#	NEW BUILDING ADDITION Ontario 2012 Building Code, Data Matrix Parts 3 or 9		OBC Reference References are to Division B unless noted [A] for Division A or [C] for Division C	
1	Project Description: ☐ New ☐ Addition ☐ Change of Use ☐ Alteration	■ Part 11 11.1 to 11.4	☐ Part 3 1.1.2.[A]	☐ Part 9 1.1.2.[A] & 9.10.1.3
2	Major Occupancy(s): A2 - ASSEMBLY		3.1.2.1.(1)	9.10.2
3	Building Area (m²): Existing: 7938 m² + New: 0 m² = Total: 7938 m²		1.4.1.2.[A]	1.4.1.2.[A]
4	Gross Area (m²): Existing: 14,726 m² + New: 0 m² = Total: 21,167 m²		1.4.1.2.[A]	1.4.1.2.[A]
5	Number of Storeys: Above Grade: 2 Below Grade: 0		1.4.1.2.[A]&3.2.1.1.	1.4.1.2.[A]&9.10.4
6	Number of Streets / Fire Fighter Access: 4		3.2.2.10 & 3.2.5	9.10.20
7	Building Classification: Existing Non-conforming		3.2.2.20 to 3.2.2.83	9.10.2
8	Sprinkler System Proposed: ☐ Entire Building ☐ Selected Compartments ☐ Selected Floor Areas ☐ Basement ☐ In Lieu of Roof Rating ■ Not Required		3.2.2.20-.83 3.2.1.5 3.2.2.17 INDEX	9.10.8.2 INDEX
9	Standpipe Required: ☐ Yes ■ No		3.2.9	N/A
10	Fire Alarm Required: ■ Yes ☐ No		3.2.4	9.10.18
11	Water Service / Supply is Adequate: ■ Yes ☐ No		3.2.5.7	N/A
12	High Building: ☐ Yes ■ No		3.2.6	N/A
13	Construction Restrictions: ☐ Combustible Permited ☐ Non-Combustible Required ■ Both Actual Construction: ☐ Combustible ☐ Non-Combustible ■ Both		3.2.2.20 to 3.2.2.83	9.10.6
14	Mezzanine(s) Area (m²): N/A m² Mechanical Mezzanine		3.2.1.1.(3) to 3.2.1.1.(8)	9.10.4.1
15	Occupant Load Based On: ☐ m²/person ■ Design of Building 1 Floor: Occupancy: N/A Load: N/A persons 2nd Floor: Occupancy: N/A Load: N/A persons		3.1.17	9.9.1.3
16	Barrier Free Design: ■ Yes ☐ No (Explain)		3.8	9.5.2
17	Hazardous Substances: ☐ Yes ■ No		3.3.1.2 & 3.3.1.19	9.10.1.3.(4)
18	Required Fire Resistance Rating (FRR) Horizontal Assemblies FRR (Hours): Floors N/A Hours; Roof N/A Hours; Mezzanine N/A Hours — Listed Design No. or Description (SG-2) FRR of Supporting Members: Floors N/A Hours; Roof N/A Hours; Mezzanine N/A Hours — Listed Design No. or Description (SG-2)		3.2.2.20 to 3.2.2.83 & 3.2.1.4	9.10.8 9.10.9
19	Spatial Separation - Construction of Exterior Walls		3.2.3	9.10.14
20	Other - Describe:			

Wall	Area of EBF (m²)	L.D. (m)	L/H or H/L	Permitted Max. % of Openings	Proposed % of Openings	FRR (Hours)	Listed Design or Description	Comb. Const.	Comb. Const. Nonc. Cladding	Non-Comb. Constr.
North	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
South	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
East	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
West	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-

CLIENT:

Hamilton Wentworth District School Board

20 Education Court | Hamilton, ON | L9A 0B9

HVAC Renovations at:

Glendale Secondary School

145 Rainbow Drive,

Hamilton, ON

PROJECT # 2328

ISSUED FOR TENDER - MARCH 27/25

DRAWING LIST:

Structural

S1.1 Typical Details

Mechanical

M0.0 Mechanical Legend & Drawing List
M0.1 Mechanical Specifications
M0.2 Mechanical Specifications
M0.3 Mechanical Specifications
M0.4 Mechanical Specifications
M1.0 Demolition Boiler Room Ground Floor Plan
M2.0 Proposed Boiler Room Ground Floor Plan
M3.0 Mechanical Schematics
M3.1 Mechanical Details
M4.0 Control Schematics
ME1.0 Mechanical & Electrical Schedules

Electrical

E0.0 Electrical Legend, Key Plan & Drawing List
E1.0 Ground Floor - Power & Systems Demolition Plans
E2.0 Ground Floor - Power & Systems New Plans
E3.0 Electrical Specifications
ME1.0 Mechanical & Electrical Schedules

PLOTTED 3/21/2025 10:05 AM

GENERAL NOTES — GN-001CS

1 GENERAL

1.1 CHECK DIMENSIONS ON STRUCTURAL DRAWINGS AGAINST ARCHITECTURAL DRAWINGS AND EXISTING SITE CONDITIONS. REPORT INCONSISTENCIES TO CONSULTANT BEFORE PROCEEDING WITH THE WORK.

1.2 READ DRAWINGS IN CONJUNCTION WITH SPECIFICATIONS.

1.3 DO NOT EXCEED DURING CONSTRUCTION DESIGN LOADS SHOWN ON PLANS REDUCED AS NECESSARY UNTIL MATERIALS REACH DESIGN STRENGTH.

1.4 DO NOT SCALE DRAWINGS.

1.5 DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.

2 DESIGN

2.1 DESIGN IS IN ACCORDANCE WITH THE ONTARIO BUILDING CODE, 2012 EDITION. (R2019)

2.2 DESIGN STANDARDS

2.2.1 CONCRETE MEMBERS ARE DESIGNED IN ACCORDANCE WITH CSA STANDARD A23.3-14.

2.2.2 STRUCTURAL STEEL IS DESIGNED IN ACCORDANCE WITH CSA STANDARD S16-14.

2.2.3 MASONRY IS DESIGNED IN ACCORDANCE WITH CSA STANDARD S304-04.

3 MATERIALS

3.1 CONCRETE: SEE SCHEDULE OF CONCRETE PROPERTIES AND SPECIFICATION.

3.2 STRUCTURAL STEEL: UNLESS NOTED OTHERWISE TO CSA G40.20/G40.21-13 OR ASTM STANDARD A992/A992M-11.
W AND WWF SHAPES: GRADE 350W
PLATES: GRADE 350 W
CHANNELS AND ANGLES: GRADE 350W
HOLLOW STRUCTURAL SECTIONS: 350W CLASS C OR ASTM STANDARD A1085
ANCHOR RODS: 300W

3.3 REINFORCING STEEL: UNLESS NOTED OTHERWISE TO CSA G30.18-09 GRADE 400W

3.3.1 REINFORCING BAR AREAS ARE 100, 200, 300, 500, 700, 1000, 1500 AND 2500 SQ. MM FOR BAR DESIGNATIONS 10M, 15M, 20M, 25M, 35M, 45M AND 55M RESPECTIVELY.

3.3.2 STRENGTH:
DEFORMED REINFORCING BARS: 400 MPAa
WELDED WIRE FABRIC: 440 MPa

STRUCTURAL GUIDELINES FOR DRILLING, CUTTING & CORING THROUGH EXISTING CONCRETE STRUCTURE — R-003

1. GENERAL

1.1 ALL OPENINGS THROUGH EXISTING STRUCTURE REQUIRED FOR MECHANICAL AND ELECTRICAL SERVICES ARE TO BE LOCATED AND CUT IN ACCORDANCE WITH THE REQUIREMENTS STIPULATED HEREIN. ALL PROPOSED NEW CORES AND OPENINGS THROUGH EXISTING STRUCTURE MUST BE REVIEWED ON SITE BY THE STRUCTURAL CONSULTANT PRIOR TO PROCEEDING WITH CUTTING OR CORING.

1.2 GENERAL CONTRACTOR IS RESPONSIBLE FOR SUBMITTING COORDINATED SLEEVING AND CORING DRAWINGS SHOWING LOCATION, SIZE AND SPACING FOR PROPOSED NEW OPENINGS FOR ALL MECHANICAL AND ELECTRICAL SERVICES AND ALL EXISTING OPENINGS WITHIN THREE FEET OF NEW ONES. THE COORDINATED DRAWINGS SHALL BE PREPARED ON STRUCTURAL FRAMING PLAN BACKGROUNDS. ALL OPENINGS TO BE REFERENCED TO GRID LINES. INDIVIDUAL SUBMISSIONS OF DRAWINGS SHOWING MECHANICAL CORES ONLY OR ELECTRICAL CORES ONLY WILL NOT BE ACCEPTED. DO NOT DRILL OR CUT HOLES THROUGH EXISTING STRUCTURE PRIOR TO SUBMISSION OF SLEEVING DRAWINGS AND FINAL REVIEW BY STRUCTURAL CONSULTANT.

1.3 PRIOR TO DRILLING FOR ANCHOR BOLTS OR CUTTING HOLES IN EXISTING REINFORCED CONCRETE STRUCTURES LOCATE ALL TOP AND BOTTOM EXISTING REINFORCING STEEL USING 'HILTI FERROSCAN' OR 'GRAFSCAN RADAR' RADAR DETECTION SYSTEMS. RESULTS OBTAINED BY X-RAY WILL NOT BE ACCEPTED. ALLOW CONSULTANT TO REVIEW ALL RESULTS BEFORE PROCEEDING.

1.4 CUTTING NEW RECTANGULAR OPENINGS THROUGH EXISTING STRUCTURE: CORE DRILL AT CORNERS OF OPENING AND SAW CUT OR CORE DRILL AROUND PERIMETER. DO NOT OVER CUT BEYOND MINIMUM DIMENSION REQUIRED.

1.5 WHERE HOLES ARE IN A GROUP, SPACE AT LEAST 3 TIMES THE DIAMETER OF THE LARGER ADJACENT HOLE, CENTER TO CENTER.

1.6 DO NOT CUT ANY EXISTING REINFORCING STEEL WITHOUT WRITTEN AUTHORIZATION BY STRUCTURAL CONSULTANT.

2. PROCEDURE FOR REVIEW OF NEW OPENINGS THROUGH EXISTING STRUCTURE

2.1 GENERAL CONTRACTOR TO SUBMIT COORDINATED CORING DRAWINGS TO ALL CONSULTANTS FOR REVIEW.

2.2 MARK PROPOSED CORE LOCATION ON EXISTING STRUCTURE.

2.3 SCAN EXISTING STRUCTURE TO IDENTIFY ALL REINFORCING STEEL IN AREA OF PROPOSED CORES. SCANNING CONTRACTOR SHALL CLEARLY MARK AND DISTINGUISH BETWEEN ALL TOP AND BOTTOM BARS.

2.4 ALLOW STRUCTURAL CONSULTANT TO REVIEW EACH PROPOSED CORE LOCATION AND REINFORCING STEEL SCAN RESULTS ON SITE. ADJUSTMENTS TO FINAL POSITION OF CORE MAY BE NECESSARY TO MINIMIZE EFFECTS TO EXISTING REINFORCING STEEL.

CONCRETE ANCHORS, INSERTS, BOLTS — GN-012CS

1 GENERAL

1.1 THE FOLLOWING REFERENCE STANDARDS SHALL GOVERN THE WORK OF THIS SECTION:
1.1.1 CSA A23.3-04, DESIGN OF CONCRETE STRUCTURES

2 PRODUCTS

2.1 TORQUE CONTROLLED EXPANSION ANCHORS
2.1.1 EXPANSION ANCHOR: PROVIDE EXPANSION ANCHORS OF SIZE SHOWN ON DRAWINGS, INCLUDING MATCHING NUTS AND WASHERS:
.1 FOR DRY LOCATIONS:
:KWIK BOLT 3 CARBON STEEL ZINC PLATED, BY HILTI (CANADA) CORPORATION, MISSISSAUGA, ONTARIO
.2 FOR WET OR HIGH HUMIDITY LOCATIONS OR LOCATIONS EXTERIOR TO THE CONDITIONED BUILDING ENVELOPE:
:KWIK BOLT 3 TYPE 304 STAINLESS STEEL, BY HILTI (CANADA) CORPORATION, MISSISSAUGA, ONTARIO
.3 FOR LOCATIONS EXPOSED TO CHLORIDES OR OTHER CORROSIVE MATERIALS:
:KWIK BOLT 3 TYPE 316 STAINLESS STEEL, BY HILTI (CANADA) CORPORATION, MISSISSAUGA, ONTARIO
2.1.2 SLEEVE ANCHOR: *PROVIDE* SLEEVE ANCHORS OF SIZE SHOWN ON DRAWINGS, INCLUDING MATCHING NUTS AND WASHERS:
.1 FOR DRY LOCATIONS:
:HSL3 CARBON STEEL BY HILTI (CANADA) CORPORATION, MISSISSAUGA, ONTARIO
.2 FOR WET OR HIGH HUMIDITY LOCATIONS OR LOCATIONS EXTERIOR TO THE CONDITIONED BUILDING ENVELOPE:
:HSL3 STAINLESS STEEL BY HILTI (CANADA) CORPORATION, MISSISSAUGA, ONTARIO

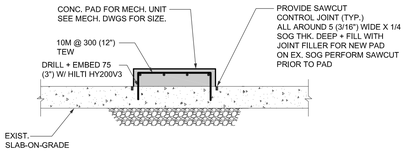
2.2 ADHESIVE ANCHORS IN DRILLED HOLE:
2.2.1 ANCHOR ROD: *PROVIDE* ANCHOR RODS OF SIZE, TYPE AND EMBEDMENT LENGTH SHOWN ON DRAWINGS INCLUDING MATCHING NUTS AND MATCHING WASHERS.
2.2.2 REINFORCING BAR: *PROVIDE* REINFORCING BAR AS ANCHOR ROD WHERE SPECIFIED ON DRAWING.
2.2.3 CORROSION PROTECTION: *PROVIDE* CORROSION PROTECTION SPECIFIED ON DRAWINGS
2.2.4 ADHESIVE: *PROVIDE* THE ADHESIVE SPECIFIED ON THE DRAWINGS.

3 EXECUTION

3.1 DRILLED-IN ANCHORS
3.1.1 ARRANGE FOR MANUFACTURER'S TECHNICAL REPRESENTATIVE TO BE PRESENT DURING INSTALLATION OF FIRST FEW ANCHORS OF EACH TYPE. SUBMIT SITE REPORTS BY MANUFACTURER TO *CONSULTANT* WITHIN ONE WEEK OF EACH VISIT. INDICATE IN REPORTS ANCHOR SIZES AND TYPES INSTALLED, LOCATIONS, AND WHETHER INSTALLATION PROCEDURES WERE IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS.
3.1.2 INSTALL ANCHORS IN STRICT ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS.
3.1.3 INSTALLERS SHALL BE TRAINED BY THE MANUFACTURER.
3.1.4 DO NOT DRILL HOLES LARGER IN DIAMETER THAN INDICATED IN MANUFACTURER'S PRINTED INSTRUCTIONS.
3.1.5 PROVIDE MANUFACTURER'S STANDARD EMBEDMENT LENGTH INTO SOLID CONCRETE, UNLESS OTHERWISE NOTED ON DRAWINGS.
3.1.6 DO NOT CUT REINFORCEMENT TO ACCOMMODATE ANCHORS.
3.1.7 RELOCATE ANCHORS, AT NO ADDITIONAL COST TO *CONTRACT*, WHEN OBSTRUCTIONS PREVENT DRILLING HOLES TO REQUIRED DEPTH IN LOCATIONS INDICATED ON *DRAWINGS*
3.1.8 OBTAIN *CONSULTANT'S* APPROVAL OF NEW LOCATION BEFORE DRILLING HOLE. FILL ABANDONED HOLES WITH SPECIFIED GROUT.
3.1.9 TIGHTEN EXPANSION ANCHORS USING TORQUE WRENCH UNLESS FINGER-TIGHT IS INDICATED ON DRAWINGS.

4 FIELD QUALITY CONTROL

4.1 ARRANGE FOR INSPECTION AND TESTING COMPANY TO RANDOMLY SELECT AND PULL TEST ANCHORS AS FOLLOWS:
4.1.1 5% OF EACH TYPE AND SIZE OF ANCHOR INSTALLED ON A WEEKLY BASIS, BUT NOT LESS THAN ONE ANCHOR OF EACH TYPE AND SIZE.
4.1.2 PULL TEST TO TWICE THE ALLOWABLE DESIGN TENSION CAPACITY OF THE ANCHOR GIVEN BY THE MANUFACTURER.
4.1.3 SUBMIT REPORTS OF PULL TESTS TO *CONSULTANT* ON WEEKLY BASIS, INDICATE ON REPORT EACH ANCHOR LOCATION, TEST LOAD AND MODE OF FAILURE, IF APPLICABLE. NOTIFY *CONSULTANT* IMMEDIATELY IF ANCHOR FAILS PULL TEST.



TYP. DETAIL - NEW SLAB ON GRADE AND MECHANICAL PAD AT BOILER ROOM

SCALE: 3/4" = 1'-0"

1. IF EXISTING MECHANICAL PADS ARE CONNECTED TO EXISTING SLAB ON GRADE: CONFIRM WITH STRUCTURAL CONSULTANT.
2. IF EXISTING MECHANICAL PADS ARE NOT CONNECTED TO EXISTING SLAB ON GRADE:
   i) DEMOLISH EXISTING MECHANICAL PADS AS REQUIRED.
   ii) INSTALL NEW MECHANICAL PAD ON EXISTING SLAB ON GRADE. DOWEL TYPICAL PAD REINFORCEMENT MIN 100 mm (4") INTO EX. SLAB ON GRADE + HILTI HY 200 V3 EPOXY.
3. ALL NEW CONCRETE TO BE MINIMUM 25 MPa CLASS N TO A23.1/2
4. REBAR TO BE 400W, TO CSA G30.18
5. CONCRETE CLEAR COVER: 50MM (2") UNO
6. NEW SOG IF REQUIRED THICKNESS TO MATCH EXISTING EXCEPT MIN. 150 (6") THICK.

1	ISSUED FOR TENDER	2025-03-21

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr,
Hamilton, ON
For the HWDSB

SEAL:

REGISTERED PROFESSIONAL ENGINEER
S.A. ZUBERY
100073296
PROVINCE OF ONTARIO

SZ/DL

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
Canada

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TRUE NORTH:

DRAWING TITLE:
TYP. DETAILS

SCALE: AS NOTED
DRAWN: TT
DATE: NOVEMBER, 2023
PROJECT #: ALL-23010629-A0
DRAWING #: S1.1

PIPING LEGEND

———	HOT WATER SUPPLY (HWS)
— — —	HOT WATER RETURN (HWR)
— D —	EQUIPMENT DRAIN LINE
— G —	GAS
— S —	SUCTION LINE
— L —	LIQUID LINE
	BOTTOM TAKE-OFF
	TOP TAKE-OFF
	ELBOW UP
	ELBOW DOWN
	VALVE – SEE SPECIFICATIONS
	UNION CONNECTION
	FLANGED CONNECTION
	PLUG CAP
LWCO	LOW WATER CUT OFF
	THERMOMETER
PG	PRESSURE GAUGE
P-1	PUMP AND DESIGNATION
AV	AIR VENT
AAV	AUTOMATIC AIR VENT
PP	PETES PLUG
FS	FLOW SWITCH
T G	THERMOSTAT w/GUARD
AFF	ABOVE FINISHED FLOOR
CBV	CIRCUIT BALANCING VALVE
GPM	GALLONS PER MINUTE
REQ'D	REQUIRED
TCV	THERMOSTATIC CONTROL VALVE
TYP.	TYPICAL
BFP	BACK FLOW PREVENTOR
CFH	CUBIC FEET HOUR

VALVE LEGEND

	VALVE – SEE SPEC
	CHECK VALVE
	STRAINER
	PRESSURE REDUCING VALVE
	CONTROL VALVE
	2-WAY CONTROL VALVE
	3-WAY CONTROL VALVE
R	RELIEF VALVE
	PLUG VALVE
SV	SOLENOID VALVE
NC	NORMALLY CLOSED VALVE
	PET COCK
	CIRCUIT BALANCE VALVE

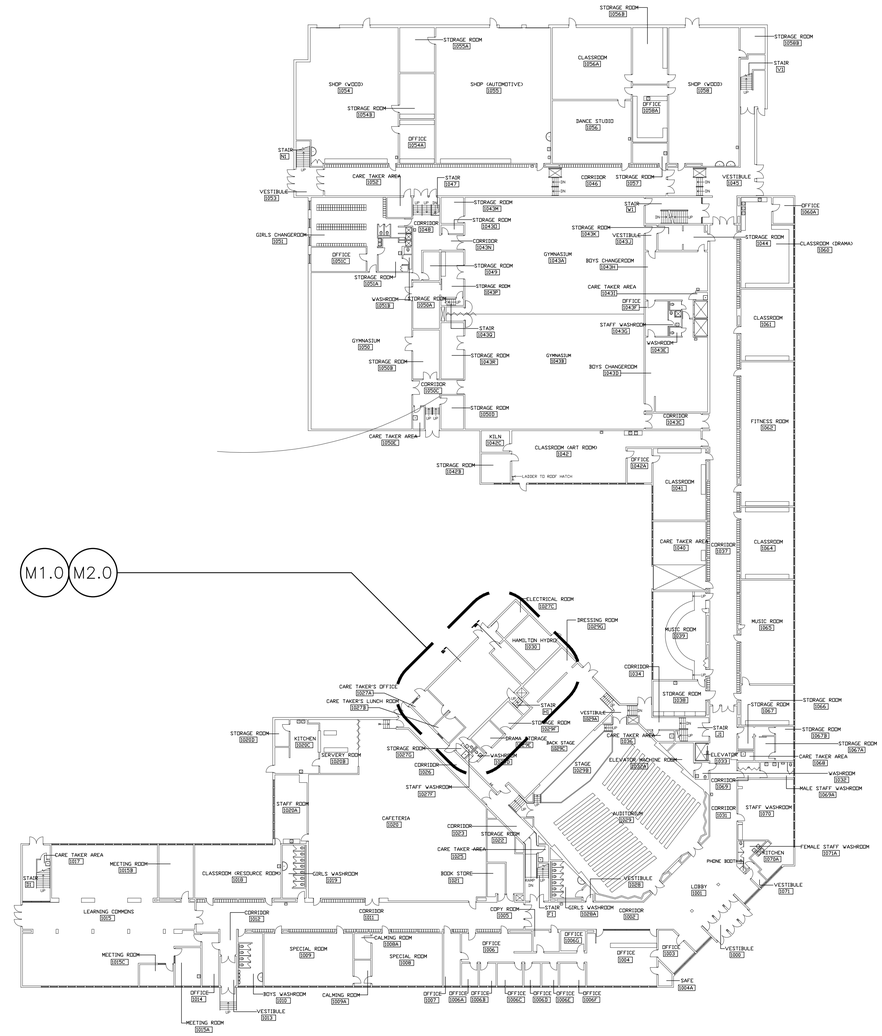
VENTILATION LEGEND

	SOUND INSULATION
	FLEXIBLE CONNECTION
DN	DUCT OFFSET
	DUCT OFFSET (SINGLE LINE)
	TURNING VANES
BD	BALANCING DAMPER
FD	FIRE DAMPER
SD	SPLITTER DAMPER
BDD	BACKDRAFT DAMPER
OBD	OPPOSED BLADE DAMPER
MD	MOTORIZED DAMPER
	SUPPLY DUCT SECTION
	RETURN DUCT SECTION
	SUPPLY DIFFUSER
	LINEAR DIFFUSER
	EXHAUST GRILLE
D– XXX	DIFFUSER DESIGNATION AND CFM
G– XXX	GRILLE DESIGNATION AND CFM
	FLEXIBLE ROUND DUCT
	CAPPED END DUCT
	DUCT REDUCER/ENLARGER
	TRANSITION □ TO ○ ROUND
T	THERMOSTAT
AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
CFM	CUBIC FEET PER MINUTE
CBV	CIRCUIT BALANCING VALVE

CONTROL LEGEND

T	THERMOSTAT
TS	TEMPERATURE SENSOR
PS	PRESSURE SENSOR
HS	HUMIDITY SENSOR
FS	FLOW SWITCH
SV	SOLENOID VALVE
PDS	PRESSURE DIFFERENTIAL SWITCH
MD	MOTORIZED DAMPER
PG	PRESSURE GAUGE
T	TEMPERATURE GAUGE
CV-1 A AB	2-WAY CONTROL VALVE
CV-1 A AB B	3-WAY CONTROL VALVE
H C	HEATING COIL
C C	COOLING COIL
OA	OUTSIDE AIR
RA	RETURN AIR
SA	SUPPLY AIR
EA	EXHAUST AIR
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
TCV	TEMPERATURE CONTROL VALVE

DRAWING LIST



GROUND FLOOR – OVERALL PLAN

SCALE– 1/32" = 1'-0"

THESE DRAWINGS ARE NOT TO BE SCALED

THE CONTRACTOR MUST FIELD VERIFY ALL DIMENSIONS AND MUST CONFIRM & CORRELATE ALL DETAILS WITHIN THE FULL DRAWING PACKAGE BEING RESPONSIBLE FOR SAME THROUGHOUT CONSTRUCTION, REPORTING ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO COMMENCING THE RELEVANT WORK

ALL DRAWINGS, DETAILS & SPECIFICATIONS REPRESENTED IN THE DRAWINGS ARE TO BE USED FOR CONSTRUCTION ONLY WHEN ISSUED BY THE ARCHITECT AND NOTED ACCORDINGLY IN THE "ISSUE/REVISIONS" BOX HEREON.

1. ISSUED FOR TENDER 25.03.21

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr, Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
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TRUE NORTH:

DRAWING TITLE:
Mechanical Legend, Key Plan & Drawing List

SCALE:
AS NOTED

DRAWN:
C.M. / J.L.

DATE:
SEPTEMBER 2023

PROJECT #:
ALL-23010629-A0

DRAWING #:
M0.0

MECHANICAL SPECIFICATIONS – GENERAL

1. GENERAL

1.1 GENERAL REQUIREMENTS

A. READ AND CONFORM TO:
   .1 THE CONTRACT CCDC 2, STIPULATED PRICE CONTRACT AS AMENDED.
   .2 DIVISION 1 REQUIREMENTS AND DOCUMENTS REFERRED TO THEREIN.

B. THE SPECIFICATIONS ARE INTEGRAL WITH THE DRAWINGS WHICH ACCOMPANY THEM. NEITHER IS TO BE USED ALONE. ANY ITEM OR SUBJECT OMITTED FROM ONE BUT IMPLIED IN THE OTHER IS FULLY AND PROPERLY REQUIRED.

C. WHEREVER DIFFERENCES OCCUR IN THE TENDER DOCUMENTS, THE MOST ONEROUS CONDITION GOVERNS. BASE THE BID ON THE COSTLIEST ARRANGEMENT.

D. CONFORM TO THE LATEST EDITION OF ONTARIO BUILDING CODE (CSA STANDARDS), ONTARIO FIRE CODE, LOCAL & DISTRICT BYLAWS, REGULATIONS, & PUBLISHED ENGINEERING STANDARDS.

E. NOTIFY CONSULTANT UPON DISCOVERY OF CONDITIONS WHICH ADVERSELY AFFECT WORK OF THIS DIVISION. NO ALLOWANCE WILL BE MADE AFTER LETTING OF CONTRACT FOR ANY EXPENSES INCURRED THROUGH FAILURE TO DO SO.

F. ARRANGE AND PAY FOR PERMITS AND INSPECTIONS BY AUTHORITIES HAVING JURISDICTION, REQUIRED IN THE UNDERTAKING OF THIS DIVISION. MAKE MODIFICATIONS REQUIRED BY AUTHORITIES.

G. ALL TRADESMEN EMPLOYED ON THE PROJECT SHALL HOLD VALID TRADE CERTIFICATES/LICENSES AND SHALL MAKE A COPY AVAILABLE FOR REVIEW BY THE CONSULTANT AND/OR OWNER WHEN REQUESTED

1.2 SCOPE OF WORK

A. PRODUCTS AND METHODS MENTIONED OR SHOWN IN THE CONTRACT DOCUMENTS COMPLETE WITH INCIDENTALS NECESSARY FOR A COMPLETE OPERATING INSTALLATION. PROVIDE ALL TOOLS, EQUIPMENT AND SERVICES REQUIRED TO DO THE WORK.

B. SITE EXAMINE EXISTING CONDITIONS WHICH MAY AFFECT WORK OF THIS DIVISION. EXAMINE ALL CONTRACT DOCUMENTS IN CONJUNCTION WITH SITE EXAMINATION TO ENSURE THAT WORK OF THIS DIVISION MAY BE SATISFACTORILY COMPLETED.

C. DISCONNECTION AND REMOVAL OF VARIOUS MECHANICAL EQUIPMENT.

D. DISCONNECTION AND MAKING SAFE OF VARIOUS MECHANICAL SYSTEMS AND EQUIPMENT IN AREAS TO BE DEMOLISHED AND/OR RENOVATED.

E. ISOLATE AND DRAIN (OR PIPE FREEZE IF DRAINING IS NOT FEASIBLE) SYSTEMS AS REQUIRED TO EFFECT DEMOLITION, RENOVATIONS, MODIFICATIONS AND/OR REPAIRS. DISCONNECT, CAP AND MAKE SAFE ALL MECHANICAL SERVICES TO THE BUILDING INCLUDING, BUT NOT LIMITED TO; SANITARY SEWER(S), STORM SEWER(S), WATER SERVICE

F. ON COMPLETION OF RENOVATIONS, MODIFICATIONS AND/OR REPAIRS, TEST ENTIRE SYSTEM AS IF NEW. REPORT REPAIRS OR REPLACEMENTS REQUIRED OF EXISTING EQUIPMENT, PIPING, FITTINGS OR DEVICES THAT ARE NOT INCLUDED IN CONTRACT TO CONSULTANT AND OWNER FOR INSTRUCTION. FLUSH, CLEAN AND REFILL RENOVATED SYSTEMS AS SPECIFIED FOR NEW.

G. CUTTING AND PATCHING OF NEW OR EXISTING WORK.

H. IDENTIFICATION OF EQUIPMENT, PIPING, VALVES AND CONTROLLERS.

I. PERFORM START–UP AND COMPLETELY COMMISSION ALL EQUIPMENT AND SYSTEMS INSTALLED AND/OR MODIFIED UNDER THIS CONTRACT. COMMISSIONING WORK SHALL BE COMPLETED TO THE SATISFACTION OF THE CONSULTANT PRIOR TO ACCEPTANCE OF THE WORK OR ANY PART THEREOF.

J. APPLY FOR & OBTAIN ALL PERMITS INCLUDING BUILDING PERMITS, & TSSA APPLICATIONS, LICENSES, OR CERTIFICATES NECESSARY FOR THE PERFORMANCE OF THE WORK. COORDINATE ALL WORK WITH BUILDING OFFICIALS & AUTHORITIES HAVING JURISDICTION.

K. TAKE SUCH MEASURES AND INCLUDE IN BID PRICE FOR THE PROPER PROTECTION OF THE EXISTING BUILDING AND ITS FINISHES AT ALL TIMES DURING ALTERATIONS AND CONSTRUCTION OF THE NEW ADDITION. COORDINATE THIS PROTECTIVE WORK WITH ALL TRADES.

L. VERIFY THE CORRECT OPERATION OF EACH EQUIPMENT ITEM PROVIDED AND/OR ALTERED AND EACH SYSTEM IN TOTAL AND OBTAIN THE OWNER'S APPROVAL PRIOR TO STARTING AND/OR RETURNING TO OPERATION.

M. SUPERVISE AND PROVIDE TRAINING OF NEW EQUIPMENT TO OWNERS MAINTENANCE STAFF. PROVIDE MINIMUM OF (2) TRAINING SESSIONS, AND (4) HOURS FOR EACH SESSION. THESE OBJECTIVES WILL BE DIVIDED INTO GROUPINGS:
   .1 BOILERS & PUMPS

N. INSTALL AND COMMISSION ALL EQUIPMENT THAT HAS BEEN PRE–APPROVED BY OWNER. REFER TO ARCHITECTURAL SPECIFICATIONS 01030 FOR FULL DETAILS. SUPPLY AND INSTALL NEW EQUIPMENT WHERE INDICATED (BOILERS, PUMPS, HYDRONIC SPECIALTIES ETC.)

O. THE PUMPS, VFDs AND BOILERS HAVE BEEN PREVIOUSLY SOURCED THROUGH COMPETITIVE TENDER. INCLUDED IN THE TENDER PACKAGE ARE QUOTATIONS FROM GRUNDFOS CANADA INC. AND ENVIRONAIR INDUSTRIES INC. THE QUOTES ARE TO BE CARRIED BY THE MECHANCIAL SUBCONTRACTOR IN THE BASE BID PRICE. REFER TO THE INCLUDED APPROVED SHOP DRAWINGS FROM GRUNDFOS AND ENVIRONAIR AND COORDINATE AS REQUIRED FOR THE FULL SCOPE OF WORK AS NOTED IN THE TENDER DRAWINGS AND SPECIFICATIONS. CONTACTS:

PUMPS AND VFDS:
Tanveer Khan
Senior District Sales Manager
Commercial Building Services (CBS)
Cell: +1–289–795–7592
Email: tkhan@grundfos.com

BOILERS:
Jorge Chávez
Technical Sales Representative
Office: 519 744–7295, ext. 3302
Cellular: 519–496–2928

IT IS THE EXPECTATION THAT THE PUMPS AND VFDS ARE ORDERED WITHIN NO MORE THAN 2 WEEKS FROM THE DATE OF GENERAL CONTRACTOR TENDER AWARD SO THAT THEY CAN BE INSTALLED PRIOR TO THE 2025 FALL HEATING SEASON.

1.3 SUBMITTALS

A. SHOP DRAWINGS: PREPARE AND SUBMIT TWO (2) COPIES OF SHOP DRAWINGS OF ALL EQUIPMENT ITEMS TO THE CONSULTANT FOR REVIEW. THE CONSULTANT WILL RETURN ONE COPY, MARKED WITH COMMENTS AND HIS REVIEW STAMP AS HE DEEMS APPROPRIATE.
   .1 CLEARLY INDICATE MANUFACTURER'S AND SUPPLIER'S NAMES, MODEL NUMBERS, DETAILS OF CONSTRUCTION, ACCURATE DIMENSIONS, CAPACITIES AND PERFORMANCE. PRIOR TO SUBMISSION CHECK AND CERTIFY AS CORRECT, SHOP DRAWINGS AND DATA SHEETS. DO NOT ORDER EQUIPMENT UNTIL A COPY OF THE SHOP DRAWINGS, REVIEWED BY CONSULTANT, HAS BEEN RETURNED TO CONTRACTOR.
   .2 THE CONSULTANT WILL NOT REVIEW SHOP DRAWINGS THAT FAIL TO BEAR THE CONTRACTOR'S STAMP OF APPROVAL OR CERTIFICATION.

B. REQUESTS FOR SHUT–DOWN: OBTAIN PERMISSION FOR SYSTEMS SHUT–DOWN AND/OR SERVICE INTERRUPTION FROM THE OWNER PRIOR TO DISRUPTION OF ANY SYSTEM OR SERVICE IN USE BY THE OWNER. EMPLOY THE OWNER'S STANDARD FORM OF REQUEST WHERE AVAILABLE.

C. REQUESTS FOR START–UP: OBTAIN PERMISSION FROM THE OWNER TO START–UP OR TO RETURN TO SERVICE ANY ITEM OF EQUIPMENT, SYSTEM OR SERVICE INSTALLED NEW OR PREVIOUSLY SHUT–DOWN.

D. WARRANTY: PROVIDE WRITTEN GUARANTEE FOR ALL NEW EQUIPMENT & WORKMANSHIP FOR ONE (1) YEAR FROM DATE OF SUBSTANTIAL COMPLETION. FIVE (5) YEARS FOR COMPRESSOR & HEAT EXCHANGER. DEFECTIVE PARTS REPAIRED OR REPLACED WITHOUT CHARGE.

2 COMMON WORK RESULTS

2.1 PIPING SPECIALTIES

A. CAST BRASS, PRESSURE, COPPER TO COPPER UNIONS SHALL BE USED WITH SEAMLESS COPPER TUBING SMALLER THAN 3" (75 MM).

B. CAST BRASS FLANGES SHALL BE USED WITH SEAMLESS COPPER TUBING, TYPE L FOR TUBING 3" (75 MM) AND LARGER.

2.2 FIRE STOPPING COMPOUNDS

A. APPROVED MANUFACTURER: 3M PRODUCTS INDICATED.

B. OTHER ACCEPTABLE MANUFACTURERS OFFERING EQUIVALENT PRODUCTS: DOW CORNING, JOHN MANVILLE, HILTI FIRESTOP SYSTEMS

C. FIRE RATED SEALANTS: INTUMESCENT MATERIAL, SYNTHETIC ELASOMERS, CAPABLE OF EXPANDING UP TO 8 TO 10 TIMES WHEN EXPOSED TO

MECHANICAL SPECIFICATIONS – GENERAL

TEMPERATURES OF 250°F (121°C) OR HIGHER. ULC LISTED AND LABELLED.

2.3 NAMEPLATES

A. PROVIDE LAMINATED PLASTIC PLATES WITH BLACK FACE AND WHITE CENTRE OF MINIMUM SIZE 3–1/2" X 1–1/2" X 3/32" (90 X 40 X 2 MM) NOMINAL THICKNESS, ENGRAVED WITH 1/4" (6 MM) HIGH LETTERING. USE 1" (25 MM) LETTERING FOR MAJOR EQUIPMENT.

B. FASTEN NAMEPLATES SECURELY IN CONSPICUOUS PLACE. WHERE NAMEPLATES CANNOT BE MOUNTED ON COOL SURFACE, PROVIDE STANDOFFS.

C. IDENTIFY EQUIPMENT TYPE AND NUMBER AND SERVICE OF AREAS OR ZONE OF BUILDING SERVED.

D. FOR EACH ITEM OF EQUIPMENT WHICH MAY BE STARTED AUTOMATICALLY OR REMOTELY, ADD A RED LAMACOID PLATE, 2–1/2" X 9" (65 X 230 MM), READING: "WARNING. THIS EQUIPMENT IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME."

2.4 ACCESS DOORS

A. STANDARD UNIVERSAL FLUSH
   .1 MATERIAL: UPT TO 16" X 16" (400X400) 16 GAUGE MOUNTING FRAME, OVER 16" X 16" (400X400) 14 GAUGE DOOR, 16 GAUGE MOUNTING FRAME.
   .2 HINGE: CONTINUOUS, CONCEALED.
   .3 LATCH: STAINLESS STEEL SCREWDRIVER OPERATED CAM LATCH
   .4 FINISH: STEEL: 5–STAGE IRON PHOSPHATE PREPARATION WITH PRIME COAT OF WHITE, ALKYD BAKING ENAMEL OR STAINLESS STEEL TYPE 304, NO. 4 SATIN POLISH.
   .5 MANUFACTURERS: ACUDOR ACORN, CEB, MIFAB, CENDRES CONTOUR

B. RECESSED ACCESS DOOR
   .1 MATERIAL: STEEL OR STAINLESS STEEL, 22 GAUGE DOOR, 22 GAUGE MOUNTING FRAME. DOOR –RECESSED 5/8"
   .2 HINGE: CONTINUOUS, CONCEALED.
   .3 LATCH: STAINLESS STEEL SCREWDRIVER OPERATED CAM LATCH
   .4 FINISH: SATIN COAT STEEL
   .5 MANUFACTURERS: ACUDOR ACORN, CEB, MIFAB, CENDRES CONTOUR

C. FIRE RATED
   .1 ACCESS DOORS IN FIRE SEPARATIONS OR FIRE RATED ASSEMBLIES: ULC LABELLED. REFER TO ARCHITECTURAL DRAWINGS FOR RATINGS OF FIRE SEPARATIONS AND ASSEMBLIES. MINIMUM 12 GAUGE.
   .2 HINGE: CONTINUOUS, CONCEALED.
   .3 LATCH: STAINLESS STEEL SCREWDRIVER OPERATED CAM LATCH
   .4 FINISH: STEEL: 5–STAGE IRON PHOSPHATE PREPARATION WITH PRIME COAT OF WHITE, ALKYD BAKING ENAMEL OR STAINLESS STEEL TYPE 304, NO. 4 SATIN POLISH.
   .5 MANUFACTURERS: ACUDOR ACORN, CEB, MIFAB, CENDRES CONTOUR

3 SUPPORTS & ANCHORS

3.1 ACCESSORIES

A. HANGER RODS: GALVANIZED, CARBON STEEL CONTINUOUS THREADED.

B. INSERTS: MALLEABLE IRON CASE OF GALVANIZED STEEL SHELL AND EXPANDER PLUG FOR THREADED CONNECTION WITH LATERAL ADJUSTMENT, TOP SLOT FOR REINFORCING RODS, LUGS FOR ATTACHING TO FORMS; SIZE INSERTS TO SUIT THREADED HANGER ROD

3.2 EQUIPMENT ROOF CURBS

A. FABRICATION: WELDED 0.05" (1.2 MM) GALVANIZED STEEL SHELL AND BASE, MITRED 3" (75 MM) CANT, VARIABLE STEP TO MATCH ROOF INSULATION, FACTORY INSTALLED WOOD NAILER.

3.3 PIPE HANGER SPACING:

PIPE SIZE (IN)	ROD DIAMETER (IN)	SUPPORT SPACING (FT) STEEL PIPE
1/2	3/8	7
3/4	3/8	7
1	3/8	7
1–1/4	3/8	7
1–1/2	3/8	9
2	3/8	10

3.4 FUEL GAS PIPE HANGER SPACING:

PIPE SIZE (IN)	SUPPORT SPACING (FT)
1/2	6
3/4 – 1	8
1–1/4 – 2–1/2	10
3 – 4	15
5 – 8	20
10 OR LARGER	25
ALL VERTICAL	EVERY FLOOR
TUBING (ALL SIZES)	6

3.5 DUCT HANGER SPACING:

DUCT SIZES (LARGEST SIDE) SPACING	ANGLE SIZE	ROD SIZE
UP TO 30" DIAMETER 10 FT	1" X 1" X 1/8"	1/4"
31" TO 42" DIAMETER 10 FT	1–1/2" X 1–1/2" X 1/8"	1/4"
43" TO 60" DIAMETER 10 FT	1–1/2" X 1–1/2" X 1/8"	3/8"
61" TO 84" DIAMETER 8 FT	2" X 2" 1/8"	3/8"

HVAC SPECIFICATIONS

1 HVAC HYDRONIC PIPING

1.1 HYDRONIC PIPING – GENERAL:

A. KEEP OPEN ENDS OF PIPE FREE FROM SCALE AND DIRT. PROTECT OPEN ENDS WITH TEMPORARY PLUGS OR CAPS. AFTER COMPLETION, FILL, CLEAN, AND TREAT SYSTEMS.

B. PROVIDE NON–CONDUCTING DIELECTRIC CONNECTIONS WHENEVER JOINTING DISSIMILAR METALS IN OPEN SYSTEMS.

C. PRIME COAT EXPOSED STEEL HANGERS AND SUPPORTS. HANGERS AND SUPPORTS LOCATED IN CRAWL SPACES, PIPE SHAFTS, AND SUSPENDED CEILING SPACES ARE NOT CONSIDERED EXPOSED.

