

MECHANICAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS FOR THIS PROJECT.

1. CONFORM WITH APPLICABLE REQUIREMENTS OF THE MINISTRY OF LABOUR, AND THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
2. DO COMPLETE INSTALLATION IN ACCORDANCE WITH THE FOLLOWING:
 1. ONTARIO BUILDING CODE (OBC);
 2. ASHRAE;
 3. SMACNA;
 4. NFPA;
 5. ALL OTHER RELEVANT CODES AND STANDARDS, AS APPLICABLE.
3. OBTAIN ALL PERMITS REQUIRED FOR THE INSTALLATION OF MECHANICAL TRADES WORK, ARRANGE FOR INSPECTIONS AND TESTS, AND PAY ALL FEES AND COSTS FOR THE PERMITS, INSPECTIONS AND FEES. OBTAIN PERMITS IMMEDIATELY AFTER NOTIFICATION OF AWARD OF CONTRACT.
4. PROVIDE DIGITAL AND HARD COPY OF COMPLETE OPERATING AND MAINTENANCE INSTRUCTIONS FOR EQUIPMENT FURNISHED UNDER THIS CONTRACT. BIND INSTRUCTIONS IN 3-RING BINDERS. INCLUDE THE FOLLOWING:
 1. SCHEMATIC DIAGRAM OF ELECTRICAL SYSTEMS.
 2. CONTROL SHOP DRAWINGS AND OPERATING SEQUENCE INCLUDING WIRING OF COMPONENTS.
 3. WIRING DIAGRAM OF CONTROL PANELS.
 4. OPERATING INSTRUCTIONS, INCLUDING START-UP AND SHUT-DOWN PROCEDURE.
 5. MAINTENANCE INSTRUCTIONS INCLUDING PREVENTIVE MAINTENANCE INSTRUCTIONS FOR COMPONENTS OF THE EQUIPMENT.
 6. COMPLETE PARTS LIST OF ASSEMBLIES AND THEIR COMPONENT PARTS, SHOWING MANUFACTURER'S NAME, CATALOGUE NUMBER, AND NEAREST REPLACEMENT SOURCE.
 7. LIST OF RECOMMENDED SPARE PARTS AND QUANTITY OF EACH ITEM TO BE STOCKED.
 8. MANUFACTURERS' WARRANTIES AND GUARANTEES.
5. CLEAN ALL MECHANICAL SYSTEMS AT PROJECT COMPLETION.
6. COMPLETE AS-BUILT DRAWINGS SHOWING ALL CHANGES AS WORK PROGRESSES.

1. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THE "TRADE QUALIFICATION AND APPRENTICESHIP ACT" AND REGULATIONS, BY PERSONS WHO HOLD THE FOLLOWING CERTIFICATES OF QUALIFICATION (AS APPLICABLE):
 1. PLUMBER;
 2. REFRIGERATION & AIR CONDITIONING SYSTEMS MECHANIC;
 3. SHEET METAL WORKER.
2. ALL FUELS-RELATED WORK TO BE CARRIED OUT IN ACCORDANCE WITH TSSA REQUIREMENTS AND ONTARIO REGULATION 215/01, "FUEL INDUSTRY CERTIFICATES" BY PERSONS WHO HOLD THE APPROPRIATE CERTIFICATE FOR THE WORK BEING PERFORMED.

- .1 LOCATE AND PROTECT ALL EXISTING EXTERIOR SITE SERVICES.
- .2 RETAIN AND PROTECT ALL EXISTING INTERIOR SERVICES AND BUILDING FABRIC. MAKE GOOD ANY AND ALL DAMAGE RESULTING FROM THIS WORK.
- .3 CONNECTIONS TO EXISTING SERVICES SHALL BE COORDINATED WITH THE OWNER.
- .4 EXECUTE WORK WITH LEAST POSSIBLE INTERFERENCE OR DISTURBANCE TO NORMAL USE OF THE EXISTING BUILDING.
- .5 EXISTING SANITARY PIPING:
 - .1 PERFORM A CAMERA INSPECTION OF THE EXISTING SANITARY PIPE TO CONFIRM EXISTING SANITARY PIPE SIZE, LOCATION AND CONDITION. REPORT ANY PIPE BLOCKAGES, INADEQUATE SLOPES, LOW SPOTS, AND POOR CONDITION TO ENGINEER, FOR COMMENT AND DIRECTION.
 - .2 FLOOR CUTTING:
 - .1 CONDUCT THERMAL IMAGING OF THE FLOOR IN ALL AREAS OF FLOOR CUTTING AND REMOVAL TO LOCATE BURIED ELECTRICAL SERVICES (IF ANY).
 - .2 CAREFULLY SAWCUT FLOOR TO PERMIT INSTALLATION OF NEW SANITARY PIPING.
 - .3 REINSTATE FLOOR TO ORIGINAL CONDITION, FOLLOWING INSTALLATION OF NEW PLUMBING.

- .1 EXECUTE CUTTING, FITTING AND PATCHING REQUIRED TO MAKE THE WORK FIT PROPERLY TOGETHER. CUT AND PATCH FOR PROCESS, MECHANICAL AND ELECTRICAL WORK.
- .2 COORDINATE WORK WITH OTHER TRADES SO THAT THERE IS A MINIMUM OF CUTTING, FITTING AND PATCHING.
- .3 DRILLING, CUTTING, FITTING AND PATCHING AND MAKING GOOD WHERE NECESSARY DUE TO FAILURE TO DELIVER ITEMS TO BE BUILT IN TIME OR INSTALLATION IN WRONG LOCATION, SHALL BE EXECUTED AS DIRECTED AT NO COST TO THE OWNER.
- .4 DRILLING AND CUTTING OF LOAD BEARING STRUCTURAL MEMBERS SHALL BE DONE ON PRIOR EXPRESS WRITTEN PERMISSION OF THE ENGINEER FOR EACH INSTANCE.
- .5 CUT HOLES ACCURATELY, WITH SMOOTH, TRUE, CLEAN EDGES. FIT UNITS TO TOLERANCES TO BEST STANDARD PRACTICE FOR APPLICABLE WORK.
- .6 HOLES IN BLOCK AND CONCRETE WORK SHALL BE SAWCUT OR CORE-DRILLED, AND SHALL NOT BE MADE WITH A HAMMER GUN.
- .7 PATCHED WORK SHALL BE INVISIBLE, SIZE HOLES AND OPENINGS FOR PIPES SO AS TO ALLOW FOR EXPANSION AND CONTRACTION OF SUCH PIPES.

- .1 PROVIDE SHOP DRAWINGS AND PRODUCT DATA FOR ALL MECHANICAL FIXTURES AND EQUIPMENT FOR APPROVAL, PRIOR TO PROCUREMENT.
- .2 INSTALL ALL MECHANICAL FIXTURES AND EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
- .3 LOCATE ALL EQUIPMENT WITH CLEARANCES, AS REQUIRED BY THE MANUFACTURER, THE FUEL CODES, AND ALL OTHER CODES AND REGULATIONS, INCLUDING THE FOLLOWING CLEARANCES:
 - .1 PROPER EQUIPMENT OPERATION;
 - .2 TO PERMIT SUFFICIENT AIRFLOW AROUND EQUIPMENT;
 - .3 FOR EQUIPMENT SERVICE;
 - .4 SUFFICIENT DISTANCE FROM COMBUSTIBLE MATERIAL;
 - .5 WITH SUFFICIENT VENT CLEARANCES;
 - .6 SUFFICIENT DISTANCE FROM ROOF EDGES OR OTHER HAZARDS;
 - .7 SERVICE PLATFORMS FOR APPLIANCES INSTALLED 10 FT OR MORE ABOVE FLOOR;
 - .8 WITH FIXED ACCESS TO ROOF.

1 GENERAL:
.1 CONFORM TO REQUIREMENTS OF MECHANICAL GENERAL REQUIREMENTS AND SPECIFICATIONS.

.1 STEEL PIPE TO ASTM A53, GRADE B.
.2 TO NPS 6, SCHEDULE 40, GROOVED END

.1 VICTAULIC QUICKVIC #107H RIGID COUPLINGS FOR STEEL, TEMPERATURE RANGE -30 degF to 250 degF.

.2 VICTAULIC GROOVED END FITTINGS.

- .1 GLOBE VALVES:
 - .1 CIRCUIT BALANCING:
 - .1 DUCTILE IRON BODY AND SEAT, EPDM SEAL.
 - .2 NPS 2 AND UNDER – THREADED END.
 - .3 NPS 2-1/2 AND OVER – GROOVED END.
 - .4 VICTAULIC TA SERIES 78.

.1 STAINLESS STEEL, BODY, END CAP AND BALL, WITH GROOVED ENDS.
.2 VICTAULIC SERIES 726S.

.1 DIAL TYPE, 0-100 PSI, CAST ALUMINUM, 4-1/2" DIAL, BRASS MOVEMENT, STAINLESS STEEL RING, 1% ACCURACY, TO ASME B40.100.

.2 TRERICE 600CB.

1. GENERAL CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR COORDINATING MECHANICAL SERVICES AND CONNECTIONS FOR ALL EQUIPMENT, SUPPLIED BY MECHANICAL OR ANY OTHER TRADES.
2. MAKE ALL MECHANICAL SERVICE CONNECTIONS TO EQUIPMENT SUPPLIED BY OTHERS.
3. CONFIRM ALL SERVICE CONNECTIONS WITH MANUFACTURER AND SUPPLIER, PRIOR TO INSTALLATION. THIS SHALL INCLUDE ALL CONNECTION SIZES, LOCATIONS AND DETAILS, AND SHALL TAKE INTO ACCOUNT EQUIPMENT CLEARANCES AND INSTALLATION REQUIREMENTS.

- .1 PROVIDE DIELECTRIC UNIONS AT ALL PIPING LOCATIONS WHERE DISSIMILAR METALS ARE JOINED.
- .2 PROVIDE ESCUTCHEONS ON ALL PIPES PASSING THROUGH WALLS, PARTITIONS, FLOORS AND CEILING: CHROME, NICKEL PLATED BRASS OR TYPE 302 STAINLESS STEEL.

- .1 SUPPLY ACCESS DOORS, AS REQUIRED IN DUCTWORK AND WALL/CEILING ASSEMBLIES, TO ALL CONCEALED MECHANICAL EQUIPMENT AND OPERATING DEVICES. ACCESS DOORS IN WALL/CEILING ASSEMBLIES TO BE INSTALLED BY OTHER TRADES.
- .2 ACCESS DOORS SHALL BE FIRE-RATED TYPE, WHERE USED IN FIRE-RATED ASSEMBLIES, AND SHALL MATCH THE RATING OF THE ASSEMBLY.

- .1. INSTALL IN ACCORDANCE WITH THERMAL INSULATION ASSOCIATION OF CANADA (TIAC) NATIONAL STANDARDS.
- .2. MAX. FLAME SPREAD RATING: 25.
- .3. MAX. SMOKE DEVELOPED RATING: 50.
- .4. DOMESTIC COLD WATER (DCW):
 - .1. 1" RIGID MOULDED MINERAL FIBRE WITH VAPOUR RETARDER JACKET.
 - .2. INSULATE ALL PIPING IN FLOORS, WALLS AND CEILINGS, TO POINT OF FIXTURE CONNECTIONS.
- .5. DOMESTIC HOT WATER (DHW):
 - .1. 1" RIGID MOULDED MINERAL FIBRE FOR PIPING UP TO 1-1/4" SIZE
 - .2. 1-1/2" RIGID MOULDED MINERAL FIBRE FOR PIPING 1-1/2" TO 3" SIZE.
 - .3. INSULATE ALL PIPING IN FLOORS, WALLS AND CEILINGS, TO POINT OF FIXTURE CONNECTIONS.
- .6. OUTER JACKET:
 - .1. CONCEALED LOCATIONS: ALL SERVICE JACKET.
 - .2. EXPOSED LOCATIONS: PVC JACKET.
 - .3. MECHANICAL/SERVICE ROOMS: PVC JACKET.

1. ABOVE GROUND: COPPER TUBE, HARD DRAWN, TYPE L. CAN. OR US MANUFACTURE, INCLUDING FITTINGS. LEAD FREE SOLDER.
2. WATER SUPPLY PIPING IS SHOWING SCHEMATICALLY. ALL PIPING SHALL BE CONCEALED UNLESS OTHERWISE NOTED.
3. INSTALL TUBING CLOSE TO BUILDING STRUCTURE TO MINIMIZE FURRING, CONSERVE HEADROOM AND SPACE. GROUP EXPOSED PIPING AND RUN PARALLEL TO WALLS.
4. ISOLATE ALL EQUIPMENT, FIXTURES AND BRANCHES WITH VALVES.
5. TEST WATER SYSTEM AT 1 1/2 TIMES SYSTEM OPERATING PRESSURE OR MINIMUM 860 KPA, WHICHEVER IS GREATER. TEST PRESSURE AND TIMEFRAME SHALL BE AS REQUIRED BY OBC 7.3.7.2.
6. FLUSH OUT, DISINFECT AND RINSE SYSTEM, PRIOR TO CONSTRUCTION COMPLETION.
7. WATER HEATERS:
 1. SHALL BE PIPED WITH HEAT TRAPS ON THE INLET AND OUTLET PIPING, AS CLOSE AS PRACTICAL TO THE TANK, IN ACCORDANCE WITH OBC 12.3.1.4.
 2. TEMPERATURE AND PRESSURE RELIEF VALVES:
 1. MAXIMUM TEMPERATURE SETTING OF 210F (99F);
 2. MAXIMUM PRESSURE SETTING OF 150 PSI;
 3. DISCHARGE PER OBC 7.6.1.1.2:
 1. TERMINATE WITH AN INDIRECT CONNECTION PIPED TO FLOOR DRAIN, SUMP OR OTHER SAFE LOCATION, WITH A 300mm AIR BREAK, OR
 2. TERMINATE AT A DISTANCE NOT LESS THAN 150mm AND NOT MORE THAN 300mm FROM A FLOOR AND DISCHARGE VERTICALLY DOWN.
8. TRAP SEAL PRIMERS AND ACCESS TO THEM, SHALL BE LOCATED IN THE WASHROOM OR AREA THAT THEY SERVE.

1. BELOW GROUND/FLOOR:
 - 1.1 PVC DWV, TYPE SDR26 SDR35.
2. ABOVE GROUND:
 1. COPPER, TYPE DWV.
 2. PVC DWV SOLID WALL SCHEDULE 40, CERTIFIED TO CAN/CSA STANDARD B181.2, FOR NONCOMBUSTIBLE CONSTRUCTION (FLAME-SPREAD RATING NOT MORE THAN 25 AND SMOKE DEVELOPED CLASSIFICATION NOT MORE THAN 50 PER CAN/ULC-S102.2 – PLenums AND HIGH BUILDINGS).
3. PROVIDE CLEANOUTS AS REQUIRED BY THE ONTARIO BUILDING CODE.
4. VENT COMPLETE PLUMBING SYSTEM IN ACCORDANCE WITH THE ONTARIO BUILDING CODE.

- .1 RECTANGULAR DUCT
 - .1 RIGID GALVANIZED STEEL, LOCK FORMING QUALITY TO ASTM A653/A653M
 - .2 THICKNESS, FABRICATION, REINFORCEMENT AND SUPPORT/ATTACHMENT TO ASHRAE OR SMACNA.
- .2 ROUND DUCT
 - .1 RIGID GALVANIZED STEEL, LOCK FORMING QUALITY TO ASTM A653/A653M
 - .2 THICKNESS, FABRICATION, REINFORCEMENT AND SUPPORT/ATTACHMENT TO ASHRAE OR SMACNA.
 - .3 FLEXIBLE BRANCH DUCT (PERMITTED WITHIN 2in/6ft FROM OUTLET):
 - .1 ALL METAL TYPE: TRIPLE LOCK, ALUMINUM CORRUGATED DUCT, MANUFACTURED USING AN ALUMINUM STRIP, WHICH IS SPIRALLY WOUND AND MECHANICALLY JOINED TOGETHER FORMING AN AIR TIGHT AND LEAKPROOF SEAM.
- .3 SEAL CLASSIFICATION:
 - .1 CLASS A: LONGITUDINAL SEAMS, TRANSVERSE JOINTS, DUCT WALL PENETRATIONS AND CONNECTIONS MADE AIRTIGHT WITH SEALANT AND TAPE.
- .4 SEALANT: OIL RESISTANT, POLYMER TYPE FLAME RESISTANT DUCT SEALANT.
- .5 TAPE: POLYVINYL TREATED, OPEN WEAVE FIBERGLASS TAPE, 2" WIDE.
- .6 FITTINGS
 - .1 FABRICATION: TO SMACNA.
 - .2 RADIUS ELBOWS
 - .1 RECTANGULAR: STANDARD WITH CENTRELINE RADIUS 1.5 TIMES DUCT DIMENSION, WITH SINGLE THICKNESS TURNING VANES.
 - .2 ROUND: FIVE PIECE WITH CENTRELINE RADIUS 1.5 TIMES DIAMETER.
 - .3 MITRED ELBOWS, RECTANGULAR: WITH DOUBLE THICKNESS TURNING VANES.

5-1/2" RIGID STRAIGHT OR ANGLE, VALOX CASE, BRASS STEM, WITH STAINLESS STEEL THERMOWELL, 30 deg.F TO 240 deg.F., 2% ACCURACY.
TRERICE HT30/31.

THERMOPLASTIC WITH BRASS BASE, 90 PSI AND 230 deg.F. OPERATING RATINGS, WITH ISOLATION VALVE.
HONEYWELL BRAUKMANN EA122A1002.

INSTALL IN ACCORDANCE WITH THERMAL INSULATION ASSOCIATION OF CANADA (TIAC) NATIONAL STANDARDS.

MAX. FLAME SPREAD RATING: 25.

MAX. SMOKE DEVELOPED RATING: 50.

HYDROKING HEATING:

- .1 2" RIGID MOULDED MINERAL FIBRE WITHOUT VAPOUR RETARDER JACKET ON HWS AND HWR PIPING AND HEADS IN MECHANICAL ROOMS.
- .2 1" RIGID MOULDED MINERAL FIBRE WITHOUT VAPOUR RETARDER JACKET ON ALL NEW BRANCH PIPING.
- .3 OUTER JACKET:
 - .1 CONCEALED LOCATIONS: ALL SERVICE JACKET.
 - .2 EXPOSED LOCATIONS: PVC JACKET.
 - .3 MECHANICAL/SERVICE ROOMS: PVC JACKET.

