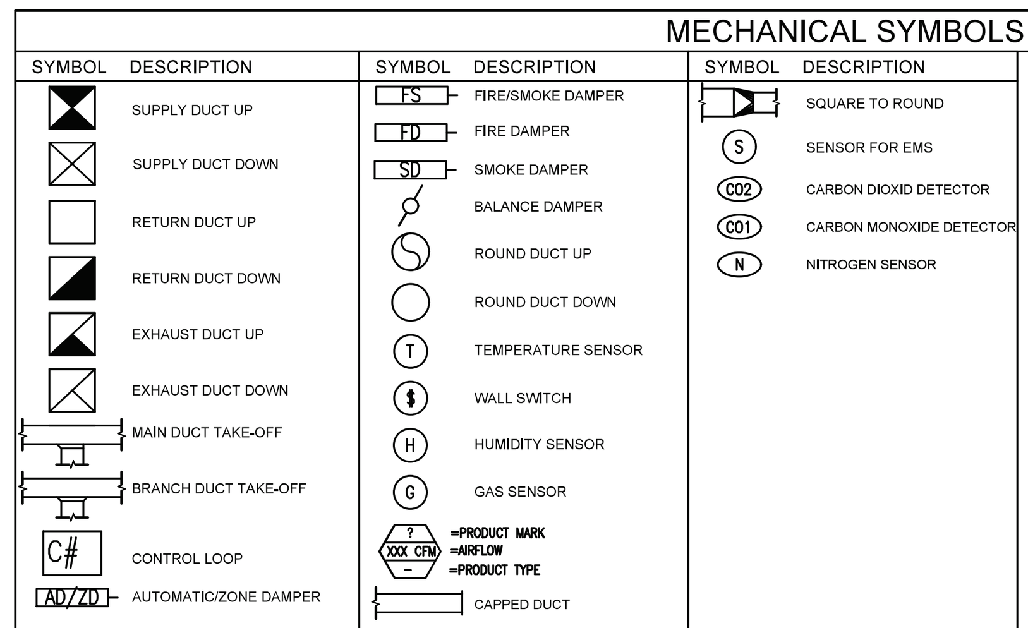
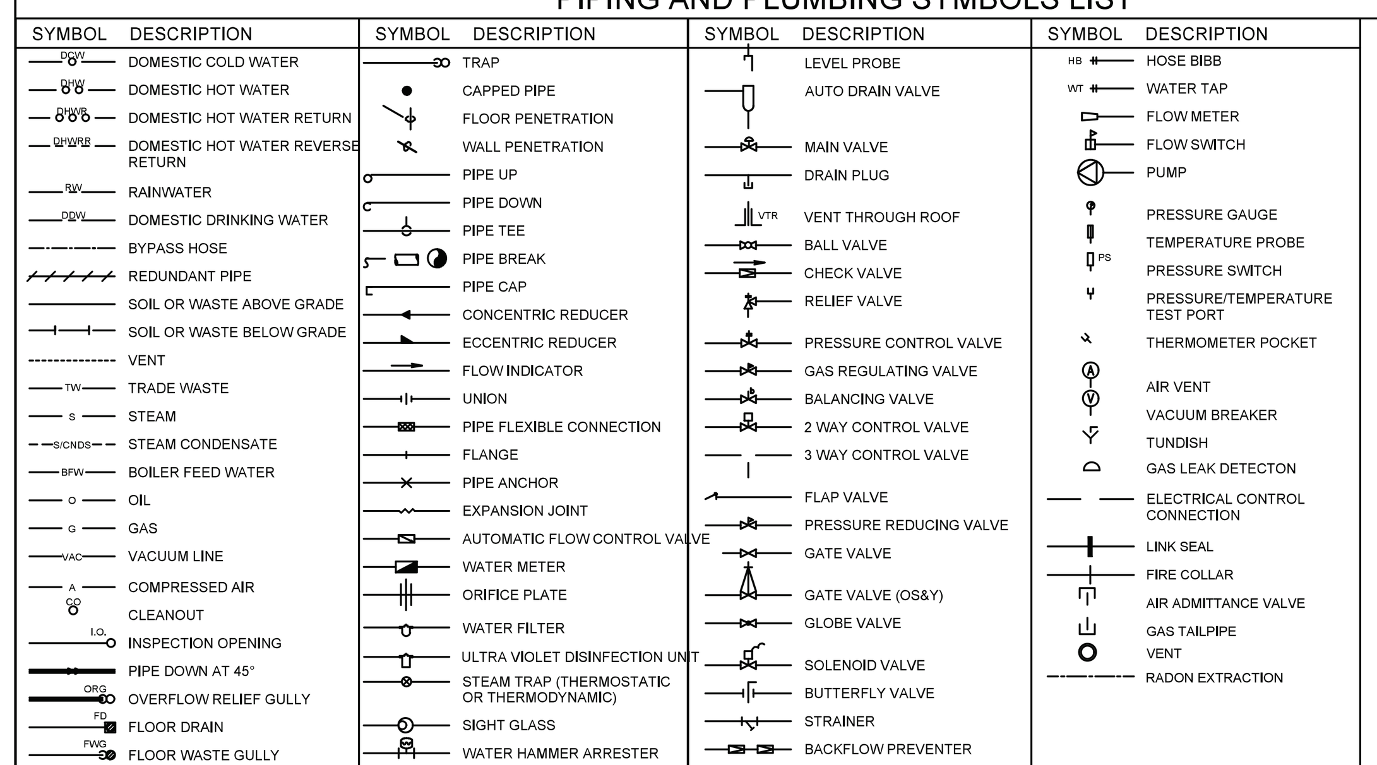
MECHANICAL SYMBOLS



PIPING AND PLUMBING SYMBOLS LIST



GENERAL ABBREVIATIONS

ACT	ACOUSTICAL CEILING	EXIST	EXISTING	RCP	REFLECTED CEILING PLAN
(V.)	FIELD VERIFY	EXP	EXPLOSION	REF	REFERENCE
AD	ACCESS DOOR	FF	FINISHED FLOOR	REQD	REQUIRED
ADJ	ADJACENT	FL	FLOOR	RM	ROOM
ADJ	ADJUSTABLE	FTG	FOOTING	SHT	SHEET
AFF	ABOVE FINISHED FLOOR	FV	FIELD VERIFY	SPECS	SPECIFICATIONS
AP	ACCESS PANEL	GC	GENERAL CONTRACTOR	SQ	SQUARE
APPROX	APPROXIMATE	HCP	HANDICAPPED	STD	STANDARD
ARCH	ARCHITECT	HORZ	HORIZONTAL	STRUC	STRUCTURAL
AUTO	AUTOMATIC	ID	INSIDE DIMENSIONS	TEMP	TEMPORARY
B/G	BELOW GRADE	JST	JOIST	TEMP	TEMPERATURE
BLDG	BUILDING	LOC	LOCATION	TYP	TYPICAL
BSMT	BASEMENT	MAG	MAGNETIC	UG	UNDERGROUND
CFCI	CONTR. FURNISHED/INSTALLED	MAX	MAXIMUM	UNO	UNLESS NOTED OTHERWISE
CL	CENTER LINE	MC	MECHANICAL CONTRACTOR	VCT	VINYL COMPOSITE TILE
CONN	CONNECTION	MECH	MECHANICAL	VEST	VESTIBULE
CONT	CONTINUATION	MEZZ	MEZZANINE	VIB	VIBRATION
CONTR	CONTRACTOR	MFR	MANUFACTURER	W/	WITH
DET	DETAIL	MIN	MINIMUM	W/O	WITHOUT
DIA	DIAMETER	MTD	MOUNTED		
DN	DOWN	NIC	NOT IN CONTACT		
DTL	DETAIL	NO	NUMBER		
DWG	DRAWING	NTS	NOT TO SCALE		
EA	EACH	OC	ON CENTER		
ELEC	ELECTRICAL	OD	OUTSIDE DIMENSION		
ELEV	ELEVATION	OFCI	OWNER FURNISHED CONT. INSTAL		
ELEV	ELEVATOR	OPG	OPENING		
EQUIP	EQUIPMENT	PT	POINT		

MECHANICAL ABBREVIATIONS

AFMS	AIR FLOW MEASURING STATION	FP	FIRE PROTECTION	PLBG	PLUMBING
BD	BALANCE DAMPER	FV	FACE VELOCITY	POS	POSITIVE
BO	BLOW OFF	GA	GAUGE	PRESS	PRESSURE
BWV	BACKWATER VALVE	GRD	GROUND	PVC	POLY VINYL CHLORIDE
CLG	COOLING	HD	HEAD	RA	RETURN AIR
CO	CLEAN OUT	HOA	HANDS-OFF-AUTOMATIC	RECIRC	RECIRCULATING
COND	CONDENSATE	HTG	HEATING	RET	RETURN
DISCH	DISCHARGE	HTR	HEATER	RFG	REFRIGERATION
DMPR	DAMPER	HVAC	HEATING,VENTILATING, AIR CONDITIONING	RH	RELATIVE HUMIDITY
DOAP	DEDICATED OUTSIDE AIR PATH	HYD	HYDRANT	SA	SUPPLY AIR
DR	DRAIN	INSUL	INSULATION	SP	STATIC PRESSURE
DS	DOWNSPOUT	INV	INVERT	STM	STEAM
DSN	DOWNSPOUT NOZZLE	ISO	ISOLATION	TA	TRANSFER AIR
EA	EXHAUST AIR	LAT	LEAVING AIR TEMPERATURE	TCC	TEMPERATURE CONTROLS CONTRACTOR
EAT	ENTERING AIR TEMPRATURE	LDB	LEAVING DRY BULB	TD	TEMPERATURE DIFFERENCE
EDB	ENTERING DRY BULB	LP	LOW PRESSURE	TDH	TOTAL DISCHARGE HEAD
EFF	EFFICIENCY	LPG	LIQUID PETROLEUM - PROPANE	TDL	TOTAL DEVELOPED LENGTH
EWB	ENTERING WET BULB	LWB	LEAVING WET BULB	V	VENT
EWT	ENTERING WATER TEMPERATURE	LWT	LEAVING WATER TEMPERATURE	VD	VOLUME DAMPER
EXH	EXHAUST	MAT	MIXED AIR TEMPERATURE	VEL	VELOCITY
EXP	EXPANSION	NC	NOISE CRITERIA	VSD	VARIABLE SPEED DRIVE
F&T	FLOAT & THERMOSTATIC	NEG	NEGATIVE	VOL	VOLUME
FD	FIRE DAMPER	OA	OUTSIDE AIR	E/A	EXCHANGE AIR
FDC	FIRE DEPARTMENT CONNECTION	OBD	OPPOSED BLADE DAMPER	T/A	TRANSFER AIR
FHC	FIRE HOSE CABINET	ORD	OVERFLOW ROOF DRAIN	S/A	SUPPLY AIR
FHR	FIRE HOSE RACK	PBD	PARALLEL BLADE DAMPER		
FLEX	FLEXIBLE	PC	PLUMBING CONTRACTOR		
FM	FIRE MAIN	PG	PROPYLENE GLYCOL		

MECH. EQUIP. ABBREVIATIONS

AHU-#	AIR HANDLING UNIT
B-#	BOILER
CH-#	CHILLER
CONV-#	CONVECTOR
CT-#	COOLING TOWER
CU-#	CONDENSING UNITS
CD-#	CONTROL DAMPER
CP-#	CONDENSATE PUMP
DC-#	DUCT COIL
EX-#	EXHAUST FAN
E-#	EXHAUST DIFFUSER/GRILLE
FCU-#	FAN COIL UNIT
FLC-#	FLUID COOLER
FTR-#	FIN TUBE RADIATION
GRV-#	GRAVITY ROOF VENTILATOR
HU-#	HUMIDIFIERS
HX-#	HEAT EXCHANGER
IR-#	INFRARED HEATER
IV-#	INTAKE HOOD
MAU-#	MAKE-UP AIR UNIT
P-#	PUMPS
PRV-#	POWER ROOF VENTILATOR
RF-#	RETURN FAN
R-#	RETURN DIFFUSER OR GRILLE
RTU-#	ROOF TOP UNIT
RV-#	RELIEF HOOD
SA-#	SOUND ATTENUATOR
S-#	SUPPLY DIFFUSER OR GRILLE
T-#	TRANSFER DIFFUSER OR GRILLE
TF-#	TRANSFER FAN
UH-#	UNIT HEATER
VAV-#	VARIABLE AIR VOLUME UNIT
WH-#	WATER HEATERS
WS-#	WATER SOFTENER

BLDG. AUTOMATION SYST. ABBREV.

BAS	BUILDING AUTOMATION SYSTEM
DP	DIFFERENTIAL PRESSURE
EMS	ENERGY MANAGEMENT SYSTEM
EP	ELECTRIC-PNEUMATIC
NC	NORMALLY CLOSED
PE	PNEUMATIC-ELECTRIC
PI	PRESSURE INDICATOR OR GAUGE
PT	PRESSURE TRANSMITTER
TCC	TEMPERATURE CONTROLS CONTRACTOR
TI	TEMPERATURE INDICATOR OR GAUGE
T-STAT	THERMOSTAT
TT	TEMPERATURE TRANSMITTER

PLUMB. EQUIP. ABBREVIATIONS

ANB-#	ACID NEUTRALIZING BASIN
DF-#	DRINKING FOUNTAIN
EEW-#	EMERGENCY EYE WASH/SHOWER
EWC-#	ELECTRIC WATER COOLER
FCO-#	FLOOR CLEAN OUT
FD-#	FLOOR DRAIN
GCO-#	GRADE CLEAN OUT
HB-#	HOSE BIB
JS-#	JANITOR SINK
KS-#	KITCHEN SINK
LAV-#	LAVATORY
MH-#	MAN HOLE
PIT-#	SUMP PIT
RD-#	ROOF DRAIN
RPZ-#	REDUCED PRESS. ZONE BACKFLOW PREV.
RWL-#	RAIN WATER LEADER
SAN-#	SANITARY
ST-#	STORM
U-#	URINAL
VTR-#	VENT THROUGH ROOF
WCO-#	WALL CLEAN OUT
WH-#	WALL HYDRANT
WF-#	WASHFOUNTAIN
WC-#	WATER CLOSET

CONTRACTOR NOTES:
THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS. THE EQUIPMENT IS SHOWN FOR DIAGRAMMATIC REPRESENTATION ONLY AND MAY NOT REPRESENT ACTUAL DIMENSIONS. THE EQUIPMENT SPECIFICATIONS ATTACHED ARE PROVIDED AS A REFERENCE AND ALIGNMENT WITH CONTRACTOR WILL BE NEEDED TO ENSURE THE EQUIPMENT PURCHASED IS AS SPECIFIED IN THIS DRAWING SET.
ALL DIMENSIONS SHOULD BE CHECKED BY THE CONTRACTOR AND ANY ERRORS OR OMISSIONS SHOULD BE REPORTED TO TOMKEE ENGINEERING IN WRITING. WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALED DIMENSIONS. THE CONTRACTOR IS RESPONSIBLE TO ENSURE ALL INSTALLATIONS ARE IN ACCORDANCE WITH THE LATEST CODES AND STANDARDS.

