

VARIABLE FREQUENCY DRIVE SCHEDULE												
TAG NO.	NAME	MANUFACTURER	VOLTAGE	NEW WIRE	PHASE	NEW FUSE/CB SIZE	HP	ENCLOSURE	FEEDER PANEL	NOTES	DRAWING LOCATION	NOTES
VD-1	BOILER B-1 PRIMARY PUMP	ABB, CUTLER HAMMER, SQUARE D, HONEYWELL, YASKAWA	480	3-#10 & #10 GND 3/4" CONDUIT	3	20	5	NEMA 1	TBD	PROVIDED BY U/O, INSTALLED BY E/C	E100	1,2,3

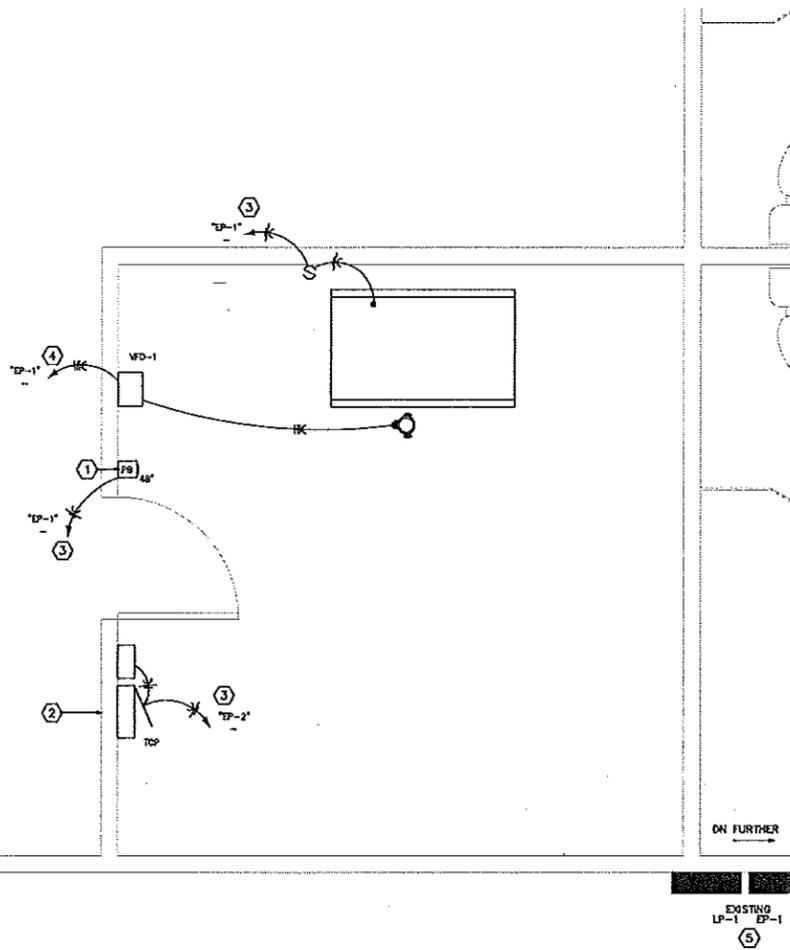
NOTE:
 1. ALL VARIABLE FREQUENCY DRIVES SHALL BE PROVIDED BY TEMPERATURE CONTROLS CONTRACTOR OR MECHANICAL CONTRACTOR. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WIRING AND CONDUIT, INCLUDING MOUNTING AND INSTALLING THE VFD.
 2. TEMPERATURE CONTROL CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING AND CONDUIT FOR NEW CONTROL. MOUNT AHU VFD ON WALL ADJACENT TO EXISTING ELECTRICAL PANELS.
 3. NO MAINTENANCE BYPASS.

CONDUIT APPLICATION SCHEDULE			
APPLICATION	MATERIAL	FITING TYPE (IF APPLICABLE)	NOTES
ALL BRANCH CIRCUITS FOR LIGHTING AND POWER	EMT	COMPRESSION	-
ALL HVAC EQUIPMENT, SUPPLY/EXHAUST FANS AND MOTORS	EMT	COMPRESSION	-
LINE VOLTAGE THERMOSTAT / CONTROL WIRING	EMT	COMPRESSION	-
T-STAT WIRING OR CONTROL WIRING IN WALLS AND IN AREAS WITHOUT CEILINGS	EMT	COMPRESSION	-
FIRE ALARM CABLING (POWER-LIMITED, FIRE-PROTECTIVE, SIGNALING CIRCUIT CABLE)	EMT	COMPRESSION	-
DATA/TELEPHONE CABLING WHERE CEILINGS INSTALLED	TRAY/J-HOOK	-	3

1. TRANSITION TO EMT SHALL BE MADE PRIOR TO COMING UP FROM BELOW GRADE
 2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN UTILITY COMPANY REQUIREMENTS FOR PRIMARY SERVICE AND ENCASING IN CONCRETE IF REQUIRED.
 3. WHERE CEILINGS EXIST, WIRING CAN BE OPEN, PLENUM-RATED WIRING. IN AREAS WITHOUT A CEILING, EMT CONDUIT IS REQUIRED.
 4. ALL WIRING SHALL BE AWG THRU/THRU.

PLAN NOTES

- 1. EMERGENCY PUSH OFF BUTTON (EPO) EQUAL TO KELE MODEL ST120SLN1-BS WITH A CLEAR HINGED COVER.
- 2. NEW TEMPERATURE CONTROL PANEL. PROVIDE 120 VOLT CIRCUIT TO ALL DEVICES AND POWER SUPPLIES.
- 3. CIRCUIT HOMERUN TO EXISTING 120/208V PANELBOARD LOCATED WITHIN MAINTENANCE BAYS (OR PANEL IN NEAR PROXIMITY). UTILIZE EXISTING SPARE 20 AMP/1-POLE BREAKER OR PROVIDE NEW BREAKER IN SPARE LOCATION. FIELD VERIFY PANEL CONDITIONS, SPARE SPACE, AND LOADS. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO VERIFY EXISTING CONDITIONS.
- 4. CIRCUIT HOMERUN TO EXISTING 120/208V PANELBOARD LOCATED WITHIN MAINTENANCE BAYS (OR PANEL IN NEAR PROXIMITY). FIELD VERIFY SPARES AND SPACES FOR INSTALLATION OF NEW 35 AMP, 3-POLE BREAKER. VERIFY ALL PANELS FOR USE NEW CIRCUITS. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO VERIFY EXISTING CONDITIONS.
- 5. APPROXIMATE LOCATIONS OF EXISTING PANELS. FIELD VERIFY SPARE POLE AVAILABILITY AND SPACE WITHIN PANELS FOR NEW CIRCUITS. DIVIDE NEW CIRCUITS AMONGST ALL PANELS TO DISTRIBUTE LOADS. UTILIZE EXISTING SPACE WHERE OLD BREAKERS SERVED PUMPS, CONTROLS, OTHER HVAC ITEMS NOW DEMOLISHED.