1. HOT WATER HEATING SUPPLY:
 .1 BACKGROUND COLOUR: YELLOW;
 .2 TEXT AND ARROW COLOUR: BLACK;
 .3 LABEL: "HEATING SUPPLY" 50mm HIGH AT PIPE CHANGE OF DIRECTION AND 3m INTERVALS;
 .4 DIRECTIONAL ARROWS: 100mm LONG x 50mm HIGH, AT PIPE CHANGE OF DIRECTION AND 3m INTERVALS;

2. HOT WATER HEATING RETURN:
 .1 BACKGROUND COLOUR: YELLOW;
 .2 TEXT AND ARROW COLOUR: BLACK;
 .3 LABEL: "HEATING RETURN" 50mm HIGH AT PIPE CHANGE OF DIRECTION AND 3m INTERVALS;
 .4 DIRECTIONAL ARROWS: 100mm LONG x 50mm HIGH, AT PIPE CHANGE OF DIRECTION AND 3m INTERVALS;

1. RECTANGULAR MAIN MAIN BRANCH: WITH RADIUS ON BRANCH 1.5 TIMES WIDTH OF DUCT 45 DEGREES ENTRY ON BRANCH.
2. ROUND MAIN AND BRANCH: ENTER MAIN DUCT AT 45 DEGREES WITH CONICAL CONNECTION.
3. PROVIDE VOLUME CONTROL DAMPER IN BRANCH DUCT NEAR CONNECTION TO MAIN DUCT.
4. MAIN DUCT BRANCHES: WITH SPLITTER DAMPER.
8. TRANSITIONS:
 1. DIVERGING: 20 DEGREES MAXIMUM INCLUDED ANGLE.
 2. CONVERGING: 30 DEGREES MAXIMUM INCLUDED ANGLE.
9. FIRE STOPPING
 1. RETAINING ANGLES AROUND DUCT, ON BOTH SIDES OF FIRE SEPARATION IN ACCORDANCE WITH SECTION.
 2. FIRE STOPPING MATERIAL AND INSTALLATION MUST NOT DISTORT DUCT.
10. DAMPERS:
 1. MANUFACTURE TO SMACNA STANDARDS.
 2. SPLITTER DAMPERS:
 1. FABRICATE FROM SAME MATERIAL AS DUCT BUT ONE SHEET METAL THICKNESS HEAVIER, WITH APPROPRIATE STIFFENING.
 2. DOUBLE THICKNESS CONSTRUCTION.
 3. CONTROL ROD WITH LOCKING DEVICE AND POSITION INDICATOR.
 4. ROD CONFIGURATION TO PREVENT END FROM ENTERING DUCT.
 5. PIVOT: PLANO HINGE.
 6. FOLDED LEADING EDGE.
 3. SINGLE BLADE DAMPERS:
 1. FABRICATE FROM SAME MATERIAL AS DUCT, BUT ONE SHEET METAL THICKNESS HEAVIER. V-GROOVE STIFFENED.
 2. SIZE AND CONFIGURATION TO RECOMMENDATIONS OF SMACNA.
 3. LOCKING QUADRANT (WITH SHAFT EXTENSION TO ACCOMMODATE INSULATION THICKNESS, IF REQUIRED).
 4. INSIDE AND OUTSIDE NYLON END BEARINGS.
 5. CHANNEL FRAME OF SAME MATERIAL AS ADJACENT DUCT, COMPLETE WITH ANGLE STOP.
 4. MULTI-BLADED DAMPERS:
 1. FACTORY MANUFACTURED OF MATERIAL COMPATIBLE WITH DUCT.
 2. OPPOSED BLADE: CONFIGURATION, METAL THICKNESS AND CONSTRUCTION TO RECOMMENDATIONS OF SMACNA.
 3. BEARINGS: PIN IN BRONZE BUSHINGS.
 4. LINKAGE: SHAFT EXTENSION WITH LOCKING QUADRANT.
 5. CHANNEL FRAME OF SAME MATERIAL AS ADJACENT DUCT, COMPLETE WITH ANGLE STOP.
11. DUCT LEAKAGE: IN ACCORDANCE WITH SMACNA HVAC AIR DUCT LEAKAGE TEST MANUAL.
12. ALL DUCT AND SEAL MATERIALS TO HAVE A FLAME SPREAD RATING OF LESS THAN 25 AND A SMOKE DEVELOPED CLASSIFICATION OF LESS THAN 50.
13. PROVIDE FLEXIBLE CONNECTIONS AT ALL EQUIPMENT DUCT CONNECTION POINTS.
14. SOUND CONTROL:
 1. ALL SUPPLY AIR BRANCH DUCT LOCATIONS SHOWN ARE SCHEMATIC.
 2. ALL SUPPLY AIR BRANCH DUCTS SHALL BE SEPARATED BY A MINIMUM HORIZONTAL DISTANCE OF 2X THE BRANCH DUCT DIAMETER TO MINIMIZE SOUND TRANSFER.

1 ALL ROOF CURBS SHALL:

2 BE SEISMICALLY DESIGNED;

3 BE SLOPED TO ACCOMMODATE ROOF SLOPE, AS REQUIRED;

4 EXTEND A MINIMUM OF 400 mm (16") ABOVE THE FINISHED ROOF SURFACE.

- .1. REFER TO DRAWING FOR DUCT THAT IS IDENTIFIED TO BE INSULATED.
- .2. INSTALL IN ACCORDANCE WITH THERMAL INSULATION ASSOCIATION OF CANADA (TIAC) NATIONAL STANDARDS.
- .3. MAX. FLAME SPREAD RATING: 25.
- .4. MAX. SMOKE DEVELOPED RATING: 50.
- .5. THERMAL INSULATION - RECTANGULAR DUCT:
 - .1. 1" (R4.3) RIGID MINERAL FIBRE BOARD WITH VAPOUR RETARDER JACKET.
 - .2. ALUMINUM JACKET WITH MOISTURE BARRIER.
- .6. THERMAL INSULATION - ROUND DUCT:
 - .1. 1" (R3.1) MINERAL FIBRE BLANKET WITH VAPOUR RETARDER JACKET.
 - .2. ALUMINUM JACKET WITH MOISTURE BARRIER.

1. MECHANICAL CONTRACTOR RESPONSIBILITY:
 1. REFER TO ARCHITECTURAL DRAWINGS, TO VERIFY LOCATION OF ALL FIRE SEPARATIONS AND FIRE-RATED MEMBRANES.
 2. PROVIDE DRAWINGS FROM HLIT1 AND/OR 3M FOR FIRE PROTECTION OF ALL PIPING, DUCT AND MECHANICAL ITEMS PENETRATING OR PASSING THROUGH A FIRE SEPARATION OR FIRE-RATED ASSEMBLY, FOR REVIEW BY ARCHITECT AND ENGINEER.
 3. ALL PIPING, DUCT AND MECHANICAL ITEMS SHALL BE TIGHTLY FITTED AND SEALED WITH FIRESTOPPING MATERIAL AT ALL FIRE SEPARATIONS AND FIRE-RATED MEMBRANES.
2. ALL PIPING SHALL BE TIGHTLY FITTED AND SEALED WITH FIRESTOPPING MATERIAL AT ALL FIRE SEPARATIONS AND FIRE-RATED MEMBRANES.
3. FIRE DAMPERS:
 1. FIRE DAMPERS SHALL BE CAN/ULC-S112 (STANDARD METHOD OF FIRE TEST OF FIRE DAMPER ASSEMBLIES) LISTED AND LABELLED.
 2. FIRE DAMPERS SHALL BE NFPA 90 (STANDARD FOR FIRE DOORS AND OTHER OPENING PROTECTIVES), NFPA 90A (STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND VENTILATING SYSTEMS), AND NFPA 101 (LIFE SAFETY CODE) COMPLIANT.
 3. DUCTWORK SHALL BE FITTED WITH FIRE DAMPERS AT ALL FIRE SEPARATIONS AND FIRE-RATED MEMBRANES.
 4. SUPPLY AND INSTALL ACCESS DOORS IN ARCHITECTURAL FINISH (WALL, CEILING OR FLOOR) TO ACCESS DUCT, IN COMMON AREA WHERE POSSIBLE.
 5. SUPPLY AND INSTALL TIGHTLY-FITTED ACCESS DOOR IN DUCT TO ACCESS, INSPECT AND RESET FIRE DAMPER.
 6. TYPES - DYNAMIC - FOR USE IN AIR HANDLING SYSTEMS THAT DO NOT SHUTDOWN UPON FIRE ALARM.
 7. RATING: 1-1/2 HR (30MIN TO 2HR FIRE RESISTANCE RATING).
4. ALL MECHANICAL MATERIALS USED WITHIN CEILING RETURN AIR PLenums SHALL HAVE FLAME-SPREAD RATING NOT MORE THAN 25 AND SMOKE DEVELOPED CLASSIFICATION NOT MORE THAN 50 PER CAN/ULC-S102.2.

PROVIDE 48 HR WRITTEN NOTICE TO ENGINEER OF DATE AND TIME OF TESTS.
INSULATE AND CONCEAL WORK ONLY AFTER TESTING AND APPROVAL BY ENGINEER.
MAINTAIN TEST PRESSURE IN PIPING FOR A MINIMUM OF 4 HOURS.

AT BEGINNING OF PROJECT, ISOLATE HYDRONIC ZONE PIPING THAT LEAVES BOILER ROOM, TO PREVENT CONTAMINATION.

FLUSH AND CLEAN ALL NEW WORK WITHIN BOILER ROOM WITH CLEANING CHEMICALS DESIGNED TO REMOVE DEPOSITS FROM CONSTRUCTION, INCLUDING LUBRICANTS, OILS, LOOSE MILL SCALE AND OTHER DELETERIOUS MATERIALS.

FLUSH AFTER PRESSURE TEST.

FLUSHING WATER SHALL BE TAKEN FROM BUILDING POTABLE SUPPLY.

FLUSH WATER SHALL CONTAIN A CORROSION INHIBITOR AND A BIOCIDES AT LEVELS SUFFICIENT TO PREVENT CORROSION AND KILL BACTERIA IN SYSTEM.

ALL NEW PIPING SHALL BE PASSIVATED WITH TREATMENT CHEMICALS APPROVED FOR THIS PURPOSE, AND TO PROVIDE A PROTECTIVE LAYER AGAINST CORROSION.

REFILL COMPLETE SYSTEM (INCLUDING ZONE PIPING) AT END OF FLUSHING AND CIRCULATE FOR A MINIMUM OF 4 HOURS. CLEAN OUT STRAINERS AND DRAIN COMPLETE SYSTEM.

REFILL SYSTEM WITH CLEAN WATER ADDING TREATMENT CHEMICALS SUPPLIED BY OWNER TO MEET EXISTING TREATMENT PROGRAM.

1. PREPARE MOCK-UPS OF TYPICAL FIRESTOP INSTALLATION OF THE FOLLOWING, FOR REVIEW AND APPROVAL BY THE OWNER, ENGINEER AND MUNICIPAL BUILDING INSPECTOR:

2. DCW AND CHW PIPING – WALL AND CEILING/FLOOR FIRE SEPARATION.

3. FIRE DAMPER INSTALLATION – WALL AND CEILING/FLOOR FIRE SEPARATION.

4. ALL FIRESTOP INSTALLATIONS SHALL BE COMPLETED IN ACCORDANCE WITH THE APPROPRIATE PRODUCT INSTALLATION INSTRUCTIONS, AND THE REFERENCED U/LC/LC LISTING AND/OR TEST STANDARD.

5. SUPPLY A COPY OF THE PRODUCT INSTALLATION INSTRUCTIONS WITH ULC LISTING AND/OR TEST STANDARD REFERENCE, FOR EACH INSTALLATION.

6. MOCK-UP MAY REMAIN AS PART OF WORK.

- .1 IDENTIFY MECHANICAL EQUIPMENT WITH LAMICOID NAMEPLATES.
- .2 LABEL ALL PIPING AT LEAST ONCE IN EVERY ROOM, AND AT NO MORE THAN 7.5 m (25 FT) CENTERS.

1. ALL MECHANICAL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE EARTHQUAKE LOAD AND EFFECTS REQUIRED BY THE ONTARIO BUILDING CODE.
2. MECHANICAL ELEMENTS AND COMPONENTS (EQUIPMENT, PIPES, DUCTS, ETC.), AND THEIR CONNECTIONS TO THE BUILDING SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE SMACNA/ANSI SEISMIC RESTRAINT MANUAL OR OTHER GUIDELINE REFERENCED IN THE ONTARIO BUILDING CODE.
3. PROVIDE SHOP DRAWINGS FOR SUPPORT, CONNECTIONS AND SEISMIC RESTRAINT OF ALL MECHANICAL EQUIPMENT, PIPES AND DUCTS, INCLUDING, BUT NOT LIMITED TO:
 1. ROOFTOP HVAC EQUIPMENT;
 2. TYPICAL DUCT SUPPORTING SYSTEM;
 3. TYPICAL SAN, DCW, DHW AND HYDRONIC PIPE SUPPORTING SYSTEM.THESE SHOP DRAWINGS SHALL BE DESIGNED AND SEALED BY A PROFESSIONAL ENGINEER IN THE PROVINCE OF ONTARIO, WITH EXPERIENCE IN SEISMIC ENGINEERING.
4. FOLLOWING PROJECT COMPLETION, SEISMIC ENGINEER SHALL PROVIDE A LETTER OF FINAL SITE REVIEW.
5. CONTRACTOR SHALL CARRY THE COST OF THE SEISMIC ENGINEERING, INCLUDING SITE REVIEWS, DESIGN AND SHOP DRAWING PREPARATION.

1. ALL MECHANICAL EQUIPMENT, PIPING, DUCTWORK, AND RELATED ITEMS SHALL BE SECURELY SUPPORTED, ATTACHED AND FASTENED TO BUILDING STRUCTURE, AND SHALL NOT BE FASTENED TO THE ROOF DECK.
2. PIPE HANGERS AND SUPPORTS SHALL BE FABRICATED AND INSTALLED IN ACCORDANCE WITH MSS STANDARD 25.10. PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION, AND INSTALLATION.
3. PLATFORMS SHALL BE FABRICATED FROM STRUCTURAL GRADE STEEL MEETING THE REQUIREMENTS OF THE ONTARIO BUILDING CODE, INCLUDING CSA STANDARD W59 WELDED STEEL STRUCT CONSTRUCTION, AND THE REQUIREMENTS OF THE CANADIAN WELDING BUREAU.
4. ZIP TIES ARE NOT PERMITTED.

1. INFORMATION INVOLVING ACCURATE DIMENSIONING OF THE BUILDING SHALL BE TAKEN FROM SITE BY CONTRACTOR.

2. DRAWINGS ARE IN DIAGRAMMATIC FORM, INTENDED TO CONVEY THE SCOPE OF WORK AND GENERAL ARRANGEMENT FOR EQUIPMENT. COORDINATE PHYSICAL LOCATION OF ALL EQUIPMENT WITH OTHER TRADES AND ALLOW FOR ANY ADDITIONAL PIPING, DUCTING, FITTINGS, SUPPORTS, ETC., IN ORDER TO AVOID INTERFERENCE AND FACILITATE THE WORK.

3. CONTRACTOR TO MAKE ANY NECESSARY MODIFICATIONS OR ADDITIONS, WITHOUT CHARGE, TO ACCOMMODATE SITE CONDITIONS AND COORDINATION.

4. COORDINATE ALL MECHANICAL EQUIPMENT WIRING, INCLUDING LOW VOLTAGE CONTROL WIRING, WITH ELECTRICAL TRADES.

1. COMMISSIONING:
 1. START-UP AND COMMISSION THE FOLLOWING SYSTEMS:
 1. PLUMBING FIXTURES;
 2. HVAC.
 2. PERFORM SYSTEMATIC TESTS, PROCEDURES AND CHECKS ON SYSTEMS, AS FOLLOWS:
 1. TO VERIFY OPERATION IN ACCORDANCE WITH CONTRACT DOCUMENTS, DESIGN CRITERIA AND INTENT, AND MANUFACTURER'S REQUIREMENTS;
 2. TO ENSURE APPROPRIATE DOCUMENTATION IS PROVIDED;
 3. TO EFFECTIVELY TRAIN BUILDING OPERATIONAL STAFF.
 3. SYSTEMS ARE TO BE OPERATED AT FULL CAPACITY, WITH CORRECTION OF ALL DEFICIENCIES AND ADJUSTMENTS TO MEET OPTIMUM PERFORMANCE.
 4. PROVIDE WRITTEN REPORT AT END OF COMMISSIONING OUTLINING EQUIPMENT OPERATIONAL CONDITIONS AND PARAMETERS.
2. TESTING, ADJUSTING AND BALANCING:
 1. TEST, ADJUST AND BALANCE (TAB) ALL PLUMBING AND HVAC EQUIPMENT AND SYSTEMS; INCLUDING THE FOLLOWING:
 1. ROOFTOP PACKAGED HVAC UNITS;
 5. EXHAUST FANS.
 2. TAB SHALL BE PERFORMED BY A THIRD PARTY TESTING AGENCY, QUALIFIED TO ONE OF THE FOLLOWING:
 1. ASSOCIATED AIR BALANCE COUNCIL, (AABC), NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE.
 2. NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB), , PROCEDURAL STANDARDS FOR TESTING, ADJUSTING, BALANCING OF ENVIRONMENTAL SYSTEMS.
 3. SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA), HVAC TAB HVAC SYSTEMS - TESTING, ADJUSTING AND BALANCING
 3. TAB PROCEDURE SHALL BE COMPLETED IN ACCORDANCE WITH ASHRAE STANDARD 111, MEASUREMENT, TESTING, ADJUSTING AND BALANCING OF BUILDING HVAC SYSTEMS.
 4. PROVIDE DETAILED REPORT AT END OF TAB, IN ACCORDANCE WITH THE REPORTING PROCEDURES OF ASHRAE STANDARD 111.
3. DEMONSTRATION AND TRAINING:
 1. DEMONSTRATE OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS TO OWNER'S PERSONNEL ONE WEEK PRIOR TO DATE OF FINAL INSPECTION
 2. PRIOR TO DEMONSTRATION AND TRAINING, ENSURE THAT EQUIPMENT HAS BEEN ADJUSTED AND PUT INTO OPERATION, INCLUDING COMPLETION OF COMMISSIONING AND TESTING, ADJUSTING, AND BALANCING.
 3. DEMONSTRATE START-UP, OPERATION, CONTROL, ADJUSTMENT, TROUBLE-SHOOTING, SERVICING, AND MAINTENANCE OF EACH ITEM OF EQUIPMENT.
 4. INSTRUCT PERSONNEL IN PHASES OF OPERATION AND MAINTENANCE USING OPERATION AND MAINTENANCE MANUALS AS BASIS OF INSTRUCTION. REVIEW CONTENTS OF MANUAL IN DETAIL TO EXPLAIN ASPECTS OF OPERATION AND MAINTENANCE.
 5. ENSURE AMOUNT OF TIME REQUIRED FOR INSTRUCTION OF EACH ITEM OF EQUIPMENT OR SYSTEM AS FOLLOWS:
 1. HVAC SYSTEM – 4 HOURS OF INSTRUCTION.
 2. CONTROL SYSTEM – 4 HOURS OF INSTRUCTION.

