



REVISIONS			
07/08/2026	CD SET		

DRAWN
LDT
APPROVED
CAT

MATRIX
CONSULTING ENGINEERS, INC

544 Cheaburg Drive
Lansing, MI 48917

PHONE (517) 487-2511

administrator@matrixinc.com
Matrix Project No. 250963.00

MECHANICAL ABBREVIATIONS

AFF	ABOVE FINISH FLOOR	ID	INSIDE DIAMETER
AC	AIR COMPRESSOR	I.E.	INVERT ELEVATION
AHU	AIR HANDLING UNIT	IAH	INTAKE HOOD
AS	AIR SEPARATOR		
A.T.C.	ARCHITECTURAL TRADES CONTRACTOR	LAT	LEAVING AIR TEMPERATURE
		LH	LATENT HEAT (MBH)
B	BOILER	LWT	LEAVING WATER TEMPERATURE
B.A.S.	BUILDING AUTOMATION SYSTEM		
CAF	COMBUSTION AIR FAN	MAX	MAXIMUM
CC	COOLING COIL	MBH	BTU PER HOUR (THOUSAND)
CFM	CUBIC FEET PER MINUTE	MIN	MINIMUM
CHLR	CHILLER	M.T.C.	MECHANICAL TRADES CONTRACTOR
CHP	CONSOLE HEAT PUMP		
CONV	CONVECTOR	N.C.	NOISE CRITERIA
CT	COOLING TOWER	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
CU	CONDENSING UNIT	NTS	NOT TO SCALE
CUH	CABINET UNIT HEATER		
CV	CONTROL VALVE	P	PUMP
CWP	CHILLED WATER PUMP	PCR	PUMPED CONDENSATE RETURN
		PD	PRESSURE DROP
DB	DRY BULB	RCP	RADIANT CEILING PANEL
DFU	DUCT FURNACE	REQD	REQUIRED
DIA	DIAMETER	RG	RETURN GRILLE
DN	DOWN	RH	RELATIVE HUMIDITY
DPR	DAMPER	RLH	RELIEF HOOD
DS	DUCT SILENCER	RTU	ROOF TOP UNIT
		SD	SUPPLY DIFFUSER
EAT	ENTERING AIR TEMPERATURE	SF	SUPPLY FAN
EF	EXHAUST FAN	SG	SUPPLY GRILLE
EG	EXHAUST GRILLE	SH	SENSIBLE HEAT (MBH)
E.T.C.	ELECTRICAL TRADES CONTRACTOR	SM	SHEET METAL
EVR	EVAPORATOR	SQ. FT.	SQUARE FEET
EWI	ENTERING WATER TEMPERATURE	SST	SATURATED SUCTION TEMPERATURE
EXH	EXHAUST	STR	STRAINER
EXIST	EXISTING		
FF	FINISH FLOOR	TC	TOTAL COOLING (MBH)
FBM	FEET PER MINUTE	TCL	TEMPERATURE CONTROL
FT	FEET	T&P	TEMPERATURE & PRESSURE RELIEF VALVE
FTR	FINED TUBE RADIATION	TPY	TYPICAL
FU	FURNACE		
		UH	UNIT HEATER
GAL	GALLON	VAV	VARIABLE AIR VOLUME BOX
GFRH	GAS FIRED RADIANT HEATER	VRH	VARIABLE AIR VOLUME REHEAT BOX
GR	GRILLE	FVAV	FAN POWERED VARIABLE AIR VOLUME BOX
		V.F.D	VARIABLE FREQUENCY DRIVE
H	HUMIDIFIER		
HC	HEATING COIL	ZD	ZONE DAMPER
HD	HEAD (FT)		
HP	HORSE POWER		
HHP	HORIZONTAL HEAT PUMP	X-SA	EXISTING ITEM (EXISTING SUPPLY AIR DUCT)
HTG	HEATING		
HVAC	HEATING, VENTILATION, & AIR CONDITIONING		
HWP	HEATING WATER PUMP		
HX	HEAT EXCHANGER		

GENERAL HVAC NOTES

- ALL WORK SHALL CONFORM TO MICHIGAN MECHANICAL CODE, LATEST APPLICABLE EDITION.
- LOCATE EXHAUST OUTLETS OF COMBUSTION EQUIPMENT STACKS, AT LEAST 10 FEET FROM OUTDOOR AIR INTAKES.
- INSTALL ALL EQUIPMENT, MATERIALS, AND ACCESSORIES PER MANUFACTURERS WRITTEN INSTRUCTIONS.
- NOTIFY OWNER OF ANY PIPING OR DUCTWORK DEMOLITION THAT MAY AFFECT NORMAL OPERATION OF OTHER AREAS.
- FIELD VERIFY LOCATIONS OF EXISTING PIPING THAT MAY CONFLICT WITH NEW CONSTRUCTION AND RELOCATE AS NEEDED.
- CONTRACTOR SHALL COORDINATE ALL WORK WITH OTHER DISCIPLINES PRIOR TO CONSTRUCTION TO AVOID CONFLICTS.
- PROVIDE MANUAL AIR VENTS WITH 3/4" HOSE CONNECTION AT ALL HIGH POINTS.
- OFFSET PIPING TO ACCOMMODATE LARGE DUCTWORK.
- THE CONTRACTOR SHALL FIELD VERIFY THE SIZES, LOCATION, ELEVATIONS, AND DETAILS OF ALL EXISTING CONDITIONS THAT MAY AFFECT THE WORK.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE INTEGRITY OF ALL EQUIPMENT AND MATERIALS IN A "NEW" CONDITION DURING CONSTRUCTION.
- ALL WORK SHALL BE PERFORMED BY LICENSED CONTRACTORS AND SUBCONTRACTORS AS REQUIRED BY LAW.
- ALL CONDENSATE DRAIN PIPING SET @ MIN. 1% SLOPE.
- ALL CONDENSATE DRAIN PIPING TO TERMINATE TO DRAIN VIA AIR GAP.
- IF THERE IS CONFLICTING INFORMATION IN THE PLANS OR SPECIFICATIONS THE MORE STRINGENT AND GREATER COST ITEM SHALL BE USED.
- DRAWINGS INDICATE REQUIRED SIZES AND POINTS OF TERMINATION OF PIPES AND DUCTS AND SUGGESTED ROUTES. IT IS NOT INTENTION OF DRAWINGS TO INDICATE ALL NECESSARY OFFSETS. INSTALL WORK IN MANNER TO CONFORM TO STRUCTURE, AVOID OBSTRUCTIONS, PRESERVE HEADROOM AND KEEP OPENINGS AND PASSAGEWAYS CLEAR. DO NOT SCALE FROM DRAWINGS.
- ANY INFORMATION FOUND ON THE DRAWINGS AND NOT IN THE SPECIFICATIONS, OR FOUND IN SPECIFICATIONS AND NOT IN THE DRAWINGS, SHALL BE CONSTRUED AS TO BE INCLUDED IN BOTH THE SPECIFICATIONS AND THE DRAWINGS. ANY CONFLICT BETWEEN THE PLANS AND THE SPECIFICATIONS WILL BE INTERPRETED BY THE ARCHITECT. IN THE EVENT OF CONFLICT, FOR THE PURPOSE OF BIDDING, THE CONTRACTOR SHALL PRESUME THE MOST EXPENSIVE COMBINATION OF QUALITY AND QUANTITY OF WORK SHALL PREVAIL.
- PERFORM WORK IN ACCORDANCE WITH THE LATEST EDITIONS, REVISIONS, AMENDMENTS, OR SUPPLEMENTS OF APPLICABLE STATUTES, ORDINANCES, CODES OR REGULATIONS OF FEDERAL, STATE, AND LOCAL AUTHORITIES HAVING JURISDICTION IN EFFECT ON THE DATE BIDS ARE RECEIVED.
- WHERE APPROVED STANDARDS HAVE BEEN ESTABLISHED BY OSHA, UNDERWRITERS LABORATORIES, AMERICAN CODES, ASA, ASHRAE, ARI, NEC, STATE FIRE INSURANCE REGULATION BODY, NFPA OR OTHERS, THESE STANDARDS SHALL BE FOLLOWED WHETHER OR NOT INDICATED ON THE DRAWING AND SPECIFICATIONS.
- DUCT/PIPING LAYOUT IS SCHEMATIC. EXACT LOCATION OF DUCT/PIPING AND EQUIPMENT SHALL BE COORDINATED WITH BUILDING STRUCTURE, EQUIPMENT FURNISHED, ARCHITECTURAL DRAWINGS, AND ALL OTHER TRADES PRIOR TO INSTALLATION. ANY CONTRACTOR INSTALLING WORK WITHOUT PRIOR COORDINATION SHALL RELOCATE HIS WORK AT HIS EXPENSE TO ALLOW PROPER INSTALLATION OF ANY AND ALL TRADES WORK.
- UNLESS OTHERWISE NOTED, ALL DUCT/PIPING SHALL BE CONCEALED WHEREVER POSSIBLE. PROVIDE CHROME ESCUTCHEON OR ALUMINUM DUCT COLLAR AT EACH PENETRATION OF A FINISHED SURFACE.
- DUCT/PIPING SHALL NOT BE RUN ABOVE ELECTRICAL GEAR IN THE SERVICE SPACE REQUIRED BY THE NATIONAL ELECTRICAL CODE.
- ANY ADDITIONAL LOW VOLTAGE CONTROL WIRING THAT IS REQUIRED SHALL BE PROVIDED BY THE HVAC CONTRACTOR. CONTROL WIRING SHALL BE RUN IN CONDUIT IF REQUIRED BY LOCAL CODES OR THE SPECIFICATIONS. POWER SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR.
- PROVIDE TRAP FOR CONDENSATION DRAIN LINES.
- PROVIDE VIBRATION ISOLATION AT EACH CONNECTION TO A MOTORIZED PIECE OF EQUIPMENT BY THE HVAC CONTRACTOR.

GENERAL DEMOLITION NOTES

- EXISTING EQUIPMENT LAYOUT IS SCHEMATIC. EXACT LOCATION OF EXISTING DUCT/PIPING AND EQUIPMENT SHALL BE COORDINATED WITH BUILDING STRUCTURE, EQUIPMENT FURNISHED, ARCHITECTURAL DRAWINGS AND ALL OTHER TRADES PRIOR TO DEMOLITION.
- PERFORM WORK IN ACCORDANCE WITH THE LATEST EDITIONS, REVISIONS, AMENDMENTS, OR SUPPLEMENTS OF APPLICABLE STATUTES, ORDINANCES, CODES OR REGULATIONS OF FEDERAL, STATE, AND LOCAL AUTHORITIES HAVING JURISDICTION IN EFFECT ON THE DATE BIDS ARE RECEIVED.
- WHERE APPROVED STANDARDS HAVE BEEN ESTABLISHED BY OSHA, UNDERWRITERS LABORATORIES, AMERICAN CODES, ASA, ASHRAE, ARI, NEC, STATE FIRE INSURANCE REGULATION BODY, NFPA OR OTHERS, THESE STANDARDS SHALL BE FOLLOWED WHETHER OR NOT INDICATED ON THE DRAWING AND SPECIFICATIONS.
- COORDINATE CUTTING AND PATCHING WITH GENERAL CONTRACTOR.
- ALL BOLD DASHED LINES INDICATE ITEMS TO BE REMOVED UNLESS NOTED BY KEYNOTE. ALL OTHER EXISTING SYSTEMS SHOWN FOR REFERENCE ONLY.
- PATCH AND REPAIR ALL FLOOR AND WALL SURFACES LEFT DAMAGED OR INCOMPLETE FROM REMOVAL OF EXISTING PARTITIONS, MILLWORK, CASEWORK, OR OTHER FIXED ACCESSORIES AND EQUIPMENT WITH MATERIALS TO MATCH EXISTING, AS ACCEPTABLE TO THE ARCHITECT.
- NOTATIONS ARE MADE IN VARIOUS PLACES ON THE DRAWINGS TO CALL ATTENTION TO DEMOLITION WHICH IS REQUIRED. HOWEVER, THESE DRAWINGS ARE NOT INTENDED TO SHOW EACH AND EVERY ITEM TO BE REMOVED. CONTRACTOR SHALL REMOVE ALL MATERIALS RELATED TO THEIR RESPECTIVE TRADES AS REQUIRED TO PERMIT THE CONSTRUCTION OF THE NEW WORK AS SHOWN.
- THE GENERAL CONTRACTOR SHALL COORDINATE THE EXTENT OF THE REQUIRED DEMOLITION OF THE EXISTING BUILDING AS REQUIRED TO FACILITATE THE CONSTRUCTION OF THE PROJECT AS SHOWN AS PART OF THIS WORK.
- ALL DEMOLITION SHALL BE APPROVED BY THE OWNER/TENANT PRIOR TO COMMENCEMENT AND SHALL BE PERFORMED UNDER REQUIREMENTS AND APPROVAL OF THE LOCAL CODE JURISDICTIONS.
- ASBESTOS ABATEMENT: CONTRACTOR SHALL NOTIFY BUILDING REPRESENTATIVE IMMEDIATELY WHEN AND IF ANY ITEMS ARE ENCOUNTERED THAT IN ANY WAY, SHAPE, OR FORM APPEAR TO BE HAZARDOUS OF NATURE. ASBESTOS ABATEMENT IS NOT PART OF THE SCOPE OF THE DESIGN. PROFESSIONALS DOCUMENTATION OR RESPONSIBILITY TO SURVEY, IDENTIFY, OR FOR CONSULTATION OF PROPER DISPOSAL.
- PROTECT ALL EXISTING WORK WHICH IS TO REMAIN AND RESTORE IN AN APPROVED MANNER IF ANY SUCH WORK WHICH BECOMES DAMAGED.
- RUBBISH AND DEBRIS RESULTING FROM THE WORK SHALL BE REMOVED IMMEDIATELY FROM THE SITE IN A SAFE AND LEGAL MANNER BY THE CONTRACTOR.
- TEMPORARY LIGHTING AND POWER SHALL BE PART OF THE SCOPE OF THIS WORK; SEE ELECTRICAL.
- DEMOLITION CONTRACTOR SHALL BE RESPONSIBLE TO CONTACT BUILDING REPRESENTATIVE TO CLARIFY ANY ITEMS NOT SHOWN ON THESE DOCUMENTS OR SHOWN NOT MATCHING FIELD CONDITIONS.

MECHANICAL SYMBOLS LEGEND

HVAC DUCTWORK SYMBOLS

HVAC DUCTWORK & DIFFUSER TAGS

SD-1	250	TAG	CFM
8"	---	NECK	REMARKS
		SIZE	

MISCELLANEOUS NOTES

- POINT OF CONNECTION BETWEEN NEW AND EXISTING
- POINT OF EXISTING TO REMAIN AND EXISTING TO BE REMOVED
- INDICATES PLAN NOTE
- INDICATES DEMOLITION NOTE
- DETAIL BUBBLE
- DETAIL NUMBER
- PAGE LOCATION INDICATES
- DIRECTION OF DETAIL SECTION

HVAC PIPING

- CWS CHILLED WATER SUPPLY
- CWR CHILLED WATER RETURN
- CD CONDENSATE DRAIN
- CS CONDENSER WATER SUPPLY
- CR CONDENSER WATER RETURN
- CTS COOLING TOWER WATER SUPPLY
- CTR COOLING TOWER WATER RETURN
- DX DIRECT EXPANSION
- HPS HEAT PUMP WATER SUPPLY
- HPR HEAT PUMP WATER RETURN
- HS HEATING WATER SUPPLY
- HR HEATING WATER RETURN
- S SUCTION (REFRIGERANT)
- L LIQUID (REFRIGERANT)
- DXS SUCTION (DIRECT EXPANSION)
- DXL LIQUID (DIRECT EXPANSION)
- LPS LOW PRESSURE STEAM (0-20 LBS.)
- MPS MEDIUM PRESSURE STEAM (21-75 LBS.)
- HPS HIGH PRESSURE STEAM (76 LBS. & ABV.)
- SC STEAM CONDENSATE (GRAVITY)
- SCP PUMPED STEAM CONDENSATE
- SC (BF) STEAM CONDENSATE BOILER FEED
- G GAS

HVAC DUCTWORK

- SA SUPPLY AIR DUCT
- X-SA EXIST SUPPLY AIR DUCT
- RA RETURN AIR DUCT
- X-RA EXIST RETURN AIR DUCT
- OA OUTSIDE AIR DUCT
- X-OA EXIST OUTSIDE AIR DUCT
- EA EXHAUST AIR DUCT
- X-EA EXIST EXHAUST AIR DUCT

HVAC PIPING VALVES

- GATE VALVE
- GAS COCK
- CHECK VALVE
- BALANCE COCK
- CIRCUIT SETTER
- TWO-WAY CONTROL VALVE
- THREE-WAY CONTROL VALVE
- GLOBE VALVE
- BALL VALVE
- SOLENOID VALVE
- EXPANSION VALVE WITH THERMOSTATIC BULB
- PLUG VALVE
- BUTTERFLY VALVE
- RELIEF VALVE
- HOSE & DRAIN END VALVE
- PRESSURE RELIEF VALVE
- PRESSURE REDUCING VALVE
- TRIPLE DUTY VALVE
- GAS PRESSURE REGULATOR
- STRAINER (BLOW-OFF)

TEMPERATURE CONTROL SYMBOLS

- THERMOSTAT
- PROGRAMMABLE THERMOSTAT
- THERMOSTAT (W/ NIGHT SETBACK)
- ROOM SENSOR
- HUMIDISTAT
- PRESSURE GAUGE
- DAMPER (ELECTRIC OPERATION)
- DAMPER (PNEUMATIC OPERATION)
- DAMPER BLADES

HVAC PIPING SYMBOLS

- FLOW DIRECTION
- PIPING DROP
- PIPING RISE
- INLINE PIPING DROP
- INLINE PIPING RISE
- PIPING TEE
- PIPING ELBOW
- THERMOMETER
- PUMP
- UNION
- PIPE ANCHOR
- PIPE GUIDE
- BACK FLOW PREVENTER
- PIPE CAP
- PIPE BREAK
- THERMOMETER WELL
- EXPANSION LOOP
- EXPANSION COMPENSATOR
- FLOAT & THERMOSTATIC STEAM TRAP
- INVERTED BUCKET STEAM TRAP

LIGHTHOUSE ELEMENTARY BOILER AND PUMP UPGRADES

51880 WASHINGTON ST.
NEW BALTIMORE, MI 48047

SHEET DESCRIPTION

MECHANICAL SYMBOLS, NOTES, AND ABBREV.

DATE

04/08/2026

PROJECT NUMBER

250963.00

SHEET NUMBER

M-100

COMMISSIONING SPECIFICATIONS

THIS SECTION INCLUDES REQUIREMENTS FOR COMMISSIONING THE HVAC SYSTEM AND ITS SUBSYSTEMS AND EQUIPMENT.

DEFINITIONS:

- 1. BOD-HVAC: HVAC SYSTEMS BASIS OF DESIGN.
- 2. CXA: COMMISSIONING AUTHORITY.
- 3. SYSTEMS, SUBSYSTEMS, AND EQUIPMENT: WHERE THESE TERMS ARE USED TOGETHER OR SEPARATELY, THEY SHALL MEAN "AS-BUILT" SYSTEMS,SUBSYSTEMS, AND EQUIPMENT.
- 4. TAB: TESTING, ADJUSTING, AND BALANCING.

CONTRACTOR'S RESPONSIBILITIES:

CONTRACTOR:

- 1. ATTEND PROCEDURES MEETING FOR TAB WORK.
- 2. CERTIFY THAT TAB WORK IS COMPLETE.
- 3. MECHANICAL SUBCONTRACTOR:
- 4. COMPLETE ALL PRE-START-UP, START-UP, AND COMMISSIONING FORMS AND PROCEDURES AS DIRECTED BY THE CXA.
- 5. ATTEND TAB VERIFICATION TESTING.
- 6. PROVIDE MEASURING INSTRUMENTS AND LOGGING DEVICES TO RECORD TEST DATA, AND DATA ACQUISITION EQUIPMENT TO RECORD DATA FOR THE COMPLETE RANGE OF TESTING FOR THE REQUIRED TEST PERIOD.
- 7. HVAC INSTRUMENTATION AND CONTROL SUBCONTRACTOR: WITH THE CXA, REVIEW CONTROL DESIGNS FOR COMPLIANCE WITH BOD, CONTROLLABILITY WITH RESPECT TO ACTUAL EQUIPMENT TO BE INSTALLED, AND RECOMMEND ADJUSTMENTS TO CONTROL DESIGNS AND SEQUENCE OF OPERATION DESCRIPTIONS.

TAB SUBCONTRACTOR:

- 1. CONTRACT DOCUMENTS REVIEW: WITH THE CXA, REVIEW THE CONTRACT DOCUMENTS BEFORE DEVELOPING TAB PROCEDURES.
- 2. VERIFY THE FOLLOWING:
 - 2.1. ACCESSIBILITY OF EQUIPMENT AND COMPONENTS REQUIRED FOR TAB WORK, ADEQUATE NUMBER AND PLACEMENT OF BALANCING VALVES TO ALLOW PROPER BALANCING AND RECORDING OF WATER FLOW.
 - 2.2. ADEQUATE NUMBER AND PLACEMENT OF TEST PORTS AND TEST INSTRUMENTATION TO ALLOW READING AND COMPIlation OF SYSTEM AND EQUIPMENT PERFORMANCE DATA NEEDED TO CONDUCT BOTH TAB AND COMMISSIONING TESTING.
 - 2.3. WATER FLOW RATES HAVE BEEN SPECIFIED AND COMPARED TO CENTRAL EQUIPMENT OUTPUT CAPACITIES.

ELECTRICAL SUBCONTRACTOR:

- 1. WITH THE MECHANICAL SUBCONTRACTOR, COORDINATE INSTALLATIONS AND CONNECTIONS BETWEEN AND AMONG ELECTRICAL AND HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT.
- 2. ATTEND TAB VERIFICATION TESTING.

COMMISSIONING DOCUMENTATION

- 1. BOD-HVAC: OWNER WILL PROVIDE BOD-HVAC DOCUMENTS, PREPARED BY ENGINEER AND APPROVED BY OWNER, TO THE CXA AND EACH CONTRACTOR FOR USE IN DEVELOPING THE COMMISSIONING PLAN, SYSTEMS MANUAL, AND OPERATION AND MAINTENANCE TRAINING PLAN.