D. AIR VENTS SHALL BE SELECTED TO SUIT THE SYSTEM OPERATING PRESSURES AND SHALL BE AUTOMATIC AND COMPLETE WITH ISOLATING VALVES.

E. PIPE ALL DISCHARGE FROM TEMPERATURE & PRESSURE SAFETY RELIEF VALVES TO A POINT OF SAFE DISCHARGE DIRECTLY INTO A FLOOR DRAIN, HUB DRAIN OR SAFE OUTDOOR LOCATION.

F. AUTOMATIC FEED VALVES: PROVIDE AUTOMATIC FEED VALVE ON THE COLD WATER MAKE–UP LINE TO EACH NEW HOT WATER HEATING SYSTEM.

G. TEST LIQUID HEAT TRANSFER PIPING HYDROSTATICALLY AT NOT LESS THAN 150% OF OPERATING PRESSURE OR NOT LESS THAN 125 PSI (860 KPA) WHICHEVER IS THE GREATER. TEST PERIOD SHALL BE NOT LESS THAN SIX (6) HOURS DURATION DURING WHICH TIME EACH JOINT SHALL BE INSPECTED, GIVEN A SHARP TAP WITH A HAMMER AND CHECKED FOR LEAKS.

1.2 VALVES – GENERAL

A. CONFORM TO REQUIREMENTS OF ANSI, ASTM, ASME, AND APPLICABLE MSS STANDARDS.

B. MANUFACTURER'S NAME AND PRESSURE RATING CLEARLY MARKED ON BODY TO MSS–SP–25.

C. VALID CRN (CANADIAN REGISTRATION NUMBER) REQUIRED FOR EACH VALVE.

D. MATERIALS:
   .1 BRONZE: ASTM B62 OR B61 AS APPLICABLE
   .2 BRASS: ASTM B283 C3770
   .3 CAST IRON: ASTM A126 CLASS B

E. END CONNECTIONS:
   .1 THREADED ENDS: ANSI B1.20.1
   .2 FLANGED ENDS: ANSI B16.1 (CLASS 125), ANSI B16.5
   .3 FACE–TO–FACE DIMENSIONS: ANSI B16.10

F. DESIGN AND TESTING:
   .1 BRONZE GATE & CHECK VALVES: MSS–SP–80
   .2 BALL VALVES: MSS–SP–110
   .3 CAST IRON GATE VALVES: MSS–SP–70
   .4 CAST IRON GLOBE VALVES: MSS–SP–85
   .5 CAST IRON CHECK: MSS–SP–71
   .6 BUTTERFLY VALVES: MSS–SP–67

G. ACCEPTABLE MANUFACTURERS: KITZ, CRANE, JENKINS, CONBRACO, NIBCO

1.3 HYDRONIC SYSTEMS TO 150 PSIG, ABOVE GROUND

A.	NOMINAL OPERATING PRESSURE	125 PSIG
B.	DESIGN PRESSURE	150 PSIG
C.	TEST PRESSURE	225 PSIG
D.	DESIGN TEMPERATURE	350°F
E.	CORROSION ALLOWANCE	0.0625 IN.
F.	STEEL PIPE	ASTM A53 GR.B ERW OR ASTM A106 GR.B SMLS, SCH 4
G.	JOINTS, 2" AND SMALLER	SCREWED
H.	SCREWED FITTINGS	150 LB. MALLEABLE IRON
I.	UNIONS	CL.150, ASTM A–47 MALLEABLE IRON, ASTM A–153 GALVANIZED, ANSI B2.1 THREADS.
J.	JOINTS	2–1/2" AND LARGER WELDED, WITH FLANGES AT CONNECTIONS TO EQUIPMENT
K.	BUTT WELD FITTINGS	ASTM A234 GR. WFB
L.	FLANGES	ASTM A105, CLASS 150, RAISED FACE, WELD NECK OR SLIP ON
M.	BOLTS	ASTM A307 C.S. BOLTS, SQ. HEAD; ASTM A563 NUTS, HEX HEAD
N.	GASKETS	1/16" (1.6 MM) THICK PREFORMED NON–ASBESTOS GRAPHITE FIBRE.
O.	COPPER TUBING	2" AND SMALLER ASTM B88, TYPE L, HARD DRAWN.
P.	JOINTS:	SOLDER, LEAD FREE, ASTM B32, 95–5 TIN–ANTIMONY, OR TIN AND SILVER, WITH MELTING RANGE 220°C TO 280°C.
Q.	FITTINGS:	ASME B16.18, CAST BRASS, OR ASME B16.22, SOLDER WROUGHT COPPER
R.	DIELECTRIC UNIONS:	UNION WITH GALVANIZED OR PLATED STEEL THREADED END, COPPER SOLDER END, WATER IMPERVIOUS ISOLATION BARRIER.

S. VALVES, 2" AND SMALLER: ASTM A105
   .1 GATE VALVES (ISOLATING) 300 PSIG NON–SHOCK WOG, ASTM B62 BRONZE BODY, SOLID WEDGE DISC, RISING STEM, BRONZE TRIM, THREADED ENDS, KITZ #25
   .2 GLOBE VALVES (THROTTLING) 300 PSIG NON–SHOCK WOG, ASTM B62 BRONZE BODY, COMPOSITION (TEFLON) DISC, RISING STEM, BRONZE TRIM, THREADED ENDS, KITZ #09
   .3 CHECK VALVES (BACKFLOW) 300 PSIG NON–SHOCK WOG, ASTM B62 BRONZE BODY, Y–PATTERN HORIZONTAL, SWING TYPE DISC, THREADED ENDS, KITZ #29
   .4 BALL VALVES (DRAIN) 600 PSIG NON–SHOCK WOG, FORGED BRASS, 2–PIECE, CHROME BALL AND STEM, FULL PORT, BLOW–OUT PROOF PTFE SEATS & STEM, LEVER HANDLE, THREADED ENDS, KITZ #68AC.

T. VALVES, 2–1/2" AND LARGER: ASTM A216
   .1 GATE VALVES (ISOLATING) 200 PSIG NON–SHOCK WOG, ASTM A126 CLASS B CAST IRON BODY, BOLTED BONNET, BRONZE MOUNTED, SOLID WEDGE DISC, OS&Y, NON–ASBESTOS PACKING, FLANGED ENDS, KITZ #72.
   .2 GLOBE VALVES (THROTTLING) 200 PSIG NON–SHOCK WOG, ASTM A126 CLASS B CAST IRON BODY, BOLTED BONNET, BRONZE MOUNTED, BEVELLED WEDGE DISC, OS&Y, NON–ASBESTOS PACKING, FLANGED ENDS, KITZ #76.
   .3 CHECK (BACKFLOW) 200 PSIG NON–SHOCK WOG, ASTM 126 CLASS B CAST IRON BODY, BOLTED COVER, BRONZE MOUNTED, SWING TYPE DISC, FLANGED ENDS, KITZ #78

U. PROVIDE STEM EXTENSIONS FOR INSULATED PIPING.

V. PROVIDE GEAR OPERATOR AND CHAIN ON VALVES INSTALLED ABOVE 10FT AFF.

W. STRAINERS, 2" AND SMALLER CLASS 250, 400 PSIG WOG, CAST IRON BODY, Y–PATTERN, SCREWED CAP AND ENDS, A167 304 STAINLESS STEEL SCREEN WITH 1/32" PERFORATIONS. MUELLER STEAM 11M.

X. STRAINERS, 2–1/2" AND LARGER CLASS 250 PSIG NON–SHOCK WOG, CAST IRON, Y–PATTERN, BOLTED FLANGE COVER, BLOW–OUT PLUG, A167 304 STAINLESS STEEL SCREEN WITH 1/32" PERFORATIONS, FLANGED ENDS, MUELLER STEAM 752.

1.4 EQUIPMENT DRAINS AND OVERFLOWS

A. COPPER TUBING: ASTM B88, TYPE M AND DWV, HARD DRAWN.
   .1 FITTINGS: ASME B16.18, CAST BRASS, OR ASME B16.22 SOLDER WROUGHT COPPER.
   .2 JOINTS: SOLDER, LEAD FREE, ASTM B32, 95–5 TIN–ANTIMONY, OR TIN AND SILVER, WITH MELTING RANGE 4428°F TO 536°F (220°C TO 280°C).

1.5 CIRCUIT BALANCING VALVES

A. CIRCUIT BALANCING VALVES; 2" (50 MM) AND SMALLER)
   .1 SCREWED CONNECTION, GLOBE STYLE DESIGN, NONFERROUS, PRESSURE DIE–CAST, NONPOROUS AMETAL COPPER ALLOY. EACH VALVE SHALL BE SUCH THAT WHEN INSTALLED IN ANY DIRECTION, IT WILL NOT AFFECT FLOW MEASUREMENT.
   .2 VALVES SHALL PROVIDE THE FOLLOWING FUNCTIONS:
      .1 PRECISE FLOW MEASUREMENT.
      .2 PRECISION FLOW BALANCING.
      .3 POSITIVE SHUT OFF WITH NO DRIP SEAT AND TEFLON DISC.
      .4 DRAIN CONNECTION WITH PROTECTIVE CAP.
   .3 VALVES SHALL HAVE FOUR 360° ADJUSTMENT TURNS OF HANDWHEEL FOR MAXIMUM VERNIER–TYPE SETTING WITH "HIDDEN MEMORY" FEATURE TO PROGRAM THE VALVE WITH PRECISION TAMPER–PROOF BALANCING SETTING.
   .4 VALVES SHALL BE SHIPPED IN A 4.5 R FACTOR POLYURETHANE CONTAINER THAT SHALL BE USED AS INSULATION AFTER VALVE IN INSTALLED.
   .5 PROVIDE VALVES SUITABLE FOR MAXIMUM WORKING PRESSURE OF 250 PSI (1720 KPA) AND MAXIMUM OPERATING TEMPERATURE OF 250°F (121°C).

HVAC SPECIFICATIONS

   .6 ACCEPTABLE PRODUCTS: S.A. ARMSTRONG CRV I INDICATED OR TOUR & ANDERSON STA–D OR NEWMAN HATTERSLEY.

B. CIRCUIT BALANCING VALVES 2 1/2" (65 MM) AND LARGER
   .1 FLANGED, LINE SIZE CONNECTION, GLOBE STYLE DESIGN, NONFERROUS, PRESSURE DIE–CAST, NONPOROUS AMETAL COPPER ALLOY.
   .2 VALVES, SHALL PROVIDE THE FOLLOWING FUNCTIONS:
      .1 PRECISE FLOW MEASUREMENT.
      .2 PRECISION FLOW BALANCING.
      .3 POSITIVE SHUT OFF WITH NO DRIP SEAT AND TEFLON DISC.
   .3 VALVES SHALL HAVE TWELVE 360° ADJUSTMENT TURNS OF HANDWHEEL FOR MAXIMUM VERNIER–TYPE SETTING WITH "HIDDEN MEMORY" FEATURE TO PROGRAM THE VALVE WITH PRECISION TAMPER–PROOF BALANCING SETTING.
   .4 VALVES SHALL BE SUITABLE FOR MAXIMUM WORKING PRESSURE OF 250 PSI (1720 KPA) AND MAXIMUM OPERATING TEMPERATURE OF 250°F (120°C).
   .5 ACCEPTABLE PRODUCTS: S.A. ARMSTRONG CBV II INDICATED OR TOUR & ANDERSON STA–F OR NEWMAN HATTERSLEY.

2 HVAC DUCT INSULATION

2.1 GLASS FIBRE, FLEXIBLE

A. MANUFACTURER: CERTAINTEED SOFT TOUCH AND WIDE WRAP

B. OTHER ACCEPTABLE MANUFACTURERS: JOHNS MANVILLE MICROLITE.

C. INSULATION: ASTM C553; ASTM C1290, CAN 51.11–92, ASTM C1136, NFPA 90A, ASTM E84, ASTM E136.
   .1 'KSI' VALUE : ASTM C518, 0.039 AT 24 °C (0.27 @ 75.2 °F)
   .2 MAXIMUM SERVICE TEMPERATURE: 121 °C (250 °F).
   .3 MAXIMUM MOISTURE ABSORPTION: ASTM C1104; <5% BY WEIGHT.
   .4 MAXIMUM FLAME SPREAD INDEX: 25
   .5 MAXIMUM SMOKE DEV INDEX: 50

D. VAPOUR BARRIER JACKET:
   .1 KRAFT PAPER WITH GLASS FIBRE YARN AND BONDED TO ALUMINIZED FILM. (FSK)
   .2 KRAFT PAPER REINFORCED WITH GLASS FIBRE YARN AND BONDED TO WHITE METALIZED POLYPROPYLENE
   .3 MOISTURE VAPOUR TRANSMISSION: ASTM E96; 0.02 PERM.
   .4 SECURE WITH PRESSURE SENSITIVE TAPE.

E. VAPOUR BARRIER TAPE:
   .1 KRAFT PAPER REINFORCED WITH GLASS FIBRE YARN AND BONDED TO ALUMINIZED FILM, WITH PRESSURE SENSITIVE RUBBER BASED ADHESIVE.

F. DOOR VAPOUR BARRIER MASTIC:
   .1 VINYL EMULSION TYPE ACRYLIC OR MASTIC, COMPATIBLE WITH INSULATION, BLACK COLOUR.

G. TIE WIRE: ANNEALED STEEL, 1/16" (1.5 MM).

2.2 GLASS FIBRE, RIGID

A. MANUFACTURER: CERTAINTEED CERTAPRO BOARD.

B. OTHER ACCEPTABLE MANUFACTURERS: JOHNS MANVILLE 800 SERIES SPIN–GLASS

C. INSULATION: ASTM C612; RIGID, NONCOMBUSTIBLE BLANKET.
   .1 'KSI' VALUE : ASTM C518, 0.25 BTU–in/Hr–Sq.Ft– F AT 75 F
   .2 MAXIMUM SERVICE TEMPERATURE: 250 °F (121 °C).
   .3 MAXIMUM MOISTURE ABSORPTION: ASTM C1104; <5% BY WEIGHT.

D. VAPOUR BARRIER JACKET:
   .1 KRAFT PAPER WITH GLASS FIBRE YARN AND BONDED TO ALUMINIZED FILM.
   .2 MOISTURE VAPOUR TRANSMISSION: ASTM E96; 0.04 PERM.
   .3 SECURE WITH PRESSURE SENSITIVE TAPE.

2.3 ALUMINUM JACKETING (APPLY TO OUTDOOR DUCTWORK)

MANUFACTURER: JOHNS MANVILLE ALUMINUM ROLL AND SHEET
COMPLIANCE: ASTM C1729, ASTM E84
FINISH: SMOOTH PLAIN MILL FINISH
EMITTANCE: ASTM C1371
MAXIMUM FLAME SPREAD INDEX: 0
MAXIMUM SMOKE DEVELOPMENT INDEX: 5

2.4 DUCT INSULATION

A. INSULATE NEW OR ALTERED DUCTWORK AND RE–INSULATE EXISTING DUCTWORK WHERE INSULATION HAS BEEN REMOVED OR DAMAGED AS FOLLOWS:

SERVICE	INSULATION TYPE	THICKNESS
EXHAUST WITHIN 6' OF OUTSIDE – RECTANGULAR	RIGID	3"
EXHAUST WITHIN 6' OF OUTSIDE – ROUND	FLEXIBLE	3"
EXHAUST AIR PLENUMS	RIGID	3"
DUCTWORK OUTDOORS (SUPPLY & RETURN)	RIGID	3"

B. INLINE DUCT SILENCERS SHALL BE INSULATED IN THE SAME MANNER AS DUCTWORK.

3. HVAC PIPING INSULATION

3.1 GLASS FIBRE

A. APPROVED MANUFACTURERS: JOHNSMANVILLE MICRO–LOK

B. OTHER ACCEPTABLE MANUFACTURERS OFFERING EQUIVALENT PRODUCTS: OWENS CORING FIBERGLASS, CERTAINTEED CRIMPWRAP.

C. INSULATION: ASTM C547; ASTM C411, ASTM C356 ASTM E84, ASTM D774, NFPA 259.
   .1 'KSI' VALUE: 0.23 BTU–in/Hr–Sq.Ft°F AT 75°F, 0.33 W/m– C AT 24 °C.
   .2 MINIMUM SERVICE TEMPERATURE: 0°F (–18°C).
   .3 MAXIMUM SERVICE TEMPERATURE: 850°F (454°C).
   .4 MAXIMUM MOISTURE ABSORPTION: <5% BY WEIGHT.

D. VAPOUR BARRIER JACKET
   .1 ASTM C136 TYPE I, WHITE KRAFT PAPER REINFORCED WITH GLASS FIBRE YARN AND BONDED TO ALUMINIZED FILM.
   .2 MOISTURE VAPOUR TRANSMISSION: ASTM E96; 0.02 PERM.
   .3 SECURE WITH SELF SEALING LONGITUDINAL LAPS AND BUTT STRIPS.
   .4 SECURE WITH OUTWARD CLINCH EXPANDING STAPLES AND VAPOUR BARRIER MASTIC

E. TIE WIRE: 1.3 MM STAINLESS STEEL WITH TWISTED ENDS ON MAXIMUM 12" (300 MM) CENTRES

F. VAPOUR BARRIER LAP ADHESIVE
   .1 COMPATIBLE WITH INSULATION.

G. INSULATING CEMENT/MASTIC
   .1 ASTM C195; HYDRAULIC SETTING ON MINERAL WOOL, VOC CONTENT NOT TO EXCEED 80 G/L.

H. FIBROUS GLASS FABRIC
   .1 CLOTH: UNTREATED; 9 OZ/SQ YD (305 G/SQ M) WEIGHT.
   .2 BLANKET: 1.0 LB/CU FT (16 KG/CU M) DENSITY.

I. INDOOR VAPOUR BARRIER FINISH
   .1 VINYL EMULSION TYPE ACRYLIC, COMPATIBLE WITH INSULATION, WHITE COLOUR, VOC CONTENT NOT TO EXCEED 250 G/L.

3.2 JACKETS

A. PVC PLASTIC
   .1 JACKET: ONE PIECE MOULDED TYPE FITTING COVERS AND SHEET MATERIAL. ASTM E84, ASTM D1784, ULC S102–M88.
   .2 MAXIMUM SERVICE TEMPERATURE: 151°F (66°C).
   .3 FINISH: GLOSS.
   .4 MAXIMUM FLAME SPREAD: ASTM E84; 25 OR LESS.
   .5 MAXIMUM SMOKE DEVELOPED: ASTM E84; 50 OR LESS.
   .6 THICKNESS: 20 MIL (0.4 MM) MINIMUM. 30 MIL (0.8 MM) MINIMUM FOR OUTDOOR USE.
   .7 COLOUR: STANDARD OFF–WHITE
   .8 COVERING ADHESIVE MASTIC
      .1 COMPATIBLE WITH INSULATION, MAXIMUM VOC CONTENT OF 50 G/L.
   .9 APPROVED MANUFACTURER: CEEL–CO 300 SERIES, ZESTON PVC

3.3 PIPE INSULATION

HVAC SPECIFICATIONS

A. INSULATE NEW OR ALTERED PIPING WITH RIGID PIPE INSULATION AND RE–INSULATE EXISTING PIPING WHERE INSULATION HAS BEEN REMOVED OR DAMAGED AS FOLLOWS:

RIGID PIPE INSULATION

SERVICE	OPERATING TEMP. (°F)	PIPE ø IN.	INSUL. THK. IN.
HYDRONIC HEATING (HOT WATER)	141 TO 200	1–1/4 AND SMALLER	1–1/2
		1–1/2 & LARGER	2

4 HYDRONIC SPECIALTIES

4.1 AIR VENTS

A. MANUAL TYPE: SHORT VERTICAL SECTIONS OF 2" (50 MM) DIAMETER PIPE TO FORM AIR CHAMBER, WITH 3 MM BRASS NEEDLE VALVE AT TOP OF CHAMBER

B. FLOAT TYPE:
   .1 MANUFACTURERS: ARMSTRONG, AMTROL, TACO
   .2 BRASS OR SEMI–STEEL BODY, COPPER, POLYPROPYLENE, OR SOLID NON–METALLIC FLOAT, STAINLESS STEEL VALVE AND VALVE SEAT; SUITABLE FOR SYSTEM OPERATING TEMPERATURE AND PRESSURE; WITH ISOLATING VALVE.

4.2 STRAINERS

A. SIZE 2" (50 MM) AND UNDER:
   .1 MANUFACTURERS: SARCO SB, CRANE, ARMSTRONG, COLTON

B. SCREWED BRASS OR IRON BODY FOR 175 PSI (1200 KPA) WORKING PRESSURE, Y PATTERN WITH 0.8 MM STAINLESS STEEL PERFORATED SCREEN.

C. SIZE 2–1/2" TO 4" (65 MM TO 100 MM):
   .1 FLANGED IRON BODY FOR 175 PSI (1200 KPA) WORKING PRESSURE, Y PATTERN WITH 1.2 MM STAINLESS STEEL PERFORATED SCREEN.

D. SIZE 6" (150 MM) AND LARGER:
   .1 FLANGED IRON BODY FOR 175 PSI (1200 KPA) WORKING PRESSURE, BASKET PATTERN WITH 3.2 MM STAINLESS STEEL PERFORATED SCREEN.

4.3 RELIEF VALVES

A. MANUFACTURERS: SARCO, WATTS, BELL & GOSSETT, CONBRAC

B. BRONZE BODY, TEFLON SEAT, STAINLESS STEEL STEM AND SPRINGS, AUTOMATIC, DIRECT PRESSURE ACTUATED, CAPACITIES ASME CERTIFIED AND LABELLED

8 TESTING, ADJUSTING, BALANCING

8.1 PREPARATION

A. TESTING ADJUSTING, AND BALANCING SHALL BE PERFORMED BY AN AABC OR NBCC CERTIFIED AGENCY.

B. PROVIDE A FINAL TESTING AND BALANCING REPORT TO ENGINEER FOR REVIEW PRIOR TO PROJECT CLOSEOUT.

A. PROVIDE INSTRUMENTS REQUIRED FOR TESTING, ADJUSTING, AND BALANCING OPERATIONS. MAKE INSTRUMENTS AVAILABLE TO CONSULTANT TO FACILITATE SPOT CHECKS DURING TESTING.

B. PROVIDE ADDITIONAL BALANCING DEVICES AS REQUIRED.

8.2 INSTALLATION TOLERANCES

A. AIR HANDLING SYSTEMS: ADJUST TO WITHIN PLUS OR MINUS 5 PERCENT OF DESIGN FOR SUPPLY SYSTEMS AND PLUS OR MINUS 5 PERCENT OF DESIGN FOR RETURN AND EXHAUST SYSTEMS.

B. AIR OUTLETS AND INLETS: ADJUST TOTAL TO WITHIN PLUS 5 PERCENT AND MINUS 5 PERCENT OF DESIGN TO SPACE. ADJUST OUTLETS AND INLETS IN SPACE TO WITHIN PLUS OR MINUS 5 PERCENT OF DESIGN.

C. HYDRONIC SYSTEMS: ADJUST TO WITHIN PLUS OR MINUS 10 PERCENT OF DESIGN.

D. ROOM PRESSURIZATION: ADJUST TO WITHIN PLUS 20 PERCENT AND MINUS OPERCENT OF DESIGN FOR ROOMS UNDER POSITIVE PRESSURE AND WITHIN PLUS OPERCENT AND MINUS 20 PERCENT OF DESIGN FOR ROOMS UNDER NEGATIVE PRESSURE.

8.3 ADJUSTING

A. ENSURE RECORDED DATA REPRESENTS ACTUAL MEASURED OR OBSERVED CONDITIONS.

B. PERMANENTLY MARK SETTINGS OF VALVES, DAMPERS, AND OTHER ADJUSTMENT DEVICES ALLOWING SETTINGS TO BE RESTORED. SET AND LOCK MEMORY STOPS.

C. AFTER ADJUSTMENT, TAKE MEASUREMENTS TO VERIFY BALANCE HAS NOT BEEN DISRUPTED OR THAT SUCH DISRUPTION HAS BEEN RECTIFIED.

D. LEAVE SYSTEMS IN PROPER WORKING ORDER, REPLACING BELT GUARDS, CLOSING ACCESS DOORS, CLOSING DOORS TO ELECTRICAL SWITCH BOXES, AND RESTORING THERMOSTATS TO SPECIFIED SETTINGS.

E. AT FINAL INSPECTION, RECHECK RANDOM SELECTIONS OF DATA RECORDED IN REPORT. RECHECK POINTS OR AREAS AS SELECTED AND WITNESSED BY THE OWNER.

F. CHECK AND ADJUST SYSTEMS APPROXIMATELY SIX MONTHS AFTER FINAL ACCEPTANCE AND SUBMIT REPORT.

8.5 WATER SYSTEM PROCEDURE

A. ADJUST WATER SYSTEMS TO PROVIDE REQUIRED OR DESIGN QUANTITIES.

B. USE CALIBRATED VENTURI TUBES, ORIFICES, OR OTHER METERED FITTINGS AND PRESSURE GAUGES TO DETERMINE FLOW RATES FOR SYSTEM BALANCE. WHERE FLOW METERING DEVICES ARE NOT INSTALLED, BASE FLOW BALANCE ON TEMPERATURE DIFFERENCE ACROSS VARIOUS HEAT TRANSFER ELEMENTS IN THE SYSTEM.

C. ADJUST SYSTEMS TO PROVIDE SPECIFIED PRESSURE DROPS AND FLOWS THROUGH HEAT TRANSFER ELEMENTS PRIOR TO THERMAL TESTING. PERFORM BALANCING BY MEASUREMENT OF TEMPERATURE DIFFERENTIAL IN CONJUNCTION WITH AIR BALANCING.

D. EFFECT SYSTEM BALANCE WITH AUTOMATIC CONTROL VALVES FULLY OPEN TO HEAT TRANSFER ELEMENTS.

E. EFFECT ADJUSTMENT OF WATER DISTRIBUTION SYSTEMS BY MEANS OF BALANCING COCKS, VALVES, AND FITTINGS. DO NOT USE SERVICE OR SHUT–OFF VALVES FOR BALANCING UNLESS INDEXED FOR BALANCE POINT.

F. WHERE AVAILABLE PUMP CAPACITY IS LESS THAN TOTAL FLOW REQUIREMENTS OR INDIVIDUAL SYSTEM PARTS, FULL FLOW IN ONE PART MAY BE SIMULATED BY TEMPORARY RESTRICTION OF FLOW TO OTHER PARTS.

10 BOILERS

10.1 STAINLESS STEEL CONDENSING BOILER

A. MANUFACTURERS
   .1 FURNISH AND INSTALL FACTORY "PACKAGED" LOW PRESSURE HOT WATER BOILER(S) AS MANUFACTURED BY PATTERSON_KELLEY, LLC OR AS APPROVED AND ACCEPTED BY THE ENGINEER AS DEFINED IN THE MECHANICAL SCHEDULES.
   .2 EACH FACTORY "PACKAGED" BOILER MUST BE COMPLETE WITH ALL COMPONENTS AND ACCESSORIES NECESSARY FOR A COMPLETE AND OPERABLE BOILER AS HEREINAFTER SPECIFIED. EACH BOILER MUST BE FURNISHED FACTORY ASSEMBLED WITH THE REQUIRED WIRING AND PIPING AS A SELF_CONTAINED UNIT. EACH BOILER MUST BE READILY TRANSPORTED AND READY FOR INSTALLATION.
   .3 ALL APPROVED EQUAL OR APPROVED ALTERNATE BOILERS MUST DEMONSTRATE COMPLIANCE WITH THE REQUIREMENTS OF THIS SPECIFICATION.

B. COMPONENTS
   .1 CABINET ENCLOSURE
      .1 EACH BOILER MUST FEATURE A FULLY ASSEMBLED CABINET ENCLOSURE FABRICATED FROM CARBON STEEL OR ALUMINUM SHEET METAL (MINIMUM 16 GAUGE) WITH POWDER COAT FINISH.
      .2 THE BOILER'S CABINET ENCLOSURE MUST NOT EXCEED 35" IN WIDTH AND THE COMPLETED BOILER MUST FIT THROUGH A STANDARD DOUBLE DOORWAY.
      .3 THE BOILER'S CABINET ENCLOSURE MUST FEATURE REMOVABLE ACCESS PANELS / DOORS THAT CAN BE EASILY OPENED.
      .4 THE BOILER'S CABINET ENCLOSURE MUST ELIMINATE THE USE OF REFRACTORY OR OTHER INSULATING MATERIALS BY BAFFLING THE COMBUSTION AIR AROUND THE HEAT EXCHANGER AND THE OUTER SURFACE TEMPERATURE MUST NOT EXCEED 20°F ABOVE AMBIENT TEMPERATURE.
      .5 THE BOILER'S CABINET ENCLOSURE MUST PROMINENTLY DISPLAY ALL REQUIRED SAFETY, INSTRUCTION, COMPLIANCE AND FACTORY RUNOUT LABELS.

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PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr,
Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
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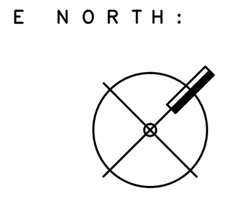

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HVAC SPECIFICATIONS

.2 HEAT EXCHANGER
.1 EACH FIRE-TUBE BOILER MUST CONTAIN AN ASME SECTION IV HEAT EXCHANGER WITH AN "H" STAMP DESIGNED FOR A MAXIMUM ALLOWABLE WORKING PRESSURE OF 160 PSIG AND A MAXIMUM ALLOWABLE TEMPERATURE OF 210°F.
.2 THE COMPLETED HEAT EXCHANGER MUST CONSIST OF WELDED 316L SS HELICAL FIRED TUBES AND PROVIDE NO LESS THAN THE TOTAL FIRESIDE HEATING SURFACE AREA OF 181.50 FT2.
.3 EACH COMPLETED HEAT EXCHANGER MUST INCLUDE AN INTEGRAL STAINLESS-STEEL CONDENSATE PAN/COLLECTOR, CONDENSATE DRAIN, REMOVABLE BURNER ASSEMBLY, INLET TEMPERATURE SENSOR, OUTLET TEMPERATURE SENSOR, FLUE GAS TEMPERATURE SENSOR, HEAT EXCHANGER TEMPERATURE SENSOR, AUTOMATIC AIR VENT, THERMOWELL FOR HIGH TEMPERATURE LIMIT CAPILLARY, LOW WATER CUTOFF PROBE OR FLOW SWITCH, AND ALL NECESSARY ASSEMBLY HARDWARE.
.4 EACH STAINLESS-STEEL HEAT EXCHANGER MUST BE DESIGNED TO MAINTAIN WATER TURBULENCE AT THE FULL PUBLISHED RANGE OF ACCEPTABLE FLOW RATES AT VARIOUS BOILER CONDITIONS AS DESCRIBED BELOW:
.1 THE MAXIMUM ALLOWABLE FLOW RATE WILL GENERATE A 20°F ΔT WHEN THE BOILER IS OPERATING AT FULL CAPACITY.
.2 THE MINIMUM ALLOWABLE FLOW RATE WILL GENERATE A 70°F ΔT WHEN THE BOILER IS OPERATING AT FULL CAPACITY.
.5 THE BOILER'S COMPLETED HEAT EXCHANGER MUST BE CAPABLE OF OPERATING WITH A MINIMUM OUTLET WATER TEMPERATURE OF 42°F.
.6 EACH HEAT EXCHANGER MUST BE HYDROSTATICALLY TESTED BY THE MANUFACTURER TO A MINIMUM OF 1-1/2 TIMES THE MAXIMUM ALLOWABLE WORKING PRESSURE FOR A MINIMUM OF 5 MINUTES. DURING THIS HYDROSTATIC PRESSURE TEST, THE OPERATOR WILL INSPECT THE PRESSURE GAUGE AND VISUALLY VERIFY THERE ARE NO WATER LEAKS.

.3 MAIN GAS TRAINS
.1 BOILERS CONFIGURED FOR SINGLE FUEL OPERATION MUST BE EQUIPPED WITH AN INTEGRAL MAIN GAS VALVE TRAIN CAPABLE OF BURNING NATURAL GAS.
.2 EACH GAS VALVE TRAIN MUST INCLUDE AT LEAST THE FOLLOWING:
.1 ONE (1) UPSTREAM MANUAL SHUTOFF VALVE FOR FIELD-CONNECTION.
.2 ONE (1) COMBINATION AIR-GAS RATIO CONTROL AND SAFETY SHUTOFF VALVE WITH DUAL SOLENOIDS (IN-SERIES) THAT CAN BE INDEPENDENTLY ENERGIZED FOR LEAK TESTING AND INTEGRATED INTO A SINGLE BODY DESIGN. THE COMBINATION GAS VALVE MUST OPERATE AS A "ZERO GOVERNOR" AND CONTROL TO A NEUTRAL GAS PRESSURE INSIDE THE GAS VALVE.
.3 ONE (1) LOW GAS PRESSURE SWITCH (MANUAL RESET).
.4 ONE (1) HIGH GAS PRESSURE SWITCH (MANUAL RESET).
.5 TWO (2) GAS PRESSURE TEST PORTS.
.6 ONE (1) DOWNSTREAM MANUAL SHUTOFF VALVE.
.3 EACH GAS TRAIN MUST BE COMPLETELY INDEPENDENT AND INCLUDE DEDICATED SAFETY DEVICES, SHUTOFF VALVES, ETC. EACH GAS TRAIN MUST BE INDIVIDUALLY IDENTIFIED BY THE MANUFACTURER WITH LABELS AND DEDICATED PAINT COLORS (YELLOW = NATURAL GAS).
.4 THE MAIN GAS VALVE TRAIN(S) MUST BE FACTORY ASSEMBLED, PIPED, AND WIRED AND ALLOW FOR OPERATION AT FULL RATED BOILER CAPACITY FROM 3.5 - 4.0" W.C. UP TO THE MAXIMUM INLET GAS PRESSURE OF 14.0" W.C.
.5 IF THE SUPPLIED GAS PRESSURE EXCEEDS 14" W.C., THE CONTRACTOR MUST SUPPLY A SUITABLE INTERMEDIATE GAS PRESSURE REGULATOR OF THE LOCK-UP TYPE TO REDUCE THE GAS PRESSURE TO ACCEPTABLE LEVELS.

.4 POWER BURNER
.1 THE BOILER MANUFACTURER MUST FURNISH AN INTEGRAL POWER TYPE FUEL BURNER WITH EACH BOILER. THE COMPLETE POWER FUEL BURNER ASSEMBLY MUST CONSIST OF A GAS BURNER, COMBUSTION AIR BLOWER, MAIN GAS VALVE TRAIN, AND IGNITION SYSTEM. THE BURNER MANUFACTURER MUST FULLY COORDINATE THE BURNER DESIGN WITH THE BOILER'S HEAT EXCHANGER AND THE BOILER CONTROL SYSTEM IN ORDER TO PROVIDE THE REQUIRED CAPACITIES, EFFICIENCIES, AND PERFORMANCE SPECIFIED. BOILERS SHIPPED WITHOUT A POWER BURNER AND FIELD-EQUIPPED WITH A 3RD/ PARTY POWER BURNER ARE NOT ACCEPTABLE.
.2 BURNER MUST BE SINGLE BURNER, FULLY MODULATING, WITH DYNAMIC AIR DENSITY COMPENSATION CONTROL.
.3 THE BURNER MUST INCORPORATE FUEL/AIR RATIO CONTROL SYSTEM TO PRESERVE EXHAUST OXYGEN LEVELS AS PER BOILER SCHEDULE, MAINTAINING CONSISTENT FLUE DEW POINT.
.4 THE SYSTEM MUST BE LINKAGE-LESS WITHOUT THE USE OF ELECTRONIC CONTROL LOOPS AND ELECTRONIC OXYGEN SENSORS REQUIRING CALIBRATION AND RENEWAL.
.5 LOW NOX BURNER MUST BE CERTIFIED BY SCAQMD FOR NOX LEVELS LISTED ON SCHEDULE WHEN O2 IS CORRECTED TO 3%. NO ADDITIONAL SETUP OR ADJUSTMENT, SUCH AS INCREASING EXCESS AIR, WILL BE NECESSARY TO ACHIEVE LEVEL LISTED
.6 EACH BURNER MUST BE INSTALLED VERTICALLY INSIDE THE COMBUSTION CHAMBER WITH COMBUSTION GASES FLOWING DOWNWARD THROUGH THE HEAT EXCHANGER. THE BURNER MUST CONSIST OF A STAINLESS STEEL FLANGE AND PERFORATED STAINLESS STEEL CYLINDER.
.7 EACH BOILER MUST BE EQUIPPED WITH DIRECT SPARK IGNITION. MAIN FLAME MUST BE MONITORED AND CONTROLLED BY A FLAME ROD/IONIZATION PROBE (RECTIFICATION) SYSTEM.

.5 BOILER SAFETY AND TRIM DEVICES
.1 THE BOILER MANUFACTURER MUST FURNISH AND TEST THE FOLLOWING SAFETY AND TRIM DEVICES WITH EACH BOILER:
.1 SAFETY RELIEF VALVE MUST BE PROVIDED IN COMPLIANCE WITH THE ASME CODE. CONTRACTOR IS REQUIRED TO PIPE THE RELIEF VALVE DISCHARGE PIPING TO AN ACCEPTABLE DRAIN.
.2 WATER PRESSURE/TEMPERATURE GAUGE.
.3 LOW WATER / FLOW CUTOFF.
.4 MANUAL RESET HIGH LIMIT WATER TEMPERATURE CONTROLLER.
.5 OPERATING TEMPERATURE CONTROL TO CONTROL THE SEQUENTIAL OPERATION OF THE BURNER.
.6 HIGH AND LOW GAS PRESSURE SWITCHES.
.7 FLAME ROD / IONIZATION PROBE FLAME DETECTION.
.2 THE BOILER MANUFACTURER MUST PROVIDE A CSD-1 FORM IDENTIFYING EACH SAFETY AND TRIM DEVICE.
.3 THE BOILER MUST BE CAPABLE OF INTERFACING WITH THE FOLLOWING EXTERNAL SAFETY DEVICES:
.1 AUXILIARY LOW WATER CUTOFF DEVICE.
.2 COMBUSTION AIR DAMPER END LIMIT SWITCH.
.3 EMERGENCY STOP (E-STOP) SWITCH.
.4 EXTERNAL SAFETY DEVICE W/ CONTACT CLOSURE.

.6 BOILER CONTROL SYSTEM
.1 EACH BOILER MUST BE PROVIDED WITH ALL NECESSARY CONTROLS, ALL NECESSARY PROGRAMMING SEQUENCES, AND ALL SAFETY INTERLOCKS. EACH BOILER CONTROL SYSTEM MUST BE PROPERLY INTERLOCKED WITH ALL SAFETIES.
.2 EACH BOILER MUST BE PROVIDED WITH A "FULL MODULATING" FIRING CONTROL SYSTEM WHEREBY THE FIRING RATE IS INFINITELY PROPORTIONAL AT ANY FIRING RATE BETWEEN LOW FIRE AND HIGH FIRE AS DETERMINED BY THE PULSE WIDTH MODULATION INPUT CONTROL SIGNAL. BOTH FUEL INPUT AND AIR INPUT MUST BE SEQUENCED IN UNISON TO THE APPROPRIATE FIRING RATE WITHOUT THE USE OF MECHANICAL LINKAGE.
.3 THE BOILER'S CONTROL SYSTEM MUST PROVIDE THE MINIMUM CAPABILITIES:
.1 7" COLOR TOUCHSCREEN DISPLAY WITH ONE OR MORE USB PORTS.
.2 STANDARD ON-BOARD ETHERNET PORT FOR WIRED INTERNET CONNECTIVITY.
.3 PARAMETER UPLOADS AND DOWNLOADS VIA EXTERNAL USB FLASH DRIVE.
.4 SOFTWARE UPDATES VIA EXTERNAL USB FLASH DRIVE.
.5 CAPTURE SCREEN SHOTS FROM THE CONTROL'S DISPLAY BY SAVING DIGITAL IMAGE FILES TO EXTERNAL USB FLASH DRIVE.
.6 LOCAL REPRESENTATIVE SCREEN CAN BE PROGRAMMED TO PROVIDE CONTACT INFORMATION FOR THE LOCAL BOILER MANUFACTURER'S REPRESENTATIVE.
.7 PROGRAMMABLE RELAY OUTPUTS FOR DIRECT CONTROL OF PUMPS, CONTROL VALVES, DAMPERS AND OTHER AUXILIARY DEVICES.
.8 MULTIPLE BOILER "CASCADE" NETWORK UP TO 32 BOILERS WITHOUT ANY EXTERNAL CONTROL PANEL. THE INSTALLATION OF EXTERNAL SEQUENCING CONTROL PANELS IS NOT ACCEPTABLE.
.9 AUTOMATIC HYBRID SYSTEM CONTROL FOR MULTIPLE BOILER "CASCADE" SYSTEMS WITH BOTH CONDENSING AND NON-CONDENSING BOILERS. THIS CONTROL LOGIC PRIORITIZES CONDENSING BOILERS AT LOW WATER TEMPERATURES AND PRIORITIZES NON-CONDENSING BOILERS AT HIGH WATER TEMPERATURES.
.10 AUXILIARY BOILER RELAY FOR MULTIPLE BOILER "CASCADE" SYSTEMS WHICH CAN BE USED TO ENABLE A 3RD/ PARTY BOILER PLATFORM IN THE EVENT THE "CASCADE" SYSTEM IS UNABLE TO SATISFY THE HEATING LOAD.
.11 PROGRAMMABLE BOILER AND SYSTEM PUMP CONTROL WITH MODULATING CAPABILITIES FOR MULTIPLE BOILER "CASCADE" SYSTEMS INSTALLED IN A PRIMARY-SECONDARY PIPING ARRANGEMENT.
.12 PROGRAMMABLE CONTROL VALVE LOGIC WITH MODULATING CAPABILITIES FOR MULTIPLE BOILER "CASCADE" SYSTEMS INSTALLED IN A PRIMARY-ONLY PIPING ARRANGEMENT.
.13 PROGRAMMABLE SYNCHRONIZATION OF EXHAUST FAN TIMING TO EQUAL THE REAL-TIME BURNER FIRING RATE.
.14 5 PRE-INSTALLED PID CONTROL SPEEDS FOR SYSTEM OPTIMIZATION IN ADDITION TO A USER-DEFINED PID FUNCTION CAPABILITY.
.15 INTEGRATION WITH EXTERNAL BUILDING MANAGEMENT SYSTEMS (BMS) VIA MODBUS®/ RTU PROTOCOL. NOTE: OPTIONAL PROTOCOL CONVERTER FOR COMMUNICATION VIA LONWORKS®/ AND BACNET®/ MUST BE AVAILABLE FOR PURCHASE FROM THE BOILER MANUFACTURER.
.16 HARDWIRE INTEGRATION WITH BUILDING MANAGEMENT SYSTEMS (BMS) VIA 4-20MA ANALOG CONTROL SIGNAL FOR TEMPERATURE OR FIRING RATE CONTROL.
.17 INTUITIVE "SETUP WIZARDS" ASK THE USER A SERIES OF QUESTIONS AND ALLOW FOR STEP-BY-STEP CONFIGURATION OF THE BOILER OPERATION, CONTROL, AND CONNECTIVITY.
.18 ON-SCREEN ERROR NOTIFICATIONS WITH A COMPREHENSIVE DESCRIPTION OF ALL ALARM CONDITIONS AND SEVERAL TROUBLESHOOTING STEPS.
.19 AUTOMATIC FLUE GAS TEMPERATURE AND OUTLET (SUPPLY) TEMPERATURE COMPENSATION TO PREVENT OVER-FIRING OF THE BOILER EQUIPMENT.
.20 AUTOMATIC DIFFERENTIAL TEMPERATURE COMPENSATION TO PREVENT OVER-FIRING OF THE BOILER EQUIPMENT IN A LOW FLOW CONDITION.
.21 AUTOMATICALLY ADJUST THE TEMPERATURE SET POINT AND SHUTDOWN THE BOILER BASED ON THE OUTDOOR AIR TEMPERATURE CONDITIONS.
.22 NIGHT SETBACK FUNCTIONALITY VIA EXTERNAL POINT OF CLOSURE (OR BMS INTEGRATION) FOR UNIQUE "OCCUPIED" AND "UNOCCUPIED" TEMPERATURE SETPOINT VALUES. SETBACK FEATURE WILL INCLUDE THE ABILITY TO SCHEDULE MULTIPLE ADJUSTMENTS WITHIN A 24-HOUR PERIOD FOR BUILDING OPTIMIZATION.
.23 BOOSTED BOILER OPERATION RESULTING IN A PRE-DETERMINED, TIMED, INCREASE IN BOILER TEMPERATURE SETTING IN AN UNEXPECTED OCCUPIED MODE.
.24 MAINTAIN SINGLE TEMPERATURE SET POINT WITH A MINIMUM OUTLET (SUPPLY) WATER TEMPERATURE OF 42°F UP TO A MAXIMUM OUTLET (SUPPLY) WATER TEMPERATURE OF 194°F.
.25 ON-BOARD DHW PRIORITY CAPABLE OF SEAMLESS TRANSITION BETWEEN COMFORT HEAT (CH) AND DOMESTIC HOT WATER (DHW) OPERATION.
.26 ON-BOARD CH&DHW OPERATION FOR SIMULTANEOUS COMFORT HEAT (CH) AND DOMESTIC HOT WATER (DHW) OPERATION.
.27 ALARM RELAY OUTPUT TO ANNOUNCE ALARM CONDITIONS WHICH REQUIRE MANUAL RESET ON MASTER OR ANY MEMBER BOILER FROM A SINGLE BOILER SOURCE.
.28 PROGRAMMABLE LOW FIRE DELAY TO PREVENT EXCESSIVE SHORT-CYCLING OF THE BOILER EQUIPMENT.
.29 LOCAL MANUAL OPERATION.
.2 THE BOILER CONTROL SYSTEM MUST BE CAPABLE OF INTERFACING WITH THE FOLLOWING EXTERNAL CONTROL DEVICES:
.1 BUILDING MANAGEMENT SYSTEM (MODBUS®/). NOTE: OPTIONAL PROTOCOL CONVERTER FOR COMMUNICATION VIA LONWORKS®/ AND BACNET®/ MUST BE AVAILABLE FOR PURCHASE FROM THE BOILER MANUFACTURER.
.2 DOMESTIC HOT WATER BREAK-ON-RISE AQUASTAT (NORMALLY CLOSED).
.3 DOMESTIC HOT WATER TANK TEMPERATURE SENSOR (12KΩ).
.4 EXTERNAL HEADER TEMPERATURE SENSOR (12KΩ).
.5 OUTDOOR AIR TEMPERATURE SENSOR (12KΩ) BOTH WIRED AND WIRELESS.