MECHANICAL SPECIFICATIONS

A - GENERAL MECHANICAL SPECIFICATIONS
1. THESE DRAWINGS ARE INTENDED TO PROVIDED A FULLY OPERATIONAL SYSTEM IN ACCORDANCE WITH ALL APPLICABLE CODES AND STANDARDS. THE MECHANICAL DRAWINGS MAY NOT COVER EVERY ITEM REQUIRED FOR THE COMPLETE MECHANICAL INSTALLATION, THE MECHANICAL CONTRACTOR SHALL SUPPLY ALL LABOR, TOOLS, MATERIAL, EQUIPMENT, AND LOGISTICS TO COMPLETE THE INSTALLATION OF A FULLY FUNCTIONAL SYSTEM.
2. DRAWINGS ARE DIAGRAMMATIC AND APPROXIMATE TO SCALE. THE CONTRACT DOCUMENTS ESTABLISH THE SCOPE BUT DO NOT INCLUDE A COMPREHENSIVE MATERIAL TAKE OFFS OR DETAILED INSTALLATION INSTRUCTIONS.
3. THE CONTRACTOR IS TO ENSURE EQUIPMENT IS PROCURED AND DELIVERED IN TIMELY FASHION TO COMPLETE THE PROJECT BASED ON CLIENT SCHEDULE. NOTIFY OWNER AND ENGINEER IF PROBLEMS ARISE.
4. THE CONTRACTOR TO EMPLOY EXPERIENCED AND LICENSED TRADESPEOPLE TO COMPLETE THIS SCOPE OF WORK.
5. ALL EQUIPMENT SHALL BE LABELLED WITH PERMANENT TAGS AS REFERENCED IN THE DRAWINGS. ALL CONTROLS TO BE LABELLED.
6. ALL WALL PENETRATIONS TO BE FLASHED TO MATCH SURFACE. PENETRATIONS THROUGH EXTERIOR WALLS SHALL BE MADE WEATHERPROOF AND WATERPROOF. PENETRATIONS THROUGH FIRE SEPARATION SHALL BE SEALED WITH APPROVED SEALANTS.
7. CONTRACTOR TO COMPLY WITH ALL INSTALLATION, COMMISSIONING, AND STARTUP INSTRUCTIONS SUPPLIED BY EQUIPMENT MANUFACTURERS.
8. CONTRACTOR TO IMMEDIATELY NOTIFY ENGINEER IF FIELD CONDITIONS OF EXISTING SYSTEMS ARE FOUND TO HAVE DEFICIENCIES.

B - EQUIPMENT SELECTION
1. WHERE ONE MANUFACTURER, MODEL OR BRAND NAME IS SPECIFIED ALONE, NO SUBSTITUTION WILL BE ALLOWED, EXCEPT IF APPROVED BY OWNER AS AN ALTERNATE.
2. WHERE MORE THAN ONE MANUFACTURER, MODEL OR BRAND NAME IS SPECIFIED FOR THE SAME ITEM, THE CONTRACTOR MAY CHOOSE BETWEEN THEM.
3. WHEN ONE OR MORE MANUFACTURERS, MODELS OR BRAND NAMES ARE MENTIONED AND FOLLOWED BY THE PHRASE “OR APPROVED EQUAL”, IT SHALL BE UNDERSTOOD THAT THE NAMES MENTIONED ARE TO SET A STANDARD, AND ANOTHER MANUFACTURER, MODEL BRAND NAME MAY BE USED IF FULLY EQUAL OR SUPERIOR IN ALL ASPECTS. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM ENGINEER FOR SUBSTITUTE MANUFACTURER PRIOR TO BID.

C - DRAWING SUBMISSION AND APPROVALS
CONTRACTOR SHALL PROVIDE SUBMITTALS FOR ALL EQUIPMENT (MECHANICAL EQUIPMENT, PLUMBING FIXTURES, INSULATION, DAMPERS, AND SPECIALIZED MECHANICAL EQUIPMENT)
1. THE EQUIPMENT MANUFACTURER SHALL SUBMIT A MINIMUM OF TWO (2) COPIES OF SUBMITTALS TO THE CONTRACTOR. THE GENERAL CONTRACTOR WILL REVIEW AND UPON APPROVAL SUBMIT TO TOMKEE ENGINEERING FOR REVIEW. THE ENGINEER REVIEW DOES NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY TO PROVIDE AND INSTALL MATERIALS AND EQUIPMENT IN ACCORDANCE WITH THE DESIGN INTENT OF THE DRAWINGS.
2. MANUFACTURER’S STANDARD DIMENSION DRAWINGS, PERFORMANCE AND PRODUCT DATA SHALL BE EDITED TO DELETE REFERENCE TO EQUIPMENT, FEATURES OR INFORMATION WHICH IS NOT APPLICABLE TO THE EQUIPMENT BEING SUPPLIED FOR THIS PROJECT.
3. ALL SHOP DRAWINGS MUST BE REVIEWED AND ACCEPTED BY THE ENGINEER PRIOR TO FABRICATION AND INSTALLATION.
4. PROVIDE SUFFICIENT COPIES OF APPROVED DATA WITH THE ENGINEERS APPROVED STAMP FOR INCLUSION IN THE OPERATION AND MAINTENANCE MANUALS THAT WILL BE SUBMITTED TO OWNER UPON COMPLETION OF THE PROJECT.
5. SUBMITTALS ON ALL EQUIPMENT SHALL BE SUBMITTED FOR APPROVAL WITH-IN ONE MONTH OF CONTRACT AWARD.
6. SUPPLY ONE (1) COPY OF THE MAINTENANCE SHOP DRAWING AND MAINTENANCE DATA FOR EACH PIECE OF EQUIPMENT IN ELECTRONIC FORMAT.
7. ALLOW A MINIMUM OF FOURTEEN (14) CALENDAR DAYS FOR THE ENGINEER TO REVIEW THE SHOP DRAWINGS. TIME IS FROM THE RECEIPT OF DRAWINGS IN THE ENGINEERS OFFICE UNTIL THEY ARE SHIPPED OUT OF THE OFFICE.
8. IF THE ENGINEER REJECTS (MAKE CORRECTIONS AS NOTED/SUBMIT SPECIFIED ITEM, REJECTED/SUBMIT SPECIFIED ITEM) TWO (2) TIMES FOR THE SAME SECTION THE ENGINEER WILL BE COMPENSATED FOR THE ADDITIONAL REVIEWS. COMPENSATION WILL BE INCORPORATED BY CHANGE ORDER AND DEDUCTED FROM THE CONTRACTOR’S APPLICATION FOR PAYMENT. CONTRACTOR IS RESPONSIBLE FOR DELAYS CAUSED BY THE RE-SUBMITTAL PROCESS.

D - PERMITS, CERTIFICATION, AND FEES
THE CONTRACTOR IS RESPONSIBLE TO OBTAIN ALL NECESSARY PERMITS AND PAY ALL ASSOCIATED FEES.

E - ENGINEER SITE REVIEWS
WHERE SITE REVIEWS ARE REQUIRED AS PER BUILDING CODE THE GC/OWNER SHALL PROVIDE A CONSTRUCTION SCHEDULE TO THE EOR AT THE BEGINNING OF THE PROJECT. A MINIMUM OF 3 DAYS NOTICE IS REQUIRED TO SCHEDULE A SITE REVIEW.

F - HVAC INSTALLATION SPECIFICATIONS
1. IN GENERAL, ALL PIPING AND DUCTING SHOULD BE RUN IN SUSPENDED CEILING SPACES AND IN SHAFT PROVIDED, UNLESS OTHERWISE INDICATED. CERTAIN ROOMS HAVE NO SUSPENDED CEILINGS; PIPING AND DUCTWORK ABOVE THESE ROOMS SHALL BE EXPOSED & INSTALLED AS HIGH AS POSSIBLE. REFER TO ARCH. PLANS FOR CEILING HEIGHTS AND SOFFIT LOCATIONS.
2. ALL DUCTWORK TO BE INSTALLED TO SMACNA CONSTRUCTION STANDARDS.
   - 2.1. DUCTING SIZES SHALL COMPLY WITH DIMENSIONS SHOWN ON THE DRAWINGS. IF THIS IS NOT POSSIBLE DUE TO INTERFERENCES THE CROSS SECTIONAL AREA OF THE DUCTING MUST BE MAINTAINED.
   - 2.2. INTAKE AND EXHAUST FANS MUST BE SIZED SO THE DISCHARGE AREA MATCHES THE CROSS SECTION AREA OF THE WALL PENETRATION.
3. NOT ALL ACCESS PANELS ARE SHOWN IN THESE DRAWINGS. ACCESS IS REQUIRED TO ALL VALVES, FIRE DAMPERS, MANUAL AND MOTIRIZED DAMPERS IN ALL CONCEALED SPACES. ALL ACCESS PANELS SHOULD BE PROVIDED BY THE GENERAL CONTRACTOR. THE MECHANICAL CONTRACTOR TO COORDINATE ALL ACCESS PANEL LOCATIONS WITH THE GC.
4. PROVIDE COORDINATION DRAWINGS FOR FABRICATION OF DUCTING AND PIPEWORK. DRAWINGS ARE PROVIDED FOR ALL ELEVATIONS WHICH ARE CONGESTED WITH WET AND DRY SIDE EQUIPMENT, SPRINKLER SYSTEMS, DUCTWORK, PLUMBING, AND HVAC SYSTEMS. INLCUDE SPACE ALLOCATIONS FOR LIGHTING AND CEILING LIGHTS. USE APPROVED EQUIPMENT SUBMITTALS FOR FINAL LAYOUT PRIOR TO SETTING HOUSEKEEPING PADS.
5. COOPERATE WITH OTHER TRADES TO ELIMINATE CONFLICTS BETWEEN PIPING, DUCTWORK, ELECTRICAL ETC. THESE DRAWINGS ARE DIAGRAMMATIC. ALL OFFSETS REQUIRED, VERTICAL AND HORIZONTAL NOT SHOWN ON THE PLANS SHALL BE INCLUDED IN THE CONTRACT.
6. DIFFUSERS, REGISTERS, AND SPRINKLER HEAD LOCATIONS SHALL BE COORDINATED WITH LIGHTING FIXTURE LOCATIONS AND SHALL BE IN ACCORDANCE WITH THE CEILING PATTERN.
7. SPECIAL CARE SHALL BE TAKEN TO ENSURE ALL SHEET METAL CONSTRUCTION, PLENUMS AND DUCTWORK HAVE AN AIRTIGHT SEAL BETWEEN SHEET METAL AND GENERAL CONSTRUCTION. USE APPROVED SEALANT TO MAKE JOINTS AIRTIGHT AND WATERTIGHT.
8. AIR HANDLING UNITS, PIPING AND DUCT CONSTRUCTION SHALL PERMIT FOR COIL AND FILTER REMOVAL WITHOUT DISMANTLING UNIT HOUSING, PIPING VALVE ASSEMBLIES OR DUCTWORK.
9. FOR DETAILS, EQUIPMENT CONNECTIONS AND SIZES NOT SHOWN ON FLOOR PLANS, REFER TO ELEVATIONS, DIAGRAMS, DETAILS, SCHEDULES, AND SPECIFICATION SHEETS.
10. SEE ARCHITECTURAL CODE SHEETS FOR ALL FIRE RATING DESIGNATIONS. PROVIDE ALL REQUIRED DAMPERS PER INDICATED RATINGS. INCLUDE COMPLETE INSTALLATION OF CONTROLS.
11. KEEP OPEN ENDS OF PIPING AND DUCTWORK CAPPED TO PREVENT CONSTRUCTION DUST AND DEBRIS FROM ENTERING.
12. WHERE PIPING OR DUCTWORK IS SHOWN CONNECTING TO EXISTING MAINS, EQUIPMENT, ETC., THIS CONTRACTOR SHALL VERIFY EXACT LOCATIONS, SIZES AND SERVICES PRIOR TO MAKING TAP.
13. DURING CONSTRUCTION TAKE SPECIAL CARE OF SURROUNDINGS. MOVE FURNITURE, MAKE USE OF DRIP PANS, DROP CLOTHS ETC. TO PROTECT PROPERTY ON FLOORS IN CONSTRUCTION.
14. COORDINATE THE LOCATIONS FOR ALL CORE DRILLING AND WALL CUTTING WITH THE GENERAL CONTRACTOR.
15. OPENINGS FOR DUTWORK THROUGH WALLS AND FLOORS SHALL BE NEATLY SAW-CUT WITH MAXIMUM OVER CUT OF 1” AROUND THE REQUIRED DUCT OPENINGS. REPAIR ALL AREAS AROUND PENETRATIONS WITH BACK-UP WALL AND FINISH TO MATCH EXISTING. DO NOT REDUCE INSULATION THICKNESS WHERE DUCT PASSES THROUGH OPENINGS.
16. WHERE OPENINGS ARE CUT THRU WALL PROVIDE STEEL ANGLE REINFORCING TO STABILIZE THE STRUCTURE. CONTACT STRUCTURAL ENGINEER FOR FURTHER DETAILS.
17. OPENINGS FOR PIPING AND ROUND DUCT THROUGH WALLS AND FLOORS SHALL BE NEATLY CORE-DRILLED LARGE ENOUGH FOR INSULATION TO PASS THROUGH, SLEEVED AND GROUTED. PROVIDE FIRE CAULKING AND/OR DAMPERS AT RATED FLOOR AND WALLS.
18. CONTRACTOR RESPONSIBLE TO COMPLETE AIR BALANCING UPON COMPLETION OF THE HVAC SYSTEM. FINAL CERTIFICATION CAN ONLY BE ISSUED ONCE THE AIR BALANCE REPORT IS OBTAINED.
19. FIRE DAMPERS TO BE INSTALLED WHERE ANY DUCTING PASSES THROUGH FIRE SEPARATION. FIRE DAMPERS TO BE INSTALLED WITH INSPECTION PORTS. CONTRACTOR TO REFERENCE ARCHITECTURAL DRAWINGS TO VERIFY FIRE SEPARATION WALLS. ALL FIRE DAMPERS TO BE DYNAMIC. STATIC DAMPERS NOT PERMITTED UNLESS APPROVED BY ENGINEER.
20. AIR FILTERS TO BE SUPPLIED FOR ALL AHU, RTU'S, AMU'S, HRV'S. AIR FILTERS TO BE MERV 11 OR BETTER. FOLLOW INDUSTRY BEST PRACTICES.

G - PLUMBING INSTALLATION SPECIFICATIONS
1. ALL PLUMBING SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT EDITION OF THE NATIONAL BUILDING CODE OF CANADA (NBCC) WITH ALL THE PROVINCIAL AND LOCAL AMENDMENTS.
2. WATER PIPING SYSTEM DISINFECTION SHALL MEET NATIONAL PLUMBING CODE WITH ALL PROVINCIAL AMENDMENTS.
3. CLEAN-OUTS MUST BE PROVIDED AT THE END OF HORIZONTAL BRANCHES OF EACH FLOOR DRAIN IF THE FLOOR DRAINS HAVE TRAPS THAT ARE NOT EASILY ACCESSIBLE OR READILY REMOVABLE WITHOUT DISTURBING CONCEALED PIPING. SEE CODE FOR REQUIREMENTS.
4. NO PIPING SHALL BE SUPPORTED FROM OTHER PIPING, DUCTWORK OR CONDUIT. ALL PIPING SHALL BE SUPPORTED FROM STRUCTURE.
5. PIPE HANGER AND SUPPORT SPACING SHALL CONFORM TO THE REQUIREMENTS SPECIFIED IN NPCC WITH ALL THE PROVINCIAL AND LOCAL AMENDMENTS.
6. COORDINATE ALL ABOVE GROUND PIPING RUNS AND DROPS WITH STRUCTURAL BEAMS, JOISTS AND COLUMNS, AND WITH ALL DUCTWORK AND HEATING PIPING. OFFSET ALL PLUMBING PIPING AS REQUIRED.
7. CONTRACTOR TO VERIFY CONDITIONS IN THE FIELD BEFORE BEGINNING WORK.
8. PROVIDE SLEEVES FOR ALL PIPING PENETRATIONS OF WALLS AND FLOORS. SEE ARCHITECTURAL DRAWINGS FOR LOCATIONS OF ALL FIRE RATED WALLS. PENETRATION THROUGH FR/FS WALLS SHOULD BE FIRE STOPPED ACCORDINGLY.
9. COORDINATE ALL UNDERGROUND PIPING WITH STRUCTURAL MEMBERS AND FOUNDATION WALLS.
10. CLEANOUTS SHALL BE OF THE SAME NOMINAL SIZE AS THE PIPE THEY SERVE UP TO 4 INCHES IN SIZE. CLEANOUTS MUST BE INSTALLED WHERE THERE IS AN INCREASE IN PIPE SIZE.
11. SEPARATION OF SEWER AND WATER LINES SHALL BE INSTALLED IN ACCORDANCE WITH NPCC AND PROVINCIAL AMENDMENTS.
12. ALL PIPING TO BE PRESSURE TESTED AS PER REGULATIONS.
13. SANITARY PIPING
   - 13.1. PIPING TO BE PVC DWV.
   - 13.2. SLOPE SHOULD BE 2% UNLESS OTHERWISE NOTED
   - 13.3. ALL VENT PENETRATIONS THROUGH THE ROOF MUST BE 3" UNLESS OTHERWISE NOTED.
   - 13.4. FLOOR DRAINS TO BE INSTALLED NEAR WATER FIXTURES SUCH AS EYE WASH/FURNACE/HRV/HWT ETC.
14. WATER PIPING
   - 14.1. ALL FIXTURES TO BE IN ACCORDANCE WITH ASME A 112.18.1 AND CAN CSA-B125.
   - 14.2. SHOWERS TO BE PROTECTED BY PRESSURE AND TEMPERATURE COMPENSATING VALVES.
   - 14.3. PIPING TO BE PEX OR COPPER.
   - 14.4. FLUSH AND STERILIZE THE ENTIRE WATER SYSTEM PRIOR TO PUTTING INTO SERVICE.
   - 14.5. ALL FIXTURE CONNECTIONS TO BE $\frac{1}{2}$" UNLESS OTHERWISE NOTED.
   - 14.6. ALL EQUIPMENT SHALL HAVE GATE OR BALL VALVES TO ISOLATE FIXTURES.
   - 14.7. ALL HOSE BIBS MUST HAVE VACUUM BREAKERS. EXTERIOR HOSE BIBS ARE TO BE OF THE NON-FREEZING TYPE.
   - 14.8. WHEN PEX PIPING IS COLOR CODED IT IS RECOMMENDED TO USE RED COLORED PIPING FOR DOMESTIC HOT WATER AND BLUE COLORED PIPING FOR DOMESTIC COLD WATER.
15. RADON EXTRACTION PIPING
   - 15.1. PIPE TO BE PVC DWV.
   - 15.2. ROUGH IN TO BE PROVIDED FOR SUB SLAB DEPRESSURIZATION SYSTEM.
   - 15.3. RADON EXTRACTION PIPE TO BE SEALED AND LABELED 'RADON'. ROUGH IN CAP TO BE ACCESSIBLE.
   - 15.4. IF RADON LEVELS ARE MEASURED THAT EXCEED 200 BECQUERELS PER METER CUBED (BQ/M3) CONSULT ENGINEER FOR RADON EXTRACTION FAN AND VENTING.