—————	DCW DOMESTIC COLD WATER PIPE	
—————	DHW DOMESTIC HOT WATER PIPE	
.....	DHWR DOMESTIC HOT WATER RETURN PIPE	
—————	SAN SANITARY PIPE	
.....	V SANITARY VENT PIPE	
—————	STM STORM PIPE	

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[illegible]

SHOALTS
& ZABACK
Architects Ltd.
Kingston, Ontario

OXFORD ON
RIDEAU
Public School
Oxford Mills, Ontario

MECHANICAL

Notes

DESIGN BY:	M. MORRIS
DRAWN BY:	A.M.
DATE:	JUL 2025
PROJECT No.:	921
SCALE:	AS SHOWN

M001

M001

ROOFTOP UNIT SCHEDULE - with Electric Heat to Temper Air only														NOTES	
UNIT	DESCRIPTION	SUPPLY AIR		OUTDR	EFF.	COOL	HEAT	ELECTRICAL				ACCEPTABLE PRODUCT			
		(cfm)	(ESP)	AIR (cfm)	(SEER)	TC (Mbtu/hr)	(kW)	VOLT	PHASE	MCA	MOCP				
RTU-4A RTU-4B	PACKAGED ROOFTOP HVAC UNIT ELECTRIC COOLING	1600	1.5	300	12.9	48	12	208	3	44	45	TRANE #THK CARRIER LENNOX YORK	BASE UNIT: HIGH ROOF CURB - INSULATED AND SEISMIC INTEGRAL ENERGY RECOVERY VENTILATOR WITH ERV WHEEL - 72% MINIMUM EFFECTIVENESS ECONOMIZER OPERATION RELIEF DAMPER HAIL GUARD		
RTU-5A RTU-5B	PACKAGED ROOFTOP HVAC UNIT ELECTRIC COOLING	2000	1.7	400	12.9	60	12	208	3	44	45		COOLING SECTION: TWO STAGE LOW AMBIENT OPERATION HOT GAS REHEAT DEHUMIDIFICATION		
RTU-6A	PACKAGED ROOFTOP HVAC UNIT ELECTRIC COOLING	2400	1.9	500	11.2	72	18	600	3	29	30		HEATING SECTION: MULTI-STAGE		
													BLOWER: ECM MOTOR W ELECTRONIC SPEED CONTROL SOFT START ADJUSTABLE SP BLOWER PROVING SWITCH		
													FILTER: MERV 13 DIRTY FILTER SENSOR		
													ELECTRICAL: THROUGH BASE WITH WEATHERPROOF DISC. SWITCH GFCI SERVICE OUTLET WITH WEATHERPROOF COVER PHASE/VOLTAGE PROTECTION		
												STANDARD OF ACCEPTANCE	CONTROLS: BACS		

ROOFTOP UNIT SCHEDULE - with Electric Space Heat														NOTES	
UNIT	DESCRIPTION	SUPPLY AIR		OUTDR AIR (cfm)	EFF. (SEER)	COOL TC (Mbtu/hr)	HEAT (kW)	VOLT	ELECTRICAL			ACCEPTABLE PRODUCT			
		(cfm)	(ESP)						PHASE	MCA	MOCP				
RTU-5C	PACKAGED ROOFTOP HVAC UNIT ELECTRIC COOLING ELECTRIC HEATING	2000	1.7	400	12.9	60	27	208	3	63	90	TRANE #THK CARRIER LENNOX YORK	BASE UNIT: HIGH ROOF CURB - INSULATED AND SEISMIC INTEGRAL ENERGY RECOVERY VENTILATOR WITH ERV WHEEL - 72% MINIMUM EFFECTIVENESS ECONOMIZER OPERATION RELIEF DAMPER HAIL GUARD		
RTU-6B RTU-6C RTU-6D	PACKAGED ROOFTOP HVAC UNIT ELECTRIC COOLING ELECTRIC HEATING	2400	1.9	500	11.2	72	36	600	3	49	50		COOLING SECTION: TWO STAGE LOW AMBIENT OPERATION HOT GAS REHEAT DEHUMIDIFICATION		
													HEATING SECTION: MULTI-STAGE		
													BLOWER: ECM MOTOR W ELECTRONIC SPEED CONTROL SOFT START ADJUSTABLE SP BLOWER PROVING SWITCH		
													FILTER: MERV 13 DIRTY FILTER SENSOR		
													ELECTRICAL: THROUGH BASE WITH WEATHERPROOF DISC. SWITCH GFCI SERVICE OUTLET WITH WEATHERPROOF COVER PHASE/VOLTAGE PROTECTION		
												STANDARD OF ACCEPTANCE	CONTROLS: BACS		

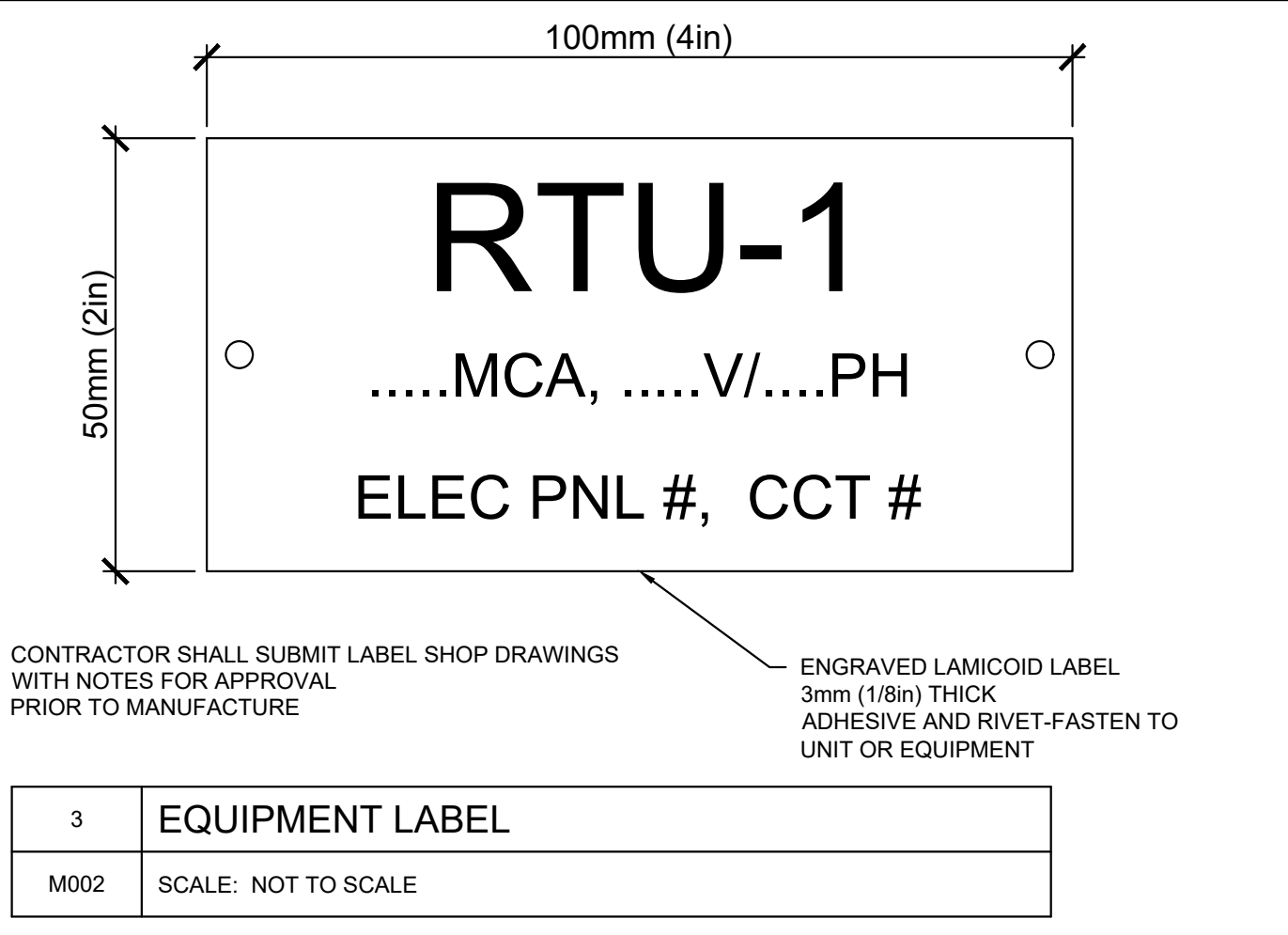
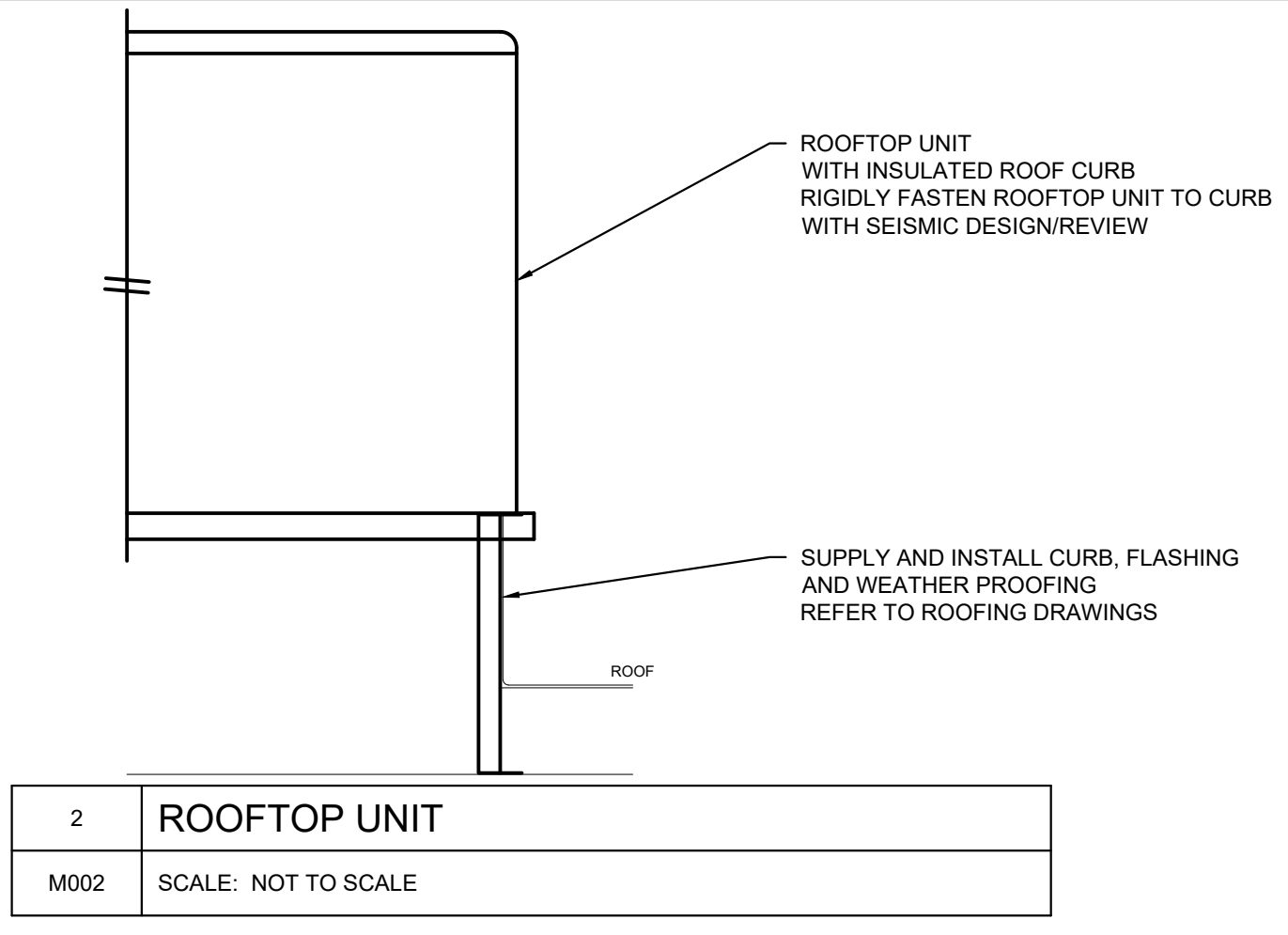
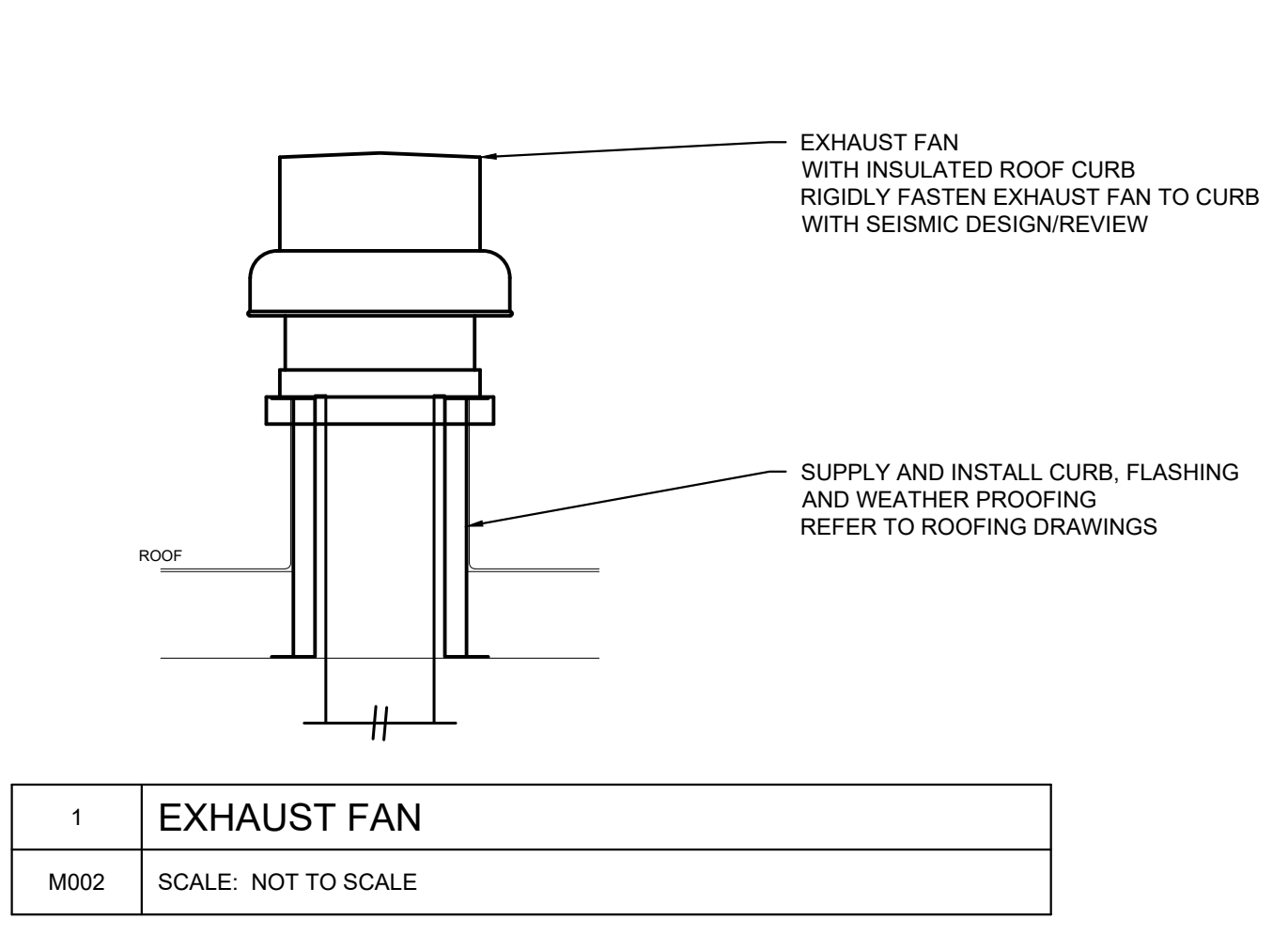
BOILER SCHEDULE									
UNIT	DESCRIPTION	ELECTRICAL					ACCEPTABLE PRODUCT	NOTES	
		HEATING INPUT	VOLT	PHASE	MCA	MOCP			
		(kW)	(V)	(PH)	(A)	(A)			
B-1	BOILER	105	600	3	106	150	BOILER	UNIT:	
B-2	ELECTRIC						LOCHINVAR #KE8	FULLY MODULATING OPERATING SET-POINT TO 215 DEG.F ASME-CERTIFIED, STEEL PRESSURE VESSEL 160 PSI WORKING PRESSURE 50 PSI RELIEF VALVE FULLY WELDED DESIGN	
								INCLUDE:	
								BOILER CIRCULATING PUMP HIGH LIMIT WITH MANUAL RESET AUTOMATIC RESET HIGH LIMIT MANUAL RESET LOW WATER CUTOFF TEMPERATURE AND PRESSURE GAUGE PRESSURE RELIEF VALVE OUTDOOR TEMPERATURE SENSOR	
								ELECTRICAL:	
								ALARM BELL FRONT DOOR SOLENOID INTERLOCK GROUND FAULT DETECTION RELAY CONTROL ENABLE/DISABLE E-STOP BUTTON POWER & ENERGY METER HIGH VOLTAGE PLEXIGLASS SCREEN	
								CONTROL:	
								DIGITAL OPERATING CONTROL MULTI-COLOR GRAPHIC LCD DISPLAY BACS SYSTEM COMPATIBLE	