A. EXECUTION
.1 INSTALLATION
.1 INSTALLATION MUST BE PERFORMED BY THE CONTRACTOR IN ACCORDANCE WITH THE REQUIREMENTS OF THE APPLICABLE CODES. CONTRACTOR MUST REVIEW THE BOILER AND INSTALLATION FOR COMPLIANCE WITH REQUIREMENTS AND/OR ISSUES THAT MAY AFFECT BOILER PERFORMANCE. INSTALLATION SHOULD NOT PROCEED UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.
.2 THE CONTRACTOR MUST MOUNT THE EQUIPMENT AS DESCRIBED BELOW:
.1 INSTALL BOILERS ON CAST-IN-PLACE CONCRETE EQUIPMENT BASE
.2 IF REQUIRED BY THE LOCAL CODE, INSTALL VIBRATION ISOLATION DEVICES
.3 THE CONTRACTOR MUST INSTALL GAS-FIRED BOILERS IN ACCORDANCE WITH NFPA 54/ANSI Z223.1 (UNITED STATES), OR CAN/CSA B/149.1 (CANADA).
.4 THE CONTRACTOR MUST INSTALL GAS-FIRED BOILERS IN ACCORDANCE WITH NBIC - PART 1 (INSTALLATION), OR ANOTHER INSTALLATION CODE HAVING LOCAL JURISDICTION.
.5 THE CONTRACTOR MUST ASSEMBLE AND INSTALL ANY EXTERNAL BOILER SAFETY/TRIM DEVICES.
.6 THE CONTRACTOR MUST INSTALL ANY ELECTRICAL DEVICES FURNISHED WITH THE BOILER, BUT NOT SPECIFIED TO BE FACTORY-MOUNTED.
.7 THE CONTRACTOR MUST INSTALL CONTROL WIRING TO FIELD MOUNTED ELECTRICAL DEVICES IN ACCORDANCE WITH THE REQUIREMENTS OF NFPA 70.
.8 THE CONTRACTOR MUST INSTALL ELECTRICAL (POWER) WIRING TO THE BOILER IN ACCORDANCE WITH THE REQUIREMENTS OF NFPA 70.
.2 GAS PIPING
.1 EACH BOILER MUST BE PROVIDED WITH ALL NECESSARY GAS CONNECTIONS. REFER TO THE BOILER'S SPECIFICATION SHEET OR MANUAL FOR CONNECTION SIZES.
.2 INSTALL GAS PIPING IN ACCORDANCE WITH NFPA 54/CAN/CSA B/149.1 (CANADA).
.3 HYDRONIC PIPING
.1 EACH BOILER MUST BE PROVIDED WITH ALL NECESSARY INLET (SUPPLY) AND OUTLET (RETURN) CONNECTIONS. REFER TO THE BOILER'S SPECIFICATION SHEET OR MANUAL FOR CONNECTION SIZES.
.2 CHECK MANUFACTURER'S INSTALLATION MANUAL FOR CLEARANCE DIMENSIONS AND INSTALL PIPING THAT WILL ALLOW FOR SERVICE AND EASE OF MAINTENANCE.
.3 INSTALL PIPING FROM EQUIPMENT DRAIN CONNECTION TO NEAREST FLOOR DRAIN. PIPING MUST BE AT LEAST FULL SIZE OF CONNECTION AND ADHERE TO PROPER CODES FOR NEUTRALIZATION.
.4 EXHAUST VENTING
.1 THE BOILERS MUST BE DUAL CERTIFIED AS CATEGORY II OR IV APPLIANCES AND ARE CAPABLE OF OPERATING WITH SLIGHTLY NEGATIVE TO SLIGHTLY POSITIVE EXHAUST VENT PRESSURE, AND THE VENT GAS TEMPERATURE IS LIKELY TO CAUSE CONDENSATE PRODUCTION IN THE VENT.
.2 INSTALL THE EXHAUST/FLUE VENTING SYSTEM IN ACCORDANCE WITH NFPA 54/CAN/CSA B/149.1 (CANADA) AND PER THE MANUFACTURER'S RECOMMENDATIONS IN THE INSTALLATION MANUAL.
.5 AIR INLET
.1 THE BOILERS MUST BE CERTIFIED FOR DIRECT VENT / SEALED COMBUSTION INSTALLATIONS WHERE THE COMBUSTION AIR IS SUPPLIED DIRECTLY TO THE BOILER THROUGH DUCTWORK.
.2 INSTALL THE AIR INLET SYSTEM IN ACCORDANCE WITH NFPA 54/CAN/CSA B/149.1 (CANADA) AND PER THE MANUFACTURER'S RECOMMENDATIONS IN THE INSTALLATION MANUAL.
.6 ELECTRICAL
.1 INSTALL AN EXTERNAL DISCONNECT AND OVERLOAD PROTECTION FOR EACH BOILER IN ACCORDANCE WITH THE REQUIREMENTS OF NFPA 70.
.2 THE VOLTAGE REQUIREMENTS FOR EACH BOILER MUST BE CONFIGURED FOR 208-240VAC OR 480VAC, THREE-PHASE (W/ NEUTRAL), 60HZ.

10.2 <u>BOILER VENTING</u>
A. POSITIVE PRESSURE VENT
.1 THE VENT SHALL BE OF DOUBLE WALL, FACTORY BUILT TYPE, DESIGNED FOR USE IN CONJUNCTION WITH CATEGORY I, II, III OR IV CONDENSING OR NON-CONDENSING GAS FIRED APPLIANCES OR AS SPECIFIED BY THE HEATING EQUIPMENT MANUFACTURER.
.2 MAXIMUM CONTINUOUS FLUE GAS TEMPERATURE SHALL NOT EXCEED 480°F (249°C).
.3 VENT SHALL BE LISTED FOR A MINIMUM POSITIVE PRESSURE RATING OF 6" W.C. AND SHALL HAVE PASSED AT 35" W.C.
.4 THE VENT SYSTEM SHALL BE CONTINUOUS FROM THE APPLIANCE'S FLUE OUTLET TO THE VENT TERMINATION OUTSIDE THE BUILDING. ALL SYSTEM COMPONENTS SHALL BE INTERTEK ETL AND SUPPLIED FROM THE SAME MANUFACTURER.
.5 THE VENT SHALL BE CONSTRUCTED WITH AN INNER AND OUTER TUBE, WHERE THE ANNULAR SPACE BETWEEN THE TUBES IS 1-INCH INDOORS AND 2-INCH INSULATION OUTDOORS.
.1 THE INNER TUBE (FLUE GAS CONDUIT) SHALL BE CONSTRUCTED FROM EITHER AL29-4C® OR 316L STAINLESS STEEL. THE AL29-4C STAINLESS STEEL WILL HAVE A WALL THICKNESS OF .015" FOR 3" THROUGH 9" DIAMETER VENTS, .020" FOR 10" THROUGH 16" AND .024" FOR 18" THROUGH 24" DIAMETER VENTS. THE 316L STAINLESS STEEL WILL HAVE A MINIMUM WALL THICKNESS OF .015" FOR 3"-9" DIAMETER VENTS, .019" FOR 10"-16" DIAMETER VENTS AND .024" FOR 18"-24" DIAMETER VENTS.
.2 THE OUTER TUBE (JACKET) SHALL BE CONSTRUCTED FROM 441 STAINLESS STEEL WITH A MINIMUM WALL THICKNESS OF .015" FOR 3" THROUGH 9" DIAMETER VENTS, .020" FOR 10" THROUGH 16" AND .024" FOR 18" THROUGH 24" DIAMETER VENTS.
.6 ALL SYSTEM COMPONENTS SUCH AS VENT SUPPORTS, ROOF OR WALL PENETRATIONS, TERMINATIONS, APPLIANCE CONNECTORS AND DRAIN FITTINGS REQUIRE TO INSTALL THE VENT SYSTEM SHALL BE INTERTEK ETL LISTED AND PROVIDED BY THE VENT MANUFACTURER.
.7 VENT LAYOUT SHALL BE DESIGNED AND INSTALLED IN COMPLIANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS AND ALL APPLICABLE LOCAL CODES.
B. EXECUTION
.1 VENT SYSTEM LAYOUT
.1 VENT SYSTEM LAYOUT
.1 THE VENT SYSTEM SHALL BE ROUTED TO MAINTAIN MINIMUM CLEARANCE TO COMBUSTIBLES AS SPECIFIED BY THE MANUFACTURER.
.2 VENT INSTALLATION SHALL CONFORM TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS, ITS LISTING AND STATE / LOCAL CODES.
.3 THE VENT SYSTEM AND BREECHINGS SHALL BE INSPECTED AND CLEANED BEFORE THE FINAL CONNECTION TO THE APPLIANCES.
.2 MECHANICAL EQUIPMENT
.1 KW ADJUSTABLE DAMPERS MUST BE INCLUDED AND INSTALLED FOR EACH INITIAL VERTICAL VENTING BRANCH.
.2 IF DAMPERS OR FANS ARE INSTALLED IN CONJUNCTION OF THE VENT SYSTEM, SUCH EQUIPMENT SHALL BE SUPPORTED INDEPENDENTLY FROM THE VENT SYSTEM. PROTECT THE VENT SYSTEM FROM TWISTING OR MOVEMENT DUE TO FAN TORQUE OR VIBRATION.
C. MANUFACTURERS
.1 THE MANUFACTURER SHALL BE RESPONSIBLE FOR PROVIDING VENTING SHOP DRAWINGS OUTING THE VENTING MATERIAL, FITTINGS AND COMPONENTS IN THE FORM OF AN ISOMETRIC VENTING DIAGRAM. THIS SHOP DRAWING SHALL BE ACCOMPANIED BY VENTING PRESSURE DROP CALCULATIONS AND SHALL BE SEALED BY A LISCENSED PROFESSIONAL ENGINEER IN THE PROVICE ON ONTARIO WITH MINIMUM TEN (10) YEARS OF RELAVENT EXPERIENCE.
.2 SPECIFICATION REQUIREMENTS SHALL BE MET BY USING SECURITY CHIMNEYS SECURE SEAL SSD DOUBLE-WALL INDOORS AND SSID OUTDOORS, EXHAUST FLUE OR EQUIVALENT AS APPROVED BY THE ENGINEER. EQUIVALENT SUBMITTALS SHALL DEMONSTRATE THAT THE ALTERNATE MATERIAL IS IN COMPLIANCE WITH ALL SPECIFICATION REQUIREMENTS. PLEASE CONTACT SMITH ENERGY - PERRY LAM (647-660-4322, EXT. 3307) FOR ANY QUESTIONS.

11 <u>HVAC PUMPS</u>

11.1 <u>VARIABLE SPEED PACKAGED PUMP SYSTEM (P-1, P-2, P-3, P-4, P-5, P-6)</u>
A. GENERAL
.1 FURNISH AND INSTALL A PRE-FABRICATED AND TESTED VARIABLE SPEED PACKAGED PUMPING SYSTEM TO MAINTAIN CONSTANT WATER DELIVERY PRESSURE.
.2 THE PACKAGED PUMP SYSTEM SHALL BE A STANDARD PRODUCT OF A SINGLE PUMP MANUFACTURER. THE ENTIRE PUMP SYSTEM INCLUDING PUMPS AND PUMP LOGIC CONTROLLER, SHALL BE DESIGNED, BUILT, AND TESTED BY THE SAME MANUFACTURER.
.3 THE COMPLETE PACKAGED WATER BOOSTER PUMP SYSTEM SHALL BE CERTIFIED AND LISTED BY UL (CATEGORY QCZJ - PACKAGED PUMPING SYSTEMS) FOR CONFORMANCE TO U.S. AND CANADIAN STANDARDS.
.4 THE COMPLETE PACKAGED PUMPING SYSTEM SHALL BE NSF61 / NSF372 LISTED FOR DRINKING WATER AND LOW LEAD REQUIREMENTS.
B. PUMPS
.1 ALL PUMPS SHALL BE ANSI NSF 61 / NSF372 LISTED FOR DRINKING WATER AND LOW LEAD REQUIREMENTS.
.2 THE PUMPS SHALL BE OF THE IN-LINE VERTICAL MULTI-STAGE DESIGN.
.3 THE HEAD-CAPACITY CURVE SHALL HAVE A STEADY RISE IN HEAD FROM MAXIMUM TO MINIMUM FLOW WITHIN THE PREFERRED OPERATING REGION. THE SHUT-OFF HEAD SHALL BE A MINIMUM OF 20% HIGHER THAN THE HEAD AT THE BEST EFFICIENCY POINT.
.4 SMALL VERTICAL IN-LINE MULTI-STAGE PUMPS (NOMINAL FLOW FROM 3 TO 125 GALLONS PER MINUTE) SHALL HAVE THE FOLLOWING FEATURES:
.1 THE PUMP IMPELLERS SHALL BE SECURED DIRECTLY TO THE PUMP SHAFT BY MEANS OF A SPLINED SHAFT ARRANGEMENT.
.2 THE SUCTION/DISCHARGE BASE SHALL HAVE ANSI CLASS 250 FLANGE OR INTERNAL PIPE THREAD (NPT) CONNECTIONS AS DETERMINED BY THE PUMP STATION MANUFACTURER.
.3 PUMP CONSTRUCTION.
.1 SUCTION/DISCHARGE BASE, PUMP HEAD, MOTOR STOOL: CAST IRON (CLASS 30)
.2 IMPELLERS, DIFFUSER CHAMBERS, OUTER SLEEVE: 304 STAINLESS STEEL
.3 SHAFT: 316 OR 431 STAINLESS STEEL
.4 IMPELLER WEAR RINGS: 304 STAINLESS STEEL
.5 SHAFT JOURNALS AND CHAMBER BEARINGS: SILICON CARBIDE
.6 O-RINGS: EPDM
SHAFT COUPLINGS FOR MOTOR FLANGE SIZES 184TC AND SMALLER SHALL BE MADE OF CAST IRON OR SINTERED STEEL. SHAFT COUPLINGS FOR MOTOR FLANGE SIZES LARGER THAN 184TC SHALL BE MADE OF DUCTILE IRON (ASTM 60-40-18).
OPTIONAL MATERIALS FOR THE SUCTION/DISCHARGE BASE AND PUMP HEAD SHALL BE CAST 316 STAINLESS STEEL (ASTM CF-8M) RESULTING IN ALL WETTED PARTS OF STAINLESS STEEL.
.4 THE SHAFT SEAL SHALL BE A BALANCED O-RING CARTRIDGE TYPE WITH THE FOLLOWING FEATURES:
.1 COLLAR, DRIVERS, SPRING: 316 STAINLESS STEEL
.2 SHAFT SLEEVE, GLAND PLATE: 316 STAINLESS STEEL
.3 STATIONARY RING: SILICON CARBIDE
.4 ROTATING RING: SILICON CARBIDE
.5 O-RINGS: EPDM
THE SILICON CARBIDE SHALL BE IMBEDDED WITH GRAPHITE.
.5 SHAFT SEAL REPLACEMENT SHALL BE POSSIBLE WITHOUT REMOVAL OF ANY PUMP COMPONENTS OTHER THAN THE COUPLING GUARD, SHAFT COUPLING AND MOTOR. THE ENTIRE CARTRIDGE SHAFT SEAL SHALL BE REMOVABLE AS A ONE PIECE COMPONENT. PUMPS WITH MOTORS EQUAL TO OR LARGER THAN 15 HP (FIFTEEN HORSEPOWER) SHALL HAVE ADEQUATE SPACE WITHIN THE MOTOR STOOL SO THAT SHAFT SEAL REPLACEMENT IS POSSIBLE WITHOUT MOTOR REMOVAL.
.5 LARGE IN-LINE VERTICAL MULTI-STAGE PUMPS (NOMINAL FLOWS FROM 130 TO 500 GALLONS PER MINUTE) SHALL HAVE THE FOLLOWING FEATURES:
.1 THE PUMP IMPELLERS SHALL BE SECURED DIRECTLY TO THE SMOOTH PUMP SHAFT BY MEANS OF A SPLIT CONE AND NUT DESIGN.
.2 THE SUCTION/DISCHARGE BASE SHALL HAVE ANSI CLASS 125 OR CLASS 250 FLANGE CONNECTIONS IN A SLIP RING (ROTATING FLANGE) DESIGN AS INDICATED IN THE DRAWINGS OR PUMP SCHEDULE.
.3 PUMP CONSTRUCTION.
.1 SUCTION/DISCHARGE BASE, PUMP HEAD DUCTILE IRON (ASTM 65-45-12)
.2 SHAFT COUPLINGS, FLANGE RINGS: DUCTILE IRON (ASTM 65-45-12)
.3 SHAFT 431 STAINLESS STEEL
.4 MOTOR STOOL CAST IRON (ASTM CLASS 30)
.5 IMPELLERS, DIFFUSER CHAMBERS, OUTER SLEEVE: 304 STAINLESS STEEL
.6 IMPELLER WEAR RINGS: 304 STAINLESS STEEL
.7 INTERMEDIATE BEARING JOURNALS: SILICON CARBIDE
.8 INTERMEDIATE CHAMBER BEARINGS: LEADLESS TIN BRONZE
.9 CHAMBER BUSHINGS: GRAPHITE FILLED PTFE
.10 O-RINGS: EPDM
.4 THE SHAFT SEAL SHALL BE A BALANCED O-RING CARTRIDGE TYPE WITH THE FOLLOWING FEATURES:
.1 COLLAR, DRIVERS, SPRING: 316 STAINLESS STEEL
.2 SHAFT SLEEVE, GLAND PLATE: 316 STAINLESS STEEL
.3 STATIONARY RING: SILICON CARBIDE
.4 ROTATING RING: SILICON CARBIDE
.5 O-RINGS: EPDM
THE SILICON CARBIDE SHALL BE IMBEDDED WITH GRAPHITE.
.5 SHAFT SEAL REPLACEMENT SHALL BE POSSIBLE WITHOUT REMOVAL OF ANY PUMP COMPONENTS OTHER THAN THE COUPLING GUARD, MOTOR COUPLINGS, MOTOR AND SEAL COVER. THE ENTIRE CARTRIDGE SHAFT SEAL SHALL BE REMOVABLE AS A ONE PIECE COMPONENT. PUMPS WITH MOTORS EQUAL TO OR LARGER THAN 15 HP (FIFTEEN HORSEPOWER) SHALL HAVE ADEQUATE SPACE WITHIN THE MOTOR STOOL SO THAT SHAFT SEAL REPLACEMENT IS

C. VARIABLE FREQUENCY DRIVE MOTORS
.1 EACH MOTOR SHALL HAVE A VARIABLE FREQUENCY DRIVE SHIPPED LOOSE
.2 THE VFD SHALL BE OF THE PWM (PULSE WIDTH MODULATION) DESIGN USING CURRENT IGBT (INSULATED GATE BIPOLAR TRANSISTOR) TECHNOLOGY.
.3 THE VFD SHALL CONVERT INCOMING FIXED FREQUENCY THREE-PHASE AC POWER INTO A VARIABLE FREQUENCY AND VOLTAGE FOR CONTROLLING THE SPEED OF MOTOR. THE MOTOR CURRENT SHALL CLOSELY APPROXIMATE A SINE WAVE. MOTOR VOLTAGE SHALL BE VARIED WITH FREQUENCY TO MAINTAIN DESIRED MOTOR MAGNETIZATION CURRENT SUITABLE FOR CENTRIFUGAL PUMP CONTROL AND TO ELIMINATE THE NEED FOR MOTOR DE-RATING.
.4 THE VFD SHALL UTILIZE AN ENERGY OPTIMIZATION ALGORITHM TO MINIMIZE ENERGY CONSUMPTION. THE OUTPUT VOLTAGE SHALL BE ADJUSTED IN RESPONSE TO THE LOAD, INDEPENDENT OF SPEED.
.5 THE VFD SHALL AUTOMATICALLY REDUCE THE SWITCHING FREQUENCY AND/OR THE OUTPUT VOLTAGE AND FREQUENCY TO THE MOTOR DURING PERIODS OF SUSTAINED AMBIENT TEMPERATURES THAT ARE HIGHER THAN THE NORMAL OPERATING RANGE. THE SWITCHING FREQUENCY SHALL BE REDUCED BEFORE MOTOR SPEED IS REDUCED.
.6 AN INTEGRAL RFI FILTER SHALL BE STANDARD IN THE VFD.
.7 THE VFD SHALL HAVE A MINIMUM OF TWO SKIP FREQUENCY BANDS WHICH CAN BE FIELD ADJUSTABLE.
.8 THE VFD SHALL HAVE INTERNAL SOLID-STATE OVERLOAD PROTECTION DESIGNED TO TRIP WITHIN THE RANGE OF 125-150% OF RATED CURRENT.
.9 THE INTEGRATED VFD MOTOR SHALL INCLUDE PROTECTION AGAINST INPUT TRANSIENTS, PHASE IMBALANCE, LOSS OF AC LINE PHASE, OVER-VOLTAGE, UNDER-VOLTAGE, VFD OVER-TEMPERATURE, AND MOTOR OVER-TEMPERATURE. THREE-PHASE INTEGRATED VFD MOTORS SHALL BE CAPABLE OF PROVIDING FULL OUTPUT VOLTAGE AND FREQUENCY WITH A VOLTAGE IMBALANCE OF UP TO 10%.
.10 THE VFD MOTOR SHALL HAVE, AS A MINIMUM, THE FOLLOWING INPUT/OUTPUT CAPABILITIES:
.1 SPEED REFERENCE SIGNAL: 0-10 VDC, 4-20MA
.2 DIGITAL REMOTE ON/OFF
.3 FAULT SIGNAL RELAY (NC OR NO)
.4 FIELDBUS COMMUNICATION PORT (RS485)
.11 THE MOTOR SHALL BE TOTALLY ENCLOSED FAN COOLED (TEFC) WITH A STANDARD NEMA C-FACE, CLASS F INSULATION WITH A TEMPERATURE RISE NO HIGHER THAN CLASS B.
.12 THE COOLING DESIGN OF THE MOTOR AND VFD SHALL BE SUCH THAT A CLASS B MOTOR TEMPERATURE RISE IS NOT EXCEEDED AT FULL RATED LOAD AND SPEED AT A MINIMUM SWITCHING FREQUENCY OF 9.0 KHZ.
.13 MOTOR DRIVE END BEARINGS SHALL BE ADEQUATELY SIZED SO THAT THE MINIMUM L10 BEARING LIFE IS 17,500 HOURS AT THE MINIMUM ALLOWABLE CONTINUOUS FLOW RATE FOR THE PUMP AT FULL RATED SPEED.
SWITCHED TO THE "OFF" POSITION BUT WITH ELECTRICITY SUPPLY STILL CONNECTED). THE INOPERATIVE PUMPS SHALL BE SWITCHED ON FOR
PERIOD OF TWO TO THREE (3-4) SECONDS EVERY 24 HOURS, 48 HOURS OR ONCE PER WEEK AND AT SPECIFIC TIME OF DAY (USER SELECTABLE).
.18 THE CONTROLLER SHALL BE CAPABLE OF CHANGING THE NUMBER OF PUMPS AVAILABLE TO OPERATE OR HAVE THE ABILITY LIMIT THE MAXIMUM POWER CONSUMPTION BY ACTIVATION OF A DIGITAL INPUT FOR PURPOSES OF LIMITED GENERATOR SUPPLIED POWER.
.19 THE CONTROLLER SHALL BE CAPABLE OF DISPLAYING INSTANTANEOUS POWER CONSUMPTION (WATTS OR KILOWATTS) AND CUMULATIVE ENERGY CONSUMPTION (KILOWATT-HOURS).
.20 THE CONTROLLER SHALL BE CAPABLE OF DISPLAYING INSTANTANEOUS SPECIFIC ENERGY USE (KW/GPM), (OPTIONAL FLOW METER MUST BE CONNECTED).
.21 THE ACTUAL PUMP PERFORMANCE CURVES (5TH ORDER POLYNOMIAL) SHALL BE LOADED (SOFTWARE) INTO THE PUMP SYSTEM CONTROLLER. PUMP CURVE DATA SHALL BE USED FOR THE FOLLOWING:
.1 DISPLAY AND DATA LOGGING OF CALCULATED FLOW RATE (NOT REQUIRING FLOW MEASUREMENT)
.2 PROPORTIONAL PRESSURE CONTROL
.3 PUMP OUTSIDE OF DUTY RANGE PROTECTION
.4 PUMP CASCADE CONTROL BASED ON PUMP EFFICIENCY
.22 THE CONTROLLER SHALL BE CAPABLE OF DISPLAYING AN ESTIMATED FLOW-RATE ON THE DEFAULT STATUS SCREEN.
.23 THE CONTROLLER SHALL HAVE PROPORTIONAL PRESSURE CONTROL TO COMPENSATE FOR PIPE FRICTION LOSS BY DECREASING PRESSURE SET-POINT AT LOWER FLOW-RATES AND INCREASING PRESSURE SET-POINT AT HIGHER FLOW- RATES BY USING ACTUAL FLOW RATE OR CALCULATED FLOW RATE. PROPORTIONAL PRESSURE CONTROL THAT USES PUMP SPEED OR POWER CONSUMPTION ONLY SHALL NOT BE CONSIDERED EQUAL TO PROPORTIONAL PRESSURE CONTROL THAT USES ACTUAL OR CALCULATED FLOW RATE.
.24 THE CONTROLLER SHALL HAVE THE ABILITY TO COMMUNICATE COMMON FIELD-BUS PROTOCOLS, (BACNET, MODBUS, PROFIBUS, AND LON), VIA OPTIONAL COMMUNICATION EXPANSION CARD INSTALLED INSIDE CONTROLLER.
.25 THE CONTROLLER SHALL HAVE ETHERNET CONNECTION WITH A BUILT IN SERVER ALLOWING FOR CONNECTION TO A NETWORK WITH READ/WRITE ACCESS TO CONTROLLER VIA WEB BROWSER AND INTERNET.
.26 THE CONTROLLER SHALL HAVE A PROGRAMMABLE SERVICE CONTACT FIELD THAT CAN BE POPULATED WITH SERVICE CONTACT INFORMATION INCLUDING: CONTACT NAME, ADDRESS, PHONE NUMBER(S) AND WEBSITE.
A. SYSTEM CONSTRUCTION
.1 SUCTION AND DISCHARGE MANIFOLD CONSTRUCTION SHALL BE IN WAY THAT ENSURES MINIMAL PRESSURE DROPS, MINIMIZE POTENTIAL FOR CORROSION, AND PREVENTS BACTERIA GROWTH AT INTERSECTION OF PIPING INTO THE MANIFOLD. MANIFOLD CONSTRUCTION THAT INCLUDES SHARP EDGE TRANSITIONS OR INTERCONNECTING PIPING PROTRUDING INTO MANIFOLD IS NOT ACCEPTABLE. MANIFOLD CONSTRUCTION SHALL BE SUCH THAT WATER STAGNATION CAN NOT EXIST IN MANIFOLD DURING OPERATION TO PREVENT BACTERIA GROWTH INSIDE MANIFOLD.
.2 THE SUCTION AND DISCHARGE MANIFOLDS MATERIAL SHALL BE 316 STAINLESS STEEL. MANIFOLD CONNECTION SIZES SHALL BE AS FOLLOWS:
.1 3 INCH AND SMALLER: MALE NPT THREADED
.2 4 INCH THROUGH 8 INCH: ANSI CLASS 150
.3 ROTATING FLANGES 10 INCH AND LARGER: ANSI CLASS 150 FLANGES
.3 PUMP ISOLATION VALVES SHALL BE PROVIDED ON THE SUCTION AND DISCHARGE OF EACH PUMP. ISOLATION VALVE SIZES 2 INCH AND SMALLER SHALL BE NICKEL PLATED BRASS FULL PORT BALL VALVES. ISOLATION VALVE SIZES 3 INCH AND LARGER SHALL BE A FULL LUG STYLE BUTTERFLY VALVE. THE VALVE DISK SHALL BE OF STAINLESS STEEL. THE VALVE SEAT MATERIAL SHALL BE EPDM AND THE BODY SHALL BE CAST IRON, COATED INTERNALLY AND EXTERNALLY WITH FUSION-BONDED EPOXY.
.4 A SPRING-LOADED NON-SLAM TYPE CHECK VALVE SHALL BE INSTALLED ON THE DISCHARGE OF EACH PUMP. THE VALVE SHALL BE A WAFER STYLE TYPE FITTED BETWEEN TWO FLANGES. THE HEAD LOSS THROUGH THE CHECK VALVE SHALL NOT EXCEED 5 PSI AT THE PUMP DESIGN CAPACITY. CHECK VALVES 1-1/2" AND SMALLER SHALL HAVE A POM COMPOSITE BODY AND POPPET, A STAINLESS STEEL SPRING WITH EPDM OR NBR SEATS. CHECK VALVES 2" AND LARGER SHALL HAVE A BODY MATERIAL OF STAINLESS STEEL OR EPOXY COATED IRON (FUSION BONDED) WITH AN EPDM OR NBR RESILIENT SEAT. SPRING MATERIAL SHALL BE STAINLESS STEEL. DISK SHALL BE OF STAINLESS STEEL OR LEADLESS BRONZE.
.5 FOR SYSTEMS THAT REQUIRE A DIAPHRAGM TANK, A CONNECTION OF NO SMALLER THAN ¾" SHALL BE PROVIDED ON THE DISCHARGE MANIFOLD.
.6 A PRESSURE TRANSDUCER SHALL BE FACTORY INSTALLED ON THE DISCHARGE MANIFOLD (OR FIELD INSTALLED AS SPECIFIED ON PLANS). SYSTEMS WITH POSITIVE INLET GAUGE PRESSURE SHALL HAVE A FACTORY INSTALLED PRESSURE TRANSDUCER ON THE SUCTION MANIFOLD FOR WATER SHORTAGE PROTECTION. PRESSURE TRANSDUCERS SHALL BE MADE OF 316 STAINLESS STEEL. TRANSDUCER ACCURACY SHALL BE +/- 1.0% FULL SCALE WITH HYSTERESIS AND REPEATABILITY OF NO GREATER THAN 0.1% FULL SCALE. THE OUTPUT SIGNAL SHALL BE 4-20 MA WITH A SUPPLY VOLTAGE RANGE OF 9-32 VDC.
.7 A BOURDON TUBE PRESSURE GAUGE, 2.5 INCH DIAMETER, SHALL BE PLACED ON THE SUCTION AND DISCHARGE MANIFOLDS. THE GAUGE SHALL BE LIQUID FILLED AND HAVE COPPER ALLOY INTERNAL PARTS IN A STAINLESS STEEL CASE. GAUGE ACCURACY SHALL BE 2/1/2 %. THE GAUGE SHALL BE CAPABLE OF A PRESSURE OF 30% ABOVE ITS MAXIMUM SPAN WITHOUT REQUIRING RECALIBRATION.
.8 SYSTEMS WITH A FLOODED SUCTION INLET OR SUCTION LIFT CONFIGURATION SHALL HAVE A FACTORY INSTALLED WATER SHORTAGE PROTECTION DEVICE ON THE SUCTION MANIFOLD.
.9 THE BASE FRAME SHALL BE CONSTRUCTED OF CORROSION RESISTANT 304 STAINLESS STEEL. RUBBER VIBRATION DAMPERS SHALL BE FITTED BETWEEN EACH PUMPS AND BASEFRAME TO MINIMIZE VIBRATION.
.10 DEPENDING ON THE SYSTEM SIZE AND CONFIGURATION, THE CONTROL PANEL SHALL BE MOUNTED IN ONE OF THE FOLLOWING WAYS:
.1 ON A 304 STAINLESS STEEL FABRICATED CONTROL CABINET STAND ATTACHED TO THE SYSTEM SKID. ON A 304 STAINLESS STEEL FABRICATED SKID, SEPARATE FROM THE MAIN SYSTEM SKID ON ITS OWN BASE (FLOOR MOUNTED WITH PLINTH)
H. TESTING
.1 THE ENTIRE PUMP STATION SHALL BE FACTORY TESTED FOR FUNCTIONALITY. FUNCTIONALITY TESTING SHALL INCLUDE THE FOLLOWING PARAMETERS: DRY RUN PROTECTION, MINIMUM PRESSURE AND MAXIMUM PRESSURE ALARMS (WHERE APPLICABLE), SETPOINT OPERATION, AND MOTOR ROTATION.
.2 THE SYSTEM SHALL UNDERGO A FACTORY HYDROSTATIC TEST AT THE END OF THE PRODUCTION CYCLE. THE SYSTEM SHALL BE FILLED WITH WATER AND PRESSURIZED TO 1.5 TIMES THE NAMEPLATE MAXIMUM PRESSURE. SYSTEMS WITH 150# FLANGE CONNECTIONS SHALL BE TESTED AT 350 PSIG, AND SYSTEMS WITH 300# FLANGE CONNECTIONS SHALL BE TESTED AT 450 PSIG. THE PRESSURE SHALL BE MAINTAINED FOR A MINIMUM OF 15 MINUTES WITH NO LEAKAGE (SLIGHT LEAKAGE AROUND PUMP(S) MECHANICAL SEAL IS ACCEPTABLE) PRIOR TO SHIPMENT.
I. WARRANTY
.1 THE WARRANTY PERIOD SHALL BE A NON-PRORATED PERIOD OF 24 MONTHS FROM DATE OF INSTALLATION, NOT TO EXCEED 30 MONTHS FROM DATE OF MANUFACTURE.

11.2 <u>CLOSE COUPLED IN-LINE PUMP (P-9, P-10, P-11)</u>
A. GENERAL
.1 FURNISH AND INSTALL CLOSE COUPLED IN-LINE PUMPS AS PER PLANS AND PUMP SCHEDULE.
.2 THE PUMP AND ELECTRIC MOTOR SHALL BE FACTORY ASSEMBLED AT THE PUMP MANUFACTURER'S FACILITY. THE PUMP MANUFACTURER SHALL HAVE COMPLETE UNIT RESPONSIBILITY.
B. PUMPS
.1 THE PUMPS SHALL BE CLOSE COUPLED, SINGLE STAGE, IN-LINE DESIGN, CAST IRON BRONZE FITTED CONSTRUCTION.
.2 THE PUMPS SHALL HAVE THE FOLLOWING FEATURES:
.1 ALL PUMPS SHALL BE OF THE BACK PULL-OUT DESIGN SO THAT THE ROTATING ELEMENT CAN BE REMOVED FROM THE CASING WITHOUT DISCONNECTING THE SUCTION OR DISCHARGE PIPING. THE CASING MATERIAL SHALL BE CLOSE-GRAINED CAST IRON ASTM A48 - CLASS 30 WITH A MINIMUM TENSILE STRENGTH OF 30,000 P.S.I. PUMPS LARGER THAN 12.2" IMPELLER SHALL HAVE CASING MATERIAL OF DUCTILE IRON ASTM A536- CLASS 65 WITH A MINIMUM TENSILE STRENGTH OF 65,000 P.S.I. VOLUTE SHALL HAVE INTEGRALLY CAST SUCTION AND DISCHARGE CONNECTIONS, GAUGE PORTS AT NOZZLES, AND VENT AND DRAIN PORTS. PUMPS SUCTION AND DISCHARGE SHALL BE OF SAME SIZE. PUMPS WITH 3" AND ABOVE SUCTION/DISCHARGE SIZES SHALL HAVE DOUBLE VOLUTE CASING AND SHALL HAVE SUCTION SPLITTER TO REDUCE PRE-ROTATION AND IMPROVE EFFICIENCY. CASINGS SHALL BE DESIGNED FOR SCHEDULED WORKING PRESSURE AND CAN WITHSTAND HYDROSTATIC TEST AT 150% OF THE MAXIMUM WORKING PRESSURE UNDER WHICH THE PUMP COULD OPERATE AT DESIGN SPEED.
.2 PUMPS SHALL BE FITTED WITH BRONZE RENEWABLE CASE WEAR RINGS.
.3 SUCTION AND DISCHARGE FLANGES SHALL BE DRILLED TO ANSI CLASS 125# STANDARDS AND BE MACHINED FLAT FACE.
.4 THE MOTOR SHAFT SHALL BE OF COLD ROLLED STEEL AISI 1024 WITH BRONZE SLEEVES COVERING THE WETTED AREA OF THE SHAFT. MOTORS WITH 56J FRAME SHALL HAVE A MOTOR SHAFT OF STAINLESS STEEL AISI 416.
.5 THE PUMP MANUFACTURER SHALL RECOMMEND THE PROPER MECHANICAL SEAL BASED ON THE PRESSURE, TEMPERATURE AND LIQUID OUTLINED ON THE EQUIPMENT SCHEDULE. MECHANICAL SEALS, AT A MINIMUM, SHALL HAVE CERAMIC STATIONARY SEATS, CARBON ROTATING RINGS, BUNA ELASTOMERS AND STAINLESS STEEL HARDWARE. APPLICATION OF A MECHANICAL SEAL SHALL BE INTERNALLY FLUSHED TYPE, WITHOUT REQUIRING EXTERNAL FLUSHING LINES. SEALS SHALL BE CAPABLE OF BEING INSPECTED AND EASILY REPLACED WITHOUT REMOVING THE PIPING OR VOLUTE.
.6 RECIRCULATION LINE OF NYLON TUBING WITH BRASS FITTING SHALL BE PROVIDED TO VENT THE MECHANICAL SEAL.
.7 IMPELLER SHALL BE OF THE ENCLOSED FRANCIS VANE TYPE, SINGLE SUCTION DESIGN, MADE OF SILICON BRONZE, ASTM B584 C87600, BOTH HYDRAULICALLY AND DYNAMICALLY BALANCED TO ISO 1940-1:2003 BALANCE GRADE G6.3 AND KEYED TO THE SHAFT. THE IMPELLER SHALL BE TRIMMED TO MEET THE SPECIFIC HYDRAULIC REQUIREMENTS.
.8 PUMP CONSTRUCTION. THE STANDARD MATERIAL OF CONSTRUCTION FOR THE PUMP SHALL BE AS BELOW. SPECIAL MATERIAL SHALL BE AVAILABLE AS OPTION TO SUIT THE LIQUID PUMPED.
- VOLUTE: CAST IRON ASTM A48 - CLASS 30 OR DUCTILE IRON ASTM A536- CLASS 65
- CASE WEAR RING: TIN BRONZE ASTM B584-90500
- IMPELLER: SILICON BRONZE ASTM B584 C87600
- SHAFT: COLD ROLL STEEL AISI 1024 OR STAINLESS STEEL AISI 416
- SHAFT SLEEVE: BRONZE III932 C89835
- MECHANICAL SEALS: CARBON - CERAMIC WITH BUNA ELASTOMERS AND STAINLESS STEEL HARDWARE
- RECIRCULATION LINE: NYLON TUBING WITH BRASS FITTINGS

.9 PUMP ROTATION SHALL BE CLOCKWISE AS VIEWED FROM THE MOTOR END.
.10 OPTIONAL SUPPORTS: PUMP SHALL BE MOUNTED ON A HEAVY DUTY CAST IRON SUPPORT STAND OR ON STEEL FLANGE SUPPORTS FOR FLOOR MOUNTING.
.11 PUMP SHALL BE OF A MAINTAINABLE DESIGN FOR EASE OF MAINTENANCE AND SHOULD USE MACHINE FIT PARTS THAT ARE EASILY DISASSEMBLED.
.12 EACH PUMP SHALL BE PAINTED WITH ONE COAT OF HIGH QUALITY FACTORY APPROVED PAINT AND NAME-PLATED BEFORE SHIPMENT FROM THE FACTORY.
.13 WHERE NOTED ON SCHEDULE THE PUMP SHALL ALSO BE NSF-50 OR NSF-61 CERTIFIED.
.14 PUMPS SHALL BE MANUFACTURED AND ASSEMBLED IN AN ISO-9001 CERTIFIED FACILITY.
B. MOTORS
.1 MOTORS SHALL MEET SCHEDULED HORSEPOWER, SPEED, VOLTAGE, AND ENCLOSURE DESIGN. PUMP AND MOTORS SHALL BE FACTORY ASSEMBLED.
.2 MOTORS SHALL BE SUITABLY SIZED PER ISO5199 AND SHALL MEET NEMA SPECIFICATIONS AND CONFORM TO THE STANDARDS OUTLINED IN EISA 2007
C. INSTALLATION
.1 THE PUMP SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS AND ACCORDING TO THE STANDARDS OF THE HYDRAULICS INSTITUTE.
D. TESTING
.1 WHERE NOTED ON SCHEDULE, PUMPING EQUIPMENT MAY REQUIRE ONE OR MORE OF THE FOLLOWING: CERTIFIED PERFORMANCE TEST
HYDRO STATIC TEST NPSH TEST
ANY OTHER FACTORY TEST AS NOTED IN THE PUMP SCHEDULE
THE TESTING SHALL BE IN ACCORDANCE WITH HYDRAULIC INSTITUTE LEVEL B OR THE LATEST HI STANDARD AS NOTED IN THE PUMP SCHEDULE.