H - GAS PIPING
1. NATURAL GAS PIPING ABOVE GRADE
   - 1.1. STEEL PIPE: ASTM A53 SCHEDULE 40 BLACK IRON
   - 1.2. FITTINGS: ASME B16.3, MALLEABLE IRON, OR ASTM A234/A234M, FORGED STEEL WELDING TYPE.
   - 1.3. JOINTS: NFPA 58, THREADED OR WELDED TO ANSI B31.1.
   - 1.4. FLANGE GASKETS: SPIRAL WOUND METAL FLEXITALIC.
2. GAS SERVICE
   - 2.1. GENERAL REQUIREMENTS: CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR INSTALLATION OFGAS METER WITH LOCAL UTILITY AS NOTED ON THE PLANS.
   - 2.2. CONTRACTOR SHALL PROVIDE NECESSARY PRESSURE REGULATORS FOR EQUIPMENT SPECIFIED TO BE CONNECTED BY THIS CONTRACTOR, AND MAIN LINE PRESSURE REGULATORS ON FIRM GAS AND DISTRIBUTION LINES AS SPECIFIED AND ALSO AS NOTED ON DRAWINGS.
     - 2.2.1. PRESSURE REGULATORS SHALL BE FISHER REGULATOR COMPANY OR APPROVEDEQUAL.
3. INSTALLATION
   - 3.1. INSTALL NATURAL GAS PIPING IN ACCORDANCE WITH NFPA 54, CSA B149: NATURAL GAS AND PROPANE CODE, AND CSA B139: OIL BURNING EQUIPMENT CODE.
   - 3.2. GAS PIPING SYSTEM: THOROUGHLY CLEAN GAS PIPING OF GREASE, RUST AND PARTICLES BEFORE INSTALLATION. UPON COMPLETION OF INSTALLATION, BLOW SYSTEM CLEAN WITH HIGH PRESSURE AIR. REMOVE CAPS FROM DRIP LEGS BEFORE BLOWING CLEAN.
4. FLUE VENTING
   - 4.1. ALL VENTING TO BE IN ACCORDANCE WITH CSA B149.1 CURRENT EDITION.
   - 4.2. FLUE VENTING MATERIALS TO BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
   - 4.3. PVC INTAKES AND VENTING TO BE INSULATED WITH MINIMUM $\frac{1}{2}$" FLEXIBLE ELASTOMER CLOSED CELL INSULATION IN ALL UNCONDITIONED SPACES. FLUE VENTS TO BE COMPLETELY VENTILATED UP TO VENT TERMINATION.

I - HYDRONIC HEATING SYSTEM
1. IN FLOOR HEATING SYSTEM
   - 1.1. IN FLOOR HEATING SYSTEMS TO BE CONSTRUCTED WITH OXYGEN BARRIER PEX TUBING.
   - 1.2. IN FLOOR TUBE SPACING IS 12" UNLESS OTHERWISE SPECIFIED.
   - 1.3. IN FLOOR TUBE BEND RADIOS MINIMUM OF 6" UNLESS OTHERWISE SPECIFIED.
   - 1.4. MANIFOLDS
     - 1.4.1. MUST BE PROVIDED WITH ISOLATION VALVES. GATE OR BALL VALVES.
     - 1.4.2. MUST BE PROVIDED WITH VENT VALVE TO RELEASE AIR FROM THE SYSTEM.
     - 1.4.3. MUST BE PROVIDED WITH BALANCING VALVES.
     - 1.4.4. MUST BE PROTECTED FROM PEDESTRIAN AND MOBILE EQUIPMENT TRAFFIC
2. ALL PIPING AND COMPONENTS TO BE IN ACCORDANCE TO CSA B51: BOILER, PRESSURE VESSELS, AND PRESSURE PIPING.
3. COORDINATE WITH OWNER/ENGINEER ON GLYCOL CONCENTRATIONS WHICH MAY VARY DEPENDING ON APPLICATION.
4. ALL HYDRONIC PIPING TO BE STEEL, COPPER, OR PEX.
5. FIRE SEPARATION PENETRATIONS MUST BE SEALED WITH APPROVED ULC FIRE STOPPING MATERIALS.
6. ALL HIGH POINTS TO BE SUPPLIED WITH VENT VALVE.
7. PROVIDE LOW WATER CUTOFF SAFETY SWITCH FOR EACH BOILER.
8. PROVIDE HOSE BIBS AS NEEDED TO FILL THE SYSTEM. PROVIDE AIR AND DIRT SEPARATORS.
9. ALL HYDRONIC PIPING TO BE INSULATED AS PER INSULATION SECTION OF THESE SPECIFICATIONS.
10. ALL HYDRONIC SYSTEMS LARGER THAN 17 CU. FT. MUST BE REGISTERED AS PER CSA B51. ENSURE ALL COMPONENTS ARE SUPPLIED WITH APPROPRIATE RATINGS AND CRN NUMBERS. CONTRACTOR RESPONSIBLE FOR REGISTRY OF THE SYSTEM.

J - CONTROLS
1. IT IS THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR TO PROVIDE A FULLY FUNCTIONAL MECHANICAL SYSTEM COMPLIANT WITH THE MECHANICAL PLANS. THE MECHANICAL OR ELECTRICAL CONTRACTOR (AS DEFINED BY THE OWNER IN SCOPE OF WORK) SHALL SUPPLY AND INSTALL ALL LOW VOLTAGE CONTROL WIRING REQUIRED PROVIDING THE FUNCTIONS DETAILED IN THE EQUIPMENT SUPPLIER INSTALLATION INSTRUCTIONS.
2. ALL ANCILLARY DEVICES REQUIRED FOR A FULLY OPERATIONAL SYSTEM COMPLIANT WITH APPLICABLE CODE SHALL BE SUPPLIED BY THE MECHANICAL CONTRACTOR. ANY INSTRUMENTATION REQUIRED FOR THE SYSTEM SHALL BE PROVIDED BY THE MECHANICAL CONTRACTOR INCLUDING BUT NOT LIMITED TO AIR FLOW SENSORS, TEMPERATURE TRANSMITTERS, FLOW TRANSMITTERS, HIGH AND LOW LEVEL LIMIT SWITCHES ETC. MOTOR STARTERS, VARIABLE FREQUENCY DRIVES, TRANSFORMERS, RELAYS, CONTACTORS, CAPACITORS, AND SIMILAR ELECTRICAL COMPONENTS ARE THE RESPONSIBLITY OF THE ELECTRICAL CONTRACTOR.
3. ALL AHU'S AND RTU'S TO RUN CONTINUOUSLY AT THE CFM VALUES LISTED WHILE BUILDINGS ARE OCCUPIED.
4. AHU'S DIRECTLY CONNECTED TO HRV'S TO BE INTERLOCKED THAT WHEN HRV FAN IS ON AHU FAN IS ALSO ON.
5. DIRECT FIRED AMU'S NEED TO BE DOUBLE INTERLOCKED WITH THE FAN SO THAT IF THE EXHAUST FAN OR THE AMU FAN DOES NOT RUN CORRECTLY THE UNIT SHUTS DOWN.
6. MECHANICAL CONTRACTOR TO COORDINATE WITH ELECTRICAL CONTRACTOR TO INSTALL ALL LINE AND LOW VOLTAGE CONTROLS. ALL WIRES SHOULD BE SUPPLIED BY ELECTRICAL CONTRATOR.
7. SPECIFIC CONTROL NARRATIVES ARE DEFINED ON THE HVAC SYSTEM AND SCHEMATIC SHEET.

K - ELECTRICAL
1. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL ALL ELECTRIC UNIT HEATERS, FORCED AIR HEATERS, AND BASEBOARD HEATERS UNLESS OTHERWISE STATED ON DRAWINGS OR IN SCOPE OF WORK DOCUMENT PROVIDED BY THE GC/OWNER.
2. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL ALL CONDUITS, WIRES, JUNCTION BOXES, AND ASSOCIATED DEVICES REQUIRED FOR THE CONTROL OF THE MECHANICAL SYSTEM. CONTROL CONDUIT RUNS AND WIRING MAY NOT BE INDICATED ON THE MECHANICAL DRAWINGS OR ELECTRICAL DRAWINGS. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE TO ENSURE ALL CONDUITS AND WIRING ARE PROVIDED FOR A FULLY OPERATIONAL MECHANICAL SYSTEM.
3. ANY ELECTRICAL COMPONENTS IN AREAS THAT ARE PRONE TO FLOODING SHOULD BE INSTALLED A MINIMUM OF 6" OFF THE GROUND AND SHOULD BE PROTECTED WITH A GFCI.
4. REFER TO BUILDING ELECTRICAL PLANS TO IDENTIFY BUILDING CLASSIFICATION DETAILS. ALL EQUIPMENT MUST MEET ELECTRICAL CLASSIFICATION REQUIREMENTS INCLUDING LABELS INDICATING COMPLIANCE. NOTIFY ENGINEER IN CASE OF ANY CONFLICTS.

L- INSULATION
- 1.1. DOMESTIC WATER
  - 1.1.1. ALL COLD WATER TO BE INSULATED WITH $\frac{1}{2}$ INCH PREFORMED FLEXIBLE ELASTOMERIC, CLOSED CELL INSULATION.
  - 1.1.2. ALL DOMESTIC HOT WATER:

LOCATION OF PIPING	REQUIRED THERMAL CONDUCTIVITY OF INSULATION (W/M-C)	NOMINAL PIPE DIAMETER INCHES (MM)	MINIMUM THICKNESS OF PIPING INSULATION, INCHES (MM)
CONDITIONED SPACE	0.035-0.040 (TESTED AT MEAN RATING TEMP OF 38C)	</= 2" (51MM)	1" (25.4MM)
		> 2" (51MM)	1" (25.4MM)
UNCONDITIONED SPACE OR OUTDOORS	0.046-0.049 (TESTED AT MEAN RATING TEMP OF 121C)	</=1" (25.4MM)	2.5" (38.1MM)
		1.25"-2" (25.4MM - 51MM)	2.5" (38.1MM)
		2.5"-4" (64MM TO 102MM)	3" (76.2MM)
		>/=5" (127 MM)	2.5" (88.9MM)

- 1.2. DUCTING
  - 1.2.1. ALL DUCTING INSULATION SHALL BE EXTERNAL WRAP OR BOARD WITH SEALED VAPOR BARRIER. DAMPER HANDLES SHALL BE EXTENDED.
  - 1.2.2. INSULATE ALL COLD FRESH AIR DUCTS WITH 1.5" EXTERNAL FOIL FACED FIBERGLASS INSULATION (UNLESS NOTED OTHERWISE).
  - 1.2.3. INSULATE ALL SUPPLY DUCTS WITH 1" EXTERNAL FOIL FACED FIBERGLASS INSULATION (UNLESS NOTED OTHERWISE).
  - 1.2.4. INSULATE ALL EXHAUST DUCTS PASSING THROUGH NON INSULATED SPACE WITH 1.5" EXTERNAL FOIL FACED FIBERGLASS INSULATION (UNLESS NOTED OTHERWISE).

M - DISCREPANCIES
CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS AND ENSURE EQUIPMENT IS INSTALLED IN ACCORDANCE WITH ALL LATEST CODES AND STANDARDS. IN CASE OF INCONSISTENCY OR DISCREPANCIES WITHIN THE DRAWINGS CONTRACTOR TO REFER TO THE MOST STRINGENT SET OF REQUIREMENTS. ANY CHANGES MUST BE COMMUNICATED TO THE GC AND THE EOR.

N - CODES AND STANDARDS
WORK SHALL MEET OR EXCEED THE REQUIREMENTS OF ALL THE LATEST CODES, REGULATIONS, STANDARDS, AND ORDINANCES APPLICABLE TO THE PROJECT. ALL INSTALLATIONS SHALL CONFORM TO THE MOST CURRENT EDITION OF THE FOLLOWING CODES AND STANDARDS:
1. PROVINCIAL AND LOCAL HEATING/VENTILATING/AIR CONDITIONING AND REFRIGERATION CODES
2. PROVINCIAL AND LOCAL PLUMBING CODES
3. PROVINCIAL AND LOCAL BUILDING CODES
4. PROVINCIAL AND LOCAL ELECTRICAL CODES
5. PROVINCIAL AND LOCAL MECHANICAL CODES
6. NATIONAL PLUMBING CODE OF CANADA
7. NATIONAL BUILDING CODE OF CANADA
8. MUNICIPAL WATER AND SEWER REGULATIONS
9. NATIONAL ELECTRIC CODE
10. PROVINCIAL AND LOCAL BOARD OF HEALTH REGULATIONS
11. LOCAL APPLICABLE ORDINANCES
12. PROVINCIAL AND LOCAL FIRE CODES AND REGULATIONS
13. GAS COMPANY REQUIREMENTS
14. PROVINCIAL AND LOCAL ENERGY CODE

REVISION	ISSUED FOR	DATE
REV 0	ISSUED FOR TENDER	JUNE 21 2025

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SAWADSKI Member 35217

CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

TITLE
MECHANICAL SPECIFICATIONS

DRAWN	CHECKED	DWG. NO.
TS	BWC	M-000
DESIGN	SHEET	
TS	1-9	

NORTH

SANITARY GROUND FLOOR PLAN

SCALE: 1/4"=1FT

SANITARY LINETYPE	
SANITARY DRAIN	
RADON PIPE	

SANITARY LEGEND	
UD-#	U-DRAIN
PIT-#	FLOOR PIT

U-DRAIN SCHEDULE

SECTION	DESCRIPTION	INLET HEIGHT	DISCHARGE HEIGHT
A	10' U-DRAIN SECTION	15.825"	15.325"
B	10' U-DRAIN SECTION	15.325"	14.825"
C	10' U-DRAIN SECTION	14.825"	14.325"
D	10' U-DRAIN SECTION	14.325"	13.825"
E	10' U-DRAIN SECTION	13.825"	13.325"
F	10' U-DRAIN SECTION	13.325"	12.825"
G	10' U-DRAIN SECTION	12.825"	12.325"
H	10' U-DRAIN SECTION	12.325"	11.825"
I	ANGLED SECTION	14.325"	14.325"
J	SUMP PIT	15.825"	NA

