 Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

.6 Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms. Except in mechanical rooms, connect sleeve with floor plate.

.7 Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

.8 Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

.9 Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

1.28 SPECIAL TOOLS AND LUBRICANTS

.1 Furnish, and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

.2 Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

.3 Tool Containers: Hardwood or metal, permanently identified for in tended service and mounted, or located, where directed by the Owner

.4 Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.29 WALL, FLOOR AND CEILING PLATES

.1 Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

.2 Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch pipe), 0.89 mm (0.035-inch) for larger pipe.

.3 Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

1.30 EXCAVATION AND BACKFILL

.1 Grade the bottom of the pipe trench excavation as required.

.2 In firm, undisturbed soil, lay pipes directly on the soil, and shape soil to fit the lower one-third segment of all pipes and pipe bells. Ensure even bearing along the barrels. Backfill excess excavation with 25 mPa concrete.

.3 Where rock or shale is encountered, arrange to have this excavated and removed. After excavation, backfill with a bedding of 10 mm crushed stone.

.4 Prepare new bedding under the pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls of buildings, at manholes and catch basins. Compact to maximum possible density and support the pipe by 200 mm (8 inches) thick firm supports. Install reinforcing steel in cradle or construct piers every eight feet or closer, down to solid load bearing strata. Provide a minimum of one pier per length of pipe. Use same method where pipes cross.

.5 Where excavation is necessary in proximity to and below the level of any footing, backfill with 25 mPa concrete to the level of the highest adjacent footing. Proximity is determined by the

angle of repose as established by the consultant.

.6 Provide support over at least the bottom one third segment of the pipe in all bedding methods.

.7 Do not open trench ahead of pipe laying and backfilling more than weather will permit. Keep walls of trenches straight to at least 450 mm (18") above the top of the pipe to keep the diameter load within the pipe design limits. Have excavations inspected at least once a week by authorities. .

.8 Before backfilling, obtain approval. Remove all shoring during backfill.

.9 Backfill trenches within building, with clean sharp sand or gravel in individual layers of maximum 150 mm (6") thickness, compacted to a density of 100% Standard Proctor. Hand compact the first layers up to a compacted level of minimum 300 mm (12") above the top of pipe. Hand or machine compact the balance up to grade, using approved equipment.

.10 Backfill trenches outside buildings, not under roads, parking lots, or traffic areas, up to a compacted level of 450 mm (18") above the pipes with individual layers of material 150 mm (6") thick, hand compacted to a density of 95% Standard Proctor, using approved 10 mm (3/8") crushed stone. Backfill the balance with 150 mm (6") layers of approved excavated material, compacted to 95% Standard Proctor, using approved equipment.

.11 Backfill all other trenches outside buildings with 150 mm (3/8") crushed stone in layers not exceeding 6" thickness, compacted to 100% Standard Proctor density up to grade level. Manual compaction up to 450 mm (18") above the pipe with approved equipment for the balance.

.12 Fill all depressions to a correct grade level with appropriate material. After a period has passed adequate to reveal any settlement, use maximum possible compaction. Pay all costs required to make good all damages caused by settlement.

.13 Dispose of excavated materials in accordance with the requirements of the Authorities having Jurisdiction.

1.31 TESTS

.1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.2 Conduct tests in presence of Consultant.

.3 Bear costs including retesting and making good.

.4 Pipe pressure:

.1 Hydraulically test piping systems at 1.5 times system operating pressure or minimum 125 psi, whichever is greater.
.2 Maintain test pressures without loss for 4 hours unless otherwise specified.
.3 Test natural gas systems to requirements of authorities having jurisdiction and as per Ontario Gas Utilization Code O.Reg. 452/89.

.4 Test drainage, waste and vent piping to code.

.5 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.32 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.

.2 Touch-up paint all damaged equipment with products matching original finish in quality and appearance.

.3 Paint the entire gas line where with two coats of yellow paint.

1.33 SPECIAL TOOLS AND SPARE PARTS

.1 Furnish spare parts as follows:

.1 One set of packing for each pump.
.2 One glass for each gauge glass installed.
.3 One set of v-belts/bolts for each piece of machinery.
.4 One spare set of filters for each filter bank installed.

.2 Upon completion of project and immediately before hand-over, replace all filters.

1.34 DIELECTRIC COUPLINGS

.1 Provide wherever pipes of dissimilar metals are joined.

.2 Provide insulating unions for pipe sizes larger than 2" diam. and under; same for flanges of pipe sizes over 2" diam.

.3 Cast brass adapters may be used on domestic water systems and where approved by the Consultant.

.4 Provide rubber gaskets to prevent dissimilar metals contact.

1.35 INSTRUCTION OF OPERATING STAFF

.1 Supply certified personnel to instruct Owner operating staff on operation of new mechanical equipment. Supply maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.2 Provide min. 6 hrs of instruction time during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.3 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn manuals over to the Consultant.

.4 Scheduling of the timing for the training of the operating staff shall be arranged 10 days prior to the completion of the project.

.5 For training on controls, refer to section 15900

1.39 MAINTENANCE MANUALS

.1 Provide minimum of one (1) hard (hard cover binder) and three (3) soft (USB's) copies of Mechanical Maintenance Manuals, in accordance to the following:

.1 Mechanical Maintenance Manuals to be delivered to the Consultant's office 10 days prior to the substantial completion of the Contract.

.2 Manuals to be bound in a hard cover neatly labeled: "OPERATING AND MAINTENANCE INSTRUCTIONS".

.3 The Maintenance Manuals shall be divided into sections with neatly labeled and tabbed dividers between each section. The sections to be included in the manual are:

.1 Section I - General.
.2 Section II - Piping and Pump Systems, Plumbing Fixtures and Accessories.
.3 Section III - Boilers, Heat Exchangers, Pool Filters and Accessories
.4 Section IV - Automatic Controls
.5 Section V - Air and Water Balancing

.4 The following information shall be contained within the sections:

.1 SECTION I: A list giving name, address and telephone number of the Consultant, Engineers, General Contractor, Mechanical Trade and Controls Trade. Written guarantees for the Mechanical Systems. A copy of the Valve directory giving number, valve location, normal valve position, and purpose of valve (a framed copy of Valve Directory to be hung in Boiler Room). Equipment lists and certificates shall be provided - certificates shall be signed and sealed by the appropriate suppliers.

.2 SECTION II, III: A copy of all pressure tests and operational tests. A copy of Gas Operational Tests for gas fired equipment. A list giving name, address and telephone number of all suppliers. Details of chemical treatment equipment and substances. A copy of all reviewed Shop Drawings for all mechanical equipment and ancillary devices (valves, expansion tanks, pumps, strainers, plumbing, etc). Copies of warranties.

.3 SECTION IV: Complete Control Diagrams, Wiring Diagrams and description of Control system and the functioning sequence of the system. Also refer to section 15900.

.4 SECTION V: For balancing reports and formats, refer to section 15015 of these specifications.

1.40 CONCRETE

.1 All concrete work required to complete this project, whether shown on the drawings or not, shall be the Contractor's responsibility.

.2 Refer to this specification section for requirements for housekeeping pad.

1.41 METALS

.1 All steel construction required for the completion of this project, whether shown on the drawings or not, shall be the Contractor's responsibility.

1.42 CUTTING, PATCHING, ROOFING AND X-RAY

.1 All cutting, patching, roofing and X-Rays required for the completion of this project whether shown on the drawings or not, shall be the Contractor's responsibility. The cutting and patching work shall be performed in accordance with the following:

.1 All cutting and patching shall be done by the trades specializing in the materials to be cut.

.2 All flashing and equipment supports on the roof shall be done in strict accordance with the Owner standards by Owner-approved roofing contractors only.

.2 Should any cutting, roofing and/or repairing of finished surfaces be required, the Sub-trade contractor for the Contractor shall employ the particular trades engaged on the site for this type of work to do such cutting and/or repairing. Obtain the approval of the Consultant before doing any cutting. In the event that tradesmen required for particular cutting and/or repairing are not already on the site, bring to the site tradesmen to do this work.

.3 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Consultant.

.4 Where slabs in the portions of the building which are existing must be saw-cut or core drilled, all locations shall be x-rayed prior to saw-cutting or core-drilling. All x-raying shall be done by personnel qualified in the use of the type of equipment required to x-ray the saw-cuts shall be permitted to perform this work on the site. No allowance will be made later for expenses incurred through the failure of performing these x-rays.

1.43 INTERFERENCE DRAWINGS

.1 The Mechanical Contractor is responsible for preparing detailed interference drawings once demolition work has proceeded to the point where all existing conditions are visible. Provide 2D plan view and 3D isometric view layouts for all project areas depicting site measurements of all floor areas, height, width and depth of all existing structural elements, new architectural walls, ceilings and floor assemblies, new structural elements and new mechanical ductwork and piping plans. Prior to proceeding with new work, ensure that any concerns of interference are alleviated; consult with the Engineer as necessary. Provide written notice to the Engineer of any potential interferences of concerns with existing conditions based on the site findings after demolition.

1.44 MECHANICAL PROJECT COMPLETION

.1 10 (ten) days prior to substantial performance of work obtain documentation and/or prepare certification of the following items and submit them to the Owner's representative.

.1 All inspection certificates including drainage, Plumbing, and refrigeration.
.2 Guarantee certificates as called for under "Warranty".
.3 Record drawings.
.4 Operating and Maintenance Manuals.
.5 Test certifications as called for under "Testing".
.6 Provide a signed statement to the effect that all tests for mechanical systems and equipment have been completely carried out in the Trade Sections of these Specifications and to the manufacturer's recommendations, and in accordance with the requirements of all authorities having jurisdiction.

1.45 PERFORMANCE TESTS AND EQUIPMENT START-UP

.1 After all equipment has been installed, adjusted, balanced and started up, subject equipment to a series of performance tests, as soon as conditions permit.

.2 The timing of the tests shall be arranged to suit the convenience of the Consultant, and the manner and duration shall be as the Consultant deems necessary. Record the daily start and stop times, operating hours and functions performed. Ensure that the performance tests are witnessed by the Consultant.

.3 All major equipment including but not limited to boilers, pumps, sand filters are to be inspected by the manufacturer to ensure that the equipment has been installed in accordance with their recommendations.

.4 Operate equipment under varying load conditions, demonstrate start-up sequence, normal shutdown, simulated emergency shutdown, operation of temperature, etc., and safety controls. Operate switches and electrical devices for correct wiring sequences. Adjust components to achieve a proper functional relationship among all the components of all the systems. Repeat these functions as many times as deemed necessary by the Consultant to achieve reliable operation.

.5 Repair defects and repeat tests as necessary. During test maintain lubrication schedule, set, align and tension drives.

.6 At the successful completion of Performance Tests and all testing and balancing, make the systems ready for final inspection and subsequent acceptance of the Owner. Replace and clean filters, flush out lines and equipment, remove and clean strainers, fill liquid systems and purge air. Provide water treatment to pipes and report in accordance to Section 15602. Disinfect all domestic water as required by current by-laws and Authorities Having Jurisdiction.

.7 Conduct tests to demonstrate operation and ability to meet requirements of all equipment and freedom from undue noise and vibration at the time of final inspection, having ensured that it has previously been subjected to Performance Tests.

1.46 PROJECT SPECIFIC NOTES

1. Obtain all approvals from public authorities having jurisdiction prior to commencing any work. Include, in the tender price, for all permit and inspection fees required by Authorities having Jurisdiction. Arrange for and attend all inspections required as per requirements of the Building Department or an Authority having Jurisdiction.

2. Examine architectural drawings and specifications and all contract documents before proceeding with the work. Any discrepancies between the drawings and specifications of all disciplines must be referred to the architect before any affected work is commenced.

3. The Mechanical Contractor shall furnish all labour, material, tools, equipment, etc. required to complete all work shown on the drawings and as specified in the contract documents. The work shall be performed in accordance with rules and regulations of all authorities having legal jurisdiction over the work. This Contractor shall provide any small items of work not specifically called for but required to complete the intended installation and/or required to achieve the desired intent or functional utility.

4. Perform all work in full accordance with the Ontario Building Code, All Applicable Codes, School Board standards and good practices and the requirements of all other Authorities Having Jurisdiction. All work performed by this division shall be done in accordance with all manufacturer's recommendations. Obtain all available manufacturer's recommendations and comply.

5. All cutting, patching, coring, scanning, xraying, making good and fire stopping required for the work of this division shall be carried out by this division. The Mechanical Contractor is responsible for and shall pay for any and all damage to the building and/or surrounding area incurred by work of this division.

6. Review the designated substances survey provided by the board in detail prior to commencing any work.

7. The Mechanical Contractor must review and submit shop drawings for all materials to be supplied as a part of the Contract in conjunction with the General Contractor to the Architect and Mechanical Consultant prior to ordering. Order only upon receipt of approval. Order, supply and install as per all comments. The Shop Drawings must be reviewed and ensured for compliance with the Contract Documents by the Mechanical Contractor and General Contractor prior to submission; confirmation of review and confirmation that the submittal is in compliance with the Contract Documents is the responsibility of the Mechanical Contractor and General Contractor to include in writing with each Shop Drawing Submittal. Any non-conformance of the Submittal with the Contract Documents identified by the Mechanical Consultant will require a resubmission of the Shop Drawing Submittal by the Mechanical Contractor prior to review. The Mechanical Contractor shall bear all costs of any review by the Mechanical Consultant

beyond the Original Shop Drawing Submission at a cost of $250.00 CAD + HST per resubmission.

8. All access panel ratings shall match that of the surface in which it is being installed. All access panels requiring supply/install as a part of the project work shall be included for in the Base Tender Price.

9. Coordinate with all other trades present on site throughout the full course of construction. Lay out of all work so as not to conflict with the work of other trades. Carry out work promptly which may interfere with the work and/or schedule of any other trades.

10. Cleanup and garbage: the contractor is responsible for maintaining as clean of a work area as possible during construction. The contractor is responsible to clean-up and remove tools from the site at the end of every working day. Disposal of all redundant materials, devices, and equipment is the responsibility of the contractor on a daily basis.

11. All work shall be done with minimum possible interruption to the existing building systems and in the time schedule permitted by the school board. Consult with the project supervisor prior to pricing. Complete the project within the allocated schedule.

12. Unless otherwise explicitly stated in writing in the Contract Documents, all materials, labour, scope and descriptions of work described in the Contract Documents is the responsibility of the Mechanical Contractor to supply and install as a part of the Base Tender Price. No materials and/or labour is to be completed under the Project Allowances unless explicitly noted as such in the Contract Documents.

13. All demolition and new work shall be completed in strict accordance with the Contract Documents with no deviations unless instructed by the Mechanical Consultant in writing prior to execution of the work. The Mechanical Consultant is not responsible, nor required, to accept any work (regardless of its compliance with code) not completed in accordance with the Contract Documents. The Mechanical Contractor will be responsible, at his/her cost, of furnishing a Sealed Letter from a Professional Engineer licensed in the Province of Ontario to accept and assume responsibility for all work not completed in accordance with the Contract Documents. The cost of obtaining this letter and the retaining of the Engineer, including all associated inspection charges, is the sole responsibility of the Contractor.

14. Unless otherwise noted, all devices, equipment, material, supplies, etc. shown on the drawings or otherwise required for a fully operational system as described/illustrated on the Drawings shall be supplied and installed under this Project. It shall not be assumed that any of the devices, equipment, material, supplies, etc. shown on the Drawings are to be provided (in part or in whole) by any other Party.

15. The Mechanical Contractor is responsible for taking pictures of work completed at the end of each week for record purposes. Pictures shall be taken throughout the work space and shall demonstrate all work completed that past week. When requested, share the pictures with the Mechanical Consultant. Pictures may be used for review of the monthly draws, conflicts identified on site, etc.

1.47 CLOSEOUT DOCUMENTS

.1 Coordinate with the General Contractor to submit a comprehensive Closeout Document Package incorporating documents from all trades in one consolidated package. Closeout Documents shall consist of one (1) 3-ring binder hard copy and 3 USBs/CDs. The Mechanical Section of the Closeout Documents shall consist of the following:

(a) Mechanical Contractor Warranty Letter, signed and dated. Warranty shall be for a period of twelve (12) months starting on the Date of Substantial Completion.
(b) Project Shop Drawings, in consecutive order of the Consultant's number scheme.
(c) O&M Manuals for all equipment supplied on the project.
(d) AHJ Inspection Certificates & All Test Certificates.
(e) Fire Damper installation letter from the Sheet Metal Contractor stating 'All fire dampers and fire flaps have been installed in strict accordance with the Manufacturer's recommendations and requirements as well as Code Requirements.'
(f) Start-Up Reports for all Equipment.
(g) Red-Line As-Builts and CAD As-Builts (both completed by the Mechanical Contractor).

1.48 PROJECT PROGRESS THROUGHOUT CONSTRUCTION

.1 The Mechanical Contractor is responsible for taking photos of all existing conditions and mechanical systems on site being affected by the Project at the onset of construction. All photos shall be date stamped.

.2 The Mechanical Contractor is responsible for taking photos of the project's progress throughout the construction site every two weeks. All progress photos shall be shared and sent electronically to the Mechanical Consultant on the 15th and 30th of every month. Photos are meant to illustrate the progress of the project and correction of any deficiencies identified in routine site reviews and review of progress photos.

.3 The Mechanical Consultant will, from time-to-time, visit the Project Site and issue a Field Review Report. The Mechanical Contractor is obligated to rectify any deficiency identified within 7 working days of receipt of the Report. The Mechanical Contractor is responsible for signing the Field Review Report upon 72 hours of the report being sent to the General Contractor, acknowledging receipt of the report. The Mechanical Contractor must take photos of all remedial work within 7 working days of receipt of the Report and distribute to the Consultant.

END OF SECTION

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.1.1 Conform to Section 20 05 11 Mechanical General Requirements as applicable.

1.2 RELATED SECTIONS

1.2.1 Installation of inserts, sleeves and anchors supplied by this Section: Section 04200, Masonry.

1.3 REFERENCES

ANSI B31.1 to B31.9 inclusive: Piping

CAN/CGSB-1.40-97	Primer, Structural Steel, Oil Alkyd Type
CSA B51-03	Boiler, Pressure Vessel, and Pressure Piping Code
CSA B52-99	Mechanical Refrigeration Code
CAN/CSA-G40.20/G40.21-98	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
CAN/CSA-S16-01	Limit States Design of Steel Structures
CSA W47.1-92(R2001)	Certification of Companies for Fusion Welding of Steel Structures
CAN/CSA W48-01	Filler Metals and Allied Materials For Metal Arc Welding.
CSA W59-M1989(R2001)	Welded Steel Construction (Metal Arc Welding)
CAN/CSA W117.2-01	Safety in Welding, Cutting and Allied Processes

1.4 SUBMITTALS

1.4.1 **Shop Drawings:** Prepare and submit shop drawings for equipment covered by this Section including upper, middle and pipe attachments, riser clamps, shields and saddles, and sway braces.

2 PRODUCTS

2.1 MATERIALS

2.1.1 **Welding Studs**

-Graham
-Omark
-Nelson

2.1.2 **Concrete Inserts and Anchors**

-Readhead by ITW
-SSS by Star
-Parabolt by USM
- Kwik-Bolt by Hilti

2.1.3 **Beam Clamps**

-Grinnell
-Myatt
- Hilti

2.1.4 **Concrete Grout:**

-Sikagrout 212 by Sika Canada Inc.
-Embeco 636 Grout by Master Builders
-Sealtight V-3 Grout by W.R. Meadows

2.1.5 **Pipe Hangers:**

- Grinnell
- Myatt
- Hilti

2.1.6 **Zinc-Rich Paint:** Galvafroid by W.R. Meadows.

2.1.7 **Primer**: CAN/CGSB-1.40-M.

3 EXECUTION

3.1 GENERAL CONSTRUCTION REQUIREMENTS

3.1.1 **Attachment to Building Construction**

3.1.1.1 Use welding studs of size not larger than 10 mm (3/8") for attaching miscellaneous materials and equipment to building steel. If weight of materials or equipment require bolts or studs larger than 10 mm (3/8") dia, use steel clips or brackets, secured to building steel by welding or bolting method of attachment as approved by Consultant.

3.1.1.2 Use self drilling expansion type concrete inserts for securing miscellaneous equipment and materials to masonry or concrete construction already in place, of sufficient number and size to prevent concrete from breaking away. Use of powder or power actuated fasteners will not be allowed unless prior written approval is obtained from Consultant.

3.1.1.3 Support rods for any suspended item must not be attached to or extended through steel pan type roofs or through concrete slab roofs.

3.1.1.4 Provide beam clamps of 2-bolt design and of such type that rod load is transmitted only concentrically to beam web centreline. Use of "C" and "I" beam side clamps and other similar items will not be allowed without written consent of Consultant.

3.1.1.5 Where roof or floor framing consists of open web or long span steel joists, ensure that hangers are located at or within 150 mm (6") of joist top or bottom chord panel points, otherwise provide additional structural steel as required where hanger spacing does not coincide with

joist spacing. Design suspension assembly such that hanger load is transmitted only concentrically to supporting joist. Do not use "C" and "I" beam side clamps, brackets and other similar, without written consent of Consultant.

3.1.1.6 Locate secondary structural steel members between joists at or within 150 mm (6") of top or bottom chord panel points. Where secondary structural steel member cannot be located at or near joist panel point, provide additional diagonal structural steel web member(s) designed for applicable load to nearest panel point in opposite chord member. This condition may be waived if load to be suspended between panel points is not in excess of 45 kg (100 lbs). Diagonal hangers which will induce lateral stresses in chord members of joist will not be permitted. Submit shop drawings of suspension assembly indicating location of suspension or support points, max load at each suspension point, location and size of hangers, brackets and intermediate framing members when required, and also details of connection to building structure.

3.2 PIPING CONSTRUCTION METHODS

3.2.1 General

3.2.1.1 Unless specified otherwise herein, construct and install piping in accordance with ANSI Sections B31.1 to B31.9 as applicable to service, except that soldered joints will not be permitted in compressed air piping.

3.2.1.2 To avoid unnecessary cutting of masonry, provide inserts, sleeves and anchors to other trades for building in as Work proceeds. Arrange with other trades to leave openings, slots and chases to accommodate later installation of mechanical work.

3.3 PIPE HANGERS AND SUPPORTS

3.3.1 General

3.3.1.1 Support or suspend piping with necessary hangers, structural supports and/or brackets as indicated on Drawings and/or as required, to prevent sagging, warping and vibration and to allow for movement due to expansion and contraction. Place hangers and supports close to fittings, valves and/or other heavy parts.

3.3.1.2 Do not allow loads of any nature to be transmitted through piping connections to equipment not specifically designed for such loads. Where flexible connections are not called for at connections to equipment, support pipe by stands attached to both pipe and supporting structure so that force in any direction is not transmitted to equipment.

3.3.1.3 Provide suitably dampened spring hangers for first 3 supports from equipment connection on piping subject to excessive movement or shock from any source, thermal expansion and contraction, selected in accordance with ANSI B31.1. Where it is evident that no undue loads will be transmitted to equipment by 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.

3.3.1.4 Use trapeze type hangers where pipes are grouped together, unless specifically indicated otherwise on Drawings. Suspend horizontal member by adjustable rods with locking feature for maintaining level and slope. Space trapeze type hangers based on closest interval required by any pipe supported thereon. Provide any auxiliary steel required to support trapeze between building steel.

3.3.1.5 Do not hang any pipe from another pipe unless specifically indicated on Drawings.

3.3.2 **Saddles and Roller Supports**

3.3.2.1 Provide saddles at roller supports for piping carrying liquids at 10.5 deg C (51 deg F) or higher. Weld saddles to black or galvanized steel piping. Refinish galvanized surfaces destroyed by welding with zinc rich paint.

3.3.3 **Hangers**

3.3.3.1 For insulated piping up to NPS 4 carrying liquids at temperatures 10.5 deg C (51 deg F) and higher, use standard weight clevis hangers with level adjustment and locknut.

3.3.3.2 For insulated lines of NPS 4 dia and larger carrying liquids at temperatures 10.5 deg C (51 deg F) or higher, use adjustable roller type hangers with locknuts, and rollers of sufficient width to clear outside diameter of insulation on piping. Support rollers at both ends, either by yoke, swivel type hanger or by 2 adjustable rods with locknuts.

3.3.3.3 For insulated piping carrying liquids at temperature of 10 deg C (50 deg F) or less, use elongated clevis type hangers, with clevis of sufficient width to fit over insulation bearing plate.

3.3.3.4 Provide insulation protection bearing plates at hangers and supports for piping carrying liquids at temperature of 10 deg C (50 deg F) or less. Install temporary spacers between plate and pipe equal to thickness of insulation specified. (Refer to Section 15081, Piping Insulation).

3.3.3.5 Bearing plates may be either shop fabricated, or manufactured plates of size required to properly fit outside diameter of pipe insulation.

3.3.3.6 Fabricate bearing plates conforming to following table for various pipe sizes:

Pipe Size (NPS)	P	Length of plate mm (in)	Thickness of Plate mm (ga)
1/2 thr. 1-1/2		130 (5)	1.2 (18)
2		150 (6)	.52 (16)
2-1/2		200 (8)	1.52 (16)
3		230 (9)	1.52 (16)
4 and up		250 (10)	1.52 (16)

3.3.3.7 Form bearing plates to outside diameter of adjoining pipe insulation and extend plate up to horizontal centre line of pipe.

3.3.3.8 For non-insulated piping use clevis type of wrought steel construction with adjustable rod, level locking feature and backnuts.

3.3.3.9 For copper tubing provide copper coated hangers. Regulations of some municipalities require that copper tubing be taped with plastic tape at hanger location, or hanger be provided with plastic insert. Meet these requirements when required, in which case copper coating may be omitted on hanger.

3.3.3.10 Attach hanger rods to building structure by means of malleable iron beam clamps, concrete inserts, and/or approved anchors as hereinbefore specified.

3.3.4 **Hanger Spacing**

3.3.4.1 For horizontal runs of plumbing and drainage piping comply with hanger spacing requirements of OBC.

3.3.4.2 For horizontal runs of black or galvanized steel pipe, other than for plumbing service, do not exceed max distances between supports and with min dia rods as follows:

Pipe Size (NPS)	Distance m (ft)	Dia. of Rod mm (in)
Up thru 1-1/4	1.8 (6)	10 (3/8)
1-1/2	1.8 (6)	10 (3/8)
2	3.05 (10)	10 (3/8)
2-1/2 & 3	3.66 (12)	12 (1/2)
4	4.27 (14)	16 (5/8)
6	5.18 (17)	19 (3/4)
8	5.79 (19)	22 (7/8)
10 & 12	6.71 (22)	22 (7/8)

3.3.4.3 Provide additional hangers in locations where there are concentrated loads such as valves, specialties and other such items.

3.3.4.4 For horizontal runs of copper tubing for services other than plumbing, do not exceed 1.8 m (6 ft) between hangers for lines up to and including NPS 3/4 and 2.4 m (8 ft) for lines of NPS 1 and larger.

3.3.4.5 For horizontal runs of piping fabricated of PVC, use hanger spacing as recommended by manufacturer.

3.3.5 **Vertical Piping Supports**

3.3.5.1 Support vertical plumbing and drainage piping as required by OBC, unless more stringent requirements are specified herein.

3.3.5.2 Support cast iron soil pipe at every floor and other piping at every other floor unless otherwise required by expansion conditions or otherwise specified.

3.3.5.3 Support bottom of riser with base fitting set on concrete pier or by hanger located at top of riser pipe as close to riser as possible.

3.3.5.4 For supports at intermediate floors, use Grinnell Fig. 261 or approved equal steel extension pipe clamp, bolted securely to pipe. Rest ends of clamp on pipe sleeve or on floor.

3.3.5.5 Provide lateral stability of vertical piping by fabricated brackets or malleable iron, extension type split hangers. Run vertical piping at columns in column webs, on either or both sides of column, unless otherwise directed.

3.3.6 **Anchors and Guides**

3.3.6.1 Supply and install anchors where indicated on Drawings and/or as required to maintain permanent location of pipe lines. Construct anchors for steel or galvanized pipe of approved steel straps and/or rods and for anchoring copper lines use copper plated anchors or provide insulation bands between tubing and clamps if steel straps or rods are used. Install anchors and guides in approved manner.

3.3.6.2 Acceptable Materials: Grinnell #256 or Myatt.

3.4 **MISCELLANEOUS STEEL**

3.4.1 **General**

3.4.1.1 Supply and install miscellaneous structural supports, platforms and braces as may be required to hang or support piping unless Drawings or other Sections of Specifications state otherwise.

3.4.1.2 Submit detailed shop drawings to structural engineer for review before commencing fabrication.

3.4.2 **Materials and Fabrication**

3.4.2.1 Conform to CAN/CSA-S16 for materials, design of details and execution of work.

3.4.2.2 Conform to CAN/CSA-G40.20/G40.21, grade 300W for structural shapes, plates, and other similar items.

3.4.2.3 Use welded construction wherever practicable, with bolted joints allowed for field assembly using high strength steel bolts. Chip welds to remove slag, and grind smooth.

3.4.2.4 Conform to latest issue of following CSA Specifications.

CSA W47.1, for qualification of welders
CSA W48.1-M, for electrodes (only coated rods allowed)
CSA W59-M, for design of connections and workmanship
CSA W117.2, for safety

3.4.3 **Painting and Cleaning**

3.4.3.1 Touch up minor damage to finish on equipment with standard factory applied baked enamel finish. If, in Consultant's opinion, damage is too extensive to be remedied by touch up, replace damaged equipment.

3.4.3.2 Clean steel by scraping, wire brushing or other effective means to remove base scale, rust, oil, dirt or other foreign matter.

3.4.3.3 Apply 1 coat of zinc chromate iron oxide primer, conforming to CAN/CGSB-1.40-M to miscellaneous steel.

3.4.3.4 In field, touch up bolt heads and nuts, previously unpainted connections and surfaces damaged during erection with primer as herein before specified.

3.4.3.5 Give 2 coats of primer to surfaces which will be inaccessible after erection.

3.4.3.6 Remove foreign matter from steelwork on completion of installation.

3.4.4 With exception of prime painting of miscellaneous steel or any other specific requirements as specified above or under respective Sections of the Mechanical Contractor, or equipment otherwise factory painted, painting will be provided under Division 9, Finishes.

3.5 **CONCRETE INSERTS**

3.5.1 Install inserts required for attachment of hangers, either for suspension of piping or equipment.

3.5.2 For masonry or poured concrete construction use expansion type units. Insert into concrete after concrete has cured. Anchors or inserts installed by explosive means shall not be used.

3.6 **SEALED (STAMPED) SHOP DRAWINGS FOR PIPE SUPPORT SYSTEM**

3.6.1 The Mechanical Contractor, as part of the Base Tender Price, is responsible for retaining the services of a Professional Engineer licensed in the Province of Ontario to prepared detailed support drawings (sealed by the Professional Engineer), with the drawings outlining the following information:

.1 Floor Plans depicting support types being proposed in each area of work for each type of piping system (plumbing, drainage, heating, etc.). The support types are to be reviewed and approved by the Engineer for use in this application.

.2 Floor Plans depicting attachment method of attaching the supports to the Building Structures.

.3 Floor Plans depicting the maximum span of the supports in each area of work.

The Professional Engineer is responsible for overseeing the construction and supply/installation of the supports and provide a Letter of Completion at the end of the work

confirming that all work has been completed in accordance with the Engineered Plans.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS

1.2.1 Submit shop drawings in accordance with 20 05 11 Mechanical General Requirements.

1.2.2 Submit for approval, manufacturer's catalogue literature related to installation and fabrication.

PART 2 - PRODUCTS

2.1 GENERAL

2.1.1 Supply access doors to the relevant building trade to provide access in furred ceilings for the following:

.1 Servicing equipment

.2 Access to plumbing cleanouts

.3 Access to shut off valves.

.4 Inspection of life safety equipment.

.5 Service of operating devices

.6 All locations where periodic maintenance is required.

2.1.2 Access door sizes shall be as follows:

.1 Body Entry: 24" x 24" (600 x 600 mm)

.2 For Hand Entry: 18" x 18" (450 x 450 mm)

.3 For Viewing Only: 12” x 12” (300mm x 300mm)

2.1.3 All doors shall open 180 degrees and have rounded safety corners

2.1.4 For fire rated ceilings or wall provide a fire rated access door that will match the fire rating of the wall that the access door is installed in. The Mechanical Contractor shall be responsible for reviewing the drawings and providing fire rated access doors where they are required.

2.1.5 Where body access is possible the access doors shall be provided with a releasing mechanism on both sides of the door.

2.1.6 Provide access panels in all ductwork where fire dampers or combination fire/smoke dampers are shown on the Drawings to allow for inspection of the dampers.

2.1.7 Provide access panels at all balancing damper locations to allow access to the damper in the future.

2.2 RECESSED ACCESS DOOR FOR DRYWALL APPLICATIONS

2.2.1 Door shall be 16 gauge steel. Mounting frame shall be 14 gauge galvanized steel.

2.2.2 Door shall be provided with a 25 mm (1") recess or 14mm (5/8") to suit the thickness of the drywall ceiling.

2.2.3 The frame shall be provided with a galvanized steel drywall taping bead on all sides.

2.2.4 The hinge shall be a concealed pivoting rod.

2.2.5 The latch shall be a flush to the surface, screwdriver operated cam latch.

2.2.6 The steel finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.2.7 Standard of Acceptance: Acudor DW-5015, Mifab, Zurn, Watrous, Williams Brothers

2.3 RECESSED ACCESS DOOR FOR PLASTER APPLICATIONS

2.3.1 Door shall be 16 gauge steel. Mounting frame shall be 14 gauge galvanized steel.

2.3.2 Door shall be provided with a 14mm (5/8") recess and shall be lined with self furring galvanized lath.

2.3.3 The frame shall be provided an expansion casing bead with 75 mm (3") wide galvanized lath, recessed 20mm (3/4") to receive plaster.

2.3.4 The hinge shall be a concealed pivoting rod.

2.3.5 The latch shall be a flush to the surface, screwdriver operated cam latch.

2.3.6 The steel finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.3.7 Standard of Acceptance: Acudor AP-5010, Mifab, Zurn, Watrous, Williams Brothers

2.4 FLUSH ACCESS DOORS FOR TILED WALL APPLICATIONS

2.4.1 For doors 400mm x 400mm (16" x 16") and smaller the door shall be 16 gauge with 18 gauge mounting frame.

2.4.2 For doors over 400mm x 400mm (16" x 16") the door shall be 14 gauge with 16 gauge mounting frame.

2.4.3 Door shall be flush to frame with rounded safety corners.

2.4.4 The frame shall be one piece welded to the mounting frame.

2.4.5 The hinge shall be a continuous concealed hinge.

2.4.6 The latch shall be a stainless steel screwdriver cam latch.

2.4.7 The finish shall be type 304 #4 satin polish stainless steel.

2.4.8 Standard of Acceptance: Acudor UF-5000, Mifab, Zurn, Watrous, Williams Brothers

2.5 FIRE RATED ACCESS DOOR

2.5.1 Door shall be constructed of 20 gauge steel with a 16 gauge mounting frame.

2.5.2 Door shall be filled with 50mm (2") thick fire rated insulation.

2.5.3 The door frame shall be provided with a 25mm (1") wide flange and mounting frame to have anchor straps.

2.5.4 The hinge shall be concealed and shall be provided with a spring closer.

2.5.5 Door shall be UL/ULC rated for 1 ½ hour "B" label with 250 degree F temp rise in 30 minutes.

2.5.6 The latch shall be a universal self latching bolt, operated by either a knurled knob.

2.5.7 The steel finish shall be 5 stage iron phosphate prepared with a prime coat of grey baked enamel.

2.5.8 For drywall applications provide a galvanized steel drywall taping bead flange.

2.5.9 Standard of Acceptance: Acudor FB-5050, Mifab, Zurn, Watrous, Williams Brothers

2.6 FIRE RATED ACCESS DOOR WITH INSIDE LATCH RELEASE

2.6.1 Door shall be constructed of 16 gauge steel with a 16 gauge mounting frame.

2.6.2 Door shall be flush to frame with reinforced edges.

2.6.3 The door frame shall be provided with a 25 mm (1") wide flange and shall be provided with anchor straps.

2.6.4 The hinge shall be concealed and shall be provided with a spring closer.

2.6.5 The door shall be UL/ULC rated for 1 ½ hour "B" label or 2 hour "B" label as required where temperature rise is not a factor.

2.6.6 The latch shall be a universal self latching bolt, operated by either a knurled knob.

2.6.7 The steel finish shall be 5 stage iron phosphate prepared with a prime coat of grey baked enamel.

2.6.8 Door shall be provided with an interior latch release.

2.6.9 For drywall applications provide a galvanized steel drywall taping bead flange.

2.6.10 Standard of Acceptance: Acudor FB-5060, Mifab, Zurn, Watrous, Williams Brothers

2.7 VALVE BOX – SURFACE MOUNT

2.7.1 Door shall be stainless steel in public areas and steel in mechanical rooms and service areas.

2.7.2 Door and box shall be 16 gauge steel.

2.7.3 The door shall overlap the box, providing a tight and secure fit.

2.7.4 The box shall be fully enclosed, attached to the door.

2.7.5 The hinge shall be a continuous piano hinge.

2.7.6 The door shall be provided with a cylinder lock and key.

2.7.7 For steel doors the finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.7.8 Stainless steel doors shall be #4 satin finish.

2.7.9 Standard of Acceptance: Acudor ASVB, Mifab, Zurn, Watrous, Williams Brothers

2.8 VALVE BOX – RECESSED

2.8.1 Door shall be stainless steel in public areas and steel in mechanical rooms and service areas.

2.8.2 Door and box shall be 16 gauge steel.

2.8.3 The door shall be flush to the frame with rounded safety corners.

2.8.4 The box shall be fully enclosed, completely attached to the frame.

2.8.5 The hinge shall be a continuous concealed hinge.

2.8.6 The door shall be provided with a cylinder lock and key.

2.8.7 For steel doors the finish shall be 5 stage iron phosphate preparation with prime coat of grey baked enamel.

2.8.8 Stainless steel doors shall be #4 satin finish.

2.8.9 Standard of Acceptance: Acudor ARVB, Mifab, Zurn, Watrous, Williams Brothers

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 On some drawings, access door locations have been indicated for coordination. The drawings do not show all access doors required.

3.1.2 The Mechanical Contractor shall provide a set of drawings showing locations and types of all access doors located in public areas to the Consultant for approval, prior to commencing the installation of any piping or ductwork within these areas.

3.1.3 Access doors shall be turned over to the building trade that is responsible for finishing the wall or ceiling where the access door is required.

3.1.4 The Mechanical Contractor shall be responsible for providing the access doors required to be installed in ductwork. Refer to other sections for requirements.

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 Section Includes:

.1 Valve Tags.
.2 Pipe Markers/Arrow Tape Above Ground.
.3 Underground Piping Warning Tape.
.4 Mechanical Equipment and HVAC Controls Identification.
.5 Safety Signs.
.6 Isolation Valves Numbering.

1.2 DEFINITIONS

.1 Exposed Areas

.1 Finished areas and other areas used by personnel in normal use of building, such as equipment rooms and storage rooms.

.2 Concealed Areas

.1 Duct or pipe tunnels, duct or pipe chases, spaces above accessible ceilings, and crawl spaces.

2 PRODUCTS

2.1 STANDARD OF ACCEPTANCE

.1 W. H. Brady Co. catalogue numbers are used as a basis of identification.

.2 Stock catalogue numbers are listed in these specifications. Subcontractor is responsible to review schedules and provide required markers. In some instances, "non-stock" markers (special) may be required.

2.2 MANUFACTURER'S NAMEPLATES

.1 Manufacturer's nameplates:

.1 Provide metal nameplate on each piece of equipment, mechanically fastened with raised or recessed letters.
.2 Provide Underwriters' Laboratories or CSA registration plates, as required by respective agency.
.3 Manufacturers nameplate to indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.
.4 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

2.3 VALVE TAGS

.1 Metal Tags: Brass or aluminium with stamped or engraved letters; tag sizes minimum 2 inches (round, square, or rectangle) with smooth edges. Thickness 19 gauge (.040 inches) minimum.

.2 Beaded Chain: Size 6, brass or aluminium, 4 1/2 inches long with locking link.

2.4 PIPE MARKERS/ARROW TAPE ABOVE GROUND

.1 Colour: Conform to ANSI A13.1.

.2 Self-Sticking Pipe Markers/Arrow Tape: Material B-946, flexible, vinyl film tape with pressure sensitive permanent adhesive backing and printed markings.

.3 Suitable for indoor/outdoor application.

.4 Temperature range: Minus 40 degrees to 180 degrees F.

2.5 UNDERGROUND PIPING WARNING TAPE

.1 Tracer wire and test station(s) required when burying cast iron, ductile iron, or non-metallic piping.

.2 Tracer Wire: #10AWG THHN/THWN, yellow, solid copper.

.3 Tracer Wire Test Station: C.P. Test Services. Test Station: Plastic Pipe, cast iron cover, 2-point terminal box.

2.6 CONTROLS IDENTIFICATION

.1 Refer to section 25 20 11.

2.7 EQUIPMENT IDENTIFICATION

.1 Labelling shall be furnished and installed by the contractor

.2 Engraved signs shall be dark letters on light background.

.3 Identify mechanical equipment and HVAC controls, e.g., air handling units, pumps, heat transfer equipment, water treatment devices, controls instruments, stationary tanks/containers, and similar items, with nameplates or tags.

.4 Provide engraved nameplates made of rigid plastic laminate in which colored top and bottom layers of the material are thermoset with a contrasting color core. Minimum thickness 0.062 inch.

.5 Size: min. 1" x 3".

.6 Material Colour: White background/ black lettering.

.7 Manufacturer: Brady, No. B-1

.8 Provide lettering as follows:

.1 Size: 10 point minimum
.2 Spacing: 1/4 inch from top, 1/8 inch from bottom, 1/16 inch between lines.
.3 Provide nameplate with component nomenclature as noted in the Equipment Schedules. Coordinate with the controls sub-contractor.

.9 As a minimum, identify the system, e.g., HVAC (heating, ventilating, and air conditioning), the component, e.g., FGF (furnace, gas fired), and the sequence number.

2.8 **SAFETY SIGNS**

.1 Colors associated with specific words such as "Danger," "Warning," "Caution," or "Notice" shall conform to ANSI Z35.1.

3 EXECUTION

3.1 **PREPARATION**

.1 Degrease and clean surfaces to receive adhesive for identification materials.

3.2 **INSTALLATION**

.1 Valve Tags:

.1 Install with brass beaded chain.
.2 Steel stamp or engrave valve tag in accordance with schedule herein.
.3 Letter style block, 1/4-inch height minimum.
.4 Tag all valves in concealed or exposed areas except isolation and by-pass valves installed adjacent to the equipment they serve.
.5 Provide typewritten letter size list of applied tags and location. Frame under glass and hang where directed.

.2 Pipe Markers Above Ground:

.1 Install in accordance with manufacturer's instructions.
.2 Seal markers with clear lacquer.
.3 Identify piping in exposed or concealed areas in accordance with schedule herein.
.4 Pipe marker consists of pipe contents identification with flow direction arrow tape. Provide consistent color scheme, unless otherwise noted.
.5 Wrap arrow tape completely around pipe at both ends of pipe markers.
.6 Install in clear view and align with axis of piping.
.7 Label piping at intervals of not more than 20 feet on horizontal and vertical runs, at each branch connection, and where pipe penetrates walls, ceilings and floors (both sides).
.8 Size of label depends on outside diameter (OD) of pipe. Pipe OD includes insulation or protective coating.

.9 Minimum length of marker including arrows:

(a) 2" diam. pipe or smaller: 8"
(b) 2" to 8" 12"
(c) 8" to 10" 24"
(d) Over 10": 32"

.3 Safety Signs

.1 Install in clear view.

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 11.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

.3 Submit type of isolator, size, height when uncompressed and maximum allowable static deflection weight of all isolated equipment, loads on each isolator and static deflection of each isolator under the specific design load.

.4 Submit marked up plans indicating all locations where pipes are to be isolated in mechanical rooms and as specified.

2 PRODUCTS

2.1 GENERAL

.1 Vibration isolator sizes and layout shall be determined by the vibration isolator supplier.

.2 Elastomeric elements that will be exposed to temperatures below freezing shall be fabricated from natural rubber instead of neoprene.

.3 All isolators to be installed outdoors or exposed to weather shall be hot dipped galvanized and shall be furnished with neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

.4 Standard of Acceptance: Kinetics Noise Control, Vibro-Acoustics.

2.2 FLEXIBLE PIPE CONNECTORS

.1 Flexible pipe connectors shall be used on all piping connected to rotating equipment (Chiller, pumps, air handling equipment) to reduce the transmission of noise and Vibration, and to eliminate stresses in piping systems due to misalignment and thermal movement of the piping.