BOILER SYSTEM PUMP SCHEDULE									
UNIT	DESCRIPTION	CAPACITY		CONN.	ELECTRICAL			ACCEPTABLE PRODUCT	NOTES
		FLOW (USgpm)	HEAD (ft)		(in)	VOLT (V)	PHASE		
PS-1	BOILER SYSTEM PUMP	110	60	3	208	3	5	ARMSTRONG #4300	VERTICAL IN-LINE PUMP
PS-2									VARIABLE FREQUENCY DRIVE

REGISTER, GRILLE & DIFFUSER SCHEDULE									NOTES
UNIT	DESCRIPTION	CONSTRUCTION	PATTERN	CONFIGURATION	BLADE SPACING	DEFLECTION (deg)	FRAME	FINISH	
S1	SA DIFFUSER CEILING SQUARE CONE	STEEL	4 CONE FIXED AIR PATTERN		-	-	LAY-IN INVERTED T DRY-WALL FLANGE	WHITE	EH PRICE #SCD STEEL OR APPROVED EQUAL
S2	LOUVRED SA GRILLE GYMNASIMUM								
R1	EGG CRATE RA CEILING	ALUMINIUM	FIXED GRID	25x25x25mm, 1x1x1in		0	LAY-IN INVERTED T DRY-WALL FLANGE	WHITE	EH PRICE #82 OR APPROVED EQUAL
R2	LOUVRED RA GRILLE CEILING/WALL	STEEL	SINGLE DEFLECTION ADJUSTABLE	19mm, 3/4 in PARALLEL TO LONG DIM		ADJUSTABLE	STANDARD 32mm, 1.25in	WHITE	EH PRICE #530 STEEL SINGLE OR APPROVED EQUAL

LEGEND - HVAC					
CFM L/s	CUBIC FEET PER MINUTE LITRES PER SECOND		SIZE TYPE	RATE	REGISTER, GRILLE, DIFFUSER IDENTIFICATION
D	DAMPER				
FD	FIRE DAMPER				
SFD	SMOKE/FIRE DAMPER				
EA	EXHAUST AIR				
OA	OUTDOOR AIR				
RA	RETURN AIR				
SA	SUPPLY AIR				
	DUCT SECTION EXHAUST AIR				
	DUCT SECTION RETURN AIR				
	DUCT SECTION SUPPLY AIR				
	TURNING VANES				

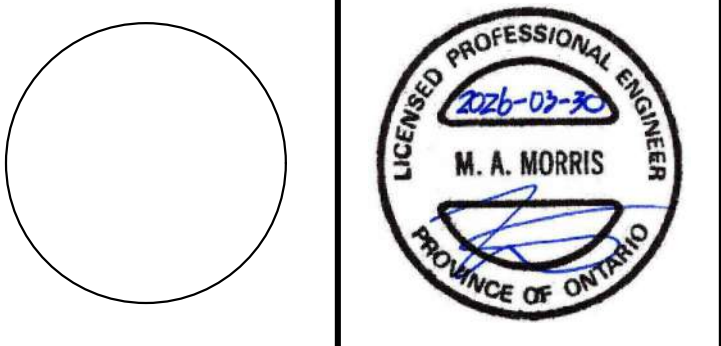
NOTES:	
1.	ALL MECHANICAL WORK SHALL BE CAREFULLY COORDINATED WITH THE GENERAL CONTRACTOR AND THE ROOFING CONTRACTOR
2.	PROVIDE SEISMIC DESIGN, SEISMIC SHOP DRAWINGS AND SEISMIC REVIEW FOR ALL MECHANICAL EQUIPMENT.
3.	ALL NEW ROOF CURBS SHALL BE A MINIMUM OF 400mm (16in) IN HEIGHT ABOVE THE NEW ROOF SURFACE. THIS SHALL BE CAREFULLY COORDINATED WITH THE GENERAL CONTRACTOR AND THE ROOFING CONTRACTOR.



EXISTING EQUIPMENT SUMMARY																			
This form shall be completed by Mechanical and Electrical Contractors to verify all existing equipment operating conditions prior to submission of shop drawings for new equipment																			
Number	Unit Desciption	Duct Size (As Applicable)			Airflow Rate (As Applicable)					Hydronic Pipe (As Applicable)			Electrical						
		Supply	Return	Exhaust	Supply	ESP	Return	ESP	Exhaust	ESP	Supply	Return	Flow	Elec Pnl	Amp/Pol	HP	Amperage	Voltage	Phase
PS-1	EXISTING BOILER SYSTEM PUMP	-	-	-	-	-	-	-	-	-									
PS-2	EXISTING BOILER SYSTEM PUMP	-	-	-	-	-	-	-	-	-									
EF-KIT	Exhaust Fan										-	-	-						
EF-WR	Exhaust Fan										-	-	-						

MORRIS
Engineering Ltd.

Brockville, Ontario (613)349-0555



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Architects Ltd.
Kingston, Ontario

PROJECT:
OXFORD ON
RIDEAU
Public School
Oxford Mills, Ontario

DRAWING:
MECHANICAL

Schedules & Details

DESIGN BY:	M. MORRIS	M002
DRAWN BY:	A.M.	
DATE:	JUL 2025	
PROJECT No.:	921	
SCALE:	AS SHOWN	

BUILDING AUTOMATION AND CONTROL SYSTEM

GENERAL NOTES

- SUPPLY AND INSTALL NEW JACE BACS BACS WORK SHALL BE TURNKEY AND FULLY OPERATIONAL
- SUPPLY AND INSTALL A NEW COMPUTER WORKSTATION WITH ALL HARDWARE AND SOFTWARE FOR SYSTEM

BUILDING AUTOMATION & CONTROL (BAC) SYSTEM

MAIN SYSTEM NOTES:

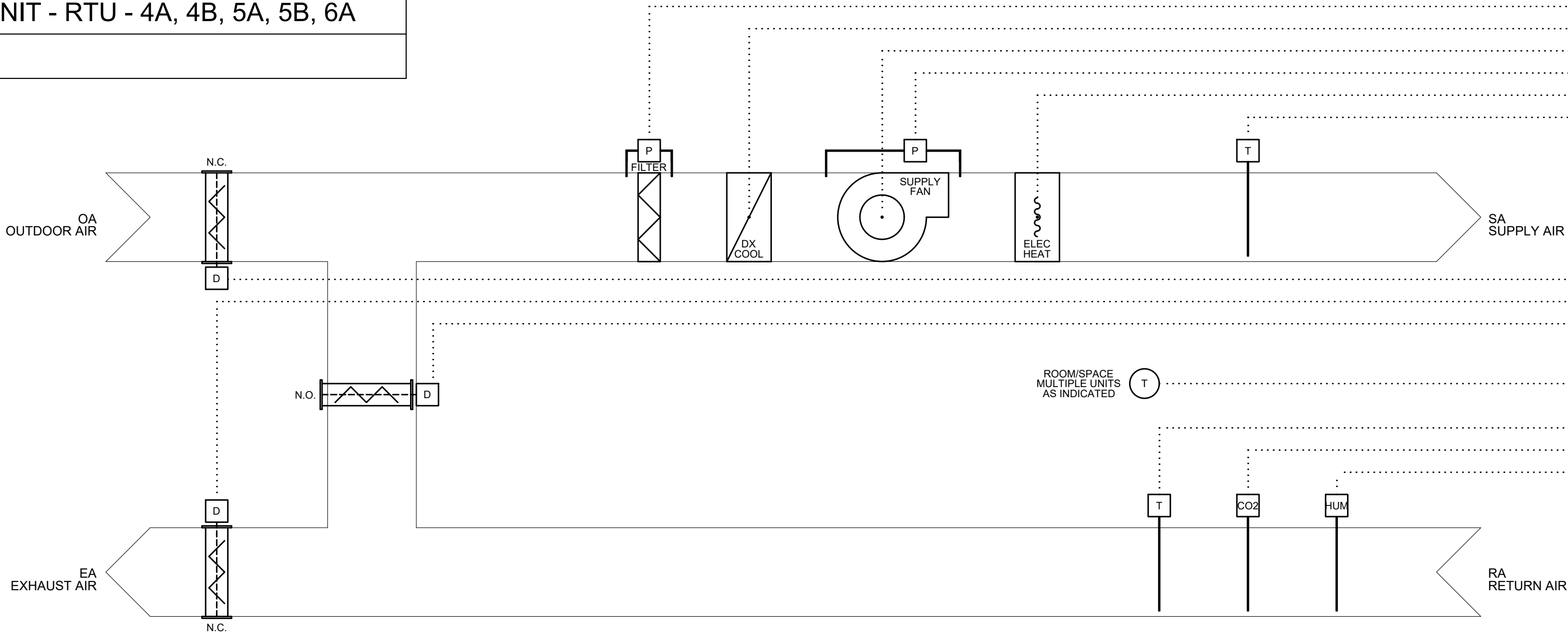
- GENERAL:
 - IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO ENSURE THAT THE BUILDING AUTOMATION AND CONTROL (BAC) SYSTEM HAS ALL EQUIPMENT, REQUIRED TO FURNISH AND INSTALL A FULLY OPERATIONAL BAC SYSTEM, INCLUDING (BUT NOT LIMITED) TO THE FOLLOWING:
 - CONNECTION TO EXISTING PRIMARY WORKSTATION WITH OPERATING SYSTEM AND SOFTWARE;
 - ALL NEW CONTROL, INPUT AND OUTPUT DEVICES IN ALL NEW MECHANICAL AND ELECTRICAL EQUIPMENT.
 - ALL NEW ELECTRICAL POWER WIRING, CONDUIT AND TRANSFORMERS TO ALL NEW CONTROL DEVICES;
 - ALL NEW CONTROL WIRING AND CONDUIT TO ALL NEW CONTROL DEVICES;
 - ALL OTHER DEVICES, WIRING AND APPURTENANCES FOR A FULL OPERATIONAL AND COMPLETE SYSTEM.
- SCOPE OF WORK:
 - ALL NEW FRONT END.
 - COMPUTER WORKSTATION AND SOFTWARE WITH GRAPHICS FOR ALL SYSTEMS AND MECHANICAL EQUIPMENT
 - ALL NEW EQUIPMENT SHALL BE BACNET BASED, WITH NEW SYSTEM CONTROLLERS, AND SHALL INTERFACE SEAMLESSLY WITH EXISTING EQUIPMENT.
 - CONTROLS CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ALL HVAC AND ELECTRICAL ALTERATIONS, REQUIRED FOR A COMPLETE BAC SYSTEM.
 - BAC SYSTEM SHALL INCLUDE CONTROL AND MONITORING OF THE FOLLOWING:
 - OUTDOOR AIR TEMPERATURE AND RELATIVE HUMIDITY.
 - ROOM TEMPERATURE SENSORS (THERMISTOR TYPE) AS INDICATED
 - WATER METER – DAILY AND TOTAL CONSUMPTION USAGE IN CU.M.
 - NATURAL GAS METER – TOTAL CONSUMPTION IN CU.M.
 - ELECTRICAL METER – TOTAL CONSUMPTION IN KWH, PHASE MONITORING.
 - SCHOOL BELLS WITH A MANUAL SWITCH IN MAIN OFFICE FOR RINGING OR STOP RINGING. IE: MANUAL/ON/OFF/AUTO.
 - SCHOOL CLOCKS – TIME SET.
 - EXTERIOR LIGHTS – ON/OFF CONTROL.
 - HVAC, EXHAUST FANS/HOODS, BOILERS, PUMPS AND HYDRONIC ZONE VALVES, AS INDICATED IN SCHEMATIC DIAGRAMS.
 - DRINKING WATER SYSTEM END-OF-LINE FLUSHING – WITH ADJUSTABLE SCHEDULES DUE TO CHANGING LEAD FLUSHING REQUIREMENTS.
 - DOMESTIC HOT WATER (DHW) CIRCULATION LOOP BALANCING VALVE – TO CONTROL DWH SUPPLY TEMPERATURE.
 - URINALS – WITH MANUAL SWITCH WHERE IT CAN BE ACTIVATED IN CASE OF PROBLEM WITH BAC SYSTEM.
 - TRAP SEAL PRIMER VALVES.

- BAC SYSTEM:
 - BAC SYSTEM DESIGN TO BE JACE8000 AS THE MAIN UNIT WITH BACNET CONTROLLERS AND DEVICES
 - BAC SYSTEM TO USE TRIDUUM JACE8000 N4 THAT WILL HAVE TO HAVE THE SOFTWARE REVISED TO INTERFACE WITH UCDSB EXISTING NETWORKS AND SOFTWARE VERSIONS, SO THAT THE UNITS CAN COMMUNICATE WITH UCDSB SERVERS.
 - BAC SYSTEM TO BE SET UP FOR POSSIBLE FUTURE ALL HTML BAC SYSTEM UPGRADE FOR ALL SITES.
- SHOP DRAWINGS:
 - PROVIDE SHOP DRAWINGS IN ACCORDANCE WITH MECHANICAL GENERAL REQUIREMENTS, BEFORE START OF CONSTRUCTION, PROVIDE SHOP DRAWINGS CONSISTING OF:
 - WIRING AND PIPING DIAGRAMS. SHOW CONDUIT SIZE AND SPARE CAPACITY, PROVIDE INTERFACE WIRING DIAGRAMS COMPLETE WITH TERMINATION CONNECTIONS FOR EXISTING EQUIPMENT AND EQUIPMENT SUPPLIED BY OTHERS. INDICATE SIGNAL LEVELS.
 - SHOP DRAWING FOR EACH INPUT/OUTPUT POINT SHOWING ALL INFORMATION ASSOCIATED WITH EACH PARTICULAR POINT INCLUDING:
 - SENSING ELEMENT TYPE AND LOCATION
 - TRANSMITTER TYPE AND RANGE.
 - DETAILS OF ASSOCIATED FIELD WIRING SCHEMATICS, SCHEDULES AND TERMINATIONS.
 - PNEUMATIC SCHEMATICS AND SCHEDULES.
 - POINT ADDRESS.
 - SETPOINTS, CURVES, GRAPHS, ALARM LIMITS (H + L, 4 TYPES) AND SIGNAL RANGE.
 - MANUFACTURER'S RECOMMENDED INSTALLATION INSTRUCTIONS AND PROCEDURES FOR EACH TYPE OF SENSOR AND/OR TRANSMITTER.
 - CONTROL SCHEMATICS WITH NARRATIVE DESCRIPTION AND CONTROL DESCRIPTION LOGIC FULLY SHOWING AND DESCRIBING OPERATION AND/OR MANUAL PROCEDURES AVAILABLE TO ACHIEVE PROPER OPERATION OF THE BUILDING.
 - COMPLETE SYSTEM CDS INCLUDING COMPANION ENGLISH LANGUAGE EXPLANATIONS ON THE SAME SHEET (USE DIFFERENT FONTS AND ITALICS). CDS'S MUST CONTAIN THE ENERGY OPTIMIZATION PROGRAMS SPECIFIED ELSEWHERE.
 - A LISTING AND EXAMPLE OF ALL REPORTS.
 - A LISTING OF ALL TIME SCHEDULES.
 - PROVIDE VALVE SCHEDULE INDICATING VALVE SELECTION, VALVE APPLICATION, CALCULATED CV, CALCULATIONS USED INDICATING PRESSURE DROP USED, AND EXPLANATION FOR EACH VALVE INDICATING APPROPRIATENESS OF SELECTION AND DIFFERENTIAL PRESSURE IN RELATION TO MAXIMUM CLOSE-OFF OF EACH VALVE IN RELATION TO ASSOCIATED PUMP PRESSURE.

- PRODUCTS:
 - BUILDING AUTOMATION SYSTEM SHALL BE INTEGRATED TO THE BOARD OFFICES BUILDING ENTERPRISE MANAGEMENT SYSTEM USING A JACE NETWORK CONTROLLER TO PERMIT REMOTE OPERATOR CAPABILITIES TO MONITOR CONTROL, PERFORM PROGRAMMING CHANGES, AND ARCHIVE ALARMS AND TREND THROUGH THE USE OF A WEB BROWSER USING I.P. ADDRESSING.
 - BAC SYSTEM TO HAVE UPS FOR SURGE PROTECTION AND BATTERY BACKUP FOR JACE MAIN UNIT AND CONTROLLERS.
 - ALL CONTROLLERS TO BE INSTALLED IN NEMA ENCLOSURES EVEN IF INSTALLED IN CEILING SPACES.
 - SYSTEM MAIN OUTDOOR AIR SENSOR TO BE A "VAISALA HV5312".
 - ACTUATED HYDRONIC CONTROL VALVES TO BE BELIMO ZONE TIGHT VALVES. NORMALLY OPEN/FAIL OPEN.
 - WASHROOM AND CORRIDORS TO HAVE PLATE SENSORS TO WITHSTAND POSSIBLE DAMAGE.
- WIRING:
 - BAC CONTROL SYSTEM SHALL BE A WIRED SYSTEM. NO WIRELESS SHALL BE ACCEPTED.
 - ALL WIRING ASSOCIATED WITH AND REQUIRED BY THE BAC SYSTEM SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR. THE TERM "WIRING" SHALL BE CONSTRUED TO INCLUDE FURNISHING OF WIRE, TRANSFORMERS, CONDUIT, MISCELLANEOUS MATERIAL AND LABOUR AS REQUIRED TO INSTALL A TOTAL WORKING SYSTEM. IF DEPARTURES FROM THE CONTRACT DRAWINGS ARE DEEMED NECESSARY BY THE CONTRACTOR, DETAILS OF SUCH DEPARTURES, INCLUDING CHANGES IN RELATED PORTIONS OF THE PROJECT AND THE REASONS THEREFORE, SHALL BE SUBMITTED WITH THE DRAWINGS TO THE CONSULTANT FOR APPROVAL. WIRING TO CONFORM WITH ELECTRICAL SPECIFICATIONS AND CONTRACT DOCUMENTS.
 - NO CABLES ARE TO BE ROUTED ACROSS OPEN AREAS.
 - IF CABLES HAVE TO BE INSTALLED IN EXPOSED LOCATIONS, THEY SHALL BE INSTALLED IN EMT CONDUIT, PAINTED TO MATCH.
 - ALL CONDUIT ROUTINGS TO BE APPROVED BY UCDSB PROJECT MANAGER PRIOR TO INSTALLING. CABLES THAT ARE ROUTED ABOVE SUSPENDED CEILINGS SHALL BE ROUTED USING J HOOKS SPACED MINIMUM 1.5m (5 FT) APART.
 - J HOOKS TO BE SECURED OFF OPEN WEB STEEL JOISTS OR BUILDING STRUCTURE. NOT TO BE MOUNTED OFF PENCIL ROD.
 - CABLES SHALL BE GROUPED TOGETHER USING VELCRO STRAPS, NO ZIP TIES PERMITTED.
 - NUMBERED TAPE MARKINGS WITH LABEL INDICATING PANEL & POINT NAME WHERE APPLICABLE ON ALL WIRING AT PANELS, JUNCTION BOXES, SPLITTERS, CABINETS, OUTLET BOXES AND DEVICES. COLOUR CODING: USE COLOUR CODED WIRING.
 - BAC SYSTEM WIRE JACKETING TO BE ORANGE IN COLOUR.