ASHRAE 90.1-2019 SPECIFIC COMPLIANCE IN COMMISSIONING

- 1. FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION PROVIDER
 - 1.1. THE COMMISSIONING AGENT SHALL BE OWNER'S HIRED REPRESENTATIVE, THE COMMISSIONING AGENT IS RESPONSIBLE FOR REVIEWING, COMMISSIONING, AND TESTING THE MECHANICAL, AND ELECTRICAL SYSTEMS AS REQUIRED BY ASHRAE 90.1-2019 (CURRENT ADOPTED MICHIGAN EGY CODE).
- 2. ITEMS TO BE REVIEWED
 - 2.1. THE FOLLOWING ARE REQUIRED TO BE REVIEWED FOR PROPER CONTROL AND/OR INCLUSION IN ACCORDANCE WITH ASHRAE 90.1-2019 BY THE CXA PROVIDER.
 - 2.2. INSULATION DESIGN/INSTALLATION
 - 2.3. MECHANICAL HVAC SYSTEMS

- 3. HVAC/PLUMBING/ELECTRICAL EQUIPMENT EFFICIENCY (ACCORDING TO SIMPLIFIED APPROACH HVAC)
 - 3.1. EQUIPMENT LABELING
 - 3.2. OFF-HOUR CONTROLS
 - 3.3. HYDRONIC SYSTEM CONTROLS
 - 3.4. OCCUPIED/STANDBY CONTROLS
 - 3.5. BOILER TURNDOWN
 - 3.6. HYDRONIC VARIABLE FLOW SYSTEMS
 - 3.7. BOILER ISOLATION
 - 3.8. HOT-WATER TEMPERATURE RESET CONTROLS

- 4. ELECTRICAL SYSTEMS
 - 4.1. ELECTRICAL EQUIPMENT EFFICIENCY (ACCORDING TO SIMPLIFIED APPROACH HVAC)
 - 4.2. AUTOMATIC RECEPTACLE CONTROL
 - 4.3. ELECTRICAL ENERGY MONITORING
 - 4.4. INTERIOR LIGHTING CONTROL
 - 4.5. SPECIAL APPLICATION LIGHTING CONTROL

OTHER BUILDING SYSTEMS:

- 5.1. ENERGY SYSTEMS MONITORING
- 5.2. ENERGY-COST BUDGET/PERFORMANCE PATHS LAID OUT IN THE PRESCRIPTIVE PATH.
- 6. MECHANICAL SYSTEMS
 - 6.1. OFF-HOUR CONTROLS
 - 6.2. HVAC/PIPING INSULATION
 - 6.3. HYDRONIC SYSTEM CONTROLS
 - 6.4. OCCUPIED/STANDBY CONTROLS
 - 6.5. BOILER TURNDOWN
 - 6.6. HYDRONIC VARIABLE FLOW SYSTEMS
 - 6.7. BOILER ISOLATION

ITEMS TO BE VERIFIED AND PERFORMANCE TESTED

- 5. THE FOLLOWING ARE REQUIRED TO BE VERIFIED AND PERFORMANCE TESTED IN ACCORDANCE WITH ASHRAE 90.1-2019 BY THE CXA PROVIDER.
- 6. MECHANICAL SYSTEMS
 - 6.1. OFF-HOUR CONTROLS
 - 6.2. HVAC/PIPING INSULATION
 - 6.3. HYDRONIC SYSTEM CONTROLS
 - 6.4. OCCUPIED/STANDBY CONTROLS
 - 6.5. BOILER TURNDOWN
 - 6.6. HYDRONIC VARIABLE FLOW SYSTEMS
 - 6.7. BOILER ISOLATION
- 7. ELECTRICAL SYSTEMS
 - 7.1. AUTOMATIC RECEPTACLE CONTROL
 - 7.2. ELECTRICAL ENERGY MONITORING
 - 7.3. INTERIOR LIGHTING CONTROL
 - 7.4. SPECIAL APPLICATION LIGHTING CONTROL

MECHANICAL SPECIFICATIONS

- 1. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH ALL APPLICABLE CODES, SPECIFICATIONS, LOCAL ORDINANCES, INDUSTRY STANDARDS AND UTILITY COMPANY REGULATIONS.
- 2. IN CASE OF DIFFERENCE BETWEEN BUILDING CODES, SPECIFICATIONS, STATE LAWS, LOCAL ORDINANCES, INDUSTRY STANDARDS, UTILITY COMPANY REGULATIONS, CONTRACT DOCUMENTS, AND AUTHORITY HAVING JURISDICTION, THE MOST STRINGENT SHALL GOVERN. CONTRACTOR SHALL PROMPTLY NOTIFY OWNER IN WRITING OF ANY SUCH DIFFERENCE.
- 3. NON-COMPLIANCE: SHOULD CONTRACTOR PERFORM ANY WORK THAT DOES NOT COMPLY WITH REQUIREMENTS OF APPLICABLE BUILDING CODES, STATE LAWS, LOCAL ORDINANCES, INDUSTRY STANDARDS, UTILITY COMPANY REGULATIONS, CONTRACT DOCUMENTS, OR AUTHORITY HAVING JURISDICTION, HE SHALL BEAR ALL COSTS ARISING IN CORRECTING THE DEFICIENCIES.
- 4. APPLICABLE CODES AND STANDARDS SHALL INCLUDE ALL STATE LAWS, LOCAL ORDINANCES, UTILITY COMPANY REGULATIONS AND APPLICABLE REQUIREMENTS OF MICHIGAN BUILDING CODE, MICHIGAN PLUMBING CODE, MICHIGAN DEPARTMENT OF FIRE AND BUILDING SERVICES.
- 5. EXCEPT AS OTHERWISE SPECIFIED HEREIN, ALL PIPING WORK AND MATERIAL ARE TO CONFORM TO THE AMERICAN STANDARDS ASSOCIATION CODE FOR PRESSURE PIPING.
- 6. PERMITS: CONTRACTOR SHALL PAY FOR ALL BUILDING PERMITS REQUIRED BY WORK AND PERMITS FOR OPENING STREETS AND FOR CONNECTION TO VARIOUS UTILITIES, INCLUDING FEES FOR WATER METER INSTALLATION AND ANY OTHER REQUIREMENTS NECESSARY TO CARRY OUT HIS WORK. WHERE STREETS OR SIDEWALKS ARE CUT, SAME MUST BE REPAIRED TO AT LEAST AS GOOD A CONDITION AS THEY WERE BEFORE, ALL AT EXPENSE OF THIS CONTRACTOR. PERMITS SHALL BE POSTED IN A PROMINENT PLACE AT THE BUILDING SITE AND BE PROPERLY PROTECTED FROM WEATHER AND PHYSICAL DAMAGE.

GUARANTEE

- 1. CONTRACTOR SHALL, BY ACCEPTING THESE DRAWINGS AND SPECIFICATIONS, GUARANTEE THE FOLLOWING:
 - 1.1. HE WILL FURNISH ALL MATERIAL AND EQUIPMENT AS SPECIFIED EXCEPT WHERE SPECIFIC WRITTEN APPROVAL IS GIVEN BY ENGINEER FOR SUBSTITUTION.
 - 1.2. ALL MATERIAL AND EQUIPMENT WILL BE INSTALLED SUBSTANTIALLY AS SHOWN ON DRAWINGS AND AS REQUIRED WITHIN INTENT OF THESE SPECIFICATIONS. ALL EQUIPMENT SHALL BE INSTALLED PER THE MANUFACTURERS RECOMMENDED INSTALLATION INSTRUCTIONS.
 - 1.3. ALL EQUIPMENT, PIPING, ETC., WILL BE DRIP/TIGHT, AIR/TIGHT, FREE OF VIBRATION, POUNDING AND OTHER OBJECTIONABLE NOISES.
 - 1.4. ALL EQUIPMENT, ACCESSORIES AND MATERIAL FURNISHED BY THE CONTRACTOR, INCLUDING INSTALLATION, PIPE JOINTS, ETC., FURNISHED AND/OR DONE BY HIM FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE AGAINST ALL DEFECTS IN MATERIAL AND WORKMANSHIP. IF ANY EQUIPMENT, MATERIAL AND/OR PIPE JOINTS, CONNECTIONS, ETC., FAILS OR DOES NOT OPERATE SATISFACTORILY OR SHOWS UNDUE WEAR, HE WILL, UPON BEING NOTIFIED, IMMEDIATELY REMEDY DEFECT AT HIS OWN EXPENSE.

WORK AND WORKMANSHIP

- 1. PROVIDE ALL REQUIRED LABOR, MATERIALS, EQUIPMENT AND CONTRACTOR'S SERVICES NECESSARY FOR COMPLETE INSTALLATION OF SYSTEMS REQUIRED IN FULL CONFORMITY WITH REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION, ALL AS INDICATED ON DRAWINGS AND HEREIN SPECIFIED.
- 2. FINISHED JOB SHALL BE FUNCTIONAL AND COMPLETE IN EVERY DETAIL, INCLUDING ANY AND ALL SUCH ITEMS REQUIRED FOR A COMPLETE SYSTEM WHETHER OR NOT THESE ITEMS BE SPECIFIED OR SHOWN ON DRAWINGS.
- 3. SPECIAL ATTENTION SHALL BE GIVEN TO ACCESSIBILITY OF WORKING PARTS AND CONTROLLING PARTS. ADJUSTABLE PARTS SHALL BE WITHIN EASY REACH. REMOVABLE PARTS SHALL HAVE SPACE FOR REMOVAL.
- 4. EACH CONTRACTOR SHALL ACQUAINT HIMSELF WITH DETAILS OF ALL WORK TO BE PERFORMED BY OTHER TRADES AND TAKE NECESSARY STEPS TO INTEGRATE AND COORDINATE HIS WORK WITH OTHER TRADES.
- 5. IT IS ASSUMED THE CONTRACTOR IS FAMILIAR WITH STANDARD 1ST CLASS INSTALLATION PROCEDURES. THEREFORE, THESE SPECIFICATIONS DO NOT ATTEMPT TO INCLUDE EVERY DETAIL OR OPERATION NECESSARY FOR THE COMPLETE INSTALLATION.
- 6. IT SHOULD BE PARTICULARLY NOTED THAT THE TERMS "FURNISH" AND "PROVIDE" ARE INTERCHANGEABLE AND THAT EACH OF THESE MEANS TO PROVIDE, INSTALL AND CONNECT, UNLESS OTHERWISE STATED.
- 7. WHENEVER TABLES OR SCHEDULES SHOW QUANTITY OF MATERIALS, THEY SHALL NOT BE USED AS A GUIDE TO CONTRACTOR. EACH CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING ALL MATERIALS NOTED ON DRAWINGS AS SPECIFIED.
- 8. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTION, SAFE-KEEPING AND CLEANLINESS OF ALL EXISTING EQUIPMENT, MATERIAL, ETC., LOCATED IN SPACES TO BE REMODELED IN WHICH HE IS WORKING, AS PART OF HIS RESPONSIBILITY, HE SHALL PROVIDE NECESSARY COVERS, STRUCTURES, ETC., AS REQUIRED TO KEEP ALL DIRT, WATER, MOISTURE AND DUST FROM EQUIPMENT. METHOD THE CONTRACTOR PROPOSES TO USE IN PROTECTING EQUIPMENT SHALL BE COORDINATED WITH ENGINEER AND OWNER'S REPRESENTATIVE FOR APPROVAL BEFORE ANY WORK IS STARTED. ANY DAMAGE SUSTAINED DURING CONSTRUCTION SHALL BE CORRECTED OR REPLACED BY CONTRACTOR.
- 9. MECHANICAL INSTALLATIONS: COORDINATE MECHANICAL EQUIPMENT AND MATERIALS INSTALLATION WITH OTHER BUILDING COMPONENTS, VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS, WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL MECHANICAL SERVICES AND OVERHEAD EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE. INSTALL MECHANICAL EQUIPMENT TO FACILITATE MAINTENANCE AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS. COORDINATE THE INSTALLATION OF MECHANICAL MATERIALS AND EQUIPMENT ABOVE CEILINGS WITH SUSPENSION SYSTEM, LIGHT FIXTURES, AND OTHER INSTALLATIONS. INSTALL EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURERS WRITTEN INSTALLATION INSTRUCTIONS.
- 10. OPERATION AND MAINTENANCE DATA: MANUFACTURER'S PRINTED OPERATION PROCEDURES TO INCLUDE START-UP, BREAK-IN, ROUTINE, NORMAL, SUMMER AND WINTER OPERATION INSTRUCTIONS, REGULATION, CONTROL, STOPPING, SHUT-DOWN, AND EMERGENCY INSTRUCTIONS, PROCEDURES FOR ROUTINE, PREVENTATIVE MAINTENANCE AND TROUBLESHOOTING, DISASSEMBLY, REPAIR AND REASSEMBLY, ALIGNING AND ADJUSTING INSTRUCTIONS, TRAIN OWNER'S PERSONNEL ON PROCEDURES FOR STARTING, STOPPING, TROUBLESHOOTING, SERVICING, AND MAINTAINING EQUIPMENT, TURN OVER TO THE OWNER.
- 11. RECORD DRAWINGS: THE CONTRACTOR SHALL KEEP A RUNNING RECORD OF EACH CHANGE AND DEVIATION FROM THE DRAWINGS. UPON THE COMPLETION OF THE PROJECT, THE CONTRACTOR SHALL SUBMIT ONE COMPLETE SET OF CLEAN DRAWINGS NEATLY SHOWING DEVIATIONS FROM THE CONTRACT DOCUMENTS WITH DIMENSIONS SHOWING THE EXACT LOCATION OF CONCEALED OR INACCESSIBLE PIPING, DUCTS, ETC.

ASSIGNMENT OF MISCELLANEOUS WORK

- 1. PAINTING: MECHANICAL CONTRACTOR WILL PROVIDE PRIME PAINTING ON ALL FERROUS METALS SUCH AS SUPPORT STEEL OR HANGERS FOR MECHANICAL PIPING AND EQUIPMENT. PIPING IS NOT TO BE PRIMED. ANY FINISH PAINTING REQUIRED, INCLUDING PAINTING OF PIPING AND STEEL EXPOSED TO OUTSIDE ENVIRONMENT WILL BE PAINTED BY MECHANICAL CONTRACTOR.
- 2. PLATFORMS AND SUPPORTING STANDS: FOR MECHANICAL EQUIPMENT SHALL BE FURNISHED BY MECHANICAL CONTRACTOR UNLESS NOTED OTHERWISE.
- 3. HOLES THRU STRUCTURAL: HOLES REQUIRED FOR PIPING OR DUCT/WORK OF SIZE 5" OR SMALLER SHALL BE CUT IN FIELD AT EXPENSE OF MECHANICAL CONTRACTOR WITH APPROVAL OF STRUCTURAL ENGINEER. OWNER SHALL BE GIVEN APPROVAL PRIOR TO ANY CUTTING. ALL LARGER HOLES SHALL BE PROVIDED BY OTHERS, WITH LOCATION APPROVAL FROM STRUCTURAL ENGINEER.
- 4. CEILING AND WALL ACCESS PANELS: MECHANICAL CONTRACTOR SHALL CUT AND PATCH FINISHED AREAS AS REQUIRED BY MECHANICAL CONTRACTOR. PROVIDE WHERE SHOWN OR REQUIRED FOR ACCESS TO COILS, VALVES, ETC., ACCESS PANELS AS SPECIFIED.
- 5. CUTTING AND PATCHING: MECHANICAL CONTRACTOR SHALL CUT AND PATCH FINISHED AREAS AS REQUIRED BY MECHANICAL CONTRACTOR. IN ABSENCE OF GENERAL CONTRACTOR, EACH CONTRACTOR SHALL DO HIS OWN CUTTING AND PATCHING.
- 6. ROOF OPENINGS AND FLASHING REQUIRED BY MECHANICAL CONTRACTOR SHALL BE BY MECHANICAL CONTRACTOR. MECHANICAL CONTRACTOR IS RESPONSIBLE FOR CORRECT SIZE AND LOCATION OF SAME. COUNTER FLASHING BY MECHANICAL CONTRACTOR. PIPE CURBS SHALL BE USED FOR ALL ROOF PENETRATIONS CREATED BY PIPING OR CONDUIT RELATED TO MECHANICAL EQUIPMENT.
- 7. PADS AND FOUNDATIONS FOR MECHANICAL EQUIPMENT SHALL BE FORMED AND POURED BY MECHANICAL CONTRACTOR. MECHANICAL CONTRACTOR SHALL VERIFY PADS AND ALL ANCHORING DEVICES.
- 8. ROOF CURBS AND BASES FOR VENTILATORS, ROOF INTAKES AND RELIEF AND SHALL BE MECHANICAL CONTRACTOR. MECHANICAL CONTRACTOR AND FLASHED WEATHER TIGHT TO ROOF TO SATISFACTION OF ENGINEER.

SHOP DRAWING

- 1. COMPLETE SCHEDULE OF EQUIPMENT, ETC., PROPOSED FOR INSTALLATION SHALL BE SUBMITTED FOR APPROVAL BEFORE ORDERS ARE PLACED.
- 2. ELECTRONIC SHOP DRAWINGS SHALL BE REQUIRED WITHIN 30 DAYS OF AWARD ON CONTRACT AND SHALL INCLUDE CATALOG NUMBERS AND OTHER PERTINENT INFORMATION.
- 3. THE CONTRACTOR SHALL SUBMIT EQUIPMENT SHOP DRAWINGS TO THE ARCHITECT FOR APPROVAL PRIOR TO ORDERING OF ANY OF THE FOLLOWING:
 - 1.1. BOILERS (B-1), (B-2), (B-3)
 - 1.2. BOILER PUMPS (BP-1), (BP-2), (BP-3)
 - 1.3. PUMPS (P-1), (P-2), (P-3), (P-4)
 - 1.4. HYDRONIC PIPING
 - 1.5. HYDRONIC SPECIALTIES
 - 1.6. INSULATION
 - 1.7. CONTROLS

DRAWINGS

- 1. MECHANICAL DRAWINGS SHOW GENERAL ARRANGEMENT OF ALL PIPING EQUIPMENT AND APPURTENANCES. THEY SHALL BE FOLLOWED AS CLOSELY AS ACTUAL BUILDING CONSTRUCTION AND WORK OF OTHER TRADES WILL PERMIT.
- 2. MECHANICAL WORK SHALL CONFORM TO REQUIREMENTS SHOWN ON ALL DRAWINGS. GENERAL AND STRUCTURAL DRAWINGS SHALL TAKE PRECEDENCE OVER MECHANICAL DRAWINGS.
- 3. BECAUSE OF SMALL SCALE OF MECHANICAL DRAWINGS IT IS NOT POSSIBLE TO INDICATE ALL OFFSETS, FITTINGS AND ACCESSORIES WHICH MAY BE REQUIRED. CONTRACTOR SHALL INVESTIGATE STRUCTURAL AND FINISH CONDITIONS AFFECTING WORK AND SHALL ARRANGE HIS WORK ACCORDINGLY, PROVIDING SUCH FITTINGS, VALVES AND ACCESSORIES AS MAY BE REQUIRED TO MEET SUCH CONDITIONS.

COORDINATION BETWEEN CONTRACTORS

- 1. EACH CONTRACTOR AND SUBCONTRACTOR SHALL STUDY ALL DRAWINGS APPLICABLE TO THIS WORK SO COMPLETE COORDINATION BETWEEN TRADES WILL BE EFFECTED. SPECIAL ATTENTION SHALL BE GIVEN TO POINTS WHERE DUCTS CROSS OTHER DUCTS OR PIPING, WHERE LIGHTS FIT INTO CEILINGS AND WHERE PIPE, DUCTS AND CONDUIT PASS THRU WALLS AND COLUMNS.
- 2. IT IS RESPONSIBILITY OF EACH CONTRACTOR AND SUBCONTRACTOR TO LEAVE NECESSARY ROOM FOR OTHER TRADES. NO EXTRA COMPENSATION WILL BE ALLOWED TO COVER COST OF REMOVING PIPING, CONDUIT, DUCTS OR EQUIPMENT FOUND ENCRoACHING ON SPACE REQUIRED BY OTHERS.

MINOR DEVIATIONS

- 1. FOR PURPOSE OF CLARITY AND LEGIBILITY, DRAWINGS ARE ESSENTIALLY DIAGRAMMATIC ALTHOUGH SIZE AND LOCATION OF EQUIPMENT AND PIPING ARE DRAWN TO SCALE WHEREVER POSSIBLE. VERIFY CONTRACT DOCUMENT INFORMATION AT SITE.
- 2. DRAWINGS INDICATE REQUIRED SIZES AND POINTS OF TERMINATION OF PIPES AND DUCTS AND SUGGESTED ROUTES. IT IS NOT INTENTION OF DRAWINGS TO INDICATE ALL NECESSARY OFFSETS. INSTALL WORK IN MANNER TO CONFORM TO STRUCTURE, AVOID OBSTRUCTIONS, PRESERVE HEADROOM AND KEEP OPENINGS AND PASSAGEWAYS CLEAR. DO NOT SCALE FROM DRAWINGS.

ATTACHING TO BUILDING CONSTRUCTION

- 1. EQUIPMENT AND PIPING SUPPORTS SHALL BE ATTACHED TO STRUCTURAL MEMBERS (BEAMS, JOISTS, ETC.) RATHER THAN TO FLOOR OR ROOF SLABS.
- 2. WHERE PIPING IS SUSPENDED FROM NEW CONCRETE CONSTRUCTION, FURNISH, LOCATE AND INSTALL BLACK STEEL CHANNEL-TYPE CONCRETE INSERTS WELDED TO COVER-PLATE. INSERTS SHALL PROVIDE FOR HORIZONTAL AND VERTICAL ADJUSTMENTS.
- 3. WHERE PIPING IS SUSPENDED FROM EXISTING CONCRETE OR MASONRY CONSTRUCTION, USE EXPANSION SHIELDS TO ATTACH PIPE SUPPORTS TO EXISTING STRUCTURE. EXPANSION SHIELD ROD 1/2" DIAMETER SHALL BE SAME SIZE AS SUPPORT ROD DIAMETER HEREINAFTER SPECIFIED.
- 4. ERECTION OF METAL SUPPORTS & ANCHORAGES: CUT, FIT, AND PLACE MISCELLANEOUS METAL SUPPORTS ACCURATELY IN LOCATION, ALIGNMENT, AND ELEVATION TO SUPPORT AND ANCHOR MECHANICAL MATERIALS AND EQUIPMENT.