U-DRAIN SPEC SHEET

SUMP-PIT SPEC SHEET

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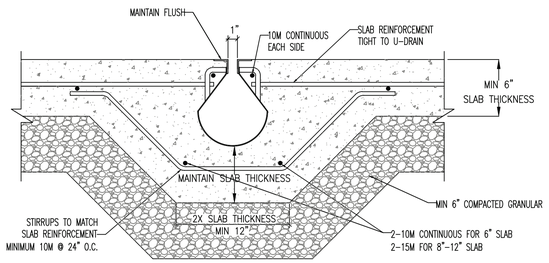
22 2025
REGISTERED PROFESSIONAL ENGINEER

CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

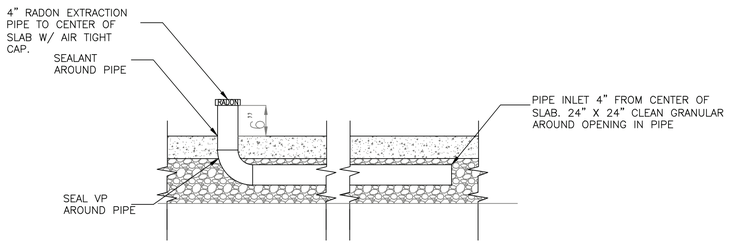
TITLE: PLAN - SANITARY PIPING PLANS

DRAWN	CHECKED	DWG. NO.
TS	BWC	M-101
DESIGN	SHEET	
TS	2-9	



U-DRAIN DETAIL SCHEMATIC

SCALE: NTS



SINGLE INLET RADON GAS PIPING

SCALE: NTS

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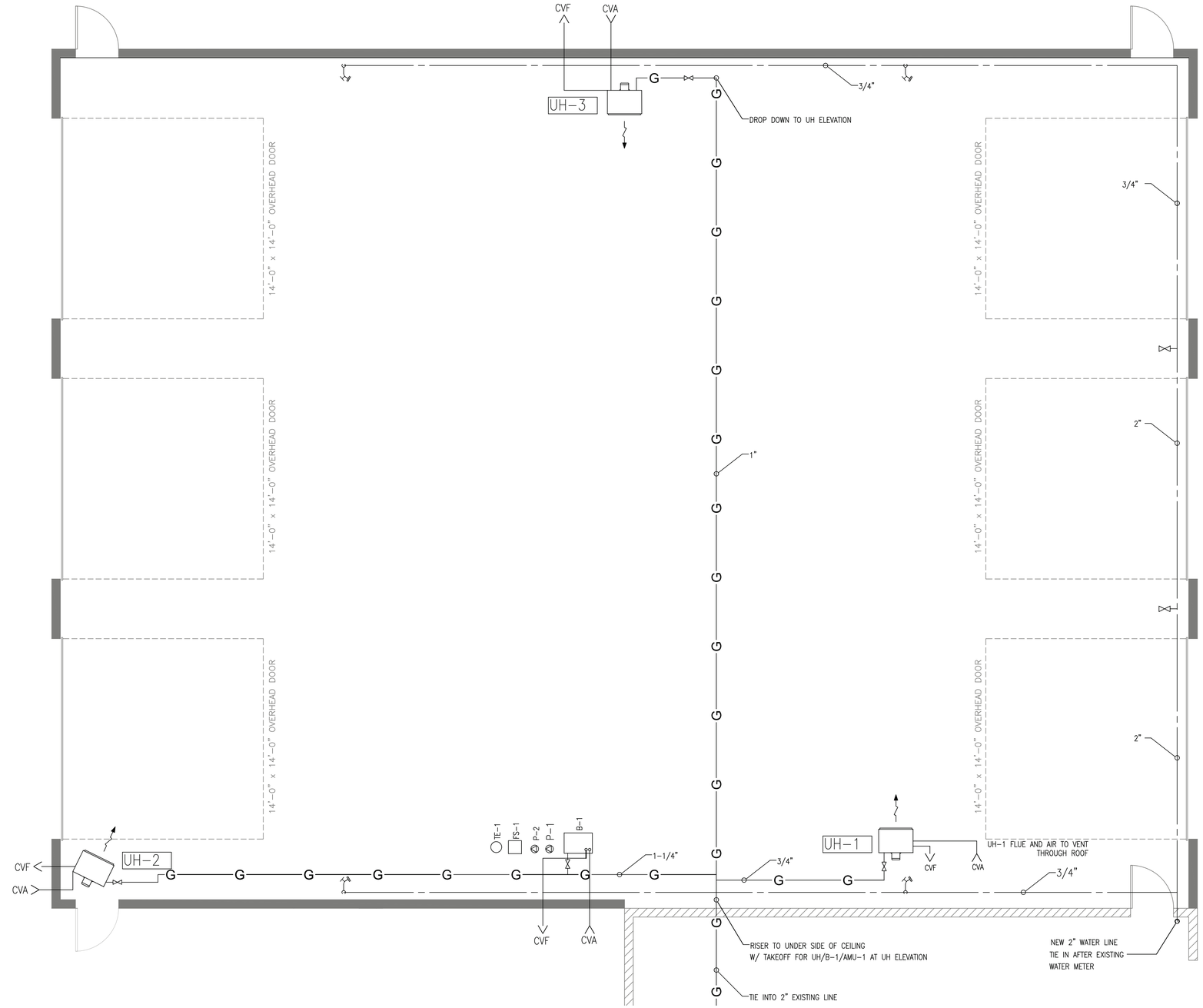
CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

TITLE
SANITARY SCHEMATICS AND DETAILS

DRAWN	CHECKED	DWG. NO.
TS	TS	M-102
DESIGN	SHEET	
TS	3-9	



NORTH

PIPING PLAN GROUND FLOOR

SCALE: 1/4"=1FT

PLUMBING LINES AND SYMBOLS	
ITEM	SYMBOL
COLD WATER	
GAS LINE	G
HOSE BIB	
BALL VALVE	
COMBUSTION VENT FRESH AIR	CVA
COMBUSTION VENT FLUE	CVF

PLUMBING LEGEND	
B-#	BOILER
P-#	PUMP
FS-#	FILL STATION
TE-#	EXPANSION TANK
UH-#	UNIT HEATER
AMU-#	AIR MAKEUP UNIT

BOILER SCHEDULE	
TAG	B-1
MANUFACTURER	IBC
MODEL	SL-26-260G3
LOCATION	SHOP SPACE
ENERGY SOURCE	NATURAL GAS
INPUT CAPACITY	250,000
EFFICIENCY	95%
ELECTRICAL	127 W @ FULL FIRE V: 120V CONTROL: 24V
CONTROL	IBC INTEGRAL ZONE CONTROL WITH SLAP SENSORS

B-1 SPEC SHEET

EXPANSION TANK/FILL STATION/PUMP SCHEDULE				
TAG	P-1	P-2	FS-1	TE-1
MANUFACTURER	TACO	TACO	AXIOM	FLEXCON
MODEL	0010	2400	MF200	SXHT 30
LOCATION	BOILER	BOILER	BOILER	BOILER
FLOW	25 GPM	25 GPM	NA	NA
SIZE	NA	NA	6.6 US GALLON	21.7 X Ø16
PRESSURE	10 FT	35 FT	MAS 25 PSIG	MAX 100 PSI
ELECTRICAL	115V, 1.2 A, 1/8 HP	115V, 1.9 A, $\frac{1}{6}$ HP	50W, 115V 60 HZ	NA
CONTROL	BOILER	BOILER	NA	NA

GAS APPLIANCE SCHEDULE				
EQUIPMENT TYPE	TAG	MBTUH	QUANTITY	MBTUH
EXISTING EQUIPMENT				990
UNIT HEATERS	UH-1,2,3	125	3	375
BOILER	B-1	250	1	250
TOTAL				1,615

TACO 0010 SPECS

TACO 2400 SPECS

AXIOM MF200 SPECS

FLEXCON SPECS

NATURAL GAS PIPING NOTES
1. CONTRACTOR TO ENSURE INSTALLATION COMPLIES WITH CAN/CGA-B149.1 M-95 NATURAL GAS INSTALLATION CODE.
2. ALL EQUIPMENT TO OPERATE AT 7" WC.

CONTRACTOR NOTES:
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REV 0	ISSUED FOR TENDER	JUNE 21 2025
REV 1	REMOVED AMU AND ADDED HRV. CHANGED UH-2 LOCATION	JULY 22 2025

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PROVINCE OF MANITOBA
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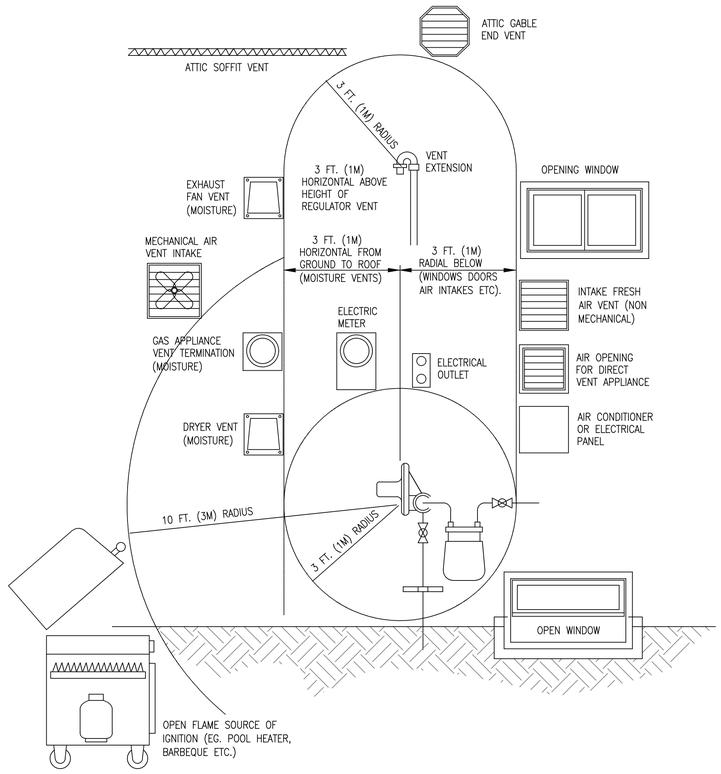
22 JUL 2025
REGISTERED PROFESSIONAL ENGINEER

CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

TITLE: PLAN – PIPING

DRAWN	CHECKED	DWG. NO.
TS	BWC	M-201
DESIGN	SHEET	
TS	4-9	



GAS CLEARANCE DETAIL

SCALE: NTS

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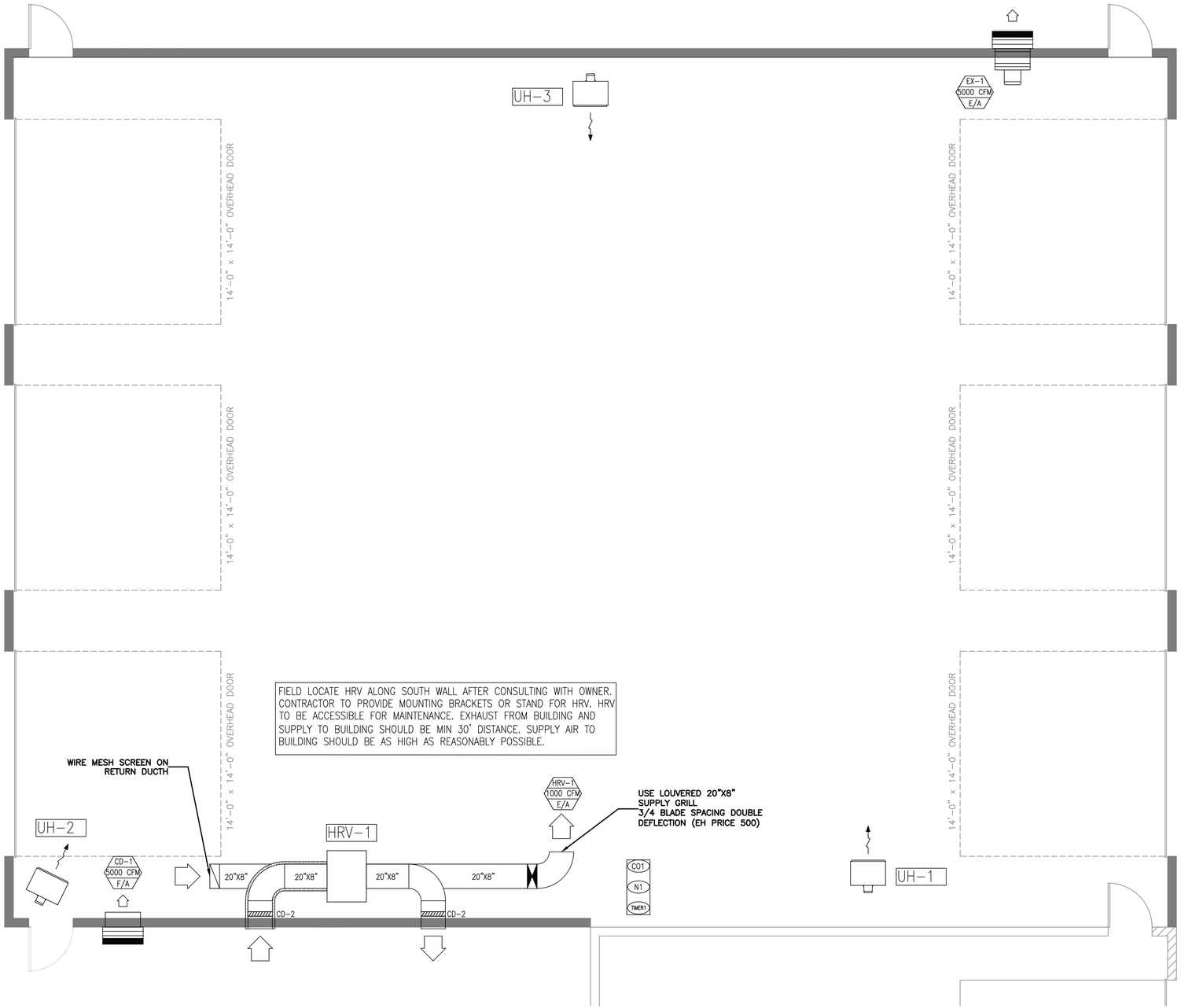
PROVINCE OF MANITOBA SAWADSKI Member 35217 22 21 REGISTERED PROFESSIONAL ENGINEER

CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

TITLE: PIPING DETAILS

DRAWN	CHECKED	DWG. NO.
TS	TS	M-202
DESIGN	SHEET	
TS	5-9	



H.V.A.C PLAN GROUND FLOOR

SCALE: 1/4"=1FT

MODINE SPECS

UNIT HEATER SCHEDULE	
TAG	UH-1, 2, 3
MANUFACTURER	MODINE
MODEL	HD-125
LOCATION	SHOP SPACE
ENERGY SOURCE	NATURAL GAS
INPUT CAPACITY	125,000 BTU
EFFICIENCY	82%
ELECTRICAL	120V
CONTROL	LOCAL THERMOSTAT

HRV-1 LIFEBREATH

HEAT RECOVERY VENTILATOR	
TAG	HRV-1
MANUFACTURER	LIFEBREATH
MODEL	1200 FD
LOCATION	SHOP SPACE
ENERGY SOURCE	ELECTRIC
REQUIRED CFM	1000
EFFICIENCY	60%
SUPPLY AIR CFM	1000 CFM
ELECTRICAL	120 VAC MCA: 23.5 MOP: 30 HP: ½
CONTROL	C1

EX-1 SPECS

FAN SCHEDULE		
TAG	EX-1	EX-2
MANUFACTURER	GREENHECK	GREENHECK
MODEL	SBE	SBE
LOCATION	SHOP SPACE	SHOP SPACE
TYPE	CENTRIFUGAL	CENTRIFUGAL
DRIVE	BELT	BELT
CFM	5000	1000
ELECTRICAL	120V	120V
CONTROL	CO2 AND NITROGEN	C1

CONTROL DAMPER/LOUVER SCHEDULE		
TAG	CD1	CD2
DAMPER MFG	TAMCO	TAMCO
ACTUATOR	BELIMO	BELIMO
LOCATION	SHOP SPACE	SHOP SPACE
SIZE	36" X 36"	20" X 8"
CFM	5000	1000
LECB LEAKAGE VALUE	LOW LEAKAGE	LOW LEAKAGE
ELECTRICAL	24V/5W	24V/5W
CONTROL	EX-1	C1

ALL FANS AND DAMPERS TO BE PROVIDED WITH APPROPRIATE SCREENS AND WEATHER HOODS. SEALING AND FLASHING TO BE INSTALLED TO PROVIDE WEATHER PROOF CONSTRUCTION AND MATCH EXTERIOR AND INTERIOR FINISHES OF THE BUILDING.