- ACCEPTABLE CONTRACTORS:
 - AINSWORTH INC.: JOEY HOULE, PROJECT MANAGER, JOEY.HOULE@AINSWORTH.COM
100-2935 CONROY RD, OTTAWA, ON K1G 6C6, T. 613-702-0427, T. 888-393-5553
 - HONEYWELL LTD.: JIM KEESLING, GENERAL MANAGER-CUSTOMER SERVICE
(EXCEL 5000 SERIES CONTROLLERS), T. 416-758-2820, F. 416-758-2740
 - LAR-MEX: ERIC MONTAMBEAULT, VICE PRESIDENT (DISTECH SYSTEM), EMONTAMBEAULT@LAR-MEX.COM
4-5509 CANOTEK ROAD, OTTAWA, ON K1J 9J8, T. 613-747-1563, F. 613-747-2435
 - B. LUNDY/CARMICHAEL: BROCKVILLE, ON, TEL. (613)342-7820
 - REGULVAR: STEPHAN RIFAULT, P.ENG, SALES REPRESENTATIVE, (DELTA CONTROLS SYSTEMS)
1250 OLD INNES RD., UNIT 518, OTTAWA, ON K1B 5L3, T. 613-565-2129, F. 613-565-8895
 - TRANE – OTTAWA: STEVE MEINCKE, SMEINCKE@TRANE.COM
1024 MORRISON DRIVE, OTTAWA, ON K2H 8H7, T. 613-820-8111

1	ROOFTOP AC UNIT - RTU - 4A, 4B, 5A, 5B, 6A
M003	SCALE: NOT TO SCALE

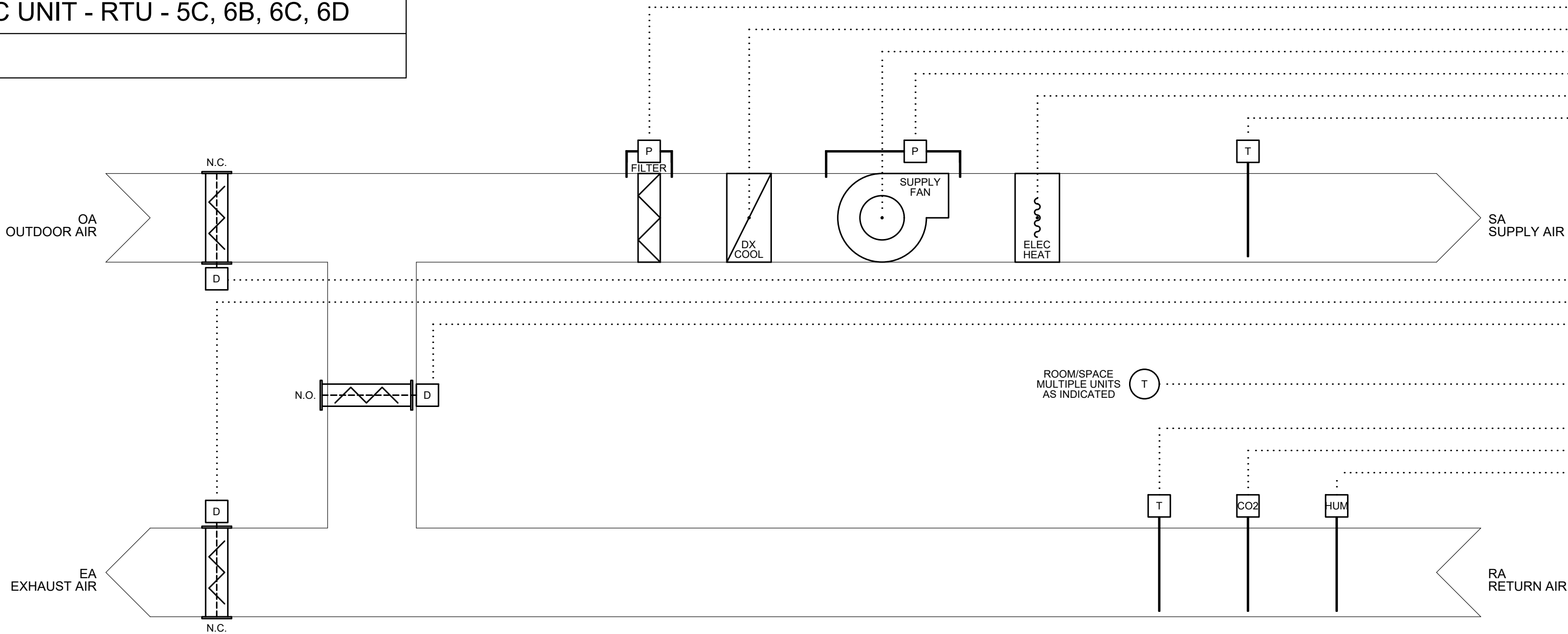


SUPPLY AND INSTALL NEW ROOFTOP UNIT

SUPPLY AND INSTALL NEW BACS WIRING AND DEVICES TO NEW UNIT

I/O	DEVICE	POINT DESCRIPTION
O	DAMPER	EXHAUST AIR DAMPER
O		BYPASS AIR DAMPER
O		OUTDOOR AIR DAMPER
O	DX COOL	ENABLE - TWO STAGE
I		STATUS - TWO STAGE
I	FILTER	SUPPLY AIR FILTER
O	ELECTRIC HEAT	ENABLE - TWO STAGE
I		STATUS
O	SUPPLY FAN	ENABLE
I		STATUS
I		PRESSURE
I	SENSORS	SPACE TEMPERATURE
I		RETURN AIR CO2
I		RETURN AIR HUMIDITY LEVEL
I		RETURN AIR TEMPERATURE
I		SUPPLY AIR TEMPERATURE

2	ROOFTOP HVAC UNIT - RTU - 5C, 6B, 6C, 6D
M003	SCALE: NOT TO SCALE



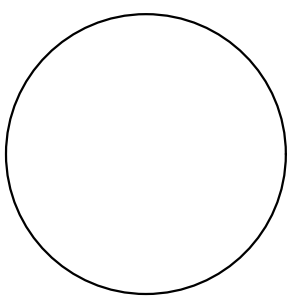
SUPPLY AND INSTALL NEW ROOFTOP UNIT

SUPPLY AND INSTALL NEW BACS WIRING AND DEVICES TO NEW UNIT

I/O	DEVICE	POINT DESCRIPTION
O	DAMPER	EXHAUST AIR DAMPER
O		BYPASS AIR DAMPER
O		OUTDOOR AIR DAMPER
O	DX COOL	ENABLE - TWO STAGE
I		STATUS - TWO STAGE
I	FILTER	SUPPLY AIR FILTER
O	ELECTRIC HEAT	ENABLE - FOUR STAGE
I		STATUS
O	SUPPLY FAN	ENABLE
I		STATUS
I		PRESSURE
I	SENSORS	SPACE TEMPERATURE
I		RETURN AIR CO2
I		RETURN AIR HUMIDITY LEVEL
I		RETURN AIR TEMPERATURE
I		SUPPLY AIR TEMPERATURE

MORRIS Engineering Ltd.

Brockville, Ontario (613)349-0555



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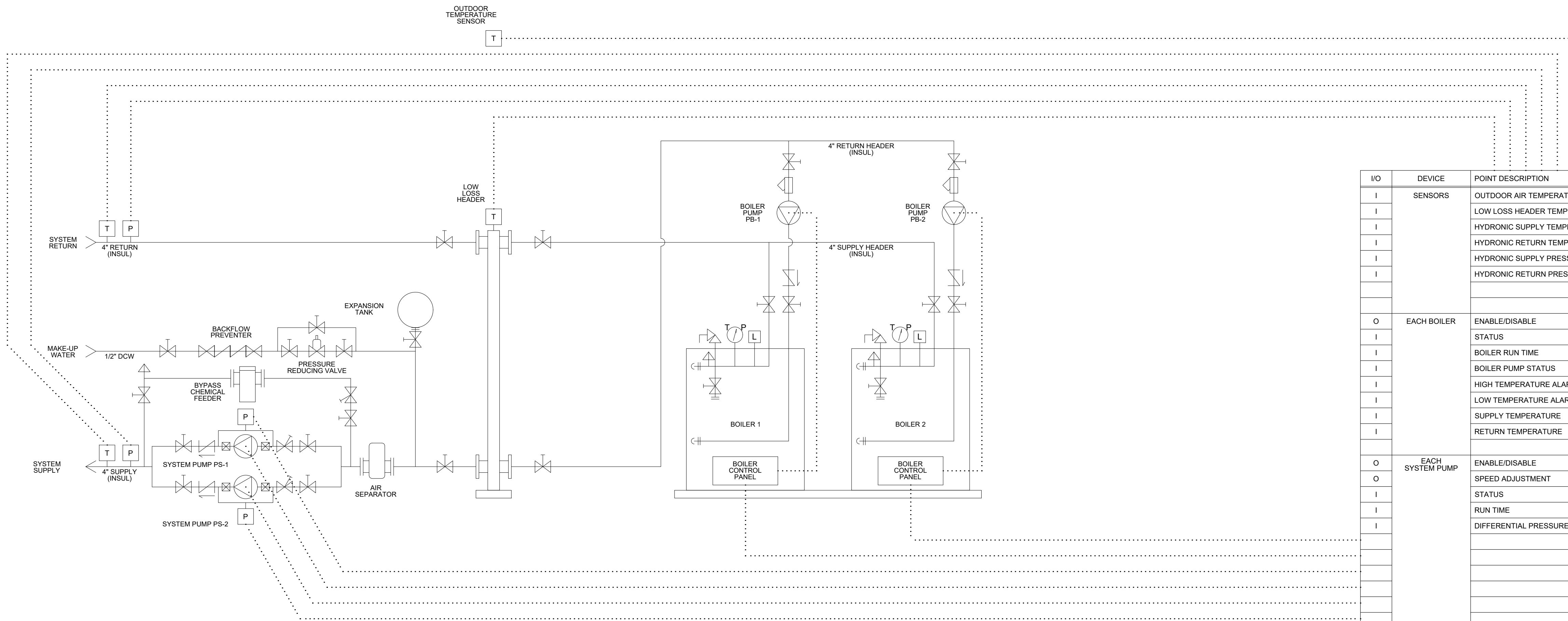
CLIENT:
SHOALTS & ZABACK Architects Ltd.
Kingston, Ontario

PROJECT:
OXFORD ON RIDEAU Public School
Oxford Mills, Ontario

DRAWING:
MECHANICAL Building Automation & Control System (BACS) Details

DESIGN BY:	M. MORRIS	M003
DRAWN BY:	A.M.	
DATE:	JUL 2025	
PROJECT No.:	921	
SCALE:	AS SHOWN	

1	BOILER SYSTEM
M004	SCALE: NOT TO SCALE

[illegible]

**RETAIN EXISTING HYDRONIC
CABINET UNIT HEATER**

**SUPPLY AND INSTALL NEW BACS WIRING
AND DEVICES TO EXISTING UNIT**

I/O	DEVICE	POINT DESCRIPTION
I	SENSORS	ROOM TEMPERATURE
O	FAN	ENABLE
I		STATUS

RETAIN EXISTING HYDRONIC RADIATOR

SUPPLY AND INSTALL NEW BACS WIRING AND DEVICES TO EXISTING UNIT

I/O	DEVICE	POINT DESCRIPTION
I	SENSORS	ROOM TEMPERATURE
O	ZONE VALVE	ENABLE - MODULATING
I		STATUS

ZONE VALVES:
 ACTUATED HYDRONIC CONTROL VALVES
 BELIMO ZONE TIGHT #Z20SDJ-J+CQKB24-LL OR ERIE POP TOP #AG23A020
 PART NUMBERS TO CHANGE DEPENDING ON APPLICATION TYPE AND SIZING
 ALL VALVES MUST FAIL OPEN IN CASE OF CONTROLS FAILURE SO HEAT IS STILL PROVIDED

The diagram illustrates the wiring connection between a BACS unit and an Exhaust Fan. A dashed line connects the 'I' (Interlock) terminal on the BACS unit to the 'I' (Interlock) terminal on the Exhaust Fan. The BACS unit is labeled 'BACS' and the Exhaust Fan is labeled 'EXHAUST FAN'.

**SUPPLY AND INSTALL NEW ELECTRICAL
POWER METER UNIT**

**SUPPLY AND INSTALL NEW BACS WIRING
AND DEVICES TO NEW UNIT**

I/O	DEVICE	POINT DESCRIPTION
I	POWER METER UNIT	VOLTAGE - ALL PHASES
I		AMPERAGE - ALL PHASES
I		TOTAL KILOWATTHOURS
I		PHASE PROTECTION

SUPPLY AND INSTALL NEW CONNECTION TO EXISTING FIRE ALARM PANEL

SUPPLY AND INSTALL NEW BACS WIRING AND DEVICES TO NEW UNIT

FIRE ALARM CONTROL AND ANNUNCIATOR PANEL

I/O	DEVICE	POINT DESCRIPTION
I	FIRE ALARM	STATUS

<h1 style="margin: 0;">MORRIS</h1> <h2 style="margin: 0;">Engineering Ltd.</h2>		Brockville, Ontario (613)349-0555
5	2026-03-30	FOR PERMIT AND TENDER
4	2025-10-31	FINAL REVIEW
3	2025-10-24	FOR REVIEW
2	2025-10-03	FOR REVIEW
1	2025-09-11	FOR REVIEW
0	2025-08-28	PRELIMINARY
NO.	DATE	REVISION
<u>CLIENT:</u> <div style="text-align: center; padding: 10px;"><h3>SHOALTS & ZABACK</h3><h3>Architects Ltd.</h3><h3>Kingston, Ontario</h3></div>		
<u>PROJECT:</u> <div style="text-align: center; padding: 10px;"><h3>OXFORD ON RIDEAU</h3><h3>Public School</h3><h3>Oxford Mills, Ontario</h3></div>		
<u>DRAWING:</u> <div style="text-align: center; padding: 10px;"><h3>MECHANICAL</h3><h3>Building Automation & Control System (BACS)</h3><h3>Details</h3></div>		
<u>DESIGN BY:</u>	M. MORRIS	
<u>DRAWN BY:</u>	A.M.	
<u>DATE:</u>	JUL 2025	
<u>PROJECT No.:</u>	921	
<u>SCALE:</u>	AS SHOWN	
M004		