.2 Flexible connectors shall be of the single- or double-sphere molded joint configuration and shall meet or exceed specifications of the Rubber Expansion Joint Division, Fluid Sealing Association.

.3 Connectors shall be made of molded neoprene reinforced with nylon tire cord and shall have mild steel floating flanges or female union ends.

.4 Control rods shall be used with unanchored systems or with spring-mounted equipment where the pressures and movements exceed those the connectors are designed to withstand.

.5 Standard of acceptance: Kinetics model Kinflex

2.3 FLEXIBLE DUCT CONNECTORS

.1 Flexible Connections

.1 Where duct connections are made to fans and air handling units (not internally isolated), install a non combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack during operation to insure that no vibration is transmitted.

.2 Length of connection: 6"

.3 Minimum distance between metal parts when system in operation: 3"

.4 Install in accordance with recommendations of SMACNA.

2.4 ELASTOMERIC PADS

.1 Neoprene waffle or ribbed; 9mm minimum thick; 50 durometer; maximum loading 350kPa. Mason type W

.1 Application: between all floor-mounted pumps supports and the house-keeping pads

2.5 ELASTOMERIC MOUNTS

.1 Neoprene, moulded from oil-resistant compounds, with a cast-in-top steel load transfer plate for bolting to supported equipment and a bolt-down plate with holes provided for anchoring to the supporting structure. Isolator shall provide lateral load resistance for loads applied parallel to mounting surface. Neoprene vibration isolators shall be Model RQ, by Kinetics Noise Control, Inc.

.1 Application: between boilers and domestic hot water heaters support frames and house-keeping pads.

2.6 PIPE HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Swivel arrangement topermit hanger box or rod to move through a 30 deg. arc without metal to metal contact. Unless specified otherwise, the static deflection shall be 9mm, with a strain not exceeding 15%, and spring hangers to have minimum static deflection of 2". A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19mm larger than the diameter of the hanger rod.

.2 Standard of acceptance: Kinetics model SRH

3 EXECUTION

3.1 INSTALLATION

.1 Provide vibration isolation for new equipment as noted in the specification, listed in the schedule and shown on the drawings.

.2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

.3 Ensure piping and electrical connections to isolated equipment do not reduce system flexibility.

.4 All suction and discharge from the pumps shall be provided with flexible pipe connections.

.5 Unless indicated otherwise, support all piping connected to the pumps and boilers with spring equipped hangers as described in these specifications, as follows:

.1 First 3 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 2".

.6 Unless specified otherwise, all pump supports will be mounted on elatomeric pads.

.7 Unless specified otherwise, the boilers, indoor air handlers, indoor chillers will be mounted on elastomeric mounts

.8 All wiring connections to the pumps shall be made in a 360 degree loop; minimum conduit length: 3 ft. Cut any ties used to install this loop prior to adjusting the isolators.

.9 Provide suitable supports for all equipment which does not have a frame with adequate rigidity.

.10 There shall be a minimum of 4" clearance between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.

.11 Piping, ductwork, conduit or mechanical equipment shall not be hung from or supported on other equipment, pipes or ductwork installed on vibration isolators. Such elements shall be supported on or suspended from building structure**.**

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 QUALITY ASSURANCE

.1 Comply with OBC and NFPA 90A requirements, particularly paragraphs pertaining to the maximum flame spread index (currently set at 25) and maximum smoke development index (currently set at 50).

.2 All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

.3 Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.3 SUBMITTALS

.1 Submit in accordance with Section 20 05 11 shop drawings and product data

.2 Provide the following:

.1 Insulation materials: Specify each type used and state surface burning characteristics.
.2 Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
.3 Insulation accessory materials: Each type used.
.4 Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.

1.4 STORAGE AND HANDLING OF MATERIAL

.1 Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.5 STANDARDS OF ACCEPTANCE

.1 Knauf Fiber Glass
.2 Owens/Corning Fiberglass
.3 Armstrong
.4 Johns Manville
.5 Rockwool Manufacturing

2 PRODUCTS

2.1 GENERAL

.1 K-factors (thermal conductivity) shown are expressed in BTU•in/hr•ft2•F.

2.2 FIBERGLASS PIPE INSULATION

.1 Insulation:

.1 Rigid molded in compliance with ASTM C547, Class 1, minimum density 3.5 pounds/cubic foot, K-factor of approximately 0.24 at 75 degrees F, suitable for temperatures from minus 20 degrees F to 450 degrees F.

.2 Vapor Barrier

.1 Factory applied vapor barrier all-service type with self-sealing lap and butt strips.

.3 Valves and Fitting Covers

.1 Pre-molded PVC covers with fiber glass insert. Manufacturers: Proto Corp., Ceelco.

.4 Applications

.1 All domestic cold water piping.
.2 All domestic hot water and recirculation piping.
.3 All hot water heating piping.
.4 All condensate piping.
.5 All horizontal and vertical sections of storm drainage.
.6 All horizontal and vertical sections of sanitary drainage.
.7 All horizontal and vertical sections of low temperature supply and return (heat pump) piping.

2.3 INSULATION THICKNESS

.1 Hot water heating, all piping sizes: 1”
.2 Domestic hot water less than 2" 1"
.3 Domestic hot water larger than 2" 1½”
.4 Domestic cold water, all piping sizes: 1"
.5 Condensate, all piping sizes: 1”
.6 Storm & Sanitary Piping, all piping sizes: 1”
.7 Low Temperature Supply & Return (LTS & LTS) Piping, all piping sizes 1”

2.4 ADHESIVE, MASTIC, CEMENT

.1 ASTM C449: Mineral fiber hydraulic setting thermal insulating and finishing cement.

.2 Other: Insulation manufacturers' published recommendations.

2.5 MECHANICAL FASTENERS

.1 Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
.2 Bands: 20 mm (3/4 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.6 CANVAS JACKETING

.1 Apply in concealed areas, compact, firm ULC listed heavy plain weave, cotton fabric at 220 g/m sq.

2.7 PVC JACKETING

.1 Apply in exposed areas on piping with operating temperatures less than 180°F. (80°C.).

.2 Piping: ULC listed PVC moulded type jacketing material, gloss white complying with 25 Flame Spread and 50 Smoke Developed ratings.

.3 Fittings: ULC listed PVC, gloss white, 1-piece, pre-moulded fittings complying with 25 Flame Spread and 50 Smoke Developed ratings.

.4 PVC Application: strictly in accordance with the requirements of Authorities having jurisdiction.

.5 Ultraviolet resistant.

.6 Fastenings: To manufacturer’s standard(s).

2.8 METAL JACKETING

.1 At all locations where the pipe is located outdoors or in heavy abuse areas, use metal jacketing to protect piping or ductwork insulation.

.2 Jacketing: Aluminum, 0.016 inches thick, embossed surface, with factory bonded moisture barrier.

.3 Valve and Fitting Insulation Covers: Fabricate from same material as jacketing or use prefabricated insulation covers made in two matching halves.

.4 Metal Jacketing Bands: 1/2 inch wide, aluminum or stainless.

2.9 PROTECTION SADDLES AND SHIELDS

.1 Provide factory engineered galvanized steel hanger shields on horizontal insulated pipe complying with MSS SP-58 and MSS SP-59 standards for gauge and length of saddle.

2.10 SADDLES (PIPING/TUBING UP TO 2 INCHES)

.1 Use 180 degree saddle on systems utilizing teardrop type hangers.

.2 Use 360 degree saddle on systems utilizing trapeze hangers or clamps.

2.11 INSERTS AND SHIELDS (PIPING/TUBING OVER 2 INCHES)

.1 Use 360 degree calcium silicate insert with a 180 degree shield on systems utilizing clevis or teardrop type hangers.

.2 Use 360 degree calcium silicate with a 360 degree shield on systems utilizing trapeze hangers or clamps.

.3 The unit shall have an integral moisture barrier consisting of a tri-laminate All-Service Jacket equal and similar to the jacketing on the adjoining insulation.

.4 Insert: Calcium silicate, minimum density 9 pounds/cubic foot.

3 EXECUTION

3.1 EXAMINATION

.1 Verify that items to be insulated have been pressure tested and approved before applying insulation material.

.2 Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION - GENERAL

.1 Install materials in accordance with manufacturer's instructions.

.2 Required pressure tests of piping joints and connections shall be completed and the work approved by the Consultant for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

.3 Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories). Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

.4 Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

.5 Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

.6 Insulation on hot piping and equipment shall be terminated square at items not to be insulated, such as access openings and nameplates. Cover all exposed raw insulation with white sealer or

jacket material.

.7 Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

.8 Piping work not to be insulated:

.1 In hot piping: Unions, flexible connectors, control valves, PRVs, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.

.9 Plumbing work not to be insulated:

.1 Piping and valves of fire protection system.
.2 Chromium plated brass piping.
.3 Piping in pipe basement serving wall hydrants.
.4 Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).

.10 Work shall be performed by qualified insulation journeymen.

.11 Apply insulation and coverings on hot piping while surface is between 50 to 60^{O}C

.12 Vapor barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, and without interruption at sleeves, pipe and fittings.

.13 Do not insulate factory-insulated equipment.

.14 Do not insulate nameplates.

.15 Fit insulation tightly against surface to which it is applied.

.16 For non-fire rated barriers (e.g., wall, floor, ceiling, or roof) continue insulation and vapor barrier through penetrations. For fire rated barriers, provide ULC/FM approved through penetration stop systems.

.17 Weatherproof outdoor installations of piping or ductwork covered with aluminum jacket. Provide watershed lap joints and seal with mastic as required.

.18 Do not install metal jacketing with raw edges; provide a safety edge.

3.3 INSTALLATION - PIPING

.1 On exposed piping located in finished areas, locate cover seams in least visible area.

.2 Provide continuous insulation through pipe hangers or supports. Do not notch insulation. Provide shields or saddles to prevent crushing insulation.

.3 Where insulation terminates, taper to pipe and finish with insulating cement or acrylic mastic.

.4 Cover insulated pipes located outdoors or in utility tunnels with aluminum jacket. Secure with aluminum bands and screws as required.

.5 Tape circumferential joints of pipe insulation with 3 inch wide white vinyl tape.

.6 Insulate fitting and valves where required with same material thickness as specified for adjacent pipe.

.7 Insulate potable and non-potable cold water piping within walls, chases, or ceiling plenums where return air is present.

.8 Insulate potable and non-potable cold water piping in equipment rooms.

.9 Do not insulate unions, flanges and valves in potable or non-potable piping systems of 140 degrees F or less, except for chilled water.

.10 Vertical pipe over 3" diameter: use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter locate on 12 ft centers and at each valve and flange.

.11 Expansion joints: Terminate single layer and each layer of multiple layers in straight cut. Leave space of 1" between terminations. Pack void tightly with glass wool. Protect joints with aluminum sleeves.

.12 Use factory fabricated, easily disassembled insulation, for valves, fittings and process equipment requiring periodic maintenance of parts and sub-assemblies listed or indicated.

END OF SECTION

1 GENERAL

1.1 DESCRIPTION

.1 Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

.1 Systems Inspection report.
.2 Duct Air Leakage test report.
.3 Balancing air and water distribution systems; adjustment of total system to provide design performance;
.4 Recording and reporting results.

1.2 DEFINITIONS

.1 TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.

.2 CAABC: Canadian Associated Air Balance Council.

.3 Hydronic Systems: Includes heating hot water, domestic hot water recirculation, and glycol water systems, as applicable to the project.

.4 Air Handling Systems: Includes all central and distributed air handling equipment that provide outside air, supply air, return air, exhaust air and relief air to and from the building, as applicable to the project.

.5 Air distribution systems: Includes all grilles, diffusers, terminal units (by pass/VAV).

.6 Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 TAB Agency: The TAB agency shall be a subcontractor of the Mechanical Contractor and shall report to and be paid by the Mechanical Contractor. Include all Balancing Costs in the Base Tender Price.

.2 The TAB agency shall be either a certified member of AABC to perform TAB service for HVAC and water balancing equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Consultant and the Owner and submit another TAB firm for approval.

.3 TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency.

.2 TAB Agency shall be identified by the General Contractor within 60 days after the award of the contract.

.3 The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Consultant. The responsibilities would specifically include:

.1 Shall directly supervise all TAB work.
.2 Shall sign the TAB reports that bear the seal of the TAB Agency. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC.
.3 Would follow all TAB work through its satisfactory completion.
.4 Shall provide final markings of settings of all HVAC adjustment devices.
.5 Permanently mark location of duct test ports.

.4 Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards and or by the instrument manufacturer.

.5 Tab Criteria:

.1 Air Filter resistance during tests, artificially imposed if necessary, shall be at least 90 percent of final values for pre-filters and after-filters.

.2 Flow rate tolerance:

.1 Air handling unit and all other fans, cubic meters/min (cubic feet per minute): 0% to plus l0%.
.2 Grilles, diffusers and air terminal units (maximum values): -5% to +l0%.
.3 Exhaust hoods/cabinets: 0 % to + l0 %.
.4 Minimum outside air: 0 % to +10 %.
.5 Individual room air outlets and inlets, and air flow rates not mentioned above: -5 % to +l0 % except if the air to a space is 100 CFM or less the tolerance would be 0 to plus 5 %.
.6 Heating hot water pumps and hot water coils: -5 % to +5 %.
.7 Heating hot water convectors, forced flow heaters, unit heaters: -5 % to +5 %.
.8 Chilled water and condenser water pumps: -5%t to +5 %.
.9 Chilled water coils: -5 % to +5 %.

1.4 SUBMITTALS

.1 Submit Following for Review to the Consultant:

.1 Systems inspection report on equipment and installation for conformance with design.

.2 Duct Air Leakage Test Report, demonstrating compliance with all ASHRAE 90.1 ductwork sealing requirements.

.3 Final TAB reports covering flow balance and adjustments, performance tests.

.4 Include in final reports uncorrected installation deficiencies noted during TAB and applicable

explanatory comments on test results that differ from design requirements.

1.5 APPLICABLE PUBLICATIONS

.1 The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

.2 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE): HVAC Applications ASHRAE Handbook, Testing, Adjusting, and Balancing

.3 Associated Air Balance Council (AABC): AABC National Standards for Total System Balance

.4 Sheet Metal and Air Conditioning Contractors National Association (SMACNA): HVAC SYSTEMS Testing, Adjusting and Balancing

2 Products

2.1 PLUGS

.1 Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

.1 Coordinate with the mechanical Contractor the TAB activity such that it does take place before the insulation is installed on ductwork and piping.

.2 In the absence of such coordination, the mechanical contractor shall be responsible for the repair to the ductwork and or piping insulation removed for TAB purposes, including the integrity of the vapor barrier material and the insulation jacket.

3 Execution

3.1 GENERAL

.1 Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 SYSTEMS INSPECTION REPORT

.1 Inspect equipment and installation for conformance with design.

.2 The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

.3 Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Consultant.

.4 Reports: Follow check list format developed by CAABC or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.3 TAB REPORT

.1 Format to be in accordance with referenced standard listed above, but using design drawing units.

.2 Produce "as-built" full system schematics. Use as-built drawings for reference.

.3 Submit 1 copy of preliminary TAB reports, each in “D" ring binders, complete with index tabs for verification and approval of Consultant.

.4 Submit copies of final TAB reports after approval by the Consultant, to be incorporated into the Maintenance and Operations Manual.

3.4 PROCEDURES

.1 Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified.

.2 Start final TAB only when building is essentially completed, including:

.1 Installation of ceilings, doors, windows and other construction affecting TAB.
.2 Application of sealing, caulking and weather-stripping.
.3 Normal operation of mechanical systems affecting TAB.

.3 General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

3.5 AIR BALANCE AND EQUIPMENT TEST:

.1 Include all air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, as applicable to this project.

.2 Adjust fan speeds to provide design air flow.

.3 Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.

.4 Parameters to be Measured

.1 Air Flow
.2 Air velocity.
.3 Static pressure.
.4 Velocity pressure.

.5 Temperature:
  .1 Wet bulb.
  .2 Dry bulb.
.6 Cross sectional area.
.7 Fans RPM
.8 Electrical power:
  .1 Voltage
  .2 Current draw.

.7 Locations of Measurements

.1 Inlet and outlet of each
  .1 Fan.
  .2 Coil.
  .3 Filter.
  .4 Balancing damper.
  .5 Other auxiliary equipment.
.2 Main ducts.
.3 Main branch ducts.
.4 Sub-branch ducts.
.5 Each supply, exhaust and return air inlet and outlet.
.6 Before and after the silencers.

3.6 WATER BALANCE AND EQUIPMENT TEST:

.1 Include all circulating pumps, heat exchangers, boilers, coils, as applicable to this project.

.2 Adjust flow rates for equipment to the values indicated on the drawings and schedules. Set balancing valves and circuit setters to the values on indicated on the equipment schedules

.3 Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for heat exchangers. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

.4 Parameters to be Measured

.1 Water/Glycol Flow (as applicable to the project)
.2 Pressure.
.3 Temperature.
.4 Specific gravity.
.5 Pumps RPM
.6 Electrical power:
  .1 Voltage
  .2 Current draw.

.5 Locations of Measurements

.1 Inlet and outlet of each

.1 Pump.
.2 Coil.
.3 Boiler.
.4 Balancing valve.
.5 Automatic control valves
.6 Chiller.

3.7 VERIFICATION

.1 Reported measurements shall be subject to verification by Consultant. Provide instrumentation and manpower to verify results of up to 30 % of all reported measurements. Number and location of verified measurements to be at discretion of Consultant.

.2 Bear costs to repeat TAB, as required, to satisfaction of Consultant.

3.8 MARKING OF SETTINGS

.1 Following approval of TAB final Report, the setting of all HVAC adjustment devices including balancing valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Consultant.

3.9 CONDUCTING THE TESTING AND BALANCING PROCEDURE

.1 Part 1 - The Mechanical Contractor is responsible for conducting testing and balancing of all new mechanical systems and equipment as specified on the Drawings, Specifications and/or other Contract Documents and providing the comprehensive report to the Engineer.

.2 Part 2 - The Contractor shall include for a repeat of all testing procedures to be conducted in witness of the Consultant on site after the completion of Part 1 (see .1). This is intended to demonstrate the operating characteristics of all mechanical systems once balancing has been complete and once the Engineer has had a chance to review the comprehensive report. The TAB Agency shall include for additional balancing during this Part as advise by the Engineer on site.

3.10 IDENTIFICATION OF TEST PORTS

.1 The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

.1 The design and installation of a hydraulically calculated automatic wet system complete and ready for operation, for all portions of Building indicated on the drawings including mechanical rooms, service rooms, elevator machine rooms, elevator pits.

.2 Design, installation and testing shall be in accordance with NFPA 13

.3 This section of the specification shall be read in conjunction with and be governed by the requirements of the General Conditions.

1.2 QUALITY ASSURANCE

.1 Installer Reliability: The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.

.2 Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used.

1.3 SUBMITTALS

.1 Submit as one package in accordance with the General Conditions, Shop Drawings, Product Data, and Samples. Prepare detailed working drawings that are signed by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. Submittals shall include, but not be limited to, the following:

.1 Drawings:

.1 Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 13. Include a site plan showing the piping to the water supply test location.

.2 Manufacturers Data Sheets:

.1 For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.

.2 Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.

.3 Calculation Sheets:

.1 Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA 13.

.4 Final Document Submittals

.1 Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in the General Conditions. Submittals shall include, but not be limited to, the following:

.1 One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the water flow switch or pressure switch and the fire alarm equipment.

.2 Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.

.3 Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13.

.4 Certificates shall document all parts of the installation.

.5 Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.

.6 Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13. Recommendations in appendices shall be treated as requirements.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 10, NFPA 13, working drawings and design requirements.

.2 Provide hydraulic calculations for all zones, most remote location, highest location and all specialty areas including window sprinklers, close spaced sprinklers, and deluge systems. Hydraulic calculations and submissions to be in accordance to NFPA 13 and this specification.

.1 Light Hazard Occupancies

.1 Obtain approval from authority having jurisdiction prior to fabrication and installation of the system. Bear all costs associated with such approval.

.2 Ordinary Hazard Group 1 Occupancies

.1 Laboratories, Mechanical Equipment Rooms, Transformer Rooms, Electrical

-

Switchgear Rooms, Electric Closets, Elevator Machine Rooms.

.3 Contractor to carry the cost of performing a pressure and flow test at the nearest available public hydrant. Coordinate with the City the performance of the test. Use the test results as the basis for hydraulic calculations.

.4 Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.

.5 Zoning: For each sprinkler zone indicated on the drawings, provide a control valve, flow switch and a test and drain assembly with pressure gauge.

PART 2 - PRODUCTS

2.1 PIPE & FITTINGS

.1 Sprinkler systems in accordance with NFPA 13.

.2 Joined by Welding or Roll Grooved

.1 Welding methods shall comply with all of the requirements of AWSI D10.9, Specification for Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3

.2 Pipe joined with grooved fittings shall be joined by a ULC listed combination of fittings, gaskets and grooves. Grooves cut or rolled on pipe shall be dimensionally compatible with the fittings.

.3 Joined by Thread Fittings or by Fittings Having Cut Grooves

.1 All threaded pipe and fittings shall have threads cut to ANSI/ASME B1 .20. 1, Pipe Threads, General Purpose.

.4 Pipe Schedule

.1 Nominal wall thickness for pressures up to 2070kPa shall be in accordance with the following table:

Pipe Size	Thickness
Under 200 mm diam.	Schedule 40
200mm diam. and larger	Schedule 30

.5 Fittings: 1200 kPa working pressure

.1 Cast iron screwed to ANSI B16. 4-1977, 1000 kPa
.2 Malleable iron, screwed to ANSI B16.3- 1977, 1000 kPa.
.3 Cast iron flanged to ANSI B16.1-1975, 1000 kPa.
.4 Mechanical groove coupling to ANSI B31.3- 1980, 1000 kPa.
.5 Flange bolts: square or hex head bolts with heavy hex nuts to ASTM A307-82a.
.6 Flange gaskets: 1.6 mm thick plain or cloth inserted red rubber to ANSI B16.20-1973 and ANSI B16.21-1978.

-

.6 Pipe size and layout:

.1 Sprinkler main pipes locations have been shown on the drawings for reference purpose only. Final size and location of mains and branch pipes to be determined based on hydraulic calculations and coordinated with the rest of the trades.

2.2 VALVES

.1 Valves in accordance with NFPA 13.

.2 Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.

.3 The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).

.4 Alarm check valves for wet sprinklers shall be ULC Listed and Factory Mutual Approved. The alarm check valve shall be equipped with a removable cover assembly. The alarm check valve shall be listed for installation in the vertical or horizontal position. The alarm check valve shall be equipped with gauge connections on the system side and supply side of the valve clapper. The alarm check valve shall be equipped with an external bypass to eliminate false water flow alarms. The alarm check valve trim piping shall be externally galvanized. Maximum water working pressure to 250 PSI. Standard of Acceptance: Tyco AV-1-300

.5 Listed Indicating valves:
.1 Gate: OS&Y, 1200kPa (175 psig) WOG.
.2 Butterfly: Gear operated, indicating type, 1200 kPa (175 psig) WOG.
.3 Check Valves: Swing type, rubber faced or wafer type spring loaded butterfly check valve, 1200 kPa (175 psig) WOG.

.6 Ported alarm connections on sprinkler riser valve to be piped to a retard chamber to absorb variable pressure surges. Circuit Closer to be installed on retard chamber with proper venting capabilities to eliminate vapor or hydraulic lock against circuit closer.

.7 Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drop with both ends threaded with iron pipe threads.

.8 Standard of Acceptance: Tyco, Wilson and Cousins.

2.3 EXCESS PRESSURE PUMP

.1 Supply and install an excess pressure pump to build up pressure on top of the alarm check valve clapper to prevent false activation on temporary pressure surges.

.2 Pump Construction:
.1 Close coupled with pump-motor unit.
.2 All bronze construction with stainless steel shafts.
.3 Carbon graphite shaft bearings.
.4 Bearings never need lubrication.
.5 Shaft seal does not require adjustment.
.6 Open drip proof motor is standard.

.3 Standard of Acceptable: Albany CEP series.

2.4 SUPERVISORY AND INDICATING DEVICES

.1 Provide a pre-manufactured riser manifold that will provide in a single assembly for use in NFPA-13 wet sprinkler system the following:

.1 Water flow alarming device (with paddle and tamper-proof cover)
.2 Listed pressure gauge
.3 Alarm test orifice
.4 Sight glass equipment

.2 The riser assembly may be installed in vertical or horizontal position.

.3 Standard of Acceptance: Tyco, National Fire Equipment

2.5 SWITCHES

.1 Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.

.2 Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.

.3 Pressure Switches: Activation by any flow of water equal to or in excess of the discharge from one sprinkler. Water Flow Indicating Pressure Switch will activate an alarm by way of an alarm pressure switch. The alarm pressure switch shall be compatible with system devices. The alarm pressure enclosure shall be UL Listed and Factory Mutual Approved for the application in which it is used. The alarm pressure switch shall have the ability to be wired for Class A or Class B service.

.4 Standard of Acceptance: Tyco, National Fire Equipment

.5 Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

2.6 GAUGES

.1 Provide gauges as required by NFPA 13.

PART 3 - EXECUTION

3.1 BACK FLOW PREVENTERS - FIRE PROTECTION LINES

.1 Assembly consists of two independently operating check valves, two shutoff valves, and four test cocks. It may be installed vertical or horizontal, under continuous pressure service and may be subjected to back pressure and back siphonage.

.2 The valves shall be cast iron with replaceable bronze seats. The construction shall be approved for use in Fire protection systems.

.3 Standard of Acceptance: Watts series 709DCDA

3.2 PIPE HANGERS AND SUPPORTS

.1 Supports, hangers, etc., of an approved pattern placement to conform to NFPA 13. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application.

3.3 FIRE DEPARTMENT SIAMESE CONNECTION

.1 Brass, flush wall type, exterior fire department connection with brass escutcheon plate, and a minimum of two 65 mm (2-1/2 inch) connections threaded to match those on the local fire protection service, with polished brass caps and chains. Provide escutcheon with integral raised letters "Automatic Sprinkler" Install an automatic ball drip between fire department connection and check valve with drain piping routed to the exterior of the building or a floor drain.

.2 Check Valves

.1 Underwriters' Laboratories pattern, iron body, bronze mounted, regrind-renew bronze disc and seat ring, bolted cap flanged ends. Design for either horizontal or vertical mounting.

.3 Standard of Acceptance: National Fire Protection model 230, Wilson and Cousins.

3.4 SPRINKLERS

.1 <u>General</u>

.1 Standard coverage, standard response

.2 Temperature rating: 165OF (74OC). Where in close proximity to unit heaters discharge or other sources of heat (stage lights, elevator machine room, generator room, etc) use 212OF (100OC) temperature rating.

.2 <u>Upright sprinklers</u>

.1 In all areas with no dropped ceilings, mechanical and service rooms and where else indicated on the drawings.

.2 Constructions

.1	Frame	Brass
.2	Sealing Button	Bronze w/Teflon†
.3	Ejection Spring	Stainless Steel
.4	Fusible Element	Solder, Copper
.5	Strut	Monel
.6	Hook	Bronze/Monel
.7	Deflector	Bronze

.3 Maximum Working Pressure: 175 psi (12,1 bar)

.4 Discharge Coefficient:

.1 K = 5.6 GPM/psi (80,6 LPM/bar)
.2 K = 8.0GPM/psi (115,2 LPM/bar)

.5 Standard of acceptance: Tyco TY-L series.

.3 Semi-recessed sprinklers

.1 In all areas where indicated on the drawings.

.2 The semi-recessed version of the sprinkler is intended for use in areas with a finished ceiling. It uses a two-piece Style 20 (1/2 inch NPT) or Style 30 (3/4 inch NPT) Recessed Escutcheon. The Recessed Escutcheon provides 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush pendent position.

.3 Construction

.1	Frame	Brass
.2	Sealing Button	Bronze w/Teflon†
.3	Ejection Spring	Stainless Steel
.4	Fusible Element	Solder, Copper
.5	Strut	Monel
.6	Hook	Bronze/Monel
.7	Deflector	Bronze

.4 Maximum Working Pressure: 175 psi (12,1 bar)

.5 Discharge Coefficient:

.1 K = 5.6 GPM/psi (80,6 LPM/bar)
.2 K = 8.0GPM/psi (115,2 LPM/bar)

.6 Standard of acceptance: Tyco TY-L series

.4 Concealed Sprinklers

.1 In all areas where indicated on the drawings.

.2 Each unit includes a Cover Plate Assembly that conceals the sprinkler operating components above the ceiling. The separable two-piece design of the Cover Plate and Support Cup Assemblies allows installation of the sprinklers and pressure testing of the fire protection system prior to installation of a suspended ceiling or application of the finish coating to a fixed ceiling. They also permit removal of suspended ceiling panels for access to building service equipment without having to first shut down the fire protection system and remove sprinklers

.3 Construction

.1	Frame	Bronze
.2	Support Cup	Chrome Plated Steel
.3	Guide Pins	Stainless Steel
.4	Deflector	Bronze
.5	Compression Screw	Brass
.6	Bulb	Glass
.7	Cap	Bronze or Copper
.8	Sealing Assembly	Beryllium Nickel w/ Teflon
.9	Cover Plate	Brass/Chrome/Custom (see architectural

-

finishes schedule)

.10	Retainer	Brass
.11	Ejection Spring	Stainless Steel

.4 Maximum Working Pressure: 175 psi (12,1 bar)

.5 Discharge Coefficient:
.1 K = 5.6 GPM/psi (80,6 LPM/bar)

.6 Standard of Acceptance: Tyco Royal Flush 2 series.

.5 Sidewall sprinklers

.1 In elevator pit (where applicable) and all areas indicated on the drawings.

.2 Construction

.1	Frame	Brass
.2	Sealing Button	Bronze w/Teflon†
.3	Ejection Spring	Stainless Steel
.4	Fusible Element	Solder, Copper
.5	Strut	Monel
.6	Hook	Bronze/Monel
.7	Deflector	Bronze

.3 Maximum Working Pressure: 175 psi (12,1 bar)

.4 Discharge Coefficient:
.1 K = 5.6 GPM/psi1/2 (80,6 LPM/bar)

.5 Standard of Acceptance: Tyco TY-L Series

3.5 SPRINKLER CABINET

.1 Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser. Sprinkler heads shall be installed in center of tile or center to center.

3.6 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS

.1 Provide chrome plated steel escutcheon plates for exposed piping passing though walls, floors or ceilings.

PART 4 - EXECUTION

4.1 INSTALLATION

.1 Provide interference drawings as required to coordinate work with other trades. Refer to details on drawings and locate sprinkler lines to avoid interference with lights, ductwork and other equipment in the ceiling space.

.2 Locate sprinkler heads as shown on architectural reflected ceiling plans and/or at centre lines of panels as required to produce orderly and symmetrical patterns with other ceiling-mounted devices, and to meet or exceed the requirements of NFPA-13, Authorities Having Jurisdiction

and insurance underwriters.

.3 Provide wire guards on all heads located in:

.1 Elevator machine rooms.
.2 All Mechanical/Fan Rooms
.3 Sprinkler heads within 2.0 m of finished floor.

.4 Protection Of Completed Work

.1 Assume responsibility for protecting sprinkler heads during painting. Replace damaged and painted components.

.5 Coordinate with the Electrical Contractor, the power supply and wiring between all supervised devices and the fire alarm panel.

.6 Owing to different levels of ceiling, allow for main and branch pipes offsets as required to accommodate structural, architectural elements and other building services. Allow 10 additional heads for final site coordination and piping for all additional heads required at no cost to the Owner.

.7 Provide auto control for excess pressure pump and final wiring and connections as required to place in operation. Adjust and maintained pump at 20 PSI above the normal water supply pressure. Pump shall be complete with 1⁄4" pressure relief valve and other associated hardware. A high & low water pressure supervisory switch shall also be provided on the system riser.

.8 All sprinkler piping shall be installed so that all parts of each system may be thoroughly drained, preferably at the main drain valve. All trapped heads in excess of five heads shall be provided with drain valves and cast iron plug. Low points where more than twenty heads are trapped shall be provided with an auxiliary drain valve.

.9 Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.

.10 Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.

.11 Welding: Conform to the requirements and recommendations of NFPA 13.

.12 Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13.

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.13 Supervisory Switches: Provide supervisory switches for sprinkler control valves.

.14 Waterflow Alarm Switches: Install waterflow switch and adjacent valves in easily accessible locations.

.15 Inspector's Test Connection: Install and supply in conformance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.

.16 Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction.

.17 Provide pressure gauge at each water flow alarm switch location and at each main drain connection

.18 For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).

.19 Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.

.20 Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Owner

4.2 INSPECTION AND TEST

.1 Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13. Test and flush underground water line prior to performing these hydrostatic tests.

.2 Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise Consultant to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

4.3 INSTRUCTIONS

.1 Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system.

End Of Section

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Hydraulic Calculations by HydraCALC

EPI FIRE PROTECTION & SECURITY
675 GARYRAY DRIVE
TORONTO, ONTARIO
M9L 1R2
416-746-2225

FEB. 06, 2024

Job Name	:	ST. MICHEL FRENCH CATHOLIC ELEMENTARY SCHOOL
Drawing	:	SECOND FLOOR - NEW ADDITION
Location	:	29 MEADOWVALE ROAD - SCARBOROUGH, ONTARIO
Remote Area	:	AREA#1
Contract	:	J#30329
Data File	:	Area#1.WXF

Hydraulic Design Information Sheet

Name - ST. MICHEL FRENCH CATHOLIC ELEMENTARY SCHOOL Date - 01.29.24
Location - 29 MEADOWVALE ROAD - SCARBOROUGH, ONTARIO
Building - SECOND FLOOR - NEW ADDITION System No. - AREA#1
Contractor - EPI FIRE PROTECTION INC & SECURITY Contract No. - J#30329
Calculated By - MINA BASSILY Drawing No. - SP-1
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 20'-0"
Occupancy - LIGHT HAZARD

SYSTEM DESIGN

(X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure NA Curve NA
Other NA
Specific Ruling 11.2.3.2.1 Made By NA Date NA

Area of Sprinkler Operation	- 900	System Type	Sprinkler/Nozzle
Density	- 0.10	(X) Wet	Make SEMI RECESSED
Area Per Sprinkler	- 324	( ) Dry	Model PENDANT
Elevation at Highest Outlet	- 22'-0	( ) Deluge	Size 3/4"
Hose Allowance - Inside	- 0	( ) Preaction	K-Factor 11.2
Rack Sprinkler Allowance	- 0	( ) Other	Temp.Rat.155F
Hose Allowance - Outside	- 100		

Note NA

Calculation Summary: Flow Required - 271.5 Press Required - 58.1 TEST
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:		Pump Data:		Tank or Reservoir:	
Date of Test	-			Cap. - NA	
Time of Test	-	Rated Cap.-	NA	Elev.-	NA
Static Press	- 71	@ Press	- NA		
Residual Press	- 61	Elev.	- NA		Well
Flow	- 397				Proof Flow
Elevation	- 0				NA

Location - SPRINKLER BASE OF RISER

Source of Information - JACON FIRE PROTECTION INC

COMMODITY

Commodity NA Class NA Location NA
Storage Ht. NA Area NA Aisle W. NA
Storage Method: Solid Piled NA % Palletized NA % Rack NA

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.	
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non	
( ) Mult. Row		( ) Open Shelf		

STORAGE RACK

Flue Spacing NA Clearance:Storage to Ceiling NA
Longitudinal NA Transverse NA

Horizontal Barriers Provided: NA

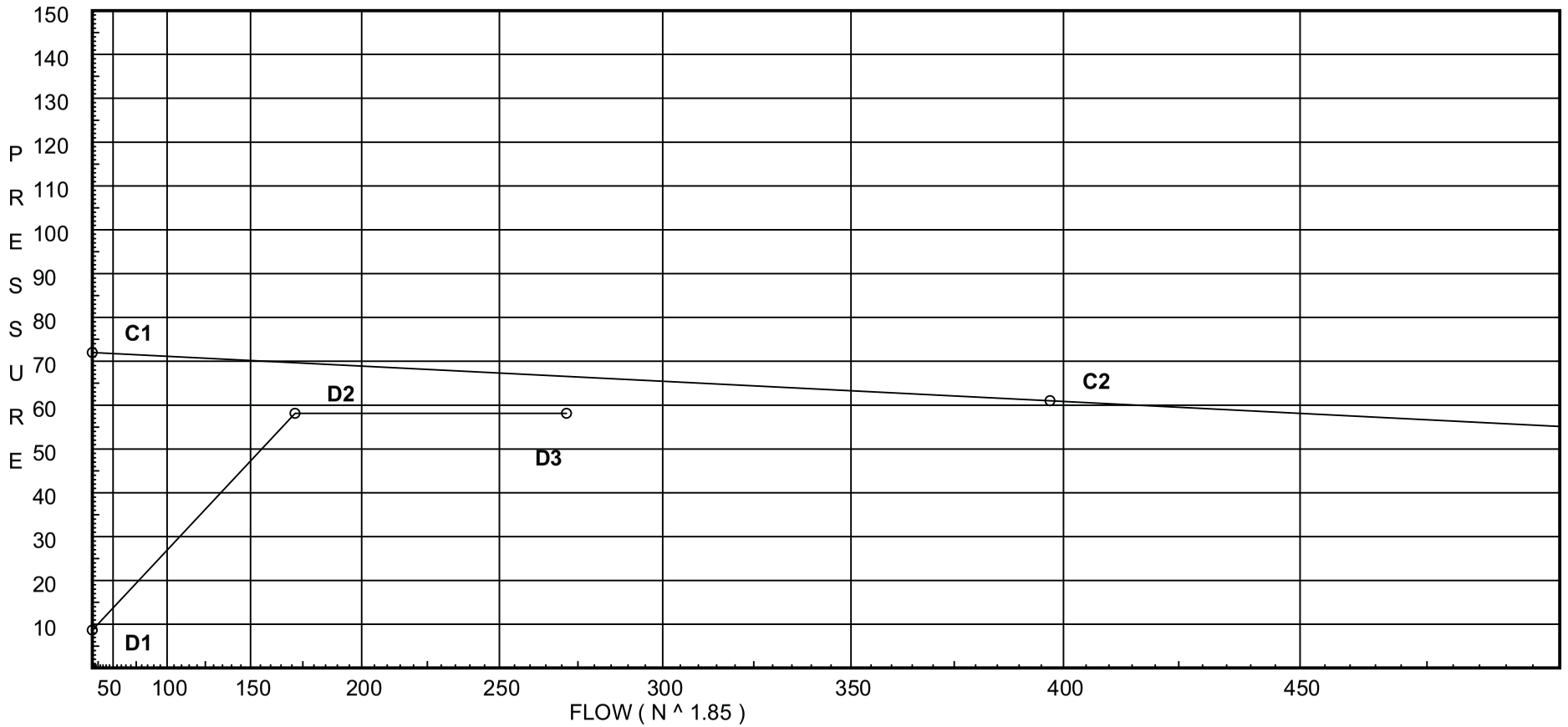
Water Supply Curve

EPI FIRE PROTECTION & SECURITY
ST. MICHEL FRENCH CATHOLIC ELEMENTARY SCHOOL

Date 01.29.24

City Water Supply:
- C1 - Static Pressure : 72
- C2 - Residual Pressure: 61
- C2 - Residual Flow : 397

Demand:
- D1 - Elevation : 8.662
- D2 - System Flow : 171.495
- D2 - System Pressure : 58.128
- Hose (Demand) : 100
- D3 - System Demand : 271.495
- Safety Margin : 8.425



Fittings Used Summary

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																			
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
Zwg	Watts 757 Vert	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
201	20.0	11.2	8.7	na	33.04	0.1	324	8.7
202	20.0	11.2	8.96	na	33.52	0.1	324	8.7
203	20.0	11.2	9.63	na	34.76	0.1	324	8.7
1	22.0		20.02	na				
2	22.0		20.61	na				
3	22.0		22.15	na				
204	20.0	11.2	9.8	na	35.06	0.1	324	8.7
205	20.0	11.2	9.83	na	35.12	0.1	324	8.7
4	22.0		22.54	na				
5	22.0		22.61	na				
20	22.0		22.7	na				
21	22.0		23.18	na				
22	22.0		33.62	na				
TOR	10.0		45.01	na				
BASE	4.0		51.87	na				
BKFL	4.0		52.31	na				
SUPP	2.0		57.21	na				
TEST	0.0		58.13	na	100.0			

The maximum velocity is 13.04 and it occurs in the pipe between nodes 205 and 5

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
201	20	11.20	33.04	1	2E	4.0	2.000	120	8.700	
to					T	5.0	35.000		-0.866	
1	22		33.04	1.049	Eql	26.0	37.000	0.3293	12.184	Vel = 12.27
			0.0							
1			33.04						20.018	K Factor = 7.38
202	20	11.20	33.52	1	2E	4.0	2.000	120	8.959	
to					T	5.0	35.000		-0.866	
2	22		33.52	1.049	Eql	26.0	37.000	0.3384	12.519	Vel = 12.44
			0.0							
2			33.52						20.612	K Factor = 7.38
203	20	11.20	34.76	1	2E	4.0	2.000	120	9.630	
to					T	5.0	35.000		-0.866	
3	22		34.76	1.049	Eql	26.0	37.000	0.3617	13.383	Vel = 12.90
			0.0							
3			34.76						22.147	K Factor = 7.39
1	22		33.04	1.5			18.000	120	20.018	
to									0.0	
2	22		33.04	1.682			18.000	0.0330	0.594	Vel = 4.77
2	22		33.52	1.5	T	9.9	7.417	120	20.612	
to							9.900		0.0	
20	22		66.56	1.682			17.317	0.1207	2.091	Vel = 9.61
			0.0							
20			66.56						22.703	K Factor = 13.97
3	22		34.76	1.5	T	9.9	5.417	120	22.147	
to							9.900		0.0	
20	22		34.76	1.682			15.317	0.0363	0.556	Vel = 5.02
			0.0							
20			34.76						22.703	K Factor = 7.30
204	20	11.20	35.06	1	2E	4.0	2.000	120	9.800	
to					T	5.0	35.000		-0.866	
4	22		35.06	1.049	Eql	26.0	37.000	0.3676	13.602	Vel = 13.02
			0.0							
4			35.06						22.536	K Factor = 7.39
205	20	11.20	35.12	1	2E	4.0	2.000	120	9.832	
to					T	5.0	35.000		-0.866	
5	22		35.12	1.049	Eql	26.0	37.000	0.3687	13.643	Vel = 13.04
			0.0							
5			35.12						22.609	K Factor = 7.39
4	22		35.06	1.5	T	9.9	7.417	120	22.536	
to							9.900		0.0	
21	22		35.06	1.682			17.317	0.0369	0.639	Vel = 5.06
			0.0							
21			35.06						23.175	K Factor = 7.28
5	22		35.12	1.5	T	9.9	5.417	120	22.609	
to							9.900		0.0	
21	22		35.12	1.682			15.317	0.0370	0.566	Vel = 5.07
			0.0							
21			35.12						23.175	K Factor = 7.30

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
20	22		101.32	2.5			16.000	120	22.703	
to									0.0	
21	22		101.32	2.635			16.000	0.0295	0.472	Vel = 5.96
21	22		70.18	2.5	3E	24.711	92.500	120	23.175	
to					T	16.474	41.185		0.0	
22	22		171.5	2.635			133.685	0.0781	10.445	Vel = 10.09
22	22		0.0	3	8E	75.261	128.000	120	33.620	
to					T	20.159	95.420		5.197	
TOR	10		171.5	3.26			223.420	0.0277	6.191	Vel = 6.59
TOR	10		0.0	3	B	13.44	12.000	120	45.008	
to					Fsp	0.0	33.599		5.599	* * Fixed Loss = 3
BASE	4		171.5	3.26	T	20.159	45.599	0.0277	1.263	Vel = 6.59
BASE	4		0.0	4	2E	26.334	6.000	120	51.870	
to					T	26.334	52.668		0.0	
BKFL	4		171.5	4.26			58.668	0.0075	0.442	Vel = 3.86
BKFL	4		0.0	4	Zwg	0.0	4.000	120	52.312	
to									4.866	* * Fixed Loss = 4
SUPP	2		171.5	4.26			4.000	0.0075	0.030	Vel = 3.86
SUPP	2		0.0	8	E	28.468	150.000	140	57.208	
to					G	6.326	90.148		0.866	
TEST	0		171.5	8.27	T	55.354	240.148	0.0002	0.054	Vel = 1.02
			100.00							Qa = 100.00
TEST			271.50						58.128	K Factor = 35.61