BELIMO

CONTRACTOR NOTES:
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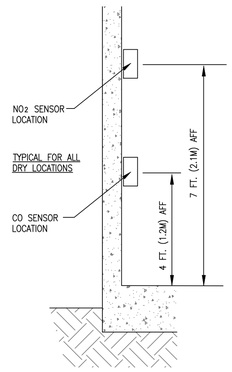
CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

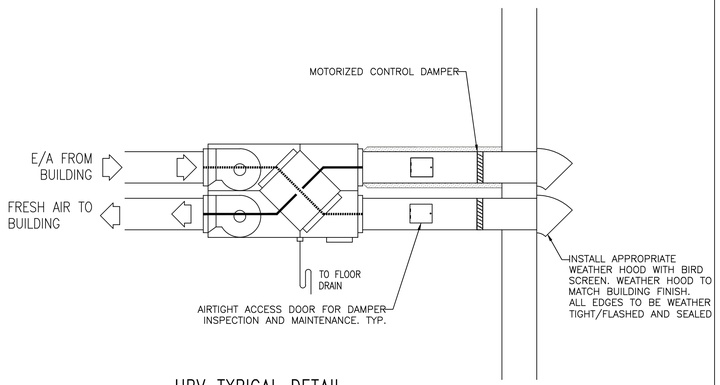
TITLE: PLAN – HEATING/AIR CONDITIONING/VENTILATION

DRAWN	CHECKED	DWG. NO.
TS	BWC	M-301
DESIGN	SHEET	
TS	6-9	



AIR QUALITY SENSOR INSTALLATION DETAILS

SCALE: NTS



HRV TYPICAL DETAIL

SCALE: NTS

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REV 1	ADDED HRV DETAIL. REMOVED AMU DETAIL.	JULY 22 2025

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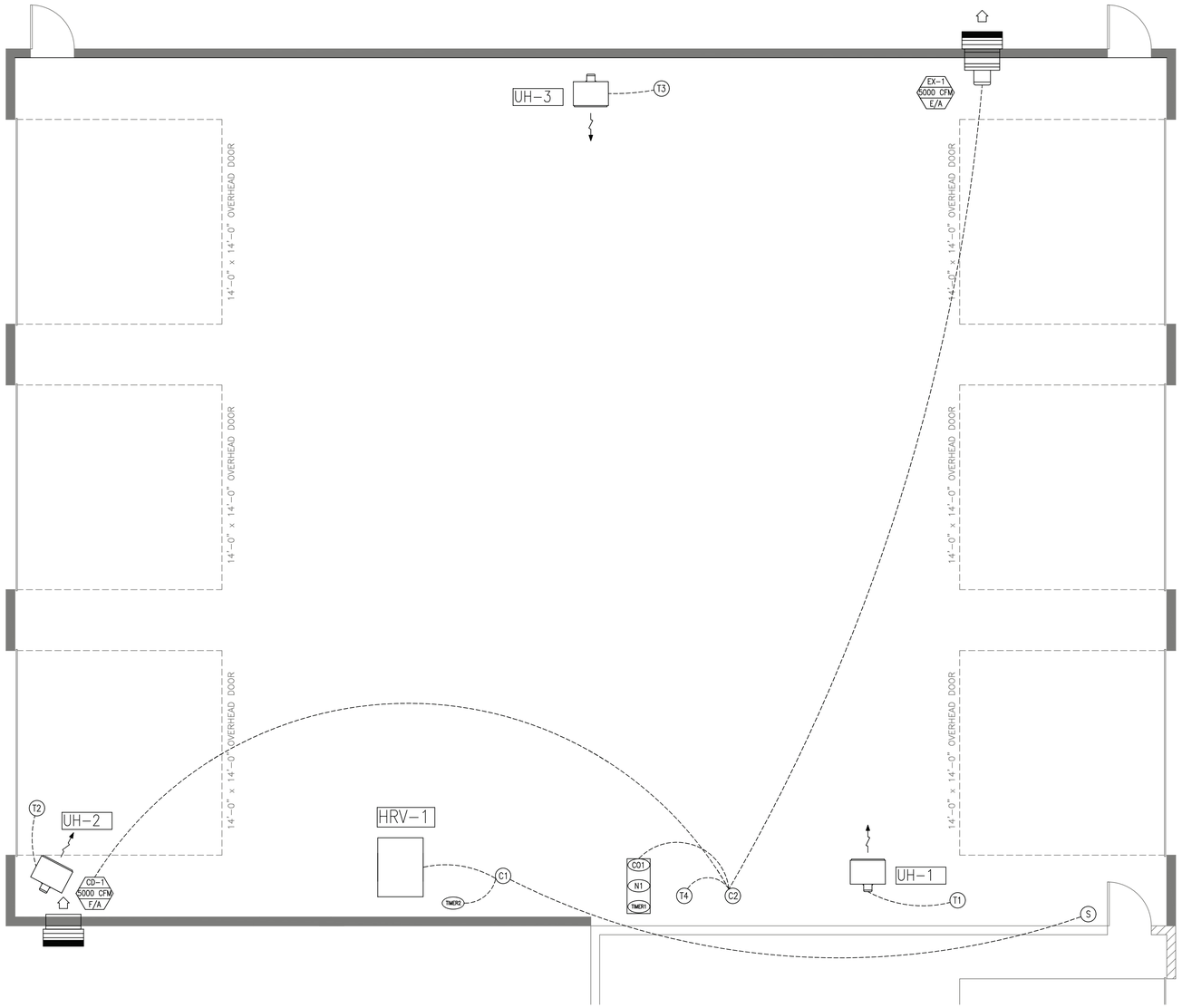
234 COCHLAN DRIVE MORDEN, MB

TITLE
DETAILS – HEATING/AIR CONDITIONING/VENTILATION

DRAWN	CHECKED	DWG. NO.
TS	TS	M–302
DESIGN	SHEET	
TS	7-9	



NORTH

H.V.A.C CONTROL STRATEGY

SCALE: NTS

CONTROL STRATEGY

EQUIPMENT ASSOCIATED WITH THESE SEQUENCES:
EX-1, EX-2, UH-1, UH-2, UH-3, AMU-1, B-1, CD-1, CD-2

CONTROL PANELS FOR EQUIPMENT SHOULD BE SUPPLIED BY EQUIPMENT PROVIDERS. ANY ADDITIONAL CONTROL PANELS NEEDED SHOULD BE SUPPLIED BY ELECTRICAL CONTRACTOR.

CONTROL LOOP C-1 (HRV-1, CD-2)
WHEN HRV-1 TURNS ON, THE CONTROL DAMPERS CD-2 ARE ALWAYS OPEN
THE FOLLOWING CONDITIONS WILL TRIGGER HRV-1 TO TURN ON
1. OCCUPANCY SENSOR OR LIGHT SWITCH TO TRIGGER HRV-1.
2. TIMER TO BE SET TO OPERATING HOURS TO ACTIVATE HRV.

CONTROL LOOP C-2 (CD-1, EX-1)
WHEN EX-1 TURNS ON, THE CONTROL DAMPER CD-1 IS ALWAYS OPEN.
THE FOLLOWING CONDITIONS WILL TRIGGER CD-1 TO TURN ON.
1. CO1 OR N1 ALARMS ALARM THRESHOLD IS REACHED.
2. TIMER1 IS MANUALLY ACTIVATED.
IF T4 IS BELOW 5C, EX-1 WILL TURN OFF AND CD-1 WILL CLOSE.

ALL UNIT HEATERS ARE CONTROLLED WITH LOCAL THERMOSTATS.
1. T-1 CALLS FOR UH-1 TO TURN ON.
2. T-2 CALLS FOR UH-2 TO TURN ON.
3. T-3 CALLS FOR UH-3 TO TURN ON.

CONTROL LOOP C-3 (B-1, P-1, P-2)
THE BOILER IS EQUIPPED WITH AN INDEPENDENT CONTROL PANEL THAT WILL BE USED TO MEASURE THE FLOOR TEMPERATURE AND CALL FOR HEAT WHEN REQUIRED.
WHEN B-1 IS ON P-1 IS ALWAYS ON.
THE FOLLOWING CONDITIONS WILL TRIGGER P-1 AND P-2 TO START.
1. ANY OF THE FLOOR SENSORS CALLING FOR HEAT.

CONTROL SCHEDULE

TAG	CONTROLLED EQUIPMENT	TYPE	MAKE/MODEL	SETPOINT	ELECTRIC REQUIREMENT
T1, T2, T3,	UH-1, UH-2, UH-3	NON PROGRAMMABLE HEATING	HONEYWELL T822	21C	24 VAC
T4	CD-1, EX-1	COOLING THERMOSTAT	HONEYWELL T651	5C	120 VAC
CO1, N1	CD-1, EX-1	CO/NO2 DECTECTOR	HONEYWELL E3 POINT	TO BE CALLIBRATED BY QUALIFIED TECHNICIAN	24 VAC
TIMER1	CD-1, EX-1	SPRING WOUND 60 MIN TIMER	HONEYWELL ULTRAPRO	NA	24 VAC
TIMER2	HRV-1	DIGITAL WALL CONTROLLER	LIFEBREATH	OCCUPANCY HOURS	24 VAC

CONTRACTOR NOTES:
THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS. THE EQUIPMENT IS SHOWN FOR DIAGRAMMATIC REPRESENTATION ONLY AND MAY NOT REPRESENT ACTUAL DIMENSIONS. THE EQUIPMENT SPECIFICATIONS ATTACHED ARE PROVIDED AS A REFERENCE AND ALIGNMENT WITH CONTRACTOR WILL BE NEEDED TO ENSURE THE EQUIPMENT PURCHASED IS AS SPECIFIED IN THIS DRAWING SET.
ALL DIMENSIONS SHOULD BE CHECKED BY THE CONTRACTOR AND ANY ERRORS OR OMISSIONS SHOULD BE REPORTED TO TOMKEE ENGINEERING IN WRITING. WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALED DIMENSIONS. THE CONTRACTOR IS RESPONSIBLE TO ENSURE ALL INSTALLATIONS ARE IN ACCORDANCE WITH THE LATEST CODES AND STANDARDS.

REVISION	ISSUED FOR	DATE
REV 0	ISSUED FOR TENDER	JUNE 21 2025
REV 1	REMOVED AMU AND ADDED HRV. CHANGED UH-2 LOCATION	JULY 22 2025

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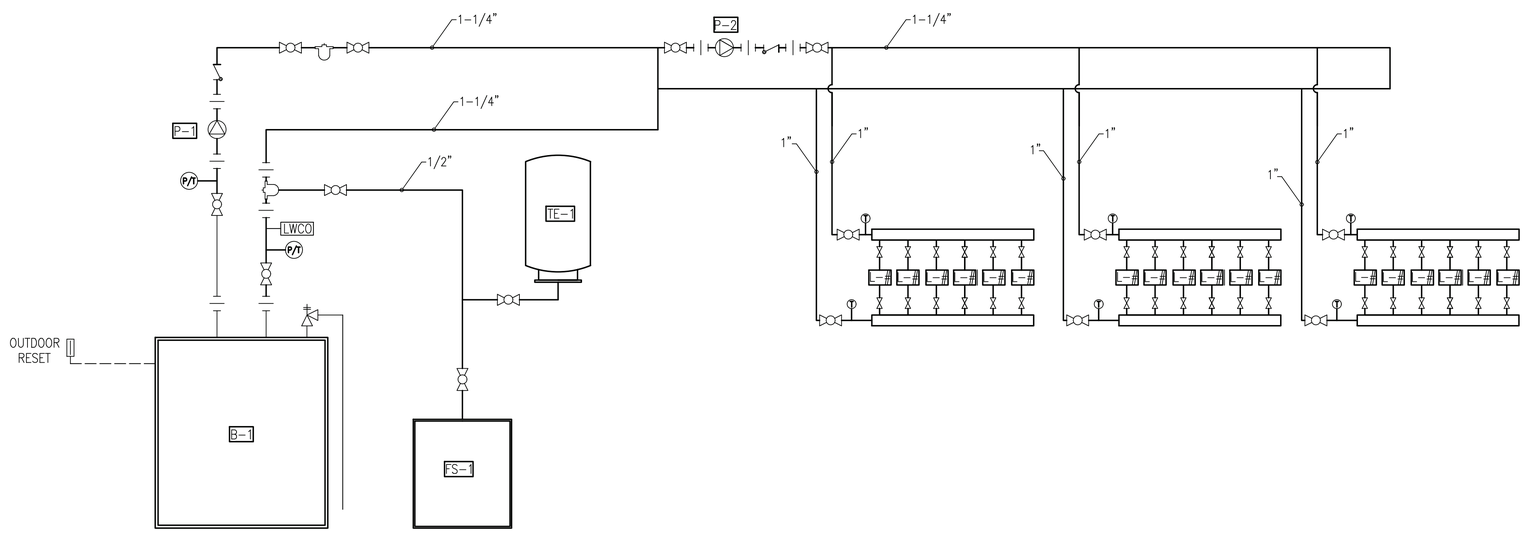
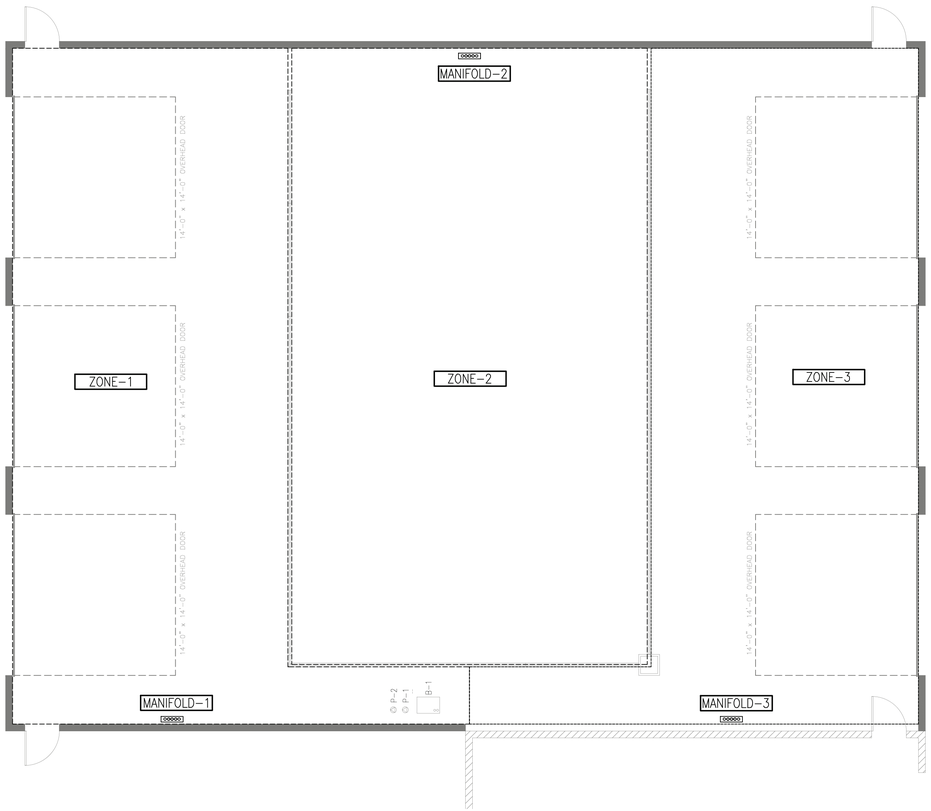
PROVINCE OF MANITOBA
SAWADSKI
Member
35217
REGISTERED PROFESSIONAL ENGINEER

CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

TITLE
HEATING/AIR CONDITIONING/VENTILATION CONTROL

DRAWN	CHECKED	DWG. NO.
TS	TS	M-303
DESIGN	SHEET	
TS	8-9	





HYDRONIC SCHEMATIC	
DESCRIPTION	SYMBOL
PUMP	
BALL VALVE	
GATE VALVE	
CHECK VALVE	
PIPE UNION	
TEMPERATURE/PRESSURE GAUGE	P/T
BOILER LOW WATER SHUTOFF	LWCO
TEMPERATURE PROBE	
PRESSURE RELIEF VALVE	
AIR ELIMINATOR	

WASSER MANIFOLDS

FLOOR HEATING								
MANIFOLD	ZONE	PIPE SIZE	LOOP SPACING	NUMBER OF LOOPS	FLOW	LOOP LENGTH	CAPACITY BTU/H	PRESSURE LOSS
M-1	ZONE 1	5/8"	12"	4	6 USGPM	380 Ft	54,187	22.40 Ft
M-2	ZONE 2	5/8"	12"	5	9 USGPM	400 Ft	74,907	29.80 Ft
M-3	ZONE 3	5/8"	12"	4	6 USGPM	380 Ft	54,195	22.70 Ft

CONTRACTOR NOTES:
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REVISION	ISSUED FOR	DATE
REV 0	ISSUED FOR TENDER	JUNE 21 2025

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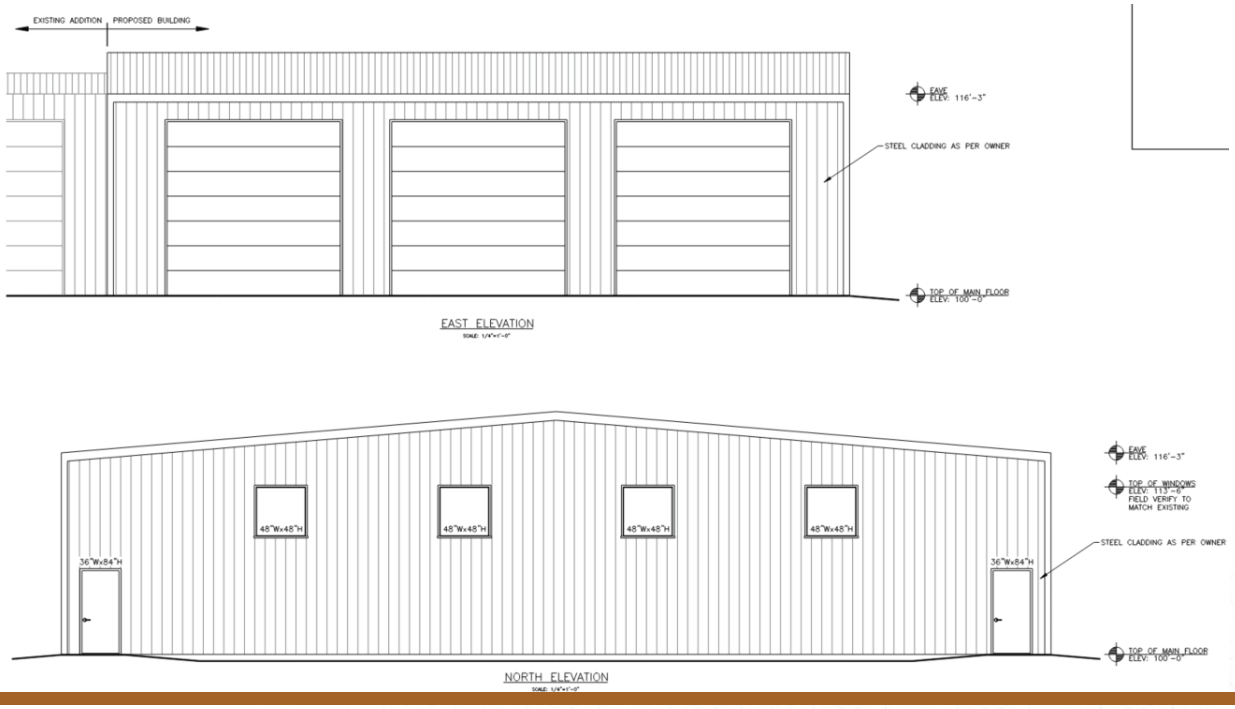
REGISTERED PROFESSIONAL ENGINEER

CLIENT
CITY OF MORDEN - PUBLIC WORKS ADDITION
234 COCHLAN DRIVE MORDEN, MB

TITLE
PLAN & DETAILS - HYDRONIC FLOOR HEAT

DRAWN	CHECKED	DWG. NO.
TS	BWC	M-401
DESIGN	SHEET	
TS	9-9	



Morden Public Works Addition

Initial MECB 2024 Energy Model

Image courtesy of Steckley Consulting Engineers.

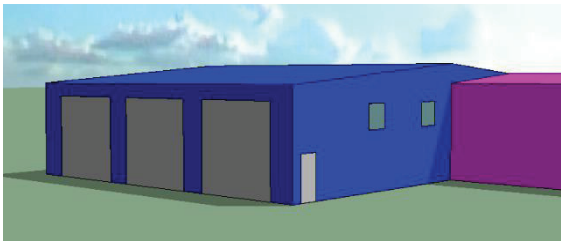
CrosierKilgour
Structural Engineering & Building Performance
Strong Relationships, Enduring Solutions.

Submitted To:	Steckley Consulting Engineers Inc.	Submitted By:	Crosier Kilgour 610 – 234 Donald Street Winnipeg, MB R3C 1M8
Attention:	Reyburn Franz	Contact:	Kelly Winder 306.230.8523
Date:	2025-July-24 Version 2	Project Number:	2025-0548

Table of Contents

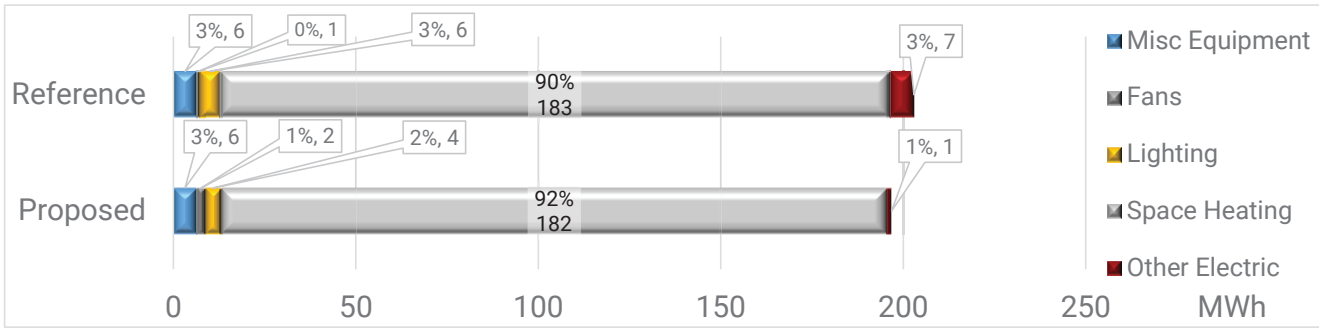
Project Summary

Location:	Morden, MB
Climate Zone:	Zone 7A
Conditioned Area:	450 m^2



Modelling Software:	IES-VE
Energy Standard:	MECB 2024
Building Performance:	3% better than reference
Weather File:	Morden CWEC
Building Use:	Shop
Constructions:	Steel stud, cavity insulation
Mechanical:	MUA w/UHTs & in-floor
FDWR:	32.5%
Fenestration:	Dual pane low-e
Certification Program:	Eff MB NBP ###
Renewables:	-

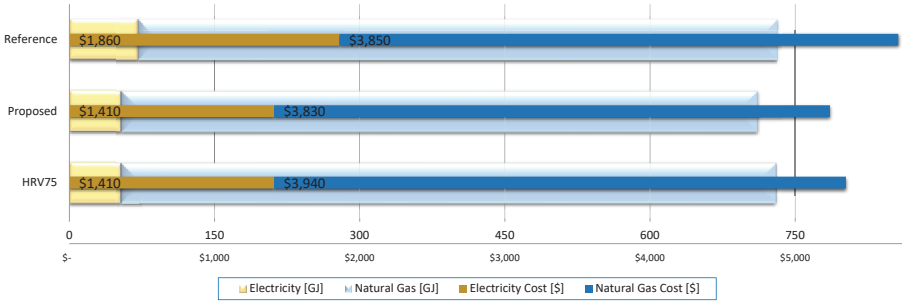
Energy Summary



Energy Use by Category

Total Energy Use:
Prop: 710 GJ/y
Ref: 731 GJ/y

Pass
3% better than energy code reference



Parametric Analyses

Other Data

Thermal Energy Demand Intensity (TEDI)

Proposed	349	kWh/m^2y
Reference	336	kWh/m^2y

Key Takeaway

The building as designed will meet the requirements of the MECB 2024 using the Part 10 Tiered Performance compliance path. Energy performance is 3% below the MECB 2024 reference.

Trade-off analyses are included to show the impact of potential design changes.

1. Introduction

A computer energy model of the proposed Morden Public Works Addition in Morden, MB was created using the IES-VE software package based on the client review drawing package. The software was used to determine the energy performance of the proposed design compared to the Manitoba Energy Code for Buildings (MECB) 2024 reference. This report documents the significant model inputs and assumptions and indicates the potential energy performance of the project. Only the addition is modelled.

The initial building energy model shows the building would perform at 3% better than the MECB 2024 reference. An image of the shell from the IES-VE model is shown in Figure 1-1.

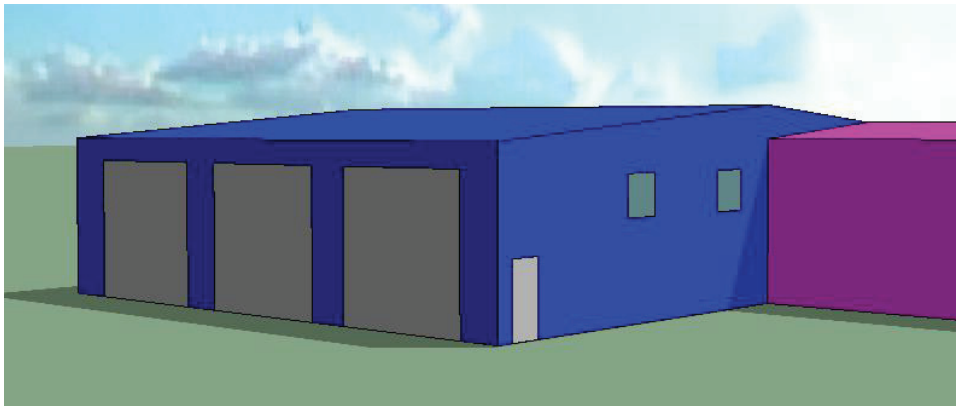


Figure 1-1: IES-VE Model Shell

1.1 Building Overview

The project is a vehicle storage building in Morden, Manitoba. The building provides six vehicle bays. The structure is a single-storey building with a grade level foundation. The conditioned area of the building is 450 m^2. Zone level heating is provided by natural gas unit heaters and/or natural gas hydronic in-floor heat. A natural gas makeup air unit is also included.

1.2 Climate Zone

Climatic data for Morden, MB is used for the energy model. The heating degree day value listed in Appendix C of the National Building Code for Winnipeg is 5400 (base 18°C). The climatic zone used for the project is Zone 7A. The hourly weather file used for the IES-VE energy model is [CAN_MB_MORDEN-CDA-CS_5021849_CWEC.epw].

1.3 Energy-saving Features

Energy-saving features analyzed for the building include the following:

- Energy efficient lighting, exceeding MECB 2024 prescriptive requirements
- Efficient mechanical system
- Good overhead doors

1.4 Summary of Model Parameters

Table 1-1 summarizes the basic model assumptions for the building energy model.

Table 1-1: Model Parameters Summary

Item	Proposed Building	Reference Building	Comments
Walls	EW1: U = 0.431 W/m^{2}K	U = 0.215 W/m^{2}K	Linear thermal bridging impacts included
Roof	R1: U = 0.319 W/m^{2}K	U = 0.121 W/m^{2}K	
Underground Surfaces	Floor: Ueff = 0.095 W/m^{2}K	Floor: Ueff = 0.146 W/m^{2}K	Ueff calculated using the ASHRAE method: Proposed F=0.58 W/m-K Reference F=0.89 W/m-K
Windows	Fixed: U = 2.66 W/m^{2}K	U = 1.73 W/m^{2}K	
Doors	Overhead: U = 0.887 W/m^{2}K Opaque: U = 2.10 W/m^{2}K	U = 1.90 W/m^{2}K	
FDWR	32.5%	30.7%	
Infiltration	0.977 L/s-m^2 facade	0.977 L/s-m^2 facade	
Lighting	As designed	Set to prescriptive levels	
Lighting Controls	As designed	Set to prescriptive	
Exterior Lighting	As designed	Per NECB section 4.2.3	
HVAC System Type	HRV w/UHT & in-floor heat	System 4: Natural gas MUA w/hydronic baseboard	
Heating Equipment Efficiency	UHT: 82% MUA: 92% Boiler: 95%	UHT: 82% Boiler: 90%	
Cooling Equipment Efficiency	-	-	No cooling included
Ventilation	Heat recovery ventilation 60% effective sensible	Ventilation rates equal to proposed Heat recovery ventilation 50% effective sensible	
Service Water Heating System	-	-	No service water heating included
Water Flow Rates	-	-	

1.5 Model Results

Table 1-2 includes a summary of the analyses as produced by the IES-VE model. Figure 1-2 shows the energy summary in graphical form. Costs presenting in these analyses are for comparison between analyzed options and not predictive of energy costs of the building.

Table 1-2: Energy Summary by End Use

Energy Summary by End Use	Energy Type	Proposed Energy [MJ]	Proposed Intensity [MJ/m²]	Reference Energy [MJ]	Reference Intensity [MJ/m²]	Energy Reduction [%]
Lighting	Electricity	16,129	36	20,219	45	0.6%
Misc Equipment	Electricity	23,041	52	23,041	52	0.0%
Space Heating	Natural Gas	656,805	1,469	660,528	1,478	0.5%
Pumps & Aux	Electricity	79	0	629	1	0.1%
Fans	Electricity	8,053	18	2,791	6	-0.7%
Other Electric	Electricity	4,394	10	24,002	54	2.7%
Total Energy		**710,423**	**1,589**	**731,209**	**1,636**	**2.8%**
Thermal Energy Demand Intensity (TEDI)		349 kWh/m²y		336 kWh/m²y		-3.8%
Energy Use Intensity		441 kWh/m²y		454 kWh/m²y		2.8%

Energy and Cost Summary by Fuel	Proposed Energy [MJ]	Proposed Cost [$]	Reference Energy [MJ]	Reference Cost [$]	Percent Savings Energy	Percent Savings Cost
Electricity	53,619 14,900 kWh/y	1,413	70,681 19,600 kWh/y	1,862	24.1%	24.1%
Natural Gas	656,805 17,000 m³/y	3,830	660,528 17,068 m³/y	3,851	0.6%	0.6%
Total	**710,423** 197,340 ekWh/y	**5,242**	**731,209** 203,114 ekWh/y	**5,713**	**2.8%**	**8.2%**

Other Loads Details	Proposed [MJ]	Proposed Cost [$]	Reference [MJ]	Reference Cost [$]	Percent Savings Energy	Percent Savings Cost
Electric						
Exterior Lighting	4,394	116	24,002	632	81.7%	81.7%

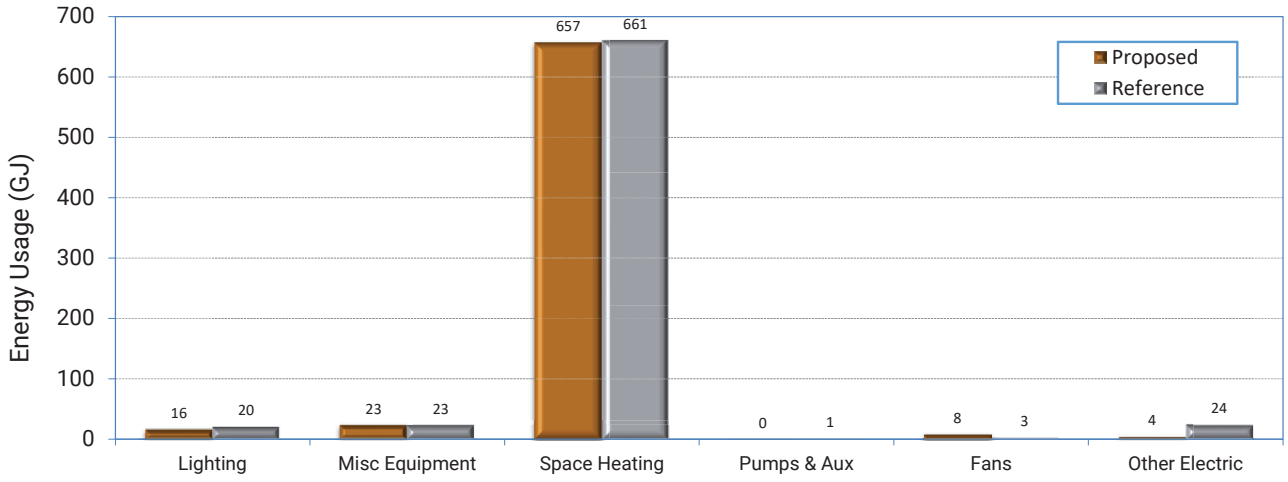


Figure 1-2: Energy by End Use Summary Comparison

2. Zoning

This building addition is modelled as a single zone. Attention was paid to the mechanical system design when determining building zones. Figure 2-1 shows the thermal zones in the energy model.