BALANCING

- 1. WORK BY MECHANICAL CONTRACTOR.
- 2. GENERAL: BALANCE AND ADJUST SYSTEMS TO ACHIEVE COMFORT AND PROPER OPERATION OF SYSTEMS.

- 2.1. USE PROCEDURES AS OUTLINED IN NATIONAL STANDARDS FOR FIELD MEASUREMENTS AND INSTRUMENTATION, CURRENT VOLUME, AS PUBLISHED BY ASSOCIATED AIR BALANCE COUNCIL.
- 2.2. IF A PIECE OF EQUIPMENT IS NOT OPERATING IN SATISFACTORY MANNER, COORDINATE WITH MANUFACTURER TO OBTAIN REPAIR PARTS.
- 2.3. SUBMIT REPORT TO ENGINEER IF SYSTEM OR PIECE OF EQUIPMENT CANNOT BE ADJUSTED TO OPERATE SATISFACTORILY.

PIPING

- 1. INSTALL CHROME-PLATED PIPE ESCUTCHEONS ON EXPOSED PIPE @ FLOORS, WALLS, AND CEILINGS.
- 2. 125# WROUGHT COPPER UNIONS WITH SOLDER JOINT FITTINGS, CRANE 633.
- 3. FURNISH AND INSTALL SUPPORTS, GUIDES AND ANCHORS REQUIRED FOR PROPER SUPPORT OF PIPES.
- 4. SUPPORT VERTICAL RUNS WITH HANGER ADJACENT TO ELBOW.
- 5. SUPPORT HORIZONTAL PIPE WITH GALVANIZED ALL-THREAD STEEL RODS (ASTM A107), SPACING: 1/2" - 2" PIPE, 8-10" ON CENTERS WITH 3/8" DIA. ROD, 2 1/2" - 3" PIPE, 12-10" ON CENTERS WITH 1/2" DIA. ROD.
- 6. DOMESTIC COLD WATER HARD COPPER TUBE, ASTM B88, TYPE-L WATER TUBE, DRAWN TEMPER WITH COPPER SOLDER JOINT PRESSURE FITTINGS, JOINING MATERIAL: SOLDER, ASTM B32, ALLOY 50NS, 50N4, OR E, LEAD FREE. CLEANING & DISINFECTING: PURGE AND DISINFECT POTABLE WATER SYSTEMS AS PRESCRIBED BY AUTHORITIES HAVING JURISDICTION.
- 7. GAS:
 - 7.1. PIPING: COMPLY WITH NFPA 70 AND MPC. STEEL PIPE: ASTM A53, TYPE E OR S, GRADE B, SCHEDULE 40, BLACK, MALLEABLE-IRON THREADED FITTINGS: ASME B16.3, CLASS 150, STANDARD PATTERN UNIONS: ASME B16.39, CLASS 150, MALLEABLE-IRON WITH BRASS TO IRON SEAT, GROUND JOINT, AND THREADED ENDS.
 - 7.2. STOPS: BRONZE BOTH WITH AGA STAMPS, PLUG TYPE WITH BRONZE PLUG AND SQUARE HEAD, 2-PSIG MINIMUM PRESSURE RATING.
- 8. BALL VALVES: TWO PIECE ALLOY, BRONZE BODY WITH FULL PORT, CHROME PLATED BALL, THE SEATS, 600-PSIG MINIMUM CWP RATING, LEVER HANDLE WITH EXTENDED STEM FOR INSULATION.
- 8.1. USE DIELECTRIC COUPLINGS WHEN JOINING DISSIMILAR PIPING MATERIALS.

PIPE HANGERS

- 1. MECHANICAL STEEL CLEVIS HANGERS, NON-METALLIC COATING FOR ELECTROLYTIC PROTECTION WHERE ATTACHMENTS ARE IN DIRECT WITH COPPER, COPPER U-STRAP HANGERS FOR UN-INSULATED PIPE, COMPLY WITH MSS STANDARD PRACTICE SP-69.

INSULATION

- 1. PIPE INSULATION
 - 1.1. SERVICE-DOMESTIC COLD WATER, MATERIAL: 1" MINERAL FIBER WITH ASJ JACKET, SEAL JOINTS TO PREVENT CONDENSATION.
 - 1.2. APPLY INSULATION ONLY AFTER PIPES HAVE BEEN TESTED AND CLEANED.
 - 1.3. INSTALL INSULATION IN A NEAT WORKMANLIKE MANNER.
 - 1.4. ALL INSULATION: RATING NOT TO EXCEED 25 FLAME, 50 SMOKE, RATED FOR USE IN RETURN AIR PLENUM.

HVAC PIPING

- 1. ACCEPTABLE MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
 - 2.1. VICTAULIC COMPANY OF AMERICA
- 2. GROOVED MECHANICAL-JOINT FITTINGS AND COUPLINGS:
 - 2.1. VICTAULIC COMPANY OF AMERICA
- 3. CALIBRATED BALANCING VALVES:
 - 3.1. FLOW DESIGN, INC.
 - 3.2. GERARD ENGINEERING COMPANY.
 - 3.3. GRISWOLD CONTROLS
 - 3.4. TOUR AND ANDERSSON, VICTAULIC
- 4. STEEL PIPE, NPS 2 AND SMALLER: ASTM A 53/A 53M, TYPE S (SEAMLESS) OR TYPE F (FURNACE-BUTT WELDED), GRADE B, SCHEDULE 40, BLACK STEEL, PLAIN ENDS.
- 5. STEEL PIPE, NPS 2-1/2 THROUGH NPS 12: ASTM A 53/A 53M, TYPE E (ELECTRIC-RESISTANCE WELDED), GRADE B, SCHEDULE 40, BLACK STEEL, PLAN ENDS.
- 6. CAST-IRON THREADED FITTINGS: ASME B16.4, CLASSES 125 AND 250.
- 7. MALLEABLE-IRON THREADED FITTINGS: ASME B16.3, CLASSES 150 AND 300.
- 8. MALLEABLE-IRON UNIONS: ASME B16.39, CLASSES 150, 250, AND 300.
- 9. CAST-IRON PIPE FLANGES AND FLANGED FITTINGS: ASME B16.1, CLASSES 25, 125, AND 250; RAISED GROUND FACE, AND BOLT HOLES SPOT FACED.
- 10. WROUGHT-STEEL FITTINGS: ASTM A 234/A 234M, WALL THICKNESS TO MATCH ADJOINING PIPE.
- 11. WROUGHT CAST- AND FORGED-STEEL FLANGES AND FLANGED FITTINGS: ASME B16.5, INCLUDING BOLTS, NUTS, AND GASKETS OF THE FOLLOWING MATERIAL GROUP, END CONNECTIONS, AND FACINGS:
 - 11.1. MATERIAL GROUP: 1.1.
 - 11.2. END CONNECTIONS: BUTT WELDING
 - 11.3. FACINGS: RAISED FACE
- 12. GROOVED MECHANICAL-JOINT FITTINGS: ASTM A 536, GRADE 65-45-12 DUCTILE IRON; ASTM A 52, TYPE F, E, OR S, GRADE B FABRICATED STEEL; OR ASTM A 106, GRADE B STEEL FITTINGS WITH GROOVES OR SHOULDERS DESIGNED TO ACCEPT VICTAULIC GROOVED END COUPLINGS.
- 13. GROOVED MECHANICAL-JOINT COUPLINGS: DUCTILE-IRON HOUSING AND SYNTHETIC RUBBER GASKET OF CENTRAL CAVITY PRESSURE-RESPONSIVE DESIGN; WITH NUTS, BOLTS, LOCKING PIN, LOCKING TOGGLE, OR LUGS TO SECURE GROOVED PIPE AND FITTINGS. COMPLY WITH ASTM A 536 GRADE 65-45-12, 65,000 PSI MINIMUM TENSILE STRENGTH.

- 13.1. KEY SECTION DESIGNED TO ENGAGE FULLY INTO THE GROOVE TYING THE JOINT INTEGRALLY TO THE PIPE.
- 13.2. GASKETS SHALL BE SUITABLE FOR THE TEMPERATURE AND FLUID USED IN THE SYSTEM USE GRADE "EPDM" EPDM GASKETS WITH UNIQUE SEALING DESIGN, RATED FOR CONTINUOUS USE AT 250 DEG F OR GRADE "E" EPDM GASKETS RATED FOR CONTINUOUS USE AT 230 DEG F UNLESS INDICATED OTHERWISE.
- 13.3. USE RIGID "QUICKVIC" OR "ZERO-FLEX" COUPLINGS UNLESS FLEX COUPLINGS ARE INDICATED FOR VIBRATION ISOLATION OR TO ACCOMMODATE SEISMIC MOVEMENT.
- 13.4. "INSTALLATION READY" COUPLINGS, 2" THROUGH 8", SHALL BE DESIGNED FOR DIRECT "STAB" INSTALLATION ONTO GROOVED END PIPE WITHOUT PRIOR FIELD DISASSEMBLY AND NO LOOSE PARTS. GASKET SHALL BE GRADE "EPDM", VICTAULIC STYLE 10TH QUICKVIC (RIGID) AND STYPE 177 (FLEXIBLE).

- 14. FLEXIBLE CONNECTORS: STAINLESS-STEEL BELLOW WITH WOVEN, FLEXIBLE, BRONZE, WIRE-REINFORCING PROTECTIVE JACKET; 150-PSIG MINIMUM WORKING PRESSURE AND 250 DEG F MAXIMUM OPERATING TEMPERATURE. CONNECTORS SHALL HAVE FLANGED OR THREADED-END CONNECTIONS TO MATCH EQUIPMENT CONNECTED AND SHALL BE CAPABLE OF 3/4-INCH MISALIGNMENT.
- 14.1. VICTAULIC STYLE 177, 77 OR W77 FLEXIBLE COUPLINGS MAY BE USED IN LIEU OF FLEXIBLE CONNECTORS FOR VIBRATION ISOLATION AT EQUIPMENT CONNECTIONS. THREE (3) COUPLINGS, FOR EACH CONNECTOR, SHALL BE PLACED IN CLOSE PROXIMITY TO THE SOURCE OF VIBRATION.
- 15. HOSE KITS: EPDM TUBE WITH BRAIDED STAINLESS STEEL OUTER JACKET; BRASS FEMALE PIPE SWIVEL, BOTH ENDS WITH CRIMP STAINLESS STEEL COLLAR; 33 TO 180 DEG F, RANGE; WITH FIBROUS FLAT WASHER; 255 PSI WORKING PRESSURE AT 70 DEG F.
- 16. PACKED, SLIP, EXPANSION JOINTS: 150-PSIG MINIMUM WORKING PRESSURE, STEEL PIPE FITTING CONSISTING OF TELESCOPING BODY AND SLIP-PIPE SECTIONS, PACKING RING, PACKING, LIMIT RODS, FLANGED ENDS, AND CHROME-PLATED FINISH ON SLIP-PIPE TELESCOPING SECTION.
- 17. IN VICTAULIC GROOVED PIPING SYSTEM, EXPANSION AND CONTRACTION SHALL BE ACCOMMODATED BY INSTALLING EXPANSION LOOPS OR BENDS CONSISTING OF (8) VICTAULIC FLEXIBLE COUPLINGS, (4) 90 DEGREE ELBOWS, AND (3) GROOVED END PIPE SPOOLS PROVIDED IN WATER SYSTEMS UP TO +250 DEGREES F IN ACCORDANCE WITH VICTAULIC RECOMMENDATION FOR EXPANSION COMPENSATION.

- 18. INSTALL VICTAULIC STYLE 150 OR STYLE 155 IN-LINE EXPANSION JOINTS IN ENCLOSURES WHERE LOOPS OR BENDS CANNOT BE APPLIED.
- 19. WELDING MATERIALS: COMPLY WITH SECTION II, PART C, OF THE ASME BOILER AND PRESSURE VESSEL CODE FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND FOR CHEMICAL ANALYSIS OF PIPE BEING WELDED.
- 20. GASKET MATERIAL: THICKNESS, MATERIAL, AND TYPE SUITABLE FOR FLUID TO BE HANDLED, AND DESIGN TEMPERATURE AND PRESSURES

HVAC PIPING INSULATION

- 1. MAINTAIN AMBIENT CONDITIONS REQUIRED BY MANUFACTURERS OR EACH PRODUCT. MAINTAIN TEMPERATURE BELOW, DURING, AND AFTER INSTALLATION FOR MINIMUM OF 24 HOURS.
- 2. SURFACE BURNING CHARACTERISTICS: FLAME SPREAD INDEX/SMOKE DEVELOPED INDEX OF 25/50, MAXIMUM, WHEN TESTED IN ACCORDANCE WITH ASTM E84 OR UL 723.
- 3. MINERAL FIBER INSULATION THICKNESS:
 - 3.1. PREFORMED PIPE SIZE 1.5" TO 4": 2" THICK
 - 3.2. PREFORMED PIPE SIZE 4" TO 8": 2" THICK
- 4. SUBMITTALS:
 - 4.1. PROVIDE PRODUCT DESCRIPTION, THERMAL CHARACTERISTICS, LIST OF MATERIALS AND THICKNESS FOR EACH SERVICE, AND LOCATIONS.
 - 4.2. INDICATE INSTALLATION PROCEDURES THAT ENSURE ACCEPTABLE WORKMANSHIP AND INSTALLATION STANDARDS WILL BE ACHIEVED.
- 5. QUALITY ASSURANCE:
 - 5.1. MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING THE PRODUCTS SPECIFIED IN THIS SECTION WITH NOT LESS THAN THREE YEARS OF DOCUMENTED EXPERIENCE.

BOILERS

- 1. ACCEPTABLE MANUFACTURERS:
 - 1.1. AERCO
- 2. SYSTEM: GAS-FIRED, DIRECT HEATING BOILER, CIRCULATING PUMP, CONTROLS, PIPING AND VALVING AS INDICATED, STORAGE TANK.
 - 2.1. PUMP: IN-LINE CIRCULATION PUMP MOUNTED ON BOILER, CONTROLLED BY TANK-MOUNTED IMMERSION THERMOSTAT.
 - 2.2. THERMOSTAT SETPOINT: 180 DEGREES F (82DEGREES C).
 - 2.3. THERMOSTATIC VALVE: THREE-WAY, SELF CONTAINED, FULL LINE SIZE, BRONZE BODY 1/2-TO 2-INCH SIZE, IRON BODY 2-1/2 INCHES AND OVER, SET AT 140 DEGREES F.
- 3. COMMERCIAL GAS-FIRED BOILERS:
 - 3.1. TYPE: AUTOMATIC, NATURAL GAS FIRED.
 - 3.2. MINIMUM EFFICIENCY REQUIRED: ASHRAE STD 90.1-1P
 - 3.3. REFER TO SCHEDULE TO ON DRAWINGS FOR BOILER PERFORMANCE AND MODULATION.
- 4. COMMERCIAL GAS-FIRED CONDENSING BOILERS:
 - 4.1. ACCEPTABLE MANUFACTURERS:
 - 5.1. LOCHINVAR
- 6. THE BOILER SHALL BE INSTALLED AND VENTED WITH A DIRECT VENT SYSTEM. REFER TO DRAWINGS FOR A VERTICAL OR HORIZONTAL TERMINATION FOR BOTH THE VENT AND COMBUSTION AIR. THE FLUE SHALL BE PVC, CPVC, POLYPROPYLENE OR STAINLESS-STEEL SEALED VENT MATERIAL TERMINATING WITH THE MANUFACTURER'S SPECIFIED VENT TERMINATION. A SEPARATE PIPE SHALL BE PVC, CPVC, ABS, GALVANIZED, POLYPROPYLENE OR STAINLESS-STEEL SEALED PIPE. THE BOILER'S TOTAL COMBINED AIR INLET MUST TERMINATE WITH THE MANUFACTURERS SPECIFIED AIR INLET CAP. THE WATER HEATERS TOTAL COMBINED EXHAUST VENTING LENGTH SHALL NOT EXCEED 150 EQUIVALENT FEET. FOAM CORE PIPE IS NOT AN APPROVED MATERIAL FOR EXHAUST PIPING.

IN-LINE PUMPS

- 1. ACCEPTABLE MANUFACTURERS:
 - 1.1. BELL & GOSSETT
 - 1.2. ARMSTRONG
- 2. DESCRIPTION: FACTORY-ASSEMBLED AND TESTED, CENTRIFUGAL, OVERHUNG-IMPELLER, CLOSE-COUPLED, IN-LINE PUMP, DESIGNED FOR INSTALLATION WITH PUMP AND MOTOR SHAFTS MOUNTED HORIZONTALLY OR VERTICALLY.
- 3. PUMP CONSTRUCTION:
 - 3.1. IMPELLER: ASTM B594, CAST BRONZE; STATICALLY AND DYNAMICALLY BALANCED, KEVED TO SHAFT, AND SECURED WITH A LOCKING CAP SCREW, FOR CONSTANT-SPEED PUMPS, TRIM IMPELLER TO MATCH SPECIFIED PERFORMANCE.
 - 3.2. PUMP SHAFT SLEEVE: BRONZE
 - 3.3. PUMP STUB SHAFT: TYPE 304 STAINLESS STEEL
 - 3.4. SEAL: MECHANICAL SEAL, CONSISTING OF CARBON ROTATING RING AGAINST A CERAMIC SEAL HELD BY A STAINLESS STEEL SPRING, AND EPB/CARBON/SILOCON-CARBIDE RUBBER BELLOW AND GASKET, INCLUDE WATER SLINGER ON SHAFT BETWEEN MOTOR AND SEAL
 - 3.5. SEAL FLUSHING: FLUSH, COOL, AND LUBRICATE PUMP SEAL BY DIRECTION PUMP DISCHARGE WATER TO FLOW OVER THE SEAL.
- 4. MOTOR: COMPLY WITH NEMA DESIGNATION, TEMPERATURE RATING, SERVICE

FACTOR, AND EFFICIENCY REQUIREMENTS FOR MOTORS.

- 4.1. ENCLOSURE : TOTALLY ENCLOSED, FAN COOLED.
- 4.2. NEMA PREMIUM EFFICIENT MOTORS AS DEFINED IN NEMA MG 1.
- 4.3. MOTOR SIZES: MINIMUM SIZE AS INDICATED. IF NOT INDICATED, LARGE ENOUGH SO DRIVEN LOAD WILL NOT REQUIRE MOTOR TO OPERATE IN SERVICE FACTOR RANGE ABOVE 1.0.
- 4.4. CONTROLLERS, ELECTRICAL DEVICES, AND WIRING: COMPLY WITH REQUIREMENTS FOR ELECTRICAL DEVICES AND CONNECTIONS SPECIFIED IN ELECTRICAL SECTIONS.
- 4.5. VARIABLE-SPEED MOTOR.
- 4.6. PROVIDE INTEGRAL PUMP MOTOR VARIABLE-SPEED CONTROLLER.
- 4.7. BASIS OF DESIGN: BELL AND GOSSETT E-90
- 4.8. CAPACITIES AND CHARACTERISTICS: REFER TO DRAWINGS.

BASE-MOUNTED END SUCTION PUMPS

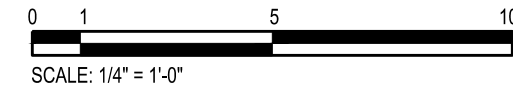
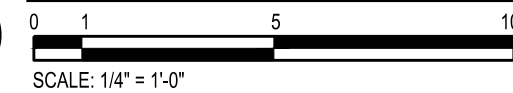
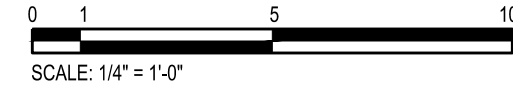
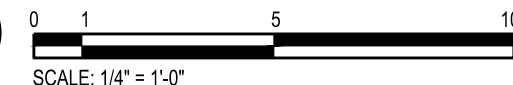
- 1. ACCEPTABLE MANUFACTURERS:
 - 1.1. BELL & GOSSETT
- 2. DESCRIPTION: FACTORY-ASSEMBLED AND TESTED, CENTRIFUGAL, OVERHUNG-IMPELLER, SEPARATELY COUPLED, END SUCTION PUMP WITH FLEXIBLE SHAFT COUPLING, DESIGNED FOR BASE MOUNTING, WITH PUMP AND MOTOR SHAFTS HORIZONTAL.
- 3. PUMP CONSTRUCTION:
 - 3.1. IMPELLER: ASTM B594, CAST BRONZE; STATICALLY AND DYNAMICALLY BALANCED, KEVED TO SHAFT, AND SECURED WITH A LOCKING CAP SCREW, FOR PUMPS THAT ARE NOT FREQUENCY-DRIVE CONTROLLED, TRIM IMPELLER TO MATCH SPECIFIED PERFORMANCE.
 - 3.2. PUMP SHAFT: CARBON STEEL, WITH COPPER-ALLOY SHAFT SLEEVE.
 - 3.3. SEAL: MECHANICAL TYPE: MECHANICAL SEAL CONSISTING OF CARBON ROTATING RING AGAINST A CERAMIC SEAL HELD BY A STAINLESS STEEL SPRING, AND BUNA BELLOW AND GASKET.
 - 3.4. SEAL, PACKING TYPE: PACKING SEAL CONSISTING OF STUFFING BOX WITH A MINIMUM OF FOUR RINGS ON GRAPHITE-IMPREGNATED BRAIDED YARN WITH BRONZE LANTERN RING BETWEEN CENTER TWO GRAPHITE RINGS, AND BRONZE PACKING GLAND.
 - 3.5. PUMP BEARINGS: GREASE-LUBRICATED BALL BEARINGS IN CAST-IRON HOUSING WITH GREASE FITTINGS.
- 4. SHAFT COUPLING: MOLDED-RUBBER INSERT AND INTERLOCKING SPIDER CAPABLE OF ABSORBING VIBRATION. COUPLINGS SHALL BE DROP-OUT TYPE TO ALLOW DISASSEMBLY AND REMOVAL WITHOUT REMOVING PUMP SHAFT OR MOTOR.
- 5. COUPLING GUARD: DUAL RATED, ANSI B15.1, SECTION 8; OSHA 1910.219 APPROVED, STEEL; REMOVABLE; ATTACHED TO MOUNTING FRAME.
- 6. MOTOR: COMPLY WITH NEMA DESIGNATION, TEMPERATURE RATING, SERVICE FACTOR, AND EFFICIENCY REQUIREMENTS FOR MOTORS.