Hydraulic Calculations by HydraCALC

EPI FIRE PROTECTION & SECURITY
675 GARYRAY DRIVE
TORONTO, ONTARIO
M9L 1R2
416-746-2225

FEB. 06, 2024

Job Name	:	ST. MICHEL CATHOLIC ELEMENTARY SCHOOL
Drawing	:	FIRST FLOOR - NEW ADDITION
Location	:	29 MEADOWVALE ROAD - SCARBOROUGH, ONTARIO
Remote Area	:	AREA#2
Contract	:	J#30329
Data File	:	Area#2.WXF

Hydraulic Design Information Sheet

Name - ST. MICHEL FRENCH CATHOLIC ELEMENTARY SCHOOL Date - 01.29.24
Location - 29 MEADOWVALE ROAD - SCARBOROUGH, ONTARIO
Building - FIRST FLOOR - NEW ADDITION System No. - AREA#2
Contractor - EPI FIRE PROTECTION INC & SECURITY Contract No. - J#30329
Calculated By - MINA BASSILY Drawing No. - SP-1
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 10'-0"
Occupancy - LIGHT HAZARD

SYSTEM DESIGN

(X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure NA Curve NA
Other NA
Specific Ruling 11.2.3.2.3.1 Made By NA Date NA

Area of Sprinkler Operation	- 900	System Type	Sprinkler/Nozzle
Density	- 0.10	(X) Wet	Make SEMI RECESSED
Area Per Sprinkler	- 324	( ) Dry	Model PENDANT
Elevation at Highest Outlet	- 22'-0	( ) Deluge	Size 3/4"
Hose Allowance - Inside	- 0	( ) Preaction	K-Factor 11.2
Rack Sprinkler Allowance	- 0	( ) Other	Temp.Rat.155F
Hose Allowance - Outside	- 100		

Note NA

Calculation Summary Flow Required - 272.7 Press Required - 62.1 TEST
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:		Pump Data:		Tank or Reservoir:	
Date of Test	-			Cap. - NA	
Time of Test	-	Rated Cap.-	NA	Elev.- NA	
Static Press	- 71	@ Press	- NA		
Residual Press	- 61	Elev.	- NA	Well	
Flow	- 397			Proof Flow	
Elevation	- 0			NA	

Location - SPRINKLER BASE OF RISER

Source of Information - JACON FIRE PROTECTION INC

COMMODITY

Commodity NA Class NA Location NA
Storage Ht. NA Area NA Aisle W. NA
Storage Method: Solid Piled NA % Palletized NA % Rack NA

STORAGE RACK

( ) Single Row ( ) Conven. Pallet ( ) Auto. Storage ( ) Encap.
( ) Double Row ( ) Slave Pallet ( ) Solid Shelf ( ) Non
( ) Mult. Row ( ) Open Shelf

Flue Spacing NA Clearance:Storage to Ceiling NA
Longitudinal NA Transverse NA

Horizontal Barriers Provided: NA

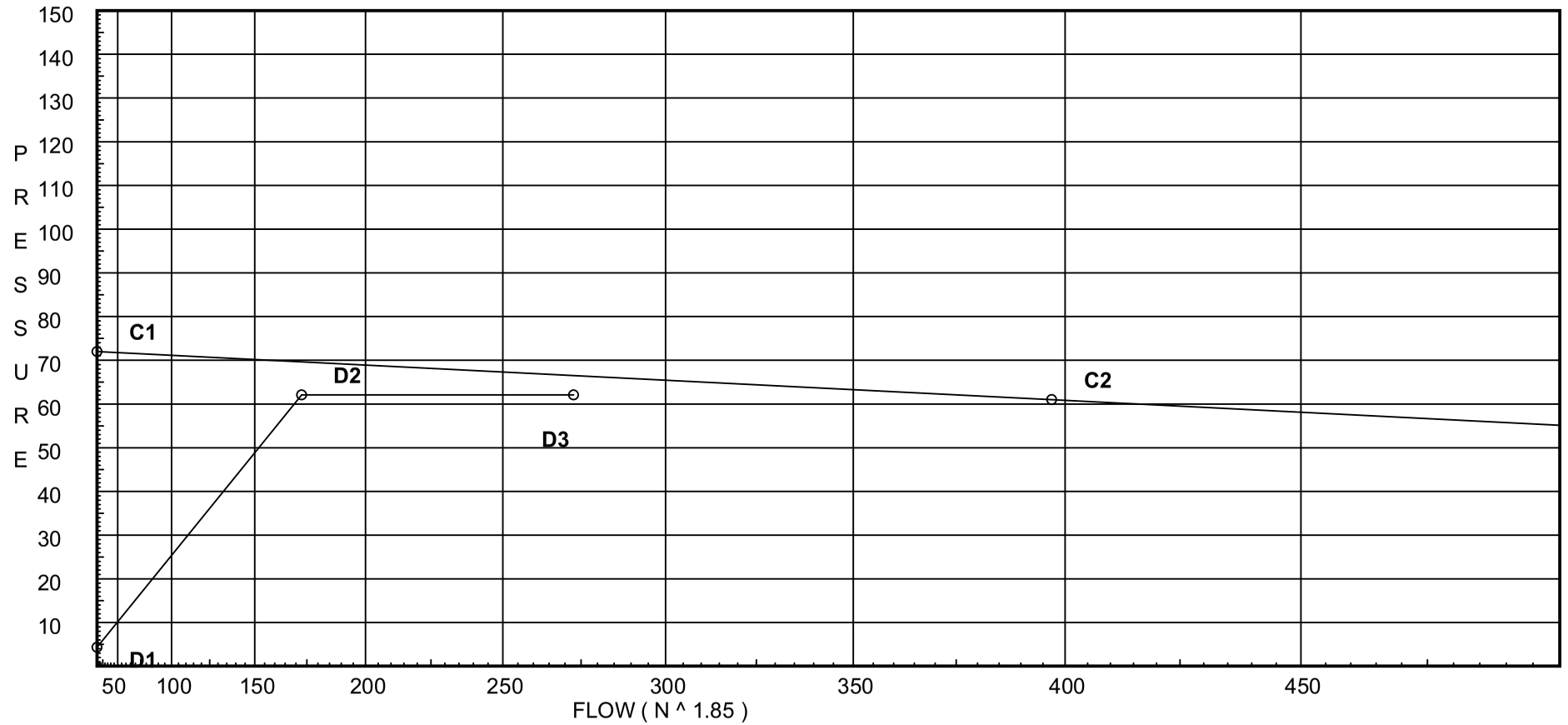
Water Supply Curve

EPI FIRE PROTECTION & SECURITY
ST. MICHEL CATHOLIC ELEMENTARY SCHOOL

Date 01.29.24

City Water Supply:
- C1 - Static Pressure : 72
- C2 - Residual Pressure: 61
- C2 - Residual Flow : 397

Demand:
- D1 - Elevation : 4.331
- D2 - System Flow : 172.676
- D2 - System Pressure : 62.057
- Hose (Demand) : 100
- D3 - System Demand : 272.676
- Safety Margin : 4.453



Fittings Used Summary

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																			
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
Zwg	Watts 757 Vert	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
101	10.0	11.2	8.7	na	33.04	0.1	324	8.7
102	10.0	11.2	8.96	na	33.52	0.1	324	8.7
103	10.0	11.2	9.63	na	34.76	0.1	324	8.7
1	12.0		20.02	na				
2	12.0		20.61	na				
3	12.0		22.15	na				
104	10.0	11.2	10.13	na	35.65	0.1	324	8.7
105	10.0	11.2	10.17	na	35.71	0.1	324	8.7
4	12.0		23.3	na				
5	12.0		23.37	na				
10	12.0		22.7	na				
11	12.0		23.95	na				
12	12.0		44.01	na				
13	12.0		47.72	na				
14	12.0		48.56	na				
TOR1	12.0		48.94	na				
BAS1	4.0		55.78	na				
BKFL	4.0		56.24	na				
SUPP	2.0		61.14	na				
TEST	0.0		62.06	na	100.0			

The maximum velocity is 15.16 and it occurs in the pipe between nodes 11 and 12

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
101	10	11.20	33.04	1	2E	4.0	2.000	120	8.700	
to					T	5.0	35.000		-0.866	
1	12		33.04	1.049	Eql	26.0	37.000	0.3293	12.184	Vel = 12.27
			0.0							
1			33.04						20.018	K Factor = 7.38
102	10	11.20	33.52	1	2E	4.0	2.000	120	8.959	
to					T	5.0	35.000		-0.866	
2	12		33.52	1.049	Eql	26.0	37.000	0.3384	12.519	Vel = 12.44
			0.0							
2			33.52						20.612	K Factor = 7.38
103	10	11.20	34.76	1	2E	4.0	2.000	120	9.630	
to					T	5.0	35.000		-0.866	
3	12		34.76	1.049	Eql	26.0	37.000	0.3617	13.383	Vel = 12.90
			0.0							
3			34.76						22.147	K Factor = 7.39
1	12		33.04	1.5			18.000	120	20.018	
to									0.0	
2	12		33.04	1.682			18.000	0.0330	0.594	Vel = 4.77
2	12		33.52	1.5	T	9.9	7.417	120	20.612	
to							9.900		0.0	
10	12		66.56	1.682			17.317	0.1207	2.091	Vel = 9.61
			0.0							
10			66.56						22.703	K Factor = 13.97
3	12		34.76	1.5	T	9.9	5.417	120	22.147	
to							9.900		0.0	
10	12		34.76	1.682			15.317	0.0363	0.556	Vel = 5.02
			0.0							
10			34.76						22.703	K Factor = 7.30
104	10	11.20	35.65	1	2E	4.0	2.000	120	10.133	
to					T	5.0	35.000		-0.866	
4	12		35.65	1.049	Eql	26.0	37.000	0.3792	14.029	Vel = 13.23
			0.0							
4			35.65						23.296	K Factor = 7.39
105	10	11.20	35.71	1	2E	4.0	2.000	120	10.165	
to					T	5.0	35.000		-0.866	
5	12		35.71	1.049	Eql	26.0	37.000	0.3803	14.071	Vel = 13.26
			0.0							
5			35.71						23.370	K Factor = 7.39
4	12		35.65	1.5	T	9.9	7.417	120	23.296	
to							9.900		0.0	
11	12		35.65	1.682			17.317	0.0380	0.658	Vel = 5.15
			0.0							
11			35.65						23.954	K Factor = 7.28
5	12		35.71	1.5	T	9.9	5.417	120	23.370	
to							9.900		0.0	
11	12		35.71	1.682			15.317	0.0381	0.584	Vel = 5.16
			0.0							
11			35.71						23.954	K Factor = 7.30

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
10	12		101.32	2			16.000	120	22.703	
to									0.0	
11	12		101.32	2.157			16.000	0.0782	1.251	Vel = 8.90
11	12		71.36	2	2E	12.307	71.000	120	23.954	
to					T	12.307	24.614		0.0	
12	12		172.68	2.157			95.614	0.2097	20.055	Vel = 15.16
12	12		0.0	2.5	T	16.474	30.417	120	44.009	
to							16.474		0.0	
13	12		172.68	2.635			46.891	0.0791	3.710	Vel = 10.16
13	12		0.0	3	E	9.408	20.417	120	47.719	
to							9.408		0.0	
14	12		172.68	3.26			29.825	0.0281	0.837	Vel = 6.64
14	12		0.0	4	E	13.167	37.833	120	48.556	
to							13.167		0.0	
TOR1	12		172.68	4.26			51.000	0.0076	0.389	Vel = 3.89
TOR1	12		0.0	4	B	15.8	6.000	120	48.945	
to					Fsp	0.0	42.134		6.465	* * Fixed Loss = 3
BAS1	4		172.68	4.26	T	26.334	48.134	0.0076	0.367	Vel = 3.89
BAS1	4		0.0	4	2E	26.334	8.000	120	55.777	
to					T	26.334	52.668		0.0	
BKFL	4		172.68	4.26			60.668	0.0076	0.463	Vel = 3.89
BKFL	4		0.0	4	Zwg	0.0	4.000	120	56.240	
to									4.866	* * Fixed Loss = 4
SUPP	2		172.68	4.26			4.000	0.0075	0.030	Vel = 3.89
SUPP	2		0.0	8	E	28.468	150.000	140	61.136	
to					G	6.326	90.148		0.866	
TEST	0		172.68	8.27	T	55.354	240.148	0.0002	0.055	Vel = 1.03
			100.00							Qa = 100.00
TEST			272.68						62.057	K Factor = 34.61

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 20 05 11 Mechanical General Requirements of the specification.

1.2 REFERENCE STANDARDS

1.2.1 Do the work in accordance with the Ontario Building Code Plumbing Code and local authority having jurisdiction.

1.2.2	CSA B70 - 2006	Specifications for Cast Iron Soil Pipe Fittings and Means of Joining.
1.2.3	CSA B125 - 2005	Specifications for Plumbing Fittings
1.2.4	ASTM B32 - 2008	Specifications for Solder Metal
1.2.5	ASTM B306 - 2009	Specifications for Copper Drainage Tube (DWV)
1.2.6	ANSI B16.29	
1.2.7	ASTM B88, ASTM B88M - 2003	Specifications for Seamless Copper Water Tube
1.2.8	ASTM A74 - 2009	Specification for Cast Iron Soil Pipe and Fittings
1.2.9	ASTM C564 -2009	Specification for Rubber Gasket for Cast Iron Soil Pipe and Fittings

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

2.1.1 For all above grade vent, sanitary and storm piping, Type DWV to:

.1 ASTM B306 - Specification for copper drainage tube (DWV).

.2 CSA B158 for cast brass fittings.

.3 ANSI B16.29 for wrought copper fittings.

.4 Solder: tin-lead, 50:50, to ASTM B32, type 50A - Specification for solder metal.

.5 ASTM B88.

.6 ASTM C564

2.2 CAST IRON PIPING AND FITTINGS

2.2.1 For above grade storm, sanitary and vent piping, minimum NPS 3, to CSA B70, ASTM A74 with heavy bituminous coating.

2.2.2 For above grade storm, sanitary and vent piping 4" (100 mm) size and larger: Cast iron.

2.2.3 For storm, sanitary and vent piping joints.

.1 Mechanical joints.

.1 Neoprene of butyl rubber compression gaskets for all pipe connections.: to ASTM C564-2009.

.2 SS clamps.

2.3 PUMPED DRAINAGE

2.3.1 Pumped drains shall be galvanized steel.

2.4 DRAINAGE AND VENTS

2.4.1 Piping And Fittings

2.4.2 For buried sanitary, storm and vent piping:

.1 ASTM D2665, ASTM D2949, ASTM B251

.2 ASTM D3034, ASTM F891

.3 CAN/CSA- B181.2 for PVC DWV or

.4 CAN/CSA B182.1- for plastic DWV.

2.4.3 Joints

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

.3 For sizes above 4" (100mm).

Provide Ring-Tite joints Canron Ring-Tite joints PVC DR35 gravity sewer pipe, with locked in rubber ring sealing feature providing tight flexible seal.

Spigot ends to be supplied complete with bevel.

2.4.4 All PVC piping below grade shall be a minimum of SDR 35.

2.5 CONDENSATE DRAIN PIPING

2.5.1 All condensate piping shall be Copper water tube, ASTM B88, Type L for runouts and Type M for mains.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Install piping parallel and close to walls to conserve space, and to grade indicated, and to suit installation of related work.

3.1.2 Apply two coats of asphalt paint to pipe laid in, or passing through concrete.

3.1.3 Where piping passes through floor or wall below grade pack and seal in concrete complete with Link Seal in accordance with Specification Section 20 05 11.

3.1.4 PVC piping shall not be utilized above grade. PVC piping is acceptable for below grade piping where permitted by Code. The PVC piping shall convert to cast iron prior to the point where it penetrates the floor slab.

3.1.5 Provide venting to plumbing fixtures and fixture groups in accordance with the Ontario Building Code Plumbing Code and local authorities having jurisdiction.

3.1.6 Install buried pipe on 6" (150 mm) bed of clean sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with clean sand.

3.1.7 Install piping parallel and close to walls to conserve space and to grade indicated, and to suit the installation of related work.

3.1.8 Apply solvent to male end of joints only.

3.1.9 Pipe installation: Pipe shall be installed as specified and indicated on the drawings.

3.1.10 The piping system shall be installed in accordance with the manufacturers current published installation procedures.

3.1.11 PVC piping shall not be utilized above grade. PVC piping is acceptable for below grade piping where permitted by Code. The PVC piping shall convert to cast iron prior to the point where it penetrates the floor slab.

3.1.12 Where piping passes through floor or wall below grade pack and seal in concrete in accordance with Mechanical General Requirements.

3.1.13 Provide venting to all plumbing fixtures and fixture groups in accordance to the Ontario Building Code - Plumbing Code and local authorities having jurisdiction.

3.1.14 If tests are required by an authority having jurisdiction, perform tests in presence of each governing authority and obtain certification. Repeat tests as often as necessary to obtain certification.

3.1.15 Test pressure shall not exceed 1-1/2 times the maximum rated pressure of the lowest related element in the system.

3.1.16 Remove all fittings which do not withstand test pressure, replace and retest.

3.1.17 Eliminate leaks, or remove and refit defective parts.

3.2 TESTING

3.2.1 The drainage and vent system shall be tested in accordance with the Ontario Building Code - Plumbing Code and tested in accordance with the requirements of the authority having jurisdiction, perform tests in the presence of each governing authority and obtain certification. Repeat tests as often as necessary to obtain certification.

3.2.2 Perform tests before piping is covered or concealed.

3.2.3 Remove all fittings which will not withstand test pressure, and replace after test.

3.2.4 Eliminate leaks, or remove and refit defective parts.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 Conform to Sections of Division 1, as applicable.

.2 Conform to Section 20 05 11 Mechanical General Requirements as applicable.

1.2 RELATED SECTIONS

.1 Plumbing Fixtures and Trim: Section 22 44 13.

1.3 REFERENCES

CAN3-B79-94	Floor Drains and Trench Drains
PDI-G101	Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data
PDI-WH201	Water Hammer Arrestors

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 20 05 11 - Mechanical General Requirements.

.2 Indicate dimensions, construction details and materials for the following: floor drains, cleanouts, water hammer arrestors, strainers, traps, trap seal primers.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in the Mechanical General Requirements.

.2 Data to include:

1. Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

2. Details of operation, servicing, and maintenance.

3. Recommended spare parts list.

PART 2 PRODUCTS

2.1 GENERAL

.1 Furnish plumbing and drainage specialties. Ancon catalogue numbers are specified to indicate quality and features required. Furnish sizes as shown on Drawings.

.2 Acceptable Manufacturers: Ancron, Zurn, Empoco.

2.2 FLOOR DRAINS

.1 General: all floor drains to be provided with trap primer tapping.

.2 Floor Drains - (Mech. Rooms/Unfinished Areas)

Duco coated cast body and flashing collar, with 200 mm (8") round cast iron vandalproof top grate and sediment bucket. Complete with trap priming connection. Outlet size: as indicated on the drawings.

Standard of Acceptance: JR Smith 2220 series

.3 Funneled Floor Drains - Mechanical and Service Rooms

Duco cast iron flanged receptor, bar grate and funnel, c/w vandal-proof secured grate and sediment bucket. Used to receive the drip, condensate or waste water from indirect waste lines. The funnel prevents splashing and directs the waste into the drain. The exposed portion of grate serves as drain for any other waste on the floor. The funnel is attached to the grate by means of concealed screws and it may be moved to any grate location desired. Outlet size: as indicated on the drawings.

Standard of Acceptance: J R Smith 3750 series.

.4 Floor Drains (Finished Areas, Washrooms, Janitor)

Duco coated cast iron body with flashing collar and adjustable strainer head, 150 mm (6") round or square top strainer head. The round top strainer may be used in all poured finished floors. Square top strainer shall be used in all tiled areas - aligned with the tile pattern. Refer to architectural floor material schedules. Floor drains c/w trap primer connection, vandal proof screws, sediment bucket. Reversible flashing collar permits adjustment of the strainer to meet finished floor level.

Standard of Acceptance: JR Smith 2005 series.

.5 Hub Drains (Condensate Drain)

Duco Cast Iron Body with 5” Adjustable Cast Iron Strainer Head and Grate, with Oval Funnel Assemble

Standard of Acceptance: JR Smith SQ-4-1753-A

2.3 FLOOR DRAIN TRAPS AND PRIMERS

.1 Furnish each floor drain installation with a deep seal "P" trap unless otherwise shown.

.2 Furnish trap seal primer valves Ancon No. M3-810 with cast brass body, vacuum breaker and NPS 1/2 sweat connections.

.3 Where a floor drain trap is not within a reasonable distance from a plumbing fixture, furnish an automatic flush tank for priming of trap, Crane No. 7-170 1/2 L, or American Standard No. AF-4104L, complete with automatic syphon, tank liner, concealed top cover, bottom supply and screw driver stop.

.4 As an alternative to automatic flush tanks for remote floor drains, furnish ZURN Model Z1022 trap primers and distribution units, as supplied by S-M-S Ltd.

2.4 DRAINAGE CLEANOUTS

.1 Stack Cleanout - Exposed Drains
1. In base of cast iron stacks with neoprene gasketed secured cover. Duco Cast Iron Cleanout Tee and Countersunk Plug
2. Standard of Acceptance: JR Smith 4510 series

.2 Stack Cleanout - Drains Behind Finished Walls.
1. In base of cast iron stacks with neoprene gasketed secured cover. Duco cast iron cleanout tee and countersunk plug with chrome plated bronze square frame and secured cover.nickel bronze frame with stainless steel cover.
2. Standard of Acceptance: J R smith 4550 series.

.3 Floor Cleanouts
1. In Ceramic Tiled Areas

   .1 Duco cast iron cleanout with square 6"x6" adjustable scoriated secured nickel bronze top. Vandal proof top, flashing flange and clamp. Gasket seal, bronze plug
   .2 Standard of Acceptance: J R Smith 4052 series.

2. In Vinyl Tiled Areas
   .1 Duco Cast Iron Cleanout with Square Adjustable Secured Nickel Bronze Top with 1/8" Tile Recess. Vandal proof top, flashing flange and clamp. Gasket seal, bronze plug
   .2 Standard of Acceptance: J R Smith 4172 series

3. In Terrazzo Areas
   .1 Floor cleanout, above with square nickel bronze cover and frame recessed for terrazzo. Cover can be adjusted to suit floor lines when installing finished floor.
   .2 Standard of Acceptance: JR Smith 4180.

4. Carpeted and Other Finished Areas
   .1 Duco cast iron cleanout with round adjustable scoriated secured nickel bronze top. Vandal proof top, flashing flange and clamp. Gasket seal, bronze plug
   .2 Standard of Acceptance: JR Smith 4032

5. In Unfinished Areas and Outside Area.
   .1 Epoxy coated cast body with integral clamp device, and removable positive seal cleanout plug and heavy duty scoriated safety finish adjustable cover secured with stainless steel screws.
   .2 Standard of Acceptance: JR Smith 4232

6. For Heavy Traffic Areas
   .1 Floor cleanout, above with extra heavy nickel bronze cover and frame. Gasket seal, bronze plug
   .2 Standard of Acceptance: JR Smith 4112

2.5 SHOCK ABSORBERS

.1 Size shock absorbers in accordance with P.D.I.-WH201.

Ancon	“Shok-Gard”
Zurn	Z-1700
Enpoco	HT Series

.2 Provide shock absorbers for all new plumbing piping.

2.6 NON-FREEZE WALL HYDRANT (HOSE BIBB):

.1 Encased recessed non-freeze wall or ground hydrant with NPS 3/4" hose outlet with vacuum breaker. Bronze quarter turn non-freeze hydrant with hose connection, integral vacuum breaker, "T" handle key, and stainless steel box with full 180 deg. cover opening. Meets ANSI A112.21.3

.2 Standard of Acceptance: JR Smith 5509 QTNB.

2.7 ROOF DRAINS

.1 Roof Drains - Controlled Flow

Duco cast iron body with combined flashing clamp and gravel stop with adjustable "flow rate control" assembly and aluminium dome, trapezoidal weirs limit the flow to the leaders. Adjustable to provide various flow rates as required. Outlet diameter as indicated on the drawings.

Standard of Acceptance: J R Smith 1083 series.

.2 Roof Drains – Standard Un-Controlled Flow

FLOFORCE™ High efficient flow performing roof drain. Roof drain engineered to evacuate water off of roof structure by incorporating a smooth funnel shaped interior surface, providing a seamless transition to outlet connection, and eliminating internal obstructions. Complete with Dura-Coated cast iron body with combination membrane flashing clamp/gravel guard and low silhouette Poly-Dome. Flashing clamp/gravel guard

provided to prevent debris from entering the drain while allowing water to immediately pass through at zero head level. Poly-dome designed to maximize effective open area and promote efficient flow.

Standard of Acceptance: Zurn Z100F complete with large sump, roof membrane waterproof flange, under-deck clamp, sump extension, roof sump receiver, cast iron dome strainer and vandal-proof secured top. Provide all accessories necessary to install the roof drain with the proposed roofing type (see Architectural Drawings).

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, provincial codes and local authority having jurisdiction except where specified otherwise.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks and rainwater leaders and where indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.3 WATER HAMMER ARRESTORS

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

.2 Hot and cold water fixture outlets provided with a vertical air chamber, a minimum of 450 mm long. Air chamber of the same pipe dimension as the branch pipe diameter leading to the fixture, and located as close to the fixture as possible.

.3 Hot and cold water main branches 75 mm (3") diameter and under to 25 mm (1") diameter: Provided with vertical air chambers of sizes and dimensions specified above, located at points where the pipe line changes direction through 90 degrees in horizontal plane, and at the top of all hot and cold water risers.

3.4 TRAP SEAL PRIMERS

.1 Install trap seal primer valve in cold water supply line to nearest plumbing fixture (preferably a water closet) and run NPS 1/2 Type K copper piping to primer connection on floor drain body. Obtain Minister's Designee's approval for location of primer valves prior to installation.

.2 Install trap primer tank in truss space or other suitable location as directed by ORC Designee, or as shown on Drawings.

.3 (Install in access pit as indicated).

3.5 COMMISSIONING

.1 After start-up, test, adjust and prove operation as indicated, to suit conditions.

.2 Clean out strainers periodically until clear.

.3 Clean out and prime all floor drain traps using trap seal primers or other means acceptable to the Canadian Plumbing Code.

.4 Prove freedom of movement of cleanouts.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION:

1.1.1. This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

1.2. RELATED WORK:

1.2.1. Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION.
1.2.2. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
1.2.3. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1.2.4. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3. SUBMITTALS:

1.3.1. Submit in accordance with Section 01 33 23, SHOP DRAWINGS AND PROJECT DOCUMENTATION, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.3.2. Shop Drawings:

1.3.2.1. Provide documentation to demonstrate compliance with drawings and specifications.
1.3.2.2. Include electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

1.3.3. Manuals:

1.3.3.1. Submit simultaneously with the shop drawings, companion copies of complete installation, maintenance and operating manuals, including technical data sheets and application data.
1.3.3.2. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Resident Engineer:
1.3.3.3. Certification that the motors have been applied, installed, adjusted, lubricated, and tested according to manufacturer published recommendations.

1.4. APPLICABLE PUBLICATIONS:

1.4.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

1.4.2. National Electrical Manufacturers Association (NEMA):

1.4.2.1. MG 1-2006 Rev. 1 2009 Motors and Generators
1.4.2.2. MG 2–2001 Rev. 1 2007 Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

1.4.3. National Fire Protection Association (NFPA):

1.4.3.1. 70-latest National Electrical Code (NEC)

1.4.4. Institute of Electrical and Electronics Engineers (IEEE):

1.4.4.1. 112-04 Standard Test Procedure for Polyphase Induction Motors and Generators

1.4.5. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

1.4.5.1. 90.1-latest Energy Standard for Buildings Except Low-Rise Residential Buildings

1.5. **STANDARDS OF ACCEPTANCE**

1.5.1. Baldor Electric Company
1.5.2. Leeson Electric
1.5.3. General Electric
1.5.4. Dayton

PART 2 - PRODUCTS

2.1. **MOTORS:**

2.1.1. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR STARTERS AND CONTROLERS; and Section 26 05 19, POWER CONDUCTORS AND CABLES.

2.1.2. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors as scheduled. Unless otherwise specified for a particular application, use electric motors with the following requirements.

2.1.3. Single phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.

2.1.4. Electrically Commutated Motor (EC Type): Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic commutation. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

2.1.5. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.

2.1.6. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

2.1.7. Number of phases shall be as follows:

2.1.7.1. Motors, less than 373 W (1/2 HP): Single phase.
2.1.7.2. Motors, 373 W (1/2 HP) and larger: 3 phase.
2.1.7.3. Exceptions:
2.1.7.3.1. Unless specified otherwise
2.1.7.3.2. Hermetically sealed motors.
2.1.7.3.3. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

2.1.8. Motors shall be designed for operating the connected loads continuously in a 40°C (104°F) environment, where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation. If the motors exceed 40°C (104°F), the motors shall be rated for the actual ambient temperatures.

2.1.9. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

2.2. **MOTOR ENCLOSURES:**

2.2.1. Shall be the NEMA types as specified and/or shown on the drawings.

2.2.2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.

2.2.3. Enclosure requirements for certain conditions are as follows:

2.2.3.1. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.

2.2.3.2. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.

2.2.3.3. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.

2.2.3.4. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

2.2.4. Special Requirements:

2.2.4.1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Board

2.2.4.2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.

2.2.5. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:

2.2.5.1. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.

2.2.5.2. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.

2.2.5.3. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

2.2.6. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

2.2.7. Motors less than 3 HP:

2.2.7.1. Steel or cast iron motor frames, cast aluminum, cast iron, or steel end plates, steel or cast iron terminal box, copper windings. Motor nameplates shall be steel, engraved-type, riveted to motor.

2.2.7.2. Bearings: Regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings, selected for a minimum L-10bearing life of 26,280 hours, for belted and direct drive.

2.2.8. Motors 3 HP and above:

2.2.8.1. Cast iron motor frame and mounting feet, cast iron end plates (bells), steel or cast iron terminal box, copper windings. Motor nameplates shall be stainless steel engraved type, riveted to the motor.

2.2.8.2. Bearings shall be regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings. Rated for an L-10 life of 40,000 hours (belted) or 130,000 hours (direct connected).

2.2.9. Bearing life calculations shall be per ABMA 9, and for belted applications shall be based on the maximum external side load limits for belted applications per NEMA MG-1 Table 14-1A. L-10 life calculations for vertical motors and horizontal motors mounted in the vertical position shall consider the application's thrust loading.

2.2.10. TEFC motors shall also include an external shaft slinger on drive end.

2.2.11. Motors shall not exceed dBA levels listed in NEMA MG-1 54 PART 9 Tables 9-1 and 9-3, at all speeds.

2.2.12. Motors utilized with variable frequency drives shall be rated "inverter-duty" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

2.3. **ENERGY EFFICIENT MOTORS (MOTOR EFFICIENCIES):**

2.3.1. All permanently wired polyphase motors of 746 Watts (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table.

2.3.2. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated.

2.3.3. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Premium Efficiencies Open Drip-Proof				**Minimum Premium Efficiencies Totally Enclosed Fan-Cooled**			
Rating kW (HP)	**1200 RPM**	**1800 RPM**	**3600 RPM**	**Rating kW (HP)**	**1200 RPM**	**1800 RPM**	**3600 RPM**
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%

2.3.4. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

PART 3 - EXECUTION

3.1. **INSTALLATION:**

3.1.1. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2. **FIELD TESTS**

3.2.1. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before start-up. All shall test free from grounds.

3.2.2. Perform Load test in accordance with ANSI/IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

3.2.3. Insulation Resistance: Not less than one half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

3.2.4. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3. **STARTUP AND TESTING**

3.3.1. The Commissioning Agent will observe startup and contractor testing of all equipment. Coordinate the startup and contractor testing schedules with Project Supervisor and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.4. **DEMONSTRATION AND TRAINING**

3.4.1. Provide services of manufacturer's technical representative for four hours to instruct Client's personnel in operation and maintenance of units.

3.4.2. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 11 – TRAINING AND DEMONSTRATION.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. This specification is to cover a complete Variable Frequency Drive (VFD aka: VSD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design B induction motor.

1.1.2. The drive manufacturer shall supply the drive and all necessary options as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable. Drive manufacturers who do not build their own power boards and assemblies, or do not have full control of the power board manufacturing and quality control, shall be considered as a "brand labeled" drive. All VFDs installed on this project shall be from the same manufacturer.

1.2. QUALITY ASSURANCE

1.2.1. Referenced Standards and Guidelines:

1.2.1.1. Institute of Electrical and Electronic Engineers (IEEE)
1.2.1.2. IEEE 519-1992, Guide for Harmonic Content and Control.
1.2.1.3. Underwriters Laboratories (as appropriate)

1.2.1.3.1. UL508
1.2.1.3.2. UL508A
1.2.1.3.3. UL508C

1.2.1.4. National Electrical Manufacturer's Association (NEMA)
1.2.1.5. ICS 7.0, AC Adjustable Speed Drives
1.2.1.6. International Electrotechnical Commission (IEC)
1.2.1.7. EN/IEC 61800-3
1.2.1.8. National Electric Code (NEC)
1.2.1.9. NEC 430.120, Adjustable-Speed Drive Systems

1.2.2. Qualifications:

1.2.2.1. VFDs and options shall be UL508 listed as a complete assembly. The base VFD shall be UL labeled 100 kA RMS Symmetrical, 600V max. C

1.2.2.2. CE Mark – The base VFD shall conform to the European Union Electromagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2). Base drives that only meet the Second Environment (Category C3, C4) shall be supplied with filters to bring the drive in compliance with the First Environment levels.

1.2.2.3. The entire VFD assembly, including the bypass (if specified), shall be seismically certified and labeled as such in accordance with the 2012 International Building Code (IBC)

1.3. **STANDARD OF ACCEPTANCE:**

1.3.1.1. ABB ACH Series.
1.3.1.2. Danfoss VLT series

1.4. **SUBMITTALS**

1.4.1. Submittals shall include the following information:

1.4.1.1. Outline dimensions, conduit entry locations and weight.
1.4.1.2. Customer connection and power wiring diagrams.
1.4.1.3. Complete technical product description include a complete list of options provided.
1.4.1.4. Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification.

PART 2 - PRODUCTS

2.1. **VARIABLE FREQUENCY DRIVES**

2.1.1. The VFD package as specified herein and defined on the VFD schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility.

2.1.2. The VFD shall provide full rated output from a line of ±10% of nominal voltage. The VFD shall continue to operate without faulting from a line of +30% to -35% of nominal voltage.

2.1.3. VFDs shall be capable of continuous full load operation under the following environmental operating conditions:

2.1.3.1. -15 to 40° C (5 to 104° F) ambient temperature. Operation to 50° C shall be allowed with a 10% reduction from VFD full load current.
2.1.3.2. Altitude 0 to 3300 feet above sea level. Operation to 6600 shall be allowed with a 10% reduction from VFD full load current.
2.1.3.3. Humidity less than 95%, non-condensing.

2.1.4. All VFDs shall have the following standard features:

2.1.4.1. All circuit boards shall be coated to protect against corrosion.
2.1.4.2. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.

2.1.4.3. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.

2.1.4.4. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VFD programming shall be held in non-volatile memory and is not dependent on battery power

2.1.4.5. The VFD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

2.1.4.6. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required, based on the temperature of and run command to the drive. VFD protection shall be based on thermal sensing and not cooling fan operation.

2.1.4.7. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).

2.1.4.8. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

2.1.4.9. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.

2.1.4.10. VFDs through 200 HP shall have internal swinging (non-linear) chokes providing impedance equivalent to 5% to reduce the harmonics to the power line. Swinging choke shall be required resulting in superior partial load harmonic reduction. Linear chokes are not acceptable. 5% impedance may be from dual (positive and negative DC bus) chokes, or 5% swinging AC line chokes. VFD's with only one DC choke shall add an AC line choke.

2.1.4.11. The input current rating of the VFD shall not be greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.122. Input and output current ratings must be shown on the VFD nameplate.

2.1.4.12. The VFD shall include a coordinated AC transient surge protection system consisting of 4 MOVs (phase to phase and phase to ground), a capacitor clamp, 1600 PIV Diode Bridge and internal chokes. The MOV's shall have a minimum 125 joule rating per phase across the diode bridge. VFDs that do not include coordinated AC transient surge protection shall include an external TVSS (Transient Voltage Surge Suppressor).

2.1.4.13. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over

the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.

2.1.4.14. The VFD shall include multiple "two zone" PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for "two zone" control.

2.1.4.15. If the input reference is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.

2.1.4.16. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

2.1.5. All VFDs to have the following adjustments:

2.1.5.1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.

2.1.5.2. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.

2.1.5.3. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.

2.1.5.4. Two (2) programmable analog inputs shall accept current or voltage signals.

2.1.5.5. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.

2.1.5.6. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

2.1.5.7. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs

are not acceptable. Drives that have only two (2) relay outputs must provide an option card that provides additional relay outputs.

2.1.5.8. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.

2.1.5.9. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 – 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.

2.1.5.10. Seven (7) programmable preset speeds.

2.1.5.11. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

2.1.5.12. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.

2.1.5.13. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.

2.1.5.14. The VFD shall include password protection against parameter changes.

2.1.5.15. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:

2.1.5.15.1. Start-up assistant
2.1.5.15.2. Parameter assistants
2.1.5.15.3. PID assistant
2.1.5.15.4. Reference assistant
2.1.5.15.5. I/O assistant
2.1.5.15.6. Serial communications assistant
2.1.5.15.7. Option module assistant
2.1.5.15.8. Panel display assistant
2.1.5.15.9. Low noise set-up assistant
2.1.5.15.10. Maintenance assistant
2.1.5.15.11. Troubleshooting assistant
2.1.5.15.12. Drive optimizer assistants

2.1.6. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

2.1.6.1. Output Frequency
2.1.6.2. Motor Speed (RPM, %, or Engineering units)
2.1.6.3. Motor Current
2.1.6.4. Motor Torque
2.1.6.5. Motor Power (kW)
2.1.6.6. DC Bus Voltage
2.1.6.7. Output Voltage

2.1.7. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.

2.2. **SERIAL COMMUNICATIONS**

2.2.1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. [Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available.] Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.

2.2.2. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

2.2.2.1. Data Sharing – Read Property – B.
2.2.2.2. Data Sharing – Write Property – B.
2.2.2.3. Device Management – Dynamic Device Binding (Who-Is; I-Am).
2.2.2.4. Device Management – Dynamic Object Binding (Who-Has; I-Have).
2.2.2.5. Device Management – Communication Control – B.

2.2.3. Serial communication capabilities shall include, but not be limited to; run-stop controls, speed set adjustment, and lock and unlock the keypad. The drive shall have the capability of allowing the BAS to monitor feedback such as process variable feedback, output speed

/ frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The BAS shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

2.2.4. Serial communication in bypass (if bypass is specified) shall include, but not be limited to; bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.

2.2.5. The VFD / bypass shall allow the BAS to control the drive and bypass digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the BAS system. This allows for remote monitoring of which (of up to 4) safeties are open.

2.2.6. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.

2.2.7. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2) with up to 100 feet of motor cable. Second environment (Category C3, C4) is not acceptable, no Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment (C2).

2.3. **DRIVE OPTIONS**

2.3.1. Options shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

2.3.2. Circuit Breaker - Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options. Circuit breaker option shall be available with or without systems requiring bypass.

2.3.3. Disconnect Switch with Fuses - Door interlocked, padlockable disconnect switch that will disconnect all input power from the drive and all internally mounted options. Drive input fusing is included.

2.3.4. Fieldbus adapters – The following optional fieldbus adapters shall be available as a plug in modules.

2.3.4.1. LonWorks
2.3.4.2. DeviceNet
2.3.4.3. Ethernet IP
2.3.4.4. ControlNet over Ethernet & ModBus TCP
2.3.4.5. BACnet IP
2.3.4.6. Profibus

2.4. **BYPASS**

2.4.1. Bypasses shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. All VFD with bypass configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

2.4.2. A complete factory wired and tested bypass system consisting of a door interlocked, padlockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses. UL Listed motor overload protection shall be provided in both drive and bypass modes.

2.4.3. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the "Off" position before either enclosure may be accessed.

2.4.4. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 Amps and this rating shall be indicated on the UL data label.

2.4.5. Drive Isolation Fuses - To ensure maximum availability of bypass operation, fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection. This maintains bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted. Third contactor "isolation contactors" are not an acceptable alternative to fuses, as contactors could weld closed and are not an NEC recognized disconnecting device.

2.4.6. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. This feature is designed to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode. Designs that will not allow input single phase operation in the VFD mode are not acceptable.

2.4.7. Motor protection from single phase power conditions - the bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor

in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.

2.4.8. The bypass system shall be designed for stand-alone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed. Bypass systems that do not maintain full functionality with the drive removed are not acceptable.

2.4.9. Serial communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet MS/TP.

2.4.10. Serial communication capabilities shall include, but not be limited to: bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (Amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus and / or via a Form-C relay output – keypad "Hand" or "Auto" selected, bypass selected, and broken belt indication. The BAS system shall also be able to monitor if the motor is running in the VFD mode or bypass mode over serial communications. A minimum of 50 field serial communications points shall be capable of being monitored in the bypass mode.

2.4.11. The bypass serial communications shall allow control of the drive/bypass (system) digital outputs via the serial interface. This control shall be independent of any bypass function or operating state. The system digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. All system analog and digital I/O shall be capable of being monitored by the BAS system.

2.4.12. There shall be an adjustable motor current sensing circuit for the bypass and VFD modes to provide proof of flow (broken belt) indication. The condition shall be indicated on the keypad display, transmitted over the BAS and / or via a Form-C relay output contact closure. The broken belt indication shall be programmable to be a system (drive and bypass) indication. The broken belt condition sensing algorithm shall be programmable to cause a warning or system shutdown.

2.4.13. The digital inputs for the system shall accept 24VDC. The bypass shall incorporate an internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 mA of 24 VDC for use by others to power external devices.

2.4.14. There shall be a coordinated run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, time-clock control, digital input, or serial communications) the bypass shall provide a dry contact closure that will signal the damper to open before the motor can run. When the damper is fully open, a normally open

dry contact (end-switch) shall close. The closed end-switch is wired to a bypass system input and allows motor operation. Up to four separate safety interlock inputs shall be provided. When any safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. This feature will also operate in Fireman's override / smoke control mode.

2.4.15. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to activate a Form-C relay output, and / or over the serial communications protocol.

2.4.16. The bypass control shall include a programmable time delay bypass start including keypad indication of the time delay. A Form C relay output commands the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.

2.4.17. There shall be a keypad adjustment to select manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will result in an automatic transfer to bypass mode and which faults require a manual transfer to bypass. The user may select whether the system shall automatically transfer from drive to bypass mode on the following drive fault conditions:

2.4.17.1. Over current
2.4.17.2. Over voltage
2.4.17.3. Under voltage
2.4.17.4. Loss of analog input
2.4.17.5. The following operators shall be provided:
2.4.17.6. Bypass Hand-Off-Auto
2.4.17.7. Drive mode selector
2.4.17.8. Bypass mode selector
2.4.17.9. Bypass fault reset
2.4.17.10. The bypass shall include the ability to select the operating mode of the system (VFD/Bypass) from either the bypass keypad or digital input.
2.4.17.11. The bypass shall include a two line, 20 character LCD display. The display shall allow the user to access and view:
2.4.17.12. Energy savings – in US dollars
2.4.17.13. Bypass motor amps
2.4.17.14. Bypass input voltage– average and individual phase voltage
2.4.17.15. Bypass power (kW)
2.4.17.16. Bypass faults and fault logs
2.4.17.17. Bypass warnings
2.4.17.18. Bypass operating time (resettable)
2.4.17.19. Bypass energy (kilowatt hours – resettable)
2.4.17.20. I/O status
2.4.17.21. Parameter settings / programming
2.4.17.22. Printed circuit board temperature
2.4.17.23. The following indicating lights (LED type) or keypad display indications shall be provided. A test mode or push to test feature shall be provided.
2.4.17.24. Power-on (Ready)

2.4.17.25. Run enable
2.4.17.26. Drive mode selected
2.4.17.27. Bypass mode selected
2.4.17.28. Drive running
2.4.17.29. Bypass running
2.4.17.30. Drive fault
2.4.17.31. Bypass fault
2.4.17.32. Bypass H-O-A mode
2.4.17.33. Automatic transfer to bypass selected
2.4.17.34. Safety open
2.4.17.35. Damper opening
2.4.17.36. Damper end-switch made

2.4.18. The Bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs. This I/O allows for a total System (VFD and Bypass) I/O count of 24 points as standard. The bypass I/O shall be available to the BAS system even with the VFD removed.