1. ISSUED FOR TENDER 25.03.21

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr,
Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
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DRAWN:
J.L.

DATE:
SEPTEMBER 2023

PROJECT #:
ALL-23010629-A0

DRAWING #:
M0.2

CONTROLS & INSTRUMENTATION SPEC.

1. GENERAL

A. THE WORK SHALL INCLUDE DESIGN, SUPPLY, INSTALLATION, AND COMMISSIONING A COMPLETE MICROPROCESSOR BASED AUTOMATIC CONTROL SYSTEM TO ACHIEVE THE PERFORMANCE SPECIFIED IN THE FOLLOWING CLAUSES.

B. FOR EXISTING SITES, VISITING THE PREMISES IS RECOMMENDED PRIOR TO TENDER TO BECOME FAMILIAR WITH FIELD CONDITIONS AND EXISTING EQUIPMENT.

C. THE CONTROL SYSTEM SHALL BE INSTALLED BY THE CONTROL SUBCONTRACTOR BUT AS AN INTEGRAL PART OF THE MECHANICAL SUB–CONTRACT. THE SYSTEM SHALL BE INSTALLED BY TRADE CERTIFIED ELECTRICIANS REGULARLY EMPLOYED BY THE CONTROL SUB–CONTRACTOR.

D. THE CONTROLS CONTRACTOR WILL SPECIFICALLY READ ALL MECHANICAL AND ELECTRICAL DRAWINGS, SPECIFICATIONS, AND ADDENDA AND DETERMINE THE CONTROLS WORK PROVIDED BY THE MECHANICAL CONTRACTOR, HIS SUBCONTRACTORS, AND THE ELECTRICAL CONTRACTOR. THE CONTROLS CONTRACTOR IS EXPECTED TO HAVE THE EXPERTISE TO COORDINATE THE WORK OF OTHER CONTRACTORS AND TO MAKE A COMPLETELY COORDINATED BUILDING AUTOMATION CONTROL SYSTEM (BACS) FOR THE MECHANICAL SYSTEMS. THE CONTROLS SPECIFICATIONS ARE SPECIFICALLY WRITTEN TO COORDINATE THE MECHANICAL AND ELECTRICAL SYSTEMS. WHERE OTHERS ARE SPECIFICALLY SPECIFIED TO ALLOW FOR CONTROLS WORK, THEN THE BACS CONTRACTOR WILL NOT ALLOW FOR THAT WORK. THIS CLAUSE IS NOT INTENDED TO MAKE THE CONTROLS CONTRACTOR RESPONSIBLE FOR WORK NOT SPECIFIED, BUT TO MAKE THE BACS CONTRACTOR RESPONSIBLE FOR EXAMINING THE SPECIFICATIONS FOR CONTRADICTIONS AND OVERLAP.

E. THE BACS CONTRACTOR SHALL PROVIDE THE NECESSARY ENGINEERING, INSTALLATION, SUPERVISION, COMMISSIONING AND PROGRAMMING FOR A COMPLETE AND FULLY OPERATIONAL SYSTEM. THE CONTRACTOR WILL PROVIDE AS MANY TRIPS TO THE JOB SITE FOR INSTALLATION, SUPERVISION, AND COMMISSIONING AS ARE NECESSARY TO COMPLETE THE PROJECT TO THE SATISFACTION OF THE CONSULTANT AND/OR BUILDING PROJECT SUPERVISOR.

F. THE SYSTEM SHALL CONSIST OF ALL OPERATOR INTERFACES, MICROPROCESSOR–BASED CONTROLLERS, SENSORS, WELLS, AUTOMATIC CONTROL VALVES, CONTROL DAMPERS, TRANSDUCERS, AND RELAYS, AUTOMATIC CONTROL VALVES, AND DAMPER ACTUATORS.

2. SCOPE OF WORK

A. THIS PROJECT SCOPE SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING WORK:

B. PREPARATION OF CONTROL SHOP DRAWINGS FOR REVIEW AND APPROVAL. SEE SUBMITTALS. SUPPLY AND INSTALL A NETWORK OF DIRECT DIGITAL CONTROL (DDC) PANELS AND FIELD DEVICES. SEE HARDWARE, SOFTWARE AND FIELD DEVICES

.1 SUPPLY AND INSTALL CUSTOMIZED GRAPHICS SOFTWARE TO BUILDING STANDARDS, SYSTEM SOFTWARE, AND THIRD PARTY SOFTWARE AS SPECIFIED. SEE SOFTWARE

.2 INSTALL, WIRE AND LABEL ALL DDC CONTROL SYSTEM COMPONENTS. SEE INSTALLATION.

.3 CALIBRATE AND COMMISSION THE INSTALLED CONTROL SYSTEM. SEE COMMISSIONING.

.4 PROVIDE MAINTENANCE MANUALS AND AS–BUILT DRAWINGS. SEE AS–BUILT DOCUMENTATION

.5 PROVIDE CUSTOMIZED TRAINING FOR BUILDING OPERATIONS, MAINTENANCE AND TECHNICAL STAFF. SEE TRAINING.

.6 PROVIDE A ONE–YEAR ON SITE PARTS AND LABOUR WARRANTY ON ALL COMPONENTS. SEE WARRANTY.

3. BASE BUILDING BAS VENDOR

3.1 BIDS FOR THE BACS CONTRACT WILL ONLY BE ACCEPTED FROM AUTHORIZED VENDORS/INSTALLERS OF THE FOLLOWING MANUFACTURERS:

– CONVERGINT TECHNOLOGIES

4. SYSTEM PERFORMANCE

A. PERFORMANCE STANDARDS – THE BAS SYSTEM SHALL CONFORM TO THE FOLLOWING:

.1 GRAPHIC DISPLAY: THE SYSTEM SHALL DISPLAY A GRAPHIC WITH A MINIMUM OF 20 DYNAMIC POINTS. ALL CURRENT DATA SHALL BE DISPLAYED WITHIN 10 SECONDS OF THE OPERATOR'S REQUEST.

.2 GRAPHIC REFRESH: THE SYSTEM SHALL UPDATE ALL DYNAMIC POINTS WITH CURRENT DATA WITHIN 10 SECONDS.

.3 OBJECT COMMAND: THE MAXIMUM TIME BETWEEN THE COMMAND OF A BINARY OBJECT BY THE OPERATOR AND THE REACTION BY THE DEVICE SHALL BE 5 SECONDS. ANALOG OBJECTS SHALL START TO ADJUST WITHIN 5 SECONDS.

.4 OBJECT SCAN: ALL CHANGES OF STATE AND CHANGE OF ANALOG VALUES SHALL BE TRANSMITTED OVER THE HIGH–SPEED NETWORK SUCH THAT ANY DATA USED OR DISPLAYED AT A CONTROLLER OR WORKSTATION WILL BE CURRENT WITHIN THE PRIOR 10 SECONDS.

.5 ALARM RESPONSE TIME: THE MAXIMUM TIME FROM WHEN AN OBJECT GOES INTO ALARM TO WHEN IT IS ANNUNCIATED AT THE WORKSTATION SHALL NOT EXCEED 10 SECONDS.

.6 PROGRAM EXECUTION FREQUENCY: CUSTOM AND STANDARD APPLICATIONS SHALL BE CAPABLE OF RUNNING AS OFTEN AS ONCE EVERY 5 SECONDS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SELECTING EXECUTION TIMES CONSISTENT WITH THE MECHANICAL PROCESS UNDER CONTROL.

.7 PROGRAMMABLE CONTROLLERS SHALL BE ABLE TO EXECUTE DDC PID CONTROL LOOPS AT A SELECTABLE FREQUENCY FROM AT LEAST ONCE EVERY 5 SECONDS. THE CONTROLLER SHALL SCAN AND UPDATE THE PROCESS VALUE AND OUTPUT GENERATED BY THIS CALCULATION AT THIS SAME FREQUENCY.

.8 MULTIPLE ALARM ANNUNCIATIONS: ALL WORKSTATIONS ON THE NETWORK SHALL RECEIVE ALARMS WITHIN 5 SECONDS OF EACH OTHER.

5. SUBMITTAL REQUIREMENTS

A. SUBMITTAL INFORMATION SHALL BE PROVIDED TO THE ENGINEER OR OWNER ELECTRONICALLY PRIOR TO COMMENCING THE PROJECT.

B. QUANTITIES OF ITEMS SUBMITTED SHALL BE REVIEWED BY THE ENGINEER AND OWNER. SUCH REVIEW SHALL NOT RELIEVE THE BAS MANUFACTURER OF FURNISHING QUANTITIES REQUIRED BASED UPON CONTRACT DOCUMENTS.

C. PROVIDE THE ENGINEER AND OWNER, ANY ADDITIONAL INFORMATION OR DATA WHICH IS DEEMED NECESSARY TO DETERMINE COMPLIANCE WITH THE SPECIFICATIONS OR WHICH IS DEEMED VALUABLE IN DOCUMENTING AND UNDERSTANDING THE SYSTEM TO BE INSTALLED.

D. SUBMIT THE FOLLOWING WITHIN 90 DAYS OF CONTRACT AWARD:

.1 A COMPLETE BILL OF MATERIALS OF EQUIPMENT TO BE USED INDICATING QUANTITIES, MANUFACTURERS AND MODEL NUMBERS.

E. PROVIDE ALL MANUFACTURERS' TECHNICAL CUT SHEETS FOR MAJOR SYSTEM COMPONENTS. WHEN TECHNICAL CUT SHEETS APPLY TO A PRODUCT SERIES RATHER THAN A SPECIFIC PRODUCT, THE DATA SPECIFICALLY APPLICABLE TO THE PROJECT SHALL BE HIGHLIGHTED OR CLEARLY INDICATED BY OTHER MEANS. INCLUDE:

.1 BUILDING CONTROLLERS

.2 CUSTOM APPLICATION CONTROLLERS

.3 APPLICATION SPECIFIC CONTROLLERS

.4 OPERATOR WORKSTATIONS

.5 PORTABLE OPERATOR TERMINALS

.6 AUXILIARY CONTROL DEVICES

F. PROVIDE PROPOSED BUILDING AUTOMATION SYSTEM ARCHITECTURAL DIAGRAM DEPICTING VARIOUS CONTROLLER TYPES, WORKSTATIONS, DEVICE LOCATIONS, ADDRESSES, AND COMMUNICATION CABLE REQUIREMENTS

G. PROVIDE DETAILED TERMINATION DRAWINGS SHOWING ALL REQUIRED FIELD AND FACTORY TERMINATIONS, AS WELL AS TERMINAL TIE–INS TO DDC CONTROLS PROVIDED BY MECHANICAL EQUIPMENT MANUFACTURERS. TERMINAL NUMBERS SHALL BE CLEARLY LABELED.

H. PROVIDE POINTS LIST SHOWING ALL SYSTEM OBJECTS AND THE PROPOSED ENGLISH LANGUAGE OBJECT NAMES.

I. PROVIDE A SEQUENCE OF OPERATION FOR EACH CONTROLLED MECHANICAL SYSTEM AND TERMINAL END DEVICES.

J. PROVIDE A BACNET PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) FOR EACH BACNET SYSTEM LEVEL DEVICE (I.E. BUILDING CONTROLLER & OPERATOR WORKSTATIONS) TYPE. THIS DEFINES THE POINTS LIST FOR PROPER COORDINATION OF INTEROPERABILITY WITH OTHER BUILDING SYSTEMS IF APPLICABLE FOR THIS PROJECT.

6. WARRANTY REQUIREMENTS

A. WARRANT ALL WORK AS FOLLOWS:

.1 BAS SYSTEM LABOR AND MATERIALS SHALL BE WARRANTED FREE FROM

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DEFECTS FOR A PERIOD OF TWELVE (12) MONTHS AFTER FINAL COMPLETION ACCEPTANCE BY THE OWNER. BAS FAILURES DURING THE WARRANTY PERIOD SHALL BE ADJUSTED, REPAIRED, OR REPLACED AT NO CHARGE TO THE OWNER. THE BAS MANUFACTURER SHALL RESPOND TO THE OWNER'S REQUEST FOR WARRANTY SERVICE WITHIN 24 HOURS OF THE INITIATED CALL AND WILL OCCUR DURING NORMAL BUSINESS HOURS (8AM–5PM).

.2 THE BAS MANUFACTURER SHALL PROVIDE A TOTAL OF (16) HOURS OF ONSITE PREVENTATIVE MAINTENANCE DURING WARRANTY PERIOD. EIGHT (8) HOURS AT SIX (6) MONTHS, AND EIGHT (8) HOURS AT TEN (10) MONTHS AFTER SUBSTANTIAL COMPLETION OF ONSITE PREVENTATIVE MAINTENANCE INTO THE WARRANTY PERIOD.

.3 AT THE END OF THE FINAL START–UP/TESTING, IF EQUIPMENT AND SYSTEMS ARE OPERATING SATISFACTORILY TO THE CUSTOMER, THE CUSTOMER SHALL SIGN CERTIFICATES CERTIFYING THAT THE BAS IS OPERATIONAL AND HAS BEEN TESTED AND ACCEPTED IN ACCORDANCE WITH THE TERMS OF THIS SPECIFICATION. THE DATE OF CUSTOMER ACCEPTANCE SHALL BE THE START OF THE WARRANTY PERIOD.

.4 OPERATOR WORKSTATION SOFTWARE, PROJECT SPECIFIC SOFTWARE, GRAPHICS, DATABASE, AND FIRMWARE UPDATES SHALL BE PROVIDED TO THE CUSTOMER AT NO CHARGE DURING THE WARRANTY PERIOD. WRITTEN AUTHORIZATION BY THE CUSTOMER MUST BE GRANTED PRIOR TO THE INSTALLATION OF THESE UPDATES.

.5 THE BAS MANUFACTURER SHALL PROVIDE A WEB–ACCESSIBLE USERS NETWORK FOR THE PROPOSED SYSTEM AND GIVE THE OWNER FREE ACCESS TO QUESTION/ANSWER FORUM, USER TIPS, UPGRADES, AND TRAINING SCHEDULES FOR A ONE YEAR PERIOD OF TIME CORRELATING WITH THE WARRANTY PERIOD.

B. THE PROJECT'S CONTROLS CONTRACTOR SHALL PROVIDE AND MAINTAIN SECURE REMOTE ACCESS TO THE FACILITIES BUILDING AUTOMATION SYSTEM (BAS) OR OTHER BUILDING SYSTEMS UNTIL UP TO 1 YEAR AFTER SUBSTANTIAL COMPLETION. PRIOR TO TRANSITION FROM WARRANTY, THE BUILDING OWNER WILL PROVIDE AND MAINTAIN THE SECURED REMOTE ACCESS.

7. DATA MONITORING, STORING, & COLLECTION STANDARDS

A. THE SYSTEM SHALL RECORD AND STORE INTERVAL DATA, 24 HOURS/DAY, 7 DAYS/WEEK, 365 DAYS/YEAR.

B. DATA TO BE COLLECTED FOR REAL–TIME CONTINUOUS MONITORING AND COLLECTION OF WHOLE–BUILDING ENERGY METERS AND SUB–METERS IF THE METERS HAVE BEEN INSTALLED AS PART OF THE WARRANTED PROJECT.

C. DATA TO BE COLLECTED FROM BUILDING AUTOMATION AND CONTROL SYSTEMS SUB–METERS AND SENSORS DATA FOR EQUIPMENT STATUS, SET POINTS, AND OPERATIONAL POINTS.

D. DATA SHALL BE STORED IN A CLASS 5 SECURE HOSTING LOCATION PROTECTED BY ISO 5001–COMPLAINT FIREWALL AND INTRUSION DETECTION SYSTEMS WITH SUPPORT FOR MAJOR NETWORK SECURITY PROTOCOLS SUCH AS HTTPS AND SFTP TO SECURELY ACCESS AND STORE DATA.

E. DASHBOARD WEB INTERFACE: THE DASHBOARD INTERFACE SHALL ALLOW DISPLAY OF ENERGY AND BUILDING SYSTEM DATA IN WIDGETS, CHARTS AND TRACKING APPLICATIONS, AND BE AVAILABLE WITHOUT REQUIRING USERS TO UTILIZE EXTERNAL, THIRD PARTY TOOLS.

.1 THE DASHBOARD WEB INTERFACE SHALL BE ACCESSIBLE VIA A WEB BROWSER WITHOUT REQUIRING ANY "PLUG–INS" (I.E. JAVA RUNTIME ENVIRONMENT (JRE), ADOBE FLASH).

.2 THE INTERFACE SHALL SUPPORT COMMON INTERNET WEB BROWSERS AT A MINIMUM INCLUDING: INTERNET EXPLORER 10.0+, FIREFOX 4.0+, CHROME 10.0+, OPERA, SAFARI

.3 THE INTERFACE SHALL SUPPORT THE FOLLOWING MOBILE WEB BROWSERS AT A MINIMUM: IOS (IPAD/IPHONE) V9.1+, ANDROID (TABLET) V4.3+, ANDROID (PHONE) V2.3+.

.4 DASHBOARDS SHALL BE CUSTOMIZABLE FOR EACH INDIVIDUAL OR GROUP OF USERS THE TO MODIFY PERSONAL DASHBOARDS AT ANY TIME USING A LIBRARY OF WIDGETS SPECIFIC TO THE PROJECT SITE.

.5 DASHBOARDS SHOULD BE CAPABLE OF TRACKING & DISPLAYING SUMMARY METRICS AND STATUS OF ENERGY AND EMISSIONS GOALS AT VARIOUS LEVELS: FLOOR/AREA, BUILDING, CAMPUS, PORTFOLIO.

F. EACH USER SHALL BE REQUIRED TO LOGIN TO THE SYSTEM WITH A USER NAME AND PASSWORD IN ORDER TO VIEW, EDIT, ADD, OR DELETE DATA

G. USER PROFILES SHALL RESTRICT THE USER TO ONLY THE OBJECTS, APPLICATIONS, AND SYSTEM FUNCTIONS AS ASSIGNED BY THE SYSTEM ADMINISTRATOR.

H. EACH USER SHALL BE ALLOWED TO CHANGE THEIR USER PASSWORD.

I. THE SYSTEM ADMINISTRATOR SHALL BE ABLE TO MANAGE THE SECURITY FOR ALL OTHER USERS.

J. THE SYSTEM SHALL INCLUDE PRE–DEFINED "ROLES" THAT ALLOW A SYSTEM ADMINISTRATOR TO QUICKLY ASSIGN PERMISSIONS TO A USER.

K. BEMS DASHBOARD SHALL INCLUDE AN OBJECT–BASED WIDGET BUILDER FOR THE CREATION OF CUSTOM WIDGETS, AS WELL AS A LIBRARY OF OFF–THE–SHELF ENERGY WIDGETS TO UTILIZE:

.1 USERS SHALL MODIFY PERSONAL DASHBOARDS AT ANY TIME USING A LIBRARY OF WIDGETS SPECIFIC TO THE PROJECT SITE OR DRAWING ON A VENDOR–PROVIDED LIBRARY OF ENERGY WIDGETS WITH EMBEDDED LOGIC FOR COMMON ENERGY CALCULATIONS.

.2 USERS ARE ALLOWED TO PICK AND CHOOSE WHICH WIDGETS ARE DISPLAYED, AND WHERE THEY ARE LOCATED.

L. 7.12 SHALL PROVIDE AN OBJECT–BASED WIDGET BUILDER FOR THE CREATION OF CUSTOM WIDGETS INCLUDING:

.1 TARGET A SPECIFIC BUILDING OR SYSTEM/EQUIPMENT

.2 CONFIGURE TIME PERIODS, PARAMETER VALUES (MAXIMUM/MINIMUM), UNITS OF MEASURE

.3 SELECT DISPLAY COLORS

.4 PREVIEW WIDGETS USING TARGET OBJECT

8. COMMUNICATION

A. CONNECTIVITY / REMOTE ACCESS / NETWORK SECURITY

B. PROVIDE THE INTEGRATION DEVICE (GATEWAY) TO COLLECT THE REQUIRED MONITORING POINTS FROM THE FACILITIES BAS. INTERFACE BETWEEN THE CLOUD STORAGE AND BAS SHALL BE VIA BACNET® IP.

C. PROVIDE AND MAINTAIN SECURE REMOTE ACCESS TO THE FACILITIES BUILDING AUTOMATION SYSTEM (BAS) OR OTHER BUILDING SYSTEMS. USERS ACCESSING SERVICE SHALL NOT HAVE ACCESS TO THE BUILDING OWNERS NETWORK. SECURE REMOTE ACCESS TO THE BAS SHALL NOT REQUIRE ADDITIONAL SOFTWARE TO BE INSTALLED ON THE CLIENT DEVICE (I.E. VPN CLIENT). SECURE REMOTE ACCESS TO THE BAS SHALL NOT REQUIRE ANY INBOUND PORTS ON A FIREWALL TO BE "EXPOSED" OR "FORWARDED".

D. SECURE REMOTE ACCESS TO THE BAS SHALL BE AVAILABLE ANYWHERE, ANYTIME, USING A COMPATIBLE CLIENT DEVICE (PC/TABLET/PHONE)

E. THIS PROJECT SHALL BE COMPRISED OF A HIGH SPEED ETHERNET NETWORK UTILIZING BACNET/IP COMMUNICATIONS BETWEEN SYSTEM CONTROLLERS. EACH SYSTEM CONTROLLER SHALL FUNCTION AS A BACNET ROUTER TO EACH UNIT CONTROLLER PROVIDING A UNIQUE BACNET DEVICE ID FOR ALL CONTROLLERS WITHIN THE SYSTEM. COMMUNICATIONS BETWEEN SYSTEM CONTROLLERS AND SUB–NETWORKS OF CUSTOM APPLICATION CONTROLLERS AND/OR APPLICATION SPECIFIC CONTROLLERS SHALL BE AS DEFINED BELOW.

F. EACH SYSTEM CONTROLLER SHALL PERFORM COMMUNICATIONS TO A NETWORK OF CUSTOM APPLICATION AND APPLICATION SPECIFIC CONTROLLERS USING BACNET/ZIGBEE (802.15.4) AS DEFINED BY THE ZIGBEE STANDARD.

.1 EACH COMMUNICATION INTERFACE SHALL BE ZIGBEE BUILDING AUTOMATION CERTIFIED PRODUCT AS DEFINED BY THE BACNET STANDARD AND THE ZIGBEE ALLIANCE.

.2 EACH SYSTEM CONTROLLER SHALL FUNCTION AS A BACNET ROUTER TO EACH UNIT CONTROLLER PROVIDING A UNIQUE BACNET DEVICE ID FOR ALL CONTROLLERS WITHIN THE SYSTEM.

.3 WIRELESS EQUIPMENT CONTROLLERS AND AUXILIARY CONTROL DEVICES SHALL CONFORM TO:

.1 IEEE 802.15.4 RADIOS TO MINIMIZE RISK OF INTERFERENCE AND MAXIMIZE BATTERY LIFE, RELIABILITY, AND RANGE.

.2 COMMUNICATION BETWEEN EQUIPMENT CONTROLLERS SHALL CONFORM TO ZIGBEE BUILDING AUTOMATION (ZBA) STANDARD AS BACNET TUNNELING DEVICES TO ENSURE FUTURE INTEGRATION OF OTHER ZBA CERTIFIED DEVICES.

.3 OPERATING RANGE SHALL BE A MINIMUM OF 200 FEET (60 M); OPEN RANGE SHALL BE 2,500 FT. (762 M) WITH LESS THAN 2% PACKET ERROR RATE.

.4 TO MAINTAIN ROBUST COMMUNICATION, MESH NETWORKING AND TWO–WAY COMMUNICATIONS SHALL BE USED TO OPTIMIZE THE WIRELESS NETWORK HEALTH.

.5 WIRELESS COMMUNICATION SHALL BE CAPABLE OF MANY–TO–ONE SENSORS PER CONTROLLER TO SUPPORT AVERAGING, MONITORING, AND MULTIPLE ZONE APPLICATIONS.

.6 CERTIFICATIONS SHALL INCLUDE FCC CFR47 – RADIO FREQUENCY

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G. EACH SYSTEM CONTROLLER SHALL PERFORM COMMUNICATIONS TO A NETWORK OF CUSTOMAPPLICATION AND APPLICATION SPECIFIC CONTROLLERS USING BACNET/MSTP (RS485) AS DEFINED BY THE BACNET STANDARD.

ANALYTICS AND CONTINUING COMMISSIONING ARE BECOMING STANDARD IN AUTOMATION. DATA IS TRANSFERRED TO THE CLOUD FOR LONG TERM TRENDING, EASY TO INTERPRET GRAPHICS AND DASHBOARDS, AND TO BE ANALYZED TO CREATE ACTIONABLE RECOMMENDATIONS FOR AUTOMATION SYSTEM IMPROVEMENT.

9. INTELLIGENT SERVICES ANALYTICS

A. ACCEPTABLE BUILDING ENERGY MANAGEMENT SYSTEM (BEMS) PROVIDERS:

.1 SIEMENS AUTOMATION

B. SYSTEM DESCRIPTION:

.1 A BUILDING ANALYTIC SERVICE IS A CLOUD–BASED MONITORING TOOL ESTABLISHING THE BUILDING OPERATION BASELINE, ASSIST IN IDENTIFY ENERGY–SAVING OPPORTUNITIES AND IMPROVE BUILDING PERFORMANCE.

C. BUILDING ANALYTIC SERVICE COMPONENT REQUIREMENTS AND TERM OF SERVICES:

.1 THE SERVICE SHALL PROVIDE ENERGY METER DATA COLLECTION AND STORAGE INCLUDING ADVANCED ENERGY ANALYTICS FOR ENERGY CONSUMPTION AND COSTS WITH DISPLAY AND REPORTING VIA DASHBOARD/WIDGET TECHNOLOGIES.

.2 THE SERVICE SHALL PROVIDE DATA COLLECTION AND STORAGE FOR BUILDING SYSTEMS AND EQUIPMENT, ANALYTICS AND PROFESSIONAL ANALYSIS, INCLUDING AT A MINIMUM: GENERAL FACILITY PERFORMANCE METRICS, AUTOMATED FAULT DETECTION AND DIAGNOSTICS, BUILDING SYSTEM/EQUIPMENT ANALYTICS WITH DISPLAY AND REPORTING VIA DASHBOARD/WIDGET TECHNOLOGIES.

.3 THE SERVICE SHALL BE PROVIDED FOR A 2–YEAR TERM FROM SUBSTANTIAL COMPLETION.

D. CONNECTIVITY / REMOTE ACCESS / NETWORK SECURITY

.1 PROVIDE THE INTEGRATION DEVICE (GATEWAY) TO COLLECT THE REQUIRED MONITORING POINTS FROM THE FACILITIES BAS. INTERFACE BETWEEN THE CLOUD STORAGE AND BAS SHALL BE VIA BACNET® IP.

.2 PROVIDE AND MAINTAIN SECURE REMOTE ACCESS TO THE FACILITIES BUILDING AUTOMATION SYSTEM (BAS) OR OTHER BUILDING SYSTEMS. USERS ACCESSING SERVICE SHALL NOT HAVE ACCESS TO THE BUILDING OWNERS NETWORK. SECURE REMOTE ACCESS TO THE BAS SHALL NOT REQUIRE ADDITIONAL SOFTWARE TO BE INSTALLED ON THE CLIENT DEVICE (I.E. VPN CLIENT). SECURE REMOTE ACCESS TO THE BAS SHALL NOT REQUIRE ANY INBOUND PORTS ON A FIREWALL TO BE "EXPOSED" OR "FORWARDED".

.3 SECURE REMOTE ACCESS TO THE BAS SHALL BE AVAILABLE ANYWHERE, ANYTIME, USING A COMPATIBLE CLIENT DEVICE (PC/TABLET/PHONE)

E. DATA MONITORING & COLLECTION STANDARDS

.1 THE SYSTEM SHALL RECORD AND STORE INTERVAL DATA, 24 HOURS/DAY, 7 DAYS/WEEK, 365 DAYS/YEAR. DATA TO BE COLLECTED FOR REAL–TIME CONTINUOUS MONITORING AND COLLECTION OF WHOLE–BUILDING ENERGY METERS AND SUB–METERS

.2 DATA TO BE COLLECTED FROM BUILDING AUTOMATION AND CONTROL SYSTEMS SUB–METERS AND SENSORS DATA FOR EQUIPMENT STATUS, SET POINTS, AND OPERATIONAL POINTS.

.3 THE SYSTEM SHALL INCLUDE AN EMBEDDED AUTOMATED WEATHER FEED.

.4 DATA SHALL BE STORED IN A CLASS 5 SECURE HOSTING LOCATION PROTECTED BY ISO 5001–COMPLAINT FIREWALL AND INTRUSION DETECTION SYSTEMS WITH SUPPORT FOR MAJOR NETWORK SECURITY PROTOCOLS SUCH AS HTTPS AND SFTP TO SECURELY ACCESS AND STORE DATA.

F. BUILDING ANALYTICS & ANALYSIS:

.1 PROVIDER SHALL BE PERFORM AUTOMATED BENCHMARKS OF FACILITY PERFORMANCE INCLUDING COMPARISONS AGAINST HOW THE BUILDING SHOULD OPERATE NORMALLY. PROVIDER SHALL DELIVER QUARTERLY COMPARISON OF BUILDING MONTH–TO–MONTH TRENDS TO KEY PERFORMANCE INDICATORS (KPI'S) AUTOMATED TESTS FOR BUILDING SCHEDULES, SYSTEMS AND EQUIPMENT SHALL PROVIDE EVIDENCE OF THE ONSET OF A PROBLEM AND PROVIDE GRAPHICAL DATA THAT DEMONSTRATES A RESOLUTION TO THE PROBLEM. KPI'S SHALL INCLUDE THE FOLLOWING:

.1 PERCENT TIME IN NORMAL OPERATIONS OF HVAC EQUIPMENT, SYSTEMS AND FACILITY

.2 ADVISORY DETAILS FOR HVAC EQUIPMENT AND SYSTEMS WITH INDICATORS FOR NORMAL OPERATION, WARNING, CRITICAL FAILURE

.3 THE BUILDING PERFORMANCE SERVICE SHALL AUTOMATICALLY PROVIDE A FULL RANGE OF BUILDING–SPECIFIC FDD ANALYTICS FOR THE SYSTEM IN THE FOLLOWING AREAS:

.1 HEATING SYSTEMS/EQUIPMENT

.2 DEDICATED OUTDOOR AIR SYSTEMS/EQUIPMENT

.3 TERMINAL EQUIPMENT.

.2 PROFESSIONAL ANALYSIS: PROVIDER SHALL HAVE TRAINED PERSONNEL WITH RELEVANT PROFESSIONAL CREDENTIALS IN HVAC SYSTEMS, ENERGY MANAGEMENT AND BUILDING OPTIMIZATION METHODOLOGIES TO PREPARE PROFESSIONAL ASSESSMENT REPORTS INCLUDING:

.1 IDENTIFY BUILDING SYSTEM PERFORMANCE TRENDS AND DEVIATIONS FROM NORMAL OPERATION

.2 PREPARE ACTIONABLE RECOMMENDATIONS TO OPTIMIZE HVAC SYSTEM PERFORMANCE

.3 PREPARE RECOMMENDATIONS FOR OPERATIONAL ADJUSTMENTS

.4 PREPARE RISK ANALYSIS OF EMERGENCY MAINTENANCE OR FAILURE

.5 DEVELOP ENERGY CONSERVATION MEASURES (ECMS) WITH ENERGY SAVINGS OR PERFORMANCE IMPROVEMENT ESTIMATES

.3 PERFORMANCE ANALYTICS AND REPORTS ARE TO BE DEVELOPED AND REVIEWED WITH BUILDING OWNER DURING SCHEDULED PERFORMANCE REVIEW MEETINGS.

.1 PROVIDER WILL INCLUDE A MINIMUM OF [2] PERFORMANCE ANALYSIS FAULT DETECTION REPORTS ANNUALLY.

.2 PROVIDER SHALL SCHEDULE [2] PERFORMANCE REVIEW MEETINGS ANNUALLY WITH OWNER OR OWNERS DESIGNATED REPRESENTATIVE TO REVIEW PERFORMANCE REPORTS.

.3 PROVIDER SHALL PROVIDE A MINIMUM OF [2] ECM / PERFORMANCE IMPROVEMENT OPPORTUNITIES AT EACH REVIEW MEETING.

G. DASHBOARD WEB INTERFACE: THE DASHBOARD INTERFACE SHALL ALLOW DISPLAY OF ENERGY AND BUILDING SYSTEM DATA IN WIDGETS, CHARTS AND TRACKING APPLICATIONS, AND BE AVAILABLE WITHOUT REQUIRING USERS TO UTILIZE EXTERNAL, THIRD PARTY TOOLS.

.1 THE DASHBOARD WEB INTERFACE SHALL BE ACCESSIBLE VIA A WEB BROWSER WITHOUT REQUIRING ANY "PLUG–INS" (I.E. JAVA RUNTIME ENVIRONMENT (JRE), ADOBE FLASH).

.2 THE INTERFACE SHALL SUPPORT COMMON INTERNET WEB BROWSERS AT A MINIMUM INCLUDING: INTERNET EXPLORER 10.0+, FIREFOX 4.0+, CHROME 10.0+, OPERA, SAFARI

.3 THE INTERFACE SHALL SUPPORT THE FOLLOWING MOBILE WEB BROWSERS AT A MINIMUM: IOS (IPAD/IPHONE) V9.1+, ANDROID (TABLET) V4.3+, ANDROID (PHONE) V2.3+.

.4 DASHBOARDS SHALL BE CUSTOMIZABLE FOR EACH INDIVIDUAL OR GROUP OF USERS TO MODIFY PERSONAL DASHBOARDS AT ANY TIME USING A LIBRARY OF WIDGETS SPECIFIC TO THE PROJECT SITE.

.5 DASHBOARDS SHOULD BE CAPABLE OF TRACKING & DISPLAYING SUMMARY METRICS AND STATUS OF ENERGY AND EMISSIONS GOALS AT VARIOUS LEVELS: FLOOR/AREA, BUILDING, CAMPUS, PORTFOLIO.

H. DASHBOARD WIDGET BUILDER/LIBRARY:

.1 DASHBOARD SHALL INCLUDE AN OBJECT–BASED WIDGET BUILDER FOR THE CREATION OF CUSTOM WIDGETS, AS WELL AS A LIBRARY OF OFF–THE–SHELF ENERGY WIDGETS TO UTILIZE:

.1 USERS SHALL MODIFY PERSONAL DASHBOARDS AT ANY TIME USING A LIBRARY OF WIDGETS SPECIFIC TO THE PROJECT SITE OR DRAWING ON A VENDOR–PROVIDED LIBRARY OF ENERGY WIDGETS WITH EMBEDDED LOGIC FOR COMMON ENERGY CALCULATIONS.

.2 USERS ARE ALLOWED TO PICK AND CHOOSE WHICH WIDGETS ARE DISPLAYED, AND WHERE THEY ARE LOCATED.

.2 SHALL PROVIDE AN OBJECT–BASED WIDGET BUILDER FOR THE CREATION OF CUSTOM WIDGETS INCLUDING:

.1 TARGET A SPECIFIC BUILDING OR SYSTEM/EQUIPMENT

.2 CONFIGURE TIME PERIODS, PARAMETER VALUES (MAXIMUM/MINIMUM), UNITS OF MEASURE

.3 SELECT DISPLAY COLORS

.4 PREVIEW WIDGETS USING TARGET OBJECT.

I. ACTIVE MONITORING SERVICE

.1 REMOTE MONITORING FACILITY AND STAFFING:

.1 THIS SPECIFICATION REQUIRES THAT, FOR 1 YEAR, XYZ WILL HAVE 24/7/365 MONITORING OF UP TO 60 OF THEIR MOST CRITICAL ALARMS

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FROM A DEDICATED REMOTE FACILITY STAFFED WITH HVAC TECHNICAL SPECIALISTS.

.2 THE ORIGINAL EQUIPMENT MANUFACTURER (OEM) MONITORING CENTER MUST HAVE FULL REDUNDANCY IN SYSTEMS AT THE DATA CENTER LEVEL TO FULLY SUPPORT A 24/7/365 OPERATION. THIS INCLUDES, BUT IS NOT LIMITED TO, THE FOLLOWING SYSTEMS: ELECTRICAL, PHONE, DATABASE, AND SUPPORT.

.3 THE CENTER MUST HAVE A STAFF OF CONTROLS SPECIALISTS WHO HAVE FIELD EXPERTISE IN HVAC APPLIED SYSTEMS OPERATIONS.

.4 FACILITY CONTROLS SPECIALISTS MUST BE FACTORY TRAINED AND CERTIFIED IN BUILDING AUTOMATION SYSTEMS (BAS).

.5 IN THE EVENT OF AN OUTAGE AT THE PRIMARY REMOTE CENTER, A REDUNDANT SITE MUST BE IN PLACE TO PROVIDE ADDITIONAL BACKUP AND SUPPORT.

.6 IT WILL BE THE RESPONSIBILITY OF THE BUILDING OWNER TO PROVIDE THE CONNECTIVITY MEDIUM REQUIRED FOR REMOTE MONITORING TO THE DDC CONTRACTOR, AS WELL AS THE ANNUAL COSTS OF MAINTAINING THAT MEDIUM (FOR EXAMPLE, PHONE LINE, INTERNET, ET CETERA). THE REMOTE CONNECTION IS CONTINGENT ON RECEIVING PERMISSION FOR REMOTE ACCESS FROM PROPERTY OWNER.

J. ACTIVE MONITORING RESPONSE REQUIREMENTS

.1 UPON RECEIPT OF AN ALARM THROUGH AN OWNER–PROVIDED CONNECTIVITY MEDIUM (SUCH AS A PHONE LINE OR INTERNET ACCESS), AN HVAC SPECIALIST FROM THE REMOTE MONITORING FACILITY WILL DIAGNOSE THE ISSUE AND TROUBLESHOOT FROM HIS/HER INTERFACE TO THE SYSTEM IN AN ATTEMPT TO CORRECT THE PROBLEM WITHOUT INITIATING ANY ON–SITE REQUIREMENT. THIS WILL PREVENT XYZ FROM PLACING ANY SERVICE CALLS THAT ARE NOT 100% NECESSARY.

.2 IF CORRECTING THE ALARM REMOTELY IS NOT POSSIBLE, THE MONITORING FACILITY MUST INTELLIGENTLY DISPATCH A SERVICE TECHNICIAN WITH INFORMATION ABOUT THE ISSUE AND PROVIDE RECOMMENDATIONS TO CORRECT THE PROBLEM IN THE FIELD.

.3 USE TELEPHONE SUPPORT TO DISPATCH A SERVICE TECHNICIAN, AS DICTATED BY XYZ, TO ENSURE THAT ONLY THE MOST APPROPRIATE OWNER CONTACTS, TECHNICIANS, AND FIELD SUPPORT PERSONNEL ARE ALWAYS INVOLVED. THIS ALLOWS FOR SMARTER AND MORE EFFICIENT SERVICE THAT ENSURES ACCURATE CALLS IN CASES WHERE THIS TYPE OF MAINTENANCE IS REQUIRED.

.4 TO GUARANTEE CONTINUAL MONITORING, COMMUNICATION BETWEEN THE REMOTE MONITORING FACILITY AND THE XYZ BUILDING CONTROL SYSTEM MUST BE TESTED AND PROVEN EACH QUARTER. DAMAGE CAUSED BY MISSED ALARMS, DUE TO LOST CONNECTIVITY IN BETWEEN TESTS, WILL NOT BE THE LIABILITY OF THE DDC CONTRACTOR. IT IS REQUIRED TO DELIVER TO XYZ EACH QUARTER, A RECORD OF THIS SUCCESSFUL TEST, AS WELL AS A RECORD OF EACH AUTOMATED CRITICAL ALARM RECORDED (AND THE ACTIONS ASSOCIATED ACTIONS IT).

.5 THE REMOTE FACILITY MUST COMPILE AND STORE A HISTORY OF ALL CRITICAL ALARMS, WITH THIS DATA BEING THE OWNED PROPERTY OF THE REMOTE MONITORING SERVICE PROVIDER, FOR FURTHER REDUNDANCY AND PROTECTION FROM FAILURES. DURING START–UP AND COMMISSIONING OF THE ALARM REPORTING, XYZ MAY TRIP AN ALARM TO DEMONSTRATE REMOTE CAPABILITY PRIOR TO ACCEPTANCE.

10. OPERATOR INTERFACE

A. FURNISH [1] PC BASED OPERATOR WEB INTERFACE AS SHOWN ON THE SYSTEM DRAWINGS. EACH OF THESE BUILDING OPERATOR WEB INTERFACES SHALL BE ABLE TO ACCESS ALL INFORMATION IN THE SYSTEM. THE BUILDING OPERATOR WEB INTERFACE SHALL RESIDE ON THE BUILDING WIDE NETWORK, WHICH IS SAME HIGH–SPEED IP COMMUNICATIONS NETWORK AS THE SYSTEM CONTROLLERS. THE BUILDING WIDE NETWORK WILL BE PROVIDED BY THE OWNER AND SUPPORTS THE INTERNET PROTOCOL (IP).

B. EACH OPERATOR INTERFACE PC SHALL INCLUDE THE FOLLOWING: (3) YEARS OF SOFTWARE SERVICE UPDATES, TREND DATA STORAGE, BACKUPS. PREFERRED CONNECTIVITY FOR BACKUPS IS THROUGH THE CLOUD. IF CLOUD IS NOT AVAILABLE PROVIDE AN ONSITE SERVER WITH 2 TB OF SECURE STORAGE.

C. SERVICE TOOL

.1 LAPTOP

D. MINIMUM HARDWARE

.1 INTEL CORE I5 OR BETTER

.2 8 GB RAM

.3 500 GB HARD DRIVE SPACE

E. INTERNET BROWSER COMPATIBILITY OUTLINED IN THE FOLLOWING SECTIONS.

.1 THE OPERATOR WEB INTERFACE SHALL BE ACCESSIBLE VIA A WEB BROWSER WITHOUT REQUIRING ANY "PLUG–INS" (I.E. JAVA RUNTIME ENVIRONMENT (JRE), ADOBE FLASH).

.2 THE OPERATOR WEB INTERFACE SHALL SUPPORT THE FOLLOWING INTERNET WEB BROWSERS:

.1 INTERNET EXPLORER 11.0+

.2 FIREFOX 47.0+

.3 CHROME 75.0+

.4 EDGE 13.0+

F. THE OPERATOR WEB INTERFACE SHALL SUPPORT THE FOLLOWING MOBILE WEB BROWSERS:

.1 IOS (IPAD/IPHONE) V9.1+

.2 ANDROID (TABLET) V4.3+

.3 ANDROID (PHONE) V2.3+

G. BUILDING OPERATOR WEB INTERFACE

.1 THE BUILDING OPERATOR WEB INTERFACE SHALL BE ACCESSIBLE VIA A WEB BROWSER WITHOUT REQUIRING ANY "PLUG–INS" (I.E. JAVA RUNTIME ENVIRONMENT (JRE), ADOBE FLASH)

H. SYSTEM SECURITY

.1 EACH OPERATOR SHALL BE REQUIRED TO LOGIN TO THE SYSTEM WITH A USER NAME AND PASSWORD IN ORDER TO VIEW, EDIT, ADD, OR DELETE DATA.