BUILDING AUTOMATION AND CONTROL SYSTEM (BACS) - SPECIFICATIONS:					
Part 1. GENERAL					
1.1. GENERAL					
1. It is the responsibility of the General Contractor to ensure that the Building Automation and Control (BAC) System has all equipment, required to furnish and install a fully operational BAC system, including (but not limited to) the following:					
.1 Connection to existing Primary workstation with operating system and software;					
.2 All new control, input and output devices in all mechanical and electrical equipment.					
.3 All new electrical power wiring, conduit and transformers to all control devices;					
.4 All new control wiring and conduit to all control devices;					
.5 All other devices, wiring and appurtenances for a full operational and complete system.					
2. This General Requirements Section applies to all work performed under this section.					
3. "Provide" in this Division shall be interpreted as "supply, install, connect, program and debug".					
4. All work shall conform to Canadian Metric Practice Guide CSA CAN3-2334.1-00, CAN/CSA-2334.1-00(R2011).					
5. Provide all required adapters between "metric" and "imperial" components.					
6. Metric descriptions in this Division are nominal equivalents of imperial values.					
7. All equipment and material to be new, CSA certified, manufactured to minimum standard quoted including additional specified requirements.					
8. Standards Compliance: Where materials or equipment are specified to conform to requirements of the standards of organizations, such as the Canadian Standards Association (CSA) that use a label or listing as a method of indicating compliance, proof of such conformance shall be submitted and approved.					
9. Indexed and cross-referenced with the Government specification. The label or listing of the specified organization will be acceptable evidence. In lieu of the label or listing, the Contractor shall submit a certificate from a testing organization adequately equipped and competent to perform such services, and approved by the manufacturer/engineer, stating that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard or code. For materials whose compliance with organizational standards or specifications is not required by an organization using its own listing or label as proof of compliance, a certificate from the manufacturer shall be furnished to the Consultant stating that the material complies with the applicable referenced standard or specifications.					
10. Where there is no alternative to supply equipment which is not CSA certified, submit such equipment to Inspection Authorities for special inspection and obtain approval before delivery of equipment to site.					
1.2. REFERENCES					
1. Canadian Standards Association (CSA)					
.1 CAN/CSA-C22.2 No.0-10, Canadian Electrical Code, Part II, General Requirements.					
.2 CAN/CSA-2334.1-00, Canadian Metric Practice Guide.					
2. American National Standards Institute (ANSI)					
.1 ANSI/ISA-5.5-1985, Graphic Symbols for Process Displays.					
.2 ANSI/IEEE 260-1978, Letter Symbols for SI and Certain Other Units of Measurements.					
3. CEMA2Y.1.					
1.3. PERMITS AND FEES					
1. Submit certificate of acceptance from authority having jurisdiction to Consultant & Owner. Obtain all permits required to perform the work listed in these specifications. Cost shall be the contractor's responsibility.					
1.4. SCOPE OF WORK					
1. All new equipment shall be BACnet based, with new system controllers, and shall interface seamlessly with existing equipment.					
2. The work covered by this specification and related sections consists of providing submittals, shop drawings, equipment, labour, materials, engineering, programming, technical supervision, commissioning, site reviews, as-builts, and transportation as required to furnish and install a fully operational Building Automation and Control System (BAC) which provides the operation specified in strict accordance with these specifications and the contract drawings, and subject to the terms and conditions of the contract. The work in general consists of but is not limited to, the following:					
.1 The preparation of submittals and provision of all related services.					
.2 Provide and install data communication equipment necessary to effect an BAC data transmission system including necessary interfaces, gateways, routers, and fiber optic transmission equipment.					
.3 Provide Programmable Control Units, sensors, control devices, conduit and wiring, as required to provide the operation specified.					
.4 Provide, test, program and debug all software required to implement a complete and operational BAC.					
.5 Provide all field equipment including control valves, control dampers, etc. as specified.					
.6 Fine-tune all control loops and calibrate sensors & transmitters and adjust all control devices to perform to tolerances specified as required until approved final inspection and provide calibration services throughout warranty period.					
.7 Provide complete operating and maintenance manuals as well as field training of operators, programmers, and maintenance personnel as outlined in these specifications.					
.8 Perform acceptance tests and technical support during commissioning as indicated.					
.9 Provide full documentation for all software and equipment in hard and soft copy.					
3. Programmable Control Units to meet the intent of the specification and space capacity requirements. The quantity and point content of the Programmable Controllers must be approved by the Consultant prior to installation.					
4. Final location for all controllers to be approved by Owner and Consultant before mounting.					
5. Controls contractor shall be responsible for extending power to all controllers and control devices.					
6. Provide all field equipment including control valves, control dampers, etc. as specified. Controls contractor shall provide all necessary relays for speed control of all equipment as required.					
1.5. METRIC REFERENCES					
1. Conform to CAN/CSA-2334.1.					
2. Provide all required adapters between Metric and Imperial components.					
1.6. WORK BY OTHERS					
1. Controls Contractor shall be responsible for installing all HVAC, plumbing and electrical alterations, required for a complete BAC system.					
1.7. ELECTRICAL WORK AND SAFETY REQUIREMENT					
1. Electrical work shall meet or exceed Canadian Electrical Code, Ontario Electrical Safety Code, Ontario Hydro Requirements, and Canada Labour Code Part IV. Electrical wiring, terminal blocks and other high voltage controls shall be fully enclosed or properly guarded and marked to prevent accidental injury to personnel. Perform electrical work as per electrical specification and contract documents.					
1.8. MANUFACTURER'S RECOMMENDATIONS					
1. Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Consultant with shop drawing submission. Installation of the					
Item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations shall be cause for rejection of the material.					
1.9. WIRING					
1. All wiring associated with and required by the BAC shall be the responsibility of this contractor. The term "wiring" shall be construed to include furnishing of wire, transformers, conduit, miscellaneous material and labour as required to install a total working system. If departures from the contract drawings are deemed necessary by the contractor, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the drawings to the Consultant for approval. Wiring to conform with DRAWING ELECTRICAL NOTES.					
2. Controls Contractor shall supply power, control transformers, wiring to controllers and devices serving miscellaneous equipment such as but not limited to motorized zone dampers, air flow sensors, etc.					
1.10. PRODUCT AND SERVICE					
1. Materials and equipment shall be essentially the catalogue products of manufacturers regularly engaged in production of such materials or equipment and shall be manufacturer's latest standard design that complies with the specification requirements. Where two units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address and the model and serial number on a nameplate securely attached in a conspicuous place.					
2. Control equipment and installation shall be the product and service of one manufacturer unless otherwise specified.					
1.11. ACCEPTABLE CONTROLS CONTRACTORS AND SYSTEM					
1. Acceptable controls contractors to be:					
.1 Ainsworth (Invenys I/A web based system by Schneider Electric					
.2 Series of Controllers and Tridium based JACE controllers)					
.3 Alcon					
.4 Carmichael/Bundy Mechanical					
.5 Honeywell Ltd. (Excel 5000 Series Controllers)					
.6 Regulvar Canada (Delta Controls System)					
.7 Trane Canada (Tracer Summit)					
1.12. QUALITY ASSURANCE					
1. The manufacturer shall provide full time, on site, experienced product manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the BAC.					
2. Materials and equipment shall be the catalogue products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.					
3. This system shall have a documented history of compatibility by design for a minimum of 10 years. Future compatibility shall be supported for no less than 20 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.					
.1 Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.					
1.13. VERIFICATION OF DIMENSIONS					
1. The Contractor shall visit the premises to thoroughly familiarize himself with all details of the work and working conditions and verify all information in the field, and shall advise the Consultant of any discrepancy before performing any work. The Contractor shall be specifically responsible for the coordination and proper relation of his work to the building structure and to the work of all trades.					
1.14. SHOP DRAWINGS					
1. Provide shop drawings in accordance with Mechanical General Requirements.					
2. Before start of construction, provide shop drawings consisting of:					
.1 Service Contracts					
.1 Provide in-depth technical expertise and assistance to Owner in preparation and implementation of service contracts and in-house preventive maintenance procedures.					
.2 Service Contracts to include:					
.1 Annual verification of field points for operation and calibration.					
.2 # visits per year.					
.3 # responses to emergency calls during day, per year.					
.4 # responses to emergency calls during silent hours per year.					
.5 Silent hours.					
.6 Completion of Commissioning					
.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved to full satisfaction of Consultant and Owner.					
.2 EEMAC3					
.3 American National Standards Institute (ANSI)					
.1 ANSI C2, National Electrical Safety Code.					
.2 CSA Standard C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations and with Ontario amendments.					
2.3. ELECTRICAL WIRING					
1. Wiring to conform to Electrical specifications and to manufacturers written requirements, installed in conduit as indicated in these specifications. Wiring type and literature to be submitted to consultant prior to installation.					
2. All controllers shall be powered through the uninterruptable power supplies (UPS) provided by the BAC contractor. BAC contractor to coordinate power distribution layout/supplement and UPS requirements with electrical contractor at time of tender.					
2.4. BAC ARCHITECTURE					
1. The design of the BAC communications Network consists of two layers. The management level network layer shall be based on standard LAN protocols for TCP/IP communications over the Ethernet and shall provide full colour interactive User Interface (GUI) operator facilities based on standard Web Browser arrangements. This layer shall consist of the primary workstation, operator workstations, remote workstations, network interfaces and Jace Universal Network controllers with web option. The controller level network layer (or layers) shall consist of modular equipment controllers, standard programmable equipment controllers, and application specific controllers.					
.1 All communications shall be via twisted pairs wires, shielded where required.					
.2 BAC microprocessor failures shall not cause loss of communications of the remainder of any network.					
.3 All networks shall be peer-to-peer supporting sensor sharing, global application programs and bus to bus communications.					
.4 Provide an BAC Incorporating full Open Database Connectivity (ODBC) facilities via Microsoft Structured Query Language (SQL), or approved equivalent, ready for interactions with other potential software applications and for primary BAC database storage on the local server.					
.5 A 10/100 MB Ethernet infrastructure within the building will be provided for use by the BAC and for the support of the BAC Network Area Controllers, Network Servers, and other BAC network node equipment.					
.6 The BAC use of the Owner's network will be provided in conformance with:					
.1 IEEE Ethernet Standard 802.3.					
.2 ANSI/ASHRAE Standard 135, Annex J with support for Internet Protocol (IP) Addressing and common routes.					
.3 The Owner's network infrastructure will be comprised primarily of Category 5, 10 Base-T, UTP-8 shielded cabling.					
2.5. MANAGEMENT LEVEL NETWORK					
1. Operating System: The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAC software shall run on a Windows 7 operating system. These Windows applications shall run simultaneously with the BAC software. The operator shall be able to use in Microsoft Word, Excel, and other Windows based software packages, with optional capability of announcing on-line BAC alarms and monitoring information.					
.2 Owner will provide the Primary Operator Workstation and printer. Controls contractor to provide and install software and devices necessary to communicate with the field control panels and devices.					
3. Web Browser Interface					
.1 The BAC shall be designed and provided so as to be theoretically capable of supporting an unlimited number of Client Workstations with operator access via standard Web Browsers such as Internet Explorer and Netscape Navigator. No additional software on the Client should be required to enable Browsers to properly access and manage the BAC.					
.2 The Web Browser shall provide viewing "windows" into the BAC including current information and status, trend graphics, schedules, calendars, log, etc.					
3. The Web Browser Client shall, at minimum, support the following security functions:					
.1 User log-on identification and password Operator access control enabled. If an unauthorized user attempts access, a blank web page shall be displayed.					
.2 Security using password, authentication and encryption techniques to prevent unauthorized access.					
4. Storage of the graphical screen database shall be in the Network Area Controller or Network Server without specifically requiring any graphics to be stored on the Client workstations. Real-time values displayed on a Web page shall update automatically without requiring a manual refresh of the Web page.					
6. Each User shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform, at minimum, the following:					
.1 Modify common application objects, such as schedules, calendars and set points in a graphical manner.					
.1 Schedule times will be adjusted using a graphical slider, or similar tool, not requiring significant key entry.					
.2 Using a graphical calendar, or similar tool, not requiring significant keyboard manual data entry, shall set holidays.					
.2 Stop/Start binary commands and analog point commands and other common commands shall use graphical icons or symbols & not require significant keyboard entry.					
7. The BAC shall incorporate the capability to implement customized multiple User's Home Pages. Provide the ability to link a specific User to their defined Home Page. From the Home Page, provide links to other pages in the BAC as governed by the System Administrator. Provide for graphic screens on the Web Browser Client, to support links to other locations on the Internet or on Intranet sites by specifying the Internet Uniform Resource Locator (URL) address for the desired link.					
Workstation Software					
1. Workstation Control Software					
.1 Enable non-programmer operator to easily perform tasks which form part of daily routine.					
.2 Must perform the following functions, facilitate keyboard visual displays, keyboard, disk, or network entry of information into system; display and logging of system information and following tasks:					
.1 Automatic logging of digital alarms and change of status messages.					
.2 Automatic logging of analog alarms.					
.3 System changes (such as alarm limits, set-points, alarm lockouts).					
4. Display specific point values, states as scheduled.					
5. Provide reports as requested and on scheduled basis when so required.					
.6 Display graphs as requested.					
.7 Display error messages library.					
.8 Display list of points within system.					
.9 Display list of systems within building.					
.10 Provide trend logs as required.					
.11 Provide manual control of DO and AO as required.					
.12 Direct output of information to selected device.					
.13 On-line changes:					
.1 Setpoints.					
.2 Control and change of state changes.					
.3 Schedule changes.					
Error Messages					
.1 Inform operator of all errors in data, errors in entry instructions, failure of equipment to respond to requests or commands, failure of communications between components of BAC.					
.2 Error messages to be comprehensive and communicate clearly to operator precise nature of problem.					
3. Password Protection					
.1 Minimum 5 levels of password access protection to limit control, display, data base manipulation capabilities as follows:					
.2 User-defnable, automatic log-off times to prevent operators leaving devices on-line inadvertently.					
.3 Ability to perform override on digital outputs at controllers.					
4. Alarms					
.1 Critical alarms shall be wired to UCDSB security/alarm panel for monitoring and call out by central station. Connection to panel to be made by UCDSB alarm employee.					
.2 All alarms to be classified as "critical", "warning", "maintenance". Personnel having required password level to detect alarms and alarm classifications.					
3. Presentation of alarms to include features identified under applicable report definitions of report program paragraph.					
4. Alarm reports to include:					
.1 Summary of all points in critical alarm. Include at least point name, point description, alarm type, current value, limit exceeded.					
2. Summary of all points in maintenance alarm. Include at least point name, point description, alarm type, current value.					
.3 Analog alarm list summary: include point acronym, alarm limits.					
4. Summary of all alarm messages: include associated point name, description, alarm description.					
5. Each point to have its own alarm message.					
6. BAC to notify operator of occurrence of alarms within following time period of detection:					
.1 Critical - 2 seconds.					
.2 Warning - 8 seconds.					
.3 Maintenance - upon operator's request.					
.7 Display alarm messages in English.					
8. Primary alarm message to include as minimum: location of alarm, time of occurrence, type of alarm.					
9. System reaction to alarms: Acknowledgement of alarm to change visual indicator from flashing to steady state and to silence audible device. Steady state and silent alarm work until alarm condition is corrected but must not impede reporting of new alarm conditions. Notification of any type of alarm not to impede notification of other alarms or operation of controllers or system network. Acknowledgement of one alarm not to be considered as acknowledgement of any other alarms.					
10. Controller network areas: system supervision of controllers and communications lines to provide following alarms as minimum.					
.1 Controller not responding - where possible delineate between controller and communication line failure.					
.2 Controller responding - return to normal.					
.3 Controller communication normal - return to normal.					
11. Digital/Alarm status to be interrogated every 2 seconds as minimum or direct interrupting non-polling type. Annunciate each non-expected status with alarm message.					
5. Scheduling: Provide a graphical format for simplification of time-of-day scheduling and overrides of building operations. Provide the following graphic schedules as a minimum:					
- Weekly schedules - Zone schedules - Monthly schedules					
Report Programs					
1. General:					
.1 The OWS to support all special reports for energy management programs, function totalization, analog/pulse totalization and event totalization features available at the Controller level.					
.2 All reports to include time, day, month, year, report title, operator's initials.					
3. Software to provide capability to create, generate and format graphic display of report for printing or temporary/permanent storage. To be able to select and assign points used in such reports. Sort output by time, system, as minimum, provide for user options for report presentation.					
4. Message control:					
.1 Message and alarm buffering to prevent loss of information.					
.2 Error detection correction and retransmission to guarantee data integrity.					
.3 Default device definition to prevent loss of alarms or data, ensure alarms are reported as quickly as possible in event that operator device does not respond.					
4. Synchronization of real-time clocks in all control panels.					
3. Periodic/automatic report:					
.1 To generate specified report(s) automatically including options of start time and date, interval between reports (hourly, daily, weekly, monthly), output device, report type, report title, report format, modify periodic/automatic reporting profile at any time.					
2. Reports to include:					
.1 Night cycle summary.					
.2 Disabled "locked-out" point summary: include point name, description, whether disabled by system or by operator.					
3. Run time summary: summary of accumulated running time of selected equipment. Include point acronym, description, run time to date, alarm limit setting. Run time to accumulate until reset individually by operator.					
4. Summary of start/stop schedules: include start/stop times and days, point acronym, description.					
5. Motor status summary:					
.1 Motor status report: printout or display of any database value requested by operator. To indicate status at time of request.					
7. Trend Data					
.1 Includes historical, archival, trend points, control loop plots.					
.2 Make separate from reports.					
3. Trend reports to trend continuously points selected by					