2.4.19. The on-board Form-C relay outputs in the bypass shall programmable for any of the following indications:

2.4.19.1. System started
2.4.19.2. System running
2.4.19.3. Bypass override enabled
2.4.19.4. Drive fault
2.4.19.5. Bypass fault
2.4.19.6. Bypass H-O-A position
2.4.19.7. Motor proof-of-flow (broken belt)
2.4.19.8. Overload
2.4.19.9. Bypass selected
2.4.19.10. Bypass run
2.4.19.11. System started (damper opening)
2.4.19.12. Bypass alarm
2.4.19.13. Over temperature

2.4.20. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

2.4.21. The bypass shall include a supervisory control mode. In this bypass mode, the bypass shall monitor the value of the VFD's analog input (feedback). This feedback value is used to control the bypass contactor on and off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps.

2.4.22. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include "FireStat", "FreezStat", "Over

pressure" and "Low suction". The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.

2.4.23. Smoke Control Override Mode (Override 1) – The bypass shall include a dedicated digital input that will transfer the motor from VFD mode to Bypass mode upon receipt of a dry contact closure from the Fire / Smoke Control System. The Smoke Control Override Mode action is not programmable and will always function as described in the bypass User's Manual documentation. In this mode, the system will ignore low priority safeties and acknowledge high priority safeties. All keypad control, serial communications control, and normal customer start / stop control inputs will be disregarded. This Smoke Control Mode shall be designed to meet the intent of UL864/UUKL.

2.4.24. Fireman's Override Mode (Override 2) – the bypass shall include a second, programmable override input which will allow the user to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs or any combination of the above. This programmability allows the user to program the bypass unit to react in whatever manner the local Authority Having Jurisdiction (AHJ) requires. The Override 2 action may be programmed for "Run-to-Destruction". The user may also force the unit into Override 2 via the serial communications link.

2.4.25. Class 10, 20, or 30 (programmable) electronic motor overload protection shall be included.

2.4.26. Drive Service Switch – Drive service switches shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. VFD/Bypass configurations that utilize contactors as a means to remove VFD input power for the purpose of VFD servicing are not acceptable. NEC Code does not recognize a contactor as a means of disconnect in a motor control circuit.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.

3.1.2. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 wiring requirements based on the VFD input current. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2. START-UP

3.2.1. Factory start-up shall be provided for each drive by a factory authorized service center. A start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3. PRODUCT SUPPORT

3.3.1. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line connected to factory support personnel located in the US shall be available. Technical support offered only through the local sales office is not acceptable.

3.3.2. Training shall include installation, programming and operation of the VFD, bypass and serial communication. Factory authorized start up and owner training to be provided locally upon request.

3.4. **WARRANTY**

3.4.1. The VFD Product Warranty shall be 36 months from the date of factory shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

END OF SECTION

1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 QUALITY ASSURANCE

.1 Comply with OBC and NFPA 90A requirements, particularly paragraphs pertaining to the maximum flame spread index (currently set at 25) and maximum smoke development index (currently set at 50).

.2 All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

.3 Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.3 SUBMITTALS

.1 Submit in accordance with Section 20 05 11 shop drawings and product data

.2 Provide the following:

.1 Insulation materials: Specify each type used and state surface burning characteristics.
.2 Insulation facings and jackets: Each type used. Make it clear that white finish will befurnished for exposed ductwork, casings and equipment.
.3 Insulation accessory materials: Each type used.
.4 Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.

1.4 STORAGE AND HANDLING OF MATERIAL

.1 Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.5 STANDARDS OF ACCEPTANCE

.1 Knauf Fiber Glass
.2 Owens/Corning Fiberglass
.3 Armstrong
.4 Johns Manville

.5 Rockwool Manufacturing
.6 Armaflex.

2 PRODUCTS

2.1 GENERAL

.1 K-factors (thermal conductivity) shown are expressed in BTU•in/hr•ft2•F.

2.2 MINERAL FIBRE BLANKET WITH VAPOUR BARRIER

.1 Provide external insulation on all of the following:
- .1 Supply air ductwork of all heat pump units (vertical and horizontal).
- .2 Outside air ductwork of all heat pump units (vertical and horizontal).
- .3 Outside air, exhaust air, supply air and return air ductwork of all energy recovery ventilators.

.2 Provide external insulation on all exhaust ductwork for its entire length.

.3 Material:

.1 Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, for use to 450 deg. F, with a factory-applied jacket manufactured from foil, reinforcing scrim, and kraft paper (FSK). Minimum density of 3/4 lb./cu.ft., maximum conductivity of 0.43 (BTU-in./hr.-sq.ft.-deg. F) at 200 deg. F.

.2 Acceptable Material: Fiberglas, Knauf, Manson.

.3 Thickness: 1".

2.3 FIBROUS GLASS RIGID WITH VAPOUR BARRIER

.1 Apply on all indoor supply rectangular ductwork larger than 30" wide and on all ductwork located outdoors, regardless of size.

.2 Material:

.1 Mineral–Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, for use to 450 deg. F, with a factory-applied jacket manufactured from foil, reinforcing scrim, and kraft paper (FSK). Minimum density of 3 lb./cu.ft., maximum conductivity of 0.40 (BTU-in./hr.-sq.ft.-deg. F) at 300 deg. F.

.2 Acceptable products: Fiberglas AF 530, Manson, Knauf.

.3 Thickness: 1"

2.4 CANVAS JACKETS

.1 Apply in mechanical rooms where rigid insulation is applied: compact, firm ULC listed heavy plain weave, cotton fabric at 220 g/m sq.

2.5 METAL JACKETING

.1 At all locations where the ductwork is located outdoors or in heavy abuse areas, use metal jacketing to protect piping or ductwork insulation.

.2 Jacketing: Aluminum, 0.016 inches thick, embossed surface, with factory bonded moisture barrier.

.3 Metal Jacketing Bands: 1/2 inch wide, aluminum or stainless.

2.6 EXTERIOR INSULATION

.1 Cover all joints of the rigid insulation and fastener penetration with 3" wide pressure sensitive All Service Jacket (ASJ) tape. Rub tape hard with a nylon sealing tool. Over the entire surface apply a weave glass reinforcing cloth embedded between two 1/8" thick wet coats of Breather mastic, i.e., B. Foster Seal Fast 6 PM 35-00-4500.

2.7 FASTENINGS

.1 Tape: self adhesive, 100 mm wide rated under 25 for flame spread and under 50 for smoke development.

.2 Contact adhesive: quick-setting, non-flammable fire resistive adhesive to adhere fibrousglass to ducts. Flame spread 15 smoke development 0.

.1 Acceptable Products Foster 85-20 Asbestos Free, Armstrong 520.

.3 Lap Seal Adhesive: Quick-setting adhesive for joints and lap sealing of vapour barriers. Flame spread 10 smoke development 0.

.1 Acceptable Products Foster 85-75, Asbestos Free, Drion.

.4 For Canvas:

.1 Washable adhesive for cementing canvas lagging cloth to duct insulation.
.2 Acceptable Products: Foster 30-36 Asbestos Free.

.5 Pins:

.1 Weld pins 4 mm diameter, with 1½" diameter head for installation through the insulation. Length to suit thickness of insulation.

.2 Weld pins: If duct is over 24" wide, use on bottom of duct as well.
.3 Acceptable Products: Duro Dyne, Clip-Pin.

3 Execution

3.1 **APPLICATION**

.1 Apply insulation after required tests have been completed and approved by Consultant. Insulation and surfaces shall be clean and dry when installed and during application of any finish.

.2 Work shall be preformed by insulation journeymen.

.3 Apply insulation and coverings on hot equipment while surface is between 50 to 60°C.

.4 Vapour barriers and insulation to be complete over full length of duct or surface, without penetration for hangers, standing duct seams and without interruption at sleeves.

.5 Install insulation with smooth and even surfaces.

.6 Apply insulation materials accessories and finishes to manufacturer's recommendations.

.7 Apply 1.0mm thick metal corners to all ductwork in mechanical rooms to a height of 7 ft.

.8 Use stand-offs for all duct mounted accessories.

.9 The last 3.0 meters of all exhaust ductwork shall be insulated, whether shown on the Drawings or not.

3.2 **DUCT INSULATION**

.1 General:

.1 Adhere and seal vapour barrier using vapour seal adhesives.
.2 Stagger longitudinal and horizontal joints, on multi-layered insulation.

.2 Mechanical Fasteners:

.1 On rectangular ducts, use 50% coverage of insulating cement and weld pins at not more than 14" centres, but not less than 2 rows per side.

3.3 **JACKETS**

.1 Provide fire retardant coating on canvas jackets.

.2 Fire retardant coating shall be approved by authority having jurisdiction prior to

application. Consultant reserves right to remove sample of covering for testing.

.3 Coat canvas covering exposed in finished spaces with diluted coat of lagging adhesive. As recommended by insulation manufacturer for priming. Dilution: 2 parts of water to 3 parts of lagging adhesive.

.4 For all ductwork externally insulated inside of the building, provide 3M VentureClad Insulation Jacketing.

END OF SECTION

1.1. **REQUIREMENTS INCLUDED**

1.2. Procedures for onsite demonstration and testing of equipment and systems, including temporary facilities.

1.3. **INSTRUCTION OF CLIENT'S OPERATING PERSONNEL.**

1.3.1. All demonstrations, instructions and testing must be completed prior to Client acceptance for beneficial use. All safety devices most pass 100 percent before the mechanical systems can be accepted for beneficial use.

1.3.2. Plumbing and emergency power systems are not included.

1.4. **DEFINITIONS**

1.4.1. Start Up: Initial inspection, cleaning, lubrication, adjustment, and operation of equipment and systems by the contractor with the assistance of the representatives of the equipment manufacturers.

1.4.2. Pre Tests: The final stage of the startup procedure. This occurs after all adjustments have been made except for minor fine-tuning that can be done during the pre test. Serves as verification that the systems are ready for the final test. Witnessing of pre test by the Consultant is not required.

1.4.3. Final Tests: Tests, witnessed by the Commissioning Agent or their representative, which demonstrate that all equipment and systems are in compliance with requirements.

1.5. **QUALITY ASSURANCE**

1.5.1. Experienced, trained technical service personnel who are representatives of the equipment manufacturers and system designers shall demonstrate, provide instructions, pre test and final test, as specified, the following equipment:

1.5.1.1. Boilers and economizers
1.5.1.2. Burners
1.5.1.3. Control systems.
1.5.1.4. Instrumentation.

1.5.2. Experienced technicians shall demonstrate and provide instructions on the following equipment (as applicable to the project):

1.5.2.1. Boilers and Burners
1.5.2.2. Chillers and Cooling Towers

1.5.2.3. Pumps and piping systems
1.5.2.4. Air handling equipment
1.5.2.5. Exhaust/Return Fans
1.5.2.6. Control and safety valves
1.5.2.7. BAS and VFDs

1.5.3. The person responsible for programming the BAS shall demonstrate and provide instructions on hardware, software and programming.

1.5.4. The Board will provide a list of personnel to receive instructions and will coordinate their attendance at agreed upon times.

1.5.5. All safety devices shall comply with the TSSA requirements.

1.6. **SUBMITTALS**

1.6.1. Names and qualifications of personnel performing demonstrations, instructions and tests.

1.6.2. Certification that pre testing is complete.

1.6.3. Preliminary schedule of all demonstrations, instructions and final tests two weeks prior to proposed dates.

1.6.4. Provide reports within three weeks after satisfactory completion of demonstrations, instructions, and tests. List date, type of work, persons participating, amount of time, test results, calculations of test results, test data.

1.6.5. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion,

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1. **PREPARATION FOR FINAL TESTS, DEMONSTRATIONS, AND INSTRUCTIONS**

3.1.1. Verify that equipment and systems are fully operational. Complete all start up and pre test activities for all equipment and systems. Complete all construction and finish work.

3.1.2. Arrange for all test personnel for all equipment to be continuously present during one period of time so that all equipment and systems can be tested in their interrelated functions.

For instance, the burner in a heating system shall be tested during the boiler testing, and instrumentation performance will be evaluated in conjunction with boiler testing.

3.1.3. Deliver maintenance and operating manuals four weeks prior to instruction period.

3.1.4. Furnish all special tools.

3.2. **FINAL TESTS**

3.2.1. Demonstrate proper operation of each equipment and system.

3.2.2. Provide tests on equipment as specified in the individual specification sections.

3.3. **STARTUP AND TESTING**

3.3.1. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contactor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.4. **COMMISSIONING**

3.4.1. Provide commissioning documentation in accordance with the requirements of the Commissioning Agency for all inspection, start up, and contractor testing required above and required by the Systems Readiness Checklist.

3.5. **DEMONSTRATIONS AND TRAINING**

3.5.1. Demonstrate operation and maintenance of equipment and systems to Board personnel no more than two weeks prior to scheduled Board operation of the plant.

3.5.2. Use operation and maintenance manuals as basis of instruction. Review contents of manuals with personnel in detail to explain all aspects of operation and maintenance.

3.5.3. Demonstrate start up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shut down of each item of equipment. Allow Government personnel to practice operating the equipment under supervision of instructors.

3.5.4. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

3.5.5. Submit training plans and instructor qualifications

3.6. TIME ALLOCATED FOR DEMONSTRATIONS AND INSTRUCTIONS

3.6.1. At least 8 total instructor hours to include all new building services installed under this project.

3.6.2. At least 4 total instructor hours to include BAS and computer workstation and programs.

3.6.3. Do not exceed three trainees per session, one four hour session, per day, per trainee.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 Water piping to connect HVAC equipment, including the following:

.1 Low temperature supply and return (LTS & LTR) piping serving heat pumps.

1.2 SUBMITTALS

.1 Submit in accordance with Section 20 05 11 Mechanical General Requirements, shop drawings, product data, and samples for the following:

.1 Pipe and equipment supports.
.2 Pipe and tubing, with specification, class or type, and schedule.
.3 Pipe fittings, including miscellaneous adapters and special fittings.
.4 Flanges, gaskets and bolting.
.5 Valves of all types.
.6 Strainers.
.7 Flexible connectors for water service.
.8 Pipe alignment guides.
.9 Expansion joints.
.10 Expansion compensators.
.11 Gages.
.1 Thermometers and test wells.
.2 Pressure Gauges

2 PRODUCTS

2.1 PIPE AND TUBING

.1 Low Temperature Supply and Return (LTS & LTR) Piping:

.1 Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40.

.2 Copper water tube option: ASTM B88, Type K or L, hard drawn. Soft drawn tubing, 20 mm (3/4 inch) and larger, may be used for runouts to floor mounted fan coil units or perimeter convectors

2.2 FITTINGS FOR STEEL PIPE

.1 65 mm (2½ inches) and Larger: Welded or flanged joints.

.1 Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.

.2 Welding flanges and bolting: ASME B16.5:

.3 Weld neck or slip on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).

.4 Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

.2 50 mm (2 inches) and Smaller: Screwed or welded.

.1 Butt welding: ASME B16.9 with same wall thickness as connecting piping.

.2 Forged steel, socket welding or threaded: ASME B16.11.

.3 Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.

.4 Unions: ASME B16.39.

.5 Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half couplings, ASME B16.11 may be used for drain, vent and gage connections.

2.3 FITTINGS FOR COPPER TUBING

.1 Solder Joint:

.1 Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.

.2 Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting.

.3 Bronze Flanges and Flanged Fittings: ASME B16.24.

2.4 DIELECTRIC FITTINGS

.1 Provide where copper tubing and ferrous metal pipe are joined.

.1 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.

.2 65 mm (2½ inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

.3 Temperature Rating, 99 degrees C (210 degrees F).

2.5 SCREWED JOINTS

.1 Pipe Thread: ANSI B1.20.

.2 Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.6 VALVES

.1 Asbestos packing is not acceptable.

.2 All valves of the same type shall be products of a single manufacturer. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.

.3 Provide chain operators for valves 100 mm (4 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.

.4 Standard of Acceptance: Crane, Jenkins, Toyo, Kitz.

.5 Gate Valves:

.1 50 mm (2 inches) and smaller: MSS SP80, Bronze, 1034 kPa (150 lb.), wedge disc, rising stem, union bonnet.

.2 65 mm (2½ inches) and larger: Flanged, outside screw and yoke.

.3 MSS SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.

.6 Globe, Angle and Swing Check Valves:

.1 50 mm (2 inches) and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.) Globe and angle valves shall be union bonnet with metal plug type disc.

.2 65 mm (2½ inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 85 for globe valves and MSS SP 71 for check valves.

.3 Non Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut off. Provide where check valves are shown in chilled water and hot water piping.

.1 Body: Cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.

.2 Seat, disc and spring: 18 8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.

.7 Butterfly Valves:

.1 May be used in lieu of gate valves. Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation.

.2 MSS SP 67, flange lug type (for end of line service) or grooved end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F).

.3 Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65 45 12 electro-plated.

.4 Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.

.5 Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.

.6 Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.

.7 Valves 200 mm (8 inches) and larger: Enclosed worm gear with handwheel, and where required, chain wheel operator.

.8 Ball Valves:

.1 Brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Screwed or solder connections. Provide stem extension to allow operation without interfering with pipe insulation.

.9 Water Flow Balancing Valves

.1 For flow regulation and shut off. Valves shall be line size rather than reduced to control valve size and be one of the following types.

.2 Butterfly valve as specified herein with memory stop.

.3 Eccentric plug valve: Iron body, bronze or nickel plated iron plug, bronze bearings, adjustable memory stop, operating lever, rated 861 kPa (125 psig) and 121 degrees C (250 degrees F).

.10 Circuit Setter Valve

.1 A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure. Provide a readout kit

including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

.11 Automatic Balancing Control Valves

.1 Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of at least 10 times the minimum required for control. Provide standard pressure taps and four sets of capacity charts. Valves shall be line size and be one of the following designs:

.1 Gray iron (ASTM A126) or brass body rated 1205 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless steel piston and spring.

.2 Brass or ferrous body designed for 2067 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self cleaning piston/spring assembly that is easily removable for inspection or replacement.

.3 Combination assemblies containing ball type shut off valves, unions, flow regulators, strainers with blowdown valves and pressure temperature ports shall be acceptable.

.2 Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.

.12 Manual Radiator/Convector Valves

.1 Brass, packless, with position indicator.

2.7 STRAINERS

.1 Basket or Y Type. Tee type is acceptable for water service.

.2 Screens: Bronze, monel metal or 18 8 stainless steel, free area not less than 2 1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter perforations.

.3 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.

.4 Suction Diffusers: Specified in the HYDRONIC PUMPS section.

2.8 EXPANSION JOINTS

.1 Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.

.2 Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.

.3 Bellows Internally Pressurized Type:

.1 Multiple corrugations of Type 304 or Type A240-321 stainless steel.
.2 Internal stainless steel sleeve entire length of bellows.
.3 External cast iron equalizing rings for services exceeding 340 kPa (50 psig).
.4 Welded ends.
.5 Design shall conform to standards of EJMA and ASME B31.1.
.6 External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.
.7 Integral external cover.

.4 Bellows Externally Pressurized Type:

.1 Multiple corrugations of Type 304 stainless steel.
.2 Internal and external guide integral with joint.
.3 Design for external pressurization of bellows to eliminate squirm.
.4 Welded ends.
.5 Conform to the standards of EJMA and ASME B31.1.
.6 Threaded connection at bottom, 25 mm (one inch) minimum, for drain or drip point.
.7 Integral external cover and internal sleeve.

.5 Expansion Compensators:

.1 Corrugated bellows, externally pressurized, stainless steel or bronze.
.2 Internal guides and anti torque devices.
.3 Threaded ends.
.4 External shroud.
.5 Conform to standards of EJMA.

.6 Expansion Joint Identification

.1 Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.

.7 Guides

.1 Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings.

2.9 GAGES, PRESSURE AND COMPOUND

.1 ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4 1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black

graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

.2 Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.

.3 Range of Gages: Provide range equal to at least 130 percent of normal operating range.

2.10 PRESSURE/TEMPERATURE TEST PROVISIONS

.1 Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

.2 Provide one each of the following test items to the Owner:

.1 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.

.2 90 mm (3 1/2 inch) diameter, one percent accuracy, compound gage, , ——100 kPa (30 inches) Hg to 700 kPa (100 psig) range.

.3 0 - 104 degrees C (220 degrees F) pocket thermometer one half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

2.11 THERMOMETERS

.1 Mercury or organic liquid filled type, red or blue column, clear plastic window, with 150 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.

.2 Case: Chrome plated brass or aluminum with enamel finish.

.3 Scale: Not less than 225 mm (9 inches), range as described below, two degree graduations.

.4 Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

.5 Scale ranges may be slightly greater than shown to meet manufacturer's standard. Required ranges in degrees C (F):

2.12 VACUUM AND AIR RELIEF VALVES

.1 Vacuum and air relief valves shall be iron body with bronze trim, and stainless steel floats.

3 EXECUTION

3.1 GENERAL

.1 The drawings show the general arrangement of pipe and equipment but do not show all required

fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

.2 Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

.3 Support piping securely.

.4 Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

.5 Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

.6 Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take offs with 3 elbow swing joints where noted on the drawings.

.7 Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

.8 Provide manual air vent at all piping system high points and drain valves at all low points.

.9 Connect piping to equipment as shown on the drawings. Install components furnished by others such as:

.1 Water treatment pot feeders and condenser water treatment systems.
.2 Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

.10 Thermometer Wells: In pipes 65 mm (2 1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.

.11 Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material.

.12 Where copper piping is connected to steel piping, provide dielectric connections.

3.2 PIPE JOINTS

.1 Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1.

.2 Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

.3 Mechanical Joint: **NO USE OF VICTAULIC FITTINGS WILL BE PERMITTED.**

.4 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

.5 Solvent Welded Joints: As recommended by the manufacturer.

3.3 EXPANSION JOINTS (BELLOWS AND SLIP TYPE)

.1 Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown.

.2 Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.

.3 Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.

.4 Access: Expansion joints must be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding packing.

3.4 LEAK TESTING

.1 Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Consultant. Tests may be either of those below, or a combination, as approved by the Owner.

.1 An operating test at design pressure, and for hot systems, design maximum temperature. The design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head

.2 A hydrostatic test at 1.5 times design pressure.

3.5 FLUSHING AND CLEANING PIPING SYSTEMS

.1 Water Piping: Clean systems as recommended by the suppliers of chemicals specified.

.2 Initial flushing:

.1 Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Consultant.

.3 Cleaning

.1 Using products supplied by the chemical treatment manufacturer, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second). Circulate each section for not less than four hours. Blow down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

.4 Final Flushing

.1 Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 DESCRIPTION

1.2.1 Ductwork and accessories for HVAC including the following:
1.2.1.1 Supply air, return air, outside air, exhaust, and relief systems.

1.3 DEFINITIONS

1.3.1 SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
1.3.2 Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
1.3.3 Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
1.3.4 Exposed Duct: Exposed to view in a finished room, and/or exposed to weather.

1.4 QUALITY ASSURANCE

1.4.1 Fire Safety Code: Comply with NFPA 90A.
1.4.2 Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
1.4.3 Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.
1.4.4 Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.5 SUBMITTALS

1.5.1 Submit in accordance with the Mechanical General Requirements:
.1 Rectangular ducts:
.1 Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
.2 Sealants and gaskets.
.3 Access doors.
1.5.2 Round and flat oval duct construction details:
.1 Manufacturer's details for duct fittings.
.2 Sealants and gaskets.
1.5.3 Access sections.
1.5.4 Volume dampers, back draft dampers.

1.5.5 Upper hanger attachments.
1.5.6 Fire dampers, fire doors, and smoke dampers with installation instructions.
1.5.7 Sound attenuators, including pressure drop and acoustic performance.
1.5.8 Flexible ducts and clamps, with manufacturer's installation instructions.
1.5.9 Flexible connections.
1.5.10 Instrument test fittings.
1.5.11 Details and design analysis of alternate or optional duct systems.

1.6 APPLICABLE PUBLICATIONS

1.6.1 The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
1.6.2 Air Moving and Conditioning Association (AMCA):
.1 500D 98 Laboratory Method of Testing Dampers for Rating
.2 500L-99 Laboratory Method of Testing Louvers for Rating
1.6.3 American Society for Testing and Materials (ASTM):
.1 A653-01 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
.2 A1011-02 Standard Specification for Steel Sheet and Strip Hot rolled Carbon structural, High-Strength Low- Alloy and High Strength Low-Alloy with Improved Formability
.3 B209 01 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate
.4 C1071-00 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
.5 E84-01 Standard Test Method for Surface Burning Characteristics of Building Materials
1.6.4 National Fire Protection Association (NFPA):
.1 90A-99 Standard for the Installation of Air Conditioning and Ventilating Systems
.2 96-01 Ventilation Control and Fire Protection of Commercial Cooking Operations
1.6.5 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
.1 2nd Edition – 1995 HVAC Duct Construction Standards, Metal and Flexible
.2 1st Edition - 1985 HVAC Air Duct Leakage Test Manual
.3 6th Edition – 1992 Fibrous Glass Duct Construction Standards

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

2.1.1 General: Except for systems specified otherwise on drawings, construct ducts, casings, and accessoriesof galvanized sheet steel, ASTM A527, coating G90.

2.2 GALVANIZED STEEL - RECTANGULAR DUCTWORK

2.2.1 G-90 coated galvanized of lock-forming grade conforming to ASTMA653 and A924 Standards. Minimals yield strength for steel sheet and reinforcements shall be 30,000 PSI(207 kPa).
2.2.2 Thickness: to ASHRAE and SMACNA.
2.2.3 Fabrication: to ASHRAE and SMACNA.
2.2.4 Joints: to ASHRAE and SMACNA or proprietary manufactured duct joint. Proprietary

manufactured flanged duct joint shall be considered to be a class B seal.

.1 Standard of Acceptance: Namasco Ductmate; Exanno Nexus.

2.2.5 Fittings

.1 Fabrication: to SMACNA.

.2 Radiused elbows: standard radius.

.3 Square elbows: over 16" with double thickness vanes. Not to be used unless specifically shown on drawings.

.4 Main supply duct branches with splitter damper. If splitter damper is not used, provide branch and main duct balancing damper.

.5 Sub branch duct with 45° entry and balancing damper on branch.

2.2.6 Transitions:

.1 Diverging: 20° maximum included angle.

.2 Converging: 30° maximum included angle.

2.2.7 Offsets: radiussed elbows as indicated.

2.2.8 Obstruction deflectors: maintain full cross- sectional area. Maximum included angles as for transitions.

2.3 SEALING CLASSIFICATION

.1 Sealing classification as follows:

Seal Class	Sealing Requirements	Applicable Static Pressure Construction Class	Allowable Leakage Rate
A	All traverse joints, longitudinal seams and duct wall penetrations	4" w.g. (1000 Pa) -4" w.g. (-1000 Pa)	1% of total system design at system operating pressure 4"(1000 Pa)
B	All transverse joints and longitudinal seams	Up to 3" w.g. (750 Pa) -3" w.g. (-750 Pa) and less	1% of total system design at 3" w.g. (750 Pa)
C	All transverse joints only	Up to 2" w.g. (500 Pa) -2" w.g. (500 Pa) and less	1.5% of total system design at 2" w.g. (500 Pa)
D	Not sealed	Up to 1" w.g. (250 Pa) -1" w.g. (-250 Pa) and less	5% of total system design at 1" w.g. (250 Pa)

2.4 PRESSURE CLASSIFICATIONS

.1 Ductwork material shall be constructed in accordance with SMACNA ratings for the following pressure classifications. Seal classifications shall be in accordance with the following table:

Ductwork	Operating Pressure	Seal Classification	Remarks
All supply ductwork	Up to 2". w.g. (500 Pa)	B	

All return ductwork	Up to 1 " w.g. (250 Pa)	B	
All exhaust ductwork	Up to -1" w.g. (-250 Pa)	B	
All Other Ductwork	Up to 0.5" w.g. (125 Pa)	D	

2.5 SEALANT AND TAPE

2.5.1 Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.

2.5.2 Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.

2.5.3 Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.

2.5.4 Gaskets in Flanged Joints: Soft neoprene.

2.5.5 Approved factory made joints such as DUCTMATE SYSTEM may be used.

2.6 DUCT CONSTRUCTION AND INSTALLATION

2.6.1 Follow SMACNA HVAC Duct Construction Standards.

2.6.2 Where specified, all ductwork shall be made liquid tight with continuous external weld for all seams and joints. Provide neoprene gaskets at flanged connections. Where ducts are not self-draining back to the equipment, provide low point drain pocket with copper drainpipe to sanitary sewer. Provide access door in side of duct at drain pockets.

2.6.3 Casings and Plenums

.1 Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches)wide by 1200 - 1350 mm (48 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

2.6.4 Volume Dampers

.1 Opposed blade, multi louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.

2.6.5 At the onset of the project, the Sheet Metal Contractor shall submit a sketch demonstrating and confirming the ability to transition the ductwork from the unit to the size shown on the Drawing within the Roof Curb. Advise of any issues prior to fabrication.

2.6.6 For all down-discharge rooftop unit, any elbows or transitions within 60’ of the unit shall be equipped with turning vanes.

2.7 HANGERS AND SUPPORTS

2.7.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

2.7.2 Hanger configuration: to ASHRAE and SMACNA. Maximum size duct supported by straphanger: 500mm.

2.7.3 Hangers: galvanized steel angle with black galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1500	40 x 40 x 3	10
1501 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

2.7.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.1 Standard of Acceptance: Myatt fig 485.

.2 For concrete after concrete pour:

.1 Expanded concrete anchors shall be made of steel.
.2 Powder actuated fasteners shall only be utilized for slabs that are thicker than 100 mm (4") and shall not be utilized in lightweight aggregate concretes.
.3 Holes for expanding fasteners shall be drilled either by a carbide bit or by the teeth on the fastener itself. Expansion shield shall be “set" by driving it into the hole and expanding it with a conical plug.

2.7.3 For steel joist: manufactured joist clamp or steel plate washer.
.1 Standard of Acceptance: Grinnell fig 61 or 86 for joist clamps.

2.7.4 For steel beams: manufactured beam clamps:
.1 Standard of Acceptance: Grinnell fig. 60

2.7.5 For round ductwork the duct shall be supported as follows:
.1 For duct dimensions 900 mm (36") single hangers are acceptable.
.2 For duct dimensions over 900 mm (36") hanger rods shall be provided on both sides of the duct.
.3 Minimum hanger sizes shall be in accordance with table 4-2 of SMACNA.

2.7.6 Loading on trapeze bars shall be in accordance with Table 4-3 of SMACNA.

2.8 DUCT ACCESS DOORS, PANELS AND SECTIONS

2.8.1 Provide access doors, sized and located for maintenance work, upstream and downstream of:
.1 Each duct mounted coil.
.2 Each fire damper (for link service), smoke damper and automatic control damper.

.3 Each duct mounted smoke detector.

2.8.2 Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12inch) minimum where possible. Access sections in insulated ducts shall be double wall, insulated. Transparent shatterproof covers are preferred for un insulated ducts.

2.8.3 For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2 12).

2.8.4 For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure2-11).

2.9 FIRE DAMPERS

2.9.1 Galvanized steel, interlocking blade type, UL listing and label, 1 1/2 hour rating, 70 degrees C (160 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

2.9.2 Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.

2.9.3 Provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.

2.9.4 Submit manufacturer's installation instructions conforming to ULC rating test.

2.9.5 Combination fire and smoke dampers: Multi louver or curtain type units meeting all requirements of both dampers shall be used where shown and may be used at the Contractor's option where applicable.

2.9.6 Standard of Acceptance: Nailor, Ruskin

2.10 INSTALLATION

2.11.1 Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

2.11.2 Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Owner. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.

2.11.3 Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.

2.11.4 Supply and install volume control dampers on all branch take-offs (applicable to supply, return and exhaust ductwork) whether shown on the drawing or not.

2.11.5 Provide bolted construction and tie rod reinforcement in accordance with SMACNA Standards.

2.11.6 Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

2.11.7 Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.

2.11.8 Install fire dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.

2.11.9 Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

2.11.10 Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

2.11.11 Control Damper Installation:

.1 Provide necessary blank off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.

.2 Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

.3 Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

.4 Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

2.11.12 Air Flow Measuring Devices (AFMD): Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.

2.11.13 Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by the Consultant. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

2.11 DUCT LEAKAGE TESTS AND REPAIR

2.12.1 Ductwork leak test shall be performed for the entire air distribution supply and return system including fans, coils and filter section designated as static pressure class 750 Pa (3 inch W.G.) and above.

2.12.2 All supply ductwork less than 500 Pa (2 inch W.G) shall also be tested to the air distribution equipment or terminal device (where applicable).

2.12.3 Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.

2.12.4 All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.

2.12.5 All tests shall be performed in the presence of the Consultant and the TAB agency. The Test and Balance agency shall measure and record duct leakage and report to the Consultant and identify leakage source with excessive leakage.

2.12.6 If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Consultant.

2.12.7 All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.

2.12.8 Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 11 Mechanical General Requirements.

PART 2 PRODUCTS

2.1 SPLITTER DAMPER

.1 Of same material as duct but one sheet metal thickness heavier.
.2 Single thickness construction.
.3 Size and configuration to recommendations of SMACNA.
.4 Control rod with locking device.
.5 Bend end of rod to prevent end from entering duct.
.6 Pivot: piano hinge.

2.2 SINGLE BLADE DAMPER

.1 Of same material as duct. V-groove stiffened.
.2 Size and configuration to recommendations of SMACNA, except maximum height 10"
.3 Locking quadrant.
.4 Inside and outside end bearings.

2.3 MULTI-BLADE DAMPER

.1 Factory manufactured of material compatible with duct.
.2 Opposed blade: configuration to recommendations of SMACNA.
.3 Maximum blade height: 4"
.4 Bearings: pin in bronze bushings.
.5 Linkage: shaft extension with locking quadrant.
.6 Channel frame complete with angle stop.

2.4 DIVERTING DAMPER

.1 Adjustable, curved vanes, mounted in supporting frame.
.2 All aluminum construction.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install where indicated on the drawings and identified herein. For ducts concealed behind plaster or drywall ceilings, provide dampers where specifically shown on the drawings.

.2 Provide splitter damper at every main branch take-off from main duct.

.3 Provide balancing damper on all sub-branch ducts.

.4 Install in accordance with recommendations of SMACNA.

.5 Provide balancing dampers on all return air ducts connected to air handling units.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 PRODUCT DATA

.1 Submit shop drawings in accordance with Section 20 05 11 Mechanical General Requirements.

.2 Indicated the following:
   a. Performance curve charts.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 11.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

PART 2 PRODUCTS

2.1 MULTI-LEAF

.1 Opposed or Parallel blade type. Two position dampers to be parallel, modulating dampers to be opposed blade type.

.2 Blades to be of extruded aluminum, internally reinforced air-foil design and connected to linkage with 7/16" hexagon rod.

.3 Blades to be complete with extruded synthetic rubber seals to be secured in an integral slot within the extrusions, spring stainless steel side seals, structurally formed and welded galvanized steel, frame.

.4 All dampers that are in contact with outside air shall be extruded aluminum, internally insulated with non CFC polyurethane foam. Blades shall be thermally broken and connected to linkage with 7/16" hexagon rod. Complete blade shall have an insulating factor of R15.

.5 Bearings to be comprised of celcon inner bearing fixed to a hexagon blade pin rotating within a polycarbonate outer bearing inserted in frame, reuslting in no metal to metal or metal to plastic contact.

.6 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.7 Operator: compatible with damper.

.8 Performance: leakage in closed position to be less than 0.6% of rated air flow at 4" W.G. differential pressure (4 cfm per square foot). Pressure drop at full open position to be less than 0.03 kPa differential across damper at maximum air flow.

.9 Dampers to be suitable for operating in temperatures between -40°F (-40°C) and 212°F (100°C).

.10 Dampers shall be made to size and shall not be limited to standard sizes.

.11 Standard of Acceptance: Tamco Air Foil Series 1000, and Tamco Air Foil Series 9000, Arrow Series AFD-20 and Arrow Series AFD-20 insulated. Ruskin

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install insulated dampers for all dampers directly in contact with outside air.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Seal multiple damper modules with UL listed non-transparent silicon sealant.

.4 Upon system start-up, ensure that dampers operate properly.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the Specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 20 05 11 Mechanical General Requirements.

1.2 REFERENCE STANDARDS

.1 Comply with requirements of:

1. ULC S110M - Fire Tests for Air Ducts
2. UL 181-2008 - Standards for Safety, Factory Made Air Ducts and Air Connectors
3. NFPA 90A-2009 - Standard for the Installation of Air Conditioning and Ventilating Systems
4. NFPA 90B-2009 - Standard for the Installation of Warm Air Heating and Air Conditioning Systems
5. SMACNA – 2005 - HVAC Duct Construction Standards - Second Edition

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 20 05 11 Mechanical General Requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by the manufacturer or Independent Testing Agency signifying adherence to Codes and Standards.

.2 Product Requirements.

PART 2 PRODUCTS

2.1 GENERAL

.1 Factory fabricated.

.2 Pressure drop coefficients listed below are based on sheet metal duct pressure drop coefficient of 1.00.

.3 Fire retardant type insulation materials, coverings and adhesives with maximum flame spread rating of 25 and maximum smoke developed rating of 50 when tested in accordance with CAN/ULC-S102 and NFPA 255-2006. Materials tested in accordance with ASTM C411-05 shall not flame, smoulder, glow or smoke at temperature to which exposed in

service. Flexible duct system shall meet OBC requirements for smoke and flame spread for return air plenums.

2.2 METALLIC-INSULATED

.1 Spiral wound flexible aluminum with 1" (25 mm) external insulation.

.2 Performance:

- Temperature range: -40°F to 250°F (-40°C to 120°C)
- Minimum bend radius: 1.5 x diameter
- Vinyl sleeve outer covering
- Maximum working pressure: 12" (3000 Pa)
- Class 1 duct material

PART 3 EXECUTION

3.1 DUCT INSTALLATION

.1 Install where indicated and in accordance with preferred method of SMACNA and the following:

1. Connections:

   a. Duct Sizes 300 mm (12") and Under:
      i. Provide a minimum of three (3) #8 sheet metal screws equally spaced to hold the flexible duct.

   b. Duct sizes above 300 mm (12"):
      i. Provide a minimum of five (5) #8 sheet metal screws equally spaced to hold the flexible duct.

   c. Screws shall be located at least 1/2" (12 mm) from the end of the duct.

   d. The collar to which the flexible duct is attached shall be a minimum 2" (50 mm) in length.

   e. Cover entire joint with tape and seal as specified in Section 15801.

2. Supports:

   a. Support shall be in accordance with SMACNA.

   b. The maximum amount of sag for flexible duct shall not exceed 1/2" (12 mm) per foot. Provide additional supports as required.

3. Length:

   a. Maximum length of flexible duct: 1500 mm (5 ft.).

   b. Minimum length of flexible duct connecting to light fixture troffers or ceiling diffusers shall be 72" (1800 mm).

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 11 Mechanical General Requirements.

1.3 SAMPLES

.1 Submit samples in accordance with Section 20 05 11 Mechanical General Requirements.

.2 Submit samples for the following:
   a. None

1.4 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers shall be product of one manufacturer for generic type (i.e. grilles and registers by one, diffusers by one, or same).

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 GENERAL

.1 Provide standard product to meet capacity, throw, noise level, throat and outlet velocity.

.2 Where grilles, registers and diffusers penetrate fire walls and fire partitions, provide approved steel sleeve secured to structure in accordance with NFPA 90A-1993 and required fire damper.

.3 Frames:
   a. Steel: primed cold rolled steel with exposed welded joints and mitred corners.
   b. Aluminum: extruded satin finish with mechanical fasteners and mitred corners.
   c. Provide full perimeter gaskets.
   d. Provide plaster frames as plaster stops where set into plaster or gypsum board.
   e. Provide concealed fasteners and balancing operators in all finished areas.

f. Final finish to be selected by Architect from standard manufacturer finishes at shop drawing stage.
g. Style, frame, and installation details as indicated.

.4 Sizes and capacities: as indicated in the schedule.

.5 Standard of Acceptance: E.H. Price, Titus, Tittley Baily, Krugger

2.2 SQUARE PLAQUE DIFFUSERS

.1 Square type 600 x 600 (24" x 24"), having fixed pattern, and volume control dampers with flow straightening devices and blank-off quadrants. Diffuser to be finished in off-white baked enamel and to be suitable for the ceiling in which it is installed.

.2 Square type 300 x 300 (12" x 12"), having fixed pattern, and volume control dampers with flow straightening devices and blank-off quadrants. Diffuser to be finished in off-white baked enamel and to be suitable for the ceiling in which it is installed.

.3 Standard of Acceptance: E. H. Price Model SPD, Titus., Tittley Baily, Krugger

2.3 LOUVERED RETURN GRILLES

.1 Supply and install return grilles of the sizes and mounting types indicated on the plans and outlet schedule. Grilles shall be 0 degree deflection fixed louver type with blades spaced 1/2" (13) on center. The outlet shall have heavy extruded aluminum border and blades held in place with aluminum mandrel tubes not to exceed 12" (305) on center. Blades shall run parallel to the long dimension of the grille. The grille shall be finished as per the architectural requirements.

.2 Standard of Acceptance: E H price 635DAL series, Tittley Baily, Krugger.

2.4 EGG-GRATE EXHAUST GRILLES

.1 Furnish and install exhaust registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be of aluminum construction, consisting of aluminum 1/2" x 1/2" x 1/2" (13 x 13 x 13) grid (egg crate core) and an extruded aluminum border. The integral volume control damper (where required) shall be of the opposed blade type and shall be constructed of heavy gauge cold rolled steel. The damper shall be operable from the register face. The damper shall be coated steel. The grille shall be finished as per the architectural requirements.

.2 Standard of Acceptance: E H Price model 80, Titus, Tittley Baily, Krugger

2.5 DOUBLE DEFLECTION SUPPLY GRILLES - ADJUSTABLE BLADES

.1 Furnish and install aluminum supply registers of the sizes and mounting types indicated on the drawings. Registers shall be double deflection type with two sets of fully adjustable deflection blades spaced 3/4" (19) on center. The front set of blades shall run

parallel to the long dimension of the register. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The grille shall be finished in a color selected by the Architect at shop drawings stage.

.2 Standard of acceptance: E.H.Price model 610DAL, Titus, Tittley Baily, Krugger

2.6 TRANSFER GRILLE TYPES

.1 Aluminum construction, 32 mm flat border, sightproof appearance, off-white baked enamel finish.

.2 Standard of Acceptance: E.H.Price Model ATG1, Titus.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 All diffusers and grilles in finished areas to have concealed mounting. In unfinished areas and where grilles or diffusers are to be installed in ductwork, install with bulkheads tight to either side. Site measure for exact fit.

.3 Final locations of diffusers and grilles to be in accordance with details of Architect's reflected ceiling plan. Coordinate with lighting fixtures installation by Div. 16.

.4 Install and adjust air registers to provide noiseless and draftless distribution. Primary air balance to be done at duct dampers with final adjustment only at diffusers and grilles.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11 Mechanical General Requirements.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 11 Mechanical General Requirements.

.2 Indicate the following: Louvers, Style and Performance.

1.3 CERTIFICATE OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by the Manufacturer or those ordered by him from an independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 STATIONARY LOUVERS

.1 Louvers shall be by Mechanical Contractor.

.2 Frame: 102 mm deep, 6063T5 extruded aluminum. 3.2 mm nominal wall thickness. Downspouts and caulking surfaces included.

.3 Blades: 6063T5 extruded aluminum. 3.2 mm nominal wall thickness. Drainable blades are positioned at 45 degree angle and spaced approximately 102 mm center to center.

.4 Screen: 19 mm X 1.3 mm expanded, flattened aluminum bird screen in removable frame. Screen adds approximately 13 mm to louver depth. Also provide insect screen.

.5 Finish: Factory-applied Kynar 500 or equivalent, colour, selected at shop drawing stage.

.6 Features:

a. Published performance ratings based on testing in accordance with AMCA Publication 511.
b. High performance frame system with drainable head collects and removes water to provide excellent water penetration performance.
c. Drain gutter in each blade minimizes water cascade between blades.
d. All aluminum construction for low maintenance and high resistance to corrosion.
e. All welded construction.

.7 Performance:

a. .1 52% minimum free area.
b. .2 Beginning point of water penetration at 0.01 oz./sq. ft. is 1075 fpm
c. .3 Pressure drop: 0.15" w.g. at 870 fpm (Intake) and 900 fpm (exhaust).

.8 Size of louvers shall be coordinated with the brickwork pattern. Minimum louver size shall be 305mm x 305 mm.

.9 Standard of Acceptance: E.H.Price, Ruskin.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers recommendations and in accordance with recommendations of SMACNA.

.2 Reinforce and brace air vents, intakes and gooseneck hoods for wind speed in accordance with NBC for location.

.3 Blank off and insulate with sheet metal, 2" of insulation and sheet metal, all unused portions of louvres.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 20 05 11.

.2 Submit shop drawings of the pumps, complete with pump curves, for review.

.3 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 11.