- 6.1. ENCLOSURE: TOTALLY ENCLOSED, FAN COOLED
- 6.2. NEMA PREMIUM EFFICIENT MOTORS AS DEFINED IN NEMA MG 1.
- 6.3. MOTOR SIZES: MINIMUM SIZE AS INDICATED. IF NOT INDICATED, LARGE ENOUGH SO DRIVEN LOAD WILL NOT REQUIRE MOTOR TO OPERATE IN SERVICE FACTOR RANGE ABOVE 1.0.
- 6.4. CONTROLLERS, ELECTRICAL DEVICES, AND WIRING: COMPLY WITH REQUIREMENTS FOR ELECTRICAL DEVICES AND CONNECTIONS SPECIFIED IN ELECTRICAL SECTIONS.
- 6.5. VARIABLE-SPEED MOTOR.
- 6.6. BASIS OF DESIGN: BELL AND GOSSETT E-1510.
- 6.7. CAPACITIES AND CHARACTERISTICS: REFER TO DRAWINGS.



792 LOS DRIVE, SUN PRAIRIE, WI 53150

REVISIONS	
07/08/2026</	



5

1. DISCONNECT, REMOVE, AND DEMOLISH EXISTING BOILER AND ASSOCIATED HEATING SUPPLY/RETURN PIPING TO EXTENTS SHOWN AND CAP, MODIFY GAS PIPING AS REQUIRED TO CONNECT TO NEW BOILER. EXISTING BOILER FRAME TO REMAIN.
2. DISCONNECT, REMOVE, AND DEMOLISH EXISTING HEATING AND CIRCULATING PUMP AND ASSOCIATED PIPING TO EXTENT'S SHOWN. EXISTING CONCRETE PAD TO REMAIN.
3. DISCONNECT, REMOVE, AND DEMOLISH EXISTING HEATING SUPPLY CIRCULATING PUMP AND ASSOCIATED PIPING TO EXTENTS SHOWN.
4. DISCONNECT, REMOVE, AND DEMOLISH EXISTING 14" FLUE VENT TO EXTENTS SHOWN.



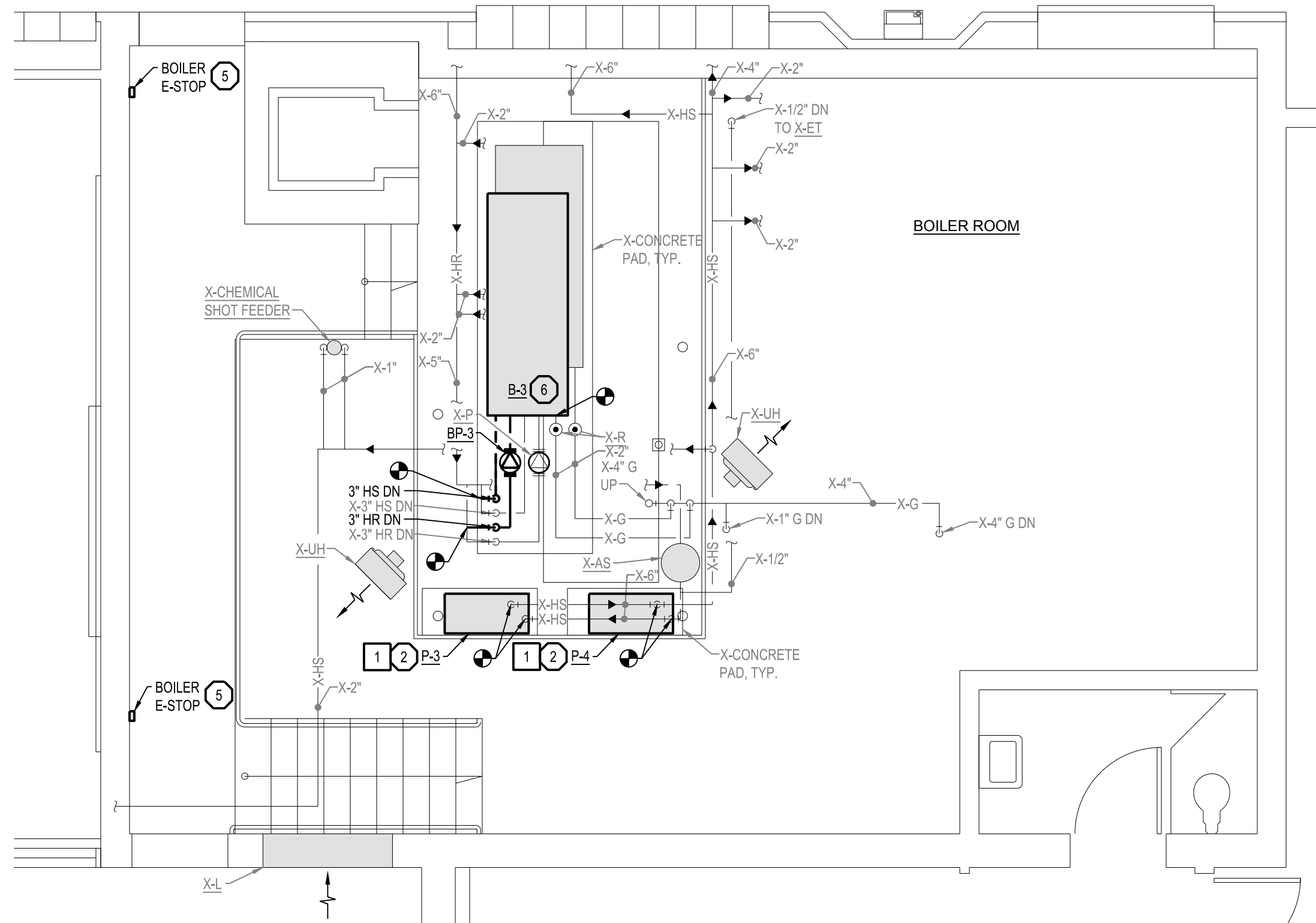
CAT

MATRIX
CONSULTING ENGINEERS, INC.

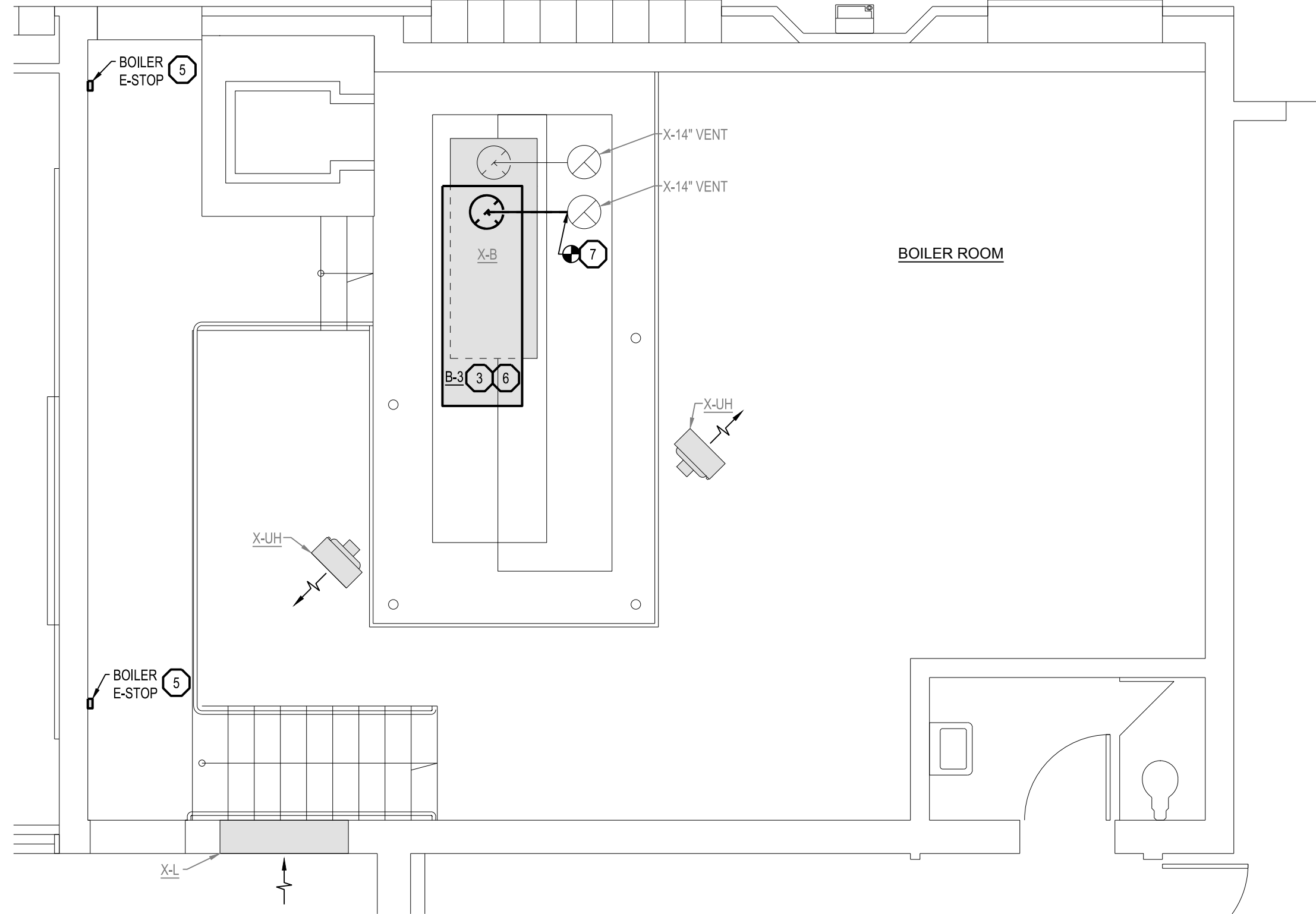
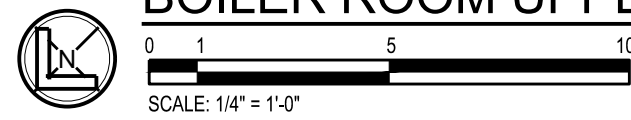
544 Chorbout Drive
Lansing, MI 48917
PHONE: (517) 487-2511
administrator@matrixceinc.com
Matrix Project No. 250963.00

51880 WASHINGTON ST.
NEW BALTIMORE, MI 48047

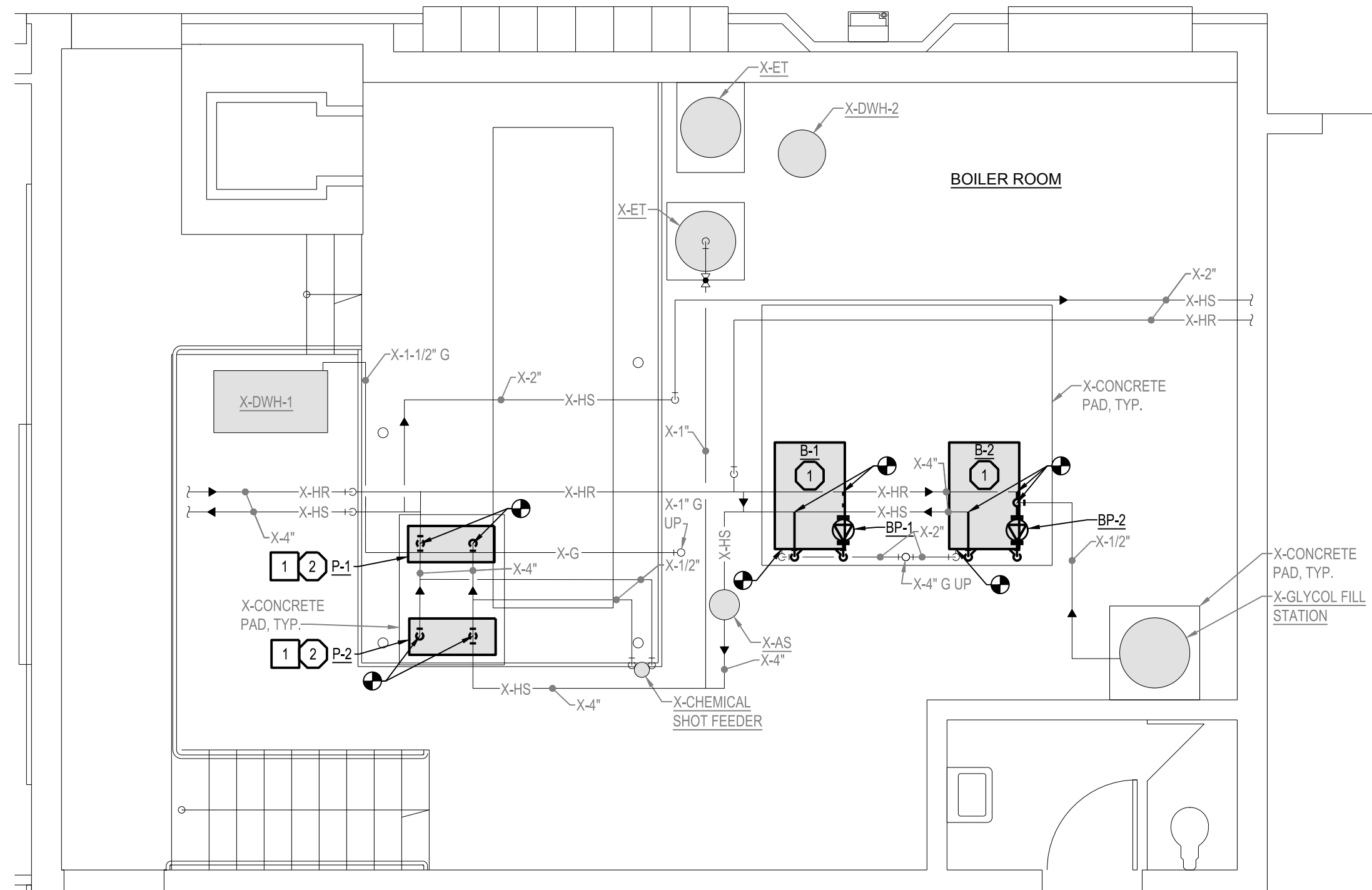
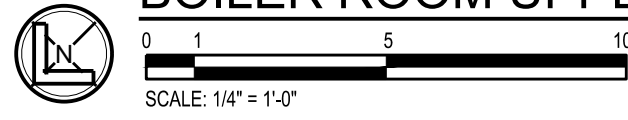
M-300



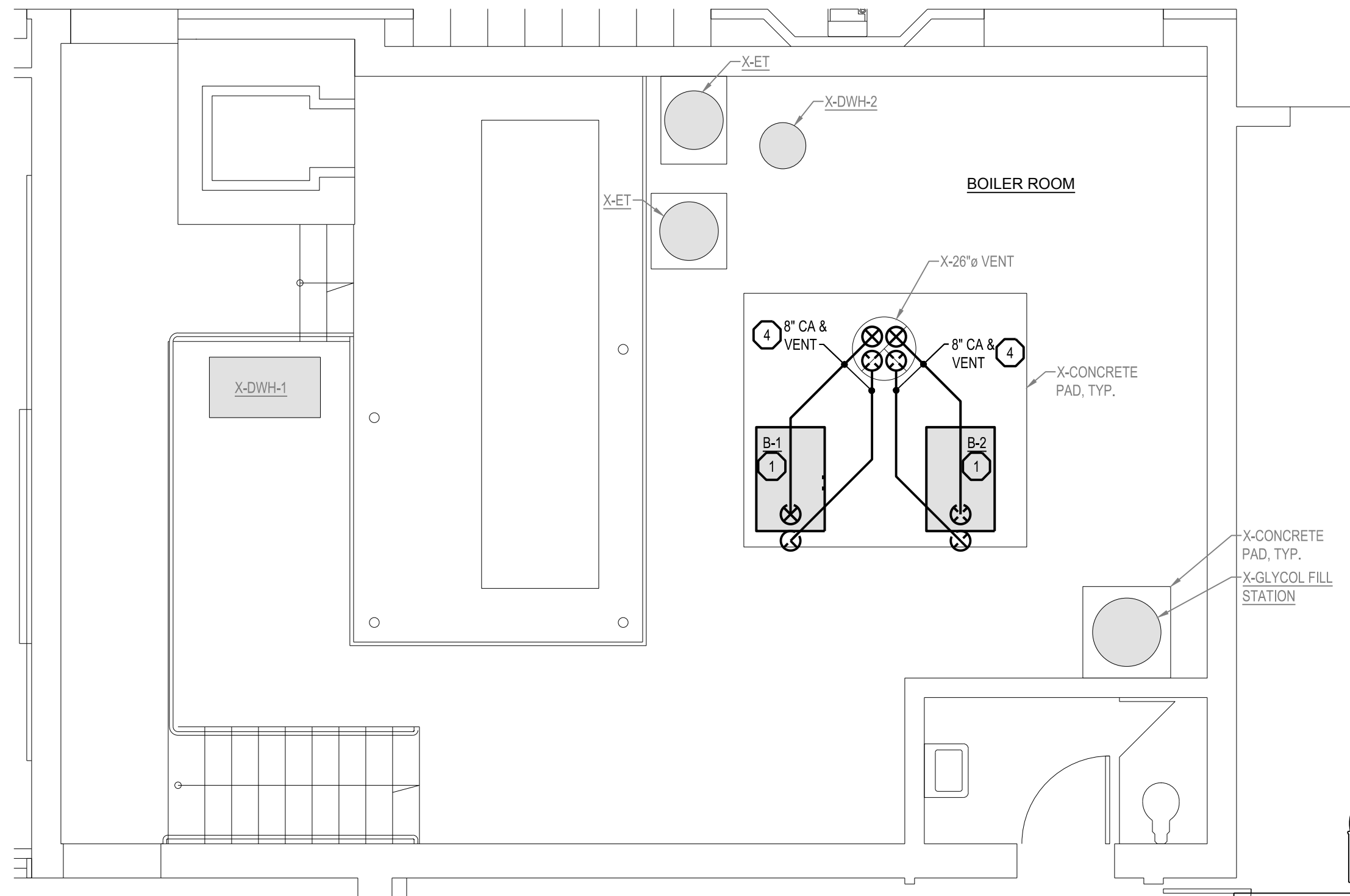
BOILER ROOM UPPER LEVEL FLOOR PLAN - PIPING NEW



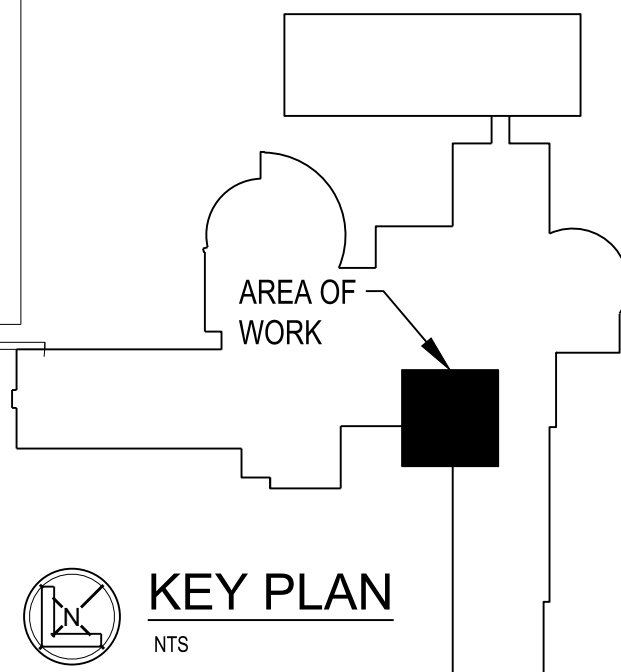
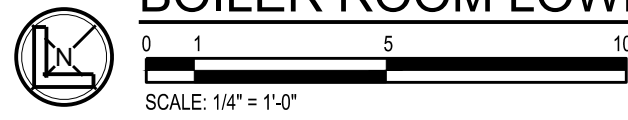
BOILER ROOM UPPER LEVEL FLOOR PLAN - HVAC NEW



BOILER ROOM LOWER LEVEL FLOOR PLAN - PIPING NEW



BOILER ROOM LOWER LEVEL FLOOR PLAN - HVAC NEW



KEY PLAN
NTS

GENERAL HVAC NOTES

1. FURNISH AND INSTALL CARBON MONOXIDE SENSOR FOR BOILER SYSTEM. CONNECT TO BAS.

ALTERNATES

1. ADD ALTERNATE #1: PROVIDE VARIABLE FREQUENCY DRIVE FOR EACH OF THE FOUR (4) SYSTEM PUMPS.

HVAC KEY NOTES

1. INSTALL BOILER ON EXISTING CONCRETE PAD. MODIFY EXISTING HEATING SUPPLY/RETURN PIPING AS REQUIRED TO CONNECT TO NEW HEATING SUPPLY/RETURN PIPING. MODIFY GAS PIPING TO CONNECT TO NEW BOILER. ROUTE PRESSURE RELIEF AND DRAIN PIPING TO NEAREST FLOOR DRAIN.
2. INSTALL PUMP ON EXISTING PAD AT LOCATION SHOWN. MODIFY ASSOCIATED EXISTING HEATING SUPPLY PIPING AS REQUIRED.
3. INSTALL 1" DRAIN LINE UP TO BOTTOM OF VENT AND ROUTE TO NEAREST FLOOR DRAIN. PATCH AND SEAL DRAIN LINE CONNECTION TO DUCTWORK WATER TIGHT.
4. ROUTE 8" GAS COMBUSTION AIR AND VENT PIPING UP THROUGH EXISTING 26" GAS VENT OPENING. PATCH ROOF AS REQUIRED TO BE WATER TIGHT AND MATCH EXISTING ALONG WITH MAINTAINING EXISTING WARRANTY.
5. INSTALL BOILER E-STOP. COORDINATE EXACT LOCATION WITH ELECTRICAL TRADES. PROVIDED BY ELECTRICAL CONTRACTOR.
6. INSTALL BOILER ON EXISTING METAL FRAMING IN LOCATION OF PREVIOUS UNIT. MODIFY EXISTING HEATING SUPPLY/RETURN AS REQUIRED FOR A COMPLETE CONNECTION. MODIFY GAS PIPING TO CONNECT TO NEW BOILER. ROUTE PRESSURE RELIEF DRAIN PIPING TO NEAREST FLOOR DRAIN.
7. CONNECT TO BOILER VENT TO EXISTING 14" VENT.