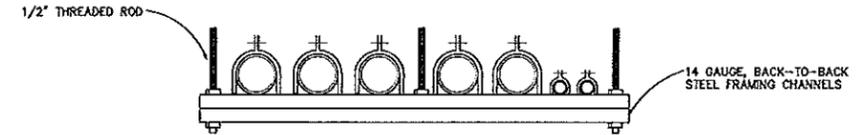
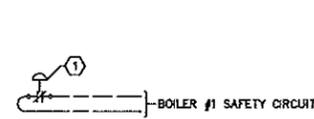


ROOM #109
 ELECTRICAL NEW WORK PLAN
 SCALE: 1/4" = 1'-0"

NOTES

- 1. EPO BUTTON EQUAL TO KELE MODEL# ST120SLN1-BS WITH A PILCHCOV1 CLEAR HINGED COVER.

2 EPO STATION DETAIL
 SCALE: NONE

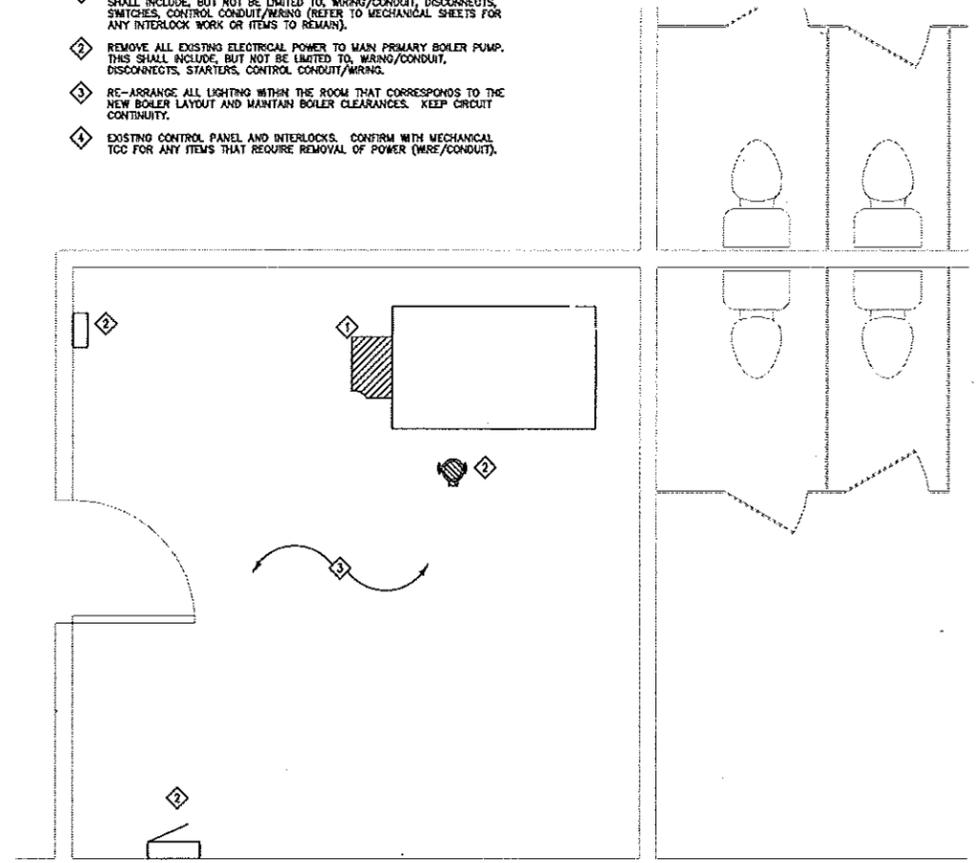


NOTES:
 ARRANGEMENT IS DIAGRAMMATIC ONLY, AND SHALL DEPICT MULTIPLE 3/4" CONDUITS, MULTIPLE PANEL FEEDERS, ETC.

1 CONDUIT MOUNTING - TYPICAL
 SCALE: NONE

DEMOLITION NOTES

- 1. REMOVE ALL EXISTING ELECTRICAL POWER TO DEMOLISHED BOILER. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, WIRING/CONDUIT, DISCONNECTS, SWITCHES, CONTROL CONDUIT/WIRING (REFER TO MECHANICAL SHEETS FOR ANY INTERLOCK WORK ON ITEMS TO REMAIN).
- 2. REMOVE ALL EXISTING ELECTRICAL POWER TO MAIN PRIMARY BOILER PUMP. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, WIRING/CONDUIT, DISCONNECTS, STARTERS, CONTROL CONDUIT/WIRING.
- 3. RE-ARRANGE ALL LIGHTING WITHIN THE ROOM THAT CORRESPONDS TO THE NEW BOILER LAYOUT AND MAINTAIN BOILER CLEARANCES. KEEP CIRCUIT CONTINUITY.
- 4. EXISTING CONTROL PANEL AND INTERLOCKS. CONFIRM WITH MECHANICAL TCC FOR ANY ITEMS THAT REQUIRE REMOVAL OF POWER (WIRE/CONDUIT).