PART 2 PRODUCTS

2.1 VERTICAL IN-LINE CENTRIFUGAL PUMPS

.1 Furnish and install, as indicated on the plans and specifications, Optional Integrated Technologic design split coupled vertical in line pumps. Capacity and power supply: as indicated on the equipment schedule.

.2 Supply and install as shown on plans and specifications, The pumps shall be single stage, single suction type, and vertical inline design suitable for future variable speed drive controls. The seal shall be serviceable without disturbing the motor or the piping connections. The capacities and characteristics shall be as outlined in the plans and specifications. The complete pump unit shall be labeled with ETL listing certification that the product conforms to UL Std 778 and is certified to CSA Std C22.2 No.108.

.3 Pump casing shall be constructed of ASTM A48 class 30 cast iron with ANSI 125 / PN16 flanges for working pressure below 175 psig (12 bar) at 150°F (66°C) and ASTM A536 ductile iron with ANSI 250 / PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (66°C). The casing shall be hydrostatically tested to 150% maximum working pressure. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line.

.4 The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.

.5 The impeller shall be bronze, fully enclosed type. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.

.6 The pump shaft shall be stainless steel.

.7 The coupling is to be rigid spacer type constructed of high tensile aluminum alloy. The coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.

.8 The pump shall be fitted with an outside balanced type mechanical seal, with Viton elastomers and antimony carbon (or resin-bonded carbon for potable water applications) vs. silicon carbide faces rated up to 250°F (121°C). A 316 stainless steel gland plate shall be provided with a factory installed flush line with manual vent.

.9 All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.

.10 If required to improve seal chamber cleanliness, supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered. Filters shall be changed, by the installing contractor, after system is flushed and on a regular basis until turned over to the Board.

.11 Alternately, supply in the flush line to the mechanical seal a maintenance-free sediment separator, with sight flow indicator for pump differential pressures exceeding 30 psig (or 200 kPa).

.12 The motor frame shall be NEMA TC type. Motor enclosure is to be TEFC with NEMA Premium Efficiency 12.12 rating. Motor shall be inverter duty type, so it can be operated by variable frequency drive in future.

.13 Pump-mounted VFDs are not permitted.

.14 Sensorless Pumps are not permitted.

.15 Standard of Acceptance: Armstrong, Patterson, Taco.

2.2 SUCTION GUIDES

.1 Furnish and install on the suction of each pump a suction guide, with outlet flow stabilizing guide vanes, removable stainless steel strainer and fine mesh start-up strainer.

.2 For 150 psig flanged pipe: Supply valve with Cast Iron body with 125 psig flanged ports.

.3 For 300 psig flanged pipe: Supply valves with Ductile Iron body and 250 psig flanged ports.

.4 Standard of Acceptance: Armstrong SG Series, Taco.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install with bearing lubrication points accessible. Check rotation.

.2 Supply and install a strainer and isolation valve upstream of each pump.

.3 Supply and install an isolation valve, check valve and balancing valve downstream of each pump.

.4 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to drawings and manufacturer's installation instructions for details.

.5 Provide vibration isolation between the pumps and pipes, and between the pumps and the concrete housekeeping pads. Refer to section 20 05 49.

.6 Pipe drain tapping to floor drain.

.7 Install volute venting pet cock in accessible location.

.8 Change cartridge filter on regular basis prior to, and at turn over to owner.

.9 Contractor to provide and install one pressure gauge, piped to pump suction, pump discharge and strainer inlet. Pressure gauge tappings with necessary isolating valves to enable differential pressure reading across pump and strainer to be taken.

.10 Contractor shall cover motor during construction and have area clean of construction debris before starting the motor.

.11 Contractor to follow the manufacturer's instructions for start-up and venting of mechanical seal.

.12 If pump is used during temporary heating or flushing of system, contractor shall be responsible for changing mechanical seal or replacing motor bearings if so instructed by the board representative.

.13 The pump manufacturer shall coordinate with the hydronic balancer to balance the system to the required flows.

.14 Provide drip pan and piped to nearest drain for each pump. Drip pan shall be sized to suit pump dimensions.

END OF SECTION

1. GENERAL

1.1 GENERAL

1.1.1 Conform to General Provisions for Mechanical Divisions Section 20 05 11.

1.2 SUBMITTALS

1.2.1 Submit shop drawings and product data in accordance with Section 20 05 11.

1.2.2 Indicate the following: complete specifications; wiring diagrams (showing all interconnections); weight; performance details.

1.2.3 Provide data for inclusion in the Operating and Maintenance manuals in accordance with Section 20 05 11.

2. PRODUCTS

2.1 GENERAL

2.1.1 Furnish and install a self-contained vertical floor standing heat pump unit ventilator. Constructed in accordance with UL 1995 standards with a label affixed to the unit listing the product code under which it is registered. Unit performance shall be rated in accordance with ISO 13256-1. Unit shall be constructed following ISO: 9001 quality control program procedures and be fully assembled, charged, wired, and tested prior to shipment.

2.1.2 Basis-of-Design Product: The design for Heat Pump units is based on Modine SchoolMate Model. No alternate Manufacturers are permitted.

2.2 CABINET

2.2.1 Insulation: 1-inch thick, acoustic Hushcloth Polyester/Polyurethane foam with density of 2-pounds per cubic foot containing no fibrous materials.

2.2.2 Fire-Hazard Classification: Insulation shall have a fire rating of UL94HF-1.

2.2.3 Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

2.2.4 Cabinet Construction: Constructed from aluminized steel with 20 gauge panels, degreased and coated with electrostatically applied baked-on polyester powder paint.

2.2.5 Cabinet Interior: Interior right and left hand sides shall employ 20 gauge galvanized steel full double wall construction.

2.2.6 Cabinet Finish: The unit color shall be a custom RAL colour chosen by the Architect and/or Owner.

2.2.7 Paint finish shall be easily cleanable and hard wearing to give maximum protection.

2.2.8 Service and Maintenance Access: All service and maintenance access shall be possible through the front of the unit only.

2.2.9 Return air openings shall be integrated into the cabinet sides.

2.2.10 Access door is factory installed on the front of the unit. Face of door shall be absent of return air openings to allow for easy cleaning. Door shall be fully insulated to provide for superior noise deadening at front of unit. Door shall employ heavy duty ¼" zinc plated steel.

2.2.11 Plunger hinges with a spring-loaded ¼" zinc plated steel pin to allow for easy removal, if required. Door is secured with two (2) key locks. Door swing designed to turn into itself allowing side of the unit to be installed directly against a wall in the corner of a room.

2.2.12 Condensate Connection: Factory installed condensate connection stub provided for connection to the field installed building condensate drain.

2.2.13 Provide an integral condensate pump in each cabinet for pumping the condensate from each respective drain pan to the ceiling space.

2.3 REFRIGERATION SYSTEM

2.3.1 Compressor: Two stage hermetic scroll compressor mounted on four (4) 125# all neoprene rubber 35-45 durometer vibration isolators for quiet operation. Compressor contains an internal unloading mechanism to provide capacity control and enable part load efficiencies to be increased.

2.3.2 An internal overload protector included to protect compressor against excessive motor temperatures and currents.

2.3.3 Compressor is equipped with a crankcase heater to guard against liquid flood-back conditions and the elimination of oil foaming upon start up.

2.3.4 Factory set high and low-pressure switches, automatic reset high pressure cutout, and automatic reset low-pressure cutout.

2.3.5 Refrigeration Circuit (Heat Pump): Heat pump systems shall utilize HFC-R410A and shall be fitted with dual thermal expansion devices and a reversing valve to enable the unit to operate in either cooling or heat pump mode. Fitted with factory set automatic reset high-pressure and low-pressure cut-out switches and a sight glass for system observation.

2.3.6 Factory installed liquid line pressure sensor and fully modulating coaxial coil valve allow for superior control of refrigerant head pressure in cooling and/or dehumidification mode via metering of entering water resulting in increased unit operating performance.

2.3.7 Indoor Coil: Patented micro-channel CFTM evaporator coil designed for maximum heat transfer with minimum footprint and pressure drop. Quick draining evaporator coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

2.3.8 Coaxial Condenser Coil: DX / water counter flow coaxial coil with a convoluted and knurled surface inner tube. Coil is insulated to prevent condensation on units used with Geothermal Ground Source Systems. Coil positioned so as to allow universal pipe fittings to the right hand side of the unit.

2.3.9 Coaxial Coil Freeze Protection: Sensor attached to the fluid leaving side of the coaxial coil. If fluid temperature falls below the adjustable low temperature set point the compressor is locked out.

2.4 FANS AND MOTOR

2.4.1 The indoor fan assembly consists of one blower inside teardrop housing assembly engineered specifically for optimal airflow with low noise and minimal power consumption. Blower is powered by electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics is possible for ultra-high efficiency and low audible noise. The ECM provides constant airflow by automatically adjusting the speed if the external static pressure changes. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.

2.4.2 Exhaust Fan Assembly: The exhaust fan assembly consists of one backward curved plug fan with a centrifugal blower wheel fitted with an electronic speed control to allow for airflow adjustment. Fan design capable of overcoming external static pressures brought on by rear extensions backs and duct work connected to the fan discharge opening. Fan is sized such that powered exhaust shall be integral to the unit to prevent over pressurization of the space when the unit is introducing outside air. Capable of exhausting 100% equivalent of the fresh air intake of the unit. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.

2.5 FILTER

2.5.1 Filter: 2” thick radial pleated disposable cotton and synthetic blend filters. Minimum Efficiency Reporting Value of MERV 13 per ASHRAE standard 52.2.

2.6 CONTROL PANEL

2.6.1 Control Panel: Located at top of the unit behind the front door for direct, centrally located access to controller, controller transformer (24V), and all necessary contactors, relays, and circuit breakers.

2.6.2 Wiring: Individually numbered terminal blocks and wires are to match job-specific wiring diagrams. All electrical wires in the control panel will run in an enclosed trough. Wiring outside the control panel to be contained in a protective sleeve. All controls and wiring is factory installed in a clean, organized arrangement.

2.6.3 Plug and Socket Wiring: Supply and Exhaust Fan decks, compressor, damper assembly, and energy wheel assembly (if applicable) wiring includes plugs local to the assembly allowing for quick wiring disconnect when the component requires removal for service.

2.7 ENERGY RECOVERY VENTILATOR WITH ECONOMIZER DAMPER

2.7.1 Energy recovery ventilation (ERV) provided within the unit through an enthalpy transfer wheel mounted in an insulated cassette frame complete with seals, drive motor, and belt. The rotary wheel is coated with silica gel desiccant and is sized to handle a maximum of 500 cfm of outside air. The entire assembly shall be a UL tested component. Performance shall be certified in accordance with the ASHRAE Standard 84 method of test and AHRI Rating Standard of 1060.

2.7.2 ERV Fans: ERV section employs dual electronically commutated ventilation fans to ensure precise control of airflow through energy wheel and provide optimal wheel frost protection as required.

2.7.3 Outside Air Damper: Separate outside air damper and actuator provided for protection from outdoor elements when unit is not in use.

2.7.4 Complete energy recovery ventilator installed on rails to allow the entire assembly to be slid out of the unit for service. Electrical and control wiring to damper assembly includes quick disconnect plug local to assembly.

2.7.5 Enhanced Economizer Mode: Includes the addition of an economizer damper with actuator. This enables enhanced economizer functionality allowing up to 75% volume of outside air during free cooling applications.

2.8 CONTROLS

2.8.1 Modine Control System: The unit is fitted with a programmable microprocessor controller provided by the unit manufacturer mounted outside the air stream in the control panel. The controller is designed specifically for operating the unit in its most energy efficient manner using pre-engineered control strategies. The microprocessor determines mode of operation based on the factory installed return air and supply air temperature sensors.

2.8.2 Factory installed controls shall enable the unit to operate in the following modes: Free Cooling – using outside air in favorable conditions.

2.8.3 Stage One Mechanical Cooling: 67% capacity compressor, low speed supply fan, reversing valve closed.

2.8.4 Stage Two Mechanical Cooling: Controller adjusts compressor capacity and supply fan speed based on load conditions through a sequence that is proprietary to Modine Controls, reversing valve closed.

2.8.5 Stage Three Mechanical Cooling: 100% capacity compressor, high speed supply fan, reversing valve closed.

2.8.6 Factory installed controls will allow the following additional modes of operation during heat pump mode:

2.8.6.1 Stage One Heating: 67% capacity compressor, low speed supply fan .
2.8.6.2 Stage Two Heating: 67% capacity compressor, high speed supply fan.
2.8.6.3 Stage Three Heating: 100% capacity compressor, high speed supply fan.

2.8.7 The microprocessor controller shall also modify the minimum damper position to compensate for mode of operation and fan speed.

2.8.8 Free Cooling Sequence: If the return air temperature is higher than the occupied set point and if the ambient air temperature is low enough to satisfy the cooling load in the occupied space, the microprocessor controller will de-energize the energy recovery ventilator.

2.8.9 Outdoor air ventilation fan is 100% energized and economizer damper will automatically modulate between 0-100% allowing up to 75% free cooling to maintain conditioned space temperature. The free cooling mode of operation leads to much reduced running time for the compressor leading to cost and equipment savings.

2.8.10 Heating Sequence: If the return air temperature is below the set point and the ambient air temperature is high enough, the microprocessor controller will de-energize the reversing valve allowing the unit to operate in the reverse cycle DX heating mode. The microprocessor controller will also determine which stage of DX heating is most efficient to handle the heating load based on pre-engineered control strategies and the return air, supply air, and ambient air temperatures. The microprocessor controller will then place the unit in one of two DX heating stages of operation.

2.8.11 Time Clock Card: The Modine Control System microprocessor includes a time clock card for units where time functions, night and weekend setback, etc. are not transmitted from a building management system or remote central time clock. The time clock shall have a full 7-day schedule and calendar function incorporated. The 7-day schedule shall have two adjustable occupied/unoccupied periods per day. The calendar function shall allow 20 calendar periods (start date / stop date = 1 period).

2.8.12 Door Mounted Digital Thermostat: Digital touchscreen thermostat used in conjunction with the Factory Microprocessor Control displays current room temperature, CO2 levels, cooling and heating setpoints, warmup time, occupancy override time as well as fan, unit, cooling, heating and dehumidification statuses. The display will also display a remote alarm from the Microprocessor Control. Thermostat allows for occupied temperature set-

point adjustment. The allowable set-point adjustment range can be limited by the Microprocessor Control.

2.8.13 Thermostat allows for occupied override activation allowing user to select the amount of time the unit is to remain in the override state. Mounted on the front door of the unit, 48" above the finished floor (48" AFF only if no floor stand selected).

2.9 SOURCE COIL AND PIPING OPTIONS

2.9.1 Copper Coaxial Coil: The unit shall be supplied with copper coaxial DX/water counter flow coil.

2.9.2 Top Piping Connections: The unit shall be fitted with 1" female NPT connections located in the back right corner on the top panel when facing the front of the unit.

2.9.3 24" Flexible Hose Kit (unit mounted): The unit shall be supplied with two 24" long, 1" diameter stainless steel braided flexible hoses with brass connections. Hoses to be factory installed to the supply and return connections. Hose liner constructed from reinforced EPDM. Hose ferrules constructed of 300 stainless steel.

2.10 ADDITIONAL FACTORY INSTALLED OPTIONS

2.10.1 Disconnect Switch: Located on the control panel, a amp power disconnect switch sized for the full load amperage of the unit. Allows the unit to be disconnected from the power supply prior to any maintenance. In the off position the switch can be locked out.

2.11 FIELD INSTALLED ACCESSORIES

2.11.1 Wall Sleeve: Designed to provide a sealed plenum for the fresh air intake and exhaust air outlet on the back of the classroom unit to the outside of the building. Intake and exhaust airstreams are separated with an insulated horizontal splitter plate. A two-piece frame allows for the sleeve to adjust to wall depths between 8" and 14". Includes double-sided gasket to create an air tight seal between the wall sleeves and the back of the unit.

2.11.2 Louver: An outdoor louver suitable for masonry, glass, or panel wall construction. The louvers are flanged style with the following finish:

2.11.3 Aluminum with bird screen and a clear 2-Coat AAMA 2605 Kynar finish - Greenheck ESU154 Model

2.11.4 Acoustic Plenum: 24" discharge plenum mounted on top of the unit allowing for supply air to discharge through the front. Plenums with front discharge supplied with aluminum grills with a clear anodized finish. Fitted with patent pending air baffle, acoustic shelf and lined with acoustic foam to minimize noise levels. Finished and painted to match the unit.

3. EXECUTION

3.1 INSTALLATION

3.1.1 Install vertical heat pumps using rubber vibration isolation pads provided by the Contractor installed below the each foot of the heat pump.

3.1.2 Install all units neat and level following Manufacturer's Instructions.

3.1.3 Install flexible pipe ball valves and duct connections between heat pump units and piping/ductwork.

3.1.4 System cleaning and flushing shall be completed as described in the "General instruction for Mechanical Sections".

3.1.5 Install all control wiring required to provide a complete and operating system between loop water controller and water cooled air conditioning units and to all accessories as per manufacturer's wiring diagrams.

3.1.6 All control wiring, conduit, accessories, etc., shall be installed in accordance with the requirements specified by the Controls Contractor and the local electrical authority.

3.1.7 All power wiring from motor control centers and/or motor starter panels to driven motor of equipment shall be by Division 26.

3.1.8 Co-ordinate with Electrical Division all power wiring to heat pumps, loop water controller and accessories.

3.1.9 Furnish the services of a trained representative of the equipment manufacturer to supervise the installation, wiring, set up and testing of the loop water controller. Upon completion of the installation, the manufacturer shall instruct a representative of the owner on the proper operation of the loop water control system.

3.1.10 All heat pumps shall be started up by the Manufacturer on site. Provide copies of all start-up reports to the Engineer and include in the Closeout Manuals.

3.2 BAS CONTROLS

3.2.1 The unit is intended to be controlled by the School's existing Building Automation System. The unit shall come complete with all hardware, software and components necessary to interface with the School's BAS System and in full compliance with the School Board's Controls Standards and Sequences. Consultant with the School Board's Controls Group and Controls Contractor at the time of Shop Drawing preparation and prior to manufacturing to ensure that the unit is properly manufactured to work with the School's BAS System. BACNet control points or functionality will not be permitted whatsoever. Refer to Controls Sequences for the full extent of control and sequences for the units. The unit shall come shipped with ready-to-go controls points to meet the desired control points and sequences. Any site modifications to the existing unit to bring it to compliance with

the School Board's Standards and requirements will be responsibility of the Unit Manufacturer in the event of miscoordination or inadequate coordination.

END OF SECTION

1. GENERAL

1.1 GENERAL

1.1.1 Conform to General Provisions for Mechanical Divisions Section 20 05 11.

1.2 SUBMITTALS

1.2.1 Submit shop drawings and product data in accordance with Section 20 05 11.

1.2.2 Indicate the following: complete specifications; wiring diagrams (showing all interconnections); weight; performance details.

1.2.3 Provide data for inclusion in the Operating and Maintenance manuals in accordance with Section 20 05 11.

2. PRODUCTS

2.1 GENERAL

2.1.1 Units shall be Daikin. No alternate Manufacturers are permitted. Units shall be A.R.I. certified and C.S.A. approved. Units shall provide capacities detailed in schedule at the ampacity and voltage detailed in the schedule. All units shall have COPs to meet the requirements of ASHRAE 90.1.

2.1.2 Minimum heat pump efficiencies shall be as listed on the equipment schedules. Equipment which does not meet or exceed the scheduled performance figures will not be considered equal.

2.2 SOUND

2.2.1 Heat pump units shall meet the sound power levels indicated in the equipment schedule. Sound power data is in accordance with AHRI 260 and must be provided in 8 octave band format, at full load.

2.2.2 Unless authorized written exception is granted by the owner or the consultant, suppliers who cannot meet the sound levels scheduled shall supply and install sound attenuating devices as required to meet the specified performance.

2.3 CABINET

2.3.1 The cabinet shall be fabricated from heavy gauge G-60 galvanized sheet metal, Interior surfaces shall be lined with 1/2 inch thick, 1-1/2 lb. coated glass fiber insulation. The insulation shall have a flame spread of less than 25 and a smoke developed classification of less than 50 per ASTM E-84 and UL 723. All insulation must meet NFPA 90A requirements.

2.3.2 All units shall have a factory-installed 1"duct flange on the discharge of the blower and must have a minimum of two access panels to provide access to the compressor compartment and one access to the blower compartment. Unit shall have an insulated panel separating the blower compartment from the compressor compartment.

2.3.2.1 All access panels shall be lined with gaskets to provide an airtight seal and improved sound attenuation.

2.3.3 All piping connections shall protrude through the cabinet for connection to flexible hoses.

2.3.4 Drain pans shall be manufactured from stainless steel and shall meet ASHRAE standard 62.1-2007 section 5.11. Drain pan shall be sloped. Mastic coated, galvanized or plastic drain pans will not be accepted.

2.4 REFRIGERATION CIRCUIT

2.4.1.1 Provide units with single stage compressor.

2.4.1.2 Single stage premium efficiency units shall be manufactured with Copeland hermetic scroll compressors. Two stage units shall be supplied with Copeland Ultra-Tech compressors which provide 67% part load operation.

2.4.2 All units shall have double isolation plates in the compressor section for added mass and improved noise attenuation. Two sets of neoprene isolators shall be provided to separate the bottom mass plate from the unit casing, and between the compressor. Provide high density insulation between the mass plate and the unit casing. Equipment without the double mass plates will not be accepted.

2.4.3 Units shall have a sealed refrigerant circuit which includes a non-CFC depleting R410A refrigerant. Refrigeration circuit shall include a compressor; reversing valve; aluminum fin and rifled copper tube refrigerant-to-air heat exchanger; thermostatic expansion device; and airside coil. The coaxial coils shall be rated for 600 psig on the refrigerant side and 500 psig on the water side. Heat exchanger shall be manufactured from copper [cupronickel].

2.4.4 Refrigeration safeties and specialties shall include high and low pressure switches, internal compressor overload protection, low refrigerant suction temperature switch for freeze protection, and high / low side refrigerant service ports for gauge connection.

2.4.5 Refrigerant metering devices shall be arranged for reversing refrigerant flow. Reversing valve shall have a pilot operated sliding piston.

2.5 FAN

2.5.1 Fan and Motor Assembly - Unit shall have a direct drive centrifugal fan motor assembly. The fan housing shall have a removable orifice ring to facilitate fan motor and fan wheel removal. Blower shall have inlet rings to allow removal of wheel and motor from one side without removing housing. Units shall have a direct-drive centrifugal fan. The fan motor shall be 3-speed, permanently lubricated, PSC type, with internal thermal overload

protection. Units supplied without permanently lubricated motors must provide external oilers for easy service.

2.6 FILTERS

2.6.1 Provide flat arrangement filter boxes designed for 2 inch deep pleated panel filters.

2.6.2 Filter efficiency shall be MERV 13.

2.7 ELECTRICAL

2.7.1 The control box shall be located within the unit and shall contain controls for compressor, reversing valve and fan motor operation and shall have either, a 50VA or 75VA transformer and a terminal block for low voltage field wiring connections. Unit shall be name-plated to accept time delay fuses or HACR circuit breaker for branch over-current protection of the power source. Unit control system shall provide heating or cooling as required by the set points of the wall thermostat. The unit control scheme shall provide for fan operation simultaneous with compressor operation (fan interlock) regardless of the thermostat type. All units shall have a Short-Circuit current rating of 5kA rms symmetrical, 600V maximum.

2.8 HOSES

2.8.1 All units shall be supplied with hose kits. Condensate hose shall be 24 inches long. Supply and return hoses shall be 24 inches long with NPT at both ends and a swivel at one end. Hoses shall have braided stainless steel outer covering. Complete hose kit shall be flame retardant. Components shall meet the requirements of ASTM E84-81a, NFPA 225 and UL 723.

3. EXECUTION

3.1 INSTALLATION

3.1.1 Install horizontal heat pumps using hanger kit and rubber isolators provided by the heat pump supplier. Support all heat pumps from the building structure.

3.1.2 Install all units neat and level following Manufacturer’s Instructions.

3.1.3 Install flexible pipe ball valves and duct connections between heat pump units and piping/ductwork.

3.1.4 System cleaning and flushing shall be completed as described in the "General instruction for Mechanical Sections".

3.1.5 Install all control wiring required to provide a complete and operating system between loop water controller and water cooled air conditioning units and to all accessories as per manufacturer's wiring diagrams.

3.1.6 All control wiring, conduit, accessories, etc., shall be installed in accordance with the requirements specified by the Controls Contractor and the local electrical authority.

3.1.7 All power wiring from motor control centers and/or motor starter panels to driven motor of equipment shall be by Division 26.

3.1.8 Co-ordinate with Electrical Division all power wiring to heat pumps, loop water controller and accessories.

3.1.9 Furnish the services of a trained representative of the equipment manufacturer to supervise the installation, wiring, set up and testing of the loop water controller. Upon completion of the installation, the manufacturer shall instruct a representative of the owner on the proper operation of the loop water control system.

3.1.10 All heat pumps shall be started up by the Manufacturer on site. Provide copies of all start-up reports to the Engineer and include in the Closeout Manuals.

3.2 BAS CONTROLS

3.2.1 The unit is intended to be controlled by the School's existing Building Automation System. The unit shall come complete with all hardware, software and components necessary to interface with the School's BAS System and in full compliance with the School Board's Controls Standards and Sequences. Consultant with the School Board's Controls Group and Controls Contractor at the time of Shop Drawing preparation and prior to manufacturing to ensure that the unit is properly manufactured to work with the School's BAS System. BACNet control points or functionality will not be permitted whatsoever. Refer to Controls Sequences for the full extent of control and sequences for the units. The unit shall come shipped with ready-to-go controls points to meet the desired control points and sequences. Any site modifications to the existing unit to bring it to compliance with the School Board's Standards and requirements will be responsibility of the Unit Manufacturer in the event of miscoordination or inadequate coordination.

END OF SECTION

CONTENTS

END OF SECTION

1.1 REFERENCES

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

1.2 APPLICATION

.1 This Section applies to and is a part of all Sections of the Electrical Contractor.

1.3 WORK INCLUDED

.1 Sections of these Electrical Specifications are not intended to delegate functions nor to delegate work and supply to any specific trade and the work shall include all labour, materials, equipment and tools required for a complete and working installation as described.

1.4 INTENT

.1 Mention herein or indication on drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated and; performance of each operation prescribed with furnishing of necessary labour, equipment and incidentals for Electrical Trade, The Electrical Contractor.

.2 Supplementary to definitions established are:

1. “Concealed” means hidden from normal sign in furred spaces, shafts, ceiling spaces, walls, or partitions. Wiring, raceways, and electrical boxes for all new or relocated devices shall be concealed.

2. “Exposed” means work normally visible, including work in equipment rooms, tunnels, and similar spaces.

3. “Provide” (and all tenses) means supply and install for a complete, operational, and code-compliant system, including all devices/equipment as specified complete with wiring, raceways, electrical boxes, and all other accessories or components required for a complete, operational, and code-compliant installation.

4. “Install” (and all tenses) means secure in position, connect as specified, test, and verify.

5. “Supply” means to supply all devices/equipment to the responsible trade.

6. “Remove” means to isolate, disconnect, disassemble, remove, and dispose of all devices, equipment, wiring, raceways, and connections to other equipment. Patch and make good all surfaces affected by the removal. Remove and dispose of all redundant material off site

.3 Where used, wordings such as "approved, to approval, as directed, permitted, permission, accepted, acceptance", shall mean: approved, directed, permitted, accepted, by authorized representative of the Owner.

.4 Equipment and installation provided under this Division shall conform to applicable standards and regulations of the following organizations:

Canadian Standards Association (CSA)
Underwriter's Laboratories of Canada (ULC)
Ontario Electrical Safety Code (OESC)
Electrical Safety Authority (ESA)
Ontario Building Code (OBC)

1.5 WORKMANSHIP

.1 Workmanship and method of installation shall conform to best standards and practice. Where required by local or other By-Laws and Regulations, tradesmen shall be licensed in their trade.

1.6 TEMPORARY & TRIAL USAGE

.1 Temporary or trial usage of any equipment or materials shall not be construed as evidence of acceptance of same and no claim for damage shall be made for injury to or breaking of any part of such work which may be so used..

1.7 BY-LAWS & REGULATIONS

.1 Work shall conform with latest rules, regulations and definitions of Canadian Electrical Code and applicable Municipal and Provincial Codes and Regulations, and with requirements of other authorities having jurisdiction in the area where work is to be performed. Minor changes required by an authority having jurisdiction shall be carried out without change to the Contract amount. Standards established by drawings and specifications shall not be reduced by applicable codes or regulations.

1.8 PERMITS & FEES

.1 File Contract Drawings with proper authorities and obtain their approval of installation and permits for same before proceeding with work. Prepare and submit necessary detailed shop drawings as required by Authorities.

.2 Pay all fees in connection with examination of drawings, permits, inspections and final certificate of approval.

.3 All ESA Costs shall be included in the Electrical Contractor’s Base Tender Price.

1.9 CERTIFICATES

.1 Furnish necessary certificates as evidence that work installed conforms with laws and

regulations of authorities having jurisdiction.

1.10 GUARANTEE - WARRANTY

.1 All material and labour provided as a part of the project shall be warrantied for a period of twelve (12) months starting from the Date of Substantial Completion for the Project.

1.11 SPECIFICATIONS, DRAWINGS & JOB CONDITIONS

.1 Electrical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to electrical work or equipment locations to accommodate structural conditions. Equipment locations may be altered by Engineer without extra charge provided change is made before installation and does not necessitate major additional material.

.2 Examine site and local conditions. Examine carefully all drawings and complete specifications to ensure that work can be satisfactorily carried out as shown. Before commencing work, examine the work of other Sections and report at once any defect or interference affecting the work, its completion or warranty. No allowance will be make later for any expense incurred through failure to make these examinations or to report any such discrepancies in writing.

.3 Relocate equipment and/or material installed but not coordinated with work of other Sections as directed, without extra charge.

.4 Furnish "built-in" items in ample time and give necessary information and assistance in connection with building-in of same. Notify Section concerned in writing of size and location of recesses, openings and chases at least 48 hours before walls are erected, floors poured and similar work.

1.12 TENDER & SUBSTITUTIONS

.1 The Base Tender Price shall be submitted based on the Base Specified Manufacturer as listed on the Drawings and/or Specifications. Any manufacturers listed as “equal” or “equivalent” may be proposed as an alternate to the Base Specified Manufacturer prior to Contract Execution with written approval only by the Consultant and Owner. Any changes to the Manufacturer of any materials/labour after execution of the Project Contract is not permitted.

1.13 INTERFERENCE DRAWINGS

.1 Prepare and submit complete interference drawings (in PDF format) to avoid and/or resolve conflict of trades and to coordinate the work of the Electrical Division with that of all other Trades. Submission of interference drawings shall be done no later than 20 business days after the Project has officially begun. The cost of producing the interference drawings shall be included for in the Base Tender Price.

.2 Interference drawings shall indicate exact arrangements, of all areas and equipment to scale with dimensions.

.3 Cooperate with work of the Mechanical Contractor and provide data requested and as required in the preparation of interference drawings for the work of The Mechanical Contractor.

.4 Make interference drawings in conjunction with all parties and trades concerned showing sleeves and openings and passage of electrical work through building structure. Drawings shall also show inserts, special hangers and other features to indicate routing through confined spaces, installation of equipment in such areas.

.5 Provide detail drawings, fully dimensioned, of equipment in Boiler and Mechanical Equipment Rooms, Electrical Rooms, Fan Rooms, etc. Base equipment drawings on approved Shop Drawings and include, but do not necessarily limit to, details pertaining to access, clearances, sleeves, connections, etc.

.6 Provide detail drawings of pulling pits, equipment bases, anchors, floor and roof curbs, etc., pertaining to Electrical work.

1.14 SHOP DRAWING MATERIAL & LISTS

.1 Prepare and submit shop drawings and lists of materials for review in accordance with Architectural Sections. Make submittals of more than two pages in booklet form. Individual and loose drawings will not be accepted for review.

.2 Prior to equipment fabrication, delivery or installation, submit complete lists of materials proposed, indicating manufacturer, catalogue numbers and complete performance data.

.3 Review of Shop Drawings by Consultant is for sole purpose of ascertaining conformance with general design concept. This review shall not mean that Architect and/or Engineer approves detail design inherent in Shop Drawings, responsibility for which shall remain with Contractor and such review shall not relieve Contractor of his responsibility for meeting all requirements of Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of work with all trades.

.4 Shop drawings transmitted via facsimile (fax) machines, or copies of same, will not be accepted for review.

1.15 RECORD DOCUMENTS

.1 Conform to General Requirements. Maintain at least two (2) sets of documents and clearly mark in RED on same as job progresses, changes and deviations from work shown so that on completion Owner will have records of exact location of ducts and equipment and record of material and equipment changes.

.2 Record all homerun conduits, junction boxes for complete lighting, power and systems on As-Built Drawings.

.3 Contractor shall obtain clean set of prints from Consultant at start of Contract Work and shall keep these prints up-to-date at jobsite, accurately recording all changes made on project and locating all services, equipment, etc. which may have been shown only diagrammatically on Contract Documents.

.4 Contractor shall ensure that as-built information is accurately recorded and shall check same. As-Built drawings shall be reviewed with Consultant at each jobsite meeting.

.5 Upon completion of Contract Work, prior to Substantial Performance inspection and after final review with Consultants, Contractor shall neatly transfer recorded information and make final As-Built submission to Consultant in the following form:

- One (1) set of clean, legible prints.
- Updated AutoCAD 2017 drawings. The cost of transferring all redline markups from the PDFs to the CAD files is the responsibility and cost of the Contractor.

.6 Consultants shall be responsible for reviewing As-Built information provided by Contractor. Revise drawings to suit any comments until acceptable for submission to the Owner.

.7 The Contractor is responsible for incorporating all information from Project Addenda, Contemplated Changes Notices, Site Instructions, Change Directives and as-found existing conditions into CAD format at no extra cost to the Contract.

1.16 JOB SITE WORK SHOP AND STORAGE

.1 Supply job site office, workshop, tools, scaffolds and material storage as required to complete the work of this Division. Location of temporary buildings, use of space on site or within building shall be to later direction.

1.17 PROTECTION

.1 Securely plug or cap open ends of electrical raceways or equipment to prevent entry of dirt, dust, debris, water, snow or ice. Clean all equipment inside and outside before testing.

.2 Equipment stored on site shall be protected from weather and kept dry and clean at all times. Take care to avoid corrosion of metal parts.

.3 Protect work installed from damage. Secure all unfinished or loose work to prevent movement.

1.18 INSTRUCTIONS TO OPERATOR

.1 Instruct Building Operators in repair, maintenance and operation of Electrical Systems and associated equipment.

.2 Supply three (3) full Operation and Maintenance Instructions each in stiff cover, three-ring binder suitably indexed, separated and labeled. Operate each item of equipment in presence of Operators to ensure understanding of working parts and function of each item of equipment. Supply one complete set of "Reviewed" Shop Drawings in separate hard cover binder suitably separated and labelled for Owner's use.

.3 Operation and maintenance manuals shall be carefully prepared in co-operation with equipment manufacturers and include miscellaneous parts necessary for proper, efficient operation of all equipment.

.4 Manuals shall also include spare parts list for each type of equipment, component, control and device installed together with manufacturer's name and address so such items can be suitably identified and purchased. Include list of recommended spares.

1.19 CLEANING, LUBRICATION AND ADJUSTMENT

.1 Immediately prior to completion of work:

1. Remove all dust, dirt and other foreign matter from internal surfaces of enclosed electrical apparatus and equipment.

2. Remove all temporary protective coverings and coatings, temporary labels.

3. Clean, repair, lubricate and adjust all mechanism and moveable parts of apparatus and equipment leaving it in new condition and operating properly.

4. Balance demand loads for service and distribution feeders within 5 percent upon completion of work and after the building is in full operation.

1.20 INSPECTION AND TESTING

.1 Systems, equipment, and all major items of material shall be tested to the satisfaction of the Architect, and as required to establish compliance with plans and specifications, and with the requirements for the Supply and Inspection Authorities.

.2 Faulty and defective equipment shall be replaced with new materials. Conductors which are found to be shorted or grounded, or to have less than proper insulation resistance, shall be replaced with new conductors.

.3 Tests shall include but are not limited to the following:

1. Test of secondary voltage cables shall include megger tests to establish proper insulation resistance, and phase-to-ground resistance of cables.

2. Proper functioning of all systems.

3. Polarity tests - to establish proper polarity connections to all sockets and

receptacles.

4. Test of system neutral to establish proper insulation resistance and isolation of neutral from ground except for required ground connection at Service.

1.21 CERTIFICATE OF TESTS

.1 When work is complete submit three copies of test results and a signed statement listing all tests that have been performed as required by specifications and manufacturer's instructions.

1.22 COMPLETION

.1 Provide receipts from designated representative of Owner for portable and loose materials (e.g. spare fuses, fixture re-lamping equipment and the like).

.2 Provide copy of final inspection certificate from Electrical Inspection Authority and fire alarm verification report.

.3 Provide manufacturers corrected "as built" shop drawings for all major electrical items and systems, including all shop drawings returned for modifications.

1.23 ALTERATIONS TO EXISTING BUILDING

.1 Note that certain alterations and structural changes are to be made to existing building. Architectural drawings and site are to be examined to determine extent of alterations affecting existing electrical systems. Where existing conduits and wires run through areas to be altered, to feed other parts of existing building, they shall be re-routed and reconnected to maintain their original function. Drawings do not necessarily indicate outlets, switches, receptacles, and the like, and other electrical equipment which are required to be relocated or abandoned. Provide decorative blank cover plates for obsolete outlet boxes remaining.

.2 Electrical services and auxiliary services (fire alarm, P.A. intercom, and the like) shall be maintained continuously without interruption. Interruptions to services shall be confined to periods of time to be designated by Architect, and/or Owner’s designated representative. Include in tender for temporary connections, overtime labour charges, and such related allowances in order to conform with these conditions.

.3 The Electrical Contractor is responsible for removal, reinstallation, cutting and patching of ceiling and walls as required in the existing building.

.4 Cutting directly related to electrical work, regardless of whether such work occurs in new or existing construction, shall be coordinated and paid for by Electrical Subcontractor involved, under supervision of Contractor.

.5 Where existing electrical items or systems are demolished and removed from existing construction assemblies, Electrical Subcontractor involved shall be responsible for

infilling entire hole left after removal of item or system with new construction assembly to match existing. Where new electrical items or systems are installed through existing construction assemblies, Electrical Subcontractor involved shall be responsible for properly sized and accurate cutting of existing construction assembly to allow installation of new work.

.6 Include all efforts for the tracing and verifying of all branch circuits and panels as required to complete the scope of work proposed on the drawings.

1.24 PROJECT SPECIFIC NOTES

1. Obtain all approvals from public authorities having jurisdiction prior to commencing any work. Include, in the tender price, for all ESA permit and inspection fees. Arrange for and attend all inspections required as per requirements of the Electrical Safety Authority and the Building Department.

2. Examine Architectural Drawings and Specifications and all contract documents before proceeding with the work. Any discrepancies between the drawings and specifications of all disciplines must be referred to the architect before any affected work is commenced.

3. The Electrical Contractor shall furnish all labour, material, tools, equipment, etc. required to complete all work shown on the drawings and as specified in the contract documents. The work shall be performed in accordance with rules and regulations of all authorities having legal jurisdiction over the work. This Contractor shall provide any small items of work not specifically called for but required to complete the intended installation and/or required to achieve the desired intent or functional utility.

4. Perform all work in full accordance with the Ontario Building Code, Ontario Electrical Safety Code, School Board standards and good practices and the requirements of all other Authorities Having Jurisdiction. All work performed by this division shall be done in accordance with all manufacturer's recommendations. Obtain all available manufacturer's recommendations and comply.

5. All cutting, patching, coring, scanning, xraying, making good and fire stopping required for the work of this division shall be carried out by this division. The electrical contractor is responsible for and shall pay for any and all damage to the building and/or surrounding area incurred by work of this division.

6. Review the designated substances survey provided by the Board in detail prior to commencing any work.

7. The Electrical Contractor must review and submit shop drawings for all materials to be supplied as a part of the Contract in conjunction with the General Contractor to the Architect and Electrical Consultant prior to ordering. Order only upon receipt of approval. Order, supply and install as per all comments. The Shop Drawings must be reviewed and ensured for compliance with the Contract Documents by the Electrical Contractor and General Contractor prior to submission; confirmation of review and confirmation that the submittal is in compliance with the Contract Documents is the

responsibility of the Electrical Contractor and General Contractor to include in writing with each Shop Drawing Submittal. Any non-conformance of the Submittal with the Contract Documents identified by the Electrical Consultant will require a resubmission of the Shop Drawing Submittal by the Electrical Contractor prior to review. The Electrical Contractor shall bear all costs of any review by the Electrical Consultant beyond the Original Shop Drawing Submission at a cost of $250.00 CAD + HST per resubmission.

8. All materials used throughout shall be new, of best quality, C.S.A. approved, and of one manufacturer. Wherever trade names are not used to describe materials, these materials shall be of the best available quality. Obtain and pay for special ESA inspections of specified non-C.S.A. electrical equipment.

9. Provide all wiring, raceways, electrical boxes, and such components as required for a complete and operational installation.

10. All conduit shall be rigid steel or EMT with gland watertight connectors and compression type couplings, unless otherwise noted. Exposed raceways in finished areas shall be wiremold channels installed neatly in appearance, run parallel to building lines, and concentric right angle bends only shall be used. Exterior exposed conduit shall be rigid galvanized steel. Supply and install access doors as necessary due to the proposed work. All access panel ratings shall match that of the surface in which it is being installed.

11. All access panel ratings shall match that of the surface in which it is being installed. All access panels requiring supply/install as a part of the project work shall be included for in the Base Tender Price.

12. All wiring shall be of minimum #12 gauge copper, except as otherwise noted or as required based on the intended use of the device/equipment. All wiring shall be 600 Volt Type RW90. All wiring shall be run in conduit from the source to the load. BX cable may be used where permitted by code in ceiling space for final connections only and for a maximum length of 5'. Maximum voltage drop shall not exceed 2 percent.

13. Coordinate with all other trades present on site throughout the full course of construction. Lay out of all work so as not to conflict with the work of other trades. Carry out work promptly which may interfere with the work and/or schedule of any other trades.

14. After completion of the work, provide the consultant with a set of 'as-built' record drawings in pdf format prior to submission to the owner. Incorporate all changes in the pdf drawings.

15. Alterations and additions: contractors shall note that this contract is an alteration to an existing building and as such the contractor shall thoroughly investigate the existing electrical installation and electrical, mechanical, structural, and architectural conditions prior to pricing and construction.

16. Demolition: remove all exposed conduits, branch wiring, outlets, etc. from surfaces being demolished.

17. Cleanup and garbage: the contractor is responsible for maintaining as clean of a work area as possible during construction. The contractor is responsible to clean-up and remove tools from the site at the end of every working day. Disposal of all redundant materials, devices, and equipment is the responsibility of the contractor on a daily basis.

18. All work shall be done with minimum possible interruption to the existing building systems and in the time schedule permitted by the school board. Consult with the project supervisor prior to pricing. Complete the project within the allocated schedule.

19. Paint all exposed conduit and backboxes, inside and outside of the building, to match the surrounding colour. Minimize exterior conduit run where feasible.

20. All backboxes installed indoors shall be wiremold or approved equal. All backboxes installed outside shall be of cast aluminum finish.

21. For all panels where new circuits are added, provide a new typed panel directory based on the new loads. Incorporate all existing circuit information from the existing panel directory on site in the new panel directory.

22. Unless otherwise explicitly stated in writing in the Contract Documents, all materials, labour, scope and descriptions of work described in the Contract Documents is the responsibility of the Electrical Contractor to supply and install as a part of the Base Tender Price. No materials and/or labour is to be completed under the Project Allowances unless explicitly noted as such in the Contract Documents.

23. All new raceways and wiring installed shall be concealed in the new partitions or above drop ceilings. No exposed run of raceway/wiring will be permitted whatsoever in the new construction area. In the existing building, all exposed raceways shall be wiremold unless approved in writing by the Owner.

24. All demolition and new work shall be completed in strict accordance with the Contract Documents with no deviations unless instructed by the Electrical Consultant in writing prior to execution of the work. The Electrical Consultant is not responsible, nor required, to accept any work (regardless of its compliance with code) not completed in accordance with the Contract Documents. The Electrical Contractor will be responsible, at his/her cost, of furnishing a Sealed Letter from a Professional Engineer licensed in the Province of Ontario to accept and assume responsibility for all work not completed in accordance with the Contract Documents. The cost of obtaining this letter and the retaining of the Engineer, including all associated inspection charges, is the sole responsibility of the Contractor.