792 LOS DRIVE, SUN PRAIRIE, WI 53590

REVISIONS	
07/06/2026	CD SET

DRAWN	LDT
APPROVED	CAT

MATRIX
CONSULTING ENGINEERS, INC.
544 Chesburg Drive
Lansing, MI 48917
PHONE (517) 487-2511
administrator@matrixinc.com
Fax: (517) 487-2511

PROJECT
LIGHTHOUSE ELEMENTARY BOILER AND PUMP UPGRADES
51880 WASHINGTON ST.
NEW BALTIMORE, MI 48047

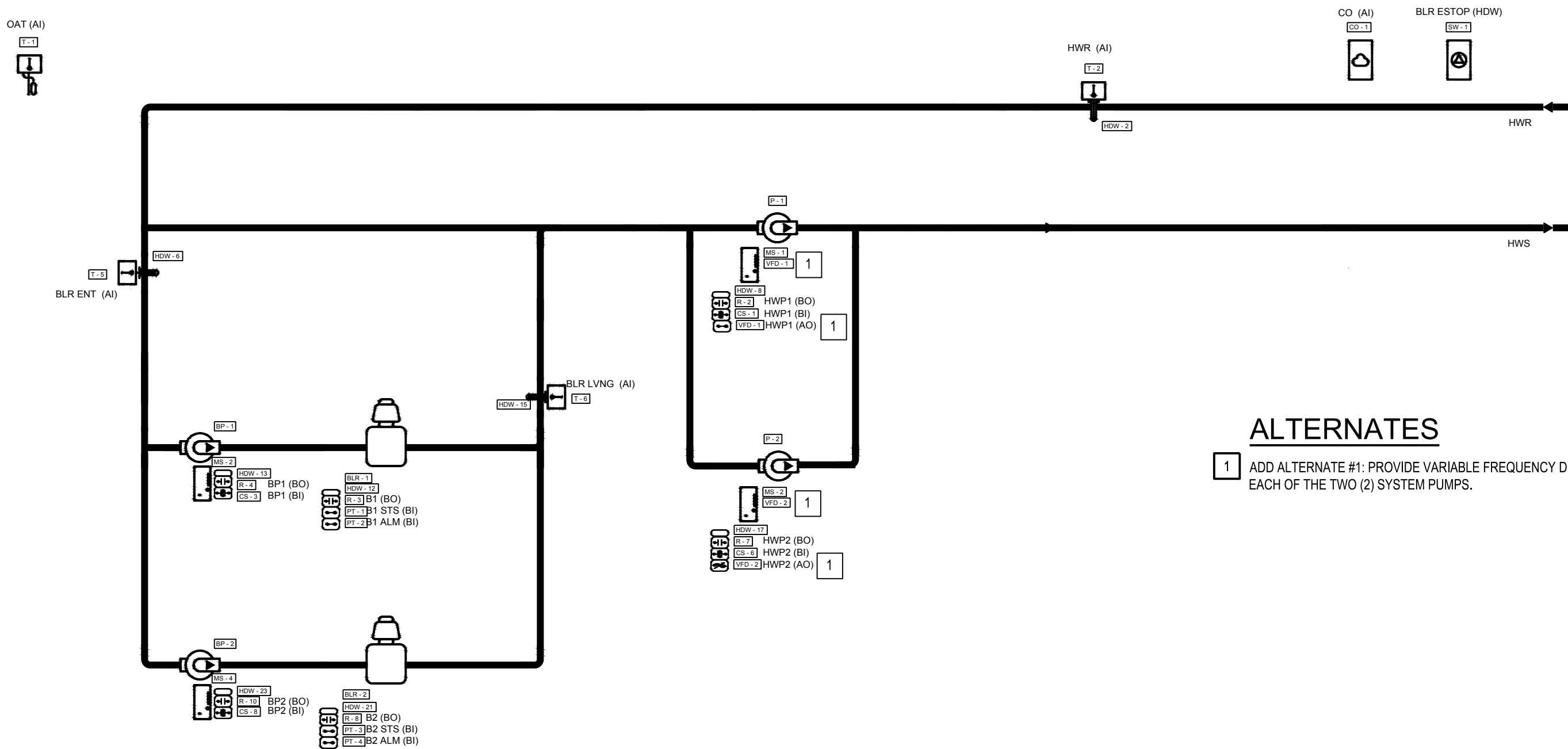
SHEET DESCRIPTION
MECHANICAL
ROOM FLOOR
PLAN - MECH.
NEW

DATE
04/08/2026

PROJECT NUMBER
250963.00

SHEET NUMBER
M-400

FLOW DIAGRAM: HEATING PLANT SYSTEM



ALTERNATES

- 1 ADD ALTERNATE #1: PROVIDE VARIABLE FREQUENCY DRIVE FOR EACH OF THE TWO (2) SYSTEM PUMPS.

SEQUENCE OF OPERATION: HEATING PLANT SYSTEM

SYSTEM GENERAL DESCRIPTION:

THE HEATING PLANT SYSTEM CONTROLLER PROVIDES STAND-ALONE CONTROL FROM AN OPTIONAL HIGHER LEVEL BUILDING AUTOMATION SYSTEM (BAS). THE HEATING PLANT CONTROL SYSTEM SHALL MONITOR AND CONTROL THE SYSTEM'S BOILER(S), PUMP(S), AND CONTROL VALVES AS SHOWN ON THE HEATING PLANT FLOW DIAGRAM, IN THE HEATING PLANT POINTS LIST AND AS DETAILED IN THE SEQUENCE OF OPERATION LISTED BELOW.

THE HEATING PLANT SYSTEM CONSISTS OF HOT WATER BOILER(S) WITH ITS PIPING CONFIGURATION ARRANGED AS A PRIMARY / SECONDARY LOOP SUPPLYING HOT WATER TO THE FACILITY.

THE MANIFOLDED HOT WATER DISTRIBUTION PUMPS ARE CONFIGURED AS LEAD / LAG CONTROL. THE FACTORY BOILER SYSTEM CONTROLLER SHALL PROVIDE STAND-ALONE CONTROL OR BAS WORKSTATION CONTROL OF THE SUPPLY HEATING WATER TEMPERATURE SETPOINT (ADJ.).

HEATING SYSTEM ENABLE/DISABLE:

THE HEATING SYSTEM SHALL BE ENABLED/DISABLED BY THE HEATING PLANT CONTROLLER AS REQUESTED BY THE BUILDING AUTOMATION SYSTEM (BAS) HUMAN-INTERFACE PANEL OR THE BAS TIME OF DAY SCHEDULE. WHEN ENABLED, THE SYSTEM SHALL ENABLE THE LEAD BOILER, THE ASSOCIATED PRIMARY BOILER PUMP AND ENABLE THE LEAD SECONDARY PUMP. THE HEATING PLANT IS DISABLED WHEN ALL BOILERS ARE DISABLED AND THERE IS NOT AN ACTIVE HOT WATER DISTRIBUTION PUMP REQUEST. WHEN THE PLANT IS DISABLED THE HOT WATER PUMP SHALL BE COMMANDED OFF.

HOT WATER RESET:

THE HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL BE LINEARLY RESET FROM 120.0 DEG. F (ADJ.) TO 180.0 DEF. F (ADJ.) AS THE OUTSIDE AIR TEMPERATURE FALLS FROM 60.0 DEG. F (ADJ.) TO 0.0 DEG. F (ADJ.)

BOILER CONTROL:

THE BOILER LEAD/LAG SEQUENCE SHALL BE BASED ON A WEEKLY SCHEDULE. FROM THE SYSTEM CONTROLLER OR A BAS WORKSTATION, AN OPERATOR SHALL BE ABLE TO MANUALLY CHANGE THE LEAD/LAG SEQUENCE.

BOILER CONTROLS SHALL BE PROVIDED BY THE MANUFACTURER BOILER SEQUENCER AND SHALL TIE TO THE BUILDING AUTOMATION SYSTEM FOR MONITORING AND ADJUSTMENT.

BOILER CIRCULATION PUMP START/STOP:

THE SYSTEM SHALL START A BOILER CIRCULATION PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S MOTOR START ENABLE CONTACTS.

BOILER CIRCULATION PUMP STATUS:

THE SYSTEM SHALL DETECT BOILER CIRCULATION PUMP RUN STATUS BY A CURRENT SWITCH.

BOILER CIRCULATION PUMP FAILURE:

IF THE BOILER CIRCULATION PUMP RELAY IS ENABLED AND THE CURRENT SWITCH STATUS IS OFF FOR MORE THAN 30 SECONDS (ADJ.), THE SYSTEM SHALL ANNUNCIATE A BOILER CIRCULATION WATER PUMP FAILURE ALARM TO THE BAS AND DISABLE THE ASSOCIATED BOILER. WHEN A PUMP FAILURE EXISTS, LEAD/LAG AUTOMATION OF THE BOILERS AND ASSOCIATED PUMPS SHALL BE DISABLED AND THE CURRENTLY RUNNING PUMP AND ASSOCIATED BOILER BECOMES THE LEAD. ONCE THE PROBLEM HAS BEEN CORRECTED, THE OPERATOR SHALL BE ABLE TO CLEAR THE ALARM FAILURE FROM THE BAS CONTROLLER OR BAS WORKSTATION. THIS ACTION SHALL RE-ENABLE THE LEAD/LAG SEQUENCE.

HOT WATER DISTRIBUTION PUMP START/STOP:

THE SYSTEM SHALL START A HOT WATER PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S MOTOR STARTER ENABLE CONTACTS.

HOT WATER DISTRIBUTION PUMP STATUS:

THE SYSTEM SHALL DETECT HOT WATER PUMP RUN STATUS BY A CURRENT SWITCH.

HOT WATER DISTRIBUTION PUMP LEAD/LAG:

THE HOT WATER PUMP LEAD/LAG SEQUENCE SHALL BE BASED ON A WEEKLY SCHEDULE. FROM THE BAS CONTROLLER OR A BAS WORKSTATION, AN OPERATOR SHALL BE ABLE TO MANUALLY CHANGE THE LEAD/LAG SEQUENCE.

HOT WATER DISTRIBUTION PUMP START/STOP:

THE SYSTEM SHALL START A HOT WATER PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S VARIABLE FREQUENCY DRIVE (VARIABLE SPEED DRIVE) RUN-ENABLE CONTACTS.

HOT WATER DISTRIBUTION PUMP STATUS:

THE SYSTEM SHALL DETECT HOT WATER PUMP RUN STATUS BY A VARIABLE SPEED DRIVE CURRENT SWITCH.

HOT WATER DISTRIBUTION PUMP LEAD/LAG:

THE HOT WATER PUMP LEAD/LAG SEQUENCE SHALL BE BASED ON A WEEKLY SCHEDULE. FROM THE BAS CONTROLLER OR A BAS WORKSTATION, AN OPERATOR SHALL BE ABLE TO MANUALLY CHANGE THE LEAD/LAG SEQUENCE.

HOT WATER DISTRIBUTION PUMP FAILURE:

IF THE LEAD START/STOP RELAY IS ENABLED AND THE CURRENT SWITCH STATUS IS OFF FOR MORE THAN 30 SECONDS (ADJ.), THE SYSTEM SHALL ANNUNCIATE A HOT WATER PUMP FAILURE ALARM TO THE BAS AND START THE LAG.

HOT WATER DISTRIBUTION PUMP SPEED:

WHEN THE SYSTEM SHALL MONITOR THE HOT WATER SYSTEM DIFFERENTIAL PRESSURE SENSOR. WHEN THE PUMP VARIABLE SPEED DRIVE IS ENABLED, THE SYSTEM SHALL CONTROL THE ANALOG SPEED SIGNAL SENT TO THE PUMP VARIABLE SPEED DRIVE TO MAINTAIN A HOT WATER DIFFERENTIAL PRESSURE SETPOINT OF 5.0 PSID (ADJ.).

FREEZE PROTECTION:

WHEN THE OUTDOOR AIR TEMPERATURE FALLS BELOW 35.0 DEG. F (ADJ.), THE HOT WATER DISTRIBUTION PUMP SHALL OPERATE CONTINUOUSLY TO PROVIDE HOT WATER CIRCULATION TO ALL ASSOCIATED HOT WATER COILS. IF THE HOT WATER SUPPLY TEMPERATURE FALLS BELOW 130.0 DEG. F (ADJ.) DURING UNOCCUPIED PERIODS, THE BOILER SEQUENCE SHALL BE ENABLED TO SAFEGUARD AGAINST LOW WATER TEMPERATURE AND BOILER CONDENSATION.

IN THE EVENT THAT A HYDRONIC AIRSIDE TYPE EQUIPMENT INITIATES A LOW LIMIT ALARM, THE HEATING SYSTEM SHALL ENABLE, IF DISABLED, AND PROVIDE HEATING MEDIUM CIRCULATION TO THE EQUIPMENT.

CARBON MONOXIDE DETECTOR:

THE CARBON MONOXIDE DETECTOR SHALL MONITOR THE BOILER ROOM FOR HIGH LEVELS OF CO. IF THE CO LEVEL RISES ABOVE 50 PPM (ADJ.), THEN AN ALARM SHALL BE SIGNALLED TO THE HEATING SYSTEM CONTROLLER OR BAS WORKSTATION.

BOILER EMERGENCY SHUTDOWN SWITCH:

IF THE BOILER EMERGENCY SHUTDOWN SWITCH HAS BEEN ACTIVATED, THE BOILERS ARE TO SHUT DOWN IMMEDIATELY AND AN ALARM SHALL BE SIGNALLED TO THE BAS WORKSTATION.

POINTS LIST: HEATING PLANT SYSTEM

POINT NAME	POINTS										ALARMS	
NOTE: CONTROLS CONTRACTOR SHALL PROVIDE ALL POINTS, HARDWARE, AND SOFTWARE AS REQUIRED TO THE SYSTEM TO MEET THE SEQUENCE OF OPERATION AND THE DESIGN INTENT.	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT (AO)	BINARY HARDWARE OUTPUT (BO)	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY
BOILER EMERGENCY SHUTDOWN SWITCH	X											
BLR ESTOP												
BOILER 1 ALARM	X	X										
B1 ALM												
BOILER 1 ENABLE COMMAND	X			X								
B1												
BOILER 1 STATUS	X	X										
B1 STS												
BOILER 2 ALARM	X	X										
B2 ALM												
BOILER 2 ENABLE COMMAND	X			X								
B2												
BOILER 2 STATUS	X	X										
B2 STS												
BOILER LOOP ENTERING TEMPERATURE LOCAL	X	X							X	X		X
BLR ENT												
BOILER LOOP LEAVING TEMPERATURE LOCAL	X	X							X	X		X
BLR LVNG												
BOILER PUMP 1 START STOP OUTPUT	X			X								
BP1												
BOILER PUMP 1 STATUS	X	X										
BP1												
BOILER PUMP 2 START STOP OUTPUT	X			X								
BP2												
BOILER PUMP 2 STATUS	X	X										
BP2												
CARBON MONOXIDE SENSOR	X	X							X			X
CO												
HOT WATER DIFFERENTIAL PRESSURE	X	X										X
HW DP												
HOT WATER PUMP 1 START STOP OUTPUT	X			X								
HWP1												
HOT WATER PUMP 1 SPEED OUTPUT	X		X									
HWP1												
HOT WATER PUMP 1 STATUS	X	X										
HWP1												
HOT WATER PUMP 2 START STOP OUTPUT	X			X								
HWP2												
HOT WATER PUMP 2 SPEED OUTPUT	X		X									
HWP2												
HOT WATER PUMP 2 STATUS	X	X										
HWP2												
HOT WATER RETURN TEMPERATURE LOCAL	X	X							X	X		
HWR												
HOT WATER SUPPLY TEMPERATURE LOCAL	X	X							X	X		
HWS												
OUTDOOR AIR TEMPERATURE LOCAL	X	X										X
OAT												
BAS COMMUNICATION STATE						X						
BAS COM												
BOILER LEAD	X			X								
B LEAD												
HOT WATER PUMP 1 FAILURE	X			X							X	
HWP1 FAIL												
HOT WATER PUMP 2 FAILURE	X			X							X	
HWP2 FAIL												
HOT WATER PUMP LEAD	X			X								
HWP LEAD												
HOT WATER RESET HIGH LIMIT	X			X								
HW RES HL												
HOT WATER RESET LOW LIMIT	X			X								
HW RES LL												
HOT WATER DISTRIBUTION SUPPLY TEMP SETPOINT	X			X								
HWS SP												
OUTSIDE AIR TEMPERATURE	X			X								
ENABLE SETPOINT												
OAT ENA SP												



792 LOIS DRIVE, SUN PRARIE, WI 53590

REVISIONS			
07/06/2026	CD SET		

DRAWN	LDT
APPROVED	CAT

544 Chebourg Drive
Lansing, MI 48917
PHONE (617) 487-2511
administrator@matrixinc.com
Matrix Project No. 250963.00

MATRIX

CONSULTING ENGINEERS, INC.

PROJECT

LIGHTHOUSE ELEMENTARY BOILER AND PUMP UPGRADES

51880 WASHINGTON ST.
NEW BALTIMORE, MI 48047

SHEET DESCRIPTION

MECHANICAL
POINTS LIST +
SEQUENCE OF
OPERATION

DATE

04/08/2026

PROJECT NUMBER

250963.00

SHEET NUMBER

M-800



1. DISCONNECT, REMOVE, AND DEMOLISH EXISTING BOILER AND ASSOCIATED HEATING SUPPLY/RETURN PIPING TO EXTENTS SHOWN AND CAP. MODIFY GAS PIPING AS REQUIRED TO CONNECT TO NEW BOILER. EXISTING BOILER FRAME TO REMAIN.
2. DISCONNECT, REMOVE, AND DEMOLISH EXISTING HEATING SUPPLY CIRCULATING PUMP AND ASSOCIATED PIPING TO EXTENTS SHOWN. EXISTING CONCRETE PAD TO REMAIN.
3. DISCONNECT, REMOVE, AND DEMOLISH EXISTING HEATING SUPPLY CIRCULATING PUMP AND ASSOCIATED PIPING TO EXTENTS SHOWN.
4. DISCONNECT, REMOVE, AND DEMOLISH EXISTING GAS PIPING TO EXTENTS SHOWN AND CAP.

1 ADD ALTERNATE #1: PROVIDE VARIABLE FREQUENCY DRIVE FOR EACH OF THE FOUR (4) SYSTEM PUMPS.

1. INSTALL BOILER ON EXISTING CONCRETE PAD. MODIFY EXISTING HEATING SUPPLY/RETURN PIPING AS REQUIRED TO CONNECT TO NEW HEATING SUPPLY/RETURN PIPING. MODIFY GAS PIPING AS NEEDED TO CONNECT TO NEW BOILER. PATCH ROOF AS REQUIRED TO MATCH EXISTING AND MAINTAIN EXISTING WARRANTIES. ROUTE PRESSURE RELIEF AND DRAIN PIPING TO NEAREST FLOOR DRAIN.
2. INSTALL PUMP ON EXISTING PAD AT LOCATION SHOWN. MODIFY ASSOCIATED EXISTING HEATING SUPPLY PIPING AS REQUIRED.
3. INSTALL 1" DRAIN LINE UP TO BOTTOM OF VENT AND ROUTE TO NEAREST FLOOR DRAIN. PATCH AND SEAL DRAIN LINE CONNECTION TO DUCTWORK WATER TIGHT.
4. PROVIDE NEW CHECK VALVE AT LOCATION SHOWN ON MAKE-UP WATER SYSTEM.
5. INSTALL BOILER ON EXISTING METAL FRAMING IN LOCATION OF PREVIOUS UNIT. MODIFY EXISTING HEATING SUPPLY/RETURN AND GAS PIPING AS REQUIRED FOR A COMPLETE CONNECTION.