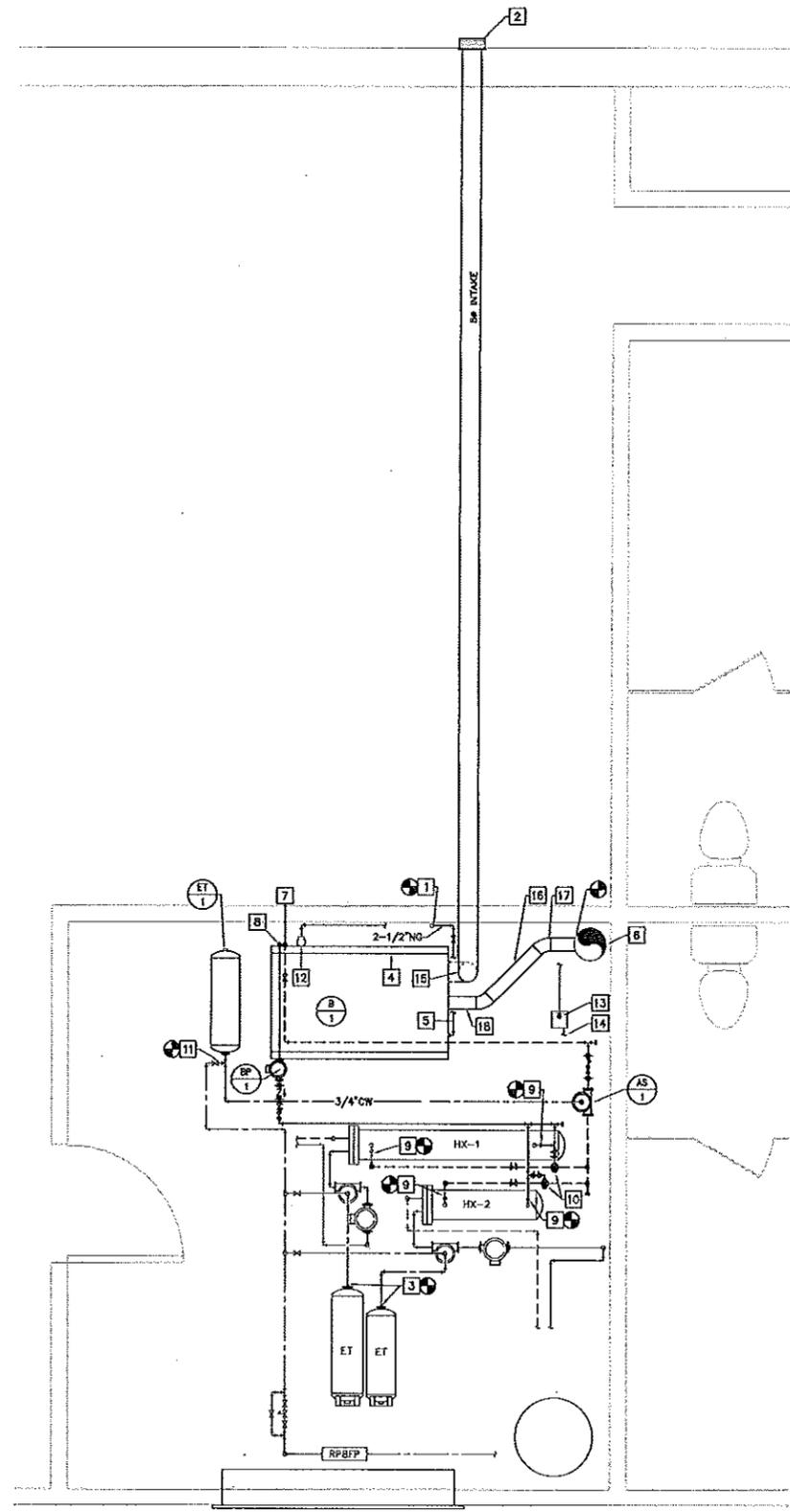
ROOM #109
 ELECTRICAL DEMOLITION PLAN
 SCALE: 1/4" = 1'-0"



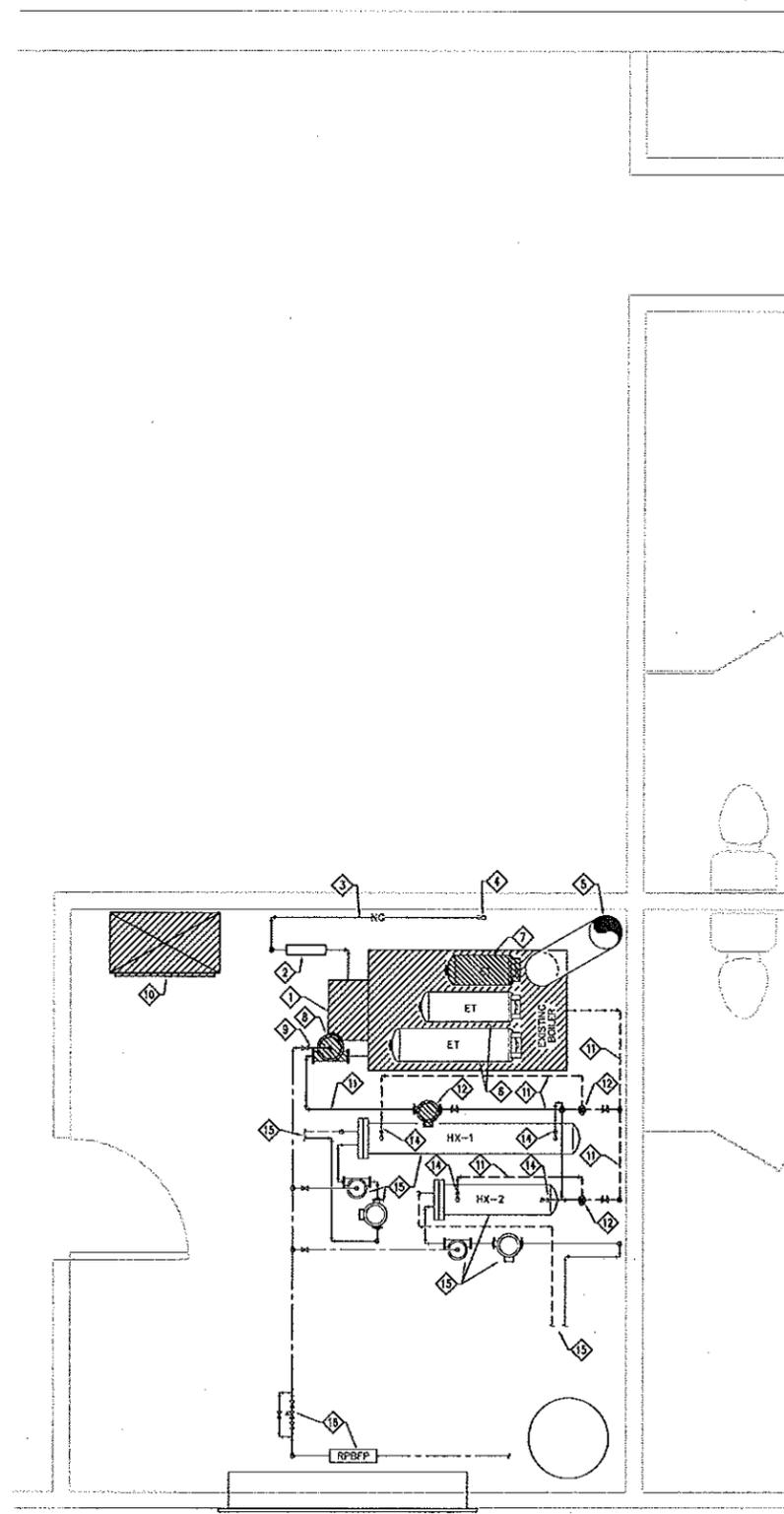
REV. NO.	DATE	REVISIONS DESCRIPTION

ELECTRICAL DEMOLITION AND NEW WORK PLANS
 MISSOURI DEPARTMENT OF TRANSPORTATION
 DISTRICT 7 MAINTENANCE OFFICE BOILER REPLACEMENT
 JOPLIN, MISSOURI