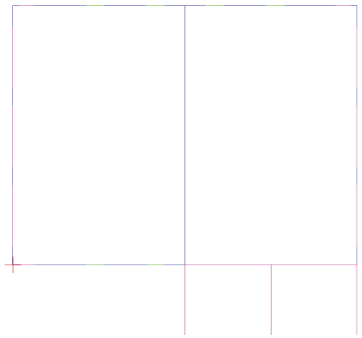


Figure 2-1: Main Floor Zoning Diagram

2.1 Space Functions and Schedules

The entire space is modelled using the MECB 'E' schedule. The default MECB 2024 receptacle power and lighting power density are used for the reference model in all zones. The proposed building model also uses the prescriptive receptacle power density, while lighting power density is based on the actual number and type of luminaires in the lighting design. Occupant density used in both models was determined from the default occupant density for the ASHRAE 62.1 analysis.

3. Envelope

The opaque envelope consists of one wall types, one roof type, and one floor type. One type of window is modelled, as well as two door types.

3.1 Above Ground Envelope Assemblies

All wall and roof dimensions for the modelled building were entered as indicated in the architectural drawings.

Each exterior construction assembly was modelled using the layer by layer approach in IES-VE. In the case of assemblies containing girts and clips which interrupt the insulation layer, the clear field U-value was set based on the NBC, and the insulation layers of the proposed model construction in IES-VE were adjusted to achieve the appropriate overall U-value. Thermal bridging calculations for the top plate, bottom plate, fenestration framing, etc. were calculated based on the details supplied in the drawing package using the Mold 5 software package and entered into the BC hydro enhanced thermal performance spread sheet. This was used to determine the thermal bridging impact to the overall wall assembly U-value. A summary of the exterior construction assemblies used in the model is given in Table 3-1 and more detailed analyses are included in Appendix A.

Table 3-1: Above Ground Opaque Building Assembly U-values

	Assembly Description	Clear Wall U-Value [W/(m²-K)]	Thermal Bridging	Proposed U-Value [W/(m²-K)]	Reference U-Value [W/(m²-K)]
EW1	Metal cladding; 203 Steel girts @~1200oc; Rsi 4.93 Batt insulation; Vapour barrier; Interior metal liner	0.255	Bottom plate 13% Fenestration head 6% Fenestration jamb / sill 21% Corner framing 1%	0.431	0.215
R1	Standing seam roofing; Rsi 1.23 Roll-over insulation; 203 Steel purlins @~1200oc; Rsi 4.93 Batt insulation; Vapour barrier; 19x89 Wood strapping @600oc; Interior metal liner	0.198	Top plate 38%	0.319	0.121

3.2 Windows and Doors

The windows proposed for the project are not specified in the current drawing package. The initial model uses dual pane, non-thermally broken aluminum frames with one low-e coating and argon fill for all windows. No performance information was available for any windows or doors, so ASHRAE Fundamentals values have been used.

The vertical fenestration and door area to gross wall area ratio (FDWR) is 32.5% in the proposed model and 28.9% in the reference model. The reference model FDWR is calculated from the heating degree day value of 5400 included in Appendix C of the NBC for Morden, MB.

Window and door U-Values for the proposed building energy model are listed in Table 3-2. Reference model windows are modelled with U=1.73 W/m²-K and doors use U=1.90 W/m²-K.

Table 3-2: Window and Door U-values

Assembly Description	U-Value Source	Frame Type	Glazing Type	Proposed U-Value [W/(m²-K)]	Shading Coefficient	Visible Transmit-tance
Fixed Windows	ASHRAE Fundamentals	Aluminum w/o Thermal Break	Dual Pane, AR fill, Low e coating	2.66	0.63	0.66
Overhead Doors	ASHRAE Fundamentals	Steel	-	0.887	-	-
Hollow Metal Insulated Doors	ASHRAE Fundamentals	Steel	-	2.10	-	-

3.3 Underground Assemblies

Effective ground contact assembly U-values for both the reference and proposed building energy models are determined using the ASHRAE F-factor adjustment method within the software. Underground wall assemblies are modelled using the layer-by-layer approach. The prescriptive requirement of U=0.757 W/m²-K under the floor perimeter is simulated with an F factor of 0.89 W/m-K.

Table 3-3: Ground Contact Assembly U-values

	Assembly Description	Location	U-Value Source	Proposed F-Factor [W/(m-K)]	Proposed U-Value [W/(m2-K)]	Reference U-Value [W/(m2-K)]
F1	150 Concrete slab; Vapour barrier; 38 Rigid insulation; 150 Comp gravel	At grade	IES material library, NBC	0.58	0.158	0.222

3.4 Infiltration

The MECB 2024 prescribes that infiltration be modelled assuming a field test value of 1.5 L/s-m^2 at 75 Pa. For the proposed and reference model, this value is converted to a value at 5 Pa and transferred to the exterior wall area only. The infiltration rate is the same in both the reference and proposed models.

Infiltration rates at 5 Pa transferred to the exposed vertical wall surfaces of the building are calculated using the following formula:

$$I_{AGW} = \mathrm{C} \times I_{75Pa} \times \frac{S}{A_{AGW}}$$

Where:

C = $(5/75)^n$ where n=0.60 by default
I_{75Pa} = 1.5 L/s-m^2 as per the NECB 2020
S = 1282 m^2 of exterior surface area
A_{AGW} = 388 m^2 of exposed wall area

Resulting in I_{AGW} = 0.977 L/s-m^2 for air leakage on façade areas.

4. Lighting and Interior Loads

A number of loads separate from the mechanical system which impact energy usage have been included in the model. Loads from electrical outlets are modelled as compliance neutral, with rates entered as suggested by the MECB 2024.

4.1 Lighting Power Density

The lighting power density is determined from the lighting quantities indicated on the drawings and power used from the lighting schedule. The reference building lighting power density is set according to the applicable MECB 2024 space type.

4.2 Lighting Controls

Occupancy controls required according to the NECB are included in this preliminary model by reducing the lighting power density as appropriate for each space. Daylighting controls are implemented in IES-VE, automatically accounting for lighting levels on an hourly basis. Additional details on lighting power density and controls for each space are included in Appendix B.

4.3 Exterior Lighting

A site lighting analysis based on NECB section 4.2.3 has been included. Exterior lights are included in the electrical drawing package. The exterior lighting power allowance is indicated in Table 4-1. Lighting energy

is determined by multiplying the lighting power by an average annual usage of 11 hours per day (one half hour after sunset to one half hour before sunrise) to determine annual energy use. The resulting energy use for the reference building is 24,000 MJ and the proposed building 4,400 MJ.

Table 4-1: Exterior Lighting Power Allowance

Location ID	Location Category	Amount	Power Allowance (W)	Installed Power (W)
North Entrances	Building Other doors [46 W/m door width]	1.8 m	83	200
Overhead Doors	Building Other doors [46 W/m door width]	25.6 m	1178	104
Facade	Facade [8.2 W/m]	0 m	-	-
Zone 2	Basic Site Allowance [400 W less facade]		400	-
Total			**1661**	**304**

5. Heating, Ventilation, and Air Conditioning

5.1 Proposed Model HVAC Equipment

Central system equipment in the building includes one makeup air unit and a central boiler providing heating water to radiant in-floor heating. Parameters used in the energy model for this equipment are listed in Table 5-1.

Table 5-1: Proposed Model Central HVAC Parameters

System Name	System Type	Equipment	Fan SP	Efficiency/ Effectiveness
MUA-1	DOAS/UHT	Greenheck DGX-H10	60 Pa	Natural gas: 92%
Boiler	Condensing Boiler	IBC SL-26-260G3	-	Natural gas: 95%

Zone level equipment includes three unit heaters and side wall exhaust fans. Parameters used for system and zone level equipment are listed in Table 5-2.

Table 5-2: Proposed Model HVAC Parameters

System Name	System Type	Schedule	Fan SP	Equipment	Heating	Cooling	Outdoor Air
Workshop UHT-1/-2/-3	UHT	MECB E	75 Pa	Modine HD-125	Natural gas: 82%	None	60% HRV 470 L/s

5.2 Reference Model HVAC Equipment

The reference model HVAC equipment is listed in Table 5-3. The central system equipment consists of a boiler with an efficiency of 90% supplying the hydronic heating loop. Outdoor air rates are equal to the proposed.

Table 5-3: Reference Model HVAC Parameters

System Name	System Type	Schedule	Fan SP	Heating	Cooling	Outdoor Air
Workshop	System 4	MECB E	75 Pa	Unit heater: 82% Baseboard: boiler loop	None	50% HRV 470 L/s

6. Hot Water

6.1 Water Heating Equipment

No domestic hot water loads are included in the design.

7. Parametric Analyses

Table 7-1 includes a summary of the energy results of the parametric analyses as produced by the IES-VE model. Comparisons are made to the MECB 2024 reference building energy model. Figure 7-1 shows the energy and cost impacts in graphical form. The Present Value analysis includes the anticipated energy savings over the lifetime of the particular upgrade but does not include added maintenance costs. Lifetimes used in the PV analysis vary depending on the nature of the change. A discount rate of 2% is assumed for the difference between the anticipated general inflation rate and utility rate increases. Additional analyses may be performed as required.

Table 7-1: Parametric Energy Analysis Summary

	Energy Use							
	Elec. [GJ]	Natural Gas [GJ]	Total [GJ]	Cost [$]	Energy Saving [%]	Cost Saving [%]	Present Value [$]	Potential Eff MB Incentive [$]
Reference	71	661	731	$5,710	-	-	-	-
Proposed	54	657	710	$5,240	2.8%	8.2%	-	$0
HRV75	53	676	730	$5,350	0.2%	6.3%	-$1,900	$0

7.1 Ventilation Air Heat Recovery, O/H Doors

The HRV75 analysis assesses the impact of implementing 75% effective heat recovery in the exhaust system combined with a reduction in performance of the overhead doors.

- Proposed building: 60% effective HRV, OHD U-value: 0.89 W/m^2-K
- Trade-off building: 75% effective HRV, OHD U-value: 1.59 W/m^2-K
- PV analysis lifetime: 15 years
- Energy Impact: increase of 3%
- Cost Impact: increase of $100/y in energy costs

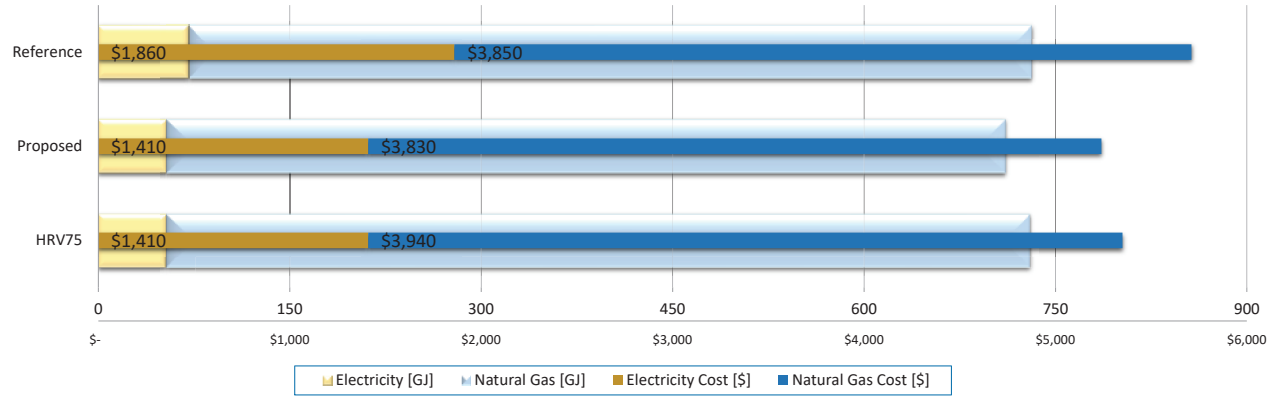


Figure 7-1: Parametric Energy and Cost Comparisons

8. Discussion and Recommendations

The building will meet the requirements of the MECB 2024 using the Part 10 Tiered Performance compliance path as designed. Energy performance is 3% better than the MECB 2024 reference.

The parametric analyses included can be used to assess the value of potential modifications to the design. If the upgrades analyzed can be performed for less than the net present value of the energy savings, or if the potential energy costs are less than the capital savings from the proposed modification, then the option should be considered.

Ventilation air heat recovery with an effectiveness of approximately 75% combined with a lower performing overhead door provides a passing result. The 15 year lifetime energy cost increase is about $2,000. If the incremental savings from this change are more than this amount, it could be considered economically advantageous.

9. Other

9.1 Utility Rates

It is assumed that electricity and natural gas for this building will be provided by MB Hydro. Energy rates have been entered as indicated in Table 9-1. Note that energy cost numbers shown in this report are not meant to predict the energy costs of the facility, by are intended to show relative energy costs compared to the appropriate reference energy model.

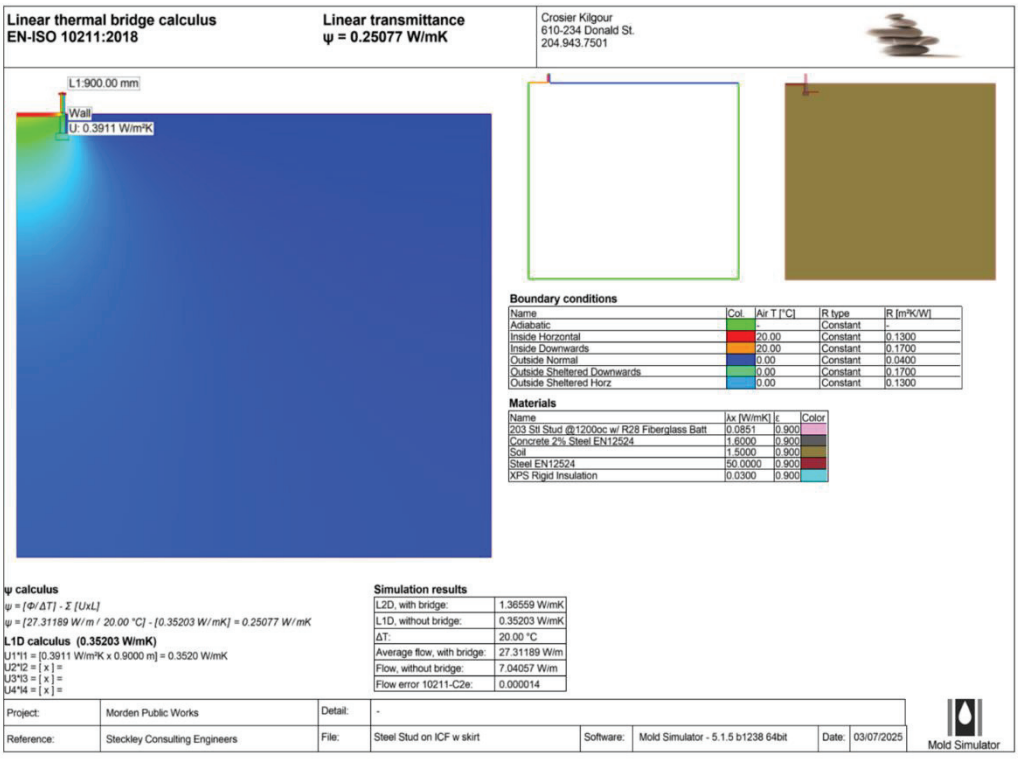
Table 9-1: Utility Rates

Electricity	Manitoba Hydro Rate as of 2024-Apr-1
Energy charge:	
First 11,000 kWh	$0.09485/kWh
Balance of kWh	$0.07277/kWh
Natural Gas	**Manitoba Hydro Small Rate as of 2025-May-1**
Total Rebundled Sales Rate	$0.2326/$m^3$

Kelly Winder, M.Sc., BEMP, P.Eng.