.2 USER PROFILES SHALL RESTRICT THE USER TO ONLY THE OBJECTS, APPLICATIONS, AND SYSTEM FUNCTIONS AS ASSIGNED BY THE SYSTEM ADMINISTRATOR.

.3 EACH OPERATOR SHALL BE ALLOWED TO CHANGE THEIR USER PASSWORD.

.4 THE SYSTEM ADMINISTRATOR SHALL BE ABLE TO MANAGE THE SECURITY FOR ALL OTHER USERS.

.5 THE SYSTEM SHALL INCLUDE PRE–DEFINED "ROLES" THAT ALLOW A SYSTEM ADMINISTRATOR TO QUICKLY ASSIGN PERMISSIONS TO A USER.

.6 USER LOGON/LOGOFF ATTEMPTS SHALL BE RECORDED.

.7 THE SYSTEM SHALL PROTECT ITSELF FROM UNAUTHORIZED USE BY AUTOMATICALLY LOGGING OFF FOLLOWING THE LAST KEYSTROKE. THE DELAY TIME SHALL BE USER DEFINABLE.

.8 ALL SYSTEM SECURITY DATA SHALL BE STORED IN AN ENCRYPTED FORMAT.

I. ON–LINE HELP AND TRAINING

.1 PROVIDE A CONTEXT SENSITIVE, ONLINE HELP SYSTEM TO ASSIST THE OPERATOR IN OPERATION AND CONFIGURATION OF THE SYSTEM.

.2 ON–LINE HELP SHALL BE AVAILABLE FOR ALL SYSTEM FUNCTIONS AND SHALL PROVIDE THE RELEVANT DATA FOR EACH PARTICULAR SCREEN.

J. SYSTEM DIAGNOSTICS

.1 THE SYSTEM SHALL AUTOMATICALLY MONITOR THE OPERATION OF ALL NETWORK CONNECTIONS, BUILDING MANAGEMENT PANELS, AND CONTROLLERS.

.2 THE FAILURE OF ANY DEVICE SHALL BE ANNUNCIATED TO THE OPERATORS.

K. EQUIPMENT & APPLICATION PAGES

.1 THE BUILDING OPERATOR WEB INTERFACE SHALL INCLUDE STANDARD PAGES FOR ALL EQUIPMENT AND APPLICATIONS. THESE PAGES SHALL ALLOW AN OPERATOR TO OBTAIN INFORMATION RELEVANT TO THE OPERATION OF THE EQUIPMENT AND/OR APPLICATION, INCLUDING:

.1 ALARMS RELEVANT TO THE EQUIPMENT OR APPLICATION WITHOUT REQUIRING A USER TO NAVIGATE TO AN ALARM PAGE AND PERFORM A FILTER.

.2 HISTORICAL DATA (AS DEFINED IN DATA LOG SECTION BELOW) FOR THE EQUIPMENT OR APPLICATION WITHOUT REQUIRING A USER TO NAVIGATE TO A DATA LOG PAGE AND PERFORM A FILTER.

L. SYSTEM GRAPHICS. BUILDING OPERATOR WEB INTERFACE SHALL BE GRAPHICALLY BASED AND SHALL INCLUDE AT LEAST ONE GRAPHIC PER PIECE OF EQUIPMENT OR OCCUPIED ZONE, GRAPHICS FOR EACH CHILLED WATER AND HOT WATER SYSTEM, AND GRAPHICS THAT SUMMARIZE CONDITIONS ON EACH FLOOR OF EACH BUILDING INCLUDED IN THIS CONTRACT. INDICATE THERMAL COMFORT ON FLOOR PLAN SUMMARY GRAPHICS USING COLORS TO REPRESENT ZONE TEMPERATURE RELATIVE TO ZONE SET POINT.

.1 FUNCTIONALITY. GRAPHICS SHALL ALLOW OPERATOR TO MONITOR SYSTEM STATUS, TO VIEW A SUMMARY OF THE MOST IMPORTANT DATA FOR EACH CONTROLLED ZONE OR PIECE OF EQUIPMENT, TO USE POINT AND–CLICK NAVIGATION BETWEEN ZONES OR EQUIPMENT, AND TO EDIT SET POINTS AND OTHER SPECIFIED PARAMETERS.

.2 GRAPHIC IMAGERY – GRAPHICS SHALL USE 3D IMAGES FOR ALL STANDARD

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AND CUSTOM GRAPHICS. THE ONLY ALLOWABLE EXCEPTIONS WILL BE PHOTO IMAGES, MAPS, SCHEMATIC DRAWINGS, AND SELECTED FLOOR PLANS.

.3 ALARM INDICATION. INDICATE AREAS OR EQUIPMENT IN AN ALARM CONDITION USING COLOR OR OTHER VISUAL INDICATOR.

M. CUSTOM GRAPHICS

.1 THE OPERATOR INTERFACE SHALL BE CAPABLE OF DISPLAYING CUSTOM GRAPHICS IN ORDER TO CONVEY THE STATUS OF THE FACILITY TO ITS OPERATORS.

.2 GRAPHICAL NAVIGATION. THE BUILDING OPERATOR WEB INTERFACE SHALL PROVIDE DYNAMIC COLOR GRAPHICS OF BUILDING AREAS, SYSTEMS AND EQUIPMENT.

.3 GRAPHICAL DATA VISUALIZATION. THE BUILDING OPERATOR WEB INTERFACE SHALL SUPPORT DYNAMIC POINTS INCLUDING ANALOG AND BINARY VALUES, DYNAMIC TEXT, STATIC TEXT, AND ANIMATION FILES.

N. MANUAL CONTROL AND OVERRIDE

.1 POINT CONTROL. PROVIDE A METHOD FOR A USER TO VIEW, OVERRIDE, AND EDIT IF APPLICABLE, THE STATUS OF ANY OBJECT AND PROPERTY IN THE SYSTEM. THE POINT STATUS SHALL BE AVAILABLE BY MENU, ON GRAPHICS OR THROUGH CUSTOM PROGRAMS.

.3 OVERRIDE OWNERS. THE SYSTEM SHALL CONVEY TO THE USER THE OWNER OF EACH OVERRIDE FOR ALL PRIORITIES THAT AN OVERRIDE EXISTS.

.4 PROVIDE A SPECIFIC ICON TO SHOW TIMED OVERRIDE OR OPERATOR OVERRIDE, WHEN A POINT, UNIT CONTROLLER OR APPLICATION HAS BEEN OVERRIDDEN MANUALLY.

O. SCHEDULING. A USER SHALL BE ABLE TO PERFORM THE FOLLOWING TASKS UTILIZING THE BUILDING OPERATOR WEB INTERFACE:

.1 CREATE A NEW SCHEDULE, DEFINING THE DEFAULT VALUES, EVENTS AND MEMBERSHIP.

.2 CREATE EXCEPTIONS TO A SCHEDULE FOR ANY GIVEN DAY.

.3 APPLY AN EXCEPTION THAT SPANS A SINGLE DAY OR MULTIPLE DAYS.

.4 VIEW A SCHEDULE BY DAY, WEEK AND MONTH.

.5 EXCEPTION SCHEDULES AND HOLIDAYS SHALL BE SHOWN CLEARLY ON THE CALENDAR.

.6 MODIFY THE SCHEDULE EVENTS, MEMBERS AND EXCEPTIONS.

P. DATA LOGS

.1 DATA LOGS DEFINITION.

.1 THE BUILDING OPERATOR WEB INTERFACE SHALL ALLOW A USER WITH THE APPROPRIATE SECURITY PERMISSIONS TO DEFINE A DATA LOG FOR ANY DATA IN THE SYSTEM.

.2 THE BUILDING OPERATOR WEB INTERFACE SHALL ALLOW A USER TO DEFINE ANY DATA LOG OPTIONS AS DESCRIBED IN THE APPLICATION AND CONTROL SOFTWARE SECTION.

.2 DATA LOG VIEWER.

.1 THE BUILDING OPERATOR WEB INTERFACE SHALL ALLOW DATA LOG DATA TO BE VIEWED AND PRINTED.

.2 THE BUILDING OPERATOR WEB INTERFACE SHALL ALLOW A USER TO VIEW DATA LOG DATA IN A TEXT–BASED FORMAT (TIME –STAMP/VALUE).

.3 THE OPERATOR SHALL BE ABLE TO VIEW THE DATA COLLECTED BY A DATA LOG IN A GRAPHICAL CHART IN THE BUILDING OPERATOR WEB INTERFACE.

.4 DATA LOG VIEWING CAPABILITIES SHALL INCLUDE THE ABILITY TO SHOW A MINIMUM OF 5 POINTS ON A CHART.

.5 EACH DATA POINT DATA LINE SHALL BE DISPLAYED AS A UNIQUE COLOR.

.6 THE OPERATOR SHALL BE ABLE TO SPECIFY THE DURATION OF HISTORICAL DATA TO VIEW BY SCROLLING AND ZOOMING.

.7 THE SYSTEM SHALL PROVIDE A GRAPHICAL TRACE DISPLAY OF THE ASSOCIATED TIME STAMP AND VALUE FOR ANY SELECTED POINT ALONG THE X–AXIS.

.3 EXPORT DATA LOGS.

.1 THE BUILDING OPERATOR WEB INTERFACE SHALL ALLOW A USER TO EXPORT DATA LOG DATA IN CSV OR PDF FORMAT FOR USE BY OTHER INDUSTRY STANDARD WORD PROCESSING AND SPREADSHEET PACKAGES.

Q. ALARM/EVENT NOTIFICATION

.1 AN OPERATOR SHALL BE NOTIFIED OF NEW ALARMS/EVENTS AS THEY OCCUR WHILE NAVIGATING THROUGH ANY PART OF THE SYSTEM VIA AN ALARM ICON.

.2 ALARM/EVENT LOG. THE OPERATOR SHALL BE ABLE TO VIEW ALL LOGGED SYSTEM ALARMS/EVENTS FROM ANY BUILDING OPERATOR WEB INTERFACE.

.3 THE OPERATOR SHALL BE ABLE TO SORT AND FILTER ALARMS FROM EVENTS. ALARMS SHALL BE SORTED IN A MINIMUM OF 4 CATEGORIES BASED ON SEVERITY.

.4 ALARM/EVENT MESSAGES SHALL USE FULL LANGUAGE, EASILY RECOGNIZED DESCRIPTORS.

.5 AN OPERATOR WITH THE PROPER SECURITY LEVEL MAY ACKNOWLEDGE AND CLEAR ALARMS/EVENTS.

.6 ALL ALARMS/EVENTS THAT HAVE NOT BEEN CLEARED BY THE OPERATOR SHALL BE STORED BY THE BUILDING CONTROLLER.

.7 THE ALARM/EVENT LOG SHALL INCLUDE A COMMENT FIELD FOR EACH ALARM/EVENT THAT ALLOWS A USER TO ADD SPECIFIC COMMENTS ASSOCIATED WITH ANY ALARM.

.8 ALARM PROCESSING.

.1 THE OPERATOR SHALL BE ABLE TO CONFIGURE ANY OBJECT IN THE SYSTEM TO GENERATE AN ALARM WHEN TRANSITIONING IN AND OUT OF A NORMAL STATE.

.2 THE OPERATOR SHALL BE ABLE TO CONFIGURE THE ALARM LIMITS, WARNING LIMITS, STATES, AND REACTIONS FOR EACH OBJECT IN THE SYSTEM.

R. REPORTS AND LOGS.

.1 THE BUILDING OPERATOR WEB INTERFACE SHALL PROVIDE A REPORTING PACKAGE THAT ALLOWS THE OPERATOR TO SELECT REPORTS.

.2 THE BUILDING OPERATOR WEB INTERFACE SHALL PROVIDE THE ABILITY TO SCHEDULE REPORTS TO RUN AT SPECIFIED INTERVALS OF TIME.

.3 THE BUILDING OPERATOR WEB INTERFACE SHALL ALLOW A USER TO EXPORT REPORTS AND LOGS FROM THE BUILDING CONTROLLER IN A FORMAT THAT IS READILY ACCESSIBLE BY OTHER STANDARD SOFTWARE APPLICATIONS INCLUDING SPREADSHEETS AND WORD PROCESSING. ACCEPTABLE FORMATS INCLUDE:

.1 CSV, HTML, XML, PDF

.4 REPORTS AND LOGS SHALL BE READILY PRINTED TO THE SYSTEM PRINTER.

.5 PROVIDE A MEANS TO LIST AND ACCESS THE LAST 10 REPORTS VIEWED BY THE USER.

.6 THE FOLLOWING STANDARD REPORTS SHALL BE AVAILABLE WITHOUT REQUIRING A USER TO MANUALLY CONFIGURE THE REPORT:

.1 ALL POINTS IN ALARM REPORT: PROVIDE AN ON–DEMAND REPORT SHOWING ALL CURRENT ALARMS.

.2 ALL POINTS IN OVERRIDE REPORT: PROVIDE AN ON–DEMAND REPORT SHOWING ALL OVERRIDES IN EFFECT.

.3 COMMISSIONING REPORT: PROVIDE A ONE–TIME REPORT THAT LISTS ALL EQUIPMENT WITH THE UNIT CONFIGURATION AND PRESENT OPERATION.

.4 POINTS REPORT: PROVIDE A REPORT THAT LISTS THE CURRENT VALUE OF ALL POINTS

1. ISSUED FOR TENDER 25.03.21

PROJECT:
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Glendale Secondary School

145 Rainbow Dr,
Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
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DRAWN:
J.L.

DATE:
SEPTEMBER 2023

PROJECT #:
ALL–23010629–A0

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13. <u>CONTROLLER SOFTWARE</u>

A. FURNISH THE FOLLOWING APPLICATIONS SOFTWARE FOR BUILDING AND ENERGY MANAGEMENT. ALL SOFTWARE APPLICATIONS SHALL RESIDE AND RUN IN THE SYSTEM CONTROLLERS. EDITING OF APPLICATIONS SHALL OCCUR AT THE BUILDING OPERATOR INTERFACE.

.1 SCHEDULING. PROVIDE THE CAPABILITY TO SCHEDULE EACH OBJECT OR GROUP OF OBJECTS IN THE SYSTEM. EACH OF THESE SCHEDULES SHALL INCLUDE THE CAPABILITY FOR START, STOP, OPTIMAL START, OPTIMAL STOP, AND NIGHT ECONOMIZER ACTIONS. EACH SCHEDULE MAY CONSIST OF UP TO [10] EVENTS. WHEN A GROUP OF OBJECTS ARE SCHEDULED TOGETHER, PROVIDE THE CAPABILITY TO DEFINE ADVANCES AND DELAYS FOR EACH MEMBER. EACH SCHEDULE SHALL CONSIST OF THE FOLLOWING:

.1 WEEKLY SCHEDULE:

PROVIDE SEPARATE SCHEDULES FOR EACH DAY OF THE WEEK.

.2 EXCEPTION SCHEDULES:

PROVIDE THE ABILITY FOR THE OPERATOR TO DESIGNATE ANY DAY OF THE YEAR AS AN EXCEPTION SCHEDULE. THIS EXCEPTION SCHEDULE SHALL OVERRIDE THE STANDARD SCHEDULE FOR THAT DAY. EXCEPTION SCHEDULES MAY BE DEFINED UP TO A YEAR IN ADVANCE. ONCE AN EXCEPTION SCHEDULE IS EXECUTED IT WILL BE DISCARDED AND REPLACED BY THE STANDARD SCHEDULE FOR THAT DAY OF THE WEEK.

.3 HOLIDAY SCHEDULES:

PROVIDE THE CAPABILITY FOR THE OPERATOR TO DEFINE UP TO 99 SPECIAL OR HOLIDAY SCHEDULES. THESE SCHEDULES MAY BE PLACED ON THE SCHEDULING CALENDAR AND WILL BE REPEATED EACH YEAR. THE OPERATOR SHALL BE ABLE TO DEFINE THE LENGTH OF EACH HOLIDAY PERIOD.

.4 OPTIMAL START:

THE SCHEDULING APPLICATION OUTLINED ABOVE SHALL SUPPORT AN OPTIMAL START ALGORITHM. THIS SHALL CALCULATE THE THERMAL CHARACTERISTICS OF A ZONE AND START THE EQUIPMENT PRIOR TO OCCUPANCY TO ACHIEVE THE DESIRED SPACE TEMPERATURE AT THE SPECIFIED OCCUPANCY TIME. THE ALGORITHM SHALL CALCULATE SEPARATE SETS OF HEATING AND COOLING RATES FOR ZONES THAT HAVE BEEN UNOCCUPIED FOR LESS THEN AND GREATER THAN 24 HOURS. PROVIDE THE ABILITY TO MODIFY THE START ALGORITHM BASED ON OUTDOOR AIR TEMPERATURE. PROVIDE AN EARLY START LIMIT IN MINUTES TO PREVENT THE SYSTEM FROM STARTING BEFORE AN OPERATOR DETERMINED TIME LIMIT.

.2 TREND LOG APPLICATION

.1 TREND LOG DATA SHALL BE SAMPLED AND STORED ON THE SYSTEM CONTROLLER PANEL AND SHALL CAPABLE OF BEING ARCHIVED TO A BACNET WORKSTATION FOR LONGER TERM STORAGE.

.2 TREND LOGS SHALL INCLUDE INTERVAL, START–TIME, AND STOP–TIME.

.3 TREND LOG INTERVALS SHALL BE CONFIGURABLE AS FREQUENTLY AS 1 MINUTE AND AS INFREQUENTLY AS 1 YEAR.

.3 TREND LOGS

.1 THE SYSTEM CONTROLLER SHALL CREATE TREND LOGS FOR DEFINED KEY PERFORMANCE INDICATORS FOR EACH CONTROLLED HVAC DEVICE AND HVAC APPLICATION.

.2 THE TREND LOGS SHALL MONITOR THESE PARAMETERS FOR A MINIMUM OF 7 DAYS AT 15 MINUTE INTERVALS. THE AUTOMATIC TREND LOGS SHALL BE USER ADJUSTABLE.

.4 ALARM/EVENT LOG

.1 ANY OBJECT IN THE SYSTEM SHALL BE CONFIGURABLE TO GENERATE AN ALARM WHEN TRANSITIONING IN AND OUT OF A NORMAL OR FAULT STATE.

.2 ANY OBJECT IN THE SYSTEM SHALL ALLOW THE ALARM LIMITS, WARNING LIMITS, STATES, AND REACTIONS TO BE CONFIGURED FOR EACH OBJECT IN THE SYSTEM.

.3 AN ALARM/EVENT SHALL BE CAPABLE OF TRIGGERING ANY OF THE FOLLOWING ACTIONS:

.1 ROUTE THE ALARM/EVENT TO ONE OR MORE ALARM LOG

.2 THE ALARM MESSAGE SHALL INCLUDE THE NAME OF THE ALARM LOCATION, THE DEVICE THAT GENERATED THE ALARM, AND THE ALARM MESSAGE ITSELF.

.3 ROUTE AN E–MAIL MESSAGE TO AN OPERATOR(S)

.4 LOG A DATA POINT(S) FOR A PERIOD OF TIME

.5 RUN A CUSTOM CONTROL PROGRAM

.5 POINT CONTROL. USER SHALL HAVE THE OPTION TO SET THE UPDATE INTERVAL, MINIMUM ON/OFF TIME, EVENT NOTIFICATION, CUSTOM PROGRAMMING ON CHANGE OF EVENTS.

.6 TIMED OVERRIDE. A STANDARD APPLICATION SHALL BE UTILIZED TO ENABLE/DISABLE TEMPERATURE CONTROL WHEN A USER SELECTS ON/CANCEL AT THE ZONE SENSOR, BUILDING OPERATOR INTERFACE, OR THE LOCAL OPERATOR DISPLAY. THE AMOUNT OF TIME THAT THE OVERRIDE TAKES PRECEDENCE WILL BE SELECTABLE FROM THE BUILDING OPERATOR INTERFACE.

.7 ANTI–SHORT CYCLING. ALL BINARY OUTPUT POINTS SHALL BE PROTECTED FROM SHORT CYCLING

14. <u>BUILDING CONTROLLERS</u>

A. THERE SHALL BE ONE OR MORE INDEPENDENT, STANDALONE MICROPROCESSOR BASED SYSTEM CONTROLLERS TO MANAGE THE GLOBAL STRATEGIES DESCRIBED IN APPLICATION AND CONTROL SOFTWARE SECTION.

B. THE SYSTEM CONTROLLER SHALL HAVE SUFFICIENT MEMORY TO SUPPORT ITS OPERATING SYSTEM, DATABASE, AND PROGRAMMING REQUIREMENTS.

C. THE CONTROLLER SHALL PROVIDE A USB COMMUNICATIONS PORT FOR CONNECTION TO A PC.

D. THE OPERATING SYSTEM OF THE CONTROLLER SHALL MANAGE THE INPUT AND OUTPUT COMMUNICATIONS SIGNALS TO ALLOW DISTRIBUTED CONTROLLERS TO SHARE REAL AND VIRTUAL POINT INFORMATION AND ALLOW CENTRAL MONITORING AND ALARMS.

E. ALL SYSTEM CONTROLLERS SHALL HAVE A REAL TIME CLOCK.

F. DATA SHALL BE SHARED BETWEEN NETWORKED SYSTEM CONTROLLERS.

G. THE SYSTEM CONTROLLER SHALL CONTINUALLY CHECK THE STATUS OF ITS PROCESSOR AND MEMORY CIRCUITS. IF AN ABNORMAL OPERATION IS DETECTED, THE CONTROLLER SHALL:

.1 ASSUME A PREDETERMINED FAILURE MODE.

.2 GENERATE AN ALARM NOTIFICATION.

.3 CREATE A RETRIEVABLE FILE OF THE STATE OF ALL APPLICABLE MEMORY LOCATIONS AT THE TIME OF THE FAILURE.

.4 AUTOMATICALLY RESET THE SYSTEM CONTROLLER TO RETURN TO A NORMAL OPERATING MODE.

H. ENVIRONMENT. CONTROLLER HARDWARE SHALL BE SUITABLE FOR THE ANTICIPATED AMBIENT CONDITIONS. CONTROLLER USED IN CONDITIONED AMBIENT SHALL BE MOUNTED IN AN ENCLOSURE, AND SHALL BE RATED FOR OPERATION AT –40° C TO 50° C [–40° F TO 122° F].

I. CLOCK SYNCHRONIZATION.

.1 ALL SYSTEM CONTROLLERS SHALL BE ABLE TO SYNCHRONIZE WITH A NTP SERVER FOR AUTOMATIC TIME SYNCHRONIZATION.

.2 ALL SYSTEM CONTROLLERS SHALL BE ABLE TO ACCEPT A BACNET TIME SYNCHRONIZATION COMMAND FOR AUTOMATIC TIME SYNCHRONIZATION.

.3 ALL SYSTEM CONTROLLERS SHALL AUTOMATICALLY ADJUST FOR DAYLIGHT SAVINGS TIME IF APPLICABLE.

J. SERVICEABILITY

.1 PROVIDE DIAGNOSTIC LEDS FOR POWER, COMMUNICATIONS, AND PROCESSOR.

.2 THE SYSTEM CONTROLLER SHALL HAVE A DISPLAY ON THE MAIN BOARD THAT INDICATES THE CURRENT OPERATING MODE OF THE CONTROLLER.

.3 SD CARD SHOULD BE PROVIDED AND USED FOR LOCAL BACKUP. IF LOCAL BACKUP THROUGH SD CARD OR SIMILAR DEVICE IS NOT AVAILABLE THEN PROVIDE OPERATOR WORKSTATION WITH SUFFICIENT MEMORY PROVIDE SCHEDULED BACKUPS OF THE SYSTEM. BAS SERVICE PROVIDER SHALL BE RESPONSIBLE FOR BAS BACKUPS DURING THE WARRANTY PERIOD.

.4 ALL WIRING CONNECTIONS SHALL BE MADE TO FIELD REMOVABLE, MODULAR TERMINAL CONNECTORS.

.5 THE SYSTEM CONTROLLER SHALL UTILIZE STANDARD DIN MOUNTING METHODS FOR INSTALLATION AND REPLACEMENT.

.6 MEMORY. THE SYSTEM CONTROLLER SHALL MAINTAIN ALL BIOS AND PROGRAMMING INFORMATION INDEFINITELY WITHOUT POWER TO THE SYSTEM CONTROLLER.

.7 IMMUNITY TO POWER AND NOISE. CONTROLLER SHALL BE ABLE TO OPERATE AT 90% TO 110% OF NOMINAL VOLTAGE RATING AND SHALL PERFORM AN ORDERLY SHUT–DOWN BELOW 80% NOMINAL VOLTAGE.

.8 BACNET TEST LABS (BTL) LISTING. EACH SYSTEM CONTROLLER SHALL BE LISTED AS A BUILDING CONTROLLER (B–BC) BY THE BACNET TEST LABS WITH A MINIMUM BACNET PROTOCOL REVISION OF 14.

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15. <u>AUXILLARY CONTROL DEVICES</u>

A. BINARY TEMPERATURE DEVICES

.1 LOW–VOLTAGE SPACE THERMOSTAT SHALL BE 24 V, BIMETAL–OPERATED, MERCURY–SWITCH TYPE, WITH EITHER ADJUSTABLE OR FIXED ANTICIPATION HEATER, CONCEALED SETPOINT ADJUSTMENT, 13°C TO 30°C (55°F TO 85°F) SETPOINT RANGE, 1°C (2°F) MAXIMUM DIFFERENTIAL, AND VENTED ABS PLASTIC COVER.

.2 LINE–VOLTAGE SPACE THERMOSTAT SHALL BE BIMETAL–ACTUATED, OPEN CONTACT TYPE, OR BELLOWS–ACTUATED, ENCLOSED, SNAP–SWITCH TYPE OR EQUIVALENT SOLID–STATE TYPE, WITH HEAT ANTICIPATOR, UL LISTED FOR ELECTRICAL RATING, CONCEALED SETPOINT ADJUSTMENT, 13°C TO 30°C (55°F TO 85°F) SETPOINT RANGE, 1°C (2°F) MAXIMUM DIFFERENTIAL, AND VENTED ABS PLASTIC COVER.

.3 LOW–LIMIT THERMOSTATS. LOW–LIMIT AIRSTREAM THERMOSTATS SHALL BE UL LISTED, VAPOR PRESSURE TYPE, WITH AN ELEMENT OF 6 M (20 FT) MINIMUM LENGTH. ELEMENT SHALL RESPOND TO THE LOWEST TEMPERATURE SENSED BY ANY 30 CM (1 FT) SECTION. THE LOW–LIMIT THERMOSTAT SHALL BE MANUAL RESET ONLY.

16. <u>COORDINATION</u>

A. SITE

.1 WHERE THE MECHANICAL WORK WILL BE INSTALLED IN CLOSE PROXIMITY TO, OR WILL INTERFERE WITH, WORK OF OTHER TRADES, THE CONTRACTOR SHALL ASSIST IN WORKING OUT SPACE CONDITIONS TO MAKE A SATISFACTORY ADJUSTMENT. IF THE CONTRACTOR INSTALLS HIS/HER WORK BEFORE COORDINATING WITH OTHER TRADES, SO AS TO CAUSE ANY INTERFERENCE WITH WORK OF OTHER TRADES, THE CONTRACTOR SHALL MAKE THE NECESSARY CHANGES IN HIS/HER WORK TO CORRECT THE CONDITION WITHOUT EXTRA CHARGE.

.2 COORDINATE AND SCHEDULE WORK WITH ALL OTHER WORK IN THE SAME AREA, OR WITH WORK THAT IS DEPENDENT UPON OTHER WORK, TO FACILITATE MUTUAL PROGRESS.

B. TEST AND BALANCE

.1 THE CONTRACTOR SHALL FURNISH A SINGLE SET OF ALL TOOLS NECESSARY TO INTERFACE TO THE CONTROL SYSTEM FOR TEST AND BALANCE PURPOSES.

.2 THE CONTRACTOR SHALL PROVIDE TRAINING IN THE USE OF THESE TOOLS. THIS TRAINING WILL BE PLANNED FOR A DURATION OF 4 HOURS.

.3 IN ADDITION, THE CONTRACTOR SHALL PROVIDE A QUALIFIED TECHNICIAN TO ASSIST IN THE TEST AND BALANCE PROCESS, UNTIL THE FIRST 20 TERMINAL UNITS ARE BALANCED.

.4 THE TOOLS USED DURING THE TEST AND BALANCE PROCESS SHALL BE RETURNED TO THE CONTRACTOR AT THE COMPLETION OF THE TESTING AND BALANCING.

C. COORDINATION WITH CONTROLS SPECIFIED IN OTHER SECTIONS OR DIVISIONS. OTHER SECTIONS AND/OR DIVISIONS OF THIS SPECIFICATION INCLUDE CONTROLS AND CONTROL DEVICES THAT ARE TO BE PART OF OR INTERFACED TO THE CONTROL SYSTEM SPECIFIED IN THIS SECTION. THESE CONTROLS SHALL BE INTEGRATED INTO THE SYSTEM AND COORDINATED BY THE CONTRACTOR AS FOLLOWS:

.1 ALL COMMUNICATION MEDIA AND EQUIPMENT SHALL BE PROVIDED AS SPECIFIED IN THE "COMMUNICATION" SECTION OF THIS SPECIFICATION

.2 EACH SUPPLIER OF A CONTROLS PRODUCT IS RESPONSIBLE FOR THE CONFIGURATION, PROGRAMMING, START–UP, AND TESTING OF THAT PRODUCT TO MEET THE SEQUENCES OF OPERATION DESCRIBED IN THIS SECTION

.3 THE CONTRACTOR SHALL COORDINATE AND RESOLVE ANY INCOMPATIBILITY ISSUES THAT ARISE BETWEEN THE CONTROL PRODUCTS PROVIDED UNDER THIS SECTION AND THOSE PROVIDED UNDER OTHER SECTIONS OR DIVISIONS OF THIS SPECIFICATION.

D. PARTS SUPPLIED BY CONTROLS CONTRACTOR MUST BE TURNED OVER TO THE MECHANICAL CONTRACTOR FOR INSTALLATION. PARTS INCLUDE BUT ARE NOT LIMITED TO CONTROL VALVES, DAMPERS, INLINE DEVICES, THERMAL DEVICES, THERMAL WELLS.

17. <u>WIRING</u>

A. BAS INSTALLING CONTRACTOR IS RESPONSIBLE FOR ALL MECHANICAL INTERLOCK WIRING, SENSOR WIRING, AND CONTROL WIRING REQUIRED UNLESS SPECIFIED TO BE FACTORY MOUNTED PER DIVISION 23.

B. ALL CONTROL AND INTERLOCK WIRING SHALL COMPLY WITH THE NATIONAL, LOCAL ELECTRICAL CODES, AND SECTION 26 00 00 OF THESE CONTRACT DOCUMENT SPECIFICATIONS. WHERE THE REQUIREMENTS OF THIS SECTION DIFFER WITH THOSE IN ELECTRICAL SPECIFICATIONS, THE REQUIREMENTS OF THIS SECTION SHALL TAKE PRECEDENCE. THIS WORK INCLUDES INTERLOCK WIRING FOR MECHANICAL EQUIPMENT REQUIRED FOR A COMPLETE INSTALLATION. EQUIPMENT SPECIFIED TO HAVE FACTORY MOUNTED CONTROLLERS AND DEVICE ARE NOT INCLUDE BY THIS DIVISION.

C. ALL CEC CLASS 1 (LINE VOLTAGE) WIRING SHALL BE UL LISTED IN APPROVED RACEWAY ACCORDING TO CEC REQUIREMENTS.

D. WHERE CLASS 2 WIRES ARE IN CONCEALED AND ACCESSIBLE LOCATIONS; INCLUDING CEILING RETURN AIR PLENUMS, APPROVED CABLES OUTSIDE OF ELECTRICAL RACEWAY CAN BE USED PROVIDED THAT THE FOLLOWING CONDITIONS ARE MET:

.1 CIRCUITS MEET CEC CLASS 2 (CURRENT_LIMITED) REQUIREMENTS. (LOW_VOLTAGE POWER CIRCUITS SHALL BE SUB_FUSED WHEN REQUIRED TO MEET CLASS 2 CURRENT_LIMIT.)

.2 ALL CABLES SHALL BE UL LISTED FOR APPLICATION (I.E., CABLES USED IN CEILING PLENUMS SHALL BE UL LISTED SPECIFICALLY FOR THAT PURPOSE).

E. DO NOT INSTALL CLASS 2 WIRING IN CONDUITS CONTAINING CLASS 1 WIRING. BOXES AND PANELS CONTAINING HIGH VOLTAGE MAY NOT BE USED FOR LOW VOLTAGE WIRING EXCEPT FOR THE PURPOSE OF INTERFACING THE TWO VIA CONTROL RELAYS AND TRANSFORMERS.

F. WHERE CLASS 2 WIRING IS RUN EXPOSED, WIRING SHALL BE RUN PARALLEL ALONG A SURFACE OR PERPENDICULAR TO IT, AND BUNDLED, USING APPROVED WIRE TIES AT NO GREATER THAN 3 M (10 FT.) INTERVALS. SUCH BUNDLED CABLE SHALL BE FASTENED TO THE STRUCTURE, USING INDUSTRY APPROVED FASTENERS, AT 1.5 M (5 FT.) INTERVALS OR MORE OFTEN TO ACHIEVE A NEAT AND WORKMANLIKE RESULT.

G. ALL WIRE–TO–DEVICE CONNECTIONS SHALL BE MADE AT A TERMINAL BLOCKS OR TERMINAL STRIP. ALL WIRE–TO WIRE CONNECTIONS SHALL BE AT A TERMINAL BLOCK, OR WITH A CRIMPED CONNECTOR. ALL WIRING WITHIN ENCLOSURES SHALL BE NEATLY BUNDLED AND ANCHORED TO PERMIT ACCESS AND PREVENT RESTRICTION TO DEVICES AND TERMINALS.

H. MAXIMUM ALLOWABLE VOLTAGE FOR CONTROL WIRING SHALL BE 120VAC. IF ONLY HIGHER VOLTAGES ARE AVAILABLE FOR USE, THE BAS MANUFACTURER SHALL PROVIDE STEP–DOWN TRANSFORMERS TO ACHIEVE THE DESIRED CONTROL VOLTAGES.

I. ALL CONTROL WIRING SHALL BE INSTALLED AS CONTINUOUS LENGTHS, WHERE POSSIBLE. ANY REQUIRED SPLICES SHALL BE MADE ONLY WITHIN AN APPROVED JUNCTION BOX OR OTHER APPROVED PROTECTIVE DEVICE.

J. INSTALL PLENUM WIRING IN SLEEVES WHERE IT PASSES THROUGH WALLS AND FLOORS. MAINTAIN FIRE RATING AT ALL PENETRATIONS IN ACCORDANCE WITH CONTRACT DOCUMENTS AND NATIONAL AND/OR LOCAL CODES.

K. CONDUIT AND WIRE SIZING SHALL BE DETERMINED BY THE BAS MANUFACTURER IN ORDER TO MAINTAIN MANUFACTURER'S RECOMMENDATION AND MEET NATIONAL AND LOCAL CODES.

L. CONTROL AND STATUS RELAYS ARE TO BE LOCATED IN PRE–FABRICATED ENCLOSURES THAT MEET THE APPLICATION. THESE RELAYS MAY ALSO BE LOCATED WITHIN PACKAGED EQUIPMENT CONTROL PANEL ENCLOSURES AS COORDINATED. THESE RELAYS SHALL NOT BE LOCATED WITHIN CLASS 1 STARTER ENCLOSURES.

M. FOLLOW MANUFACTURER'S INSTALLATION RECOMMENDATIONS FOR ALL COMMUNICATION AND NETWORK BUS CABLING. NETWORK OR COMMUNICATION CABLING SHALL BE RUN SEPARATELY FROM ALL CONTROL POWER WIRING.

N. ADHERE TO ELECTRICAL REQUIREMENTS FOR INSTALLATION OF ELECTRICAL RACEWAYS.

O. BAS MANUFACTURER SHALL TERMINATE ALL CONTROL AND/OR INTERLOCK WIRING AND SHALL MAINTAIN UPDATED (AS_BUILT) WIRING DIAGRAMS WITH TERMINATIONS IDENTIFIED AT THE JOB SITE.

P. FLEXIBLE METAL CONDUITS AND LIQUID_TIGHT FLEXIBLE METAL CONDUITS SHALL NOT EXCEED 3' IN LENGTH AND SHALL BE SUPPORTED AT EACH END. FLEXIBLE METAL CONDUIT LESS THAN 1/2" ELECTRICAL TRADE SIZE SHALL NOT BE USED. IN AREAS EXPOSED TO MOISTURE, INCLUDING CHILLER AND BOILER ROOMS, LIQUID_TIGHT, FLEXIBLE METAL CONDUITS SHALL BE USED.

18. <u>SUPPLY OF CONTROL DEVICES</u>

CONTROLS & INSTRUMENTATION SPEC.

A. UNLESS OTHERWISE SPECIFIED, SUPPLY ALL REQUIRED CONTROL DAMPERS. HAND THE DAMPERS TO THE SHEET METAL TRADE AT THE SITE IN THE LOCATION WHERE THEY ARE REQUIRED FOR INSTALLATION AS PART OF THE SHEET METAL WORK. ENSURE THAT EACH DAMPER IS CORRECTLY LOCATED AND MOUNTED.

B. PROVIDE LINKAGE AND OPERATORS FOR THE DAMPERS. WHEREVER POSSIBLE LOCATE DAMPER OPERATORS SO THAT THEY ARE ACCESSIBLE FROM OUTSIDE DUCT, PLENUM, AND EQUIPMENT CASINGS. BRACKET MOUNT OPERATORS ON DUCTS OR PLENUMS CLEAR OF INSULATION WHERE APPLICABLE.

C. WHERE SEQUENCE OPERATION IS INDICATED, OR WHERE MULTIPLE OPERATORS DRIVE A SERIES OF DAMPERS, PROVIDE PILOT POSITIONERS TO COUPLE THEIR ACTION.

D. ENSURE THAT DAMPERS LOCATED IN DUCTWORK OTHER THAN GALVANIZED STEEL ARE CONSTRUCTED OF TYPE 316 STAINLESS STEEL.

E. UNLESS OTHERWISE SPECIFIED, SUPPLY ALL REQUIRED AUTOMATIC CONTROL VALVES. HAND THE VALVES TO THE APPROPRIATE PIPING TRADES AT THE SITE IN THE LOCATIONS THEY ARE REQUIRED FOR INSTALLATION AS PART OF THE PIPING WORK. ENSURE THAT EACH VALVE IS PROPERLY SIZED, LOCATED AND INSTALLED.

F. PROVIDE AN OPERATOR FOR EACH VALVE WITH ON/OFF CONTROL FOR 2 POSITION, 0–10VDC OR 4–20MA FOR MODULATING FOR CONTROL. SPRING RETURN ACTUATORS ARE REQUIRED ON AS DEFINED ON THE DRAWINGS FOR FAIL SAFE OPERATION, OR AS NEEDED TO PROTECT THE EQUIPMENT, SUCH AS NORMAL CLOSED POSITION FOR OUTSIDE AIR DAMPERS.

19. <u>TRAINING</u>

A. PROVIDE MINIMUM OF (2) TRAINING SESSIONS, AND (4) HOURS FOR EACH SESSION, THROUGHOUT THE CONTRACT PERIOD. THE TRAINING WILL BE PROVIDED FOR PERSONNEL DESIGNATED BY THE OWNER.

B. THESE OBJECTIVES WILL BE DIVIDED INTO LOGICAL GROUPINGS; PARTICIPANTS MAY ATTEND ONE OR MORE OF THESE, DEPENDING ON LEVEL OF KNOWLEDGE REQUIRED:

.1 DAY–TO–DAY BAS OPERATORS

.2 BAS TROUBLESHOOTING & MAINTENANCE

C. THE INSTRUCTOR(S) SHALL BE FACTORY–TRAINED AND EXPERIENCED IN TEACHING THIS TECHNICAL MATERIAL.

D. TRAINING WILL BEGIN WHEN THE OPERATING AND MAINTENANCE MANUALS HAVE BEEN DELIVERED TO THE OWNER OR REVIEWED BY THE ENGINEER'S REPRESENTATIVE.

E. BUILDING WALK THROUGH AND LOCATION OF CONTROL DEVICES

F. OPERATING PROCEDURES

G. MAINTENANCE PROCEDURES

H. TROUBLE–SHOOTING PROCEDURES

I. SPARE PARTS REQUIRED

J. PROJECT RECORD DOCUMENTS: UPON COMPLETION OF INSTALLATION, SUBMIT AN ELECTRONIC COPY. THE DOCUMENTS SHALL BE SUBMITTED FOR APPROVAL PRIOR TO FINAL COMPLETION AND INCLUDE:

.1 PROJECT RECORD DRAWINGS – THESE SHALL BE AS–BUILT VERSIONS OF THE SUBMITTAL SHOP DRAWINGS. ONE SET OF ELECTRONIC MEDIA .PDF DRAWING FILES SHALL BE PROVIDED.

.2 TESTING AND COMMISSIONING REPORTS AND CHECKLISTS SIGNED OFF BY TRAINED FACTORY (EQUIPMENT MANUFACTURERS) AND FIELD (BAS) COMMISSIONING PERSONNEL.

20. <u>OPERATING AND MAINTENANCE (O & M) MANUALS</u>

A. THESE SHALL BE AS–BUILT VERSIONS OF THE SUBMITTAL PRODUCT DATA. IN ADDITION TO THE INFORMATION REQUIRED FOR THE SUBMITTALS, OPERATING & MAINTENANCE MANUAL SHALL INCLUDE:

.1 24–HOUR/7–DAY PER WEEK EMERGENCY SERVICE TELEPHONE NUMBERS OF CONTRACTOR SERVICE DEPARTMENT ALONG WITH NAMES, ADDRESS OF SERVICE PERSONNEL RESPONSIBLE FOR SUPPORTING THE ONGOING WARRANTY AND SERVICES OF THE CONTROL SYSTEM.

.2 PREVENTATIVE MAINTENANCE AND CALIBRATION PROCEDURES; HARDWARE TROUBLESHOOTING; AND HARDWARE REPAIR AND/OR REPLACEMENT PROCEDURES.

.3 ONE SET OF ELECTRONIC MEDIA CONTAINING FILES OF ALL OPERATOR COLOR GRAPHIC SCREENS FOR THE PROJECT.

.4 LOCAL SUPPLY STORE SHOULD HAVE A MINIMUM 3 UNIT CONTROLLERS, SYSTEM CONTROLLERS, AND ROOM SENSORS AVAILABLE FOR SAME DAY PURCHASE.

.5 DOCUMENTATION, INSTALLATION, AND MAINTENANCE INFORMATION FOR ALL THIRD PARTY HARDWARE/SOFTWARE PRODUCTS PROVIDED INCLUDING PERSONAL COMPUTERS, PRINTERS, HUBS, SENSORS, VALVES, ETC.