Drawn by: KJW
 Checked by: KJW
 Approved by: CMN
 Date: 01/20/2012
 Drawing no: E100



ROOM #109
MECHANICAL NEW WORK PLAN
 W100 SCALE: 1/2" = 1'-0"



ROOM #109
MECHANICAL DEMOLITION PLAN
 W100 SCALE: 1/2" = 1'-0"

DEMOLITION NOTES

- 1 REMOVE EXISTING BOILER AND ALL ASSOCIATED SUPPORTS, WRING, BURNER, PIPING CONNECTIONS, FLUES, ETC. REFER TO NEW WORK PLAN FOR EXISTING COMPONENTS TO REMAIN FOR RECONNECTION.
- 2 REMOVE EXISTING NATURAL GAS VALVE TRAIN ASSOCIATED WITH DEMOLISHED BOILER.
- 3 REMOVE EXISTING NATURAL GAS PIPING ROUTED TO SERVE DEMOLISHED BOILER. CAP AT CONNECTION TO EXISTING MAIN VERTICAL GAS PIPELINE.
- 4 EXISTING VERTICAL GAS PIPING SHALL REMAIN FOR RECONNECTION PER NEW WORK PLAN.
- 5 EXISTING FLUE PIPING ASSOCIATED WITH DEMOLISHED BOILER TO REMAIN. CONTRACTOR SHALL CONNECT NEW FLUE TO EXISTING CHIMNEY STACK.
- 6 EXISTING EXPANSION TANKS ASSOCIATED WITH RADIANT FLOOR AND AIR HANDLING UNIT SYSTEM HEAT EXCHANGERS SHALL BE RELOCATED PER NEW WORK PLANS.
- 7 REMOVE EXISTING EXPANSION TANK ASSOCIATED WITH DEMOLISHED BOILER. EXISTING SUPPORT SHALL REMAIN FOR REUSE PER NEW WORK PLAN.
- 8 REMOVE EXISTING AIR SEPARATOR ASSOCIATED WITH DEMOLISHED BOILER. DEMOLITION SHALL INCLUDE, BUT NOT BE LIMITED TO, REMOVAL OF AIR SEPARATOR AND ASSOCIATED MAKEUP WATER PIPING, SUPPORTS, ETC.
- 9 REMOVE EXISTING MAKEUP WATER PIPING PAST EXISTING ISOLATION VALVE. ISOLATION VALVE SHALL REMAIN FOR RECONNECTION PER NEW WORK PLANS.
- 10 REMOVE EXISTING COMBUSTION AIR DUCTWORK UP TO ABOVE CEILING. CAP AND SEAL DUCTWORK AIRTIGHT ABOVE CEILING.
- 11 REMOVE EXISTING BOILER PRIMARY HEATING HOT WATER SUPPLY/RETURN PIPING TO POINTS SHOWN. CONNECTIONS TO EXISTING HEAT EXCHANGERS SHALL REMAIN AS NOTED.
- 12 REMOVE EXISTING INLINE BOILER PUMP IN ITS ENTIRETY.
- 13 REMOVE EXISTING 3-WAY CONTROL VALVE.
- 14 REMOVE EXISTING PRIMARY HEATING HOT WATER SUPPLY/RETURN PIPING UP TO EXISTING HEAT EXCHANGER. CAP PIPING AT CONNECTION FOR REUSE PER NEW WORK PLANS.
- 15 EXISTING AIR HANDLING UNIT AND RADIANT FLOOR SYSTEM HEAT EXCHANGERS, AND ALL ASSOCIATED SECONDARY HEATING HOT WATER PIPING, AIR SEPARATORS, EXPANSION TANKS, CHEMICAL FEEDERS, ETC. SHALL REMAIN. REFER TO NEW WORK PLANS FOR ALL NECESSARY REWORK ASSOCIATED WITH INSTALLATION OF NEW BOILERS.
- 16 EXISTING MAKEUP WATER PIPING AND COMPONENTS SHALL REMAIN UNCHANGED, EXCEPT AS NOTED.

NEW WORK NOTES

- 1 CONNECT NEW 2-1/2" NATURAL GAS PIPING TO EXISTING VERTICAL RISER. FIELD VERIFY SIZE AND LOCATION OF EXISTING PIPING PRIOR TO MAKING CONNECTION.
- 2 CONNECT 8" BOILER AIR INTAKE DUCTWORK TO BOILER MANUFACTURER APPROVED SIDEWALL INTAKE WITH BIRD/INSECT SCREEN.
- 3 RELOCATE EXISTING EXPANSION TANKS AND ASSOCIATED MOUNTING FRAME, SUPPORTS, ETC. TO LOCATION SHOWN. HIGH AS POSSIBLE. PROVIDE NEW PIPING AS REQUIRED TO CONNECT TO EXISTING ASSOCIATED AIR SEPARATOR. SIZE TO MATCH EXISTING.
- 4 COORDINATE LOCATION OF NEW BOILER WITH EXISTING CONDITIONS AND INSTALL PER MANUFACTURER'S REQUIREMENTS ON ELASTOMER GASKETS. ISOLATORS. PROVIDE ALL PIPING CONNECTIONS PER DETAIL 2/M200 AND MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- 5 2-1/2" NATURAL GAS PIPING DOWN TO BOILER GAS VALVE ASSEMBLY. PROVIDE SHUTOFF AND UNION PRIOR TO CONNECTING TO INLET OF VALVE ASSEMBLY. COORDINATE WITH EXISTING GAS SERVICE TO ENSURE MINIMUM 7" W.C. IS SUPPLIED TO EACH BOILER. ROUTE FULL SIZE GAS VENT FROM PRESSURE REGULATOR TO TERMINATE OUTDOORS.
- 6 EXISTING 12" BOILER FLUE PIPING UP TO ROOF TERMINATION. NEW CATEGORY IV PIPING INTO SIZE WITH TRANSITION. MAINTAIN MINIMUM 1/4" PER 1'-0" SLOPE BACK TO BOILER CONNECTION.
- 7 3" HEATING HOT WATER RETURN PIPING DOWN TO BOILER. CONNECT PER MANUFACTURER'S REQUIREMENTS.
- 8 3" HEATING HOT WATER SUPPLY PIPING DOWN TO BOILER. CONNECT PER MANUFACTURER'S REQUIREMENTS.
- 9 CONNECT NEW HEATING HOT WATER SUPPLY/RETURN PIPING TO EXISTING HEAT EXCHANGER. SIZE TO MATCH EXISTING CONNECTION SIZE OF HEAT EXCHANGER.
- 10 PROVIDE NEW 3-WAY MODULATING CONTROL VALVE, WITH BALANCE VALVES ON BYPASS LEG AND HEATING HOT WATER RETURN LEG, FOR CONTROL OF HEATING HOT WATER PASSING THRU HEAT EXCHANGER.
- 11 CONNECT NEW 3/4" MAKEUP WATER PIPING TO EXISTING AT ISOLATION VALVE.
- 12 SAFETY RELIEF VALVE SIZE IN ACCORDANCE WITH ASME REQUIREMENTS. EXTEND FULL SIZE TO DISCHARGE TO NEAREST FLOOR DRAIN.
- 13 ROUTE FULL SIZE CONDENSATE DRAIN FROM EACH BOILER TO CONDENSATE NEUTRALIZATION KIT.
- 14 ROUTE FULL SIZE DISCHARGE FROM NEUTRALIZATION KIT TO DISCHARGE TO NEAREST FLOOR DRAIN WITH AIR GAP.
- 15 CONNECT FULL SIZE COMBUSTION AIR INTAKE PIPING TO BOILER PER MANUFACTURER'S REQUIREMENTS.
- 16 CONNECT FULL SIZE CATEGORY IV (STAINLESS STEEL AL-294C) FLUE VENT PIPING TO BOILER PER BOILER MANUFACTURER'S REQUIREMENTS.
- 17 TRANSITION AS NECESSARY TO INCREASE INTAKE/FLUE PIPING SIZE AS NECESSARY WITHIN INITIAL 10'-0" OF CONNECTION TO BOILER.
- 18 CONNECT 8" BOILER FLUE TO BOILER CONNECTION. PROVIDE CONDENSATE DRAIN PER E/M INSTRUCTIONS.