792 LOS DRIVE, SUN PRAIRIE, WI 53590

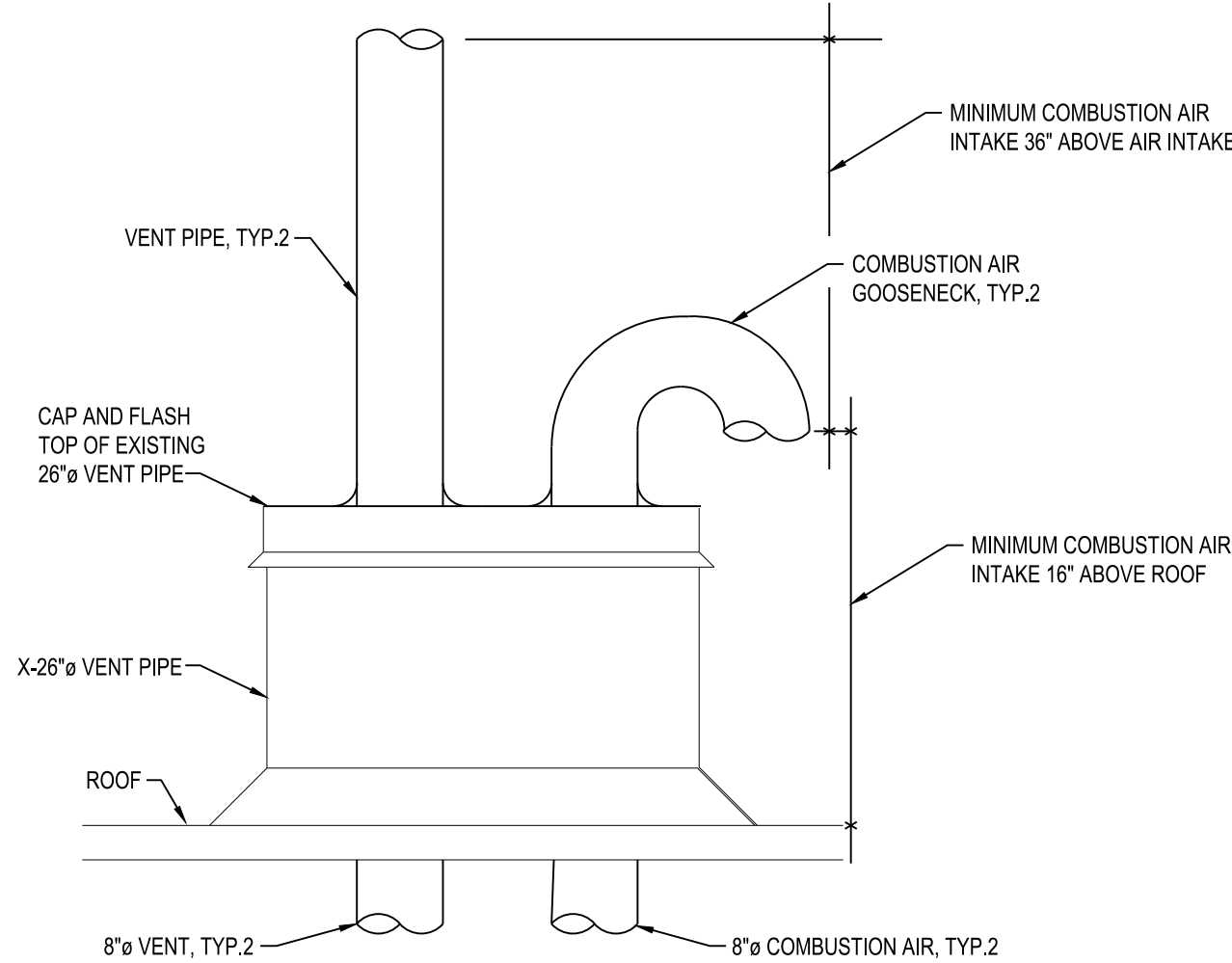
REVISIONS			
07/06/2026	CD	SET	

DRAWN	
LDT	

APPROVED	
CAT	

**MATRIX**
CONSULTING ENGINEERS, INC

544 Chesburg Drive
Lansing, MI 48917
PHONE (517) 487-2511
administrator@matrixinc.com
Fax: (517) 487-2513



1 COMBUSTION AIR AND VENT DETAIL
SCALE: NTS

PUMP SCHEDULE																		
TAG	SERVES	LOCATION	MODEL	SERIES	TYPE	FLUID			PUMP				MOTOR					COMMENTS
						TYPE	% CONC.	TEMP. °F	GPM	HEAD (FT)	IMP. DIA.	% EFF	RPM	HP	VOLT	PHASE	DISC BY	
P-1	BUILDING	BOILER ROOM	2BD	E-1510	END SUCTION	ETHL	30%	190	210	80	9.5	75.3	1,724	7 1/2	208	3	EC	1,2,3,5
P-2	BUILDING	BOILER ROOM	2BD	E-1510	END SUCTION	ETHL	30%	190	210	80	9.5	75.3	1,724	7 1/2	208	3	EC	1,2,3,5
P-3	BUILDING	BOILER ROOM	2.5BB	E-1510	END SUCTION	WATER	-	190	320	70	9.5	75.9	1,681	10	208	3	EC	1,2,3,5
P-4	BUILDING	BOILER ROOM	2.5BB	E-1510	END SUCTION	WATER	-	190	320	70	9.5	75.9	1,681	10	208	3	EC	1,2,3,5
BP-1	B-1	BOILER ROOM	2AAB	E-90	IN-LINE	ETHL	30%	190	126	20	5.25	72	1,713	1 1/2	208	3	EC	1,2
BP-2	B-2	BOILER ROOM	2AAB	E-90	IN-LINE	ETHL	30%	190	126	20	5.25	72	1,713	1 1/2	208	3	EC	1,2
BP-3	B-3	BOILER ROOM	CB 2067	2B1050	IN-LINE	WATER	-	190	86	8.7	-	-	-	3/4	120	1	EC	4
NOTES:																		
1. BASED ON: BELL GOSSETT					ABBREVIATIONS:													
2. MOUNT ON EXISTING CONCRETE PAD					EC - ELECTRICAL CONTRACTOR													
3. ALTERNATE #1: EC PROVIDE VFD FOR PUMP					ETHL - ETHELEINE GLYCOL													
4. BASED ON ARMSTRONG																		
5. ODP CASE ENCLOSURE																		

BOILER SCHEDULE																									
TAG	MODEL	LOCATION	AIR INLET SIZE (in.)	VENT SIZE (in.)	INPUT ENERGY (MBH)	HEAT OUTPUT (MBH)	TURNDOWN	MIN. WATER FLOW RATE (GPM)	MAX. WATER FLOW RATE (GPM)	WATER SIDE PRESSURE DROP (FT)	OUTPUT EFFICIENCY (%)	BOILER WATER VOLUME (GAL)	FLUID	EWT (°F)	LWT (°F)	DIMENSIONS			ELECTRICAL					SHIPPING WEIGHT	COMMENTS
																LENGTH	WIDTH	HEIGHT	VOLTS	PHASE	FLA	DISC.	STARTER		
B-1	2000	BOILER ROOM	8	8	2,000	1,892	20:1	25	350	3.0	94.6	40	30% ETHL	160	190	42.6"	28"	78"	120	1	16	EC	EC	1,700	1,2,3,4,5,6,7,8,9
B-2	2000	BOILER ROOM	8	8	2,000	1,892	20:1	25	350	3.0	94.6	40	30% ETHL	160	190	42.6"	28"	78"	120	1	16	EC	EC	1,700	1,2,3,4,5,6,7,8,9
B-3	CBN2067	BOILER ROOM	-	14	2,065	1,735	-	56	90	4.5	84.0	4.8	WATER	160	190	92.5"	33.5"	33.75"	120	1	8	EC	EC	1,350	6,7,8,9,10,11
NOTES: 1. BASED ON: AERCO 2. NATURAL GAS CONDENSING BOILER 3. CONDENSATE NEUTRALIZATION KIT 4. RE-USE EXISTING BOILER FLUE PENETRATION FOR NEW COMBUSTION AIR AND FLUE PIPES 5. MOUNT ON EXISTING CONCRETE PAD 6. MANUFACTURER BOILER SEQUENCE 7. BACNET CARD 8. E-STOP BY EC 9. CONNECT TO EXISTING AUTOMATED LOGIC BUILDING AUTOMATION SYSTEM 10. BASED ON LOCHINVAR 11. MOUNT ON EXISTING STEEL FRAME ABBREVIATIONS: EC - ELECTRICAL CONTRACTOR ETHL - ETHELEYNE GLYCOL																									

PROJECT

LIGHTHOUSE ELEMENTARY BOILER AND PUMP UPGRADES

51880 WASHINGTON ST.
NEW BALTIMORE, MI 48047

SHEET DESCRIPTION

MECHANICAL SCHEDULES AND DETAILS

DATE

04/08/2026

PROJECT NUMBER

250963.00

SHEET NUMBER

M-900

ELECTRICAL SYMBOLS LEGEND

OUTLETS		FIXTURES	
	SINGLE RECEPTACLE (120 VOLT)		LIGHT FIXTURE
	DUPLEX RECEPTACLE		STRIP FIXTURE
	EMERGENCY RECEPTACLE		IN-GRADE LIGHT FIXTURE
	DOUBLE DUPLEX RECEPTACLE		SPOTLIGHT (number of heads shown)
	FLUSH FLOOR BOX		EXIT SIGN (face & direction as shown)
	SURFACE FLOOR BOX		WALL MOUNT LIGHT FIXTURE
	SPECIAL EQUIPMENT RECEPTACLE		CEILING LIGHT FIXTURE
	TELEPHONE OUTLET		TRACK & FIXTURE
	DATA OUTLET		STREET TYPE POLE FIXTURE
	TELEPHONE / DATA OUTLET		POLE MOUNTED LIGHT FIXTURE
	POWER POLE		EXTERIOR WALL MOUNT LIGHT FIXTURE
	JUNCTION BOX		WALLPACK LIGHT FIXTURE
	WALL JUNCTION BOX		SPECIAL PURPOSE LIGHT FIXTURE
	PULL (JUNCTION) BOX		HIGH BAY LIGHT FIXTURE
	UNDERFLOOR JUNCTION BOX		EMERGENCY EGRESS LIGHT FIXTURE (number of heads shown)
	CEILING MOUNTED WIFI		DOCK LIGHT FIXTURE
SWITCHES		SERVICE and EQUIPMENT	
	SINGLE-POLE SWITCH		TRANSIENT VOLTAGE SURGE SUPPRESSION
	THREE-WAY SWITCH		VARIABLE FREQUENCY DRIVE
	FOUR-WAY SWITCH		TRANSFORMER
	SWITCH WITH PILOT LIGHT		FUSED DISCONNECT SWITCH
	THERMAL OVERLOAD SWITCH		MAGNETIC STARTER
	MANUAL MOTOR SWITCH		COMB. STARTER
	KEY SWITCH		PANELBOARD, SURFACE MOUNTED
	TIME SWITCH		PANELBOARD, FLUSH MOUNTED
	DIMMER SWITCH		WEATHERHEAD
MECHANICAL			UTILITY METER, AS REQUIRED
	SINGLE PHASE MOTOR		DIGITAL EQUIPMENT METER, AS REQUIRED
	THREE PHASE MOTOR		CURRENT TRANSFORMERS
	RESISTANCE HEATER, KW SHOWN		GENERATOR, KW SHOWN
	PIPE TRACE HEATER		TELEPHONE TERMINAL BOARD
	ELECTRIC UNIT HEATER		GROUND CONNECTION PER N.E.C.
	ELECTRIC WATER HEATER		WIREWAY
DESIGNATIONS			TRANSFER SWITCH
	DEMOLITION NOTE		ENCLOSED CIRCUIT BREAKER
	PLAN NOTE		CAPACITOR
	ADDENDUM NOTE	FIRE ALARM	
CIRCUITRY and RACEWAYS			SMOKE DETECTOR
	CONDUIT INSTALLED (by E.C.)		HEAT DETECTOR
	CONDUIT INSTALLED (by others)		DUCT SMOKE DETECTOR
	CONDUIT STUB UP		DUCT SMOKE DETECTOR
	CONDUIT STUB DOWN		HORN
	HOME RUN (with circuit numbers)		HORN & LIGHT
	END OF CONDUIT RUN		SPEAKER
	END OF CONDUIT RUN, CAP AND STAKE		SPEAKER & LIGHT
	"CONDUIT RUN CONTINUES" INDICATION		PULL STATION
	FLEXIBLE PIGTAILS/CONNECTIONS		FIRE ALARM CONTROL PANEL
	WIREMOLD AS SPECIFIED		ANNUNCIATOR PANEL
	PLUGMOLD AS SPECIFIED		END OF LINE DEVICE
	BUS DUCT		REMOTE INDICATING LIGHT, WALL MTD.
	UNDERFLOOR DUCT		REMOTE INDICATING LIGHT, CLG. MTD.
			MAGNETIC DOOR HOLDER
			FIREFIGHTER COMMUNICATION JACK
			FLOW SWITCH (furnished by FPI/C)
			TAMPER SWITCH (furnished by FPI/C)
			VISUAL ONLY UNIT
			FIRE CONTROL POWER SUPPLY
			MONITOR MODULE
			CONTROL MODULE
			CARBON MONOXIDE DETECTOR

ABBREVIATIONS LEGEND

A	AMPS	GC	GENERAL CONTRACTOR	P	POLE
AC	ABOVE COUNTER	GFI	GROUND FAULT INTERRUPTER	P-	PUMP
ACU-	AIR CONDITIONING UNIT	GND	GROUND	PB	PULL BOX
AFF	ABOVE FINISHED FLOOR			PNL	PANEL
AHJ	AUTHORITY HAVING JURISDICTION	H-	HUMIDIFIER	PRV-	POWER ROOF VENTILATOR
AHU-	AIR HANDLING UNIT	HID	HIGH INTENSITY DISCHARGE	PVC	POLY VINYL CHLORIDE
AIC	AMPS INTERRUPTING CAPACITY	HOA	HAND-OFF-AUTO SELECTOR SWITCH	PWR	POWER
AS	ABOVE SHELF	HP	HORSEPOWER		
ATS	AUTOMATIC TRANSFER SWITCH	HR	HOUR	RECEPT	RECEPTACLE
		HVAC	HEATING/VENTILATING/AIR CONDITIONING	RGC	RIGID GALVANIZED STEEL CONDUIT
B-	BOILER			RTU-	ROOF TOP UNIT
BC	BELOW COUNTER			SF-	SUPPLY FAN
BLDG	BUILDING	IG	ISOLATED GROUND	SPEC	SPECIFICATIONS
		IMC	INTERMEDIATE METAL CONDUIT	SW	SWITCH
		JB	JUNCTION BOX	SWBD	SWITCHBOARD
CHLR-	CHILLER			TCC	TEMPERATURE CONTROL CONTRACTOR
CND (C)	CONDUIT	LC	LIGHT CONTROL	TR	TAMPER PROOF RECEPTACLE
CKT	CIRCUIT	LT	LIGHT	TS	TAMPER PROOF SWITCH
CKT BKR	CIRCUIT BREAKER	LTG	LIGHTING	TYP	TYPICAL
CT-	COOLING TOWER	LTG FLEX	LIQUID TIGHT FLEXIBLE METAL CONDUIT		
CU-	CONDENSING UNIT			UF	UNDER FLOOR
CUH-	CABINET UNIT HEATER			UH-	UNIT HEATER
				UL	UNDERWRITERS' LABORATORIES, INC.
DFU-	DUCT FURNACE	MAX	MAXIMUM	UNO	UNLESS NOTED OTHERWISE
DISC	DISCONNECT	MC	MECHANICAL CONTRACTOR		
DWG	DRAWING	MCC	MOTOR CONTROL CENTER	V	VOLTS
DWH-	DOMESTIC WATER HEATER	MIN	MINIMUM	VL	VERIFY LOCATION WITH OWNER
		MLO	MAIN LUG ONLY		
		MT	MOUNT	W	WATTS
EBB-	ELECTRIC BASEBOARD	MTD	MOUNTED	W/	WITH
EC	ELECTRICAL CONTRACTOR	MTGS	MOUNTING	W/O	WITHOUT
EF-	EXHAUST FAN	MUJL-	MAKE-UP AIR UNIT	WP	WEATHER PROOF
EM	EMERGENCY				
EMT	ELECTRICAL METALLIC TUBING	NC	NORMALLY CLOSED		
EWIC	ELECTRIC WATER COOLER	NIC	NOT IN CONTRACT		
EXIST./EX.	EXISTING	NL	NIGHT LIGHT		
		NO	NORMALLY OPEN		
FLA	FULL LOAD AMPS	NTS	NOT TO SCALE	XFMR	TRANSFORMER
FLEX	FLEXIBLE CONDUIT				
FLR	FLOOR				
FLUOR	FLUORESCENT				
FSES	FOOD SERVICE EQUIP. SUPPLIER				
F/S	FIRE/SMOKE				
FU-	FURNACE				

GENERAL ELECTRICAL NOTES

- ALL WALL AND FLOOR PENETRATIONS ARE TO BE SEALED TO MAINTAIN ORIGINAL RATING.
- ALL CONDUITS TO BE FIELD ROUTED ALONG EXISTING PIPING AND STRUCTURAL STEEL.
- THE DIVISION 26 CONTRACTORS SHALL VISIT THE PROJECT AND DETERMINE THE EXACT EXTENT OF THE DEMOLITION WORK BEFORE BIDDING THE PROJECT.
- REMOVE ALL EXISTING OBSOLETE EXPOSED CONDUIT, WIRE AND UNUSED EQUIPMENT WHERE WORK IS BEING DONE EXCEPT ITEMS NOTED OTHERWISE.
- WHERE BUILDING SURFACES ARE DAMAGED BY THE REMOVAL OF OLD WORK, SURFACES SHALL BE PATCHED TO MATCH ADJACENT.
- EXISTING WORK WHICH IS PRESENTLY CONCEALED AND WHICH WILL REMAIN CONCEALED AND DOES NOT INTERFERE WITH ANY NEW WORK OF ANY TRADE NEED NOT BE REMOVED. HOWEVER, ALL CONDUIT SHALL BE CAPPED BELOW FINISH SURFACE AND THEN PATCHED TO MATCH, OR AS NOTED.
- EXISTING OPENINGS, WHICH ARE TO BE REUSED, SHALL BE MODIFIED OR ENLARGED TO SUIT THE NEW SYSTEMS AS REQUIRED. PROVIDE ALL REQUIRED CUTTING AND PATCHING.
- IF ASBESTOS IS PRESENT, IT WILL BE REMOVED OR RENDERED HARMLESS UNDER SEPARATE CONTRACT BY THE OWNER.
- THE DIVISION 26 CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING THE EXISTING WALLS TO MATCH THE ADJACENT SURFACES BEHIND ALL SURFACE MOUNTED EQUIPMENT.
- CONTRACTOR SHALL FIELD VERIFY ALL EQUIPMENT VOLTAGES AND LOADS PRIOR TO INSTALLING SERVICE TO EQUIPMENT.
- DRAWINGS ARE BASED ON EXISTING RECORD DOCUMENT AND CASUAL FIELD OBSERVATION. REPORT ANY DISCREPANCIES TO ENGINEER FOR CLARIFICATION.

DIVISION 26 - ELECTRICAL SPECIFICATIONS

DESCRIPTION OF WORK

WORK SHALL INCLUDE, BUT IS NOT NECESSARILY LIMITED TO, THE FOLLOWING:

- DEMOLITION
- CONDUIT AND RACEWAYS
- CONDUCTORS
- GROUNDING
- SAFETY DISCONNECT SWITCHES
- MOTOR STARTERS AND CONTROLS
- VARIABLE FREQUENCY MOTOR CONTROLLERS

STANDARDS

ELECTRICAL MATERIALS AND EQUIPMENT SHALL CONFORM TO THE REQUIREMENTS LISTED BELOW. ALL ELECTRICAL MATERIALS AND EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE MANUFACTURER. IN THE ABSENCE OF SPECIFIC INSTRUCTION IN THE TECHNICAL SPECIFICATIONS, EQUIPMENT AND INSTALLATION SHALL CONFORM TO THE FOLLOWING APPLICABLE CODES, STANDARDS AND REGULATIONS, LATEST EDITIONS:

- AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM).
- AMERICAN NATIONAL STANDARD INSTITUTE (ANSI).
- UNDERWRITER'S LABORATORIES, INC. (UL).
- AMERICAN WELDING SOCIETY CODE (AWS).
- LOCAL BUILDING, ELECTRICAL, AND FIRE CODES.
- NATIONAL ELECTRICAL CODE (NEC).
- SERVICE RULES AND REGULATIONS OF LOCAL ELECTRICAL UTILITY COMPANY.
- NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA).
- U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES "HRS-M-HF" 84_1.
- OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA).
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA).
- AMERICANS WITH DISABILITIES ACT (ADA).

CODES AND ORDINANCES

COMPLY WITH ALL LOCAL, STATE AND NATIONAL CODES AND ORDINANCES. COMPLY WITH OWNER'S SPECIFICATIONS, GUIDELINES AND REQUIREMENTS. BIDDERS SHALL FAMILIARIZE THEMSELVES WITH CODE REQUIREMENTS FOR THE TYPE OF FACILITY WHERE THE WORK IS BEING PERFORMED.

PERMITS AND INSPECTION FEES

THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND INSPECTION FEES. FINAL INSPECTION CERTIFICATES BY THE AUTHORITIES HAVING JURISDICTION, INCLUDING THE LOCAL ELECTRICAL INSPECTOR AND FIRE MARSHAL, SHALL BE OBTAINED BY THE CONTRACTOR. COPIES SHALL BE SUBMITTED IN DUPLICATE TO THE OWNER.

SUBMITTALS

SUBMIT PRODUCT DATA, SHOP DRAWINGS, WIRING DIAGRAMS, AND DESCRIPTIVE LITERATURE FOR ALL ELECTRICAL MATERIALS AND EQUIPMENT TO BE INSTALLED UNDER THIS CONTRACT. MAKE SUBMITTALS WITHIN THIRTY (30) DAYS AFTER THE SIGNING OF THE CONTRACT. PRODUCT SHIPMENTS ARE NOT PERMITTED UNTIL SUBMITTALS HAVE RECEIVED FINAL APPROVAL.

AS CONSTRUCTED DOCUMENTS

UPON PROJECT COMPLETION, THE CONTRACTOR SHALL PROVIDE A MARKED-UP COPY OF THE ORIGINAL CONTRACT DOCUMENTS TO THE OWNER, INDICATING CHANGES, ADDITIONS AND MODIFICATIONS TO THE ORIGINAL DESIGN. DRAWINGS SHALL BE MANUALLY PREPARED.

OPERATION & MAINTENANCE MANUALS

PROVIDE OPERATING INSTRUCTIONS AND MAINTENANCE INFORMATION, FOR EACH SYSTEM AND EQUIPMENT SPECIFIED, FOR USE BY FACILITY OPERATION AND MAINTENANCE PERSONNEL. MANUALS SHALL BE PROVIDED IN 3-RING BINDERS OR ELECTRONIC COPIES. THE MANUALS SHALL INCLUDE:

- WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH SYSTEM AND ITEM OF EQUIPMENT.
- START-UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUT-DOWN PROCEDURES.
- SAFETY PRECAUTIONS.
- THE PROCEDURE TO BE FOLLOWED IN THE EVENT OF EQUIPMENT FAILURE.
- OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.

TRAINING

DURING OR UPON COMPLETION OF THE PROJECT, CONTRACTOR SHALL PROVIDE TRAINING OF OPERATION AND MAINTENANCE PERSONNEL FOR ALL REQUIRED ELECTRICAL COMPONENTS AND SYSTEMS. TRAINING SHALL BE CONDUCTED AT THE OWNER'S FACILITY. COORDINATE WITH THE OWNER FOR SCHEDULE.