.6 ORIGINAL ISSUE MEDIA FOR ALL SOFTWARE PROVIDED, INCLUDING OPERATING SYSTEMS, PROGRAMMING LANGUAGE, OPERATOR WORKSTATION SOFTWARE, AND GRAPHICS SOFTWARE.

.7 LICENSES, GUARANTEE, AND WARRANTY DOCUMENTS FOR ALL EQUIPMENT AND SYSTEMS.

.8 RECOMMENDED PREVENTIVE MAINTENANCE PROCEDURES FOR ALL SYSTEM COMPONENTS INCLUDING A SCHEDULE OF TASKS (INSPECTION, CLEANING, CALIBRATION, ETC.) AND TASK DESCRIPTIONS.

21. <u>SEQUENCE OF OEPRATIONS</u>

21.6 <u>BOILER (B–1, B–2, B–3)</u>

A. RUN CONDITIONS:

THE BOILER SYSTEM SHALL BE ENABLED TO RUN WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).

TO PREVENT SHORT CYCLING, THE BOILER SYSTEM SHALL RUN FOR AND BE OFF FOR MINIMUM ADJUSTABLE TIMES (BOTH USER DEFINABLE), UNLESS SHUTDOWN ON SAFETIES OR OUTSIDE AIR CONDITIONS.

EACH BOILER SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.

THE BOILER SYSTEM SHALL ALSO RUN FOR FREEZE PROTECTION WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 38°F (ADJ.)

B. BOILER SAFETIES:

THE FOLLOWING SAFETIES SHALL BE MONITORED FOR EACH BOILER:

- BOILER ALARM.
- LOW WATER LEVEL.

C. BOILER PRIMARY PUMP:

EACH BOILER PRIMARY HOT WATER PUMP SHALL RUN ANYTIME THE RESPECTIVE BOILER IS CALLED TO RUN AND SHALL HAVE A USER DEFINABLE DELAY (ADJ.) ON STOP.

D. BOILER ENABLE:

EACH BOILER SHALL BE ENABLED WHEN THE BOILER SYSTEM IS COMMANDED ON. THE BOILER SHALL BE ENABLED AFTER PUMP STATUS IS PROVEN ON AND SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.

E. HOT WATER SUPPLY TEMPERATURE SETPOINT RESET:

THE HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL RESET BASED ON OUTSIDE AIR TEMPERATURE. AS OUTSIDE AIR TEMPERATURE RISES FROM 0°F (ADJ.) TO 70°F (ADJ.) THE HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL RESET DOWNWARDS BY SUBTRACTING FROM 0°F (ADJ.) UP TO 20°F (ADJ.) FROM THE CURRENT BOILER SETPOINT.

F. PRIMARY HOT WATER TEMPERATURE MONITORING:

THE FOLLOWING TEMPERATURES SHALL BE MONITORED:

- PRIMARY HOT WATER SUPPLY.
- PRIMARY HOT WATER RETURN.

BOILER STAGING:

THE CONTROLLER SHALL DETERMINE THE FACILITY HEATING LOAD AND SHALL STAGE THE BOILERS ON IN SEQUENCE TO MEET RISING HEATING DEMAND AND PRIMARY HOT WATER SUPPLY TEMPERATURE WHERE:

- LOAD (MBTU/H) = [HWS TEMP (DEGREES F) – HWR TEMP (DEGREES F)] X FLOW (GPM) X 0.5
- UNITS SHALL BE CONVERTED AS REQUIRED TO REFLECT ACTUAL SYSTEM OF UNITS USED (METRIC OR ENGLISH)

THE CONTROLLER SHALL DETERMINE THE FACILITY HEATING LOAD FROM:

CONTROLS & INSTRUMENTATION SPEC.

- HWS FLOW
- HWS TEMPERATURE
- HWR TEMPERATURE

THE LEAD BOILER TRAIN SHALL RUN ANYTIME THE BOILER MANAGER IS ENABLED. ADDITIONAL BOILERS SHALL STAGE ON AS FOLLOWS. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

- SECOND BOILER:

G. STAGE ON IF HOT WATER SUPPLY TEMPERATURE DROPS BELOW SETPOINT BY 10°F (ADJ.)

STAGE OFF IF HOT WATER SUPPLY TEMPERATURE RISES ABOVE SETPOINT BY 20°F (ADJ.)

- THIRD BOILER:

H. STAGE ON IF HOT WATER SUPPLY TEMPERATURE DROPS BELOW SETPOINT BY 10°F (ADJ.)

STAGE OFF IF HOT WATER SUPPLY TEMPERATURE RISES ABOVE SETPOINT BY 20°F (ADJ.)

THE BOILER STAGING ORDER SHALL BE USER DEFINABLE. THE DESIGNATED LEAD BOILER SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):

- MANUALLY THROUGH A SOFTWARE SWITCH
- IF BOILER RUNTIME (ADJ.) IS EXCEEDED
- DAILY
- WEEKLY
- MONTHLY

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- BOILER ALARM (TYP. OF 3).
- LOW WATER LEVEL ALARM.
- BOILER HOT WATER PUMP FAILURE (TYP. OF 3): COMMANDED ON, BUT THE STATUS IS OFF.
- BOILER HOT WATER PUMP RUNNING IN HAND (TYP. OF 3): COMMANDED OFF, BUT THE STATUS IS ON.
- BOILER HOT WATER PUMP RUNTIME EXCEEDED (TYP. OF 3): STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- HIGH PRIMARY HOT WATER SUPPLY TEMP: IF GREATER THAN 200°F (ADJ.).
- LOW PRIMARY HOT WATER SUPPLY TEMP: IF LESS THAN 120°F (ADJ.).
- BOILER FAILURE (TYP. OF 3): COMMANDED ON, BUT THE STATUS IS OFF.
- BOILER RUNNING IN HAND (TYP. OF 3): COMMANDED OFF, BUT THE STATUS IS ON.
- BOILER RUNTIME EXCEEDED (TYP. OF 3): STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.

21.8 <u>SYSTEM PUMPS (P–1, P–2, P–3, P–4, P–5, P–6)</u>

A. RUN CONDITIONS:

THE HOT WATER PUMPS SHALL BE ENABLED WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 54°F (ADJ.).

THE PUMPS SHALL RUN FOR FREEZE PROTECTION ANYTIME OUTSIDE AIR TEMPERATURE IS LESS THAN 38°F (ADJ.).

TO PREVENT SHORT CYCLING, THE PUMPS SHALL RUN FOR AND BE OFF FOR MINIMUM ADJUSTABLE TIMES (BOTH USER DEFINABLE).

B. LEAD/LAG OPERATION:

THE FOLLOWING SETS OF PUMPS SHALL BE GROUPED TOGETHER TO HAVE LEAD/LAG OPERATION:

- P–1 AND P–2
- P–3 AND P–4
- P–5 AND P–6

THE ABOVE GROUPED HOT WATER PUMPS SHALL OPERATE IN A LEAD/LAG FASHION.

- THE LEAD PUMP SHALL RUN FIRST.
- ON FAILURE OF THE LEAD PUMP, THE LAG PUMP SHALL RUN AND THE LEAD PUMP SHALL TURN OFF.
- ON DECREASING HOT WATER DIFFERENTIAL PRESSURE, THE LAG PUMP SHALL STAGE ON AND RUN IN UNISON WITH THE LEAD PUMP TO MAINTAIN HOT WATER DIFFERENTIAL PRESSURE SETPOINT.

THE DESIGNATED LEAD PUMP SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):

- MANUALLY THROUGH A SOFTWARE SWITCH
- IF PUMP RUNTIME (ADJ.) IS EXCEEDED
- DAILY
- WEEKLY
- MONTHLY

(P–1, P–2) HOT WATER DIFFERENTIAL PRESSURE CONTROL:

THE CONTROLLER SHALL MEASURE HOT WATER DIFFERENTIAL PRESSURE AND MODULATE THE HOT WATER PUMP VFDS IN SEQUENCE TO MAINTAIN ITS HOT WATER DIFFERENTIAL PRESSURE SETPOINT.

THE FOLLOWING SETPOINTS ARE RECOMMENDED VALUES. ALL SETPOINTS SHALL BE FIELD MEASURED BY THE TESTING, ADJUSTING AND BALANCING CONTRACTOR AND ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE REQUIREMENTS OF ACTUAL FIELD CONDITIONS.

THE CONTROLLER SHALL MODULATE HOT WATER PUMP SPEEDS TO MAINTAIN A HOT WATER DIFFERENTIAL PRESSURE OF 12LBF/IN2 (ADJ.). THE VFDS MINIMUM SPEED SHALL NOT DROP BELOW 30% (ADJ.).

ON DROPPING HOT WATER DIFFERENTIAL PRESSURE, THE VFDS SHALL STAGE ON AND RUN TO MAINTAIN SETPOINT AS FOLLOWS:

- THE CONTROLLER SHALL MODULATE THE LEAD VFD TO MAINTAIN SETPOINT.
- IF THE LEAD VFD SPEED IS GREATER THAN A SETPOINT OF 90% (ADJ.), THE LAG VFD SHALL STAGE ON.
- THE LAG VFD SHALL RAMP UP TO MATCH THE LEAD VFD SPEED AND THEN RUN IN UNISON WITH THE LEAD VFD TO MAINTAIN SETPOINT.

ON RISING HOT WATER DIFFERENTIAL PRESSURE, THE VFDS SHALL STAGE OFF AS FOLLOWS:

- IF THE VFDS SPEEDS DROPS BACK TO 60% (ADJ.) BELOW SETPOINT, THE LAG VFD SHALL STAGE OFF.
- THE LEAD VFD SHALL CONTINUE TO RUN TO MAINTAIN SETPOINT.

P–3/P–4 AND P–5/P–6 OPERATION:

THE ABOVE GROUPS OF PUMPS SHALL RUN ANYTIME THE PUMPS ARE COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE PUMPS SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME AND OPERATE AT CONSTANT VOLUMETRIC FLOWRATE.

C. HOT WATER TEMPERATURE MONITORING:

THE FOLLOWING TEMPERATURES SHALL BE MONITORED:

- HOT WATER SUPPLY.
- HOT WATER RETURN.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HOT WATER PUMP (P–1, P–3, P–5)
- FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD FAULT.
- HOT WATER PUMP (P–2, P–4, P–6)

CONTROLS & INSTRUMENTATION SPEC.

- FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD FAULT.
- HIGH HOT WATER DIFFERENTIAL PRESSURE: IF 25% (ADJ.) GREATER THAN SETPOINT.
- LOW HOT WATER DIFFERENTIAL PRESSURE: IF 25% (ADJ.) LESS THAN SETPOINT.
- HIGH HOT WATER SUPPLY TEMP: IF THE HOT WATER SUPPLY TEMPERATURE IS GREATER THAN 200°F (ADJ.).
- LOW HOT WATER SUPPLY TEMP: IF THE HOT WATER SUPPLY TEMPERATURE IS LESS THAN 120°F (ADJ.).

1. ISSUED FOR TENDER 25.03.21

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr,
Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
Canada

www.exp.com

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TRUE NORTH:

DRAWING TITLE:
Mechanical Specifications

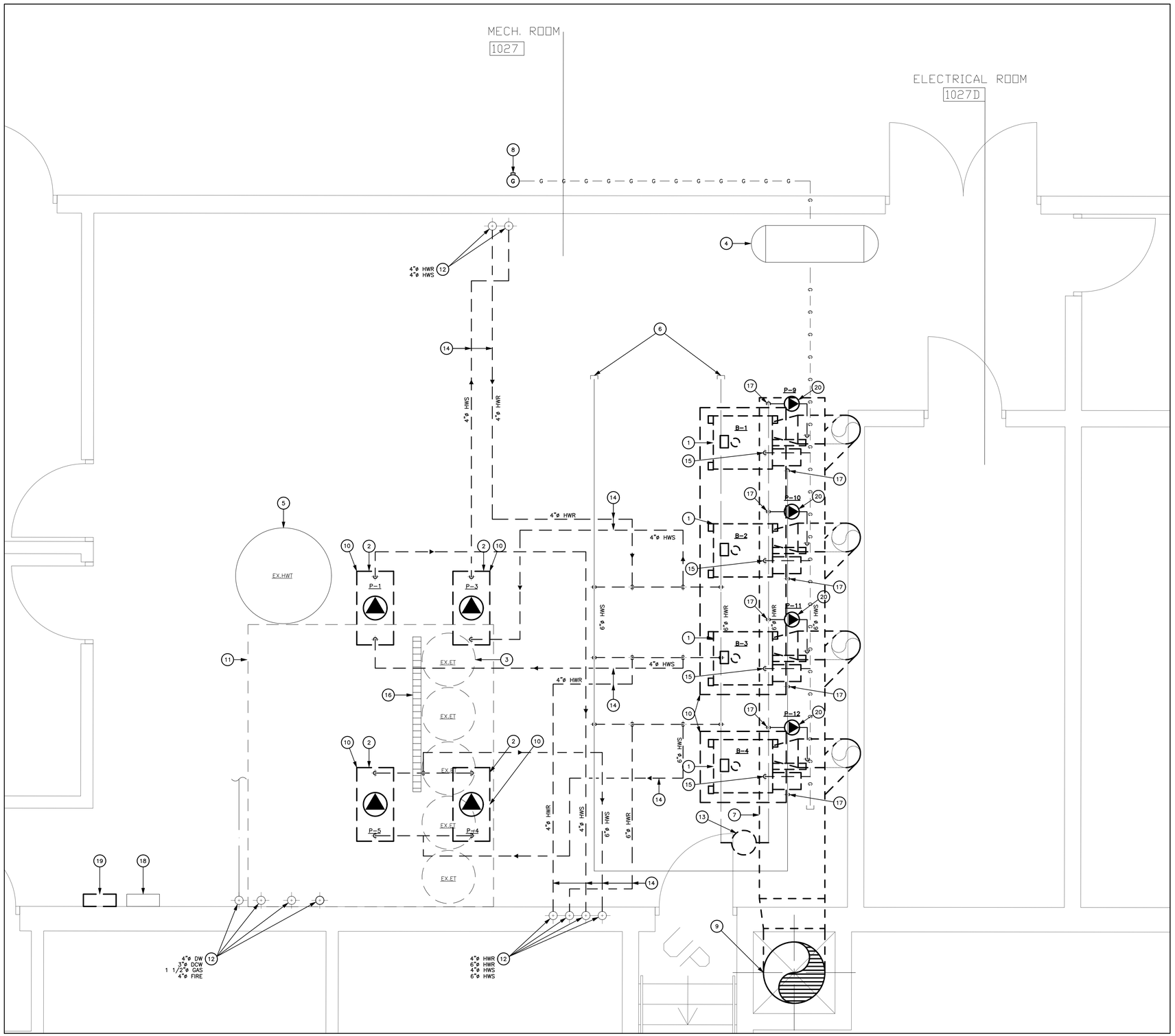
SCALE:
AS NOTED

DRAWN:
J.L.

DATE:
SEPTEMBER 2023

PROJECT #:
ALL–23010629–A0

DRAWING #:
M0.4



DEMOLITION BOILER ROOM GROUND FLOOR PLAN

SCALE– 1/2" = 1'–0"

DRAWING NOTES

1. DEMOLISH AND DISPOSE OF EXISTING BOILER AND CIRCULATION PUMP. REMOVE AND DISPOSE OF PIPING BACK TO MAIN HEADER, DEMOLISH VENTING AND COMBUSTION AIR INTAKE. DISCONNECT ALL CONTROL WIRING. REFER TO MECHANICAL SCHEMATICS.
2. DEMOLISH AND DISPOSE OF EXISTING HORIZONTAL BOILER SYSTEM PUMPS. PROVIDE CAPPED CONNECTION AND PREPARE PIPING FOR INSTALLATION OF NEW VERTICAL INLINE SYSTEM PUMPS.
3. EXISTING EXPANSION TANKS ON MEZZANINE LEVEL TO REMAIN.
4. EXISTING AIR COMPRESSOR TO REMAIN.
5. EXISTING DOMESTIC HOT WATER HEATER TO REMAIN
6. EXISTING HOT WATER SUPPLY AND RETURN HEADERS TO REMAIN AND BE REUSED.
7. EXISTING STAINLESS STEEL LINED CHIMNEY SERVING BOILERS IS TO BE REMOVED AND DISPOSED OF.
8. EXISTING GAS METER ON BUILDING EXTERIOR. CONTRACTOR IS TO COORDINATE WITH THE UTILITY AND OWNER FOR ALL SERVICE INTERRUPTIONS.
9. DEMOLISH AND DISPOSE OF EXISTING CHIMNEY VENTING. VENTING CONTINUES UP TO HIGH ROOF ABOVE AND TERMINATES AT 15' ABOVE FINISHED ROOF.
10. DEMOLISH EXISTING CONCRETE HOUSEKEEPING PAD SERVICING EXISTING MECHANICAL EQUIPMENT.
11. OUTLINE OF EXISTING EQUIPMENT MEZZANINE.
12. EXISTING PIPING TO REMAIN SIZE AND SERVICE AS INDICATED.
13. DEMOLISH EXISTING AIR SEPARATOR PROVIDE TEMPORARY TAPPED CONNECTIONS.
14. DEMOLISH EXISTING HYDRONIC PIPING TO EXTENT SHOWN. PROVIDE TEMPORARY CAPPED CONNECTION AT MAINS.
15. DISCONNECT NATURAL GAS PIPING BACK TO MAIN DISTRIBUTION HEADER WITHIN MECHANICAL ROOM.
16. EXISTING TRENCH DRAIN TO REMAIN.
17. DEMOLISH BOILER CONNECTION BACK TO PRIMARY HEADER AND PROVIDE CAPPED CONNECTION.
18. EXISTING BAS PANEL TO BE RE–USED TO INTERFACE NEW MECHANICAL EQUIPMENT.
19. DEMOLISH AND DISPOSE OF EXISTING BOILER CONTROL PANEL. REMOVE EXISTING CONDUIT.
20. DEMOLISH AND DISPOSE OF EXISTING BOILER CIRCULATION PUMP AND ASSOCIATED BRANCH PIPING.

GENERAL NOTES

A) THE EXISTING SERVICES SHOWN ON THIS DRAWING HAVE BEEN TAKEN FROM THE ORIGINAL AS–BUILT DRAWINGS. THIS INFORMATION MUST NOT BE ASSUMED TO BE COMPLETE OR UP–TO–DATE. THE MECHANICAL CONTRACTOR SHALL CARRY OUT A FULL SURVEY OF ALL EXISTING SERVICES AND STRUCTURE TO CONFIRM THE SIZE AND LOCATION OF THESE SERVICES, BEFORE THE COMMENCEMENT OF ANY WORK.

B) ALL DISCONNECTED DUCTWORK AND PIPING TO BE CAPPED OFF UNLESS OTHERWISE NOTED

C) ALL CUTTING AND PATCHING OF EXISTING ROOF, FLOORS AND WALLS TO BE BY MECHANICAL CONTRACTOR

D) FOR DRAWING LEGENDS SEE DRAWING M0.0

E) ALL DEMOLITION WORK SHALL BE DONE VIA PIPE FREEZING. THE EXISTING HEATING SYSTEM SHALL NOT BE DRAINED DOWN.

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY

TRUE NORTH:

DRAWING TITLE:
Demolition Boiler Room Ground Floor Plan

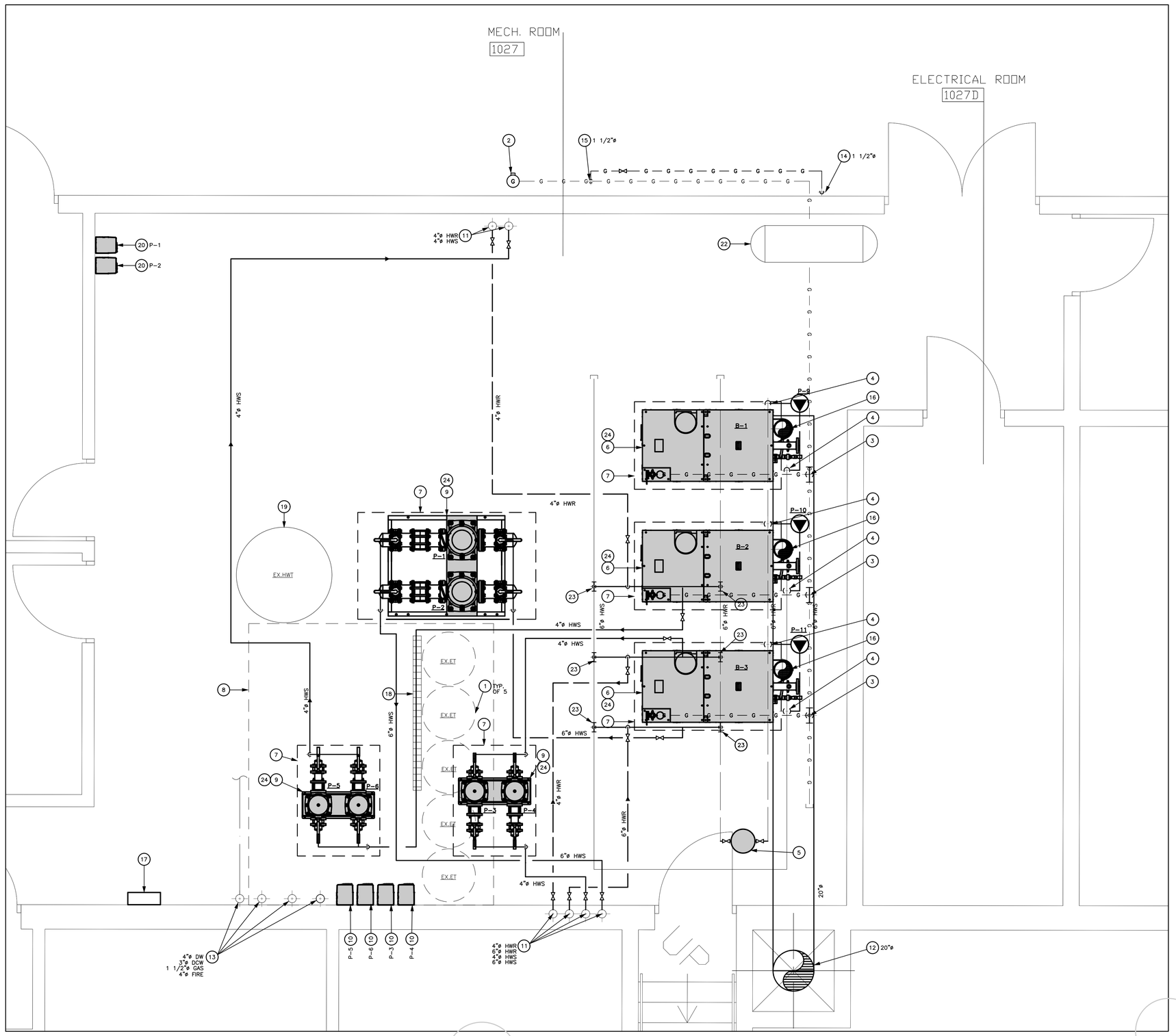
SCALE:
AS NOTED

DRAWN:
C.M. / J.L.

DATE:
SEPTEMBER 2023

PROJECT #:
ALL–23010629–A0

DRAWING #:
M1.0



PROPOSED BOILER ROOM GROUND FLOOR PLAN

SCALE– 1/2" = 1'–0"

DRAWING NOTES

1. EXISTING EXPANSION TANKS TO REMAIN.
2. EXISTING GAS METER ON BUILDING EXTERIOR. CONTRACTOR IS TO COORDINATE WITH THE UTILITY AND OWNER FOR ALL SERVICE INTERRUPTIONS.
3. CONNECT TO EXISTING GAS LINE AT APPROXIMATE LOCATION INDICATED. PROVIDE GAS VALVE AND DIRT LEG. REFER TO SCHEMATICS FOR PIPE SIZES AND CONNECTION DETAILS.
4. CONNECT TO EXISTING HOT WATER RETURN AND SUPPLY HEADERS. PROVIDE ALL NECESSARY PIPE TRANSITIONS TO CONNECT FROM NEW 4"ø BOILER PIPING TO EXISTING 6"ø HEADERS.
5. INSTALL NEW AMTROL 6–ASL HYRDRONIC AIR SEPARATOR OR EQUIVALENT WITHIN EXISTING RETURN PIPING.
6. INSTALL NEW BOILERS AS PER MANUFACTURERS INSTRUCTIONS. EQUIPMENT TO BE MOUNTED ON NEW 4" CONCRETE HOUSE KEEPING PAD. REFER TO M3.0 FOR PIPING SCHEMATIC.
7. PROVIDE NEW 4" THICK CONCRETE HOUSE KEEPING PAD.
8. OUTLINE OF EXISTING EQUIPMENT MEZZANINE.
9. INSTALL PACKAGED PUMP SKID AS PER MANUFACTURERS INSTRUCTION ON NEW HOUSEKEEPING PAD. PROVIDE ALL PIPE TRANSITIONS NEEDED TO SKID MANIFOLD. COMPLETE ALL REQUIRED WIRING BACK TO CORRESPONDING VFD. REFER TO M3.0 FOR PIPING SCHEMATIC.
10. INSTALL NEW PUMP VFD ON WALL SECURED TIGHT AS REQUIRED. PROVIDE ALL REQUIRED WIRING BACK TO MAIN PUMP INDICATED.
11. CONNECT TO EXISTING PIPE AT APPROXIMATE LOCATION INDICATED.
12. VENTING CONTINUES UP EXISTING CHIMNEY STRUCTURE AND TERMINATES AT 15' ABOVE ROOF LEVEL.
13. EXISTING PIPING TO BE PROTECTED DURING CONSTRUCTION.
14. GAS LINE CONTINUES UP TO ROOF ABOVE. REFER TO M0.2 AND M2.3 FOR CONTINUATIONS.
15. CONNECT NEW GAS PIPE SERVING NEW ERV AND RTUs TO EXISTING GAS TRAIN. COORDINATE WITH THE UTILITY FOR ALL SERVICE INTERRUPTIONS.
16. 8"ø VENT CONNECTION ON BOILER CONTINUES UP TO 20" COMMON VENT. REFER TO SPECIFICATION FOR ADDITIONAL DETAILS.
17. EXPAND EXISTING BUILDING CONTROL PANEL AS REQUIRED TO CONNECT ALL NEW EQUIPMENT TO CONTROLLER TO SUIT NEW SEQUENCES AND POINTS.
18. EXISTING TRENCH DRAIN TO REMAIN.
19. EXISTING HOT WATER TANK TO REMAIN.
20. INSTALL NEW PUMP VFD ON WALL. COMPLETE ALL REQUIRED WIRING BACK TO MAIN PUMP SKID INDICATED.
21. (N O T U S E D)
22. EXISTING AIR COMPRESSOR TO REMAIN.
23. CONNECT NEW HOT WATER SUPPLY AND RETURN TO EXISTING MAIN HEADER.
24. EXISTING HYDRONIC SYSTEM IS TO BE FLUSHED PRIOR TO COMMISSIONING. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH AQUARIAN CHEMICALS INC FOR WATER CHEMICAL TREATMENT. (MCESA@AQUARIANCHEMICALS.COM, P: 416–540–1883) PROVIDE PRE–START UP AND START UP REPORT.

GENERAL NOTES

A) FOR EXACT LOCATION OF GRILLES AND DIFFUSERS REFER TO ARCHITECTURAL REFLECTED CEILING PLAN.

B) ALL DUCTWORK AND EQUIPMENT TO BE CONCEALED IN CEILING SPACE UNLESS NOTED OTHERWISE.

C) DUCT RUNOUTS TO MATCH GRILLE/DIFFUSER SIZE UNLESS OTHERWISE NOTED.

D) DUCTWORK LOCATIONS TO BE FULLY CO–ORDINATED WITH GENERAL, PLUMBING, SPRINKLER AND ELECTRICAL CONTRACTORS PRIOR TO FABRICATION OR INSTALLATION.

E) FOR DRAWING LEGENDS SEE DRAWING M–1.

F) ALL DEMOLITION WORK SHALL BE DONE VIA PIPE FREEZING. THE EXISTING HEATING SYSTEM SHALL NOT BE DRAINED DOWN.

1. ISSUED FOR TENDER 25.03.21

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr, Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
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TRUE NORTH:

DRAWING TITLE:
Proposed Boiler Room Ground Floor Plan

SCALE:
AS NOTED

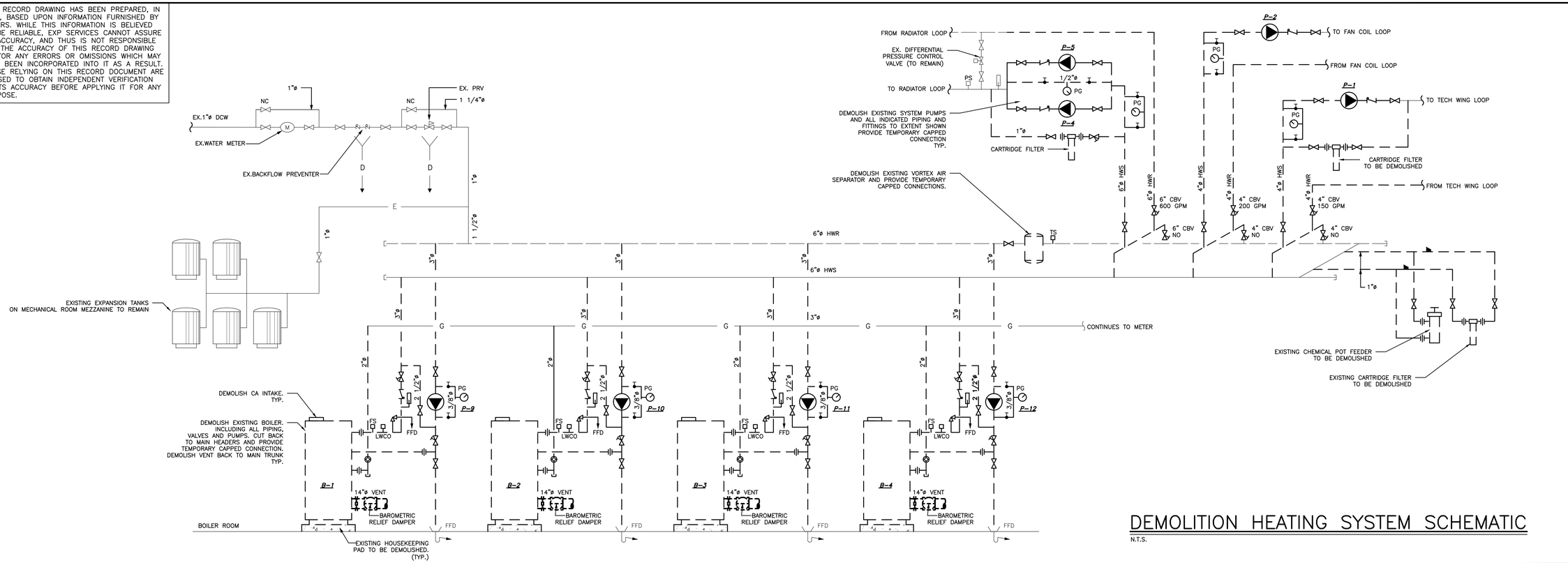
DRAWN:
C.M. / J.L.

DATE:
SEPTEMBER 2023

PROJECT #:
ALL–23010629–A0

DRAWING #:
M2.0

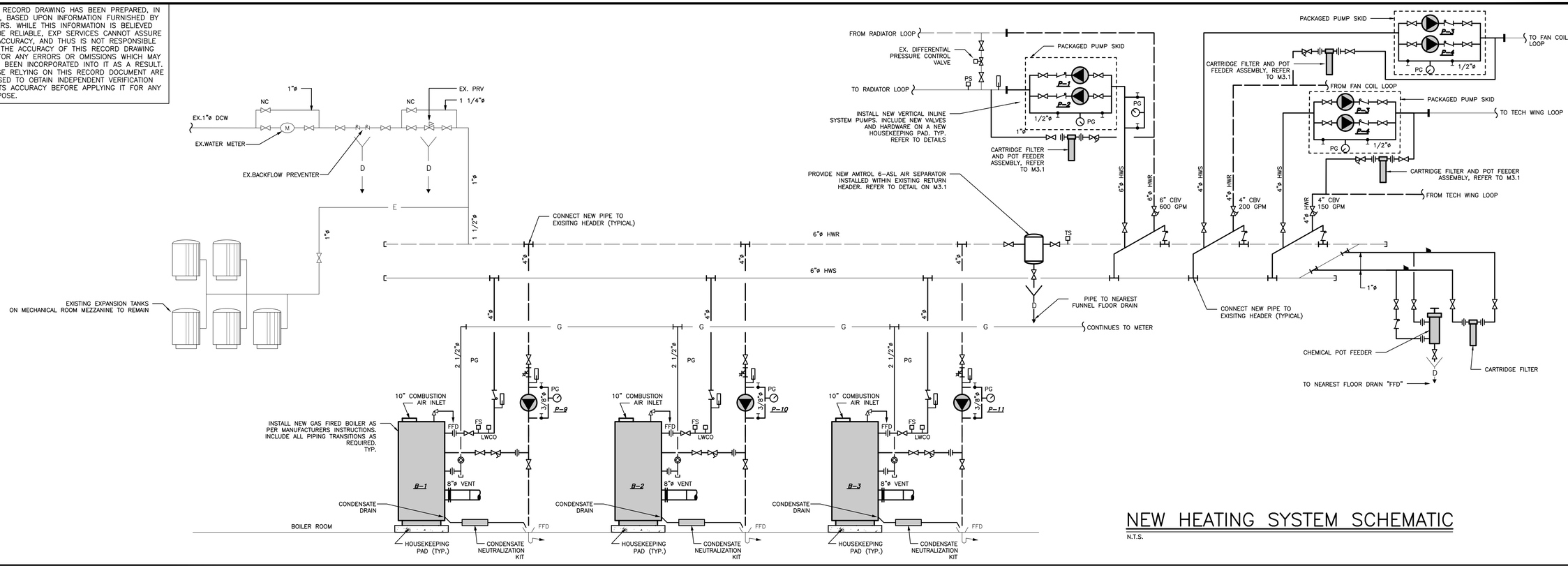
THIS RECORD DRAWING HAS BEEN PREPARED, IN PART, BASED UPON INFORMATION FURNISHED BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, EXP SERVICES CANNOT ASSURE ITS ACCURACY, AND THUS IS NOT RESPONSIBLE FOR THE ACCURACY OF THIS RECORD DRAWING OR FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO IT AS A RESULT. THOSE RELYING ON THIS RECORD DOCUMENT ARE ADVISED TO OBTAIN INDEPENDENT VERIFICATION OF ITS ACCURACY BEFORE APPLYING IT FOR ANY PURPOSE.



DEMOLITION HEATING SYSTEM SCHEMATIC

N.T.S.

THIS RECORD DRAWING HAS BEEN PREPARED, IN PART, BASED UPON INFORMATION FURNISHED BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, EXP SERVICES CANNOT ASSURE ITS ACCURACY, AND THUS IS NOT RESPONSIBLE FOR THE ACCURACY OF THIS RECORD DRAWING OR FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO IT AS A RESULT. THOSE RELYING ON THIS RECORD DOCUMENT ARE ADVISED TO OBTAIN INDEPENDENT VERIFICATION OF ITS ACCURACY BEFORE APPLYING IT FOR ANY PURPOSE.



NEW HEATING SYSTEM SCHEMATIC

N.T.S.

THESE DRAWINGS ARE NOT TO BE SCALED

THE CONTRACTOR MUST FIELD VERIFY ALL DIMENSIONS AND MUST CONFIRM & CORRELATE ALL DETAILS WITHIN THE FULL DRAWING PACKAGE BEING RESPONSIBLE FOR SAME THROUGHOUT CONSTRUCTION, REPORTING ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO COMMENCING THE RELEVANT WORK

ALL DRAWINGS, DETAILS & SPECIFICATIONS REPRESENTED IN THE DRAWINGS ARE TO BE USED FOR CONSTRUCTION ONLY WHEN ISSUED BY THE ARCHITECT AND NOTED ACCORDINGLY IN THE "ISSUE/REVISIONS" BOX HEREON.

1. ISSUED FOR TENDER 25.03.21

PROJECT:
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For the HWDSB

SEAL:

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t: 905.525.6069 | f: 905.528.7310
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ON L8E 5R9
Canada
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TRUE NORTH:

DRAWING TITLE:
Mechanical Details & Schedules

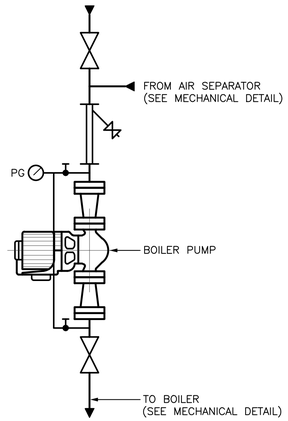
SCALE:
AS NOTED

DRAWN:
J.L.

DATE:
SEPTEMBER 2023

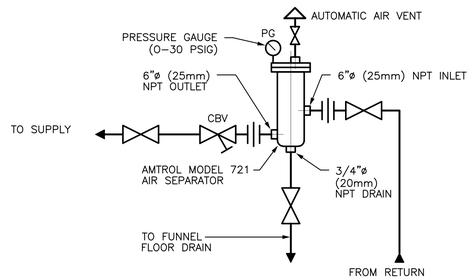
PROJECT #:
ALL-23010629-A0

DRAWING #:
M3.0



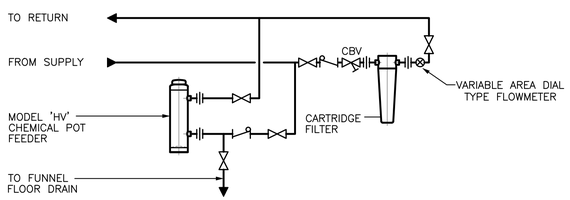
BOILER IN-LINE CIRCULATING PUMP

N.T.S.



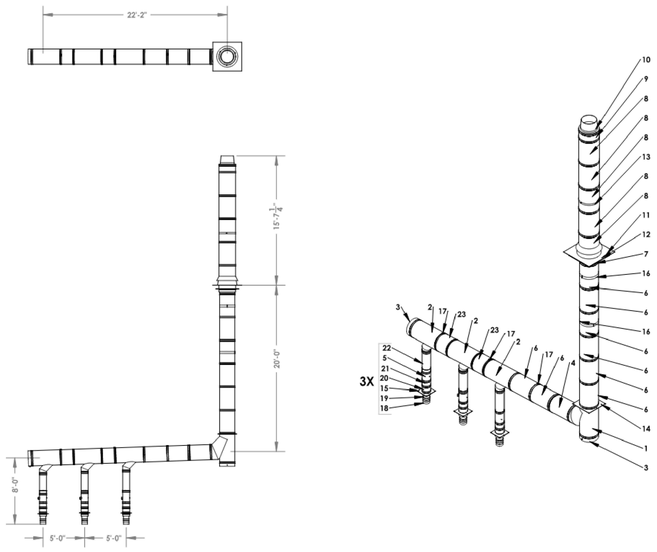
AIR SEPARATOR SCHEMATIC

N.T.S.



TYPE 'HV' CHEMICAL FEEDER SCHEMATIC PIPING AND BY-PASS FILTER

N.T.S.



NOTES:
1. EXACT BOILER VENTING DIMENSIONS ARE TO BE FINALIZED BASED ON SITE CONDITIONS AND SITE MEASUREMENTS.
2. REFER TO MECHANICAL SPECIFICATIONS FOR ADDITIONAL DETAIL AND BOILER MANUFACTURER CONTACT INFORMATION.

BOILER VENTING SCHEMATIC

N.T.S.

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t: 905.525.6069 | f: 905.528.7310
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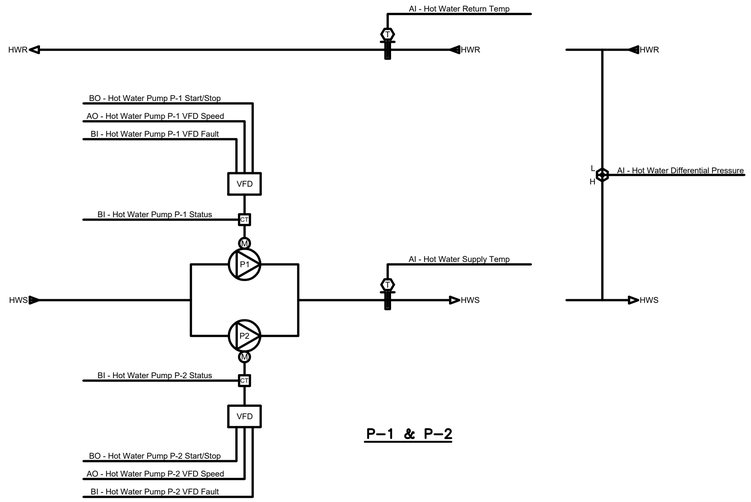
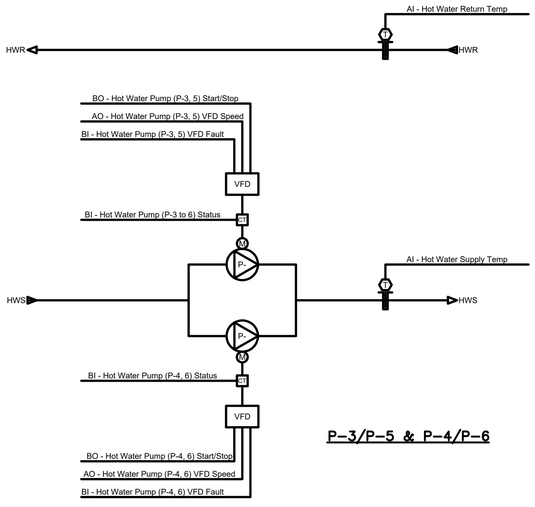
TRUE NORTH:

DRAWING TITLE:
Mechanical Details & Schedules

SCALE: AS NOTED
DRAWN: J.L.
DATE: SEPTEMBER 2023
PROJECT #: ALL-23010629-A0
DRAWING #: M3.1



P–1 & P–2

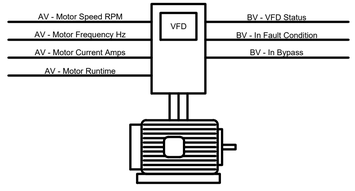


P–3/P–5 & P–4/P–6

POINT NAME	HARDWARE POINTS	SOFTWARE POINTS	TREND	ALARM	SHOW ON GRAPHIC
HOT WATER DIFFERENTIAL PRESSURE	AI	-	Y	N	Y
HOT WATER RETURN TEMP	AI	-	Y	N	Y
HOT WATER SUPPLY TEMP	AI	-	Y	N	Y
HOT WATER PUMP (P-1 TO P-6) VFD SPEED	AO	-	Y	N	Y
HOT WATER PUMP (P-1 TO P-6) STATUS	BI	-	Y	N	Y
HOT WATER PUMP (P-1 TO P-6) VFD FAULT	BI	-	N	Y	Y
HOT WATER PUMP (P-1 TO P-6) START/STOP	BO	-	Y	N	Y
HOT WATER DIFFERENTIAL PRESSURE SETPOINT	-	AV	N	N	Y
OUTSIDE AIR TEMP	-	AV	N	N	Y
HIGH HOT WATER DIFFERENTIAL PRESSURE	-	-	N	Y	N
HIGH HOT WATER SUPPLY TEMP	-	-	N	Y	N
HOT WATER PUMP (P-1 TO P-6) FAILURE	-	-	N	Y	N
HOT WATER PUMP (P-1 TO P-6) RUNNING IN HAND	-	-	N	Y	N
HOT WATER PUMP (P-1 TO P-6) RUNTIME EXCEEDED	-	-	N	Y	N
LOW HOT WATER DIFFERENTIAL PRESSURE	-	-	N	Y	N
LOW HOT WATER SUPPLY TEMP	-	-	N	Y	N

SYSTEM PUMP CONTROL SCHEMATIC

N.T.S.