Appendix A: Envelope Calculations

Irregular Thermal Bridging Calculations:



Linear thermal bridge calculus
EN-ISO 10211:2018

Linear transmittance
ψ = 0.25077 W/mK

Crosier Kilgour
610-234 Donald St.
204.943.7501

L1:900.00 mm
Wall
U: 0.3911 W/m²K

Boundary conditions

Name	Col.	Air T [°C]	R type	R [m²K/W]
Adiabatic		-	Constant	-
Inside Horzontal		20.00	Constant	0.1300
Inside Downwards		20.00	Constant	0.1700
Outside Normal		0.00	Constant	0.0400
Outside Sheltered Downwards		0.00	Constant	0.1700
Outside Sheltered Horz		0.00	Constant	0.1300

Materials

Name	λx [W/mK]	ε	Color
203 Stl Stud @1200oc w/ R28 Fiberglass Batt	0.0851	0.900	
Concrete 2% Steel EN12524	1.6000	0.900	
Soil	1.5000	0.900	
Steel EN12524	50.0000	0.900	
XPS Rigid Insulation	0.0300	0.900	

ψ calculus

ψ = [ΦV ΔT] - Σ [UxL]

ψ = [27.31189 W/m / 20.00 °C] - [0.35203 W/mK] = 0.25077 W/mK

L1D calculus (0.35203 W/mK)

U1*l1 = [0.3911 W/m²K x 0.9000 m] = 0.3520 W/mK
U2*l2 = [x] =
U3*l3 = [x] =
U4*l4 = [x] =

Simulation results

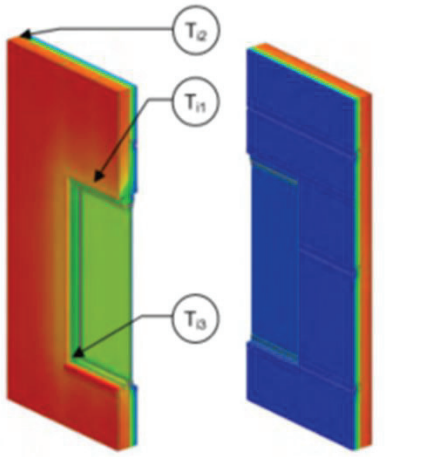
L2D, with bridge:	1.36559 W/mK
L1D, without bridge:	0.35203 W/mK
ΔT:	20.00 °C
Average flow, with bridge:	27.31189 W/m
Flow, without bridge:	7.04057 W/m
Flow error 10211-C2e:	0.000014

Project:	Morden Public Works	Detail:	-				
Reference:	Steckley Consulting Engineers	File:	Steel Stud on ICF w skirt	Software:	Mold Simulator - 5.1.5 b1238 64bit	Date:	03/07/2025

Mold Simulator

Detail 6.3.2

Horizontal Insulated Metal Panel – Window Glazing Transition with Steel Support Framing



View from Interior View from Exterior

Thermal Performance Indicators

Assembly 1D (Nominal) R-Value	R_{1D}	Nominal thermal resistance value of wall
Transmittance / Resistance without Anomaly	U_o, R_o	"clear wall" U and R-value
Transmittance / Resistance	U, R	U- and R-values for overall assembly
Surface Temperature Index[1]	T_I	0 = exterior temperature 1 = interior temperature
Linear Transmittance	Ψ	Incremental increase in transmittance per length of glazing transition

[1]Assumptions and limitations for surface temperatures identified in ASHRAE 1365-RP

Nominal (1D) vs. Assembly Performance Indicators

Base Assembly – Wall

Insulated Panel 1D R-Value (RSI)	R_{1D} ft²·hr·°F / Btu (m² K / W)	R_o ft²·hr·°F / Btu (m² K / W)	U_o Btu/ft²·hr·°F (W/m² K)
R-21.0 (3.70)	R-23.2 (4.09)	R-19.5 (3.43)	0.052 (0.29)

Window Transition Transmittance

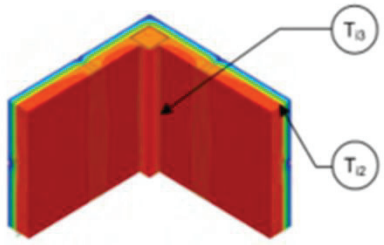
R ft²·hr·°F / Btu (m² K / W)	U Btu/ft²·hr·°F (W/m² K)	Ψ Btu/ft·hr·°F (W/m K)
R-7.5 (1.32)	0.133 (0.75)	0.263 (0.454)

Temperature Indices

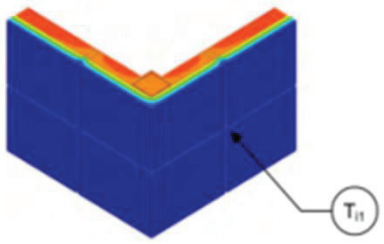
T_{i1}	0.45	Min T on interior panel face, at top track
T_{i2}	0.91	Max T on interior panel face, away from window, between joints
T_{i3}	0.54	Min T on frame, at jamb and sill intersection

Detail 6.5.2

Horizontal Insulated Metal Panel – Corner Intersection with Post and Steel Stud Backup Wall



View from Interior



View from Exterior

Thermal Performance Indicators

Assembly 1D (Nominal) R-Value	R_{1D}	R-2.2 (0.39 RSI) + exterior insulation
Transmittance / Resistance without Anomaly	U_o, R_o	"clear field" U and R-value, without corner
Transmittance / Resistance	U, R	U- and R-values for overall assembly
Surface Temperature Index[1]	T_i	0 = exterior temperature 1 = interior temperature
Linear Transmittance	ψ	Incremental increase in transmittance per length of corner

[1]Assumptions and limitations for surface temperatures identified in ASHRAE 1365-RP

Nominal (1D) vs. Assembly Performance Indicators

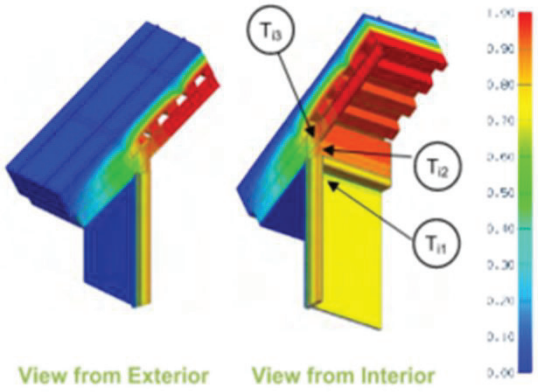
Insulated Panel 1D R-Value (RSI)	R_{1D} $ft^2 \cdot hr \cdot {}^\circ F$ / Btu (m^2 K / W)	R_o $ft^2 \cdot hr \cdot {}^\circ F$ / Btu (m^2 K / W)	U_o Btu/$ft^2 \cdot hr \cdot {}^\circ F$ (W/m^2 K)	R $ft^2 \cdot hr \cdot {}^\circ F$ / Btu (m^2 K / W)	U Btu/$ft^2 \cdot hr \cdot {}^\circ F$ (W/m^2 K)	ψ Btu/$ft \cdot hr \cdot {}^\circ F$ (W/m K)
R-21.0 (3.70)	R-23.2 (4.09)	R-19.5 (3.43)	0.052 (0.29)	R-15.2 (2.68)	0.066 (0.37)	0.037 (0.064)

Temperature Indices

T_{i1}	0.85	Min T on interior panel face, at bolts, at joint intersection
T_{i2}	0.91	Max T on interior panel face, between joints away from corner
T_{i3}	0.92	Min T on interior surfaces, at inner drywall corner

Detail 10.2.6

Exterior Insulated Sloped Metal Roof with Metal Sub-Girts (24" o.c.) Supporting Standing Seam Metal Roof and Curtain Wall – Roof to Wall Intersection with Through Wall Structural Beam and Fully Insulated Soffit



View from Exterior View from Interior

Thermal Performance Indicators

Assembly 1D (Nominal) R-Value	R_{1D}	R-2.5 (0.44 RSI) + exterior insulation
Transmittance / Resistance without Anomaly	U_o, R_o, U_g	"clear field" U- and R-value: o = without curtainwall g = glazing
Transmittance / Resistance	U, R	U and R-values for the combined assembly
Surface Temperature Index[1]	T_i	0 = exterior temperature 1 = interior temperature
Linear Transmittance	Ψ	Incremental increase in transmittance per linear length of curtainwall

[1]Surface temperatures are a result of steady-state conductive heat flow with constant heat transfer coefficients. Limitations are identified in final report.

Nominal (1D) vs. Assembly Performance Indicators

Base Assembly Roof

Roof Insulation 1D R-Value (RSI)	R_{1D} ft²·hr·°F / Btu (m² K / W)	R_o ft²·hr·°F / Btu (m² K / W)	U_o Btu/ft²·hr·°F (W/m² K)
R-36 (6.34)	R-38.5 (6.78)	12.4 (2.18)	0.081 (0.46)

Base Assembly Glazing

$U_{centre\ of\ glass}$ Btu/ft²·hr·°F (W/m² K)	U_g Btu/ft²·hr·°F (W/m² K)
0.321 (1.82)	0.344 (1.95)

Roof to Wall Linear Transmittance

R ft²·hr·°F / Btu (m² K / W)	U Btu/ft²·hr·°F (W/m² K)	Ψ Btu/ft·hr·°F (W/m K)
3.1 (0.55)	0.318 (1.81)	0.365 (0.633)

Temperature Indices

T_{i1}	0.58	Upper corner of glazing
T_{i2}	0.82	Beam at curtain wall interior closure panel
T_{i3}	0.71	Underside of roof deck at beam

Effective Thermal Bridging Calculation Sheets:

BChydro powersmart FORTIS BC

Scenario Description

Create New Worksheet
Copy to New Worksheet
Reset Current WorkSheet

Enhanced Thermal Performance Spread Sheet

SI Units
Change Units

Clear Field Area Method

Select Area Calculation (Choose One)	Area	Units
◉ Sum of Active Clear Field Areas (Default)	387.70	m^2
○ User Defined Area	2136.40	m^2

Overall Opaque Wall Thermal Performance Values

Base Building		Proposed Building	
Opaque USI-Value (W/m^2K)	0.215	Opaque USI-Value (W/m^2K)	0.431
Effective RSI-Value (m^2K/W)	4.7	Effective RSI-Value (m^2K/W)	2.3

Proposed Building Entries

								Totals	167.0	100%
Add/Remove Detail	Transmittance Type	Include	Transmittance Description	Area, Length or Amount Takeoff	Units	Transmittance Value	Units	Source Reference	Heat Flow (W/K)	%Total Heat Flow
Add Clear Field	Clear Field	☑	EW1 Exterior Wall	387.70	m^2	0.255	W/m^2K	NBC	98.9	59%
Add Linear Interface Detail	Linear Interface Detail	☑	Bottom Plate	85.40	m	0.251	W/mK	Mold5	21.4	13%
Remove Linear Interface Detail	Linear Interface Detail	☑	Fenestration Head	22.00	m	0.454	W/mK	BETBG	10.0	6%
Remove Linear Interface Detail	Linear Interface Detail	☑	Fenestration Jamb/Sill	78.00	m	0.454	W/mK	BETBG	35.4	21%
Remove Linear Interface Detail	Linear Interface Detail	☑	Corners	20.00	m	0.064	W/mK	BETBG	1.3	1%

BChydro powersmart FORTIS BC

Scenario Description

Create New Worksheet
Copy to New Worksheet
Reset Current WorkSheet

Enhanced Thermal Performance Spread Sheet

SI Units
Change Units

Clear Field Area Method

Select Area Calculation (Choose One)	Area	Units
◉ Sum of Active Clear Field Areas (Default)	448.07	m^2
○ User Defined Area	2136.40	m^2

Overall Opaque Wall Thermal Performance Values

Base Building		Proposed Building	
Opaque USI-Value (W/m^2K)	0.121	Opaque USI-Value (W/m^2K)	0.319
Effective RSI-Value (m^2K/W)	8.3	Effective RSI-Value (m^2K/W)	3.1

Proposed Building Entries

								Totals	142.8	100%
Add/Remove Detail	Transmittance Type	Include	Transmittance Description	Area, Length or Amount Takeoff	Units	Transmittance Value	Units	Source Reference	Heat Flow (W/K)	%Total Heat Flow
Add Clear Field	Clear Field	☑	R1 Exterior Roof	448.07	m^2	0.198	W/m^2K	NBC	88.7	62%
Add Linear Interface Detail	Linear Interface Detail	☑	Top Plate	85.40	m	0.633	W/mK	BETBG	54.1	38%

Exterior Assembly Effective R-Value Calculations:

Effective Thermal Resistance Calculator

Isothermal-Planes and/or Parallel-Path Flow Method

Assembly Tag:	EW1
Structure Type:	Steel
Cavity Insulated Steel:	Yes
Assembly Orientation:	Wall
Adjacent to:	Exterior

Description:

Exterior air film $R_{(si)}$	0.03
Interior air film $R_{(si)}$	0.12

Catagory	Material	Custom Material Thickness (mm)	Listed Material Thickness (mm)	Material Conductance W/mK	Thermal Resistance of Material (m² K)/W
Cladding Materials	Metal or vinyl siding over sheathing: Hollow-backed		0	0.000	0.11
Structural Materials	Steel stud, galvanized sheet	203		62.112	0.00
Insulating Materials	R28 - rock or glass mineral fibre (batt and blanket)		178/216		4.93
Cladding Materials	Metal or vinyl siding over sheathing: Hollow-backed		0	0.000	0.11

Assembly Thickness: 203.0 mm

U-Value $_{(SI)}$: 0.255 W/m^2K

R-Value $_{(SI)}$: 3.92 m^2K/W

Effective Thermal Resistance Calculator

Isothermal-Planes and/or Parallel-Path Flow Method

Assembly Tag:	R1
Structure Type:	Steel
Cavity Insulated Steel:	Yes
Assembly Orientation:	Roof
Adjacent to:	Exterior

Description:

Exterior air film $R_{(si)}$	0.03
Interior air film $R_{(si)}$	0.11

Catagory	Material	Custom Material Thickness (mm)	Listed Material Thickness (mm)	Material Conductance W/mK	Thermal Resistance of Material (m² K)/W
Cladding Materials	Metal or vinyl siding over sheathing: Hollow-backed		0	0.000	0.11
Insulating Materials	Glass fibre loose fill insulation for attics (CAN/ULC-S7(	51		0.053	0.96
Structural Materials	Steel stud, galvanized sheet	203		62.112	0.00
Insulating Materials	R28 - rock or glass mineral fibre (batt and blanket)		178/216		4.93
Air Cavities	ceiling air cavity 20 mm		20	0.133	0.15
Cladding Materials	Metal or vinyl siding over sheathing: Hollow-backed		0	0.000	0.11

Assembly Thickness: 274.0 mm

U-Value $_{(SI)}$: 0.198 W/m^2K

R-Value $_{(SI)}$: 5.04 m^2K/W

Appendix B: Interior Space Loads

Room Name	NECB Space Type	Area (m^2)	NECB Table LPD	Reference Controls	Proposed LPD (W/m^2)	Proposed Controls	Equip Power Density	Occupancy
Morden Public Works	Vehicle maintenance area	446.5	6.5		3.5		5.0	22
OC = Occupancy Sensor DL = Daylight Sensor								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