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REV. NO.	DATE	REVISIONS DESCRIPTION

MECHANICAL DEMOLITION AND NEW WORK PLANS

MISSOURI DEPARTMENT OF TRANSPORTATION

DISTRICT 7 MAINTENANCE OFFICE BOILER REPLACEMENT

JOPLIN, MISSOURI

Drawn by: NAL

Checked by: NAL

Approved by: CMW

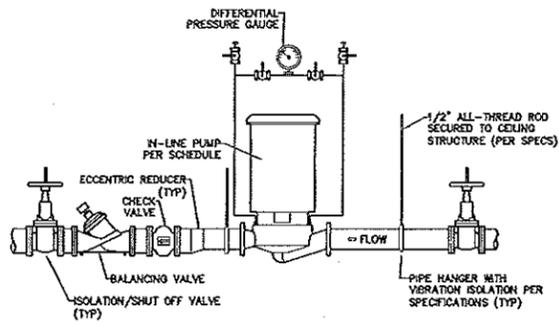
QA/QC by: CMW

Project no.: 016-2002

Drawing no.: 18-314-00

Date: 6.1.2012

SHEET
M100



3 IN-LINE PUMP DETAIL
SCALE: NONE

WATER SPECIALTIES SCHEDULE	
SYSTEM	HEATING WATER
SYSTEM OPERATING TEMP.	180°
SYSTEM WORKING PRESSURE	125
AIR SEPARATOR(S)	AS-1
MANUFACTURER	BELL & GOSSETT
MODEL NO./QUANTITY	R-3F
CPW/MPD (FT.)	144/CS
SIZE	3"
EXPANSION TANK(S)	ET-1
MANUFACTURER	BELL & GOSSETT
MODEL NO.	D-40
MIN. TANK VOLUME	21.7 GAL
MIN. ACCEPTANCE VOLUME	11.3 GAL
PRESSURE REDUCING VALVE(S)	EXISTING
MANUFACTURER	-
MODEL NO.	-
WORKING PRESSURE	-
SIZE	-
PRESSURE SETTING	-
SHOT FEEDER	N/A
MANUFACTURER	-
MODEL NO.	-
CAPACITY	-
SUCTION DIFFUSER	N/A
MANUFACTURER	-
MODEL NO.	-
CPW/MPD (FT.)	-
SIZE	-

HVAC PIPING MATERIAL SCHEDULE												
SYSTEM	SIZE	TYPE	SCH	GRD	ASTM	MATERIAL	MAT.	TYPE	MAX WORKING		FIELD TEST	
									PRESS (PSI)	TEMP (°F)	PRESS (PSI)	TME
HEATING HOT WATER SUPPLY & RETURN *	0.5"-3"	CS/BLK	40	A	B88	CP	CS	MJ	125	45-80	150	1 HR
HEATING HOT WATER SUPPLY & RETURN *	3" & UP	CS/BLK	40	A	A120	CS/BLK	CS	MJ	125	45-80	150	1 HR
CONDENSATE DRAIN ABOVE GRADE	ALL	M	---	---	B88	CP	CP	DR/S	10FT	40-70	10FT	1 HR
TEMPERATURE & PRESSURE RELIEF DRAIN	ALL	M	---	---	B88	CP	CP	DR/S	10FT	40-70	10FT	1 HR
REFRIGERANT PIPING	ALL	ACR	---	---	B280	CP	CP	SJ	150	40-140	200	4 HR
NATURAL GAS ABOVE GRADE	0.5"-2.5"	SL/CW	40	A	A53	CS/BLK	CS	WELD	1	-	100	1 HR
NATURAL GAS ABOVE GRADE	ABOVE 3"	SL/CW	40	A	A53	CS/BLK	CS	WELD	1	-	100	1 HR

ATP - ARMO TRUSS PIPE MJ - MECHANICAL JOINT
 BLK - BLACK NO - NEOPRENE GASKET
 BS - BELL & SPIGOT NH - NO-HUB
 CI - CAST IRON PE - POLYETHYLENE
 CP - COPPER PVC - POLYVINYL CHLORIDE
 CS - CARBON STEEL S - BRAZED JOINT - SILVER BRAZING ALLOY
 CW - CONTINUOUS WELD SJ - SOLDER JOINT 65-5 TIN-ANTIMONY
 DI - DUCTILE IRON SL - SEAMLESS STEEL
 DR - DRAINAGE FITTING SS - STANDARD STRENGTH - SERVICE WEIGHT
 GLV - GALVANIZED SW - SOLVENT WELD
 LC - LEAD CAULKING THRD - THREADED
 MI - MALLEABLE IRON WELD - WELDED