1. VARIABLE FREQUENCY DRIVE INTERFACE (TYPICAL FOR ERVS, RTUS, PUMPS)VFD INTERFACE MONITOR:

   CURRENT VFD STATUS AND OPERATING CONDITIONS SHALL BE MONITORED THROUGH ITS COMMUNICATIONS INTERFACE PORT. THE INTERFACE SHALL MONITOR AND TREND THE POINTS AS SHOWN ON THE POINTS LIST.

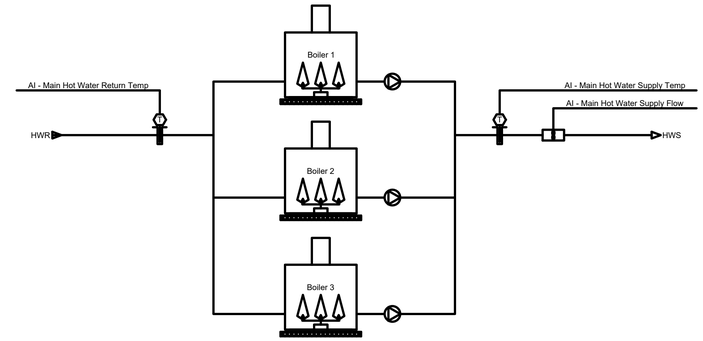
2. THIS VARIABLE FREQUENCY DRIVE (VFD) INTERFACE SCHEMATIC MAY NOT REFLECT THE ACTUAL SENSORS AND POINTS AS SUPPLIED BY THE VFD MANUFACTURER. ALL INTERFACE POINTS SHALL BE COORDINATED WITH THE VFD SUPPLIER.

POINT NAME	SOFTWARE POINTS	TREND	ALARM	SHOW ON GRAPHIC
MOTOR CURRENT AMPS	AV	Y	N	Y
MOTOR FREQUENCY HERTZ	AV	Y	N	Y
MOTOR RUNTIME	AV	N	N	Y
MOTOR SPEED RPM	AV	Y	N	Y
IN BYPASS	BV	Y	Y	Y
IN FAULT CONDITION	BV	Y	Y	Y
VFD STATUS	BV	Y	N	Y

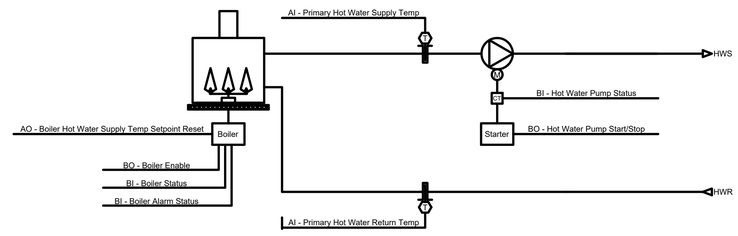
VARIABLE SPEED DRIVE SCHEMATIC

N.T.S.

The boiler manager calls each boiler to run based on load. See individual boiler schematics for specific points.



Individual boiler control (Typical of 3.)



POINT NAME	HARD-WARE POINTS	SOFT-WARE POINTS	TREND	ALARM	SHOW ON GRAPHIC
PRIMARY HOT WATER RETURN TEMP	AI	-	Y	N	Y
PRIMARY HOT WATER SUPPLY TEMP	AI	-	Y	N	Y
BOILER HOT WATER SUPPLY TEMP SETPOINT RESET	AO	-	Y	N	Y
BOILER ALARM STATUS (TYP. OF 3)	BI	-	Y	Y	Y
BOILER STATUS (TYP. OF 3)	BI	-	Y	N	Y
HOT WATER PUMP STATUS (TYP. OF 3)	BI	-	Y	N	Y
BOILER ENABLE (TYP. OF 3)	BO	-	N	N	Y
HOT WATER PUMP START/STOP (TYP. OF 3)	BO	-	Y	N	Y
OUTSIDE AIR TEMP	-	AV	N	N	Y
BOILER FAILURE (TYP. OF 3)	-	-	N	Y	N
BOILER RUNNING IN HAND (TYP. OF 3)	-	-	N	Y	N
BOILER RUNTIME EXCEEDED (TYP. OF 3)	-	-	N	Y	N
HIGH PRIMARY HOT WATER SUPPLY TEMP	-	-	N	Y	N
LOW PRIMARY HOT WATER SUPPLY TEMP	-	-	N	Y	N
HOT WATER PUMP FAILURE (TYP. OF 3)	-	-	N	Y	N
HOT WATER PUMP RUNNING IN HAND (TYP. OF 3)	-	-	N	Y	N
HOT WATER PUMP RUNTIME EXCEEDED (TYP. OF 3)	-	-	N	Y	N

BOILER CONTROL SCHEMATIC

N.T.S.

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PROJECT:
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t: 905.525.6069 | f: 905.528.7310
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TRUE NORTH:

DRAWING TITLE:
Control Schematics

SCALE: AS NOTED
DRAWN: J.L.
DATE: SEPTEMBER 2023
PROJECT #: ALL–23010629–A0
DRAWING #: M4.0

JOB NAME:	HWDSB GLENDALE SEC SCH BOILER AHU REPLACEMENT	JOB No.	ALL-23010629-A0

MECHANICAL SCHEDULE - BOILERS

DWG. DESIGNATION	SYSTEM and ROOM	MODEL	Type	WEIGHT (LBS)	OUTPUT (MBH)	INPUT (MBH)	EFFICIENCY (%)	WATER CONDITIONS				MECHANICAL REMARKS	WIRING FOR MECHANICAL EQUIPMENT SCHEDULE						ELECTRICAL WIRING INSTRUCTIONS
								FLOW (GPM)	PD (FT)	EWT (°F)	LWT (°F)		MOTOR W or HP	MCA	MCOP	VAC/ø	ROOM STARTER TYPE	REMOTE CONTROL DEVICE	DISC. TYPE	
B-1	BOILER ROOM	PATTERSON KELLY PK SOLIS SL-2000	CONDENSING	3000	1920	2000	96%	192	5.2	180	160	CONDENSING FIRETUBE BOILER, 10:1 TURNDOWN, NURO INTEGRAL BOILER CONTROLS.	-	15	-	208V/1ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE RED PAINTED DISCONNECT AND WIRE COMPLETELY. DIV. 26 TO PROVIDE EPO SWITCH WITH COVER TO REMOTELY SHUT DOWN BOILER. ALL CONTROL WIRING BY MECHANICAL DIVISION
B-2	BOILER ROOM	PATTERSON KELLY PK SOLIS SL-2000	CONDENSING	3000	1920	2000	96%	192	5.2	180	160	CONDENSING FIRETUBE BOILER, 10:1 TURNDOWN, NURO INTEGRAL BOILER CONTROLS.	-	15	-	208V/1ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE RED PAINTED DISCONNECT AND WIRE COMPLETELY. DIV. 26 TO PROVIDE EPO SWITCH WITH COVER TO REMOTELY SHUT DOWN BOILER. ALL CONTROL WIRING BY MECHANICAL DIVISION
B-3	BOILER ROOM	PATTERSON KELLY PK SOLIS SL-2000	CONDENSING	3000	1920	2000	96%	192	5.2	180	160	CONDENSING FIRETUBE BOILER, 10:1 TURNDOWN, NURO INTEGRAL BOILER CONTROLS.	-	15	-	208V/1ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE RED PAINTED DISCONNECT AND WIRE COMPLETELY. DIV. 26 TO PROVIDE EPO SWITCH WITH COVER TO REMOTELY SHUT DOWN BOILER. ALL CONTROL WIRING BY MECHANICAL DIVISION

JOB NAME:	HWDSB GLENDALE SEC SCH BOILER AHU REPLACEMENT	JOB No.	ALL-23010629-A0

MECHANICAL SCHEDULE - PUMPS

DWG. DESIGNATION	SYSTEM and ROOM	MODEL	SPEC TYPE	FLOW (GPM)	HEAD (FT)	EFF. (%)	VFD	MECHANICAL REMARKS	WIRING FOR MECHANICAL EQUIPMENT SCHEDULE							ELECTRICAL WIRING INSTRUCTIONS
									MOTOR W or HP	MCA FLA	MCOP	VAC/ø	ROOM STARTER TYPE	REMOTE CONTROL DEVICE	DISC. TYPE	
P-1	RADIATOR LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 125-1	VP	600	105.2	78.10%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	25 HP			208/3ø	VFD (DV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-2	RADIATOR LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 125-1	VP	600	105.2	78.10%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	25 HP			208/3ø	VFD (DV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-3	FAN COIL LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 45-1	VP	250	85.2	73.40%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-4	FAN COIL LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 45-1	VP	250	85.2	73.40%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-5	TECH WING LOOP	GRUNDFOS HYDRO NP (ABB)(CUE) 2CR 45-1	VP	200	85.2	74.90%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-6	TECH WING LOOP	GRUNDFOS HYDRO NP (ABB)(CUE) 2CR 45-1	VP	200	85.2	74.90%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-9	BOILER PUMP	GRUNDFOS 40959 VL	CP	192	30	88.70%	NO	BOILER CIRCULATOR PUMP	3 HP	7.64		208/3ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-10	BOILER PUMP	GRUNDFOS 40959 VL	CP	192	30	88.70%	NO	BOILER CIRCULATOR PUMP	3 HP	7.64		208/3ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-11	BOILER PUMP	GRUNDFOS 40959 VL	CP	192	30	88.70%	NO	BOILER CIRCULATOR PUM	3 HP	7.64		208/3ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY. ALL CONTROL WIRING BY MECHANICAL DIVISION

NOTES – ELECTRICAL WIRING INSTRUCTIONS:

1. DEEMED LIFE SAFETY EQUIPMENT IE SMOKE CONTROL, AREA PRESSURIZATION ETC.
2. USE FIRE RATED CABLES FOR POWER FEEDER TO EQUIPMENT
3. USING ONE FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT FAN STARTS/RUNS BY MANUALLY SELECTING "RUN" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
4. USING ONE FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT FAN STARTS/RUNS EITHER AUTOMATICALLY ON FIRE ALARM SYSTEM ALERT OR EVAC SIGNAL, OR BY MANUALLY SELECTING "RUN" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
5. USING SECOND FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT THE FAN STOPS BY MANUALLY SELECTING THE "OFF" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
6. USING FAIM INTERLOCK WITH FIRE ALARM SYSTEM TO INDICATE FAN'S RUN/OFF STATUS AT THE CACF.
7. INTERLOCK DIRECTLY WITH DUCT DETECTOR SO THAT FAN SHUTS DOWN WHEN DETECTOR ACTUATES.
8. USING FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT FAN SHUTS DOWN ON FIRE ALARM SYSTEM ALERT OR EVAC SIGNAL.
9. PROVIDE 120 VOLT CIRCUIT AND LOCAL TOGGLE DISCONNECT SWITCH FOR BUILT-IN PREWIRED SERVICE RECEPTACLES AND/OR LIGHTS.
10. PROVIDE 2 FAIMS PER DAMPER. CONNECT ONE TO DAMPER "CLOSED" POSITION END SWITCH(ES) AND ONE TO DAMPER "OPEN" POSITION END SWITCH(ES) TO PROVIDE DAMPER POSITION STATUS SIGNAL TO FA SYSTEM. WHERE THERE ARE MULTIPLE END SWITCHES, WIRE IN SERIES TO FA INPUT MODULE. DAMPER END SWITCHES ARE SUPPLIED AND INSTALLED BY MECHANICAL DIVISION.
11. USING FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT NORMALLY CLOSED DAMPER CLOSES ON FIRE ALARM SYSTEM ALERT OR EVAC SIGNAL OR MANUALLY BY SELECTING THE "OPEN" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
12. INTERLOCK DIRECTLY WITH DUCT DETECTOR SO THAT FAN SHUTS DOWN WHEN DETECTOR ACTUATES.
13. MOUNT STARTER AT UNIT AS A DISCONNECT.
14. INTERLOCK DISCONNECT SWITCH AUXILIARY CONTACT TO VFD FOR SHUT DOWN WHEN SWITCH IS OPEN.
15. USE NEXANS "DRIVERX (CSA)" CABLES OR APPROVED EQUAL FOR POWER WIRING FROM VFD THROUGH DISCONNECT SWITCH AND ONTO MOTOR. ALL ASSOCIATED CABLE CONNECTORS SHALL BE RATED FOR CLASS II, GROUPS E, F AND G HAZARDOUS LOCATIONS.
16. PROVIDE 120VAC "VAV" JUNCTION BOXES AS INDICATED FOR USE BY MECHANICAL DIVISION TO CONNECT VAV BOX LOW VOLTAGE TRANSFORMER PRIMARY WIRING.
17. ALL SUMP PUMP MOTORS CAN OPERATE AT THE SAME TIME. CONNECT FLOAT SWITCHES (FOUR(4) PER PUMP PACKAGE) AND PUMP CABLES TO CONTROL PANEL. INSTALL HORN/LIGHT ALARM SUPPLIED BY MECHANICAL DIVISION AND WIRE TO CONTROL PANEL. CONFIRM EXACT LOCATION WITH OWNER (ALLOW 100 M RUN).
18. FEED FIRE PUMP AUTOMATIC TRANSFER SWITCH/CONTROLLER FROM BOTH NON-ESSENTIAL POWER AND ESSENTIAL POWER SUPPLIES AS INDICATED. PROVIDE SIX (6) FAIM'S AND CONNECT EACH FAIM TO ONE OF THE FOLLOWING SWITCHES/CONTACTS WITHIN CONTROLLER:
    a. "LOSS OF EXCESS WATER PRESSURE"
    b. "LOSS OF POWER"
    c. "PUMP MOTOR RUNNING"
    d. "PHASE LOSS"
    e. "PHASE REVERSAL"
    f. "CONTROLLER CONNECTED TO ESSENTIAL POWER"

    ALL FIRE ALARM CONNECTIONS ARE SUPERVISORY ZONE CONNECTIONS AS INDICATED ON PLANS.
19. WIRE PRESSURE SWITCH (PS) (LOCATED WITHIN 6 METERS) SO THAT PUMP STARTS WHEN PS IS ACTIVATED.
20. PROVIDE FAIM AND CONNECT TO CONTROLLER FOR "LOSS OF POWER" SIGNAL.
21. RUNS Nos 4, 5 AND 6 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
22. RUNS Nos 8, 9, 10 AND 11 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
23. RUNS Nos 13 AND 14 SHARE A COMMON BREAKER A COMMON CONTROLLER AND FAIM.
24. RUNS Nos 16 AND 17 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
25. RUNS Nos 18 AND 19 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
26. RUNS Nos 22 AND 23 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
27. RUNS Nos 24 AND 25 SHARE A COMMON BREAKER AND A COMMOM CONTROL THERMOSTAT.
28. PROVIDE ONE(1) CAT. 6 CABLE IN CONDUIT AND CONNECT TO NEAREST ROP LAN PATCH PANEL.
29. USING TWO (2) FACR'S, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT DAMPER OPENS BY MANUALLY SELECTING THE "OPEN" POSITION ON THE SELECTOR SWITCH AT THE CACF AND THE DAMPER CLOSES BY MANUALLY SELECTING THE "CLOSE" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
30. NOT IN USE.
31. PROVIDE A FAIM FOR EACH DEVICE AND WIRE TO SAME AND CONNECT FAIM TO FIRE ALARM SYSTEM AS INDICATED. CONFIRM EXACT DEVICE LOCATION WITH SPRINKLER SYSTEM CONTRACTOR PRIOR TO ROUGH-IN. ALLOW FOR CHANGE OF LOCATION WITHIN SIX (6) METERS OF WHAT IS INDICATED.
32. PROVIDE TWO (2) FACR'S AND CONNECT TO PANEL. PROGRAM FACR'S TO PROVIDE SEPARATE FIRST STAGE AND SECOND STAGE FIRE ALARM SIGNALS TO THE BAS SYSTEM.
33. RUNS Nos 30, 31 AND 32 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.

WIRING FOR MECHANICAL EQUIPMENT SCHEDULE LEGEND

AM –	ACTUATOR MOTOR
APS –	AIR PROVING SWITCH
AST –	AQUASTAT
BAS –	CONTROL BY BUILDING AUTOMATION SYSTEM CONTRACTOR
BIC –	BUILT IN CONTROLLER
C1 –	EEMAC-1 TYPE DISC. SWITCH
C2 –	EEMAC-2 TYPE DISC. SWITCH
C3R –	EEMAC-3R TYPE DISC. SWITCH
C4 –	EEMAC-4 TYPE DISC. SWITCH
C12 –	EEMAC-12 TYPE DISC. SWITCH
COMB –	COMBINATION MAGNETIC STARTER
CP –	CONTROL PANEL
CSR –	CURRENT SENSING RELAY
CT –	CONTROL TRANSFORMER
CWSV –	COLD WATER SOLENOID VALVE
(D23) –	ITEM ADJACENT IS SUPPLIED, INSTALLED AND WIRED BY MECHANICAL DIVISION.
(D23A) –	ITEM ADJACENT IS SUPPLIED AND INSTALLED BY MECHANICAL DIVISION. ELECTRICAL DIVISION WIRES ITEM.
(D26) –	ITEM ADJACENT IS SUPPLIED BY MECHANICAL DIVISION. ELECTRICAL DIVISION INSTALLS AND WIRES ITEM.
(D26A) –	ITEM ADJACENT IS SUPPLIED, INSTALLED AND WIRED BY ELECTRICAL
DISC –	DISCONNECT
DM –	DAMPER MOTOR
DMSW –	DAMPER MOTOR SWITCH
DVR –	DOUBLE VOLTAGE RELAY
FA –	FIRE ALARM SYSTEM CONNECTION
FAIM –	ADDRESSABLE FIRE ALARM INPUT MODULE
FACR –	ADDRESSABLE FIRE ALARM CONTROL RELAY MODULE
FL –	FLOAT SWITCH
FLA –	FULL LOAD RUNNING AMPERES
FPU –	FIELD PROCESSOR UNIT BY DIV. 15900*
FPU/SS –	START/STOP CONTROL OUTPUT FROM FPU*
FPU/ST –	MOTOR RUNNING STATUS INPUT TO FPU*
FRAC –	FRACTIONAL HORSEPOWER
FS –	FLOW SWITCH
GSV –	GAS SOLENOID VALVE
HOA –	HAND/OFF/AUTO SWITCH IN STARTER COVER
HUM –	HUMIDISTAT
HWSV –	HOT WATER SOLENOID VALVE
IRS –	INFRARED SENSOR
KMSW –	KEY OPERATED MOMENTARY CONTACT SWITCH
KSW/PL –	KEY SWITCH(15A, 120V,SPST, LOCK TYPE C/W PILOT LIGHT)

WIRING FOR MECHANICAL EQUIPMENT SCHEDULE LEGEND

LS –	LEVEL SWITCH
LWCO –	LOW WATER CUT OFF
MAG –	MAGNETIC STARTER
MAN –	MANUAL STARTER
MCA –	MINIMUM CIRCUIT AMPS
MCC –	MOTOR CONTROL CENTRE
MFA –	MAXIMUM FUSE AMPACITY
MOCP –	MAXIMUM OVER CURRENT PROTECTION
MVS –	MONITORED VALVE SWITCH
ODT –	OFF DELAY TIMER
PB –	PUSHBUTTON ON/OFF SWITCH IN STARTER COVER
PL –	PILOT LIGHT IN STARTER COVER
PLG –	120V RECEPTACLE BY ELECTRICAL DIVISION
PS –	PRESSURE SWITCH
RPB –	REMOTE STOP/START PUSHBUTTON
RPL –	REMOTE PILOT LIGHT
SD –	SMOKE DETECTOR (DUCT TYPE)
SS –	SPEED SWITCH
SLS & PL –	SELECTOR SWITCH AND PILOT LIGHT
SV –	SOLENOID VALVE
SW –	HP RATED TOGGLE SWITCH
TC –	TEMPERATURE CONTROLLER
TI –	TIMER (INTERVAL)
T7 –	TIMER (7-DAY)
TRS –	THERMOSTAT REVERSING SWITCH
TS –	THERMOSTAT
T –	THERMOSTAT OR TEMPERATURE SENSING UNIT
VM –	VALVE MOTOR
VFD – (VSD)	VARIABLE FREQUENCY (OR SPEED) DRIVE
TOA –	TEST/OFF/AUTO SWITCH IN STARTER COVER.

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5. ISSUED FOR CONSTRUCTION 02.05.24

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr, Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
Canada

www.exp.com

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TRUE NORTH:

DRAWING TITLE:
Mechanical & Electrical Schedules

SCALE: AS NOTED
DRAWN: J.L.
DATE: SEPTEMBER 2023
PROJECT #: ALL-23010629-A0
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ELECTRICAL LEGEND

POWER & DISTRIBUTION SYSTEMS

▬	PANELBOARD (SURFACE MOUNT).
▬	PANELBOARD (RECESSED MOUNT).

RECEPTACLE/DIRECT CONNECTIONS

	120V, 2P, 3W, 15A DUPLEX RECEPTACLE (CSA #5 SERIES).
	120V, 2P, 3W, 15A SPLIT TYPE DUPLEX RECEPTACLE.
	120V, 2P, 3W, 20A T-SLOT TYPE DUPLEX RECEPTACLE. CSA#5 SERIES FOR OFFICE AND GENERAL AREAS.
	120V, 2P, 3W, 15A FOUR PLEX RECEPTACLE 2. DUPLEXES UNDER COMMON PLATE).
	1 PHASE, 3W DIRECT CONNECTION (L, N, G) OR (L1, L2, G).
	3 PHASE, 4W DIRECT CONNECTION (L1, L2, L3, G).
HD	ELECTRIC HAND DRYER: XLERATOR XL-BW-1.1N-120 UNIT 12.2 AMPS, 120V. 1 PHASE, 1450 WATTS. MOUNT 3'-1" (0.94M) AFF. TO BOTTOM OF UNIT, UNLESS OTHER WISE NOTED. PANELBOARD BREAKERS (20A-1P. GFCI) TO BE GROUND FAULT TYPE
T	THERMOSTAT.
NOTES	1. DIRECT CONNECTION VOLTAGE INFORMATION INDICATION BY CIRCUIT No. 2. UNLESS NOTED OTHERWISE MOUNTING HEIGHT OF ALL OUTLETS IS 455mm (18") A.F.F. 3. UNLESS NOTED OTHERWISE (IE: 30A, 20A) ALL RECEPTACLES/DIRECT CONNECTIONS RATED FOR 15A.

MECHANICAL WIRING SYSTEMS

M	MECHANICAL EQUIPMENT/MOTOR.
	DISCONNECT SWITCH (UNFUSED). SUBSCRIPT INDICATES SIZE. SUBSCRIPT 'N' INDICATES COMPLETE WITH SOLID NEUTRAL.
	DISCONNECT SWITCH (FUSED). SUBSCRIPT INDICATES FUSE RATING. SUBSCRIPT 'N' INDICATES COMPLETE WITH SOLID NEUTRAL.
P	MANUAL STARTER COMPLETE WITH PILOT LIGHT.
	MAGNETIC STARTER.
	COMBINATION MAGNETIC STARTER.
TS	TIME SWITCH.
VFD	VARIABLE FREQUENCY DRIVE (VFD)
	EPO SWITCH/ KILL SWITCH

FIRE ALARM SYSTEM

	MANUAL PULL STATION C/W PROTECTIVE 9VDC BATTERY OPERATED LEXAN COVER.
X	HEAT DETECTOR. COMBINATION, FIXED 57°C AND RATE OF RISE. SUBSCRIPT 'X' INDICATES 88°C FIXED TEMPERATURE.
X	HEAT DETECTOR. FIXED ONLY (57°C) SUBSCRIPT 'X' INDICATES 88°C RATING.
R	SMOKE DETECTOR. IONIZATION TYPE. SUBSCRIPT "R" INDICATES RELAY BASE.
	120V LOCAL SMOKE ALARM CEILING MOUNTED. IONIZATION TYPE.
	120V LOCAL SMOKE ALARM WITH STROBE.
	CARBON MONOXIDE.
	COMBINATION SMOKE/CARBON MONOXIDE/STROBE.
	AIR DUCT TYPE SMOKE DETECTOR.
R	REMOTE INDICATING LIGHT. SUBSCRIPT INDICATES FAN SYSTEM.
	FIRE ALARM HORN.
	FIRE ALARM BELL.
	FIRE ALARM STROBE
	COMBINATION FIRE HORN/STROBE LIGHT.

SECURITY SYSTEM

AA	AUDIBLE ALARM (BUZZER)
GB	GLASS BREAK DETECTOR
M	SECURITY SYSTEM MONITORING STATION
PA	PANIC ALARM
	MOTION DETECTOR.

MISCELLANEOUS ABBREVIATIONS/SUBSCRIPTS/SYMBOLS

SUBSCRIPTS

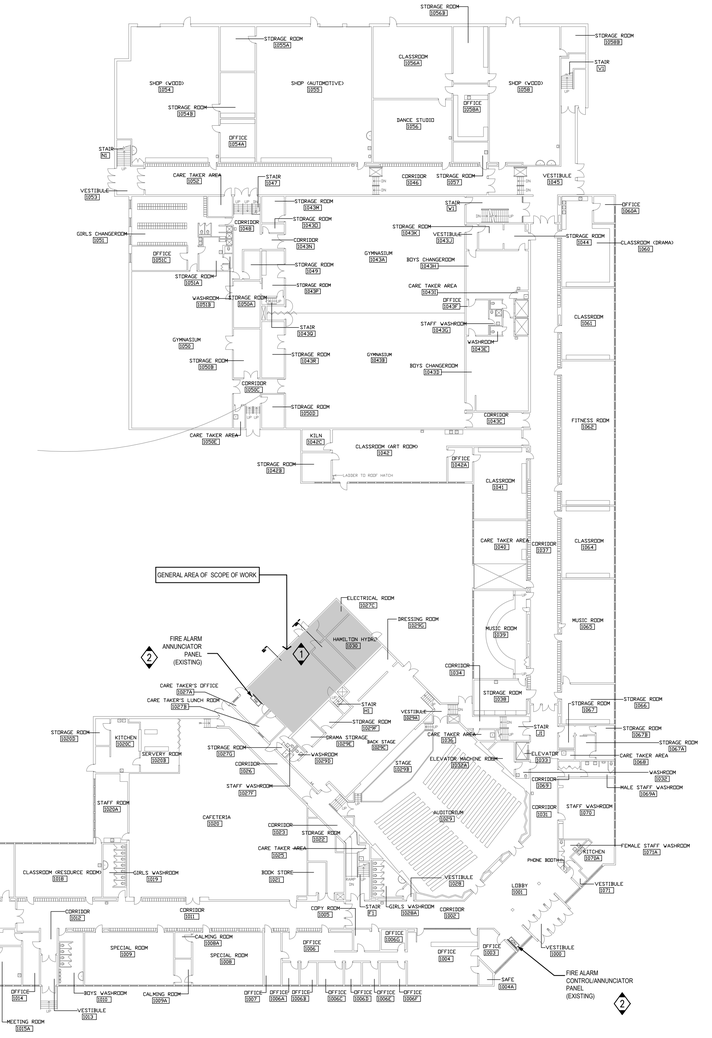
A	– MOUNTING HEIGHT FOR DEVICES ABOVE COUNTER/SINK MILLWORK TO BE 1020mm FROM TOP OF DEVICE TO A.F.F. (UNLESS NOTED OTHERWISE).
1–3	– TYPICAL NORMAL POWER CIRCUIT NUMBER EG. PANELBOARD LP–1 CIRCUIT NUMBER 3.
E1–3	– TYPICAL ESSENTIAL POWER CIRCUIT NUMBER EG. PANELBOARD LPE–1 CIRCUIT NUMBER 3.
1A–3	– TYPICAL CONTROL PANEL CIRCUIT NUMBER EG. PANELBOARD LP–1A CIRCUIT NUMBER 3.
3P+N	– 3 POLE & UNSWITCHED NEUTRAL.
AFF	– ABOVE FINISHED FLOOR.
B	– BENCH MOUNTED.
C	– CEILING SPACE MOUNTED.
D/I	– WITH DISCONNECT AND VISIBLE ISOLATION.
EXP/EP	– EXPLOSION PROOF.
E	– EXISTING TO REMAIN
ER	– EXISTING TO BE RELOCATED
F	– FLOOR MOUNTED.
GF	– GROUND FAULT CIRCUIT INTERUPTER.
IG	– ISOLATED GROUND TYPE.
MH	– MOUNTING HEIGHT.
N	– EXISTING TO BE REPLACED WITH NEW
NL	– NIGHT LIGHT
R	– EXISTING TO BE REMOVED
RE	– EXISTING RELOCATED AT THE NEW LOCATION
S	– SURGE SUPRESSION TYPE DEVICE.
T	– LOCKING TYPE (TWISTLOCK).
V	– MOUNT IN VERTICAL FACE.
WG	– WIREGUARD.
WP	– WEATHERPROOF TYPE.
Z	– MOUNT 42" (1065mm) A.F.F.
PTZ	– PAN, TILT, ZOOM

IDENTIFICATIONS

ACB	– AIR CIRCUIT BREAKER.
ARMS	– ARCFLASH REDUCTION MAINTENANCE MODE
ATS	– AUTOMATIC TRANSFER SWITCH.
AV	– AUDIO VISUAL.
CO	– CARBON MONOXIDE
CM	– COFFEE MAKER.
CR	– CASH REGISTER.
CS	– COMMUNICATION STATION.
DP	– DISTRIBUTION PANEL.
EVR	– ELECTRONIC VOLTAGE REGULATOR.
FACP	– FIRE ALARM CONTROL PANEL
FAAP	– FIRE ALARM ANNUNCIATOR PANEL
FR	– FRIDGE.
GEN	– ELECTRICAL GENERATOR.
HP	– HYDRO POLE
HWD	– HOT WATER DISPENSER
IM	– ICE MACHINE
LS	– LIFE SAFETY.
MCB	– MINIATURE CIRCUIT BREAKER.
MCCB	– MOULDED CASE CIRCUIT BREAKER.
MSB	– MAIN SWITCH BOARD (SERVICE ENTRANCE RATED).
NLS	– NON LIFE SAFETY.
PC	– PHOTOCOPIER.
PF	– POWER FACTOR CORRECTION CAPACITOR BANKS.
PR	– PRINTER.
SB	– SMARTBOARD.
SP	– SPLITTER.
SPD	– SURGE PROTECTIVE DEVICE.
TR	– LOW VOLTAGE TRANSFORMER.
TV	– TELEVISION.
TVSS	– TRANSIENT VOLTAGE SURGE SUPPRESSOR.
UPS	– UNINTERRUPTIBLE POWER SUPPLY.
VM	– VENDING MACHINE.
XFMER	– UTILITY TRANSFORMER.

DRAWING LIST

DWG No.	DRAWING TITLE
E0.0	ELECTRICAL LEGEND, KEYPLAN AND DRAWING LIST
E1.0	GROUND FLOOR – POWER & SYSTEMS DEMOLITION PLANS
E2.0	GROUND FLOOR – POWER & SYSTEMS NEW PLANS
E3.0	ELECTRICAL SPECIFICATIONS
ME1.0	MECHANICAL AND ELECTRICAL SCHEDULES



1 E0.0 GROUND FLOOR - OVERALL PLAN

SCALE: 1/32" = 1'-0"

DRAWING NOTES

1. ALLOW IN PRICE FOR TEMPORARILY REMOVING CEILING TILES, LIGHT FIXTURES OR ANY OTHER IMPEDIMENTS TO INSTALL THE FEEDER CONDUIT IN CEILING SPACE. AFTER INSTALLATION, RE-INSTATE ALL LIGHT FIXTURES AND CEILING MOUNTED DEVICES. COORDINATE WITH MECHANICAL DIVISION.
2. ALL NEW FIRE ALARM DEVICES SHALL BE WIRED TO THE EXISTING PANEL. MODIFY ANNUNCIATOR PANEL TO REFLECT CHANGES. IT IS RECOMMENDED BIDDERS WALKTHROUGH TO DETERMINE LOCATION OF THE FIRE ALARM AND ANNUNCIATOR PANELS AND INCLUDE FOR WIRING TO NEW DEVICES. VERIFY NEWLY ADDED DEVICES AND PROVIDE A VERIFICATION REPORT.

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Glendale Secondary School

145 Rainbow Dr,
Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
Canada

www.exp.com

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TRUE NORTH:

DRAWING TITLE:
ELECTRICAL LEGEND AND DRAWING LIST

SCALE: AS NOTED

DRAWN: ABS

DATE: SEPTEMBER 2023

PROJECT #: ALL–23010629–A0

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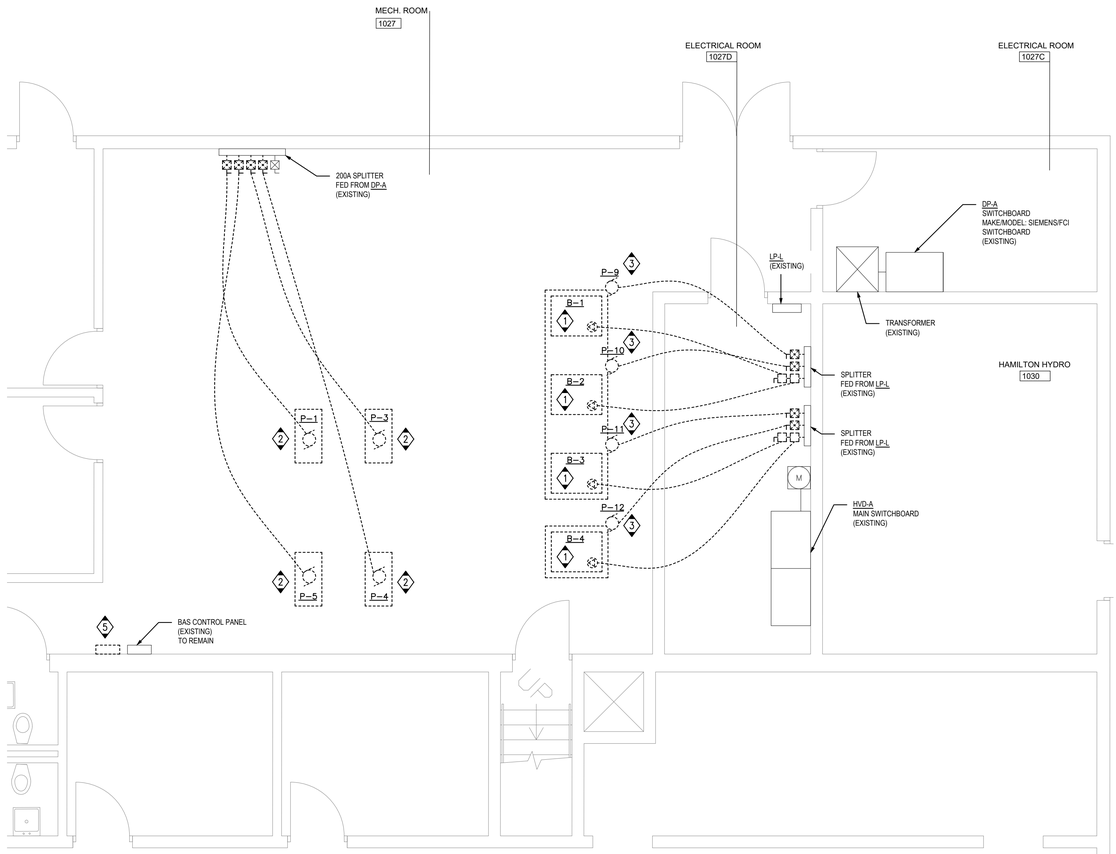

GROUND FLOOR - POWER & SYSTEMS DEMOLITION PLANS

1 / E1.0

SCALE: 1/4" = 1'-0"

ELECTRICAL GENERAL DEMOLITION NOTES

1. THE ELECTRICAL CONTRACTOR SHALL, AS PART OF HIS WORK, PERFORM ALL RELATED DEMOLITION, MODIFICATIONS, RELOCATION OF ELECTRICAL DISTRIBUTION AND OTHER EQUIPMENT AND RELATED WORK, INCLUDING NEW WORK NECESSARY TO COMPLETE THE PROJECT.
2. IT IS RECOMMENDED BIDDERS VERIFY ALL FIELD CONDITIONS AND DIMENSIONS PRIOR TO MOBILIZATION. REFER TO EXISTING DRAWINGS AND THE SITE TO DETERMINE THE EXTENT OF THE DEMOLITION AND NEW WORK REQUIRED.
3. THE ELECTRICAL CONTRACTOR SHALL VERIFY ALL TECHNICAL DETAILS OF EQUIPMENT TO BE REMOVED. WHERE THERE IS A DISCREPANCY WITH THE TENDER DOCUMENTS, CONTRACTOR SHALL ENGAGE CONSULTANTS FOR DIRECTIONS. ELECTRICAL CONTRACTOR SHALL MAKE A LIST OF ALL EQUIPMENT TO BE REMOVED. THIS LIST SHALL BE WITH ALL FOLLOWING INFORMATION.
   MAKE/MODEL#
   ** MANUFACTURER
   ** TECHNICAL DETAILS
   ** LOCATION THIS LIST SHALL BE SUBMITTED TO THE OWNER FO RECORD PURPOSES.
4. THE ELECTRICAL CONTRACTOR SHALL NOT DISCONNECT EQUIPMENT AND ELECTRICAL CIRCUITS IN THE RENOVATION AREA OR ANY PART OF THE BUILDING WITHOUT PRIOR NOTIFICATION AND PERMISSION FROM THE OWNER. EXTREME CARE SHALL BE TAKEN TO MINIMIZE DISTURBANCE TO THE SURROUNDING AREA.
5. ITEMS REMOVED AND NOT SCHEDULED TO BE RELOCATED SHALL BE OFFERED TO THE OWNER FOR THEIR USE AND IF NOT ACCEPTED BY THE OWNER, THE ELECTRICAL CONTRACTOR SHALL DISPOSE OF THE MATERIAL FROM THE SITE IN ACCORDANCE WITH LOCAL REGULATIONS. THE ELECTRICAL CONTRACTOR SHALL DELIVER ITEMS ACCEPTED BY THE OWNER TO THE DESIGNATED LOCATIONS AS DIRECTED BY THE OWNER.
6. IN ALL CASES WHERE WORK IS REMOVED, THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL NECESSARY MATERIALS, EQUIPMENT AND LABOR TO SUSTAIN OPERATION OF ALL PARTS OF THE SYSTEMS CONNECTING TO OR FROM THE PART REMOVED, COMPLETING ALL WORK IN STRICT ACCORDANCE WITH APPLICABLE CODES.
7. ALL WIRING, CABLES AND FEEDERS INCLUDING BOTH CONNECTED TO DEVICES AND EQUIPMENT TO BE DEMOLISHED AND EXISTING THAT WERE ABANDONED IN PLACE SHALL BE REMOVED BACK TO THEIR SOURCES. UNLESS NOTED OTHERWISE, CONDUITS AND/OR WIRING SHALL, WHERE NECESSARY, BE RE-CIRCUIT AROUND THE REMOVED PART, KEEPING OCCUPIED PARTS OF THE BUILDING SYSTEM IN FULL SERVICE.
8. ALL EXISTING CONDUITS WHICH HAVE BEEN ABANDONED OR ARE UNUSED SHALL BE REMOVED.
9. PROVIDE BLANK METAL COVER PLATES FOR ALL JUNCTION/DEVICE BOXES NO LONGER IN USE THAT ARE EMBEDDED IN FLOOR SLAB OR MASONRY WALLS. PROVIDE PLUGS FOR ALL PANELS WHERE CONDUIT HAS BEEN REMOVED. COVER PLATES SHALL BE PAINTED TO MATCH EXISTING CONDITIONS.
10. WHERE REQUIRED COORDINATE WITH THE CONSULTANTS/OWNER FOR EXISTING PARTITIONS TO BE REMOVED TO FACILITATE WORK. DISCONNECT EXISTING BRANCH CIRCUITS SERVICING DEVICES IN PARTITIONS TO BE REMOVED. MAINTAIN CONTINUITY OF CIRCUITS SERVICING EXISTING DEVICES IN OTHER AREAS TO REMAIN.
11. FIRE ALARM SYSTEM: COORDINATE AND CONSULT WITH CURRENT F/A SYSTEM SERVICE CONTRACTOR (HAMILTON FIRE CONTROL) OR THEIR QUALIFIED REPRESENTATIVE FOR ALL FIRE ALARM DEMOLITION AND MODIFICATIONS. OPERATION SHALL BE MAINTAINED OF EXISTING FIRE ALARM SYSTEM SPECIFICALLY AS IT RELATES TO ADJACENT AREAS WHICH ARE NOT INCLUDED IN THE SCOPE OF THIS PROJECT.
12. ELECTRICAL CONTRACTOR SHALL PROVIDE UPDATED TYPE WRITTEN PANEL DIRECTORIES FOR ALL PANELS AFFECTED BY THE DEMOLITION AND/OR NEW WORK. CIRCUIT BREAKERS NOT USED FOR NEW WORK SHALL BE LABELED AS SPARE.
13. FOR EXISTING DEVICES/CIRCUITRY THAT ARE INDICATED TO BE REMOVED BACK TO POINT OF ORIGIN-THESE ITEMS ARE TO BE REMOVED BACK TO POINT OF ORIGIN UNLESS THERE WILL BE EXISTING DEVICES ON THE SAME CIRCUIT THAT ARE LOCATED OUTSIDE AREA OF WORK THAT ARE TO REMAIN. IN THAT CASE, REMOVE THE EXISTING DEVICES/CIRCUITRY IN AREA OF WORK BACK TO THESE EXISTING DEVICES TO REMAIN. ALL DEVICES/CIRCUITRY IN SURROUNDING AREAS THAT ARE TO REMAIN ARE TO BE KEPT ENERGIZED. FOR REMOVAL OF CONDUIT AND WIRING OUTSIDE OF AREA OF WORK COORDINATE AND SCHEDULE WITH OWNER PRIOR TO PERFORMING WORK.

DRAWING NOTES

GENERAL:

PRIOR TO BIDDING, IT IS RECOMMENDED BIDDERS VISIT SITE AND BE FAMILIAR WITH ALL EXISTING CONDITIONS INCLUDING BUT NOT LIMITED TO EQUIPMENT LOCATIONS AND OTHER POSSIBLE INSTALLATION DIFFICULTIES. PAY AND OBTAIN ANY PERMITS REQUIRED INCLUDING ESA.