SIGNAGE AND IDENTIFICATION OF SYSTEMS AND EQUIPMENT

- OPERATING INSTRUCTIONS: PRINT OR ENGRAVE INSTRUCTIONS AND FRAME UNDER GLASS OR APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS IN VIEW OF EQUIPMENT. PROVIDE WEATHER-RESISTANT MATERIALS FOR EXTERIOR APPLICATIONS.
- EQUIPMENT: PROVIDE NAMEPLATES FOR ALL EQUIPMENT AND DEVICES. NAMEPLATES SHALL BE SELF-ADHESIVE WITH ENGRAVED, LAMINATED ACRYLIC OR MELAMINE LABELS. PROVIDE NAMEPLATES WITH WHITE LETTERS ON A BLACK BACKGROUND. MINIMUM LETTER HEIGHT SHALL BE 1/8-INCH.
- WARNING SIGNS: PROVIDE A SELF-ADHESIVE WARNING LABEL THAT IS FACTORY PRINTED AND MULTI-COLOR. COMPLY WITH N.E.C. 70 AND 29 CFR 1910.145. LABELS FOR MULTIPLE POWER SOURCES SHALL READ: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES". LABELS FOR OTHER EQUIPMENT REQUIRING WORK SPACE CLEARANCES SHALL READ: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36-INCHES".
- ARC-FLASH WARNING SIGNS: PROVIDE A SELF-ADHESIVE ARC-FLASH WARNING LABEL ON ALL SAFETY SWITCHES, STARTERS, SWITCHBOARDS, PANELBOARDS AND OTHER REQUIRED EQUIPMENT. LABEL SHALL READ: "WARNING, ARC FLASH AND SHOCK HAZARD. APPROPRIATE PPE AND TOOLS REQUIRED WHEN WORKING ON THIS EQUIPMENT."

GUARANTEE

PROVIDE WRITTEN GUARANTEE FOR ALL LABOR AND MATERIALS FOR ONE (1) YEAR AFTER OWNER'S WRITTEN ACCEPTANCE OF THE PROJECT.

LAYOUT OF THE WORK

THE CONTRACTOR SHALL EXAMINE THE AREA OF WORK, AND ALL OTHER DISCIPLINE DRAWINGS, BEFORE PROCEEDING WITH THE LAYOUT AND INSTALLATION OF THE ELECTRICAL WORK. LOCATE ELECTRICAL EQUIPMENT ESSENTIALLY AS SHOWN ON THE DRAWINGS. EXACT LOCATION OF EQUIPMENT SHALL BE DETERMINED AT THE JOB SITE, TO SUIT ACTUAL CONDITIONS. THE CONTRACTOR SHALL COORDINATE WITH OTHER TRADES PRIOR TO INSTALLATION, SO THAT ALL COMPONENTS WILL BE INSTALLED IN PROPER RELATIONSHIP AND SEQUENCE.

DEMOLITION

CONTRACTOR SHALL REMOVE ALL EQUIPMENT AND MATERIAL INDICATED ON THE DEMOLITION PLANS OR AS REQUIRED TO INSTALL THE EQUIPMENT THAT IS PART OF THIS CONTRACT. LIGHT FIXTURES INDICATED TO BE REMOVED SHALL BE REMOVED, CLEANED AND RE-LAMPED BEFORE REINSTALLING. REMOVED LIGHT FIXTURES TO BE DEMOLISHED SHALL BE TURNED OVER TO THE OWNER UNLESS OTHERWISE SPECIFIED. ALL OTHER ELECTRICAL DEMOLITION ITEMS SHALL BE REMOVED FROM THE SITE. EXISTING CONDUITS MAY BE REUSED WHEN PRACTICAL. CONTRACTOR SHALL PATCH EXISTING WALL AND CEILING OPENINGS IN FINISHED AREAS UPON REMOVAL OF ELECTRICAL EQUIPMENT. CONTRACTOR SHALL PROTECT ALL EXISTING ELECTRICAL EQUIPMENT, INDICATED TO REMAIN, DURING CONSTRUCTION PERIOD.

CUTTING AND PATCHING

ALL NECESSARY CUTTING AND PATCHING OF THE BUILDING WALLS, FLOORS AND CEILINGS REQUIRED FOR REMOVAL OR INSTALLATION OF THE NEW WORK, SHALL BE FURNISHED BY THE CONTRACTOR. NO STRUCTURAL MEMBERS OF THE BUILDING SHALL BE CUT WITHOUT PRIOR APPROVAL OF THE ENGINEER. ALL NECESSARY PATCHING AND PAINTING OF SURFACES SHALL BE BY CONTRACTOR. PAINT SHALL MATCH EXISTING.

GROUNDING

ALL ELECTRICAL EQUIPMENT SHALL BE GROUNDED IN A MANNER APPROVED BY THE AUTHORITY HAVING JURISDICTION. PROVIDE GROUND RODS AND BARE COPPER GROUND CONDUCTORS AT UTILITY TRANSFORMER PAD. PROVIDE A GROUND ROD AND GROUND CONDUCTOR AT THE BUILDING MAIN DISCONNECT SWITCH. PROVIDE A GROUND CONDUCTOR IN ALL POWER RACEWAYS. GROUND ELECTRICAL SYSTEMS PER NEC ARTICLE 250 OR AS DETAILED ON THE DRAWINGS.

WIRE AND CABLE

SECONDARY FEEDERS SHALL BE TYPE THWN-2 OR XHHW-2, 600V RATED, COLORED BLACK OR COLOR CODED. BRANCH CIRCUIT WIRING SHALL BE TYPE THWN-2 OR XHHW-2, 600V RATED, 7 STRAND, #12 AWG MINIMUM, COLORED HOT-BLACK, NEUTRAL-WHITE AND GROUND-GREEN. BARE COPPER GROUND WIRE SHALL BE STRANDED TYPE.

ALL BRANCH CIRCUIT WIRING SHALL BE CONTINUOUS BETWEEN JUNCTION BOXES, WITH SPLICES MADE ONLY WITHIN BOXES. SOLDERLESS PRESSURE-TYPE CONNECTORS, PROPERLY INSULATED, SHALL BE USED FOR ALL SPLICES. NO POWER WIRE SMALLER THAN #12 AWG MAY BE USED UNLESS SPECIFIED UNDER DESCRIPTIONS OF SPECIAL SYSTEMS.

LABEL ALL CONDUCTORS WITH CIRCUIT NUMBERS AT BOTH ENDS, MINIMUM.

CONDUIT AND BOXES

CONDUIT SHALL BE 3/4" MINIMUM. EXPOSED OUTDOOR CONDUIT SHALL BE RGC. BELOW GRADE CONDUIT SHALL BE SCHEDULE 40 PVC OR HDPE. EXPOSED INTERIOR CONDUIT SHALL BE EMT. CONDUIT INSTALLED IN INDUSTRIAL FACILITIES SHALL BE RGC. CONDUIT FOR CONDUCTORS GREATER THAN 480-VOLTS SHALL BE RGC. CONCEALED INTERIOR CONDUIT SHALL BE EMT. CONDUIT AND BOXES IN CORROSIVE ENVIRONMENTS SHALL BE PVC-COATED RGC. BELOW GRADE, NON-METALLIC CONDUIT CONTAINING DATA AND COMMUNICATIONS WIRING, SHALL BE INSTALLED WITH A TRACER WIRE.

WHERE FLEXIBLE CONNECTIONS ARE REQUIRED, SUCH AS CONNECTIONS TO MOTORS AND LIGHT FIXTURES, LIQUID-TIGHT, FLEXIBLE METAL CONDUIT SHALL BE USED, WHERE PERMITTED BY THE NEC.

EXTERIOR RGC CONDUIT JOINTS SHALL BE MADE WATERTIGHT BY COATING THREADS WITH A ZINC PAINT.

EXTERIOR-MOUNTED DEVICE BOXES AND BOXES INSTALLED IN INDUSTRIAL FACILITIES SHALL BE CAST TYPE. INTERIOR OUTLET BOXES SHALL BE PRESSED STEEL, COMPLETE WITH PLASTER RING IF NECESSARY. FOR EACH SWITCH, RECEPTACLE OR DEVICE SHOWN, CEILING OUTLET BOXES SHALL BE 4-INCH OCTAGON, 1-1/2-INCH DEEP. EACH OUTLET SHALL BE RIGIDLY SUPPORTED FROM THE BUILDING CONSTRUCTION (INDEPENDENT OF THE RACEWAY SYSTEM). LIGHT FIXTURE BOXES SHALL BE SUPPLIED WITH FIXTURE SUPPORT HARDWARE AND SUPPORTED TO WITHSTAND 80 LBS.

SUPPORTS AND HANGERS

PROVIDE AND INSTALL NECESSARY STEEL BRACKETS, RODS, CHANNELS, CLAMPS, ETC., FOR SUPPORT OF ALL WORK UNDER THIS CONTRACT. MOUNT SECURELY TO CEILING OR WALL.

SAFETY DISCONNECT SWITCHES

SAFETY DISCONNECT SWITCHES SHALL BE CIRCUIT BREAKER OR FUSED TYPE, 250VAC OR 480VAC, CLASS A, HEAVY DUTY, DUAL HORSEPOWER RATED IN NEMA 1 ENCLOSURE OR WEATHER-PROOF AS INDICATED ON DRAWINGS. BUILDING SAFETY DISCONNECT SWITCHES SHALL BE RATED FOR "SERVICE ENTRANCE". VOLTAGE, CURRENT RATING, NUMBER OF POLES, CIRCUIT BREAKER OR FUSES AS INDICATED. CONSTRUCTION SHALL BE SUCH THAT, WHEN THE SWITCH HANDLE IS IN THE "ON" POSITION, THE COVER CANNOT BE OPENED. SWITCHES FOR 30-AMPERE TO 200-AMPERE LOADING SHALL BE SQUARE D TYPE HQ OR EQUAL.

MOTOR STARTERS

THREE-PHASE MOTOR STARTERS SHALL BE COMBINATION TYPE, 250VAC OR 480VAC AS REQUIRED, CLASS A, HEAVY DUTY, DUAL HORSEPOWER RATED WITH OVERLOADS AND TIME DELAY SWITCH. UNITS SHALL BE SQUARE D OR EQUAL.

FRACTIONAL HORSEPOWER MOTOR STARTERS SHALL BE TOGGLE TYPE, 120VAC WITH RED PILOT LIGHT.

VARIABLE FREQUENCY MOTOR CONTROLLERS

PROVIDE VARIABLE-FREQUENCY MOTOR CONTROL SYSTEM CONSISTING OF REQUIRED CONTROLLER ASSEMBLIES, OPERATOR INTERFACES, CONTROL POWER TRANSFORMERS, INSTRUMENTATION AND CONTROL WIRING, SENSORS, ACCESSORIES, SYSTEM PROGRAMMING, ETC. AS NECESSARY FOR COMPLETE OPERATING SYSTEM. PROVIDE PRODUCTS LISTED, CLASSIFIED, AND LABELED AS SUITABLE FOR PURPOSE INTENDED. CONTROLLER ASSEMBLIES SHALL COMPLY WITH NEMA ICS 7, NEMA ICS 7.1, AND NEMA ICS 61800-2 LIST AND LABEL AS COMPLYING WITH UL 61800-5-1 OR UL 508A AS APPLICABLE.

DIVISION 26
ELECTRICAL SPECIFICATIONS

MANUFACTURERS:

- ABB.
- ATCON.
- SCHNEIDER ELECTRIC.
- YASKAWA

PROVIDE CONTROLLERS SELECTED FOR ACTUAL INSTALLED MOTORS AND COUPLED MECHANICAL LOADS IN ACCORDANCE WITH NEMA ICS 7.2, NEMA MG 1 PART 30, AND RECOMMENDATIONS OF MANUFACTURERS OF BOTH CONTROLLER AND LOAD, WHERE NOT IN CONFLICT WITH SPECIFIED REQUIREMENTS; CONSIDERATIONS INCLUDE, BUT ARE NOT LIMITED TO:

- MOTOR TYPE (E.G., INDUCTION, RELUCTANCE, AND PERMANENT MAGNET); CONSIDER NEMA MG 1 DESIGN LETTER OR INVERTER DUTY RATING FOR INDUCTION MOTORS.
- MOTOR LOAD TYPE (E.G., CONSTANT TORQUE, VARIABLE TORQUE, AND CONSTANT HORSEPOWER); CONSIDER DUTY CYCLE, IMPACT LOADS, AND HIGH INERTIA LOADS.
- MOTOR NAMEPLATE DATA.
- REQUIREMENTS FOR SPEED CONTROL RANGE, SPEED REGULATION, AND BRAKING.
- MOTOR SUITABILITY FOR BYPASS STARTING METHOD, WHERE APPLICABLE.

DEVICES ON LOAD SIDE OF CONTROLLER: SUITABLE FOR APPLICATION ACROSS FULL CONTROLLER OUTPUT FREQUENCY RANGE.

OPERATING REQUIREMENTS:

- INPUT VOLTAGE TOLERANCE: PLUS/MINUS 10 PERCENT OF NOMINAL.
- INPUT FREQUENCY TOLERANCE: PLUS/MINUS 5 PERCENT OF NOMINAL.
- EFFICIENCY: MINIMUM OF 96 PERCENT AT FULL SPEED AND LOAD.
- INPUT DISPLACEMENT POWER FACTOR: MINIMUM OF 0.96 THROUGHOUT SPEED AND LOAD RANGE.
- OVERLOAD RATINGS:
 - VARIABLE TORQUE LOADS: MINIMUM OF 110 PERCENT OF NOMINAL FOR 60 SECONDS.
 - CONSTANT TORQUE LOADS: MINIMUM OF 150 PERCENT OF NOMINAL FOR 60 SECONDS.

POWER CONVERSION SYSTEM: MICROPROCESSOR-BASED, PULSE WIDTH MODULATION TYPE.

CONTROL SYSTEM:

- PROVIDE MICROPROCESSOR-BASED CONTROL SYSTEM FOR AUTOMATIC CONTROL, MONITORING, AND PROTECTION OF MOTORS. INCLUDE SENSORS, WIRING, AND CONNECTIONS NECESSARY FOR FUNCTIONS AND STATUS/ALARM INDICATIONS SPECIFIED.
- PROVIDE INTEGRAL OPERATOR INTERFACE FOR CONTROLLER PROGRAMMING, DISPLAY OF STATUS/ALARM INDICATIONS, FAULT RESET, AND LOCAL CONTROL FUNCTIONS INCLUDING MOTOR RUN/STOP, MOTOR FORWARD/REVERSE SELECTION, MOTOR SPEED INCREASE/DECREASE, AND LOCAL/REMOTE CONTROL SELECTION.
- CONTROL FUNCTIONS:

- CONTROL METHOD: SELECTABLE VECTOR AND SCALAR/VOLTS PER HERTZ UNLESS OTHERWISE INDICATED.
 - SCALAR/VOLTS PER HERTZ CONTROL: PROVIDE IR COMPENSATION FOR IMPROVED LOW-SPEED TORQUE.
 - VECTOR CONTROL: PROVIDE SELECTABLE AUTOTUNING FUNCTION.
- ADJUSTABLE ACCELERATION AND DECELERATION TIME; LINEAR AND S-CURVE RAMPS, SELECTABLE COAST TO STOP.
- SELECTABLE BRAKING CONTROL; DC INJECTION OR FLUX BRAKING.
- ADJUSTABLE MINIMUM/MAXIMUM SPEED LIMITS.
- ADJUSTABLE PULSE WIDTH MODULATION SWITCHING CARRIER FREQUENCY.
- ADJUSTABLE MOTOR SLIP COMPENSATION.
- SELECTABLE AUTO RESTART AFTER NONCRITICAL FAULT; PROGRAMMABLE NUMBER OF TIME DELAY BETWEEN RESTART ATTEMPTS.
- STATUS INDICATIONS:
 - MOTOR RUN/STOP STATUS.
 - MOTOR FORWARD/REVERSE STATUS.
 - LOCAL/REMOTE CONTROL STATUS.
 - OUTPUT VOLTAGE.
 - OUTPUT CURRENT.
 - OUTPUT FREQUENCY.
 - DC BUS VOLTAGE.
 - MOTOR SPEED.
- PROTECTIVE FUNCTIONS/ALARM INDICATIONS:
 - OVERCURRENT.
 - MOTOR OVERLOAD.
 - UNDERVOLTAGE.
 - OVERVOLTAGE.
 - CONTROLLER OVERTEMPERATURE.
 - INPUT/OUTPUT PHASE LOSS.
 - OUTPUT SHORT CIRCUIT PROTECTION.
 - OUTPUT GROUND FAULT PROTECTION.
- INPUTS:
 - DIGITAL INPUT(S): THREE.
 - ANALOG INPUT(S): TWO.
- OUTPUTS:
 - ANALOG OUTPUT(S): ONE.
 - RELAY OUTPUT(S): TWO.
- FEATURES:
 - PASSWORD-PROTECTED SECURITY ACCESS.
 - EVENT LOG.

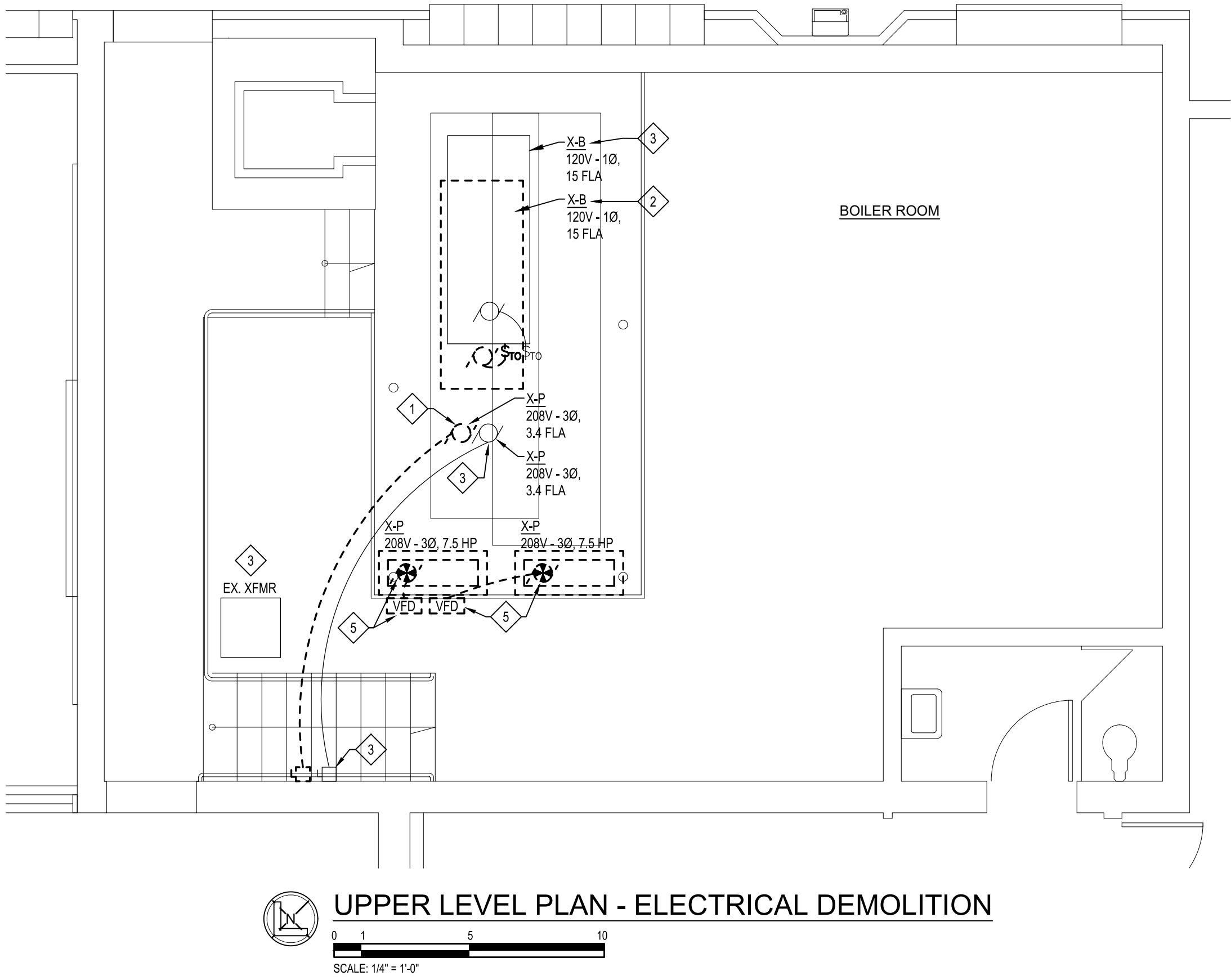
POWER CONDITIONING/FILTERING: PROVIDE DC LINK CHOKE OR INPUT/LINE REACTOR FOR EACH CONTROLLER UNLESS OTHERWISE INDICATED OR REQUIRED. REACTOR IMPEDANCE: 3 PERCENT, UNLESS OTHERWISE INDICATED OR REQUIRED.

PACKAGED CONTROLLERS: CONTROLLERS FACTORY-MOUNTED IN SEPARATE ENCLOSURE WITH EXTERNALLY OPERABLE DISCONNECT AND SPECIFIED ACCESSORIES.

- DISCONNECTS: CIRCUIT BREAKER OR DISCONNECT SWITCH TYPE.
- DISCONNECT SWITCHES: FUSIBLE TYPE WITH SEPARATE INPUT FUSES.
 - PROVIDE EXTERNALLY OPERABLE HANDLE WITH MEANS FOR LOCKING IN OFF POSITION. PROVIDE SAFETY INTERLOCK TO PREVENT OPENING COVER WITH DISCONNECT IN ON POSITION WITH CAPABILITY OF OVERRIDING INTERLOCK FOR TESTING PURPOSES.
 - PROVIDE AUXILIARY INTERLOCK FOR DISCONNECTION OF EXTERNAL CONTROL POWER SOURCES WHERE APPLICABLE.
- PROVIDE DOOR-MOUNTED REMOTE OPERATOR INTERFACE.