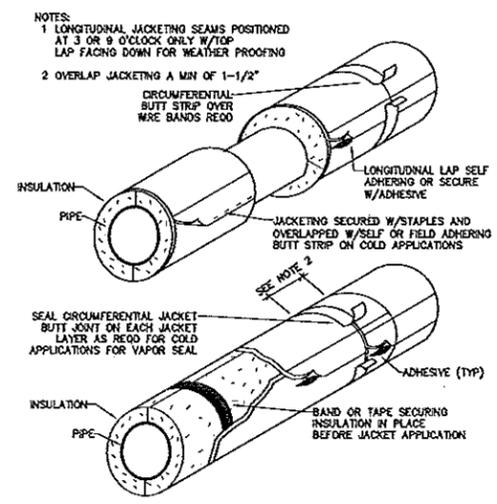
NOTE: NO "PULLED TEES" ALLOWED ON COPPER PIPING.
 * USE GROOVED STEEL WITH VITALIC JOINTS.

BOILERS												
MARK	SERVICE	FUEL TYPE	FLOW (GPM)	PD (FT/HD)	MBH INPUT	MBH OUTPUT	EWT (°F)	LWT (°F)	WORKING PRESS (PSIG)	VOLT/PH/Hz	MANUFACTURER & MODEL	REMARKS
B-1	HTG HOT WATER	NAT GAS	125	12	1850	1378	160	180	160	120/1/60	LAARS RHEOS	1-10

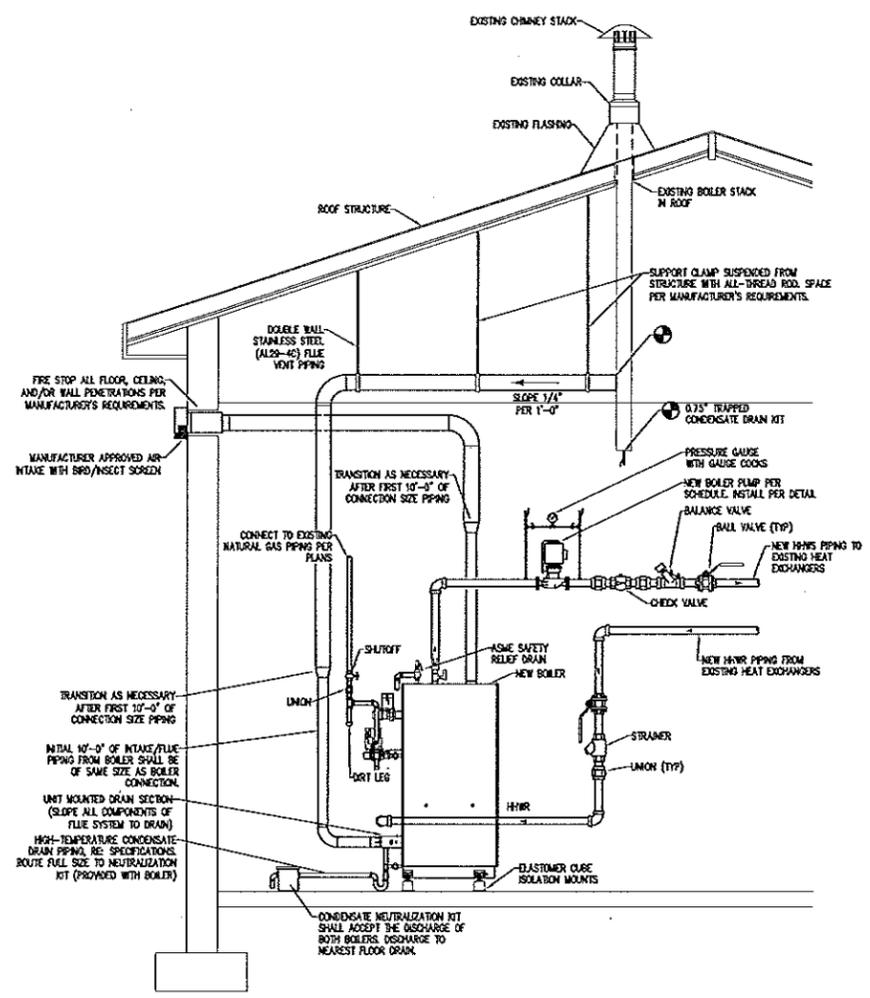
- ACCESSORIES:
- ELASTOMER COATED FIBERGLASS MOUNTING CUBES
 - CONDENSATE DRAIN KIT
 - SAFETY RELIEF VALVE SIZED IN ACCORDANCE WITH ASME REQUIREMENTS
 - WATERIZED GAS VALVE
 - GAS PRESSURE REGULATOR
 - GAS SAFETY SOLENOID
 - SPARK IGNITION
 - INTEGRAL CONTROL PANEL RE: CONTROLS DIAGRAM
 - HI-TEMP AND LO-WATER CUTOFFS WITH MANUAL RESET
 - EXTERNAL BOILER PUMP, CONTRACTOR HAS OPTION TO BE INTEGRAL IF FT HD MET PER PUMP SCHEDULE

PUMPS													
MARK	LOCATION	SERVES	GPM	HEAD (FT)	HP	EFF. %	VOLT/PH/Hz	RPM	TYPE	MANUFACTURER	SERIES	MODEL	REMARKS
BP-1	ROOM #109	HTG HOT WATER	135	55	5	63	208/3/60	1750	INLINE	BELL & GOSSETT	80	3x3x9.5B	-

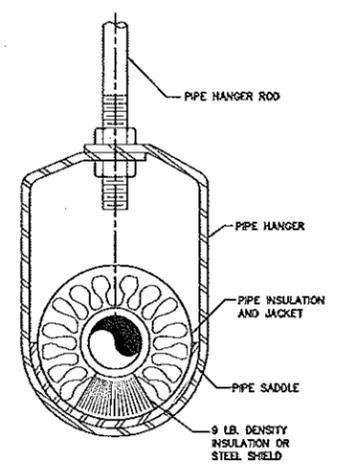
REMARKS:
1.