		1. Non-volatile EPROM to contain all operating system, executive, application, sub-routine, operator error notifications definition software. Tape media not acceptable.	1. Input and output short circuit and open circuit protection.	1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.	1. Identify all field devices properly.	1. Co-ordinate with all other trades.
		2. Battery backed RAM 72h or EPROM to eliminate operating data reload in event of power failure RAM to contain all CDS, application functions, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDI and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS, or locally installed CD or diskette.	2. Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.	2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each SEC shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.	2. Refer to identification.	2. Correct deficiencies, re-test in presence of Consultant/Consultant until satisfactory performance is obtained.
2.6 CONTROLLER LEVEL NETWORK			3. Temperature effects: not to exceed plus or minus 1.0% of full scale/50°C.	3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hours destinations) or based on priority.	3. Do complete installation in accordance with requirements of:	3. Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
1. Standard Equipment Controller (SEC)			4. 0 to 100°C, plus or minus 0.5°C.	4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.	4. Electrical, this specification.	4. Load system with project software.
2. Each SEC shall have sufficient memory to support its own operating system and databases, including:			5. 10 to 35°C, plus or minus 0.25°C.	5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.	5. Ontario Electrical Safety Code.	5. Test all points as required.
1. Control processes				6. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.	6. ANS/NFPA 70.	6. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the manufacturer. Verify that all system are operable from local control in the specified failure mode upon panel failure or loss of power.
2. Energy management applications				7. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each SEC point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each SEC shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 2000 data samples. All trend data shall be available for transfer to a Workstation without manual intervention.	7. ANSI C2.	7. Provide any recommendation for system modification in writing to consultant. Do not make any system modification, including operating parameters and control settings, without prior approval of consultant.
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system				8. SEC shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.	8. ANSI C2.	8. Test and calibrate all field hardware including stand-alone capability of each controller.
4. Historical/trend data for points specified				9. The peer to peer network shall allow the SEC to assign a minimum of 50 passwords access and control points on the network. The Access Manager (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, while only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.	9. ANSI C2.	9. Verify each A-to-D converter.
5. Maintenance support applications				10. Loop tuning shall be capable of being initiated either locally at the SEC, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.	10. ANSI C2.	10. Test and calibrate each A/E using calibrated digital instruments.
6. Custom processes				11. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	11. ANSI C2.	11. Test each DI to ensure proper settings and switching contacts.
7. Operator I/O				12. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	12. ANSI C2.	12. Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
8. Dial-up communications				13. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	13. ANSI C2.	13. Test all operating software.
3. Each SEC shall support firmware upgrades without the need to replace hardware.				14. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	14. ANSI C2.	14. Test all applications and provide samples of all logs and commands.
4. SEC shall provide an RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.				15. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	15. ANSI C2.	15. Verify each CDI including energy optimization programs.
5. SEC shall provide local LED status indication for each digital input and output for constant, up-to date verification of all point conditions without the need for an operator I/O device.				16. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	16. ANSI C2.	16. Debug all software.
6. SEC shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The SEC shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:				17. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	17. ANSI C2.	17. Shut out flow measuring and static pressure stations with high pressure air at 700 kPa.
1. RF Conducted Immunity (RFI) per EN 50141 (IEC 1000-4-6) at 3V.				18. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	18. ANSI C2.	Final Startup/Check-out Tests
2. Electro Static Discharge (ESD) immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.				19. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	19. ANSI C2.	1. Upon satisfactory completion of all tests, perform point-by-point test of entire system under direction of BAC Commissioning Contractor.
3. Electrical Fast Transients (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power.				20. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	20. ANSI C2.	2. Detailed daily schedule showing items to be tested and personnel available.
4. Output Circuit Transients per UL 864 (2400V, 10A, 1.2 Joule max) isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:				21. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	21. ANSI C2.	3. Key document for recording all procedures to be listing of system database, including keyname, English description, point type and address, engineering units, low and high limits. Include space for listing for remarks and signatures of commissioning technician.
1. IEEE Standard S87-1980.				22. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	22. ANSI C2.	Final Operational Acceptance Tests
2. UL 864 Supply Line Transients.				23. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	23. ANSI C2.	1. Purpose to demonstrate that BAC functions in accordance with all contract requirements.
3. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (IEC 1000-4-11).				24. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	24. ANSI C2.	2. Test to last at least 30 consecutive 24 hour days.
8. In the event of the loss of normal power, there shall be an orderly shutdown of all SEC to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated				25. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	25. ANSI C2.	3. Tests to include:
for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.				26. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	26. ANSI C2.	1. Demonstration of correct operation of all monitored and controlled points.
1. Upon restoration of normal power, the SEC shall automatically resume full operation without manual intervention.				27. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	27. ANSI C2.	2. Operation and capabilities of all sequences, reports, special control algorithms, diagnostics, software.
2. Should SEC memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.				28. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	28. ANSI C2.	4. System is accepted if:
3. Provide a separate SEC for each AHU or other HVAC system. It is intended that each unique system be provided with its own point resident DDC Controller.				29. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	29. ANSI C2.	1. Equipment operates at AEL of at least 99% for test period.
9. Controller shall communicate schedules, measurable variables, command values and be capable of time clock synchronization all using the BACNET protocol.				30. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	30. ANSI C2.	2. All other requirements of Contract have been met.
2. Application Specific Controllers (ASC)				31. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	31. ANSI C2.	5. In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
1. Each DDC Controller shall be able to extend its performance and capacity through the use of application specific controllers (ASCs).				32. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	32. ANSI C2.	6. Correct all defects when they occur and before resuming tests.
2. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.				33. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	33. ANSI C2.	3.6 COMMISSIONING, TESTING AND ACCEPTANCE
1. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences.				34. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	34. ANSI C2.	1. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of system or deviation from normal function shall be performed when the conditions of the system are not required. The commissioning must be coordinated with the owner and construction manager to ensure systems are available when needed. Notify the operating personnel in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.
2. Each controller shall support its own real-time operating system.				35. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	35. ANSI C2.	1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:
3. All programs shall be customizable to meet the user's exact control strategy requirements. Controller user's utilized canned programs shall be acceptable. Provided it meet the specified sequence of operation in full.				36. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	36. ANSI C2.	1. Sensor accuracy at 10, 50 and 90% of range.
4. Programming of controllers shall utilize the same language and code as used by MEC Controllers to maximize system flexibility and ease of use.				37. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	37. ANSI C2.	2. Sensor range.
5. Each controller shall have connection provisions for a portable operator's terminal. This tool shall allow the user to display, generate or modify all point databases and operating programs.				38. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	38. ANSI C2.	3. Verify analog limit and binary alarm reporting.
3. Application Specific Controllers shall be capable of control of the following equipment, but not limited to, the following:				39. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	39. ANSI C2.	4. Point value reporting.
1. Fan coils				40. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	40. ANSI C2.	5. Binary alarm and switch settings.
2. Constant Air Volume (CAV) boxes				41. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	41. ANSI C2.	6. Actuator ranges.
3. Dual Duct Terminal Boxes				42. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	42. ANSI C2.	7. Fail safe operation on loss of control signal, electric power, network communications.
4. Unit Conditioners				43. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	43. ANSI C2.	2. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BAC program shall be put on line and commissioned. The contractor shall, in the presence of the Owners and Consultant, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, with specified accuracy. The system program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.
5. Heat Pumps				44. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	44. ANSI C2.	3. After all BAC programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:
6. Unit Ventilators				45. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	45. ANSI C2.	1. Data communication, both normal and failure modes.
7. Room Pressurization				46. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	46. ANSI C2.	2. Fully loaded system response time.
4. Controllers shall include all points inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 psi pneumatic, 0-10V, allowing for interface to a variety of modulating actuators.				47. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	47. ANSI C2.	3. Impact of component failures on system performance and system operation.
5. All controller sequences and operation shall provide closed loop control of the intended application.				48. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	48. ANSI C2.	4. Time of day change.
6. Acceptable material: Controller shall communicate schedules, Measured variables, Command values and capable of time clock synchronization all using the BACNET protocol.				49. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	49. ANSI C2.	5. End of month/end of year operation.
2.7 BAC FIELD CONTROL DEVICES				50. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	50. ANSI C2.	6. Season changeover.
1. General				51. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	51. ANSI C2.	7. Global application programs and point sharing.
1. Control devices of each category to be of same type of manufacturer.				52. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	52. ANSI C2.	8. System backup and reloading.
2. External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.				53. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	53. ANSI C2.	9. System status displays.
3. Operating conditions: 0-44°C with 10-90% RH (non-condensing) for indoor equipment and -40 to +60°C with 10-90% RH non-condensing for outdoor equipment unless otherwise specified.				54. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	54. ANSI C2.	10. Diagnostic functions.
4. Terminations: use standard conduit bus with split screwdriver compression connector block unless otherwise specified.				55. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	55. ANSI C2.	11. Power failure routines.
5. Transmitters to be unaffected by external transmitters (eg. walkie talkies).				56. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	56. ANSI C2.	12. Battery backup.
6. Account for hysteresis, relaxation time, maximum and minimum limits in all applications of sensors and controls.				57. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	57. ANSI C2.	13. Smoke Control, stair pressurization, stair, vents, in concert with Fire Alarm System testing.
2. Temperature Sensors				58. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	58. ANSI C2.	14. Testing of all electrical and HVAC systems with other division of work.
1. General: except for space temperature sensors, temperature sensors are to be resistance or thermocouple type to following requirements:				59. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	59. ANSI C2.	4. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure has been accepted, to verify that sensors and control devices maintain specified accuracy and the system performance does not degrade over time.
1. Thermocouples: to be limited to temperature range of 200°C and over.				60. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	60. ANSI C2.	5. Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate all system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.
2. RTDs: 10 Kohm at 0°C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm.C				61. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	61. ANSI C2.	
3. Sensing element: hermetically sealed.				62. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	62. ANSI C2.	
4. Stem and tip construction: copper or type 304 stainless steel.				63. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	63. ANSI C2.	
5. Time constant: response less than 3 seconds to temperature change of 10°C.				64. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	64. ANSI C2.	
6. Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length to equal 1/3 of the pipe diameter.				65. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	65. ANSI C2.	
2. Sensors:				66. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	66. ANSI C2.	
1. Room type: wall mounting, covers having white ABS plastic with guard. Provide occupancy override push button and setpoint adjustment on temperature sensors, drawings and documents. Accuracy of plus or minus 0.5°C. Sensors to be equipped with plug in connection for access to the DDC network by the portable operator terminal. (Plug-in connection not to be wired). Sensor to have software limitation of setpoint capability.				67. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	67. ANSI C2.	
1. Acceptable material: T.A.C. thermistor model TSMN-90230-850-0-1.				68. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	68. ANSI C2.	
2. General purpose duct type: suitable for insertion into ducts at any angle, insertion length to be 2/3 of duct width.				69. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	69. ANSI C2.	
1. Acceptable material: T.A.C. Balco model TS-8201.				70. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	70. ANSI C2.	
3. Averaging duct type: continuous filament with minimum immersion length 6000mm. Bend probe at field installation time to 100mm radius at any point along probe without degradation of performance.				71. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	71. ANSI C2.	
4. Outside air type: Combination outdoor temperature and humidity sensor complete with solar radiation shield. Mount device in easily accessible location for maintenance and well away from any exhaust openings. Standard of acceptance: Vaisala model HMS112.				72. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	72. ANSI C2.	
3. Combination Temperature and CO2 Sensor:				73. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	73. ANSI C2.	
1. Temperature Operating Range: 5°C to 40°C.				74. SEC shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.	74.	

MORRIS

Engineering Ltd.

Brockville, Ontario

(613)349-0555

LICENSED PROFESSIONAL ENGINEER

M. A. MORRIS

PROVINCE OF ONTARIO

5	2026-03-30	FOR PERMIT AND TENDER
4	2025-10-31	FINAL REVIEW
3	2025-10-24	FOR REVIEW
2	2025-10-03	FOR REVIEW
1	2025-09-11	FOR REVIEW
0	2025-08-28	PRELIMINARY
NO.	DATE	REVISION

CLIENT:

SHOALTS & ZABACK Architects Ltd. Kingston, Ontario

PROJECT:

OXFORD ON RIDEAU Public School Oxford Mills, Ontario

DRAWING:

MECHANICAL Building Automation & Control System (BACS) Notes - Page 2

DESIGN BY:	M. MORRIS	M006
DRAWN BY:	A.M.	
DATE:	JUL 2025	
PROJECT No.:	921	
SCALE:	AS SHOWN	

Brockville, Ontario (613)349-0555

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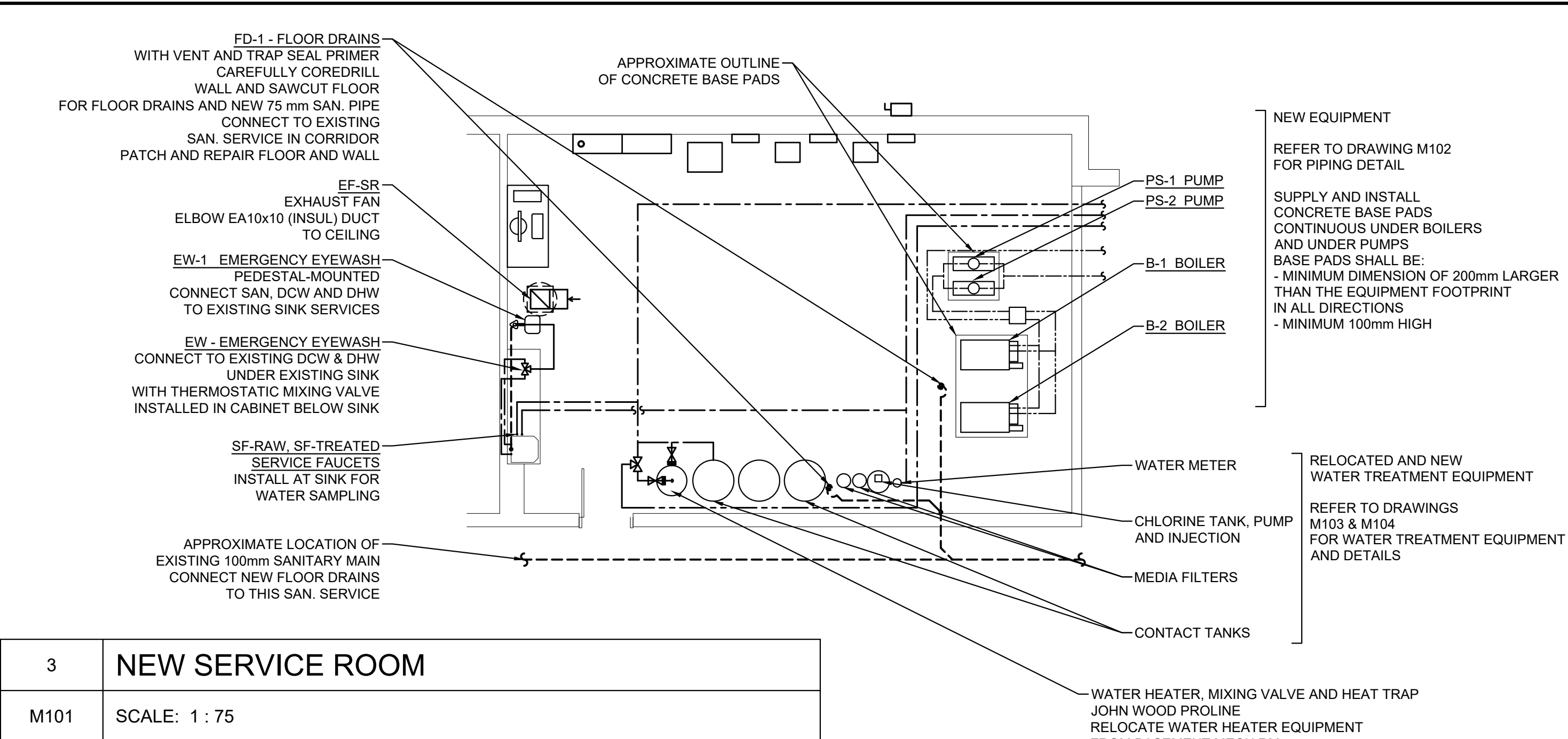
PROJECT:

**OXFORD ON
RIDEAU
Public School**
S.D.
Oxford Mills, Ontario

Floor Plan

New Construction

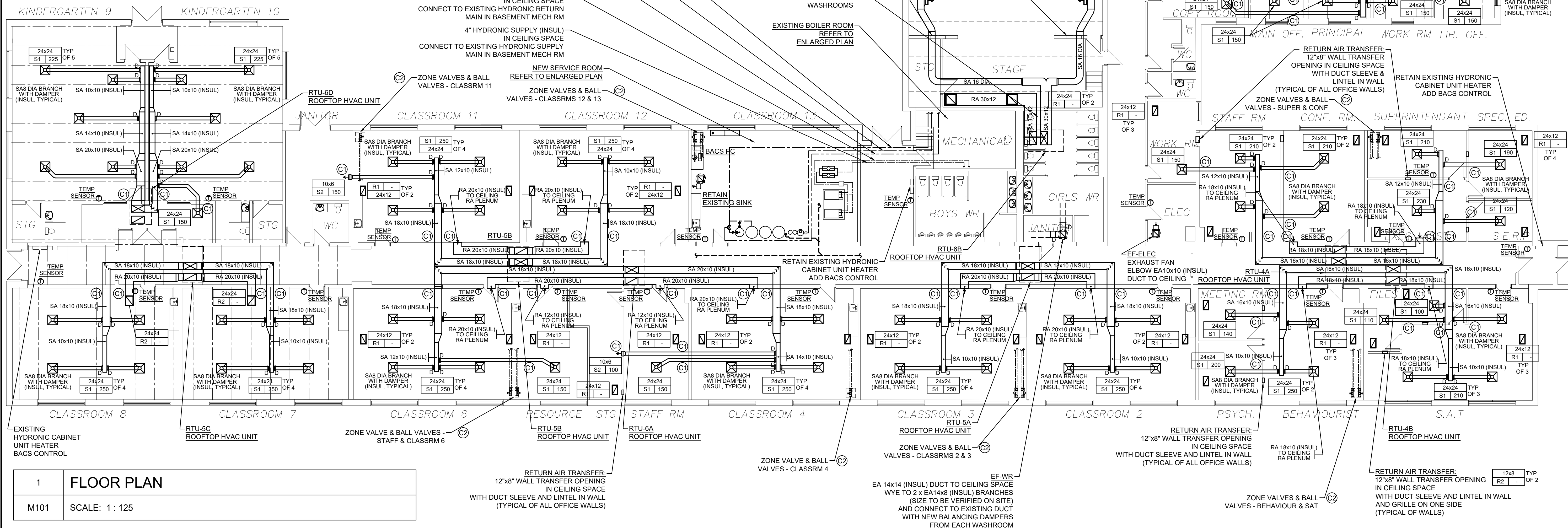
M101

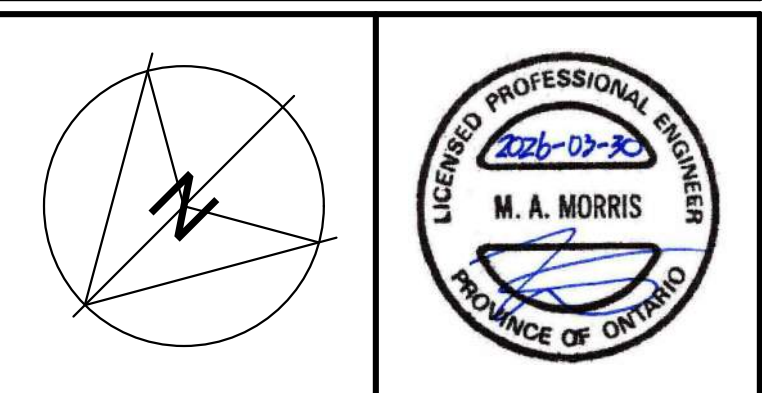
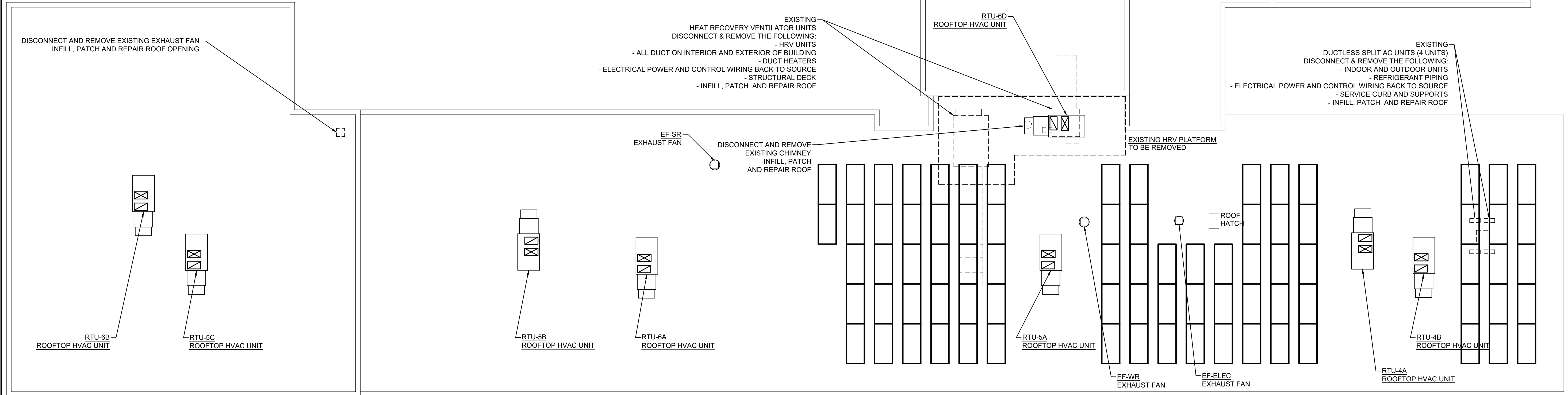
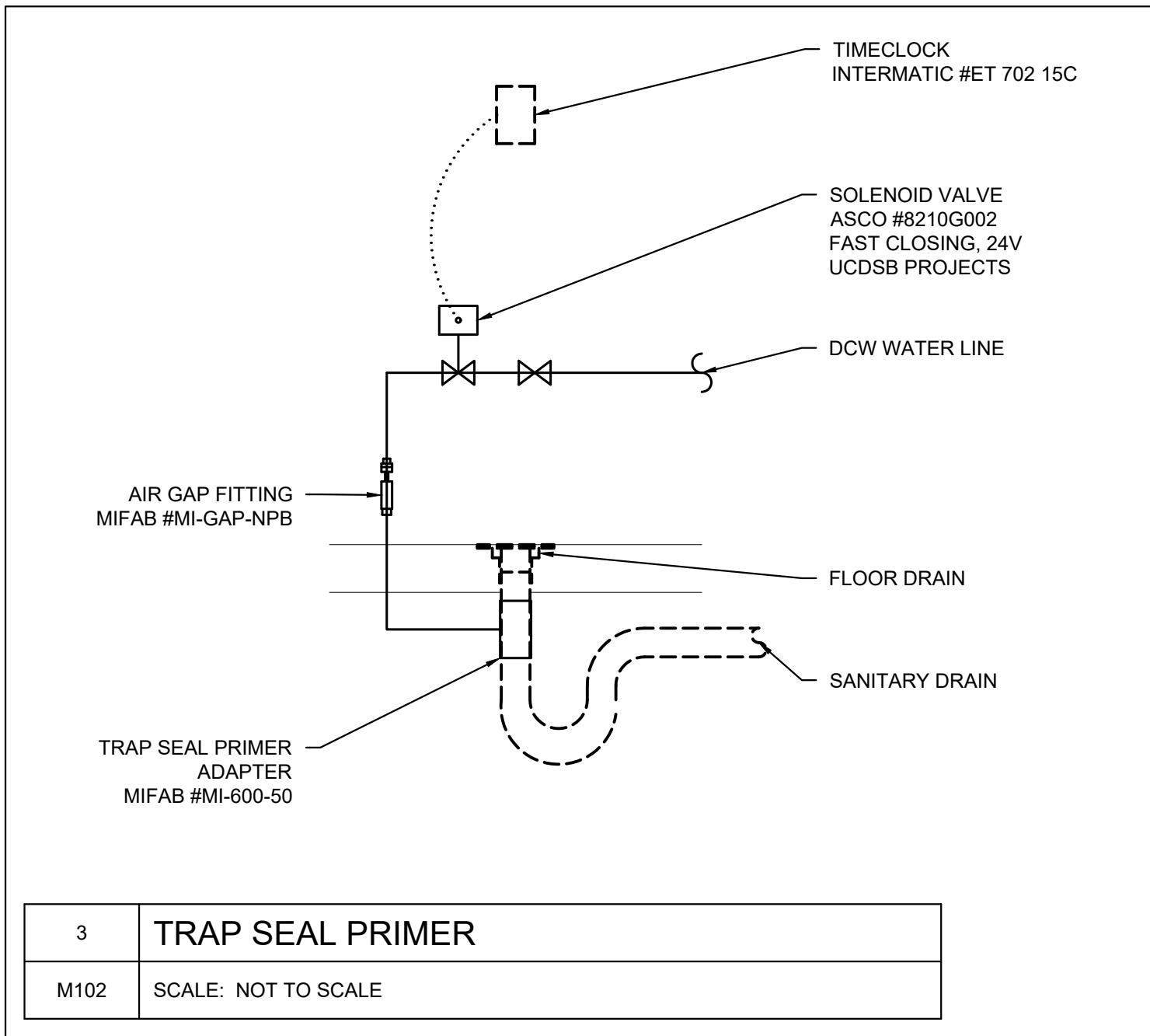
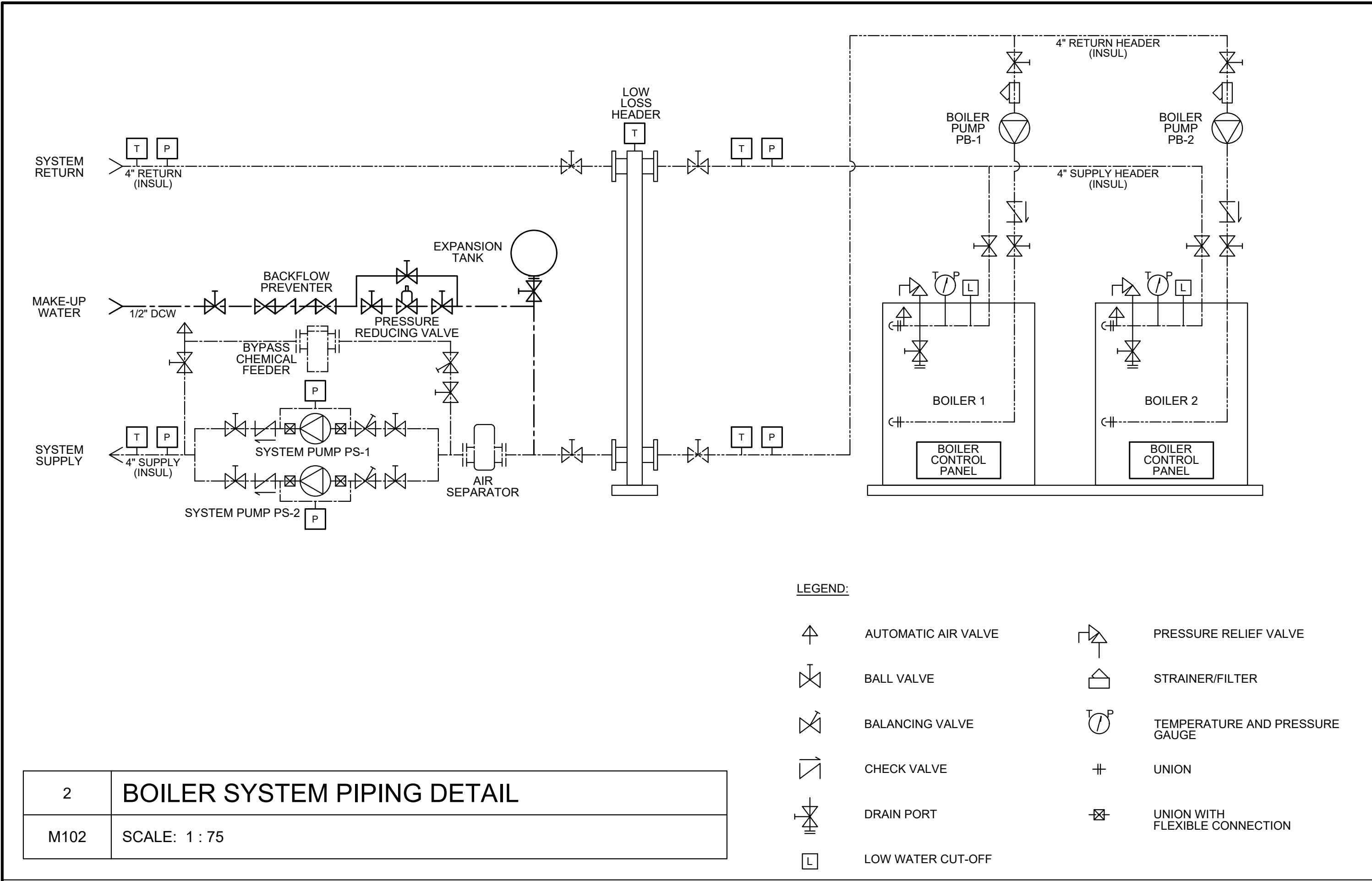


TYPICAL CONSTRUCTION NOTES: ○

C1 CAREFULLY CUT NEW OPENING IN EXISTING WALL
FOR NEW DUCT
SUPPLY AND INSTALL STRUCTURAL SUPPORT FOR OPENING
INFILL, PATCH AND REPAIR AROUND DUCT

C2 HYDRONIC SUPPLY AND RETURN PIPE
SUPPLY AND INSTALL NEW ZONE VALVE
AND BALL VALVES (ON BOTH SUPPLY AND RETURN)
WITH BACS CONTROL





NO.	DATE	REVISION
5	2026-03-30	FOR PERMIT AND TENDER
4	2025-10-31	FINAL REVIEW
3	2025-10-24	FOR REVIEW
2	2025-10-03	FOR REVIEW
1	2025-09-11	FOR REVIEW
0	2025-08-28	PRELIMINARY



CLIENT:

SHOALTS & ZABACK
Architects Ltd.
Kingston, Ontario

PROJECT:

OXFORD ON RIDEAU
Public School
Oxford Mills, Ontario

DRAWING:

MECHANICAL

Roof Plan
Piping Details

DESIGN BY:	M. MORRIS
DRAWN BY:	A.M.
DATE:	JUL 2025
PROJECT No.:	921
SCALE:	AS SHOWN

M102

1	WATER TREATMENT SYSTEM DESCRIPTION
M103	SCALE: NOT TO SCALE

2	SUMMARY OF UPGRADES & EQUIPMENT
M103	SCALE: NOT TO SCALE

MORRIS

Engineering Ltd.

Brockville, Ontario

(613)349-0555

LICENSED PROFESSIONAL ENGINEER

2246-D-30

M. A. MORRIS

PROVINCE OF ONTARIO

5	2026-03-30	FOR PERMIT AND TENDER
4	2025-10-31	FINAL REVIEW
3	2025-10-24	FOR REVIEW
2	2025-10-03	FOR REVIEW
1	2025-09-11	FOR REVIEW
0	2025-08-28	PRELIMINARY
NO.	DATE	REVISION

CLIENT:

SHOALTS & ZABACK Architects Ltd. Kingston, Ontario

PROJECT:

OXFORD ON RIDEAU Public School Oxford Mills, Ontario

DRAWING:

MECHANICAL Water Treatment System Notes and Details

DESIGN BY:

M. MORRIS

DRAWN BY:

A.M.

DATE:

JUL 2025

PROJECT No.:

921

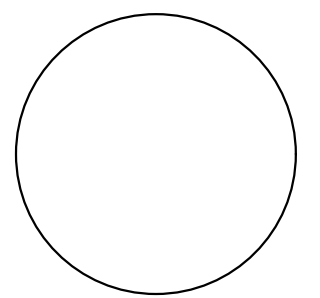
SCALE:

AS SHOWN

M103

2	SUMMARY OF UPGRADES & EQUIPMENT
M103	SCALE: NOT TO SCALE

Brockville, Ontario (613)349-0555



5	2026-03-30	FOR PERMIT AND TENDER
4	2025-10-31	FINAL REVIEW
3	2025-10-24	FOR REVIEW
2	2025-10-03	FOR REVIEW
1	2025-09-11	FOR REVIEW
0	2025-08-28	PRELIMINARY
NO.	DATE	REVISION

CLIENT:

SHOALTS &
ZABACK
Architects Ltd.
Kingston, Ontario

PROJECT:

OXFORD ON
RIDEAU
Public School
Oxford Mills, Ontario

DRAWING:

MECHANICAL























Water Treatment System - Process Flow Diagram

DESIGN BY:	M. MORRIS
DRAWN BY:	A.M.
DATE:	JUL 2025
PROJECT No.:	921
SCALE:	AS SHOWN

M104

**OXFORD ON RIDEAU
PUBLIC SCHOOL DRINKING
WATER TREATMENT
SYSTEM DESIGN**
UPPER CANADA DISTRICT
SCHOOL BOARD
50 Water Street
Kemptville, Ontario

LEGEND

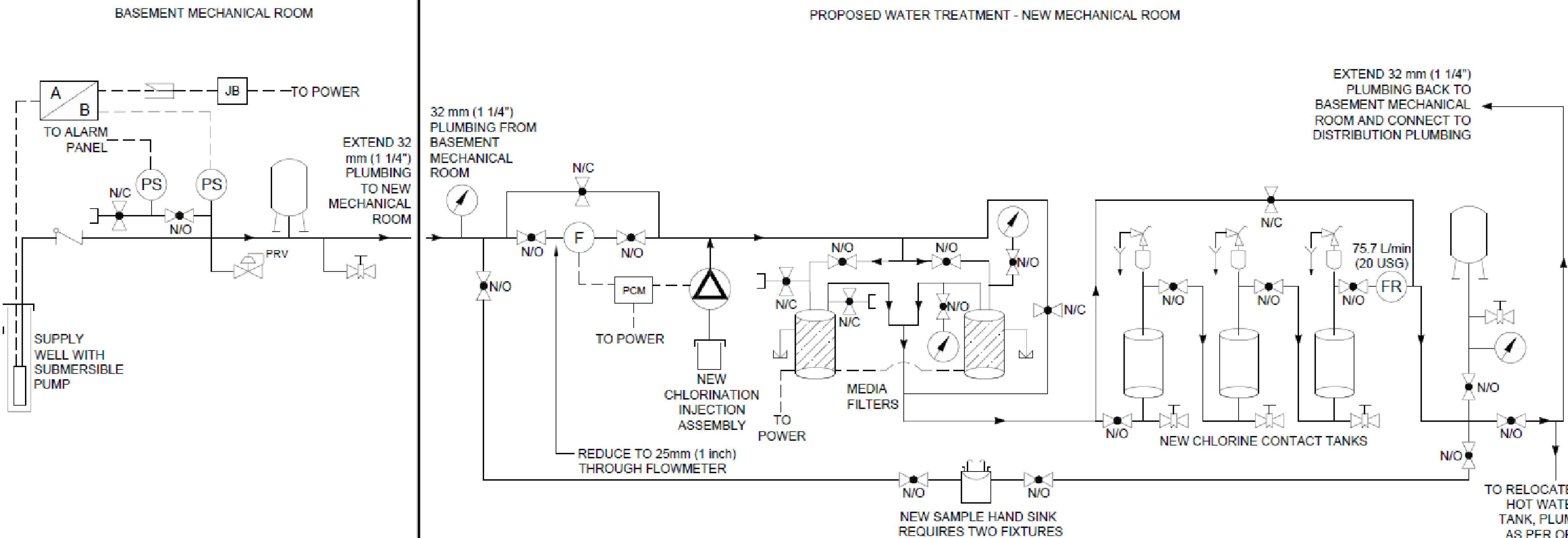
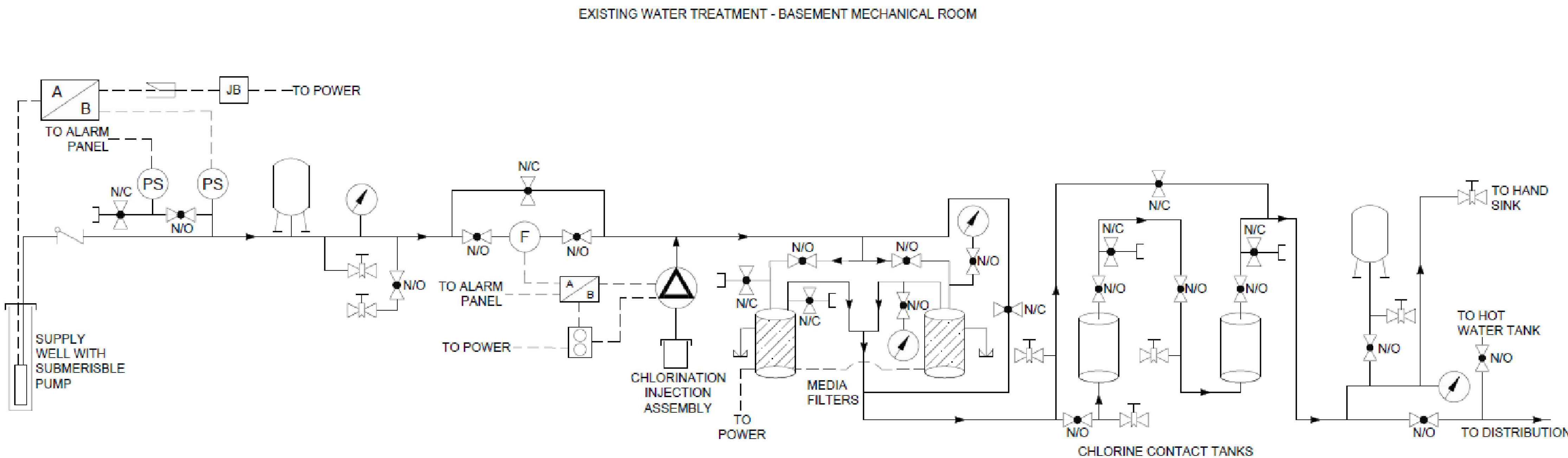
- | | |
|---|--------------------------|
|  | Ball Valve |
|  | Normally Open |
|  | Normally Closed |
|  | Tap |
|  | Air/Vacuum Release Valve |
|  | Pressure Relief Valve |
|  | Check Valve |
|  | Drain |
|  | Hand Sink |
|  | Open-ended Pipe |
|  | Electrical Outlet |
|  | Flow Meter |
|  | Flow Restrictor |
|  | Pressure Switch |
|  | Pressure Gauge |
|  | Chlorine Injection Pump |
|  | Control Panel |
|  | Pump Control Module |
|  | Junction Box |
|  | Tank |
|  | Media Filter Tank |
|  | Pressure Tank |



194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: 705-742-7900 Fax: 705-742-7907
www.cambium-inc.com

PROCESS FLOW DIAGRAM

Project No.: 24917-001		Date: February 2026	
Scale: N/A		Vertical Scale: N/A	
Drawn By: NLB	Checked By: SD	Figure:	1



1	PROCESS FLOW DIAGRAM
M104	SCALE: NOT TO SCALE

M104