1. EXISTING BOILERS (B-1,B-2,B-3,B-4) FED FROM EXISTING DISCONNECT SWITCHES IN ELECTRICAL ROOM 1027D. DISCONNECT POWER SUPPLY FROM UNITS. DISCONNECT AND REMOVE EXISTING DISCONNECT SWITCHES. REMOVE ALL FEEDER CABLES FEEDING UNITS. REMOVAL OF UNITS BY MECHANICAL DIVISION. REFER TO DRAWING NOTE NO.1 ON NEW PLANS.
2. EXISTING PUMPS (P-1,P-3,P-4,P-5) FED FROM EXISTING 200A SPLITTER AND DISCONNECT SWITCHES IN MECHANICAL ROOM 1027. DISCONNECT POWER SUPPLY FROM UNITS. DISCONNECT AND REMOVE EXISTING DISCONNECT SWITCHES. REMOVE ALL FEEDER CABLES FEEDING UNITS. REMOVAL OF UNITS BY MECHANICAL DIVISION. REFER TO DRAWING NOTE NO.2 ON NEW PLANS.
3. EXISTING BOILER PUMPS (P-9,P-10,P-11,P-12) FED FROM DISCONNECT SWITCHES IN MECHANICAL ROOM 1027D. DISCONNECT POWER SUPPLY FROM UNITS. DISCONNECT AND REMOVE EXISTING DISCONNECT SWITCHES. REMOVE ALL FEEDER CABLES FEEDING UNITS. REMOVAL OF UNITS BY MECHANICAL DIVISION. REFER TO DRAWING NOTE NO.3 ON NEW PLANS.
4. EXISTING CEILING HUNG COOLING UNIT FED FROM PANEL (PNL-U) IN SHOP (AUTOMOTIVE) ROOM 1055. DISCONNECT POWER SUPPLY FROM UNITS. REMOVE AND DISPOSE FEEDERS, CONDUITS AND ALL ASSOCIATED SUPPORTS UP TO THE PANEL. REMOVE STARTER/DISCONNECT SWITCH AND DISPOSE FROM SITE. REMOVAL OF UNITS BY MECHANICAL DIVISION.
5. EXISTING BOILER CONTROL PANEL. DISCONNECT POWER SUPPLY FROM PANEL. EXISTING FEEDERS TO BE RE-USED TO FEED NEW PANEL. REMOVAL OF UNITS BY MECHANICAL DIVISION. REFER TO DRAWING NOTE ON NEW PLANS.

THESE DRAWINGS ARE NOT TO BE SCALED

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145 Rainbow Dr,
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SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
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TRUE NORTH:

DRAWING TITLE:
GROUND FLOOR – POWER & SYSTEMS DEMOLITION PLANS

SCALE:
AS NOTED

DRAWN:
ABS

DATE:
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PROJECT #:
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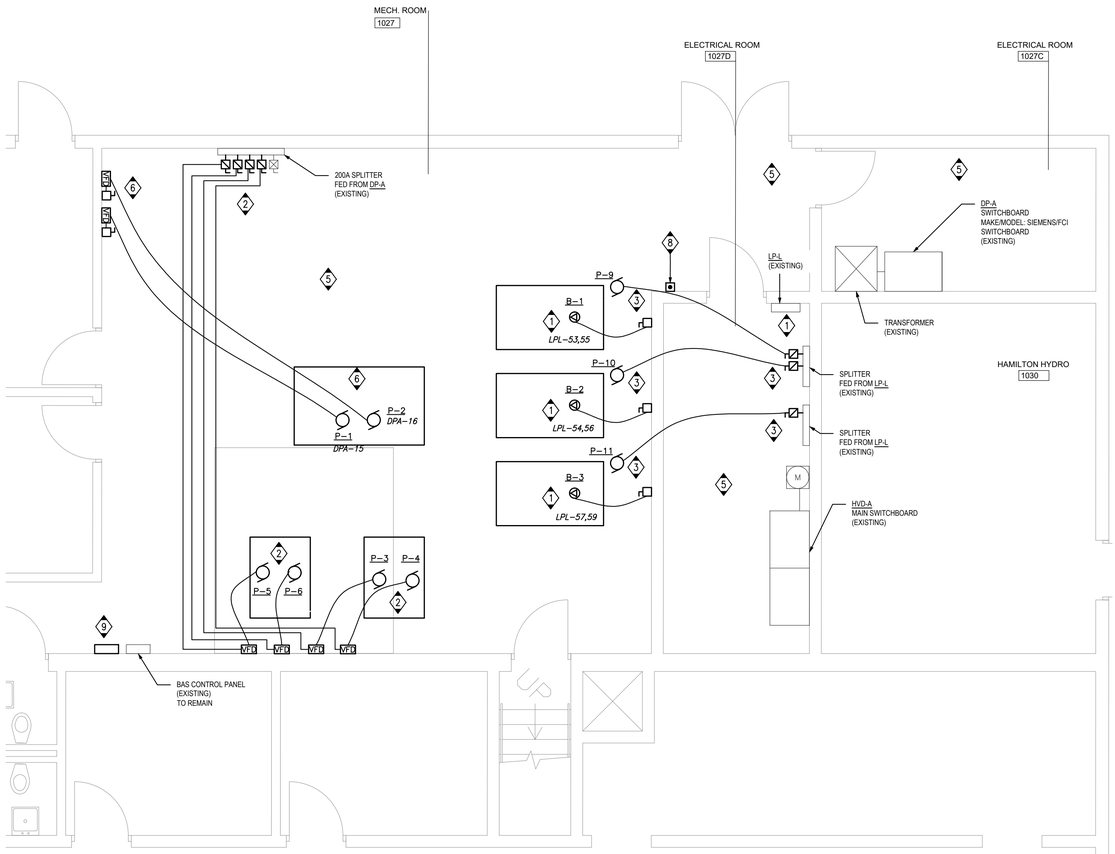

1 E2.0

GROUND FLOOR - POWER & SYSTEMS NEW PLANS

SCALE: 1/4" = 1'-0"

ELECTRICAL GENERAL NOTES

A. PRIOR TO BIDDING, IT IS RECOMMENDED BIDDERS VISIT SITE AND BE FAMILIAR WITH ALL EXISTING CONDITIONS INCLUDING BUT NOT LIMITED TO EQUIPMENT LOCATIONS AND OTHER POSSIBLE INSTALLATION DIFFICULTIES. PAY AND OBTAIN ANY PERMITS REQUIRED INCLUDING ESA.

B. ALL CONDUIT ROUTES SHOWN ON DRAWINGS ARE APPROXIMATE AND NOT FINAL. CONTRACTOR SHALL VERIFY ROUTES AND DO A WALKTHROUGH BEFORE BID. CONTRACTOR SHALL ACCOUNT FOR POSSIBLE DAMAGE AND REPAIR TO EXISTING CEILING AND LIGHT FIXTURES. ALL MAIN CONDUIT RUNS SHALL BE IN CORRIDOR CEILING SPACE.

C. EXTEND/PROVIDE NEW WIRING/CONDUIT FOR ALL DEVICES THAT ARE RELOCATED.

D. ALL NEW RECEPTACLES IN THE SCHOOL SHALL BE TAMPER RESISTANT TYPE.

E. REMOVE AND RE-INSTATE ALL REQUIRED T-BAR OR DRY TYPE CEILINGS TO FACILITATE ELECTRICAL INSTALLATIONS. ANY DAMAGES TO T-BAR SHALL BE RE-INSTATED.

F. UNLESS OTHERWISE NOTED WITH A CIRCUIT NUMBER, RE-USE EXISTING CIRCUIT BREAKERS THAT HAD BECOME SPARE FROM THE DEMOLITION TO FEED NEW RECEPTACLES. MAXIMUM 6 DUPLEX RECEPTACLES PER CIRCUIT UNLESS OTHERWISE NOTED.

G. CONTRACTOR SHALL ACCOUNT FOR POSSIBLE DAMAGE AND REPAIR TO CEILING TILES FOR CONDUIT RUNS FROM PANELS TO NEW ELECTRICAL DEVICES.

H. CIRCUIT NUMBERS SHOWN ON THIS PLAN ARE FOR CIRCUITING PURPOSE ONLY. REUSE EXISTING SPARE BREAKERS OR EXISTING BREAKERS MADE SPARE FROM DEMOLITION AND/OR REPLACE OBSOLETE BREAKERS WITH NEW ADD/OR ADD NEW BREAKERS IN AVAILABLE SPACES IN EXISTING ELECTRICAL PANELS AS REQUIRED OR REPLACE EXISTING PANELS WITH NEW AS INDICATED. CONFIRM EXISTING CONDITIONS ON SITE.

DRAWING NOTES

GENERAL:

PRIOR TO BIDDING, IT IS RECOMMENDED BIDDERS VISIT SITE AND BE FAMILIAR WITH ALL EXISTING CONDITIONS INCLUDING BUT NOT LIMITED TO EQUIPMENT LOCATIONS AND OTHER POSSIBLE INSTALLATION DIFFICULTIES. PAY AND OBTAIN ANY PERMITS REQUIRED INCLUDING ESA.

1. NEW BOILERS (B-1,B-2,B-3). PROVIDE THREE (03) 15A-2P BREAKERS IN PANEL EXISTING (LP-L (SIEMENS)) TO FEED NEW BOILERS. SUPPLY AND INSTALL NEW THREE (03) 30A/15AF DISCONNECT SWITCH (FUSED) AND NEW POWER WIRING (2#12 AWG CU+G IN 21mmC) & WIRE BOILERS COMPLETELY. ALL CONDUITS AND WIRING SHALL BE SUPPORTED TO UNDERSIDE OF CEILING IN ROOM. PROVIDE UNISTRUT AS REQUIRED. REFER TO ME1.0 DRAWING.
2. NEW PUMPS (P-3,P-4,P-5,P-6). SUPPLY AND INSTALL FOUR (4) NEW 60A/50AF DISCONNECT SWITCH (FUSED) FOR PUMPS (P-3,P-4) (P-5,P-6) AND NEW POWER WIRING (3#8 AWG CU+G IN 27mmC) & WIRE PUMPS COMPLETELY. ALL CONDUITS AND WIRING SHALL BE SUPPORTED TO UNDERSIDE OF CEILING IN ROOM. PROVIDE UNISTRUT AS REQUIRED. REFER TO ME1.0 DRAWING.
3. NEW PUMPS (P-9,P-10,P-11). SUPPLY AND INSTALL NEW THREE (03) 30A/15AF DISCONNECT SWITCH (FUSED) AND NEW POWER WIRING (3#12 AWG CU+G IN 21mmC) & WIRE PUMPS COMPLETELY. ALL CONDUITS AND WIRING SHALL BE SUPPORTED TO UNDERSIDE OF CEILING IN ROOM. PROVIDE UNISTRUT AS REQUIRED. REFER TO ME1.0 DRAWING.
4. NOT USED.
5. ALLOW IN PRICE FOR TEMPORARILY REMOVING CEILING TILES, LIGHT FIXTURES OR ANY OTHER IMPEDIMENTS TO INSTALL THE FEEDER CONDUIT IN CEILING SPACE. AFTER INSTALLATION, RE-INSTATE ALL LIGHT FIXTURES AND CEILING MOUNTED DEVICES.
6. NEW PUMPS (P-1,P-2). PROVIDE A TWO (2) 150A-3P BREAKERS IN PANEL (DP-A) TO FEED NEW PUMPS SUPPLIED BY MECHANICAL DIVISION. SUPPLY AND INSTALL NEW POWER WIRING (3#1/0 AWG CU+G IN 53mmC) & WIRE COMPLETELY. ALL CONDUITS AND WIRING SHALL BE SUPPORTED TO UNDERSIDE OF CEILING IN ROOM. PROVIDE UNISTRUT AS REQUIRED. REFER TO ME1.0 DRAWING.
7. NOT USED.
8. PROVIDE EPO EMERGENCY KILL SWITCH FOR HEATING BOILERS. PROVIDE SEE THROUGH TAMPER PROOF TYPE ENCLOSURE WITH LAMACOID IDENTIFICATION NAMEPLATE. CONFIRM EXACT LOCATION ON SITE.
9. NEW BOILER CONTROL PANEL BY MECHANICAL DIVISION. RECONNECT EXISTING POWER FEEDERS TO PANEL. EXTEND CABLES/CONDUITS AS REQUIRED.

1. ISSUED FOR TENDER 25.03.21

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr,
Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
Canada

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TRUE NORTH:

DRAWING TITLE:
GROUND FLOOR – POWER & SYSTEMS NEW PLANS

SCALE: AS NOTED

DRAWN: ABS

DATE: SEPTEMBER 2023

PROJECT #: ALL–23010629–A0

DRAWING #: E2.0

ELECTRICAL SPECIFICATIONS

1. RELATED INSTRUCTIONS

1.1. THIS SPECIFICATION SHALL APPLY TO AND GOVERN ALL WORK BY DIVISION 16. THIS PROJECT WILL BE CARRIED OUT PER CCDC CONTRACT PROCEDURES. SEE ARCHITECTURAL AND FRONT END SPECIFICATIONS FOR DETAILS.

1.2. FURNISH ALL LABOUR, MATERIAL, TOOLS, EQUIPMENT, ETC., REQUIRED TO COMPLETE ALL WORK SHOWN ON THE DRAWINGS AND HEREIN SPECIFIED. THE WORK SHALL BE IN ACCORDANCE WITH RULES AND REGULATIONS OF ALL AUTHORITIES HAVING LEGAL JURISDICTION OVER THE WORK. PROVIDE ANY SMALL ITEMS OF WORK NOT SPECIFICALLY CALLED FOR BUT REQUIRED TO COMPLETE THE INTENDED INSTALLATION.

1.3. DEVICE/EQUIPMENT LOCATIONS ARE APPROXIMATE. CHANGE LOCATION OF ANY DEVICE/EQUIPMENT WITHIN 3M OF INDICATED LOCATION AT NO ADDITIONAL COST TO OWNER PROVIDED INSTRUCTIONS ARE RECEIVED PRIOR TO COMMENCING ROUGH-IN WORK. PRIOR TO COMMENCING ANY ROUGH-IN OR INSTALLATION WORK VISIT SITE, MEET WITH THE OWNERS REPRESENTATIVE AND CONFIRM EXACT LOCATION OF ALL DEVICES.

2. LIABILITY INSURANCE

2.1. OBTAIN AND CARRY PROPER INSURANCE TO FULLY PROTECT BOTH THE OWNER AND HIMSELF FROM ANY AND ALL CLAIMS DUE TO ACCIDENTS, MISFORTUNES, ACTS OF GOD, ETC.

3. CODES, PERMITS AND INSPECTION

3.1. BUILDING PERMIT SHALL BE OBTAINED BY OWNER.

ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR, AND OBTAIN ALL OTHER PERMITS, INSPECTIONS, VERIFICATIONS, ETC., AS REQUIRED BY ALL AUTHORITIES HAVING JURISDICTION OVER THIS WORK AND PAY FOR ALL FEES RELATED TO SAME.

3.2. DELIVER ALL PERMITS TO THE OWNER AS SOON AS THEY BECOME AVAILABLE.

3.3. AT THE CONCLUSION OF THE PROJECT, SUBMIT TO THE OWNER, THE ELECTRICAL SAFETY AUTHORITY FINAL ACCEPTANCE CERTIFICATE.

4. RECORD DRAWINGS AND EQUIPMENT MANUALS

4.1. AS THE PROJECT PROGRESSES, RECORD, ON A SET OF WHITE PRINTS, ALL ADDENDA, CHANGES TO AND DEVIATIONS FROM THE PLANS MADE DURING THE CONSTRUCTION PERIOD. ALSO, RECORD THE LOCATION OF ALL LIGHT FIXTURES AND OTHER ELECTRICAL EQUIPMENT AND WIRING FOR SAME.

4.2. MAKE THESE PROGRESS RECORD DRAWING WHITE PRINTS AVAILABLE TO THE CONSULTANTS FOR THEIR REVIEW AT ALL TIMES DURING THE CONSTRUCTION PERIOD.

4.3. AT THE CONCLUSION OF THE PROJECT, TRANSFER ALL RECORD DRAWING INFORMATION TO A USB.

4.4. BEFORE SUBSTANTIAL PERFORMANCE OF THE CONTRACT, COMPLY WITH THE FOLLOWING:

4.4.1. PROVIDE USB CONTAINING ALL UPDATED RECORD DRAWING INFORMATION AS SPECIFIED HEREIN.

4.4.2. PROVIDE TWO (2) SETS OF EQUIPMENT DATA SHEETS AND/OR MANUFACTURER'S MAINTENANCE MANUALS COVERING EACH SYSTEM AND ITS COMPONENTS IN ACCORDANCE WITH REQUIREMENTS OF EACH APPROPRIATE SECTION. THESE SETS ARE TO BE IN GOOD QUALITY BINDERS EQUAL TO VYN-L-LINE #VL-3096-B 2", (51mm) RINGS. THE BINDER IS TO BE DIVIDED INTO SECTIONS WITH TABS CLEARLY MARKED INDICATING THE SYSTEMS, ETC.

5. EQUIPMENT AND MATERIAL

5.1. ALL EQUIPMENT AND MATERIAL, UNLESS SPECIFICALLY NOTED OTHERWISE, SHALL BE NEW AND WITHOUT BLEMISH OR DEFECT. ALL MATERIAL AND EQUIPMENT SHALL BEAR ULC. OR CSA LABELS.

6. ACCESSIBILITY

6.1. INSTALL ALL WORK SO AS TO BE READILY ACCESSIBLE FOR OPERATION MAINTENANCE AND REPAIRS.

7. RESPONSIBILITY

7.1. BE RESPONSIBLE FOR WORK UNTIL COMPLETION AND FINAL ACCEPTANCE, FOR REPLACING ANY ITEM THAT MAY BE DEFECTIVE, DAMAGED, LOST OR STOLEN WITHOUT ADDITIONAL COST TO THE OWNER OR DELAY TO THE COMPLETION OF THE PROJECT.

8. CONDUIT, AND WIRING

8.1. USE EMT CONDUIT FOR ALL WIRING UNLESS NOTED OTHERWISE. ALL CONDUIT SHALL BE INSTALLED PARALLEL TO BUILDING LINES AND SECURELY FASTENED.

8.2. UNLESS NOTED OTHERWISE, CONDUITS SHALL BE CONCEALED EMT COMPLETE WITH STEEL SET SCREW TYPE CONNECTORS AND COUPLINGS.

8.3. DO NOT RUN CONDUITS IN FIRE RATED CEILING SPACES.

8.4. SURFACE RACEWAY SYSTEM WITH WIRING LAID IN SHALL BE ACCEPTABLE BUT KEPT TO A MINIMUM IN AREAS WHERE EMT CONDUIT CAN NOT BE CONCEALED, TWO PIECE STEEL ASSEMBLY MANUFACTURED AS LAY-IN TYPE RACEWAY C/W TEES, ELBOWS AND HANGER FITTING AND SUPPORTS REQUIRED FOR A COMPLETE SYSTEM – WIREMOLD OR APPROVED EQUAL.

8.5. ALL CONDUCTORS SHALL BE COPPER, RW90 XLPE #12 AWG MINIMUM UNLESS NOTED OTHERWISE. WHERE THE DISTANCE FROM THE PANELBOARD TO THE LAST OUTLET EXCEEDS 50', #10 AWG CONDUCTOR MUST BE USED FOR THE FULL LENGTH OF THE CIRCUIT.

9. WIRING DEVICES

9.1. SWITCHES: RATED 125VAC, 20 AMPERES AND LOW VOLTAGE IVORY TOGGLE TYPE COMPATIBLE WITH EXISTING.

9.1.1. INSTALL SINGLE THROW SWITCHES WITH HANDLE IN "UP" POSITION WHEN SWITCH CLOSED (ON).

9.1.2. INSTALL SWITCHES IN GANG-TYPE OUTLET BOX WHEN MORE THAN ONE SWITCH IS REQUIRED IN ONE LOCATION AND AT 1200mm(48") ABOVE FINISHED FLOOR UNLESS INDICATED OTHERWISE.

9.1.3. 125V SWITCHES AS SHOWN SHALL BE LOW VOLTAGE COMPLETE WITH TRANSFORMERS AND CONTROL RELAYS LOCATED CONCEALED IN CEILING SPACES

9.2. RECEPTACLES: 3-WIRE, U-GROUND TYPE GENERAL PURPOSE, HEAVY DUTY, NEMA 5-15R.

9.2.1. INSTALL RECEPTACLES IN GANG-TYPE OUTLET BOX WHEN MORE THAN ONE SWITCH IS REQUIRED IN ONE LOCATION AND AT 450mm(18") ABOVE FINISHED FLOOR UNLESS NOTED OTHERWISE.

9.2.2. NEW RECEPTACLES SHALL MATCH EXISTING IN COLOUR.

9.3. COVERPLATES:

9.3.1. PROVIDE No.301 STAINLESS STEEL, BRUSHED COVERPLATES C/W PROTECTIVE PLASTIC FILM UNTIL PAINTING AND OTHER WORK IS FINISHED FOR ALL WIRING DEVICES MOUNTED IN A FLUSH MOUNTED OUTLET BOX. PROVIDE COMMON COVERPLATE WHEN WIRING DEVICES ARE GROUPED TOGETHER.

9.3.2. PROVIDE FITTING SHEET METAL (CAST) COVERPALTES FOR WIRING DEVICES MOUNTED IN SURFACE FS OR FD TYPE CONDUIT BOXES.

9.3.3. DO NOT USE COVERPLATES MEANT FOR FLUSH OUTLET BOXES ON SURFACE MOUNTED BOXES.

9.4. ACCEPTABLE MANUFACTURERS ARE:

9.4.1. BRYANT
9.4.2. CROUSE-HINDS
9.4.3. HUBBELL
9.4.4. LEVITON
9.4.5. PASS & SEYMOUR
9.4.6. OR OTHER APPROVED EQUALS

10. WIRING FOR MECHANICAL EQUIPMENT

10.1. SUPPLY AND INSTALL ALL STARTERS, DISCONNECTS, RELAYS, WIRING, ETC., TO ACCOMMODATE THE COMPLETE MECHANICAL SYSTEM, UNLESS NOTED OTHERWISE.

10.2 OTHER DIVISIONS SUPPLYING MOTOR-DRIVEN EQUIPMENT SHALL SUPPLY AND INSTALL ALL NECESSARY MOTORS WITH SUCH EQUIPMENT. ALL INTERNAL CONTROL WIRING IN SUCH EQUIPMENT SHALL BE FACTORY INSTALLED, OR SHALL BE SUPPLIED AND INSTALLED BY THOSE SUPPLYING THE EQUIPMENT.

10.3 REFER TO MECHANICAL DRAWINGS AND SPECIFICATIONS DURING TENDERING AND CONSTRUCTION TO ENSURE ENTIRE MECHANICAL EQUIPMENT WIRING SCOPE OF WORK IS UNDERSTOOD.

10.4 THIS DIVISION IS RESPONSIBLE FOR THE FOLLOWING:

10.4.1 SUPPLY AND INSTALLATION OF ALL STARTERS, DISCONNECT SWITCHES, PUSHBUTTON STATIONS, SPLITTER TROUGHS, JUNCTION BOXES AND TIME SWITCHES, ETC., AS NOTED ON DRAWING.

10.4.2 INSTALLATION AND WIRING OF ALL SEPARATELY MOUNTED THERMOSTATS, MOTOR CONTROLLERS AND CONTROL UNITS WHICH ARE SUPPLIED BY MECHANICAL.

10.4.3 SUPPLY AND INSTALLATION OF ALL POWER WIRING AND CONDUITS FROM THE DISTRIBUTION PANEL THROUGH THE STARTER AND DISCONNECT SWITCH ONTO THE MOTOR (OR EQUIPMENT).

10.4.4 SUPPLY AND INSTALLATION OF ALL CONTROL WIRING FROM REMOTE SWITCHES OR PUSHBUTTON STATIONS TO CONTROL STARTERS.

10.4.5 SUPPLY AND INSTALLATION OF ALL WIRING TO PROVIDE INTERLOCKING BETWEEN STARTERS COMPLETE WITH NECESSARY DOUBLE VOLTAGE RELAYS.

10.4.6 SUPPLY AND INSTALLATION OF TRANSIENT (SURGE) SUPPRESSERS ON HOLDING COILS OF MAGNETIC STARTERS, RELAYS, ETC., WHERE INDICATED FOR PROTECTION TO SOLID STATE EQUIPMENT THAT IS SENSITIVE TO SURGES, SPIKES, ETC.

11. MOTOR STARTERS

11.1. MANUAL STARTER SHALL HAVE QUICK-MAKE, QUICK-BREAK, SWITCHING MECHANICAL COMPLETE WITH OVERLOAD HEATERS, MANUAL RESET, TRIP INDICATING HANDLE, AND LOCKING TAB TO PERMIT PADLOCKING IN "ON" OR "OFF" POSITION.

11.2 MAGNETIC AND COMBINATION MOTOR STARTERS TO BE MINIMUM SIZE 1 TYPE, AND RATING TO SUIT MOTOR LOAD. C/W CONTROLTRANSFORMER, CONTACTOR SOLENOID OPERATED, MOTOR OVERLOAD PROTECTIVE DEVICE IN EACH PHASE, MANUALLY RESET, POWER AND CONTROL TERMINALS, PUSHBUTTONS AND SELECTOR SWITCHES, TWO N/O AND TWO N/C AUXILIARY CONTACTS, PROVISION FOR PREVENTING SWITCHING TO "ON" POSITION WHILE ENCLOSURE DOOR IS OPEN.

12. LIGHTING

N/A

13. PANELBOARDS

13.1 PANELBOARDS: TO CSA C22.2, NO. 29.

13.2 PANELBOARDS ARE TO BE THE PRODUCT OF ONE (1) MANUFACTURER.

13.3 PANELBOARDS: BUS AND BREAKERS RATED FOR MINIMUM 14,000A (SYMMETRICAL) INTERRUPTING CAPACITY AT SYSTEM VOLTAGE OR AS INDICATED ON THE DRAWINGS.

13.4 SEQUENCE PHASE BUSSING WITH ODD NUMBERED BREAKERS ON LEFT AND EVEN ON RIGHT, WITH EACH BREAKER IDENTIFIED BY PERMANENT NUMBER IDENTIFICATION AS TO CIRCUIT NUMBER.

13.5 PANELBOARDS: COPPER MAINS, NUMBER OF CIRCUITS, AND NUMBER AND SIZE OF BRANCH CIRCUIT BREAKERS AS INDICATED.

13.6 TWO (2) KEYS FOR EACH PANELBOARD AND KEY PANELBOARDS ALIKE.

13.7 COPPER BUS WITH FULL SIZE NEUTRAL.

13.8 MAINS FOR BOLT-ON BREAKERS.

13.9 FINISH TRIM AND DOOR BAKED GREY ENAMEL. PAINT TUB SAME AS DOOR.

13.10 COMPLETE CIRCUIT DIRECTORY WITH TYPEWRITTEN LEGEND SHOWING LOCATION AND LOAD OF EACH CIRCUIT UNDER PLASTIC COVER.

13.11 WHERE BREAKERS ARE ADDED OR CIRCUITING CHANGED IN EXISTING PANELBOARDS, PROVIDE NEW TYPED INDEX CARD TO SHOW WHAT IS FED ON ALL NEW AND EXISTING CIRCUITS.

13.12 MANUFACTURERS: EATON, SCHNEIDER, SIEMENS.

1. ISSUED FOR TENDER 25.03.21

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145 Rainbow Dr,
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SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
Canada

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TRUE NORTH:

DRAWING TITLE:
ELECTRICAL SPECIFICATIONS

SCALE: AS NOTED

DRAWN: ABS

DATE: SEPTEMBER 2023

PROJECT #: ALL-23010629-A0

DRAWING #: E3.0

JOB NAME: HWDSB GLENDALE SEC SCH BOILER AHU REPLACEMENT — JOB No. ALL-23010629-A0

MECHANICAL SCHEDULE - BOILERS

DWG. DESIGNATION	SYSTEM and ROOM	MODEL	Type	WEIGHT (LBS)	OUTPUT (MBH)	INPUT (MBH)	EFFICIENCY (%)	WATER CONDITIONS				MECHANICAL REMARKS	WIRING FOR MECHANICAL EQUIPMENT SCHEDULE						ELECTRICAL WIRING INSTRUCTIONS
								FLOW (GPM)	PD (FT)	EWT (°F)	LWT (°F)		MOTOR W or HP	MCA	MCOP	VAC/ø	ROOM STARTER TYPE	REMOTE CONTROL DEVICE	DISC. TYPE	
B-1	BOILER ROOM	PATTERSON KELLY PK SOLIS SL-2000	CONDENSING	3000	1920	2000	96%	192	5.2	180	160	CONDENSING FIRETUBE BOILER, 10:1 TURNDOWN, NURO INTEGRAL BOILER CONTROLS.	-	15	-	208V/1ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE RED PAINTED DISCONNECT AND WIRE COMPLETELY. DIV. 26 TO PROVIDE EPO SWITCH WITH COVER TO REMOTELY SHUT DOWN BOILER. ALL CONTROL WIRING BY MECHANICAL DIVISION
B-2	BOILER ROOM	PATTERSON KELLY PK SOLIS SL-2000	CONDENSING	3000	1920	2000	96%	192	5.2	180	160	CONDENSING FIRETUBE BOILER, 10:1 TURNDOWN, NURO INTEGRAL BOILER CONTROLS.	-	15	-	208V/1ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE RED PAINTED DISCONNECT AND WIRE COMPLETELY. DIV. 26 TO PROVIDE EPO SWITCH WITH COVER TO REMOTELY SHUT DOWN BOILER. ALL CONTROL WIRING BY MECHANICAL DIVISION
B-3	BOILER ROOM	PATTERSON KELLY PK SOLIS SL-2000	CONDENSING	3000	1920	2000	96%	192	5.2	180	160	CONDENSING FIRETUBE BOILER, 10:1 TURNDOWN, NURO INTEGRAL BOILER CONTROLS.	-	15	-	208V/1ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE RED PAINTED DISCONNECT AND WIRE COMPLETELY. DIV. 26 TO PROVIDE EPO SWITCH WITH COVER TO REMOTELY SHUT DOWN BOILER. ALL CONTROL WIRING BY MECHANICAL DIVISION

JOB NAME: HWDSB GLENDALE SEC SCH BOILER AHU REPLACEMENT — JOB No. ALL-23010629-A0

MECHANICAL SCHEDULE - PUMPS

DWG. DESIGNATION	SYSTEM and ROOM	MODEL	SPEC TYPE	FLOW (GPM)	HEAD (FT)	EFF. (%)	VFD	MECHANICAL REMARKS	WIRING FOR MECHANICAL EQUIPMENT SCHEDULE							ELECTRICAL WIRING INSTRUCTIONS
									MOTOR W or HP	MCA FLA	MCOP	VAC/ø	ROOM STARTER TYPE	REMOTE CONTROL DEVICE	DISC. TYPE	
P-1	RADIATOR LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 125-1	VP	600	105.2	78.10%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	25 HP			208/3ø	VFD (DIV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-2	RADIATOR LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 125-1	VP	600	105.2	78.10%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	25 HP			208/3ø	VFD (DIV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-3	FAN COIL LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 45-1	VP	250	85.2	73.40%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DIV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-4	FAN COIL LOOP	GRUNDFOS HYDRO NP (ABB) 2CR 45-1	VP	250	85.2	73.40%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DIV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-5	TECH WING LOOP	GRUNDFOS HYDRO NP (ABB)(CUE) 2CR 45-1	VP	200	85.2	74.90%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DIV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-6	TECH WING LOOP	GRUNDFOS HYDRO NP (ABB)(CUE) 2CR 45-1	VP	200	85.2	74.90%	YES	PACKAGED PUMP SKID WITH VFD SHIPPED LOOSE. PRESSURE TRANSDUCER FACTORY INSTALLED	10 HP			208/3ø	VFD (DIV.23)	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY THROUGH VFD SUPPLIED BY MECHANICAL DIVISION. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-9	BOILER PUMP	GRUNDFOS 40959 VL	CP	192	30	88.70%	NO	BOILER CIRCULATOR PUMP	3 HP	7.64		208/3ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-10	BOILER PUMP	GRUNDFOS 40959 VL	CP	192	30	88.70%	NO	BOILER CIRCULATOR PUMP	3 HP	7.64		208/3ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY. ALL CONTROL WIRING BY MECHANICAL DIVISION
P-11	BOILER PUMP	GRUNDFOS 40959 VL	CP	192	30	88.70%	NO	BOILER CIRCULATOR PUM	3 HP	7.64		208/3ø	BIC	BAS	TYPE 1	DIV. 26 TO PROVIDE DISCONECT AND WIRE COMPLETELY. ALL CONTROL WIRING BY MECHANICAL DIVISION

NOTES – ELECTRICAL WIRING INSTRUCTIONS:

1. DEEMED LIFE SAFETY EQUIPMENT IE SMOKE CONTROL, AREA PRESSURIZATION ETC.
2. USE FIRE RATED CABLES FOR POWER FEEDER TO EQUIPMENT
3. USING ONE FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT FAN STARTS/RUNS BY MANUALLY SELECTING "RUN" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
4. USING ONE FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT FAN STARTS/RUNS EITHER AUTOMATICALLY ON FIRE ALARM SYSTEM ALERT OR EVAC SIGNAL, OR BY MANUALLY SELECTING "RUN" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
5. USING SECOND FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT THE FAN STOPS BY MANUALLY SELECTING THE "OFF" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
6. USING FAIM INTERLOCK WITH FIRE ALARM SYSTEM TO INDICATE FAN'S RUN/OFF STATUS AT THE CACF.
7. INTERLOCK DIRECTLY WITH DUCT DETECTOR SO THAT FAN SHUTS DOWN WHEN DETECTOR ACTUATES.
8. USING FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT FAN SHUTS DOWN ON FIRE ALARM SYSTEM ALERT OR EVAC SIGNAL.
9. PROVIDE 120 VOLT CIRCUIT AND LOCAL TOGGLE DISCONNECT SWITCH FOR BUILT-IN PREWIRED SERVICE RECEPTACLES AND/OR LIGHTS.
10. PROVIDE 2 FAIMS PER DAMPER. CONNECT ONE TO DAMPER "CLOSED" POSITION END SWITCH(ES) AND ONE TO DAMPER "OPEN" POSITION END SWITCH(ES) TO PROVIDE DAMPER POSITION STATUS SIGNAL TO FA SYSTEM. WHERE THERE ARE MULTIPLE END SWITCHES, WIRE IN SERIES TO FA INPUT MODULE. DAMPER END SWITCHES ARE SUPPLIED AND INSTALLED BY MECHANICAL DIVISION.
11. USING FACR, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT NORMALLY CLOSED DAMPER CLOSES ON FIRE ALARM SYSTEM ALERT OR EVAC SIGNAL OR MANUALLY BY SELECTING THE "OPEN" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
12. INTERLOCK DIRECTLY WITH DUCT DETECTOR SO THAT FAN SHUTS DOWN WHEN DETECTOR ACTUATES.
13. MOUNT STARTER AT UNIT AS A DISCONNECT.
14. INTERLOCK DISCONNECT SWITCH AUXILIARY CONTACT TO VFD FOR SHUT DOWN WHEN SWITCH IS OPEN.
15. USE NEXANS "DRIVERX (CSA)" CABLES OR APPROVED EQUAL FOR POWER WIRING FROM VFD THROUGH DISCONNECT SWITCH AND ONTO MOTOR. ALL ASSOCIATED CABLE CONNECTORS SHALL BE RATED FOR CLASS II, GROUPS E, F AND G HAZARDOUS LOCATIONS.
16. PROVIDE 120VAC "VAV" JUNCTION BOXES AS INDICATED FOR USE BY MECHANICAL DIVISION TO CONNECT VAV BOX LOW VOLTAGE TRANSFORMER PRIMARY WIRING.
17. ALL SUMP PUMP MOTORS CAN OPERATE AT THE SAME TIME. CONNECT FLOAT SWITCHES (FOUR(4) PER PUMP PACKAGE) AND PUMP CABLES TO CONTROL PANEL. INSTALL HORN/LIGHT ALARM SUPPLIED BY MECHANICAL DIVISION AND WIRE TO CONTROL PANEL. CONFIRM EXACT LOCATION WITH OWNER (ALLOW 100 M RUN).
18. FEED FIRE PUMP AUTOMATIC TRANSFER SWITCH/CONTROLLER FROM BOTH NON-ESSENTIAL POWER AND ESSENTIAL POWER SUPPLIES AS INDICATED. PROVIDE SIX (6) FAIM'S AND CONNECT EACH FAIM TO ONE OF THE FOLLOWING SWITCHES/CONTACTS WITHIN CONTROLLER:
    a. "LOSS OF EXCESS WATER PRESSURE"
    b. "LOSS OF POWER"
    c. "PUMP MOTOR RUNNING"
    d. "PHASE LOSS"
    e. "PHASE REVERSAL"
    f. "CONTROLLER CONNECTED TO ESSENTIAL POWER"

    ALL FIRE ALARM CONNECTIONS ARE SUPERVISORY ZONE CONNECTIONS AS INDICATED ON PLANS.
19. WIRE PRESSURE SWITCH (PS) (LOCATED WITHIN 6 METERS) SO THAT PUMP STARTS WHEN PS IS ACTIVATED.
20. PROVIDE FAIM AND CONNECT TO CONTROLLER FOR "LOSS OF POWER" SIGNAL.
21. RUNS Nos 4, 5 AND 6 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
22. RUNS Nos 8, 9, 10 AND 11 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
23. RUNS Nos 13 AND 14 SHARE A COMMON BREAKER A COMMON CONTROLLER AND FAIM.
24. RUNS Nos 16 AND 17 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
25. RUNS Nos 18 AND 19 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
26. RUNS Nos 22 AND 23 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.
27. RUNS Nos 24 AND 25 SHARE A COMMON BREAKER AND A COMMOM CONTROL THERMOSTAT.
28. PROVIDE ONE(1) CAT. 6 CABLE IN CONDUIT AND CONNECT TO NEAREST ROP LAN PATCH PANEL.
29. USING TWO (2) FACR'S, INTERLOCK WITH FIRE ALARM SYSTEM SO THAT DAMPER OPENS BY MANUALLY SELECTING THE "OPEN" POSITION ON THE SELECTOR SWITCH AT THE CACF AND THE DAMPER CLOSES BY MANUALLY SELECTING THE "CLOSE" POSITION ON THE ASSOCIATED SELECTOR SWITCH AT THE CACF.
30. NOT IN USE.
31. PROVIDE A FAIM FOR EACH DEVICE AND WIRE TO SAME AND CONNECT FAIM TO FIRE ALARM SYSTEM AS INDICATED. CONFIRM EXACT DEVICE LOCATION WITH SPRINKLER SYSTEM CONTRACTOR PRIOR TO ROUGH-IN. ALLOW FOR CHANGE OF LOCATION WITHIN SIX (6) METERS OF WHAT IS INDICATED.
32. PROVIDE TWO (2) FACR'S AND CONNECT TO PANEL. PROGRAM FACR'S TO PROVIDE SEPARATE FIRST STAGE AND SECOND STAGE FIRE ALARM SIGNALS TO THE BAS SYSTEM.
33. RUNS Nos 30, 31 AND 32 SHARE A COMMON BREAKER AND A COMMON CONTROL THERMOSTAT.

WIRING FOR MECHANICAL EQUIPMENT SCHEDULE LEGEND

- AM – ACTUATOR MOTOR
- APS – AIR PROVING SWITCH
- AST – AQUASTAT
- BAS – CONTROL BY BUILDING AUTOMATION SYSTEM CONTRACTOR
- BIC – BUILT IN CONTROLLER
- C1 – EEMAC-1 TYPE DISC. SWITCH
- C2 – EEMAC-2 TYPE DISC. SWITCH
- C3R – EEMAC-3R TYPE DISC. SWITCH
- C4 – EEMAC-4 TYPE DISC. SWITCH
- C12 – EEMAC-12 TYPE DISC. SWITCH
- COMB – COMBINATION MAGNETIC STARTER
- CP – CONTROL PANEL
- CSR – CURRENT SENSING RELAY
- CT – CONTROL TRANSFORMER
- CWSV – COLD WATER SOLENOID VALVE
- (D23) – ITEM ADJACENT IS SUPPLIED, INSTALLED AND WIRED BY MECHANICAL DIVISION.
- (D23A) – ITEM ADJACENT IS SUPPLIED AND INSTALLED BY MECHANICAL DIVISION. ELECTRICAL DIVISION WIRES ITEM.
- (D26) – ITEM ADJACENT IS SUPPLIED BY MECHANICAL DIVISION. ELECTRICAL DIVISION INSTALLS AND WIRES ITEM.
- (D26A) – ITEM ADJACENT IS SUPPLIED, INSTALLED AND WIRED BY ELECTRICAL
- DISC – DISCONNECT
- DM – DAMPER MOTOR
- DMSW – DAMPER MOTOR SWITCH
- DVR – DOUBLE VOLTAGE RELAY
- FA – FIRE ALARM SYSTEM CONNECTION
- FAIM – ADDRESSABLE FIRE ALARM INPUT MODULE
- FACR – ADDRESSABLE FIRE ALARM CONTROL RELAY MODULE
- FL – FLOAT SWITCH
- FLA – FULL LOAD RUNNING AMPERES
- FPU – FIELD PROCESSOR UNIT BY DIV. 15900*
- FPU/SS – START/STOP CONTROL OUTPUT FROM FPU*
- FPU/ST – MOTOR RUNNING STATUS INPUT TO FPU*
- FRAC – FRACTIONAL HORSEPOWER
- FS – FLOW SWITCH
- GSV – GAS SOLENOID VALVE
- HOA – HAND/OFF/AUTO SWITCH IN STARTER COVER
- HUM – HUMIDISTAT
- HWSV – HOT WATER SOLENOID VALVE
- IRS – INFRARED SENSOR
- KMSW – KEY OPERATED MOMENTARY CONTACT SWITCH
- KSW/PL – KEY SWITCH(15A, 120V,SPST, LOCK TYPE C/W PILOT LIGHT)

WIRING FOR MECHANICAL EQUIPMENT SCHEDULE LEGEND

- LS – LEVEL SWITCH
- LWCO – LOW WATER CUT OFF
- MAG – MAGNETIC STARTER
- MAN – MANUAL STARTER
- MCA – MINIMUM CIRCUIT AMPS
- MCC – MOTOR CONTROL CENTRE
- MFA – MAXIMUM FUSE AMPACITY
- MOCP – MAXIMUM OVER CURRENT PROTECTION
- MVS – MONITORED VALVE SWITCH
- ODT – OFF DELAY TIMER
- PB – PUSHBUTTON ON/OFF SWITCH IN STARTER COVER
- PL – PILOT LIGHT IN STARTER COVER
- PLG – 120V RECEPTACLE BY ELECTRICAL DIVISION
- PS – PRESSURE SWITCH
- RPB – REMOTE STOP/START PUSHBUTTON
- RPL – REMOTE PILOT LIGHT
- SD – SMOKE DETECTOR (DUCT TYPE)
- SS – SPEED SWITCH
- SLS & PL – SELECTOR SWITCH AND PILOT LIGHT
- SV – SOLENOID VALVE
- SW – HP RATED TOGGLE SWITCH
- TC – TEMPERATURE CONTROLLER
- TI – TIMER (INTERVAL)
- T7 – TIMER (7-DAY)
- TRS – THERMOSTAT REVERSING SWITCH
- TS – THERMOSTAT
- T – THERMOSTAT OR TEMPERATURE SENSING UNIT
- VM – VALVE MOTOR
- VFD (VSD) – VARIABLE FREQUENCY (OR SPEED) DRIVE
- TOA – TEST/OFF/AUTO SWITCH IN STARTER COVER.

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5. ISSUED FOR CONSTRUCTION 02.05.24

PROJECT:
Boiler Renovations

Glendale Secondary School

145 Rainbow Dr, Hamilton, ON
For the HWDSB

SEAL:

EXP Services Inc.
t: 905.525.6069 | f: 905.528.7310
1266 South Service Road,
Suite C1-1, Stoney Creek,
ON, L8E 5R9
Canada

www.exp.com

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