4 FACTORY AND FIELD APPLIED NON-METALLIC PIPE JACKETING
SCALE: NONE



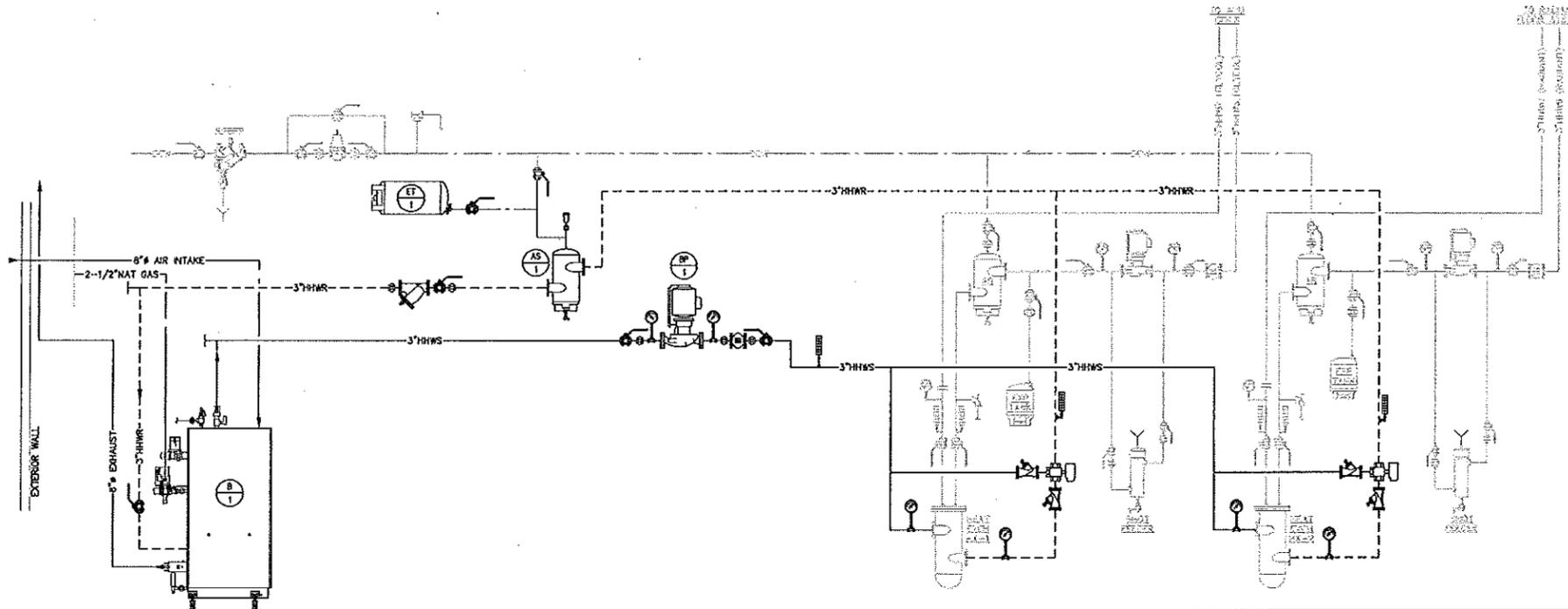
2 BOILER CONNECTIONS DETAIL
SCALE: NONE



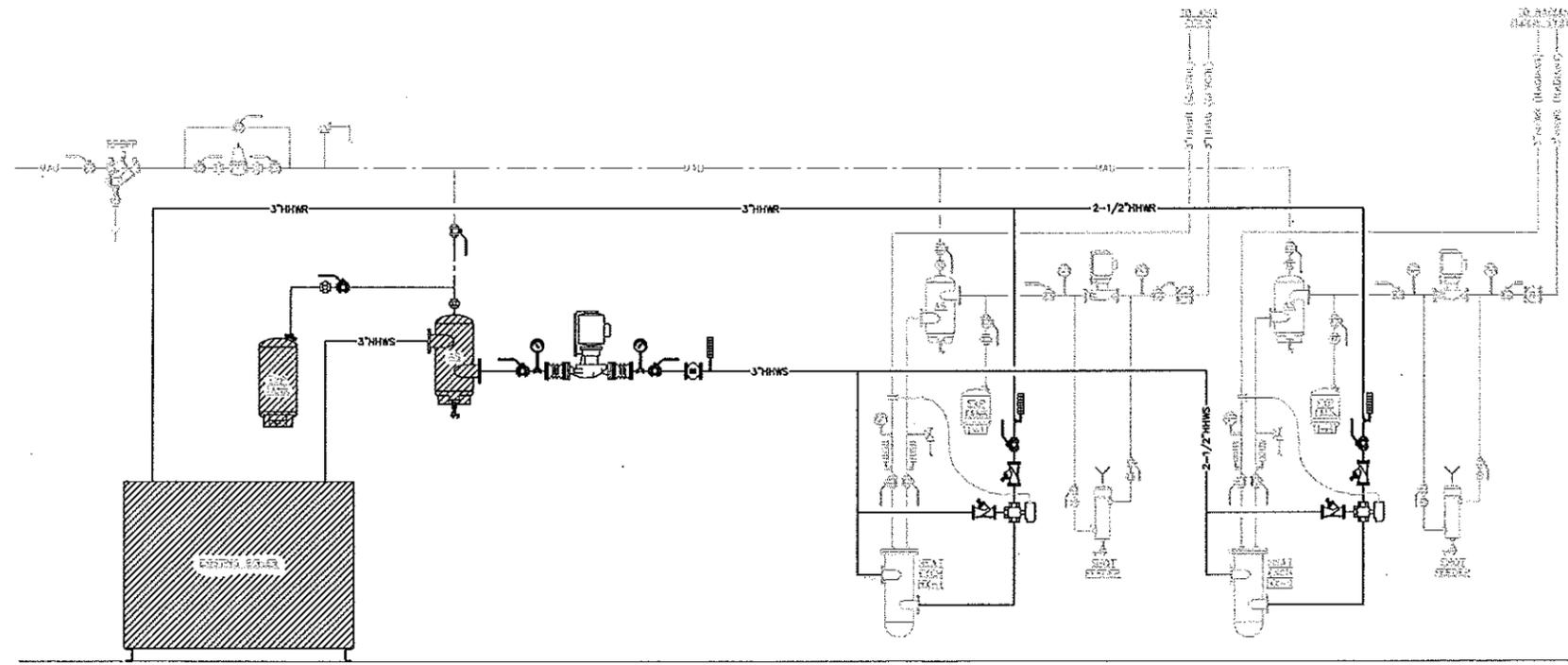
1 PIPE HANGER SUPPORT DETAIL
SCALE: NONE



REV. NO.	DATE	REVISION DESCRIPTION



2 HEATING HOT WATER SYSTEM NEW WORK DIAGRAM
SCALE: NONE



1 HEATING HOT WATER SYSTEM DEMOLITION DIAGRAM
SCALE: NONE



REV. NO.	DATE	REVISIONS DESCRIPTION

MECHANICAL DIAGRAMS
 MISSOURI DEPARTMENT OF TRANSPORTATION
 DISTRICT 7 MAINTENANCE OFFICE BOILER REPLACEMENT
 JOPLIN, MISSOURI