25. Unless otherwise noted, all devices, equipment, material, supplies, etc. shown on the drawings or otherwise required for a fully operational system as described/illustrated on the Drawings shall be supplied and installed under this Project. It shall not be assumed that any of the devices, equipment, material, supplies, etc. shown on the Drawings are to be provided (in part or in whole) by any other Party.

26. Leave two (2) full sets of As-Built Drawings in full size (36”x48”) on site at the

conclusion of the project; handover to the Caretaker.

27. Panel directories shall include room numbers and names to identify the location of the device/equipment; obtain the finalized room numbering from the Architect at the time of preparation.

1.25 CLOSEOUT DOCUMENTS

.1 Coordinate with the General Contractor to submit a comprehensive Closeout Document Package incorporating documents from all trades in one consolidated package. Closeout Documents shall consist of one (1) 3-ring binder hard copy and 3 USBs/CDs. The Electrical Section of the Closeout Documents shall consist of the following:

(a) Electrical Contractor Warranty Letter, signed and dated. Warranty shall be for a period of twelve (12) months starting on the Date of Substantial Completion, except for the Fire Alarm System which shall be for a period of eighteen (18) months starting on the Date of Substantial Completion
(b) Project Shop Drawings, in consecutive order of the Consultant's number scheme.
(c) O&M Manuals for all equipment supplied on the project.
(d) ESA Inspection & 'Final' Certificates.
(e) Red-Line As-Builts (by the Electrical Contractor) and CAD As-Builts (completed by the Electrical Contractor in 2004 Format).
(f) Emergency Lighting Letter, signed and dated, stating "The emergency lighting for the project has been supplied and installed in strict accordance with the Drawings, Specifications, Contract Documents, Code Requirements, Manufacturer's Recommendations and the requirement of all Authorities having Jurisdiction. The emergency lighting system as a whole has been tested and confirmed to be in continuous operation for a consecutive period of thirty minutes or more. All emergency lighting has been tested on site and confirmed to provide illumination as per OBC requirements with no deficiencies."
(g) Fire Alarm Installation Letter, signed and dated, stating "The fire alarm system for the project has been supplied and installed in strict accordance with the Drawings, Specifications, Contract Documents, Code Requirements, Manufacturer's Recommendations and the requirement of all Authorities having Jurisdiction. All new devices and equipment has been supplied and installed in accordance with CAN/ULC-S524 and verified as per CAN/ULC-S537."
(h) Emergency Lighting illumination testing results.
(i) Fire Alarm Verification Report.
(j) Lighting Control Commissioning Report, by the Lighting Controls Manufacturer.
(k) Short Circuit Calculation, Coordination and Arc Flash Study Report, Test Report for Switchboard and Thermal Graphic Scan.
(l) Integrated Systems Testing Certification.

1.26 TRAINING & DEMONSTRATION

.1 At the completion of the project, provide a complete training and walkthrough of all new and/or replaced electrical systems provided as part of the project. Participants of the training and walkthrough will be established by the Owner. Responsibilities including the following:

(a) Demonstrate to the appointed Staff the intent of all new devices, equipment and system and how to operate them and maintain them in accordance with the Manufacturer's Requirements.
(b) Provide end-to-end training on how to use the new devices, equipment and systems installed for the School's day-to-day operations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Conform to Section 26 05 00 Common Work Results for Electrical.

1.2 MATERIALS

.1 Materials shall be new, of Canadian manufacture where available, first quality and uniform throughout. Submit tender based on the use of materials and equipment specified, or on the listed acceptable alternate equipment as further detailed.

.2 Electrical materials shall be C.S.A. approved and be so labeled. Material not C.S.A. approved shall receive acceptance for installation by Electrical Safety Authority (ESA) Special Inspections Branch before delivery, and modifications and charges required for such acceptance shall be included in work of this Section. Material shall not be installed or connected to the source of electrical power until approval is obtained.

.3 Confirm capacity, ratings and characteristics of equipment items being provided to supply power to equipment provided under other Sections of the work. Resolve discrepancies before such items are purchased.

1.3 MATERIAL ACCEPTANCE

.1 Acceptance of materials installed presumes that materials have not been damaged or exposed to conditions that would adversely affect performance and life expectancy.

.2 If in the opinion of the Consultant, materials have sustained damage, or have been exposed to abnormal conditions it shall be the responsibility of the Contractor to have such tests performed as deemed necessary by the Consultant to establish condition and therefore, acceptability of installed materials.

PART 2 - PRODUCTS

2.1 RACEWAYS

.1 Rigid galvanized steel conduit shall comply with CSA Specification C22.2 No. 45.

.2 Electrical metallic tubing (EMT) may be used in place of rigid conduit in dry locations subject to governing regulations, embedded in masonry walls, and concealed above suspended ceilings. Connectors shall be of gland watertight EMT type with factory-installed insulated throats and provide compression type EMT couplings (cast fittings/set-screws are not acceptable) to be forged steel.

.3 Rigid PVC conduit shall comply with CSA Specification C22.2 No. 136.

.4 Watertight flexible conduit: "Sealtite" PVC jacketed flexible steel with Hubbell-Kellum strain relief grips; shall comply with CSA Standard C22.2 No. 56.

.5 Surface wall-mounted raceways shall be Wiremold No. 4000 metallic type complete with two channels and all necessary fittings, closers, device modules, etc. Wiremold or approved equal only.

2.2 WIRE & CABLE

.1 Branch wire and cable shall comprise copper conductors, sized as noted, rated 75 deg. C., 600 volt minimum flame retardant insulation, and CSA approved for application.

.2 Wire and cable installed in conduit shall be PVC insulated Type TWH - Flame retardant and comply with CSA Specification C22.2 No. 75.

.3 Use Electrovert "Z-Type" code markers for control & communication conductors.

4. All branch wiring shall be RW90.

5 All feeder cables shall be XLPE RW90.

6. All underground feeders and branch circuits run from and to outdoor environment shall be XLPE RWU90.

2.3 DEVICES

.1 Wiring devices unless otherwise specified herein, or noted, shall be as manufactured by Hubbell, Leviton or Pass & Seymour.

.2 Light Switches for shall be of low-voltage type as scheduled on the Drawings.

.3 Occupancy sensors shall be of low-voltage type as scheduled on the Drawings.

.4 Key-operated switches shall be of low-voltage type as scheduled on the Drawings.

.5 Standard 15 Ampere, 120 volt duplex receptacles generally shall be specification grade Hubbell, Black, CSA #5-15R and tamperproof type throughout the Area of Work.

.6 Special purpose receptacles as noted on the drawings shall be Hubbell Conforming to CSA configurations (Table 46 and Table 47 of Canadian Electrical Code) for non-locking and locking receptacles. Provide attachment cap for each special purpose receptacle.

.7 "Range" receptacles shall be CSA Type 14-50R, 50 amp. 3 pole, 4 wire, grounding 125/250V flush receptacle. Provide the above with 5 foot rubber cord set, 50 amp. and connect equipment.

.8 Receptacles with integral ground fault interrupter shall be Hubbell No. GF-5252 or approved equal.

.9 Service receptacle shall be Hubbell No. 5262-RD.

.10 Clock receptacle shall have recessed fitting. Leviton No. 5261/CH. Mount as per the Modular Control Panel detail.

2.4 DEVICES - SPECIALIZED

.1 Flush floor boxes shall be Hubbell Cat. No. 3SFB-SSC 3-service box complete with devices shown on drawings.

.2 Provide low-voltage lighting control, as detailed.

2.5 DEVICE COVER PLATES

.1 Switch and receptacle and other device faceplates for flush mounted devices, generally shall be single or multi-gang as required, type 301, stainless steel, #4 brushed finish with removable protective covering.

.2 Weatherproof enclosures for outdoor receptacles shall be P&S 4600 with 4600-26 Mounting Plate, duplex ground fault receptacles and two #4609 Keys.

.3 Cover plates for other devices such as flush fan controls, telephone, etc., shall be stainless steel to match above.

2.6 PANELBOARDS

.1 See Section 26 05 20 for details.

2.7 SWITCHES

.1 Provide fusible and non-fusible switches, NEMA Type `HD' with quick-make, quick-break contacts, horsepower-rated where required, to match the motor protected. Provide holders to accept specified fuses. Switches to include mechanical cover interlocks and line side barriers.

.2 Where applicable and available, switches shall be CSA "Approved For High Service Factor".

.3 Provide safety disconnect switches adjacent to motors and other equipment when required by regulations.

2.8 FUSES

.1 Provide fuse holders in fusible equipment with a complete set of proper size Form 1, HRC Nema J or L current limiting fuses. Fusible equipment so provided shall be adapted to reject CSA Standard C22.2 No. 59 fuses. Fuses shall be Federal Pioneer - "Econolim".

.2 Provide one complete set of spare fuses for each rating and type used, unless otherwise scheduled.

.3 Apply Thomas & Betts "Kopr/Shield" conductive anti-seize compound to all fuse ferrules and holders.

2.9 CLOCKS AND PROGRAM BELLS

.1 Clocks to be synchronized analogue type 12" round surface mount on the Modular Control Panel with a white face, Black Finish Case, 12/24 hour, seep second hand, stem for correcting extended through bottom of housing, 120VAC.

Clock shall be American Time R54BHAV904-WEB complete with mounting bracket/hanger or approved equal.

.2 Program Bells shall be fully recessed, in a recessed stainless steel wall box complete with stainless steel, vandal resistant grille for physical proection. The Contractor shall verify the existing bell circuit voltage and wiring and ensure that the proposed device will suit the existing voltage and wiring configuration. Bells shall be of vibrating type, NEMA 3R rated, 10" size and CSA Certified.

Bell shall be Edwards 340-10N5 (verify voltage and AC/DC configuration of the existing bells on site prior to ordering; order new to match the existing) complete with recessed wall box and stainless steel grille c/w brushed stainless finish.

PART 3 - EXECUTION

3.1 EQUIPMENT LOCATIONS

.1 Approximate locations of electrical equipment, fixtures switches, outlets, and the like,

are given on the drawings. Refer to the architectural drawings and room elevations for application. In absence of definite detail exact location of outlets shall be determined on site as work progresses.

.2 Device plates shall cover opening left for outlet box, and plates shall be attached to boxes in an approved manner. Outlets and fixtures are to be located symmetrically, (i.e. centered in wall panels, ceiling panels or tiles, columns, between and above doors and the like).

.3 The right is reserved to alter the location of equipment and outlets a distance of up to 3 metres without involving a change to the Contract amount, providing notice is given prior to installation.

3.2 MOUNTING HEIGHTS

.1 Mounting heights of outlets, center of outlet to finished floor, except for exposed masonry construction, shall generally be as follows:

Light Switches - 1100 mm
Receptacles - 450 mm

Television Outlets - 400 mm
Data/Telephone Outlets - 400 mm
Manual Fire Alarm Stations – 1,150 mm
Panelboards – 2,000 mm to top of trim for standard panels.
Clocks - 2000 mm or 300 mm below ceiling (except where mounted in a Control Panel).
Thermostats – 1,200 mm
Fire Alarm Audible Temporal Pattern Horn/Strobes – As per CAN/ULC-S524.

3.3 HOLES & DRILLING

.1 Pneumatic hammers and percussion drills are prohibited.

.2 Where not sleeved, make holes through concrete walls and floors by core-drill only. Obtain Architect's approval before drilling.

.3 Seal holes and sleeves through floors to serve as water dam.

3.4 CUTTING & PATCHING

.1 Layout and install work in advance of other Sections for all new work. Bear all costs resulting from failing to comply with this requirement.

.2 Pay for cutting and patching and making good as required for work of this Division by reason of faulty or late work. Employ appropriate trades already engaged on the site to perform such cutting, patching and making good existing walls, floor, ceiling, etc. Before commencing, obtain Architect's approval for extent and nature of cutting. Make

good, disturbed surfaces to the Architect's approval.

3.5 EXCAVATION & BACKFILL

.1 Provide necessary excavating and backfilling inside and outside building required for work of this Division, performed as specified under another Division of the work, except as modified below.

.2 Keep excavations free from water, pump as necessary.

.3 Excavation for underground services shall be to required depths and dimension and shall be prepared as required, so that no portion of any conduit, bears directly against any rock or other hard surface.

.4 Remove and dispose of all surplus excavated material.

.5 Backfill promptly after approval of work. Prevent damage to or displacement of walls, piping, conduits, waterproofing and other work.

.6 For direct buried conduit and cable in all soil conditions excavate to 150 mm (6") below and a minimum of 200 mm (8") to either side of the cable run. Fill back with a bedding

of sand.

.7 Backfill trenches within building, with clean sharp sand in individual layers of maximum 150 mm (6") thickness, compacted to a density of 100% Standard Proctor. Hand compact the first layers up to a compacted level of minimum one foot. Hand or machine compact the balance up to grade, using approved equipment.

.8 Backfill trenches outside buildings with granular `A' gravel in layers not exceeding 150 mm (6") thickness, compacted to 100% Standard Proctor density up to grade level; manual compaction up to 450 mm (18") and mechanical compaction, using approved equipment, for the balance.

.9 Make good work where damaged by excavation and filling work of this Division. Repair any subsequent settlement of fill placed under this Division and pay all costs in replacement of other work damaged by such settlement and restoration.

3.6 CONCRETE WORK

.1 Provide concrete work where required for work of this Division in accordance with applicable requirements specified in Concrete Division 3.

.2 Provide concrete Lighting Standard Bases, required for the work of this Division. Refer to detail on drawings.

.3 Provide concrete Duct Banks required for the work of this Division. Refer to detail on drawing for typical construction details.

.4 Reinforced concrete duct banks shall be keyed into sides of foundation walls. Extend and connect reinforcing steel of duct banks to reinforcing steel of foundation wall construction to prevent failure at the junction of the pipe support and wall.

.5 Provide 100 mm (4”) high housekeeping pads for all floor mounted electrical equipment, such as switchboard, distribution panels and transformer, etc.

3.7 HANGERS & INSERTS

.1 Provide necessary hangers and inserts for work of this Division.

.2 Fasten to cast-in place concrete by suitable drilled or cast-in inserts.

.3 Fasten to structural steel using bolts or welded fasteners.

.4 Do not use wood, chain, wire lashings, strap or grappler bar hangers except where noted or detailed.

.5 Support fixtures independently of ceiling suspension systems. Provide additional supports as required, which shall be fastened to building structure steel members, joists, beams, etc., but not metal pan or roof decking. Material for additional supports and their

installation shall comply with requirements of U.L.C. Refer to "List of Equipment and Materials" Vol. 2, and "Supplement" for application to rated assemblies.

.6 Support outlet and junction boxes independently of the conduits running to them where required by electrical code and where deemed necessary by the Architect, use steel angle brackets or steel rods to support outlets and fixtures, to the building structure.

.7 Drilled fastenings to concrete shall be self-drilling concrete anchors, Phillips 'Red-Head' or approved equal. The maximum weight per fastening shall not exceed 25% of manufacturer's 'pull-out' load data.

.8 Surface mounted or stem suspended fixtures fastened to non-removable ceilings, 2 hr. fire rated ceiling assemblies, or mounted between metal suspension of exposed T-grid ceilings, shall be provided with minimum of two points of attachment for each 300 mm x 1200 mm (1' x 4') luminaire, using metal `channel-bar' fastened to building structure. Attach luminaires to `channel-bar' by means of threaded steel rods. Channel-bar shall be adequately supported and of a construction to prevent deflection under load, as selected from manufacturer's published data, and to Architect's approval. `Channel-bar' shall be Unistrut, Burndy, Flexibar, Cantrough or Canadian Strut Products or approved equal.

.9 Use support clips (e.g. Caddy Type IDS) for suspension of fixtures attached to exposed T-grid ceilings. Clips shall be supported directly from building structure and not from suspended ceiling system.

.10 Provide recessed fluorescent fixtures with support frames, and plastering frames where applicable.

.11 Chain where permitted and specified for the installation of fluorescent lighting fixtures shall be No. 4, 2 mm (.080") Tenso Pattern coil steel chain, plated with a strength of 82 kg (180 lbs.) as manufactured by Dominion Chain Co. Ltd. or approved equal. Where 'S' hooks are used with chain, they shall be No. 6 type with open strength of 82 kg (180 lbs.) minimum. Attachment of chain at both ends of support shall develop full strength of chain.

.12 Support outlet boxes, junction boxes, conduit and the like, mounted on exposed steel deck roofing by means of self-tapping minimum #10 gauge screws, secured through bottom member of deck corrugation. Do not pierce top of steel deck.

3.8 PAINTING

.1 Hangers, support framing and all equipment fabricated from ferrous metals which are not protected with zinc or other suitable corrosion-resistant finish shall have at least one coat of a corrosion-resistant paint applied before shipment or immediately on arrival at the site.

.2 After installation, touch up all scratches, chips, other damage and defects in paint, using zinc chromate primer or paint or special enamels as necessary to match the original.

.3 Finish and colour of all equipment shall be coordinated to provide uniform appearance.

.4 Painting of conduits and supports and other exposed surface work will be done under Painting Section except as noted. Install materials in time to be painted together with mounting surfaces.

.5 Do not paint over nameplates.

.6 Refer to other Sections for special paint finishes of equipment.

3.9 NAMEPLATES & SCHEDULES

.1 Identify electrical equipment supplied under this Division with 3 mm thick black laminated plastic nameplate to indicate equipment controlled to provide instruction or warning. Fasten each plate with two chrome plated screws. Lettering shall be 6 mm high for small devices such as control stations and at least 13 mm high for all other equipment. Submit a list of proposed nameplates for approval before manufacture.

.2 Provide panelboards with typewritten schedules identifying outlets and equipment controlled by each branch circuit including existing panels being changed. Protect schedules with non-flammable clear plastic.

.3 Identify junction boxes, pull boxes, cover plates, conduits and the like, provided for future extension, indicating their function (e.g. power, fire alarm, communication).

.4 Verify room names and numbers prior to listing on nameplates and schedules.

3.10 BRANCH CIRCUIT WIRING & FEEDER CABLES

.1 Provide branch circuit wiring, conduits and feeders as required for Lighting, Power and Auxiliary Systems. Separate conduit systems shall be provided for feeder, lighting and power systems, for exit light system and auxiliary communication systems.

3.11 CONDUIT, RACEWAYS AND WIREWAYS

.1 Wire and cable shall be installed in conduit as follows:

Rigid galvanized steel conduit shall be used:
.1 Where noted and required by regulations.
.2 Where subject to mechanical damage.
.3 For all exposed conduit work.

.2 Electrical metallic tubing (EMT) may be used in place of rigid conduit in dry locations subject to governing regulations, embedded in masonry walls, and concealed above suspended ceilings. Connectors shall be of gland watertight EMT type with factory-installed insulated throats and provide compression type EMT couplings (cast fittings/set-screws are not acceptable) to be forged steel.

.3 Use flexible metallic conduit for connections to chain suspended and recessed fixture drops, motors and similar equipment to prevent transmission of vibration. A code-gauge green grounding conductor shall be provided for all such connections. Use "Sealtite" conduit with Hubbell-Kellum Sealtite conduit strain relief grips for all such connections at motors.

.4 Fasten every conduit and cable to structure by means of approved conduit clamps or clips. Wire lashing is not acceptable.

.5 Conceal conduits and wiring except where noted. Run exposed conduits parallel to building lines and to other conduits. Provide every empty conduit with a pull rope (3 mm polypropylene rope) and identify to designate its function (Power, Telephone, Fire Alarm and the like).

.6 Where conduit is installed in concrete slabs, obtain general approval, prior to commencing the work, on both maximum dimension and cross-overs which may be used therein.

.7 Install conduits in such a manner as to conserve head room and interfere as little as possible with free use of space through which they pass. Obtain approval for routing of same. Keep conduits at least 150 mm clear high temperature work.

.8 Conduit installed at the roof level of exposed structures, shall be run tight to roof deck, above purlins and beams.

.9 Conduit and cables for electrical work in demountable type and drywall type partitions shall enter from above, from a junction box concealed in the ceiling above and shall comprise a flexible conduit connection.

.10 All branch wiring shall be provided with a separate code gauge supplementary grounding conductor run in each conduit or duct, terminating at ground block at panelboards.

.11 Run conduit exposed in mechanical equipment rooms, electrical rooms, fan rooms, and the like, and installed after mechanical and other equipment is completed. Install fixtures, outlets, starters, etc., to clear and to suit application.

.12 Wiring, boxes, conduit fittings, etc., in hazardous areas shall conform with Ontario Electrical Code, covering explosion-proof areas. Provide conduit seals where required by these regulations.

.13 Provide housekeeping curbs around exposed conduits feeding panels, disconnect switches, starters, etc. penetrating floors in front of walls.

3.12 WIRE & CABLE

.1 Wire and cable shall not be installed at temperatures below 20^{o}C unless "minus 40" type is used. Wiring to heating equipment shall be rated 90^{o}C minimum, the ampacity of which shall be limited to 75^{o}C value.

.2 Conductors used for all auxiliary systems (e.g. Fire Alarm) shall be tagged and/or colour-coded, and where applicable shall agree with manufacturer`s wiring diagrams.

.3 Minimum wire size for power wiring shall be No. 12 AWG gauge unless specified otherwise. Minimum wire size for "Common" neutral conductors shall be No. 10 AWG. Control wiring shall be #14 AWG red insulation. Maximum voltage drop between furthest outlet of any circuit, when fully energized, and panel to which it is connected shall not exceed two percent except for electric heating circuits which shall not exceed one percent.

.4 Cables shall be terminated with moisture-proof connectors, clamped to sheet metal enclosure by a single non-ferrous locknut and grounding bushing.

.5 Sheaths of multi-conductor cables shall be grounded at both cable ends.

.6 Sheaths of single conductor cables shall be grounded at supply end only. Provide a Code Gauge Grounding Conductor with each feeder cable run.

.7 Number of wires indicated for lighting and power, motor and motor control, alarm, signal, communications, and auxiliary systems is intended to show general scheme only. The required number and types of wires shall be installed in accordance with equipment manufacturer's diagrams and requirements, and with requirements of the installation, except that specification standards shall not be reduced.

.8 Solderless connectors with nylon-jacketted "Vibration-proof" screw-on wire connectors ideal "Wing Nuts", rated 600 volts shall be used for joints in Branch Wiring.

.9 Use compression joints and terminals for all control wiring; and all conductors #4 AWG and larger. Mechanical connections are acceptable at panelboards and circuit breakers where these are part of factory-assembly.

.10 Wire or cables in feeders, sub-feeders and branch circuits shall be colour-coded in accordance with Ontario Electrical Safety Code. Each end of feeder terminations (e.g. in Switchboard, Panelboards, switches, splitters and the like) Code Phase A - Red, Phase B - Black, Phase C - Blue, Neutral - White.

.11 Use C.G.E. Vulkan X-Link insulated cables for circuits protected by ground fault circuit interrupters.

.12 Include in each conduit, tubing and raceway, a code gauge green supplementary grounding conductor which shall be connected to suitable ground bus in equipment.

.13 Armoured or sheathed cables may be used only for wiring within demountable and dry wall type partitions and if additionally specified or detailed; however it shall not be directly buried in or below concrete slabs.

3.13 OUTLET, JUNCTION & PULL BOXES

.1 Use suitable electrical boxes for terminations and junctions on conduit work. Install pull boxes where necessary to permit installation of conductors. Support pull boxes, outlet boxes, panels and other cabinets independently of conduit.

.2 Provide each light switch, wall receptacle and other device with an outlet box of suitable dimensions and a faceplate. Outlet boxes shall be adapted to their respective locations.

.3 "Thruwall" and "Utility" type boxes shall not be used.

.4 Electrical boxes and panels shall be CSA approved, code-gauge sheet metal, galvanized or with suitable protective treatment. Secure covers with screws or bolts.

.5 Outlet boxes shall not be installed "Back-to-Back" in walls; separate by a minimum of 150 mm.

.6 Use "Masonry Type" outlet boxes for flush installation in masonry walls as detailed on standard Detail Drawings attached hereto.) Standard sectional boxes, 1004, 1104 and the like, shall not be used).

.7 Install surface mounted devices, in cast conduit fittings, with threaded hubs and suitable stainless steel faceplates.

.8 Paint the full length of conduits (installed above accessible and inaccessible ceilings) and main pull and junction boxes (excluding obvious outlet boxes) as per the following colour scheme:

- Lighting	Yellow
- Lighting Controls	Orange
- Power	Blue
- Fire Alarm	Red
- Telephone/Data	Green
- Public Address, Sound and Clock System	Purple

All conduits shall be painted with minimum three (3) coats of paint along the full circumference of the conduit for a clean and consistent finish. Conduits shall be painted prior to installation.

.9 In addition, each box shall be identified with a system and service designator of logic reference to the service.

3.14 ACCESS DOORS & ACCESS MARKERS

.1 Supply access doors for installation under the work of other Divison where electrical equipment requiring maintenance or adjustment or inspection is located above ceilings, within walls or behind furring; except ceilings of lay-in removable panel type.

.2 Access doors shall be 12 gauge hinged metal Stelpro Ltd. or equal #722 flush type, minimum size 300 mm x 300 mm (12" x 12") "Reach-in" 300 mm x 600 mm (12" x 24") "Crawl-in", with prime coat finish, concealed hinges, screwdriver lock and plaster key. Access doors in finished masonry or drywall construction shall be #722 less plaster key. Access doors shall be #726 in acoustic tile ceilings; #704 in drywall ceiling and #726E in plaster ceilings.

.3 Access doors in fire rated ceiling assemblies, all fire rated walls, duct shaft or in corridor walls shall be UL, ULC or WHI listed 1-1/2 hour fire rated access doors equal to LeHage #L1010 or Acudor #150B with screwdriver lock.

.4 Where lay-in removable panel ceilings requiring hold-down clips are used, access doors are not required but panels shall be secured with accessible hold-down clips and marked with Buildemup #6 RH brass paper fasteners inserted through acoustic panel and bent over. paint heads with blue enamel before installation.

.5 Obtain approval for sizes and locations.

3.15 PANELBOARDS

.1 Provide handle locking devices on circuit breakers feeding Plumbing, Heating, Ventilating equipment and controls and all auxiliary systems, time switches, and other devices as noted. Paint handles white, to permanently identify location and function. Provide 30 spare handle locking devices for future use.

.2 Circuit numbers on drawings do not necessarily correspond to the numbers on the lighting panels. Circuits sharing a common neutral shall not be connected to the same main. Panel circuit breakers which are used directly for the switching of lighting fixtures shall be grouped in consecutive numbers commencing at breaker number one.

.3 Use "Panduit" lok-strap cable ties for panelboard branch wiring.

.4 Provide empty conduits from flush panelboards, and others as noted, terminating in accessible ceiling spaces, sized to accommodate spare and space breaker provisions. One 25 mm (1") conduit for each three spare breakers or spaces.

3.16 ELECTRIC WORK FOR OTHER DIVISIONS

.1 Examine Architectural and Mechanical (Plumbing, Heating, Ventilating and Air Conditioning) plans and specifications to determine extent of electrical work in connection with these Divisions which is to be done under the work of the Electrical Division.

.2 In general, all loose motor starters and associated controls for mechanical equipment will be supplied under Division 16 for installation and connection to both source and load side of the equipment.

.3 Co-ordinate the exact location and verify characteristics of electrical provisions for the

work of the Mechanical Division.

.4 Coordinate locations of starters, motors and associated equipment with the work of the Mechanical Contractor's Sections to ensure proper location of equipment. The exact locations of conduit terminations at Mechanical units shall be determined from equipment manufactures' approved shop drawings. Conduits must be installed to enter only in the locations designated by equipment manufactures.

.5 Provide safety switches required for disconnection of remotely controlled motors, and where required at motors by C.E.C. regulations whether shown on the drawings or not. Where required at fan motors, they shall be concealed in the fan housing if possible.

.6 Provide for the 120 volt mechanical equipment where noted, all necessary wiring and connections including wiring and installation of starters, thermostats, aquastats, speed controllers and time switches controlling equipment.

.7 Where motor starters, switches and the like, are grouped together, a suitable 19 mm (3/4") thick plywood panelboard shall be provided to which all such equipment shall be secured. Provide all necessary angle iron supports for support of panelboard and paint entire assembly with two coats of fire retardant type enamel acceptable to Building Inspection Department.

.8 Provide weatherproof unfused safety disconnect switches, fastened to exterior of roof mounted units, to approval.

.9 Connect high temperature thermostats "Firestats" provided in ductwork by the Mechanical Contractor, to exhaust fan systems, to provide fan shutdown on activation.

3.17 GROUNDING & BONDING - GENERAL

.1 Ground and bond all electrical systems in accordance with provisions of the Ontario Electrical Code.

.2 Provide a grounding electrode in accordance with Section 10 of the Canadian Electrical Code.

.3 Install grounding conductors to permit the shortest and most direct path from equipment to ground. Install grounding conductors in rigid galvanized conduit with both conductor and conduit bonded at both ends. Provide bonding jumpers with approved clamps to maintain ground continuity of metallic raceway systems at all expansion joints.

.4 Ground connections to grounding conductors shall be accessible for inspection and made with approved solderless connectors bolted to the equipment of structure to be grounded. Clean contact surface prior to making connections to ensure proper metal to metal contact. Connections shall be of the type that grounds both conduit and conductor, and cap screws, bolts, nuts and washers shall be silicon bronze.

3.18 FIRESTOPPING & SEALING

.1 Make watertight seal at sleeves and other openings through floors above grade. Sleeves to extend minimum 25 mm (1 inch) above finished floors.

.2 Provide firestopping protection of openings through floors and fire rated walls, floor assemblies and ceiling assemblies. Refer to Architectural Drawings for rated surfaces.

.3 Caulk spaces between conduit, cables, bus ducts, raceways, cabletrays with "Cerafibre" 2300 F packing to Building Department approval. Pack and seal both sides of openings with Electrovert "Flameseal" putty, minimum thickness 25 mm (1"). Install in accordance with Electrovert Instruction Bulletin #3601.

END OF SECTION

PART 1 GENERAL

1.1 RELATED INSTRUCTIONS

1.1.1 Refer to Section 26 05 00, Common Work Results for Electrical.

1.2 SCOPE

1.2.1 Work includes, but not limited to:

1.2.1.1 Providing new Electrical Panels as per the Drawings.

1.2.1.2 Obtaining approvals from and cooperation with Authorities having Jurisdiction, before and commencing Work.

1.2.1.3 Preparation of all necessary Working Drawings for submission to Inspection Authorities.

1.3 INSPECTION & TESTING

1.3.1 Systems, equipment and all major items of material shall be tested to the satisfaction of the Consultant, and as required to establish compliance with plans and specifications, and with the requirements for the Authorities having jurisdiction.

1.3.2 Faulty and defective equipment shall be replaced with new materials. Conductors which are found to be shorted or grounded, or to have less than proper insulation resistance, shall be replaced with new conductors.

1.3.3 Tests shall include but are not limited to the following:

1.3.3.1 Test of power cables shall include megger tests to establish proper insulation resistance, and phase-to-ground resistance of cables.

1.3.3.2 Test of all adjustable electrical protective devices of switchgear to establish calibration and operation in accordance with Specifications and approved co-ordination curves.

1.3.3.3 Visual examination of switchgear to determine adherence to allowable manufacturing tolerance and compliance with manufacturer's recommended installation requirements.

1.3.3.4 Proper functioning of all systems.

1.3.3.5 Polarity tests - to establish proper polarity connections to all sockets and receptacles.

1.3.3.6 Calibration setting, and test-tripping, of all protective relays and devices, using "Primary-injection" equipment, in accordance with approved co-ordination schedule.

1.3.3.7 Test of all alarm devices and contacts.

1.3.3.8 Inspection after system is energized shall include infrared thermo graphic examination of

current carrying parts in switchgear, transformers, and at ducts. The Contractor shall cooperate with Inspection personnel, open all equipment enclosures to permit inspection, and make good defective conditions.

1.3.4 Testing Company

1.3.4.1 Retain the services of an independent testing company, to Consultant's approval to perform the above tests.

1.3.4.2 The testing company shall submit test results directly to the Consultant.

1.3.4.3 Include copies of tests in Maintenance and Operating Manual.

1.3.5 Certification of Tests

1.3.5.1 When work is complete, submit three (3) copies of test results and a signed statement listing all tests that have been performed as required by Specifications and manufacturer's instructions.

PART 2 PRODUCTS

2.1 ELECTRICAL PANELS:

2.1.1 Panelboards as scheduled, shall comprise "Branch" panelboards, with fixed bolted connection thermal-magnetic, quick-make, quick-break, 40oC, calibrated ULC rated `SWD' switching duty, molded-case circuit breaker branches. "Plug-in" breakers are not acceptable. Multipole breakers shall be common trip type.

2.1.2 Panelboards shall include the following features:

.1 Flush or surface trim as noted.
.2 Concealed hinges and lockable door.
.3 Combination catch and lock semi flush tumbler type - all keyed alike.
.4 Adjustable self-positioning trims.
.5 Plain trims not displaying any names or Symbols.
"Vault" type handles shall not be used except in unfinished areas.
.6 Typed schedules of circuits indicating equipment and area controlled on the backs of panel doors, in a steel trim pocket, covered with transparent non-inflammable plastic.
.7 Insulated neutral block.
.8 Supplementary ground block.
.9 Copper Bus.
.10 Isolated ground bar, as noted.
.11 Surge-suppression system, as noted.
.12 Sprinkler-proof

2.1.3 Power and Distribution type panelboards shall be breaker type, as scheduled on the drawings.

2.1.4 Unless noted otherwise, panelboards with main breakers or remote controlled switches shall be

provided with an indicating pilot lamp flush mounted in top of face trim which shall be connected to a 15 amp. circuit in the panelboard which shall be locked on and shall serve to indicate when the main breaker is in the closed position. Pilot lamp units shall be LED type or other approved types designed to provide maximum lamp life. Provide lamacoid nameplate to identify main breaker.

2.1.5 Panelboard shall be of circuit breaker type 120/208 Volt, 3 phase, 4 wire mains, minimum interrupting rating of 22,000A, RMS symmetrical at 208 volt.

2.1.6 All panels shall be of code gauge steel with prime coat finish for painting. All locks on all panels shall be common to one key and shall also be common to the locks on the distribution panel. The Subcontractor shall be deliver three duplicate keys to the Owners. All panel hardware shall be chrome plated. All tubs shall be a minimum of 6" deep. Where panels are surface mounted they shall be sprinkler-proofed.

2.1.7 Acceptable Manufacturers are:

.1 Eaton (Cutler-Hammer) Pow-R-Line BCM Panelboard (Integrated Metering Panelboards – Advanced E3XA

or equivalent from:

.2 Schneider (Square `D')

.3 Siemens

PART 3 EXECUTION

3.1 ELECTRICAL PANELBOARDS

3.1.1 Provide complete electrical service as shown on the drawings and as further described here.

3.1.2 Grounding service, equipment, feeders, and the like shall be performed in accordance with Electrical Safety Regulations.

3.1.3 Submit shop drawings of all panelboards prior to ordering.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

1.2 STANDARDS

1.2.1 ANSI/IEEE Standard 242 Recommended practice for protection and coordination of commercial power system most current edition.

1.2.2 ANSI/IEEE Standard 399 Recommended practice for power system analysis most current Edition.

1.2.3 NETA STANDARD ATS 2005: Electrical Acceptance Testing Specification for electrical power equipment and distribution system most current Edition.

1.2.4 NFPA 70-E Standard for Electrical Safety in the Work Place most current Edition.

1.2.5 IEEE STD- 1584 Guide for performing Shock and Arc Flash Hazard Calculations most current Edition.

1.2.6 Canadian Electrical Code most current Edition.

1.2.7 Ontario Electrical Safety Code most current Edition.

1.2.8 CSA Z462 Electrical Safety in the Work Place (Draft).

1.3 SCOPE OF WORK

1.3.1 The Short Circuit; Protection and Coordination and Shock & Arc Flash Studies shall be completed for all distribution system modes of operation;

1.3.2 Normal power distribution operating mode;

1.3.3 The studies need to take into account how the about power distribution system modes of operation interrelate to each other in completion of the studies and recommendations provided with the studies.

1.3.4 The following minimum Utility Design Fault Levels shall be used in completion of the studies:

1.3.5 13,800 volts the minimum Design Fault Level to be used is 500 MVA.

1.3.6 27,600 volts the minimum Design Fault Level to be used is 835 MVA.

1.3.7 The Professional Engineer, licensed to practice in the Province of Ontario, completing the studies shall confirm the noted Design Fault Levels with the Local Power Utility. The above is the minimum that shall be used in the completion of the studies.

1.3.8 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E – 2004 annex D

1.3.9 The power system(s) short circuit; protection and coordination; shock and arc flash studies shall be completed by a Professional Engineer, licensed to practice in the Province of Ontario, specializing in this field. All information required to complete these studies shall be obtained through formal requests to related Trade(s) such as the Local Power Utility and manufacturers supplying the equipment.

1.3.10 Once the required Short Circuit; Protection and Coordination and Shock & Arc Flash Studies have been completed and submitted for review by the Consultant and all clarification have been provided and the reviewed studies have been acknowledged by the Consultant. The recommendations shall be implemented by the Contractor and a letter confirming that the implementations of the recommendations have been completed shall be submitted by the Contractor to the Consultant.

1.3.11 Arc Flash Study shall be focused on achieving incident energy level "Category 2" in the main electrical room; sub electrical rooms; and other associated electrical spaces.

1.3.12 No exceptions shall be permitted with respect to these required studies.

1.3.13 The Study shall be completed by **Enkompass Power and Energy Corporation**.

1.4 DESCRIPTION OF WORK

1.4.1 The Contractor shall provide all studies as required by code and as outlined within this Specification section. The studies shall cover all electrical distribution systems and all of the various modes of operation of the electrical distribution systems.

1.4.2 The Study shall be a fully comprehensive study including the following:
- .1 All Utility Equipment upstream of the Main Service.
- .2 The Main Service Equipment (including the main switchboard/main distribution panel and switch).
- .3 All existing and new panelboards, transformers, motor loads and mechanical equipment throughout the Existing School and the Addition.

1.4.3 No electrical distribution equipment Shop Drawings for any of the electrical distribution systems shall be reviewed by the Consultant prior to the required studies being submitted and the review process with respect to the studies being completed. Should the Contractor order any or all of the electrical distribution equipment they do so at their own risk. Should changes be required to be made to any or all of the distribution equipment the Contractor will cover all costs.

1.4.4 It is important that all requests to related trades such as mechanical, equipment supplier is completed and information obtained in less than ten (10) working days of commencing of contract.

1.4.5 No assumption shall be made where it is possible to obtain the information from the manufacturer and equipment suppliers regarding impedances, protective device time current curves and cable lengths, type and size from the Contractor.

1.4.6 The Contractor will need to provide following information to the Consultant completing the studies:

1.4.6.1 Preliminary types and cable lengths.

1.4.6.2 All of the required equipment data from the electrical equipment vendor(s);

1.4.6.3 All of the required equipment data from the generator vendor(s);

1.4.6.4 All of the required equipment data from the UPS vendor(s);

1.4.6.5 All of the required equipment data from the transformer (power and distribution transformers) vendor(s);

1.4.6.6 All protective device co-ordination curves;

1.4.6.7 All protective device ground fault curves;

1.4.6.8 All damage curves for equipment and cables;

1.4.6.9 All required electrical data for elevators;

1.4.6.10 All required electrical data for mechanical equipment; and

1.4.6.11 Other data as required and requested by the Professional Engineer completing the studies.

1.4.7 The " input data revised or modified " for performing studies will be required to be updated and resubmitted to the Consultant once the Contractor has finalized all of his actual electrical types and feeder lengths.

1.4.8 These studies of high important and shall be completed and submitted within 20 - 25 working days after the letter of intent has been issued to the Contractor.

1.5 SYSTEM PROTECTION AND CO-ORDINATION

1.5.1 Retain one of the designated testing companies who specialize in this type of Work to prepare an equipment coordination study and schedule for all protective devices in the system in cooperation with suppliers of all pertinent switchgears; testing covered under cash allowance.

1.5.2 The firm of testing specialists shall be responsible for calculating short circuit kA rating, checking, adjusting, calibration and setting up of all protective devices in accordance with the values shown in the reviewed coordination study under this Contract.

1.5.3 Coordinate the relays, breakers and fuses to provide selective tripping or blowing. Coordinate the breakers, fuses, protective relaying and ground fault protection so that the breaker or fuse immediately ahead of a fault will trip or blow clearing the fault and leaving the system ahead of the tripped or blown protective device in the normal operating mode the study must also address the other distribution system modes of operation.

1.5.4 The curves shall be accompanied by the individual time current curves of each device to enable the verification of the ratings and settings used. These coordination curves shall be submitted for review and the various ratings and settings shall be made by the manufacturer's before the equipment is shipped. Review of these coordination curves will not eliminate the responsibility of the Contractor to provide correct protection and coordination.

1.5.5 Co-ordination curves shall be plotted showing the following:

1.5.5.1 Plot utility relays or fuses protecting the incoming service. This information shall be obtained directly from the Local Utility;

1.5.5.2 Main and feeder protection devices at every voltage level;

1.5.5.3 Main and feeder protection devices ground fault curves at every voltage levels;

1.5.5.4 Protection devices associated with the largest motor or refrigeration compressor; and

1.5.5.5 Protection devices associated with the emergency power distribution system; UPS power distribution system and the Co-Generation power distribution system and showing all fault levels.

1.5.6 Each co-ordination time-current curve shall include:

1.5.6.1 A single line diagram for the portion of the system involved;

1.5.6.2 Transformer and cable damage curves where applicable;

1.5.6.3 Available fault current level on the portion of the system involved;

1.5.6.4 Ground fault curves; and

1.5.6.5 Generator fault and damage curves where applicable.

1.5.7 Protection and Coordination curves shall be submitted as part of a report outlining the protection and coordination procedures, final breaker and relay settings and fuse ratings for the entire power distribution system(s) and modes of operation. The report shall clearly list all the breakers with their tag and final settings even if there are identical systems on the Project. I.e. information about the same settings can be duplicated if applicable with breaker in different locations. This list will be checked and signed off by the Professional Engineer who prepared and completed the studies.

1.5.8 Co-ordinate with the electrical equipment vendors; mechanical equipment vendors and obtain the recommended settings on protection devices (re: breaker and overloads). Incorporate this information on the associated studies.

1.5.9 The goal of this portion of the study is to achieve selective protection and coordination of protective devices including ground fault and to reduce the incident energy levels to within “Category 2” where applicable.

1.6 SHOCK AND ARC FLASH HAZARDS

1.6.1 This portion of the study shall be prepared and completed by a Professional Engineer, licensed to practice in the Province of Ontario. The study shall be based on power distribution systems diagrams and the various power distribution operating modes.

1.6.2 The Contractor shall obtain and provide all required information as required for the study to be completed.

1.6.3 The study and the report shall provide a full summary of the shock and arc flash hazard. The completion of the study shall with compliance with NFPA 70E and related standards and methods established in the industry.

1.6.4 The IEEE-1584 must be used for the calculation of the incident energy.

1.6.5 The study will ensure that worst case hazards are identified. This means that arc flash energy is calculated at the maximum fault and to include overloads conditions where applicable.

1.6.6 The study shall cover all electrical distributed equipment and distribution systems operating modes and voltage levels within the facility and site as well as the main incoming service to the building(s) and site.

1.6.7 The study will identify the arc flash boundaries, and incident energy at suggested distance of working. Determination of system operating modes and conditions that can impact short circuit currents and arc flash hazard energy levels shall be identified well in advance and shall be conveyed to the Owner and Consultant for confirmation.

1.6.8 The study will clearly state any assumptions made for arc-fault currents. L-G ground fault and L-L-L. The worst case scenario(s) shall be reflected in the reported as minimum requirement.

1.6.9 Arc-flash labels shall be created and installed on each piece of electrical distribution equipment for all electrical distribution systems.

1.6.10 The labels shall be per ANSI Z535. The labels shall identify the hazard level and protective clothing required.

1.6.11 Safe working distances shall be based upon the calculated arc flash boundary considering incident energy of 1.2 Cal / cm2.

1.6.12 The label reflected below is an example of the required detail of what is to be on the label. A separate label shall be provided for each piece of the electrical distribution systems.