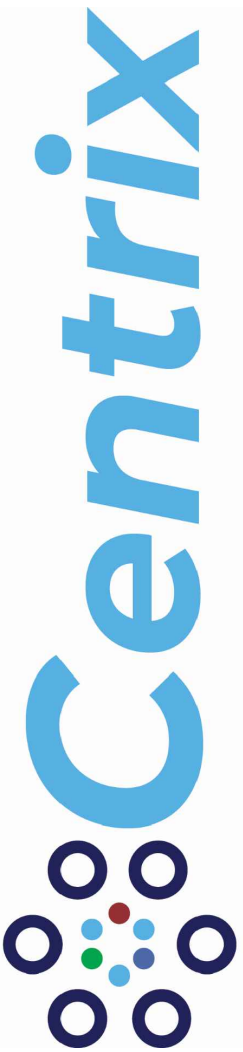
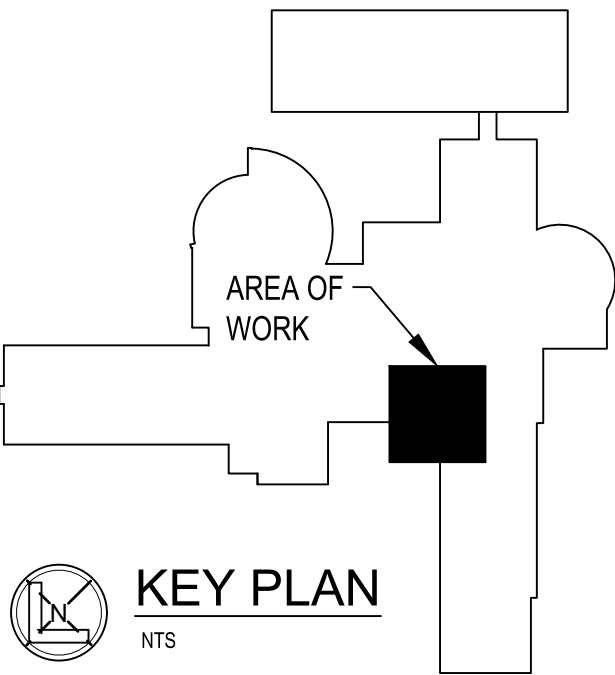
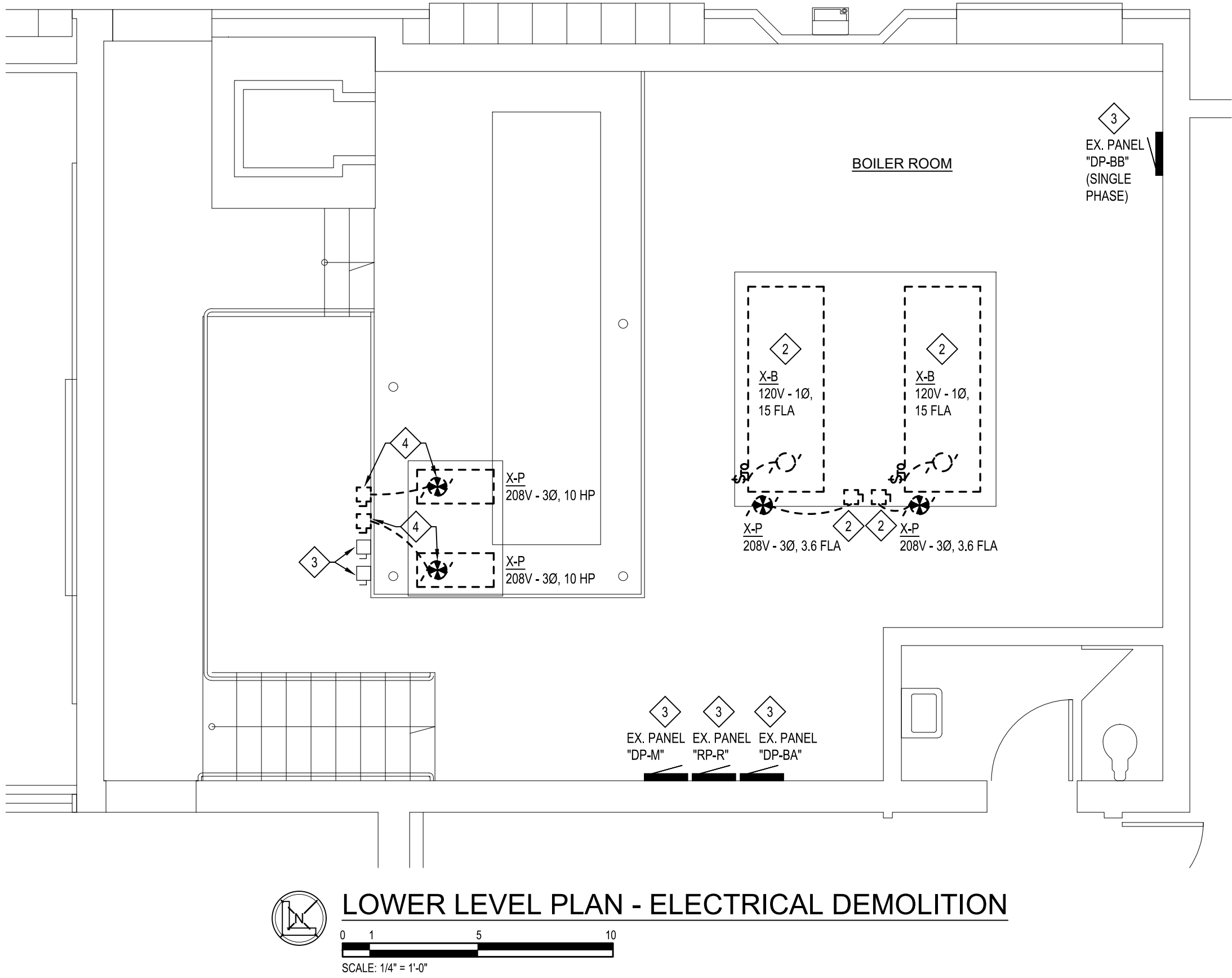
ENCLOSURES:

- COMPLY WITH NEMA ICS 6.
- NEMA 250 ENVIRONMENT TYPE OR EQUIVALENT IEC 60529 RATING: UNLESS OTHERWISE INDICATED, AS SPECIFIED FOR FOLLOWING INSTALLATION LOCATIONS:
 - INDOOR CLEAN, DRY LOCATIONS: TYPE 1 OR TYPE 12.
 - FINISH: MANUFACTURER'S STANDARD UNLESS OTHERWISE INDICATED.
 - COOLING: FORCED AIR OR NATURAL CONVECTION AS DETERMINED BY MANUFACTURER.
- OVERCURRENT PROTECTIVE DEVICES
 - OVERLOAD RELAYS:
 - PROVIDE OVERLOAD RELAYS AND, WHERE APPLICABLE, ASSOCIATED CURRENT ELEMENTS/HEATERS SELECTED FOR ACTUAL INSTALLED MOTOR NAMEPLATE DATA, IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND NFPA 70; INCLUDE CONSIDERATION FOR MOTOR SERVICE FACTOR AND AMBIENT TEMPERATURE CORRECTION, WHERE APPLICABLE.
 - COMPLY WITH



DEMOLITION NOTES

- 1 DISCONNECT PUMP AND REMOVE MOTOR STARTER, REMOVE ASSOCIATED CONDUIT & WIRE BACK TO SOURCE.
- 2 DISCONNECT MECHANICAL EQUIPMENT AND REMOVE MOTOR STARTER, CONDUIT AND WIRE TO REMAIN FOR RECONNECTION TO NEW EQUIPMENT.
- 3 EXISTING EQUIPMENT TO REMAIN.
- 4 DISCONNECT 10 HP MOTOR AND REMOVE MOTOR STARTER, REWORK CONDUIT AND WIRE FOR RECONNECTION TO NEW STARTER AND 10 HP MOTOR ON UPPER LEVEL.
- 5 DISCONNECT 7.5 HP MOTOR AND REMOVE VFD, REWORK CONDUIT AND WIRE FOR RECONNECTION TO NEW STARTER AND 7.5 HP MOTOR ON LOWER LEVEL.



792 LOS DRIVE, SUN PRAIRIE, WI 53590

REVISIONS	
07/08/2026	CD SET

DRAWN	
AGS	
APPROVED	
RCH	

**MATRIX**
CONSULTING ENGINEERS, INC

544 Chestnut Drive
Lansing, MI 48917
PHONE (517) 487-2511
administrator@matrixinc.com
Matrix Project No. 250963.00

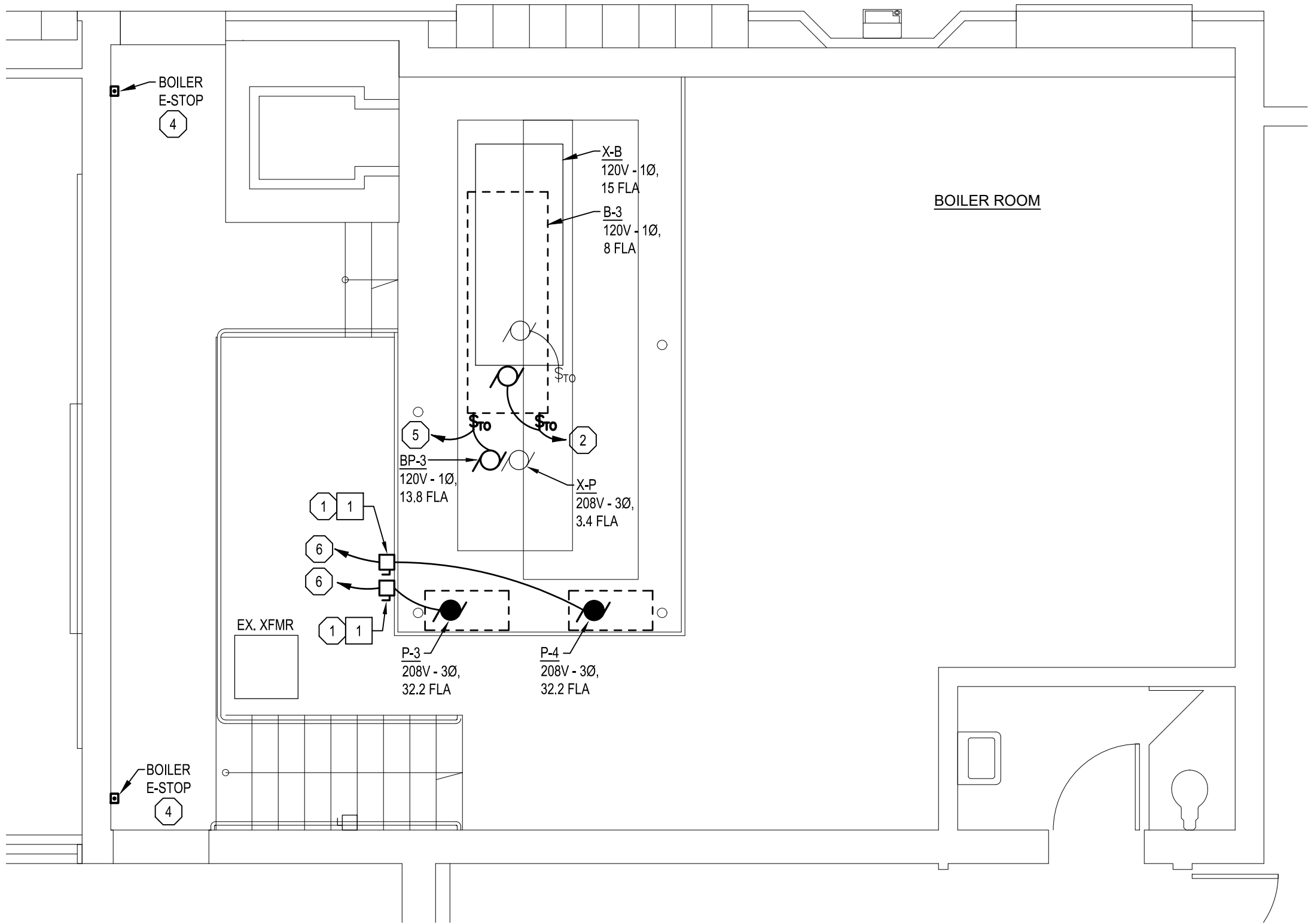
PROJECT
LIGHTHOUSE ELEMENTARY BOILER AND PUMP UPGRADES
51880 WASHINGTON ST.
NEW BALTIMORE, MI 48047

SHEET DESCRIPTION
UPPER AND LOWER LEVEL ELECTRICAL DEMOLITION

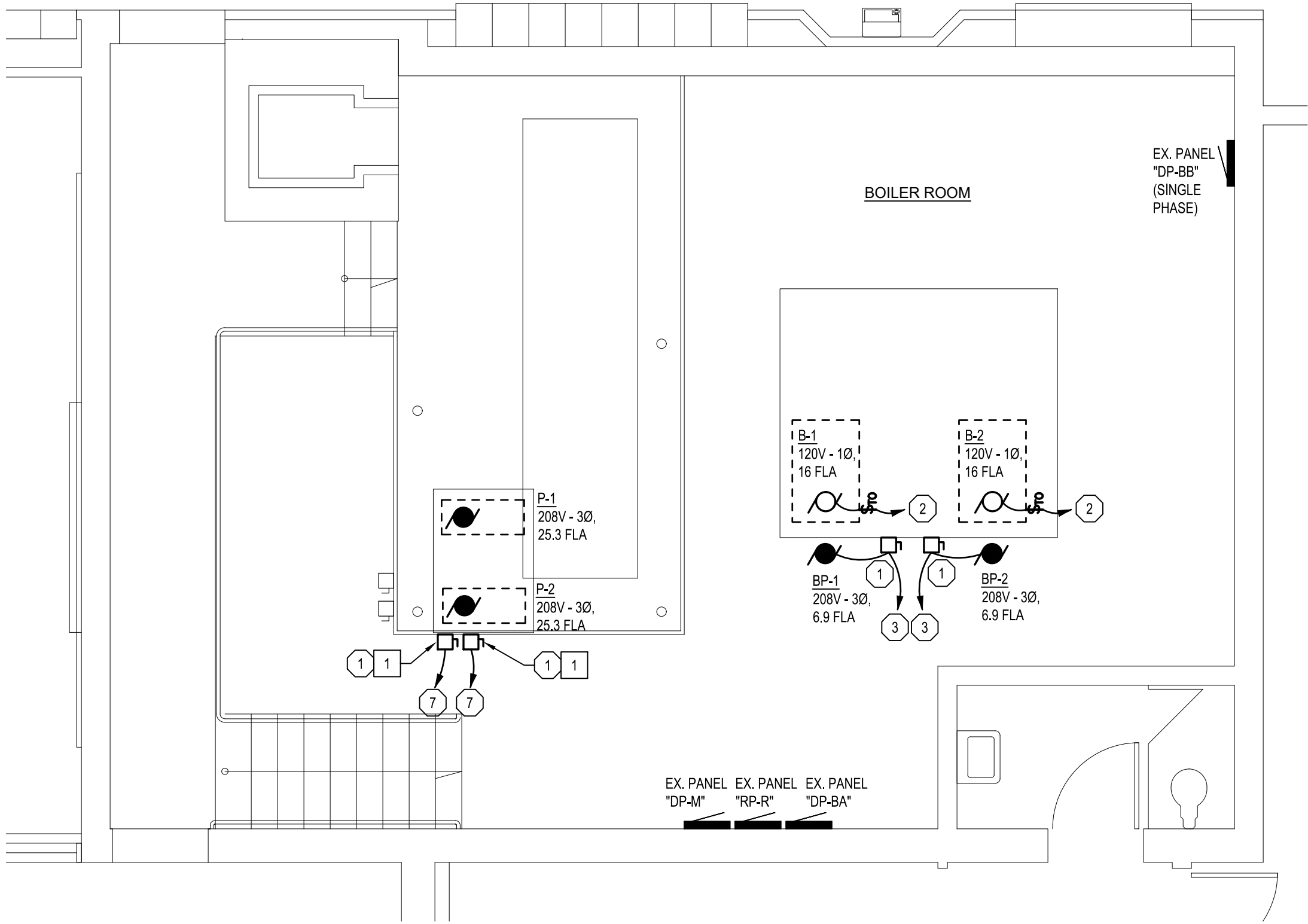
DATE
04/08/2026

PROJECT NUMBER
250963.00

SHEET NUMBER
E-300



UPPER LEVEL PLAN - POWER
SCALE: 1/4" = 1'-0"



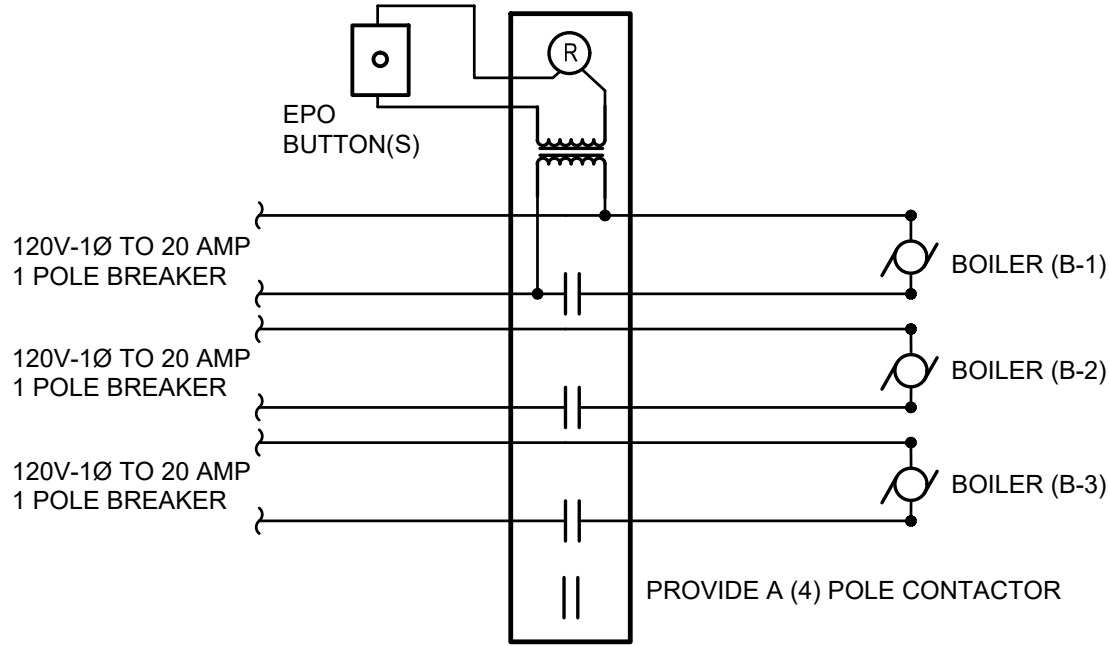
LOWER LEVEL PLAN - POWER
SCALE: 1/4" = 1'-0"

ELECTRICAL KEY NOTES

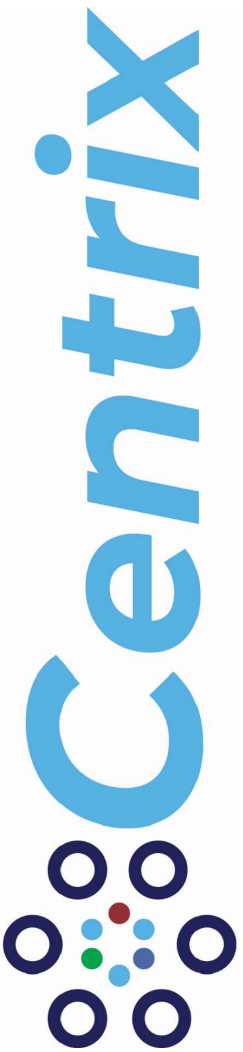
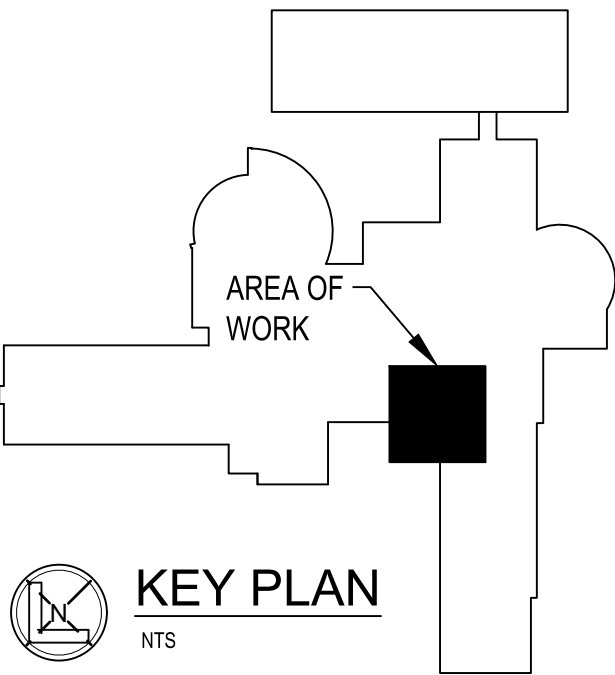
- 1 NEW COMBINATION STARTER FUSED DISCONNECT WITH INTEGRAL HAND/OFF/AUTO. MOUNT TO EXISTING UNISTRUT.
- 2 RECONNECT NEW BOILER TO EXISTING 120V BOILER CIRCUIT. EXTEND CONDUIT AND WIRE AS NECESSARY.
- 3 RECONNECT MOTOR STARTER TO EXISTING CIRCUIT. EXTEND CONDUIT AND WIRE AS NECESSARY.
- 4 PROVIDE ALL NECESSARY PARTS AND WIRING FOR A COMPLETE INSTALLATION OF BOILER E-STOP SYSTEM. REFER TO DETAIL 1 ON SHEET E-500.
- 5 PROVIDE SINGLE POLE 20A BREAKER FOR NEW 120V, 20A CIRCUIT FROM SPACE IN PANEL RP-R.
- 6 RECONNECT MOTOR STARTER TO EXISTING 10 HP MOTOR CIRCUIT.
- 7 RECONNECT MOTOR STARTER TO EXISTING 7.5 HP MOTOR CIRCUIT.

ALTERNATES

- 1 ADD ALTERNATE #1: PROVIDE NEW VARIABLE FREQUENCY DRIVE FOR SYSTEM PUMP.



1 TYPICAL BOILER EMERGENCY OFF SWITCH
SCALE: N.T.S.



792 LOS DRIVE, SUN PRAIRIE, WI 53590

REVISIONS	
07/08/2026	CD SET

DRAWN
AGS

APPROVED
RCH

MATRIX
CONSULTING ENGINEERS, INC

544 Cheabogue Drive
Lansing, MI 48917
PHONE (517) 487-2511
administrator@matrixinc.com
Fax: Project No. 250963.00

LIGHTHOUSE ELEMENTARY BOILER AND PUMP UPGRADES

51880 WASHINGTON ST.
NEW BALTIMORE, MI 48047

SHEET DESCRIPTION	
UPPER AND LOWER LEVEL POWER PLAN	
DATE	04/08/2026
PROJECT NUMBER	250963.00
SHEET NUMBER	E-500