1.6.13 The shock and arc flash warning label shall have as a minimum the following information reflected on it:

1.6.13.1 Boundaries as per NFPA and CSA Z462 (Draft);

1.6.13.2 Flash Protection boundary;

1.6.13.3 Limited shock approach boundary;

1.6.13.4 Restricted shock approach boundary;

1.6.13.5 Prohibited shock approach boundary;

1.6.13.6 Personal protective equipment required to be employed and used with respect to each piece of electrical distribution equipment;

1.6.13.7 Incident Energy per IEEE 1584 recommended distance; and

1.6.13.8 Voltage value for Shock Hazard.

1.6.14 At least 24-hour training shall be provided to the staff employed at the facility to explain meaning of labels and protective equipment, and work permits for energized work. This is to ensure the implementation of the safety program that addresses the following as a minimum:

1.6.14.1 Ministry of Labour requirements;

1.6.14.2 Personal protective equipment;

1.6.14.3 Understanding of the shock and arc flash categories;

1.6.14.4 Electrical equipment labeling requirements;

1.6.14.5 Development of local Standard Operating Procedures (SOPs);

1.6.14.6 Lock out and tag out; and

1.6.14.7 Remote switching of equipment.

1.7 INSTALLATION

1.7.1 On completion of the calibration and testing, a full report shall be prepared by the testing specialists and submitted to the Consultant for review, comments and approval.

1.7.2 The report shall confirm that all protective devices have been adjusted and set in accordance with the protection and coordination study and that the protective systems provide the necessary degree of selective protection as well as selective ground fault protection.

1.7.3 The report shall include tabulation of settings and/or rating of all protective devices.

1.7.4 Each protective device shall be labelled with the proper setting for the device. Labels shall be installed or marked on the protective device behind glass windows. Fusible devices shall be labelled showing the size, type and current rating of the fuse element.

1.7.5 The firm conducting the protection and coordination study shall conduct on-site verification testing to ensure that all relays, breaker settings and fuse sizing has been set in accordance with the coordination study recommendations.

1.7.6 All shock and arc flash labels have been installed.

1.7.7 The Owner reserves the right to retain the services of an independent testing company to monitor, review and verify the results of the test report submitted by the Contractor.

1.7.8 Provide the services of electricians to assist in equipment tests performed by the independent testing companies appointed by the Owner, including thermo graphic (infrared) testing of bus bar joints and contacts of circuit breakers, etc. Remove cover plates, etc. to enable testing company to gain access to the equipment.

1.7.9 The Contractor shall be responsible to co-ordinate with equipment manufacturers to ensure that the equipment is furnished with protection as recommended in the co-ordination study.

1.7.10 Upon completion of the Project, after the commissioning stage has been completed and all commissioning deficiencies have been corrected and the Owner has acknowledged the commissioning is now complete. The Contractor shall conduct a complete thermo infrared scan of the entire electrical distribution systems. The timing of this scan shall be coordinated with the Owner.

1.7.11 The Short Circuit; protection and coordination; shock and arc flash studies shall be completed and the Consultants review process finalized in advance of any electrical equipment being manufactured, ordered and delivered to the Project.

1.7.12 Remove all existing Arc Flash Labels on the existing electrical and mechanical equipment on site when replacing with new Labels.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED INSTRUCTIONS

.1 Refer to Section 26 05 00 Common Work Results for Electrical.

1.2 WORK INCLUDED

.1 Provide electrical lighting fixtures and systems scheduled, complete with lamps, drivers and necessary accessories required for their installation and performance.

.2 Obtain and review all information with regards to the proper installation of all lighting systems from the Manufacturer. No installation shall be completed without a thorough review of the Manufacturer's recommendations and guidelines for installation. All installations shall comply with these recommendations and guidelines as well as any other requirements mandated by Authorities having Jurisdiction and local governing codes.

1.3 LAMP AND DRIVER CONDITIONING

.1 Upon first energizing all LED fixtures shall remain energized for a stabilizing period as recommended by manufacturer.

1.4 SHOP DRAWINGS

.1 Conform to requirements of Section 26 05 00 Common Work Results for Electrical.

.2 Submit for review an electronic submission of shop drawings containing illustrations of each fixture. Illustrations to be complete showing dimensions light distribution and mounting requirements. Illustrations to be noted to indicate special features and finishes. A copy is to be retained by the Contractor on the site, to ensure co-ordination of installation requirements.

.3 LED fixture shop drawings must indicate Driver Manufacturer and Model No. for each fixture.

.4 No light fixtures shall be ordered without the review and written approval of the Electrical Engineer. Shop drawings should indicate proposed mounting method and hardware required to facilitate a complete and safe installation.

PART 2 - PRODUCTS

2.1 REFERENCE NUMBERS

.1 Catalogue reference numbers given for individual fixture types are intended as a guide when read with the description and the fixture as finally applied. Verify catalogue references with description and coordinated with installation conditions, with particular regard to ceiling construction details, type and finish before ordering fixtures.

2.2 LENSES

.1 Plastic lenses in lighting fixtures shall be acrylic with minimum thickness of 3 mm (.125 inches) and, providing flame spread and smoke density ratings, complying with applicable Federal and Provincial Codes; Ontario Fire Marshal's Fire Safety Design Standard; and the Ontario Building Code. Paragraph 3.1.13.1 (1).

.2 Removable components of fixtures (louvres, lenses, wire guards, and the like) to be limited to maximum 1220 mm (48") in length.

2.3 FIXTURE SCHEDULE

Interior Fixtures

See Drawings for Specifications.

Exterior Fixtures

See Drawings for Specifications.

2.4 LIGHTING HARDWARE

.1 The Contractor must supply and install all light fixtures as per the Manufacturer’s recommendations as well as to the satisfaction of all Authorities having Jurisdiction, Code requirements, the Architect, and the Electrical Engineer.

.2 Include, in the tender price, for all lighting hardware required for a complete and safe installation.

.3 Lighting hardware includes, but isn’t limited to, the mounting hardware required for each fixture. The Contractor is responsible for reviewing architectural finishes in all areas and providing lighting and mounting hardware to suit.

.4 All parts used as a part of the installation must be of the same manufacturer as the respective light fixture. Wherever available, all parts must be unique to the respective fixture and purchased with the light fixture from the same supplier and manufacturer.

2.5 PHOTOMETRIC

.1 The Electrical Contractor is responsible for obtaining a complete photometric of the entire area of lighting installation, both interior and exterior, prepared by a professional, third-party specializing in such work. All fixtures of all types shall be depicted on one layout. Refer to Architectural drawings for ceiling heights. Submit a copy of the interior and exterior photometric with the shop drawing submittal for the light fixtures. The Electrical Contractor in conjunction with the Manufacturer remains responsible for the accuracy of the photometric results and acceptance of fixtures based on this.

.2 Photometric statistics shall be prepared for each zone/room. Statistics such as max/min

and average footcandle readings shall be included in the photometric submittal.

.3 Photometric shall take into account site condition impacts such as partitions, washroom stall partitions, suspended ceilings, reflectances, etc.

2.6 APPROVED EQUAL PRODCUTS

.1 The Contractor is permitted to provide alternate products to the base product specified as long as the alternate fixture is equal or superior to the base bid product in all specifications. The Contractor remains responsible for ensuring compliance of the alternate product to the base specifications outlined above.

.2 All alternate fixtures must be reviewed and approved in writing by the Electrical Engineer or Owner **during pricing**. No substitutions will be permitted to the base product upon award of the Contract.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Do not install or energize lamps until directed by Architect which generally shall be just prior to occupancy of the building by the Owner. Read `Temporary and Trail Usage'.

.2 Provide two new safety chains per light fixture for all light fixtures through the existing and new school. Mount from the building structure. Provide unistrut supports throughout as necessary to support the safety chains where obstructions (ductwork, etc.) might prohibit installation without Unistrut.

3.2 RECESSED FIXTURES

.1 Provide plaster and/or framing rings for recessed fixtures (except for `Lay-in Tee-Bar' types) the installation of which shall be the responsibility of this Section.

.2 Recessed incandescent fixtures shall conform with requirements of Ontario Electrical Safety Code and its latest bulletins. Thermal insulation and combustible materials shall be kept clear of recessed fixtures, unless approved, rated fixtures are utilized.

3.3 SUSPENSION STEEL

.1 Provide angle-iron channels welded to the top side of bottom-chord of the L.S.S.J.'s in the Gymnasium for securing light fixtures.

.2 Provide supports for light fixtures from separate uni-strut members attached and/or secured to building structure. No supports shall be attached to metal deck.

3.4 SITE AIMING

.1 Position and aim adjustable lighting equipment as directed on the site. Position outdoor

units after daylight hours as directed. Provide labour and materials necessary to accomplish this.

.2 Locate and aim emergency lighting remote heads to optimally illuminate egress route.

3.5 COMPLETION

.1 Fixtures shall be clean at the time of final acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Refer to Section 26 05 00 Common Work Results for Electrical.

.2 All specifications must be read in conjunction with the Electrical Drawings.

.3 The drawings and specifications must be read in conjunction with all front-end and tender documents (RFQ, etc.) issued by the Board and/or its representative along with the Drawing and Specification package.

1.2 WORK INCLUDED

.1 Provide emergency lighting fixtures and systems scheduled, complete with lamps, and all necessary accessories required for their complete installation, performance, and on-going operation.

.2 Additional details of 'Work Included' may be found throughout the specifications and/or drawing package.

1.3 SHOP DRAWINGS

.1 Conform to requirements of Section 26 05 00.

.2 The Contractor must submit electronic copies of all shop drawings for the Engineer's review and approval prior to ordering anything. The shop drawing package must include shop drawings for the following (as applicable):

.1 Exit Signs

Each package must contain illustrations of each fixture. Illustrations are to be complete showing dimensions light distribution and mounting requirements. Illustrations to be noted to indicate special features and finishes. A copy is to be retained by the Contractor on the site at all times, to ensure co-ordination of installation requirements. The Contractor must work with the Manufacturer to provide a photometric study based on the proposed design and the selected devices/equipment. CAD will be made available by the Engineer for the Contractor to use.

PART 2 - PRODUCTS

2.1 REFERENCE NUMBERS

.1 Catalogue reference numbers given for individual fixture types are intended as a guide when read with the description and the fixture as finally applied. Verify catalogue references with description and coordinated with installation conditions, with particular regard to wall or ceiling construction details, type and finish before ordering fixtures.

2.3 EMERGENCY LIGHTING SYSTEM

.1 Emergency Lighting Battery Units:

.1 Reserved.

.2 Emergency Single Remote Heads:

.1 Reserved.

.3 Emergency Dual Remote Heads:

.1 Reserved.

.4 Exit Sign (without built-in battery unit & remote heads):

.1 Supply and install the Emergi-Lite® EAE Series slim-profile pictogram edge-lit sign. The unit shall operate with universal 2-wire AC input voltage of 120 to 347VAC at less than 3W and universal 2-wire DC input voltage from 6 to 24VDC at less than 2.5W. The housing assembly shall be constructed of extruded aluminum with textured finish and colour. The canopy shall be of die-cast aluminum and allow for wall, end, or ceiling mount. The legend shall be printed on a pure-acrylic panel. The panel shall come standard with double-face legend, for single-face and double-face applications. The light source shall be longlife white light-emitting diodes (LED) and shall provide even illumination in normal and emergency operation.

.2 Exit sign shall be Emergi-Lite Model: EAE-UNIVERSAL-TA-U or approved equal.

Specifications:

- Universal faces.
- Universal mounting kit
- 120 to 347VAC input; 6 to 24VDC output.

.3 Wireguard shall be Emergi-Lite Model: 460.0079-E (wall-mount), 460.0027-E (end-mount) or 460.0028-E (ceiling-mount) or approved equal.

.5 Acceptable Alternate Manufacturers

1. Lumacell
2. Beghelli

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Do not install or energize lamps until directed by Consultant which generally shall be just prior to occupancy of the building by the Owner.

.2 Provide wiring in conduit and install devices in accordance to all Manufacturer recommendations and instructions. Advise the Consultant of any discrepancies or conflicts between the instructions set out in these drawings and specifications and the Manufacturer's recommendations and instructions prior to commencing work.

.3 Prior to installation of any devices, verify the existing conditions around the proposed location and ensure there are no conditions that restrict visibility of exit signs, may affect coverage of emergency lighting, or atmospheric or climate conditions that may affect the operation of new devices (unheated areas, moist/damp air, etc.). Advise the Consultant in writing of all such conditions prior to installation and seek instruction prior to proceeding.

3.2 SITE AIMING

.1 Position and aim adjustable lighting equipment as directed on site and to obtain light levels as required by code. Position outdoor units after daylight hours as directed. Provide labour and materials necessary to accomplish this.

.2 Locate and aim emergency lighting remote heads to optimally illuminate egress route to meet or exceed all code requirements.

3.3 COMPLETION

.1 Fixtures shall be clean and 100% operational at the time of final acceptance.

.2 Upon a complete installation of the systems as proposed on the drawings, as per all code requirements, and to the satisfaction of all Authorities having Jurisdiction, commission and test the new system in entirely with the Manufacturer's Representative. Make allowance for adjustments as required by the Manufacturer or Authorities having Jurisdiction. Provide a letter to the Consultant that the system is complete, has been tested, adjusted (as required), and is in proper operating condition. Testing shall be performed during non-daylight hours.

.3 Upon completion of installation, engage a professional third-party agency to complete an illumination level test throughout all areas of the building where the installation has taken place. The Contractor must work with the third-party agency to properly aim remote light heads, recording light level readings on a record set of floor plans, calculating light level readings, and issuing to the Consultant a letter stating that the emergency lighting levels meet the requirements of the Ontario Building Code. Notify the Owner and Consultant at least ten (10) days prior to the proposed testing and verification data and schedule a time and date that is acceptable to all.

.4 The Contractor is responsible for engaging a professional third-party agency to complete a voltage drop test testing the voltage at each panel as well as the voltage at the most remote fixture.

.5 Include (in the tender price) for the hiring of all third-party agencies (including, but not limited to, the Manufacturer's representative) as required by the drawing and specifications.

END OF SECTION

PART 1 – GENERAL

1.1 Summary

A. Section includes a networked lighting control system comprised of the following components:
   1. System Software Interfaces
      a. Management and Visualization Interface
      b. Historical Database and Analytics Interface
      c. Personal Control Applications
      d. Smartphone Programming Interface for wired devices

   2. System Backbone and Integration Equipment
      a. System Controller
      b. OpenADR Interface

   3. Wired Networked Devices
      a. Wall Switches, Dimmers and Scene Controllers
      b. Graphic Wall Stations
      c. Auxiliary Input/Output Devices
      d. Occupancy and Photocell Sensors
      e. Power Packs and Secondary Packs
      f. Networked Luminaires
      g. Relay and Dimming Panel

   4. Wireless Networked Devices
      a. Sensor Interface
      b. Light Controllers
      c. Digital Sensor Attachments
      d. Networked Luminaires
      e. Communication Bridge

B. The networked lighting control system shall meet all of the characteristics and performance requirements specified herein.
C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2. Related Documents

A. 26 05 00 Common Work Results for Electrical
B. 26 05 01 Basic Materials & Methods
C. Section 26 50 00 Lighting Systems

1.2 Submittals

A. Submittal shall be provided including the following items.
   1. Bill of Materials necessary to install the networked lighting control system.

2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
3. Riser Diagrams showing device wiring connections of system backbone and also typical per room/area type.
4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
8. Hardware and Software Operation Manuals.

1.4 Approvals

A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.
B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.
C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.
D. For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.5 Quality Assurance

A. Product Qualifications
   1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
   2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
   3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
   4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
   5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.
B. Installation and Startup Qualifications
   1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.
C. Service and Support Requirements
   1. Phone Support: Toll free technical support shall be available.
   2. Remote Support: The bidder shall offer a remote support capability.

3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.6 Warranty

A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.7 Maintenance & Sustainability

A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

1.8 Installer Experience

A. The Bidding Contractor shall ensure they are familiar with the installation of the lighting control system as proposed on the drawings and within the specifications. No extra will be granted after award of Contract as a result of unfamiliarity to the requirements of producing a fully operational lighting control system to meet the specified requirements and ASHRAE 90.1 compliance.
B. The Bidding Contractor shall have a minimum experience of three past projects from the last three years installing a lighting control system of equal or larger size to that proposed on the drawings. The experience shall only be valid if it was installing the base specified system or that of one of the approved equal products and that is the respective system of installation on this project.
C. The Bidding Electrical Contractor shall retain the services of another Electrical Contractor to perform the full extent of the lighting control system work if they lack the experience outlined in this section. The retention of services shall be included for in the tender price.

PART 2 – EQUIPMENT

2.1 Manufacturers

A. The basis of this specification and the drawings is the Acuity nLight Lighting Control System.
B. Alternate systems from Cooper or Hubbell will be accepted. No other manufacturer is permitted.

2.2 System Performance Requirements

A. System Architecture
   1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) optional system backbone for remote, time based and global operation between control zones.

a. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

b. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wallstations without requiring connection to a higher level system backbone; this capability is referred to as "distributed intelligence."

c. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see *Control Zone Characteristics* sections for each type of network connection, wired or wireless).

2. The system shall be capable of providing individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs from centralized panels to provide design flexibility appropriate with sequence of operations required in each project area or typical space type. A single platform shall be used for both indoor and outdoor lighting controls.

3. Lighting control zones shall be capable of being networked with a higher level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.

4. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.

5. System shall be capable of "out of box" sequence of operation for each control zone. Standard sequence is:

a. All switches control all fixtures in a zone

b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.

B. Wired Networked Control Zone Characteristics

1. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The "out of box" default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

2. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.

3. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:

a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss of power sensed via line voltage connections.
c. Emergency egress devices shall be provided and UL labeled by the lighting control manufacturer.

C. Wireless Networked Control Zone Characteristics
1. Following proper installation and provision of power, all wireless networked devices paired, meshed or grouped together shall automatically follow the "out of box" default sequence of operations.
2. Wireless network communication shall support uniform and instant response such that all luminaires in a lighting control zone respond immediately and synchronously in response to a sensor or wallstation signal.
3. To support the system architecture requirement for distributed intelligence, wireless network communication shall support communication of control signals from sensors and wallstations to networked luminaires and wireless load control devices, without requiring any communication, interpretation, or translation of information through a backbone device such as a wireless access point, communication bridge or gateway.
4. All wireless communication shall be encrypted using at least 128-bit Advanced Encryption Standard (AES).
5. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
a. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss or interruption of power sensed via line voltage connections.

D. System Integration Capabilities
1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet/MSTP protocols.

2.3 System Software Interfaces

A. Management Interface
1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
3. All system software updates must be available for automatic download and installation via the internet.

B. Historical Database and Analytics Interface

1. System shall provide a browser-based trending and monitoring interface that stores historical data for all occupancy/daylight sensors and lighting loads. Additionally, the system shall optionally upload that data to a cloud based server.

C. Visualization Interfaces
1. System shall provide an optional web-based visualization interface that displays a graphical floorplan. System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.

D. Portable Programming Interface for Standalone Control Zones
1. Portable handheld application interface for standalone control zones shall be provided for systems that allows configuration of lighting control settings.
2. Programming capabilities through the application shall include, but not be limited to, the following:
    a. Switch/occupancy/photosensor group configuration
    b. Manual/automatic on modes
    c. Turn-on dim level
    d. Occupancy sensor time delays
    e. Dual technology occupancy sensors sensitivity
    f. Photosensor calibration adjustment and auto-setpoint
    g. Trim level settings

2.4 System Backbone and System Integration Equipment

A. System Controller
1. System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
2. System Controller shall perform the following functions:
    a. Facilitation of global network communication between different areas and control zones.
    b. Time-based control of downstream wired and wireless network devices.
    c. Linking into an Ethernet network.
    d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
    e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
3. System Controller shall not require a dedicated PC or a dedicated cloud connection.
4. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
5. Device shall have a standard and astronomical internal time clock.
6. Shall be capable of connecting to the customers Local Area Network (LAN) via IEEE 802.11.x Wireless and IEEE 802.3 Wired connection.
7. System Controller shall support BACnet/IP and BACnet/MSTP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
    a. BACnet/MSTP shall support a minimum of 50 additional BACnet MS/TP controllers in addition to the Expansion I/O modules.

b. BACnet/MSTP shall support 9600 to 115200 baud.
c. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
d. System controller must support BACnet/IP Broadcast Management Device (BBMD) and Foreign Device Registration (FDR).

B. OpenADR Interface
1. System shall provide an interface to OpenADR protocol Demand Response Automation Servers (DRAS) typically provided by local electrical utility.
2. OpenADR interface shall meet all of the requirements of Open ADR 2.0a Virtual End Nodes (VEN), including:
a. Programmable with the account information of the end-user's electrical utility DRAS account credentials.

2.5 Wired Networked Devices

A. Wired Networked Wall Switches, Dimmers, Scene Controllers
1. Wall switches & dimmers shall support the following device options:
a. Number of control zones: 1, 2 or 4
b. Control Types Supported: On/Off or On/Off/Dimming
2. Scene controllers shall support the following device options:
a. Number of scenes: 1, 2 or 4
b. Control Types Supported:
1) On/Off or On/Off/Dimming
2) Preset Level Scene Type
3) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene
4) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones

B. Wired Networked Graphic Wall Stations
1. Device shall have a full color touch screen.
2. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
3. Graphic wall stations shall support the following device options:
a. Number of control zones: Minimum of 16
b. Number of scenes: Minimum of 16
c. Optional password protection for setup screens.

C. Wired Networked Auxiliary Input / Output (I/O) Devices
1. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
a. Contact closure input
1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, ramp light level up or down, or toggle lights on/off.
b. 0-10V analog input
1) Input shall be programmable to function as a daylight sensor.
c. RS-232/RS-485 digital input
1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.

d. 0-10V dimming control output, capable of sinking a minimum of 20mA of current
1) Output shall be programmable to support all standard sequence of operations supported by system.

D. Wired Networked Occupancy and Photosensors
1. Sensors shall utilize passive infrared (PIR) or passive dual technology (PDT) to detect both major and minor motion as defined by NEMA WD-7 standard.
2. Sensing technologies that are acoustically passive, meaning they do not transmit sounds waves of any frequency do not require additional commissioning. Ultrasonic or Microwave based sensing technologies may require commissioning due to the active nature of their technology, if factory required.
3. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device.
4. Sensor mounting type shall match project design requirements as shown on plans.
a. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation.
2. The system shall support the following types of photocell-based control:
a. On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.
b. Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

E. Wired Networked Wall Switch Sensors
1. Wall switches sensors shall support the following device options:
a. User Input Control Types Supported: On/Off or On/Off/Dimming
b. Occupancy Sensing Technology: PIR only or Dual Tech
c. Daylight Sensing Option: Inhibit Photosensor

F. Wired Networked Embedded Sensors
1. Embedded sensors shall support the following device options:
a. Occupancy Sensing technology: PIR only or Dual Tech
b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor

G. Distributed System Power, Switching and Dimming Controls
1. Devices shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
2. Device programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
3. Device shall be plenum rated.
4. Devices shall be UL Listed for load and load type as specified on the plans.

H. Wired Networked Luminaires
1. Networked luminaire shall have a factory installed mechanically integrated control device and carry a UL Listing as required.
2. Networked LED luminaire shall provide low voltage power to other networked control devices.

3. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
4. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
5. Controls manufacturer is responsible for primary troubleshooting and tech support of complete fixture.

I. Wired Networked Relay and Dimming Panel
1. Relay and dimming panel(s) shall be capable of providing the required amount of relay capacity, as required per panel schedules shown on drawings, with an equal number of individual 0-10V dimming outputs.
2. Standard relays used shall have the following required properties:
   a. Configurable in the field to operate with normally closed or normally open behavior.
   b. Provides visual status of current state and manual override control of each relay.
   c. Be individually programmable
3. 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
4. Panel shall be UL924 listed for control of emergency lighting circuits.
5. Panel shall provide a contact closure input that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel.

2.6 Wireless Networked Devices

A. Wireless Networked Sensor Interface
1. The device shall be capable of broadcasting the following manual wall control commands: on, off, and adjust dim level.

B. Wireless Networked Light Controllers (No Sensor)
1. The wireless light controller shall be capable of providing continuous dimming and on/off control of one commercial light fixture including fluorescent, HID, induction and LEDs.
2. An external antenna attached to the luminaire shall not be allowed.
   a. Each wireless light controller shall provide measurement capability of the amperage, voltage, wattage, and watt-hours of its controlled lighting.

C. Wireless Networked Digital Sensors
1. In addition to providing Wireless Networked Light Controllers functionality, also provides:
   a. Integrated digital occupancy sensing and digital photocell sensor.
   b. Sensor shall connect directly to the wireless light controller and shall be suitable for embedding into the enclosure of a luminaire.
   c. Sensor shall have software-adjustable settings
   d. Photocell shall be suitable for closed and open loop applications.

D. Wireless Network Communication Bridge
1. A communication bridge device shall be provided that interfaces with the System Controller via Owner’s LAN connection and interfaces with wireless network.
2. Device shall be capable of communicating with a group of a minimum of 250 wireless networked devices and luminaires, so as to reduce the amount of communication bridges required in the system.

2.7 Devices

1. Provide occupancy sensors, power packs, switches, dimmers and all other lighting control components, devices, equipment and panels as specified on the drawings or in these specifications.
2. Provide a Graphic Floorplan.

PART 3 – EXECUTION

3.1 Installation Requirements

A. Installation Procedures and Verification
   1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
   2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
   3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
      a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
      b. Length
      c. Insertion Loss
   4. During shop drawing submission, the Electrical Contractor in conjunction with the Manufacturer is responsible for preparing a full layout of all devices in all areas of work including wiring diagrams for each zone showing how everything will be wired. The wiring diagram is to be reviewed by the Manufacturer to ensure accuracy of the design. All device locations are to be as per the Manufacturer's recommendations and subject to change from the location shown on the drawing.

B. Coordination with Owner's IT Network Infrastructure
   1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
      a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
      b. The bidder shall provide, to the manufacturer's representative, all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

C. Coordination with Mechanical Division
   1. The successful bidder shall provide all integration equipment detailed in Division 260943.
   2. The successful bidder to verify integration scope with the Mechanical Contractor prior to submittal phase and provide all necessary schedules to the Lighting Control manufacturer.

D. Documentation and Deliverables
   1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device addresses corresponding to locations of installed equipment.

2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
    a. As-Built floor plan drawings showing wired network control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
    b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
        1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
        Titleblock
        Text- Inclusive of room names and numbers, fixture tags and drawings notes
        Fixture wiring and homeruns
        Control devices
        Hatching or poché of light fixtures or architectural elements
        2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 System Startup

A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
    1. Low voltage network cable testing shall be performed prior to system startup at the discretion of the manufacturer.
B. System start-up and programming shall include:
    1. Verifying operational communication to all system devices.
    2. Programming the network devices into functional control zones to meet the required sequence of operation.
    3. Programming and verifying all sequence of operations.
    4. Customization of owner's software interfaces and applications.
C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.
D. The Manufacturer shall include for, in their bid price, full testing and commissioning of the Lighting Control system on site, including training to the User Group.
E. Exact sequence of operations of the Control System will be advised by the Consultant during Construction. Include for room-by-room/zone-by-zone adjustment of all lighting control devices (power packs, switches, sensors, etc.) based on the instructions of the Consultant. Product specified is generic and does not account of room-by-room requirements, all of which are expected to be incorporated during the programming and on-site commissioning stage. Items subject to be programmed include, but are not limited to:
    1. Time-out period.
    2. Vacancy vs. Occupancy setting
    3. Automated On/Off Scheduling Times
    4. Auto On/Manual On settings

F. The Contractor shall return the services of a Third-Party Commissioning Agent to test the new lighting control system as per ASHRAE 90.1 requirements and standards. The Manufacturer is not deemed to be the Third-Party Agent. All costs associated with the testing shall be included for in the tender price.

3.3 Project Turnover

A. System Documentation
   1. Submit software database file with desired device labels and notes completed.
B. Owner Training
   1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

3.4 System Installation

A. All light switches coverplates shall be stainless steel.
B. Provide new electrical box to serve the new power packs. All power packs shall be installed in an electrical box. Leaving power packs exposed in the ceiling space will not be permitted. Electrical box shall be vented to permit air flow.
C. All low-voltage cabling shall be plenum rated and minimum CAT5E.
D. All low-voltage cabling may run exposed in accessible ceiling spaces, unless restricted by Code Requirements of Authorities having Jurisdiction.
E. All low-voltage cabling in inaccessible ceiling spaces or in exposed ceiling conditions shall be run in raceways.
F. Ensure all low-voltage cabling runs do not exceed the Manufacturer's instructions.
G. Note all device address on the As-Built Drawings.
H. Review sensor locations with the Manufacturer onsite prior to commencing work. Sensor locations shown on the drawing are generic and meant to illustrate the general design intent only. Locate sensors for best coverage of the space and clear of any obstructions.

END OF SECTION

1 GENERAL

1.1 RELATED INSTRUCTIONS

.1 Conform to Section 26 05 00.

.2 Conform with applicable requirements governing installation of Section 26 05 01, Basic Materials & Methods.

1.2 WORK INCLUDED

.1 Work includes, but is not limited to:

Provide empty conduit system c/w pull wire, PVC end bushing, and backbox to accessible ceiling space for equipment wiring in the building:

1. Voice and Data System
2. Security System

.2 Coordinate work to ensure compatibility of conduit provisions before installation.

2 PRODUCTS

2.1 OUTLETS

.1 Provide a backbox for each Voice, Data and and Security Device noted on drawings. **Coordinate backbox requirements with the respective Low Voltage Contractor prior to procurement and rough-in.**

3 EXECUTION

3.1 SUPPLY & INSTALLATION – CONDUITS AND ROUGH-INS.

.1 Conduit shall be 19 mm (3/4”) trade size minimum, with PVC end bushings and shall be cleared and free from water. Provide pull wires installed continuously from outlet and fastened at each box.

.2 Provide 2 x 2” sleeve c/w PVC bushing between all classrooms with accessible ceiling space in order to facilitate low voltage wiring by others. Division 26 will be responsible to provide fire stopping inside and outside the sleeves upon low voltage cable run is completed.

.3 Conduit shall not have more than two 90 degree or equivalent bends and 30 metres between outlets or pull boxes, and bending radius shall not be less than 10 times the conduit diameter. Conduit ends to be identified with paint.

.4 For each telephone outlet shown on the drawings, provide a single-gang outlet box complete with 19 mm (3/4”) conduits from the outlet box to the accessible ceiling space complete with PVC end bushing.

.5 For each data outlet shown on the drawings, provide a single-gang outlet box complete with 19 mm (3/4") conduits from the outlet box to the accessible ceiling space complete with PVC end bushing.

.6 For each security device shown on the drawings, provide a single-gang outlet box complete with 19 mm (3/4") conduits from the outlet box to the accessible ceiling space complete with PVC end bushing.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 All model numbers listed here-in pertain to the Telecor XL system unless otherwise noted.

.2 The existing Public Address System Rack is existing to remain. No new Public Address System Rack or head-end equipment is required for this project.

.3 Field wiring should terminate to a "crossover" BIX termination or 66 Block. The rack side of the BIX/Block will terminate to 25 pair Amphenol cables with male plugs. The rack would be equipped with 25 pair female Amphenol cables, so that the rack can be detached from the field wiring by undoing the Amphenol plugs.

.4 System shall be programmed for paging zones as shown the drawings, and time zones as negotiated with the Principal.

.5 All devices, components, wiring material etc. is to be new unless noted otherwise.

.6 System programming shall be a discussed with and approved by the Principal. However the following programming format should be adhered to:

Corridor and washroom speakers on each floor should be connected to a separate port.

Outdoor horns should be connected to a separate port and programmed as a separated zone.

Each classroom would be connected to its own individual port and programmed with its own room number as the programmed phone number.

.7 Each floor of corridor speakers should be on a separate circuit. Washroom speakers should be tied in with corridor speakers, unless otherwise noted and there is a call station, in which case there would be a separate circuit.

.8 Outdoor speakers should be programmed as a separate zone so announcements are not broadcast to the neighborhood.

.9 Three sets of operational manuals are required (school, maintenance department and design & construction). Included in these manuals should be a CD with the system programming information & software, all closeout documents and an AutoCAD diskette of the as-built drawings.

.10 Include for work schedule to be after hours and weekends. During weekdays, only activities possible and mutually agreeable to school operation will be accepted.

.11 The system shall be ULC listed and labelled, CSA approved, and microprocessors based and controlled with all of the following, but not limited to, features:

1. Simultaneous program distribution and direct dialing, two-way and room-to-room communications
2. Built-in remote diagnostics
3. Selectable single queue operation
4. Built-in analogue tone generator and chime
5. User programmable inputs and outputs
6. Provide user programmable inputs and outputs
7. Provide user programmable signalling of exterior programme bells
8. Standard manufacturer's features

.12 Installer to verify adequate volume levels in each space where speaker(s) are installed. Ambient noise should be taken into consideration when setting audibility levels.

.13 Refer to the bid documents for all close-out document requirements. The Contractor is responsible for providing all such information at his/her own cost. Provide one (1) set of this information in a binder (to be given to the school) and two (2) sets of this information on two (2) USBs to be provided to the Board.

.14 All wiring must be FT6. All vertical runs of wire must be in concealed in conduit imbedded in the new partition walls. Horizontal wiring, if it is running in an enclosed ceiling space may be pulled using open wiring techniques, provided it is held up off the T-bar ceiling grid by means of J-Hooks. Any exposed wiring & in areas with drywall or plaster ceiling must be run in painted conduit or raceway (wiremold).

.15 No volume controls shall be installed.

1.2 CONTRACTOR

.1 The contractor shall furnish all equipment, accessories and material required for the installation of a comprehensive communication system in strict compliance with these specifications and applicable contract drawings. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this specification.

.2 The communications system shall be DOC approved and have C.S.A or Electrical Safety Authority Approval and must comply with all Electrical Codes.

.3 The system is to be designed and configured for maximum ease of service and repair. All major components of the system shall be designed as a standard component of one type of card cage. All internal connections of the system shall be with factory keyed plugs designed for fault-free connection. The printed circuit card of the card cage shall be silk screened to indicate the location of each connection.

1.3 MANUFACTURER

.1 All equipment shall be manufactured by Telecor Inc. No alternates will be accepted.

1.4 QUALIFICATIONS

.1 The system shall be supplied by the manufacturer's authorized contractor who is qualified in the proper installation, operation and service of the system. Certification shall be submitted verifying that the contractor is the manufacturer's authorized contractor.

1.5 EQUIPMENT WARRANTY

.1 The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of installation, repair or replace any equipment found to be defective. This warranty shall not apply to any equipment which has been subject to misuse, abuse, negligence, accident, or unauthorized modification.

1.6 SERVICE FACILTIES

.1 The contractor shall make available, and maintain a satisfactory service department capable of furnishing equipment inspection and service. The contractor shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.

1.7 TRAINING

.1 The contractor shall instruct personnel designated by the owner in the proper use, basic care, and maintenance of the equipment. Such training shall be provided as an integral component of the system. Training shall be minimum of 2 hours.

PART 2 PRODUCTS

2.1 PUBLIC ADDRESS SYSTEM FEATURES

.1 Telecor XL, UL listed and labeled, CSA approved, microprocessors based and controlled public address and intercom system with the following features:

1. Simultaneous program distribution and direct dialing, two-way and room to room communications
2. Built-in and remote diagnostics
3. Selectable single queue operation
4. Built-in analogue tone generator and chime
5. User programmable inputs and outputs
6. User programmable, battery backed remote clock driver
7. Provide user programmable signaling of exterior program bells
8. Standard manufacturer’s features
9. Ability to integrate PA handsets into an IP based telephone
10. Hybrid Capability. Option of connecting IP speakers and devices.

2.2 CENTRAL CONTROL UNIT

.1 The existing Central Control Unit is to remain as is and be upgraded as necessary to accommodate the Addition.

2.3 MUSIC SOURCE

.1 The existing Central Control Unit is to remain as is.

2.4 PAGING CAPABILITES

.1 The paging requirements must include at least the following "paging" capabilities/hardware:

1. Only centrally amplified paging component systems are acceptable
2. Operation - Depressing the talk switch code on the desk microphone shall activate the call zone, and sound a pre-tone.
3. Muting - automatic muting of the page channel unless signal activated.
4. Output levels - automatic leveling of page channel.
5. Program muting - voice activated, variable-level muting of program Input during a page.
6. Administration - capability for user to readily modify zones, paging functions, etc. via the telephone keypad.
7. Clock - provide as an internal modular component, a master program clock for tone signaling operating the P.A. to simulate approved tone over speakers.
8. Emergency call - ability to activate an emergency alert tone and/or voice page that overrides all normal paging features (specify activation required and paging functionality possible).
9. Simultaneous high and low power paging.
10. Zone and zone group paging (plus growth capacity for 25%).
11. Built-in talk back amplification.
12. Capability of distributing and monitoring audio program sources from the control console. Inputs shall be provided for microphones, tuner, CD player and AUX. Program distribution shall be accomplished on a SELECTED ROOMS or SELECTED ZONES basis as programmed from the console.
13. Facilities for the distribution of highest priority emergency announcements or tones from the control console to all locations equipped with telephone sets or loud speakers.
14. Emergency all-facility page override.
15. Twenty-four daily time-triggered signaling event.
16. Daily master clock synchronization.
17. Relay driver per zone.
18. Auxiliary contracts (2 N.O. and 2 N.C.) for external device control.
19. Compatible with desktop microphone, with on-off switch and jacked outlet and connector plug for use with system including any additional interfacing hardware.
20. Night ringer - ability to sound a night ringer tone through the paging speakers.
21. Music program source.
22. Capabilities of overriding a local gym or multi-purpose room sound systems.

2.5 ADMINISTRATIVE CONTROL CONSOLE

.1 Not required for this project.

2.6 PHONE HANDSET

.1 The telephone shall be a standard utility grade instrument, equipped with automatic side tone balancing networks, electrets transmitters and dynamic receivers. A receiver volume control shall be provided on the side of the telephone base allowing for the adjustment of the handset listen level. The telephone housing and handset shall be manufactured from a high impact plastic which will be available in either charcoal or grey colors. Each telephone shall be supplied with a retractable handset cord of at least 5 ft. (1.53 m) and a connecting cord of at least 7 ft. (2.14 m). The telephone shall be suitable for use as a desk telephone or shall be wall mounted. The telephone shall be equipped with a standard 12-button dial keypad, along with four special function buttons (store, recall, save and flash), three one touch priority dial buttons, and a redial button.

.2 Phone shall be TELECOR HS-1301 or Astra Model 8004 only.

2.7 CALL SWITCH

.1 The switch shall be a three-position, rocker-type, single-pole, normally open switch, designed for use with TELECOR/EDCOM (Model CS-3-PT). When pressed, the switch shall energize the corresponding circuit to provide the call-in tone at the main control console, and shall maintain this condition after the switch is released and until the call is acknowledged by the operator. The holding action shall be accomplished without the use of relays or other mechanical devices.

2.8 SPEAKERS

.1 The speaker/transformer assembly shall be a Telecor model S8T2570 or approved equal. The grille shall be Telecor B25 or approved equal. It shall be used for flush mounting on ceilings. Furnish and install as indicated on the plans.

1. The loudspeaker size shall be 8 inches in diameter and have a power handling capacity of 15 watts. The voice coil shall be of high-temperature bonded construction, be one inch in diameter and have an impedance of 8 ohms. The speaker shall have a frequency range of at least 50 Hz to 15,000 Hz and an axial sensitivity of 91dB at 4 ft., with a 1 watt input signal @ 1000Hz.

2. The loudspeaker shall be equipped with a factory wired 25/70 volt line-matching transformer. The transformer shall have the primary taps at ¼, ½, 1, 2, and 4 watts. The insertion loss shall be no greater than 1.0 dB. The transformer shall be mounted to the speaker with the secondary leads soldered to the speaker terminals.

3. The assembly shall include a baffle constructed of 22 gauge, cold-rolled steel finished with a mar-resistant white, semi-gloss, epoxy coating. The baffle shall have a diameter of 13". The complete assembly shall mount to a Telecor H20 recessed

back box with bridge/rails CC-1, used to attach the assembly to suspended ceilings. The support bridge/rails CC-1 will accept an enclosure, model H20, to provide a protective enclosure. The H20 enclosure shall attach to the support bridge with appropriate mounting screws.

.2 The loudspeaker/transformer/baffle and enclosure shall be Telecor models S8T2570, B25 and H20. It shall be used for surface mounting on walls or ceilings. Furnish and install as indicated on the plans.

1. The speaker/transformer assembly shall be a Telecor model S8T2570 or approved equal. The loudspeaker size shall be 8 inches with a ceramic magnet and seamless cone. The ceramic magnet shall weigh no less than 6 oz. The speaker shall have a frequency range of at least 50 Hz to 15,000Hz at a 10 watt handling capability, and an axial sensitivity of at least 95 dB at 4 feet, with a 1 watt input. The voice coil shall be 1.0 inch in diameter with an 8 impedance. The loudspeaker shall be equipped with a factory wired 25/70 volt line-matching transformer. The transformer shall have the primary taps at ¼, ½, 1, 2, and 4 watts. The insertion loss shall be no greater than 1.0 dB. The transformer shall be mounted to the speaker with the secondary leads soldered to the speaker terminals.

2. The baffle shall be a Telecor Model B25 or approved equal. It shall be constructed of 22 gauge, cold rolled steel and finished with a mar-resistant, white, semi-gloss, epoxy coating. Speaker studs shall be concealed. The baffle shall measure 12 ½" square, and shall mount a standard 8" loudspeaker. It shall mount to a Telecor H20 recessed or SH20 surface enclosure.

3. The enclosure shall be a Telecor Model SH20 or approved equal suitable for the surface installation of 8" speaker/baffle assembles. The enclosure shall be suitable for ceiling or wall installation. It shall be a welded assembly, constructed of 18 gauge, cold rolled steel and finished with a mar-resistant, white, semi-gloss, epoxy coating. The enclosure is furnished with four "J" clips to facilitate screw mounting of the baffle. For Recessed applications the enclosure shall be Telecor Model H20, suitable for T-bar or Drywall applications. It shall be a welded assembly, constructed of 18 gauge, cold rolled steel and shall be coated to prevent mechanical and acoustical resonances.

.3 Bi-Directional (Double-Faced) Corridor speakers shall be McBride 8224/75/7025-10 or approved equal. Speaker shall include a bi-directional corridor enclosure speaker assembly with 8” dual cone speaker and 10 oz. magnet. The speaker shall be pre-assembled bi-directional corridor enclosure with 2 piece bi-directional steel enclosure baffle and 70/25 dual voltage 10 watt transformer.

2.9 HORN-TYPE SPEAKER

.1 Indoor horn style loudspeaker shall be a Telecor model A-15T or approved equal. Furnish and install as indicated on the plans.

1. The horn shall be a double re-entrant type, with a flared bell and an integral compression driver rated for 15 watts of continues audio power. The frequency response shall be 375 -14,000Hz. Nominal sensitivity shall be such that a sound pressure level of 110 dB at 1000 Hz (on axis) at distance of one meter is produced with an input of one watt. Sound dispersion shall be no less than 100 degrees, regardless of the mounting position.

2. The horn shall contain a weatherproof, built-in, 25/70 volt line matching transformer. Power taps shall be at 0.48, 0.94, 1.8, 7.5 or 15 watts for a 25V line and 1, 2, 3.8, 7.5 or 15 watts for a 70 V line. The power taps shall be screwdriver adjustable. Impedance selection shall be 5,000, 2500, 1300, 666, 333, 87, or 45 ohms.

3. The unit shall include a die-cast universal mounting bracket, allowing the horn to be positioned both in the vertical and horizontal planes with a single adjustment. The wiring terminals and the screwdriver power tap shall be enclosed by a clear plastic cover for security and weather protection.

4. The horn shall be finished in a grey epoxy. Dimensions shall be 9 1/4" deep with a diameter of 8”.

.2 Outdoor horn style loudspeaker shall be a Telecor model A-30T or approved equal. Furnish and install as indicated on the plans.

1. The horn shall be a double re-entrant type, with a flared bell and an integral compression driver rated for 30 watts of continues audio power. The frequency response shall be 275 -14,000Hz. Nominal sensitivity shall be such that a sound pressure level of 115 dB at 1000 Hz (on axis) at distance of one meter is produced with an input of one watt. Sound dispersion shall be no less than 90 degrees, regardless of the mounting position.

2. The horn shall contain a weatherproof, built-in, 25/70 volt line matching transformer. Power taps shall be at 0.94, 1.8, 7.5, 15 or 30 watts for a 25V line and 2, 3.8, 7.5, 15 or 30 watts for a 70 V line. The power taps shall be screwdriver adjustable. Impedance selection shall be 5,000, 2500, 1300, 666, 333, 168, 87, or 45 ohms.

3. The unit shall include a die-cast universal mounting bracket, allowing the horn to be positioned both in the vertical and horizontal planes with a single adjustment. The wiring terminals and the screwdriver power tap shall be enclosed by a clear plastic cover for security and weather protection.

4. The horn shall be finished in a grey epoxy. Dimensions shall be 10 ½" deep with a diameter of 10

2.10 POWER AMPLIFIERS

.1 Solid state amplifiers suitable for rack mounting in component enclosure. The amplifiers shall be capable of an audio output of 120 WRMS/channel (8 ohms) at less than 1% distortion. The frequency shall be flat from 20 hz to 20 kHz ± 1 db. The amplifiers shall be

designed to operate continuously on line voltages of 105 to 130 VAC, 60 Hz. Separate output terminals shall be provided for 4/8 ohms and 25/70 volts. The number of amplifiers required shall accommodate capacity for all connected devices plus an additional 30% future spare capacity. The amplifier shall be Telecor SI Series 125 or 250 watt rating.

2.11 INTEGRATED MASTER CLOCK SYSTEM

.1 Supply and install a complete fully integrated master clock system in the existing rack. All of the clocks in the school shall be synchronised through the Intercom/master clock system. The system shall provide for automatic clock correction for Daylight Savings Time, Spring Ahead/Fall Back. Daylight savings shall not require the use of any user input at the time of daylight savings. Master Clock System Driver shall be TELCOR RCD-7-XL.

.2 The time control system shall be capable of operating and correcting the clocks as well as controlling class change signals to all speakers and/or bells.

.3 The integrated Master Clock controller shall provide a 10-year battery back-up real time clock to ensure for correct timekeeping of the internal master clock during power failure. Once power is restored, the clock driver shall update the clocks as follows:

1. Digital clocks shall receive an instantaneously update with the correct time.

2. The analog clocks will receive a correction of the minute hand once an hour and the hour hand once every 12 hours. An 8-second signal is required to set the minute and second hands to HH: 59:00. In addition a 14 second signal, to initiate the 12-hour correction cycle shall also be provided.

.4 The master clock system shall support a minimum of 16 schedules and 1536 events as outlined in the Intercom/PA Features section.

.5 Provide remote Digital Secondary clocks in locations as indicated on the plans:

- Classroom and small spaces shall have surface mounted digital clocks with 2.5” display size.

2.12 RELAYS

.1 Provide required relays in device boxes to connect program horns, speakers and night call bell to main central control unit.

2.13 EQUIPMENT CABINETS

.1 Equipment cabinets shall be used to house the central control unit, system power supply, amplifiers, music sources and shall be complete with surge protected power distribution strip of receptacles.

.2 Equipment cabinets shall be floor mounted 19" EIA type, enclosed racks with steel enclosure constructed from minimum 16 gauge cold roll steel, enamel painted finish to Consultant's approval.

.3 A surface wall mounting termination cabinet, minimum 2' x 2' x 4" (600mm x 600mm x 100mm) shall be provided for cable termination where needed.

2.14 UNINTERRUPTIBLE POWER SUPPLY (UPS) UNIT

.1 Upgrade the existing Uninterrupted Power Supply Unit mounted in both the main and satellite cabinet (as applicable) to operate PA System for minimum of 120 minutes at full load (inclusive of the new Load). The make shall be APC, MGE or approved equal.

2.15 CONDUCTORS

.1 Wiring shall be of FT6 type and be run individually and directly from each of the speakers and in-house phone sets to be installed in classroom, staff room, private office, lunch room, etc. to the rack. No junctions in the field will be permitted. Wiring for corridor speakers and horns shall be FT6 rated 2 conductor 18 AWG. Cabling shall be suitable for the selected manufacturer's product and system and enable full functionality. In case any potential issues, advise the Consultant prior to installation. The Contractor and Manufacturer are responsible for reviewing the proposed wiring to confirm suitability for the proposed system. Provide a wiring diagram for the full system illustrating wiring type from the rack to each field device.

.2 Cabling specifications shall be as per the following:

1) For Classrooms - 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252),
2) For Hallways- 1 twisted pair jacketed #18 AWG FT6 (Provo 999182),
3) For Outside horns- 1 twisted pair jacketed #18 AWG FT6 (Provo 999182),
4) For Strobe DC- 1 twisted pair jacketed #18 AWG FT6 (Provo 999182),
5) For Admin Phone- 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252),
6) For Remote Wall display- 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252) plus 1 twisted pair jacketed #18 AWG FT6 (Provo 999182), and
7) For Night Bell Door Station- 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252).
8) For Clocks, to each clock from the rack:
   a. 1 twisted pair jacketed #18 AWG FT6 (Provo 999182), **and**
   b. 2 twisted pair jacketed #22 AWG FT6 each pair individually shielded (Provo 992252)

2.16 STROBES

.1 Provide strobes at locations specified on the drawings. A blue strobe shall be used to denote an incoming call. A yellow/amber strobe shall be used to denote an emergency all-call (or lockdown initiation).

.2 Strobes shall be located such that the strobe is visible from all areas of the room and its output is unobstructed. Make adjustments as required from the proposed location as required. Strobes serving the handset shall be installed at a height of 8’ AFF and right above the handset. Strobes serving the emergency all-call shall be installed adjacent the speaker.

.3 Strobes shall not be line voltage type. Provide one central power supply for all strobes at the location of the head end PA System. Connect to the 120V circuit serving the PA Headend. Strobes shall also be connected to the UPS. Where multiple power supplies are required, provide all necessary 120V power connections.

.4 Strobes shall ATW 4111155416 or approved equal. Provide a backbox. Strobes located in the gymnasium shall be installed with a wireguard.

.5 Where there are multiple strobes located within the same room of within the same line-of-sight, all strobes shall be synchronized.

PART 3 EXECUTION

3.1 DIVISION OF WORK

.1 While all work included under this specification is the complete responsibility of the contractor, the division of actual work listed following shall occur.

.2 The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work shall be furnished and installed completely by this contractor. The balance of the system, including installation of speakers and equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative. The entire responsibility of the system, its operation, function, testing and complete maintenance for two (2) years after final acceptance of the project by the owner, shall also be the responsibility of the installing contractor and manufacturer's authorized representative.

3.2 EQUIPMENT MANUFACTURER’S REPRESENTATIVE

.1 All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.

.2 The manufacturer's representative shall have completed at least ten (10) projects of equal scope, giving satisfactory performance and have been in the business of furnishing and installing sound systems of this type for at least five (5) years. The manufacturer's

representative shall be capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

.3 The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state the manufacturer guarantees service performance for the life of the equipment, and that there will always be an authorized distributor assigned to service the area in which the system has been installed.

.4 The contractor shall furnish a letter from the manufacturer of the equipment, which certifies that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written unconditional guarantee, guaranteeing all parts and all labor for a period of one (1) year after final acceptance of the project by the owner.

3.3 INSTALLATION

.1 Plug disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.

.2 All low-voltage wires and cables concealed in walls shall be run in EMT conduit from flush outlet boxes to above accessible ceilings. Provide conduit where cables penetrate firewalls above ceilings.

.3 Where raceways cannot be run concealed in walls, use Wire mold Series surface raceway complete with all fittings, box extension rings, and required accessories. Co-ordinate routing of surface raceways with the Owner.

.4 Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T & B "Ty-Rap" cable. Edge protection material ("cat-track") shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge.

.5 Cable identification: Cable conductors shall be color coded and individual cables shall be individually identified. Each cable identification shall be a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height.

.6 Shielding: Cable shielding shall be connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in same manner as conductors.

.7 Provide complete "in service" instructions of system operation to school personnel. Assist in programming of telephone system.

3.4 APPROVED P.A. VENDOR

.1 **The Electrical Contractor must retain the services of Barrie Communications for all Public Address Supply and Installation work; all costs of Barrie Communications shall be included for in the Base Tender Price. All material for this project shall be supplied by Barrie Communications only. No alternate sourcing of material and/or labour is permitted.**

END OF SECTION

PART 1 - GENERAL

1.1 RELATED INSTRUCTIONS

.1 Refer to Section 26 05 00 - Common Work Results for Electrical.

1.2 DESCRIPTION

.1 This section of the specification includes the supplying, installation, connection and verification of an intelligent reporting, microprocessor controlled, addressable, fire detection system consisting of new fire alarm devices tied to the existing fire alarm control panel at the School. 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.

.2 The fire alarm system shall comply with requirements of NFPA Standard 72 and shall be ULC Listed for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

.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.

.4 Each designated zone shall have ability to transmit separate and different alarm, supervisory and trouble signal.

.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.

.6 The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

.7 The testing company shall employ technician certified and approved for fire alarm system testing & verification by Canadian Fire Alarm Association (CFAA) and the Ontario Fire Marshal as applicable.

1.3 SCOPE OF WORK

.1 A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance with the specifications and drawings and connecting to the existing fire alarm control panel at the School.

.2 The system shall be sized and wired such that each signaling line circuit (SLC) is limited to only **75% of its total capacity** at initial installation.

.3 Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 6 (CLASS B) Signaling Line Circuits (SLC).

2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

3. Notification Appliance Circuits (NAC) shall be wired CLASS B (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

4. On Style 6 or 7 (CLASS B) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

5. 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.

.4 Basic Systems 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:

a. The System Alarm LED shall flash.
b. A local piezo electric signal in the control panel shall sound.
c. The 2-line 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.
d. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
e. 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 SUBMITTALS

.1 General:

1. One (1) electronic copy of all submittals shall be submitted to the Consultant for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

.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.

.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.

.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 on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

.5 Certifications:

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.

1.5 WARRANTY:

.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 at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.6 APPROVALS:

.1 The system shall have proper listing and/or approval from the following nationally recognized agencies:

ULC Underwriters Laboratories Canada

.2 The Fire Alarm Control Panel and all transponders shall meet the modular listing requirements of Underwriters Laboratories, Inc. Each subassembly, including all printed circuits, shall include the appropriate UL 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

.1 All equipment and components shall be new, and the manufacturer's (Notifier'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 signaling (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 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.

.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:

.1 Conduit:

1. Conduit shall be in accordance with Ontario Electrical Safety Code (OESC 2015), local and provincial requirements.
2. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable 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 signaling 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 backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 1/2 inch (16 mm) minimum.

.2 Wiring

1. All fire alarm system wiring must be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., OESC 2009) 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 16 AWG (1.02 mm) for initiating device circuits and signaling 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 signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in OBC & Fire Code.
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.

.3 Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be ULC listed for their intended purpose.

.4 Initiating circuits shall be arranged to serve like categories (manual, smoke). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

.5 The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 15 amperes. This circuit shall be labeled 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:

1. The existing Fire Alar, Control Panel of NOTIFIER Model NFS-640 is existing and shall remain. Connect all new signaling and initiating devices to the existing Fire Alarm Control Panel. Expand and upgrade the existing panel as necessary to support the new fire alarm devices, zones, functionality and any other enhancement required to achieve the desired intent.

2. The Bidding Fire Alarm Manufacturer/Supplier shall site verify the existing Fire Alarm Control Panel on site prior to bidding and ensure that all material and labour required to complete the project is accounted for in the submitted bid price.

3. All new fire alarm devices shall be compatible with the existing Fire Alarm Control Panel at the School.

2.4 SYSTEM COMPONENTS-SIGNAL DEVICES:

.1 All audible and visual signal devices shall be UL listed and labeled as such.

.2 In finished areas, the horn/speakers and strobe signal devices shall be installed in recessed backbox where feasible. Where recessing of backboxes is not feasible provide surface mounted red finish backbox with no knockouts.

.3 In finished areas, audible signal device shall consist of horn/cone speaker with sound output of 90dBA 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 flashing tube under lexan lens with “FIRE” marking. Devices shall be System Sensor #SPRVA (Speaker) & SPSRVA (Speaker Strobe). Ensure synchronization compatibility with control panel. Provide wall mount backbox skirt #SPBBS.

.4 In Utility Rooms such as Mechanical Rooms etc. units shall be heavy duty construction consisting of sealed high compression driver with high dB output upto 90dBA @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. Devices shall be System Sensor #SPRVA (Speaker) & SPSRVA (Speaker Strobe). Ensure synchronization compatibility with control panel. Provide wall mount backbox skirt #SPBBS.

.5 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

.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 Analog and Addressable, and shall connect to the fire alarm control panel's Signaling 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 UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
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:
    a. Sounder base rated at 85 DBA minimum.
    b. Form-C Relay base rated 30VDC, 2.0A
    c. 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 Addressable Manual Fire Alarm Box (manual 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.

.3 Reserved.

.4 Intelligent Photoelectric Smoke Detector

1. The detectors shall use the dual-chamber photoelectric principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

.5 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 signaling line circuit.

.6 Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent photoelectric detector, of that provides continuous analog 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.

.7 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 SLCs.
2. The IDC zone shall be suitable for Style D or Style B 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 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

.8 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.

.9 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 may be wired for Style Z or Style Y (Class A/B) 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 UL 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.

.10 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.

.11 Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC 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 SLC. 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.

.12 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. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.

2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. An optional version shall allow the EIA-485 circuit to be transmitted over Fiber optics. The repeater shall be UL864 approved.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" 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 EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

8. Provide colored passive graphics showing each zone in different color and labels with zone description. All stairs shall be colored yellow. “YOU ARE HERE” wording shall be red in color. Minimum of six (6) colors shall be used.

2.6 BATTERIES AND EXTERNAL CHARGER:

.1 Battery:

1. Shall be 12 volt, Gell-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.
4. Upgrade and/or replace the existing batteries to increase the capacity to support the additional load incurred as part of this project for a 24-hour continuous runtime of the fire alarm system upon power loss.

.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 120/240-volt 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.

PART 3 - EXECUTION

3.1. INSTALLATION:

.1 Installation shall be in accordance with the OESC (Ontario Electrical Safety Code), OBC (Ontario Building Code), CAN/ULC-S524 and local codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

.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 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.

.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 42 inches, nor more than 47 inches above the finished floor.

3.2 TYPICAL OPERATION:

.1 Actuation of any manual station, smoke detector or heat detector shall cause the following operations to occur unless otherwise specified:

1. Activate all programmed speaker circuits.
2. Actuate all strobe units until the panel is reset.
3. Light the associated indicators corresponding to active speaker circuits.
4. Release all magnetic door holders to doors to adjacent zones on the floor from that the alarm was initiated.
5. Duct type smoke detectors shall, in addition to the above functions shut down the ventilation system or close associated control dampers as appropriate.

3.3 TEST:

.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. Verification shall be done by CFAA certified technician(s) and in accordance with CAN/ULC-S537 standards and local authorities requirements.

.2 Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

.3 Open initiating device circuits and verify that the trouble signal actuates.

.4 Open signaling line circuits and verify that the trouble signal actuates.

.5 Open and short notification appliance circuits and verify that trouble signal actuates.

.6 Ground initiating device circuits and verify response of trouble signals.

.7 Ground signaling line circuits and verify response of trouble signals.

.8 Ground notification appliance circuits and verify response of trouble signals.

.9 Check presence and audibility of tone at all alarm notification devices.

.10 Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.

.11 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.

.12 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.

.13 Include for audibility levels testing and plotting readings on complete floor plan for records and local authorities requirements. Include for tap adjustment as required to achieve optimum code required audibility.

3.4 FINAL INSPECTION:

.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.

.2 Consultant will apply and obtain building permit on school board’s behalf. The successful contractor shall be responsible for arranging final inspection by building and fire department at the end of project and include for all time, material & services required to obtain final approval from authorities having final jurisdiction.

3.5 INSTRUCTIONS:

.1 Provide instructions 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.

.2 The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.6 CAN/ULC-S1001 INTEGRATED SYSTEMS TESTING

1. The Owner, through the allocated Cash Allowance in the Project, will be retaining a ULC-certified Integrated Testing Provider to provide integrated systems testing for the new Addition.

2. The Electrical Contractor and Fire Alarm Technicians utilized for the new fire alarm install shall include for all materials and labour, in the base tender price, necessary to conduct the Integrated Systems Testing in accordance with the Integrated Testing Provider's protocol. Demonstrate and test all systems as required. Re-demonstrate and test all systems until all systems pass the requirements of the Integrated Testing Provider and Building Department.

3. The Systems to be included in the Integrated Systems Testing include, but are not limited to the following:

   a. Air Handling Unit Shut-Down.
   b. Sprinkler flow and supervisory devices.
   c. Hold-Open Devices

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Excavation and Fill	Section 31 23 00
.2	Sub-Drainage	Section 33 46 00
.3	Building mechanical work	Divisions 22, 23

1.2 GENERAL

.1 Comply with Division 01, General Requirements, and all documents referred to therein.

.2 All construction to be carried out in accordance with the most current design criteria, standards and specifications of the Municipality, the Region, and OPSD/OPSS.

1.3 SCOPE OF WORK

.1 The work covered by this specification includes the supply of all labour, materials, consumables and equipment for:

.1 Installation and maintenance of sediment and erosion control measures as specified on the Contract Drawings.

.2 Excavating and backfilling of trenches for pipes, conduits and appurtenances. The work includes; but is not limited to the following; sheet piling, sheathing, shoring and bracing, installation and operation of all equipment required for de-watering excavations and control of ground and surface water; protection and supporting of existing structures and utilities; removal of all debris and surplus material; compaction of the backfill, rough grading and restoration of surfaces; maintenance of existing travel on streets and roads and access to private and public property and each and everything required to complete the work as specified. Comply with safety requirements of the Federal and Provincial Governments and of the local municipal authority.

.3 The installation of sewers, fittings, drain connections, manholes, frame and covers, necessary for the complete construction, testing and flushing of the sewer systems to 1.5 metres beyond the outside face of building walls as specified in the specification and/or on the Contract Drawings.

.4 The installation of the infiltration feature. The work includes the preparation of the base for the infiltration gallery, supply and placement of the geotextile, storage media and piping. It also includes, but is not limited to excavation, sheet piling, shoring and bracing, as well as all de-watering and control of groundwater associated with the installation.

.5 The installation of sub-drain connections to the catchbasins, as specified in the specifications and/or the Contract Drawings.

.6 The installation of watermains, fittings, valves, service connections, cathodic protection, tracer wire and any other appurtenances necessary for the complete

construction, testing, chlorination and flushing of the water distribution system as specified in the specifications and/or on the Contract Drawings.

.2 The Contractor shall arrange and pay for all necessary permits, fees, inspections and complete restoration whether on site or on any other property affected by the work.

1.4 **DEFINITIONS**

.1 For excavation work, only two classes of excavation shall be considered, namely earth excavation and rock excavation.

.2 Earth excavation under this contract shall comprise deposits of whatever nature, including shale that does not come under the classification of rock. For the purpose of this Contract, earth excavation shall include both surface and buried boulders regardless of size. All boulders shall be removed and disposed of offsite at no extra cost.

.3 Rock excavation shall be defined as material, which cannot be reasonably removed with a conventional trenching backhoe outfitted with either a Vee bucket or Tiger Teeth. Blasting shall not be permitted without written authorization from the Consultant.

1.5 **PROTECTION**

.1 All existing utilities shown on the drawings are for reference purposes only. The Contractor shall be responsible for the field stakeout of all existing utilities on-site and off-site and shall be responsible for adequately protecting all existing utilities and services within the construction area. Furthermore, any damage to the existing utilities by the Contractor, or the activities of his subcontractors or suppliers shall be repaired at the expense of the Contractor. The Contractor shall be responsible to expose all existing stubs, services, and utilities prior to commencement of construction and to verify all existing inverts, depths, etc. to verify no conflicts exist. If a conflict exists, it shall be reported to the Consultant immediately. Work shall not proceed until the conflict is resolved.

.2 The Contractor shall record location of maintained, re-routed and abandoned underground lines.

1.6 **UTILITY SERVICES**

.1 The Contractor shall ensure that all existing hydrants, valve boxes, curb stop boxes, fire or police call boxes, or any other utility controls remain unobstructed and accessible during the construction of the work.

.2 The Contractor shall not operate any valve, switch, or other control in any existing utility services without the written approval of the Consultant and the utility concerned. All consumers affected by such operation shall be notified in writing by the Contractor a minimum of 48 hours before the operation and shall be advised of the probable time when service will be restored.

.3 The Contractor shall pay all claims, damages, and all required rectification caused by his failure to comply with items .1 and .2 of this subsection.

1.7 **BARRIER AND LIGHTS**

.1 The Contractor shall, at his own expense, supply, erect and maintain all required barriers, fences, lights, signage, etc., as may be necessary, or as ordered by the Consultant, to ensure safety to the Public and to those engaged in any activities around and about the work.

1.8 DELIVERY OF GEOTEXTILES

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

1.9 NOTIFICATION OF AGENCIES

.1 The Contractor shall be responsible for fully complying with the requirements of all official and other agencies governing all or any part of the work under this Contract. These requirements may affect methods of installation and construction methods and may include written notification of the appropriate authority prior to commencement of the Contract. Where a written notification of the above authorities is required, a copy of the said notification shall be submitted to the Architect. Work commencement notices required by the Municipality or Region shall be submitted at minimum 48 hours prior to the start of the work.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fill materials shall conform to the requirements of Section 31 23 00, Excavation and Fill, and these specifications. The Contractor shall advise the Consultant of the supplier(s) of the bedding aggregates prior to commencement of construction so that adequate samples can be obtained for grain size distribution testing.

.2 All granular materials shall conform to the requirements of OPSS form 1010.

.3 All storm sewer pipe bedding shall be in accordance with OPSD 802.01 to 802.03. All sanitary sewer bedding type and material to be in accordance with local standards.

.4 Storm sewer pipe 375mm diameter or smaller shall be polyvinyl chloride (PVC) pipe conforming to CSA B182.2 and B182.3 with a minimum Class of SDR 35, or latest amendment with rubber ring bell joints conforming to CSA 182.2 and installation as per CSA 182.11 or ribbed polyvinyl chloride (PVC) pipe conforming to CSA B182.4. Storm sewer pipe 450mmand larger shall be reinforced concrete pipe conforming to CSA specification A 257.2 for class 65-D or as noted on Drawings.

.5 All polyvinyl chloride (PVC) sanitary sewers shall conform to CSA specification B182.2 for class SDR35 or latest amendment with rubber ring bell joints conforming to ASTMS 1869.

.6 All polyvinyl chloride (PVC) watermains shall meet AWWA C900 specification for Class 150 minimum and conform to CSAB 137.3. Wall thickness to conform to cast iron (CI) outside diameter (OD). Pipes to have integral wall-thickened bell ends. Joining to be accomplished by using rubber rings conforming to ASTM D.3139.

.7 Watermain bedding to be Granular bedding in accordance with Region Standards. Compacted granular material shall be Granular A. Cover material shall be Granular B, Type II.

.8 All Storm manholes shall be supplied in accordance with the Municipality and OPSD standards.

.1 Precast manholes shall conform to meet M.O.E.C.C. specifications and conform to OPSD 701.01 to 701.04.

.2 Ladder rungs shall be solid rectangular aluminum as shown in OPSD 406.010.

.3 Manhole covers shall be Type B as shown in OPSD 401.010.

.4 Safety Grates are to be provided for manholes whose depth exceeds 5m.

.9 All sanitary manholes shall be supplied in accordance with the Region.

.1 Precast manholes shall conform to meet M.O.E.C.C. specifications and Region standards.

.2 Manhole steps shall be solid rectangular aluminum as shown in OPSD 405.020.

.3 Manhole covers shall be Type A as shown in OPSD 401.010.

.4 Safety Grates are to be provided for manholes greater than 5m deep, in accordance with Provincial regulations.

.10 All catchbasins shall be supplied in accordance with OPSD 705.010 with frames and grates as per OPSD 400.020.

.11 All catchbasin manholes to have frames and grates as per OPSD 400.020.

.12 Ditch inlet catchbasins shall be as per OPSD 705.030 and 403.010.

.13 Geotextile:

.1 To be Terrafix 270R or approved equal.

.14 Tracer wire shall be 12 gauge stranded copper CSA Type T.W.U.

.15 Hydrants:

.1 To be Darling Century with Storz Pumper connection, Clow's Brigadier M67 (Standard Style), and to be in accordance with Municipal and Regional standards. Breakaway flange set 0.05 to 0.15 m above finished grade, unless otherwise specified. Mechanical joint inlet connection.

.2 Hydrants must have:

Two 63.5mm dia. Hose nozzles at 180deg to each other.
114mm I.D., 146mm O.D. with four threads per 25mm, pumper nozzle, at 90deg to hose nozzles
Operating nut to open left (counter clockwise).
Hose nozzles and operating nut threads in accordance with the Province of Ontario Standard.
Base (Boot) with 150 mm mechanical connection end.

.16 Valves:

.1 Gate valves to be iron body, bronze mounted, double-disc type, double faced and sealed, and non-rising stem, conforming to AWWA C509.

.2 Valve ends to be mechanical joint B AWWA C111 (ANSI A21.11).

.3 Direction of opening-counter-clockwise unless otherwise specified.

.4 Operating nut to be 50 mm unless otherwise specified.

.5 Valves to be supplied in accordance with Region's standards.

.17 Valve Boxes:

.1 To be either Mueller A769 with guide plate; or Clow-Bibby VB 1100/Rb645

.18 Fittings:

.1 Ductile iron fittings to conform to AWWA C110 (ANSI A21.10) with 1724 kPa pressure rating. PVC fittings to conform to AWWA C900, C907, CSA B137.3.

.2 Joints to conform to AWWA with ductile iron pipe electrical conductivity must be provided.

.3 Where fittings are used with ductile iron pipe electrical conductivity must be provided.

.19 The following criteria shall be met for backfill material:

.1 In landscaped areas, native material can be used for backfilling excavations and trenches up to the specified sub-grade provided the native material is deemed acceptable by the Geotechnical Consultant.

.2 In areas where paving and walks occur, fill trenches to subgrade with Type F2 fill, Granular B, Type 1, as specified in Section 31 23 00, Excavation and Fill.

.3 Backfill material shall be free of topsoil, organic material and other debris.

.4 Stones and boulders exceeding 300 mm shall not be permitted as backfill. No stones exceeding 50 mm shall be permitted within 300 mm of a pipe structure.

.5 Backfilling the trenches with fragmented rock material will only be permitted if authorized by the Geotechnical Consultant.

.6 No frozen material shall be utilized as backfill material unless authorized by the Geotechnical Consultant.

.20 All materials shall meet the specifications of the Contract.

.21 All materials shall be furnished by the Contractor and shall be delivered and distributed at the site by the Contractor.

.22 All materials shall be handled at all times with care and diligence so as not to inflict damage to the material, which may adversely affect its performance.

.23 Any damaged materials must be replaced or repaired by the Contractor at his expense as ordered by the Consultant.

.24 Concrete shall conform with MTO Form 904 except modified as follows:

.1 Unless otherwise specified, all concrete shall have a minimum compressive strength of 25 kPa @ 28 days.

.2 All concrete shall have a maximum slump of 75 mm.

.3 A 5% air-entraining admixture shall be employed in all exterior concrete exposed to freezing and thawing.

.4 Reinforcing steel shall conform to CSA G30.12 and G30.13 and shall be Grade 60 minimum.

.25 Trench Drains

.1 Trench drains shall be ACO trench drains, system K10S complete with all necessary fittings and type 411Q/413Q perforated galvanized steel gratings. Trench drains shall be polymer concrete with cast in galvanized steel edge rails. Gratings shall be bolted in place.

.26 150mm perforated subdrains are to be installed where noted on the engineering drawings. The subdrains are to be wrapped in filter cloth. Refer to Section 33 46 00.

.27 Detector Check Valves

.1 The detector check valves shall be Watts Series SS07F Stainless Steel Single Detector Check Valves. The valves are to be installed as per Region standards.

.28 Post Indicating Valves:

.1 Supply and install where shown on the drawing, Clow McAvity Factory Mutual and Underwriters' Laboratories approved Model 6168 post indicator gate valves and Model 6225 indicator posts with supervisory switch and tamperproof cover. Clow Canada (416) 738-1818.

.2 Wiring by Division 26.

PART 3 - EXECUTION

3.1 EXCAVATION, TRENCHING AND BACKFILLING

.1 Protection of existing surface and sub-surface features shall comply with subsection 1.5 above.

.2 Stripping of topsoil shall be as outlined in specifications Section 31 10 00.

.3 Stockpile fill materials in areas designated by the prime Consultant. Protect fill materials from contamination. Remove all surplus fill off-site on completion of work.

3.2 DEWATERING

.1 Keep excavation free of water while work is in progress. Protect open excavations against flooding and damage due to surface run-off.

.2 Dispose of water in a manner not detrimental to public and/or private property, or any other portion of work completed or under construction.

.3 When necessary and if required, submit for Consultant's approval details of proposed dewatering methods, such as dikes or well points.

.4 The Contractor shall be responsible for all ground and surface water control.

3.3 EXCAVATION

.1 All excavation shall be in open cut and shall comply with the requirements of the Occupational Health and Safety Act.

.2 Should existing utilities be encountered during excavation, these utilities shall be adequately protected and/or supported by the Contractor to the satisfaction of the Consultant and/or the utility company having jurisdiction over the utility.

.3 Should in the opinion of the Consultant unsuitable subgrade material be encountered at the bottom of the trench, the Consultant shall direct the Contractor to further excavate the unsuitable material and backfill with approved material.

.4 The trench width and sewer bedding shall be constructed in accordance with the specification and/or as indicated on the Contract Drawings. Should the Contractor erroneously over-excavate the trench width, the Consultant may direct the Contractor to construct a higher class of bedding or install a stronger class of pipe, or both; at no additional expense to the Owner.

.5 Sheeting and shoring or trench box construction shall be carried out in accordance with the Occupational Health and Safety Act. The Contractor shall submit drawings to the Consultant for review prior to commencement of the sheeting and shoring. Removal of sheeting and shoring or the travel of the trench box shall be carried out such that disturbance of the pipe or bedding material does not occur. Sheeting ordered left in place by the Consultant shall be cut off at least one metre below finished grade.

.6 The sewer trenches shall only be excavated a maximum of 30 m in advance of the complete pipe laying unless authorized by the Consultant. The open portion of the trench at workday's end shall be secured off with the erection of snow fencing as directed by the Consultant.

.7 Trenches are to be backfilled and compacted to subgrade immediately following inspection of the underground service by the Consultant and the appropriate authorities. Trenches under floor slab must be backfilled with imported Granular B fill as specified in Section 31 23 00.

.8 All trenches shall be kept free and clear of water to the extent that any portion of the pipe shall not be laid in water. Disposal of the water shall be as per subsection 3.2, above. If directed by the Consultant, the Contractor shall construct sedimentation ponds to facilitate the removal of sand and silts from the trench water being disposed of.

3.4 GRANULAR BEDDING

.1 All granular bedding to be placed as per subsection 2.1, above.

.2 Compact full width of bed to at least 98% Standard Proctor Density.

3.5 INSTALLATION AND TESTING

.1 Storm and Sanitary Sewer Installation

.1 Pipes shall not be installed within 7 days of manufacture.

.2 Pipe shall be lowered into the trench excavation with slings so as not to damage the pipes.

.3 The pipes shall be laid in a down to upstream direction with the bell ends facing upstream.

.4 The pipes shall be laid and jointed in accordance with the manufacturer's specifications. Should any cutting of the pipe be required, this should also be carried out in accordance with the manufacturer's specifications.

.5 The open ends of the pipe shall be protected from foreign material entering during the course of installation.

.6 The pipes shall be constructed to the line and grade indicated on the Contract Drawings to within the following tolerance.

.1 Line - Diameter /5
.2 Grade - Diameter /10

.2 Storm and Sanitary Sewer Testing

.1 Infiltration Test

.1 Isolate the upstream end of the section to be tested with a plug or bulkhead.

.2 Place a V notch weir or other approved measuring device in the pipe at the lower end.

.3 The duration of the test shall be two hours. The actual infiltration shall be the average of at least 8 readings taken at even intervals during the test.

.2 Exfiltration Test

.1 Isolate the section to be tested by temporarily blocking the inlets of two manholes with expandable plug or bulkheads.

.2 Fill the pipe and manhole with water to a depth of 600 mm above the crown of the pipe in the upstream manhole. Do not exceed 7.5m maximum head at the downstream manhole.

.3 Allow 24 hours for absorption of water and escape of air from the line.

.4 The duration of the test shall be two hours. The actual exfiltration shall be determined by measuring the change of elevation of the water in the manhole.

.3 Air Test

.1 The test section shall be plugged at each end.

.2 All service laterals, stubs and fittings into the sewer test section shall be properly capped or plugged.

.3 Air shall be supplied to the test section slowly, until a constant pressure of 25 kPa is maintained. If the ground water is above the sewer line being tested, the air pressure shall be increased by 3.0 kPa for each 300mm the ground water level is above the inverts of the pipe.

.4 A stabilization period of a least 5 minutes shall be allowed during which time the pressure shall be regulated to prevent it from fluctuating more than 10kPa above or more than 3.5 kPa below the required pressure.

.4 Video Inspections

.1 The Contractor shall carry out T.V. camera inspections of all sewers installed under this Contract. The camera can be either pulled of self-propelled through the pipes, the equipment is to have features to enable closer examination of faults and to view up lateral connections. The equipment is to provide measured location of the camera relative to manholes in order to locate faults, laterals, etc.

.2 Two T.V. camera inspections are required; one at the start of the maintenance period and a second at assumption.

.3 Two copies of each video recording shall be made and delivered by the Contractor; one to the Site Services Consultant and one to the Owner, each accompanied by a written report with photographs of problem areas.

.3 Allowable Limits of Storm Sewer Tests

.1 Infiltration : 0.28 litres per hour per millimeter of pipe diameter per 100 metres of sewer (0.28 L/hr/mm dia/100m).

.2 Exfiltration : 0.35 litres per hour per millimeter of pipe diameter per 100 metres of sewer (0.35 L/hr/mm dia/100m).

.4 Allow able Limits of Sanitary Sewer Tests

.1 Infiltration : 0.09 litres per hour per millimeter of pipe diameter per 100 metres of sewer (0.09 L/hr/mm dia/100m).

.2 Exfiltration : 0.11 litres per hour per millimeter of pipe diameter per 100 metres of sewer (0.11 L/hr/mm dia/100m).

.3 Air Tests : The test pressure shall be 3.5 kPa less than the above-required pressure. The time required for a pressure loss of 3.5 kPa shall not be less than that shown in the following table.

Time Required for Air Testing

	Time	
Pipe Size (mm)	Min	Sec
100	2	32
150	3	50
200	5	06
250	6	22
300	7	39

.5 Watermain and Appurtenances Installation

.1 Watermains shall be laid to the line and grade specified on the Contract Drawings. Deviation from this line and grade shall not be more than 75 mm. Watermain depth to top of pipe from finished grade shall be a minimum 1.8 metres unless otherwise specified on the Contract Drawings.

.2 Pipe Installation

.1 Pipe lengths shall be laid and jointed in accordance with the manufacturer's instruction and without damage to the pipes. Pipe joints may be deflected to provide for a long radius curve provided this is carried out to within the manufacturer's specifications.

.2 Mechanical joint nuts shall be tightened in alternating 180 degree positions with a torque wrench to the manufacturer's specifications.

.3 Valve Installation

.1 Valves shall be installed at the locations shown on the Contract Drawings with the stems vertical and plumb and in accordance with Municipality and Region's Standards

.2 All valves to open in a counter-clockwise direction.

.4 Valve Box Installation

.1 Valve boxes shall be installed at the locations shown on the Contract Drawings and shall be centred and plumb overtop the valve operating nut with the top set to finished grade level.

.5 Hydrant Installation

.1 Hydrants shall be installed at the locations shown on the Contract Drawings and in accordance with Municipality and Region's standards.

.2 Hydrants shall be connected to the main with a 150 mm ductile iron branch tee controlled by an independent gate valve. The hydrant 'boot' shall be installed against undisturbed soil with concrete anchorage.

.3 The hydrant valve box shall be centered and plumb over the gate valve and set to its finished grade level.

.6 Thrust Anchorage

.1 All bends, fittings, tees, hydrants subject to movement due to pressure thrust shall be anchored with mechanical restrainers in accordance with municipal and regional standards.

.7 Connections to Existing Watermains

.1 Obtain permission from the operating authority before making any connections to an existing watermain.

.2 Valves on existing watermains shall not be operated by the Contractor unless approved by the Consultant and the Operating Authority.

.3 All affected water users shall be notified in writing at least 48 hours in advance of any planned interruption of service.

.4 Swab fittings and pipes placed into the existing line with a solution of chlorine having a minimum strength of 50 ppm.

.5 Take precautions to prevent contamination of the existing system and follow all instruction of the Operating Authority.

.8 Plug and Blow-offs

.1 Temporary plug and blow-offs shall be constructed as required for the purposes of hydrostatic testing, and chlorination and flushing.

.9 Tracer Wire

.1 Tracer wire shall be taped to the watermains with fiberglass tape every 3m (Min.).

.10 Cathodic Protection

Zinc anodes shall be affixed to all ferrous watermain fittings and tracer wire.

.1 Watermain Testing:

.1 The Municipality or and Region must be notified at least 48 hours in advance of any pressure and leakage testing, chlorination or flushing which must be carried out in accordance with OPSS 701.

.2 Samples for bacteriological testing will be collected by the Municipality for submission to the Ministry of Health and Long Term Care. The system will not be put into operation until directed by the Municipality that clearance from the Ministry of Health and Long Term Care has been received.

.2 Hydrostatic Testing:

.1 After the pipe has been laid and backfilled, all newly laid pipe or valve sections shall be subject to a hydro static pressure test. The pressure test shall be of 1035 kPa and shall last at least two hours in duration.

.2 Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Consultant.

.3 The pump, pipe connection and all necessary apparatus including gauges shall be furnished by the Contractor. The Contractor will furnish the gauge for the test and will make all taps into the pipe and the Contractor shall furnish all labour and material for conducting tests. All testing shall be performed in the presence of the Consultant and if required, the municipal operating authority.

.4 Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants or blow-offs are not available at high points, the Contractor shall make the necessary taps at his expense at points of highest elevation before the test is made and insert the plugs after the test has been completed.

.5 All exposed pipes, fittings, valves, hydrants and joints will be carefully examined. Any cracked or defective pipe fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the Consultant.

.6 A leakage test shall be conducted after the pressure test has been satisfactorily completed. The Contractor will furnish the pump, pipe, connections and all labour and material to conduct the test.

.7 No pipe installation will be accepted until the leakage is less than 222 litres per 100 mm diameter per kilometre per 24 hours based on a 1035 kPa pressure.

.8 Should any test of watermain laid disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

.9 All testing of the watermains and fitting such as hydrostatic pressure test, chlorination, flushing required, requested or performed by the Municipality or Consultant will be the responsibility of the Contractor. All costs associated with the testing will be borne by the Contractor.

.3 Chlorination:

.1 When the Contractor has completed the installation of the watermain and has carried out satisfactorily the specified pressure and leakage test thereon, he shall thoroughly flush the whole system so as to remove completely from the system all unwanted matter.

.2 When required flushing has been completed satisfactorily, the Contractor shall proceed with disinfections of the system in accordance with AWWA Standards for disinfecting watermains per C601-68.

.3 Water from the existing distribution system or other approved sources of supply shall be permitted to flow at a constant measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 ppm available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals.

.4 During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing into existing mains. Application shall not cease until the entire main is filled with the chlorine solution.

.5 The chlorinated water shall be retained in the main for at least 24 hours during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hour period the treated water shall contain no less than 25 ppm chlorine through the length of the main.

.6 After the chlorination has been completed, the system shall be flushed out completely and recharged with water normal to the operation of the system or part of the system concerned.

.7 The Contractor shall provide for the safe disposal of all chlorinated water used for testing, flushing, or disinfections. The Contractor shall note that acceptable chlorine residual of water discharge to storm sewers or watercourses shall not be greater than 0.5 mg/L. Methods employed for disposal of all chlorinated water shall be approved by the Consultant.

.8 After the system has been recharged, it shall not be put into operation until samples have been taken by the Consultant and have been seen by an approved laboratory for testing, test results have been obtained and clearances have been given by the health authority having jurisdiction.

.9 The Contractor shall supply sufficient chlorine or suitable chlorine compounds such as sodium hypochlorite or calcium hypochlorite to produce a strength of not less than 50ppm at all points in the pipeline.

3.6 INSTALLATION OF MANHOLES AND CATCHBASINS

.1 Manholes

.1 Manholes shall be installed at the locations shown on the Contract Drawings.

.2 Manholes shall be equipped with safety gratings as specified on the Contract Drawings.

.3 Each pipe entering a manhole shall be cut flush to the inside face of the manhole wall and be grouted into the manhole wall.

.4 Each pipe entering a manhole shall have a pipe joint within one metre of the outside wall of the manhole.

.5 Manhole benching is to be a minimum of 230 mm wide. Manhole chamber openings are to be located on the upstream side of the manhole.

.6 Manhole frames and grates not located in an asphalt area shall be set at finished grade.

.2 Catchbasins

.1 Catchbasins and leads shall be installed at the locations shown on the Contract Drawings.

.2 Catchbasin leads shall be cut flush with the inside face of the catchbasin wall and be grouted into the catchbasin wall.

.3 Catchbasin leads shall be bedded to undisturbed ground with compacted granular bedding.

.4 The top of the catchbasin concrete shall be set at the elevation of the pavement subgrade (if applicable). Unless otherwise specified, precast adjusting rings shall be utilized in adjusting the catchbasin frame and grate to the desired interim or final elevation.

3.7 FILL TYPES AND COMPACTION

.1 Backfill and compaction shall be in conformance with the requirements of Section 31 23 00, Excavation and Fill, and as indicated below.

.2 In areas where paving and walks occur, fill trench to subgrade with Type F2 fill, Granular B, Type 1, and compact in accordance with Section 31 23 00.

.3 In areas where paving and walks do not occur, fill trench to subgrade with selected material from on-site excavation or other sources.

.4 Compaction

.1 Compact bedding to minimum 98% Standard Proctor Maximum Dry Density.

.2 Compact backfill where paving and walks occur to 100% Standard Proctor Maximum Dry Density in top 500mm below subbase/base materials and to minimum 98% Standard Proctor density below that level. This includes the areas immediately adjacent to paved areas.

.3 Compact backfill under sports field to 98% SPMDD.

.4 In other areas compact backfill to minimum 95% SPMDD.

3.1 BACKFILLING AND SEWER PIPE

.1 Backfill placed against pipes should be done so in a manner as not to permit any damage or movement.

.2 Backfill material shall be placed in 300mm lifts in a manner so as not to damage the pipe structures. These lifts shall be individually compacted as specified.

.3 No main line sewer stubs or building connection laterals shall be backfilled until as-built elevations and locations have been taken.

.4 Any settlement that occurs after backfilling shall be repaired without compensation.

3.2 BACKFILLING AROUND CATCHBASINS AND MANHOLES

.1 Catchbasins and manholes shall be backfilled with Granular B, Type 1.

.2 Use a sand backfill in confined areas, where compaction is difficult.

3.3 INSTALLATION OF INFILTRATION GALLERY

.1 The Contractor shall excavate the Infiltration Gallery to line and grade as shown on the Construction Drawings.

.2 A 50mm layer of coarse sand shall be placed over the area of the Infiltration Gallery.

.3 The geotextile material shall be laid over the sand layer, as follows:

.1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated on the construction drawings

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.3 Overlap each successive strip of geotextile 500 mm over previously laid strip.

.4 Pin successive strips of geotextile with securing pins at 500 mm interval at mid-point of lap.

.5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.6 Replace damaged or deteriorated geotextile to approval of Consultant.

.4 Place stone storage media over geotextile. Fold over the sides of the infiltration gallery wrap and overlap as per subsection .3.3.

.5 Place and compact soil layers in accordance with Section 31 23 10 Excavating Trenching and Backfilling.

3.4 **PROVISIONAL ITEMS**

.1 Do not proceed with any additional work unless written authorization is obtained from the Consultant.

3.5 MEASUREMENT AND PAYMENT

.1 This is a stipulated price contract. The stipulated price shall be compensation in full for the supply of all labour, materials, consumables and equipment necessary to carry out construction of the sewers, watermains, subdrains, and appurtenances including trench excavation, subgrade preparation, control of ground and surface water, bedding, pipe, fittings, valves, valve boxes, valve chambers, hydrant, blow-offs, trench excavation, connection(s) to existing main(s), protection of any existing utilities, construction and maintenance of all siltation controls, preparation of subgrade, bedding, thrust blocking, tracer wire, cathodic protection, backfilling, compaction, cleaning, flushing, testing, video inspection, chlorination, benching, precast adjusting rings, safety grates, frames and grates and all other works necessary to install the site services as specified. Operation or testing of existing watermains performed by the Municipality or others.

.2 The depth of the excavation shall be sufficient to allow for the necessary depth of bedding below pipe. Any erroneous over-excavation by the Contractor shall be backfilled with acceptable bedding material at no additional expense to the Owner.

.3 Any additional sub-excavation ordered by the Consultant due to poor soil conditions encountered will be excavated and backfilled with additional granular backfill. Measurement shall be made on a per tonne basis.

.4 Rock excavation shall be measured on a cubic metre volume basis. The contract price tendered (as a contingency item) for rock excavation shall be compensation in full for the supply of all labour, materials, consumables or equipment necessary to carry out the rock excavation including disposal off site.

End of Section