Drawn by: NAL
 checked by: NAL
 approved by: CFW
 GA-50 by: CFW
 project no: 012-0002
 drawing no: ME-NEA-002
 date: 6.1.2012

SECTION 16000 - SEQUENCE OF OPERATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

- A. HVAC CONTROL SEQUENCES DESCRIBED HEREIN INDICATE THE MANNER AND CHRONOLOGICAL SEQUENCE IN WHICH, AND METHODS BY WHICH, AUTOMATIC TEMPERATURE CONTROL FUNCTIONS.
- B. THE BAS CONTROL SYSTEM INSTALLED UNDER THIS PROJECT SHALL BE PROGRAMMED TO PROVIDE THE SEQUENCES DESCRIBED HEREIN. THE BAS SHALL BE FURNISHED AND INSTALLED COMPLETE AND SHALL BE PROPERLY ADJUSTED AND PROGRAMMED TO PERFORM ALL SEQUENCES, FUNCTIONS, AND STATUS INDICATIONS FOR ALL EQUIPMENT AND SYSTEMS AS HEREIN SPECIFIED AND AS INDICATED ON DRAWINGS AND AS REQUIRED BY EXISTING CONDITIONS.

PART 2. CONTROL SEQUENCE

2.1 HEATING HOT WATER PLANT (B-1, HHWP-1)

A. GENERAL SYSTEM OPERATION

- 1) THE HEATING HOT WATER PLANT IS COMPRISED OF ONE GAS-FIRED BOILER (B-1) WITH A DEDICATED HEATING HOT WATER PUMP (HWP-1). WHEN IN OPERATION THE BOILER MANUFACTURER PROVIDED CONTROLS SHALL CONTROL TO MAINTAIN THE LEAVING HOT WATER SETPOINT.

B. HEATING HOT WATER PLANT MODES OF OPERATION:

- 1) SYSTEM SCHEDULING -- THE HEATING HOT WATER PLANT CONTROL ALGORITHMS SHALL EMPLOY ADVANCED SCHEDULE/CALENDAR ARCHITECTURE TO FACILITATE SCHEDULED OCCUPIED/UNOCCUPIED MODES OF OPERATION. THE SCHEDULE/CALENDAR SHALL PROVIDE THE ABILITY TO SETUP UP DIVERSE SCHEDULES OF OPERATION BASED ON SPECIAL EVENTS, HOLIDAYS, AND NORMAL OPERATION.
- 2) OCCUPIED MODE: WHILE OPERATING IN THE OCCUPIED MODE AND THE HEATING HOT WATER PLANT IS ALLOWED TO OPERATE THE PLANT WILL BE CONTINUOUSLY ENABLED AND CONTROLLING TO MAINTAIN THE LEAVING HOT WATER TEMPERATURE AT THE DESIRED SETPOINT.
- 3) UNOCCUPIED MODE: WHILE OPERATING IN THE UNOCCUPIED MODE IF ANY AIR HANDLING UNIT SERVED BY THE HEATING HOT WATER PLANT BEGINS OPERATION IN THE UNOCCUPIED MODE, THE HEATING HOT WATER PLANT IS ALLOWED TO OPERATE, AND THE RUNNING UNIT REQUIRES HEATING HOT WATER THE PLANT SHALL ENABLE.
- 4) OUTSIDE AIR RESET: THE LEAVING WATER SETPOINT SHALL BE RESET BASED UPON THE FOLLOWING:
 - <20° ---> 180°
 - 20-30° ---> 170°
 - 30-40° ---> 160°
 - 40-50° ---> 150°

C. PLANT INITIALIZATION:

- 1) LEAD/LAG: BOILERS AND PUMPS SHALL SWITCH LEAD/LAG BASED UPON EQUIPMENT RUNTIMES. THE RUNTIME SWITCH SHALL INITIATE WHEN EQUIPMENT RUNTIME HAS REACHED 300-HRS (ADJ.)
- 2) UPON A PLANT INITIATION COMMAND IF ALL SAFETIES ARE IN THE "NORMAL POSITION" THE LEAD HEATING HOT WATER PUMP SHALL BE ENABLED, UPON A PROOF OF LEAD PUMP OPERATION AN ENABLE COMMAND SHALL BE SENT TO THE LEAD BOILER.

- 3) IF THE NUMBER OF BOILERS ALLOWED TO OPERATE BASED UPON OUTSIDE AIR TEMPERATURE IS GREATER THAN 1 AND THE HEATING HOT WATER SUPPLY TEMPERATURE IS 5 DEGREES (ADJ.) BELOW THE HEATING HOT WATER SUPPLY TEMPERATURE SETPOINT OF 150 DEGREES (ADJ.) FOR 30-MINUTES (ADJ.) THEN THE LEAD HEATING HOT WATER PUMP SHALL BE ENABLED, UPON A PROOF OF LEAD PUMP OPERATION AND ENABLE COMMAND SHALL BE SENT TO THE LEAD BOILER.
- 4) IF AT ANY POINT THE BOILER COMMAND IS ENABLED AND BOILER STATUS IS FALSE FOR 2-MINUTES (ADJ.) THE BOILER SHALL GO INTO SHUTDOWN ALARM. THE LEAD BOILER AND PUMP SHALL IMMEDIATELY ENABLE. THE FAILED BOILER SHALL REQUIRE A SOFTWARE RESET AFTER THE ALARM EVENT HAS BEEN CLEARED IN ORDER TO OPERATE.

D. PLANT SHUTDOWN:

- 1) WHILE THE SYSTEM IS OPERATING WITH 2-BOILERS AND THE MEASURED HEATING HOT WATER SUPPLY TEMPERATURE RISES ABOVE THE HEATING HOT WATER SUPPLY TEMPERATURE SETPOINT FOR 30-MINUTES THE LEAD BOILER SHALL SHUTDOWN.
- 2) WHEN THE PLANT ISSUES A SHUTDOWN COMMAND TO EITHER THE LEAD OR LAG BOILER IT SHALL BE DISABLED AND THE HEATING HOT WATER PUMP OPERATING WITH THE BOILER SHALL REMAIN COMMANDED FOR 1-HR (ADJ.).

2.2 RADIANT FLOOR SYSTEM AND AIR HANDLING UNITS

A. NO CHANGES REQUIRED TO SYSTEM CONTROL.

2.3 SECONDARY PUMPS

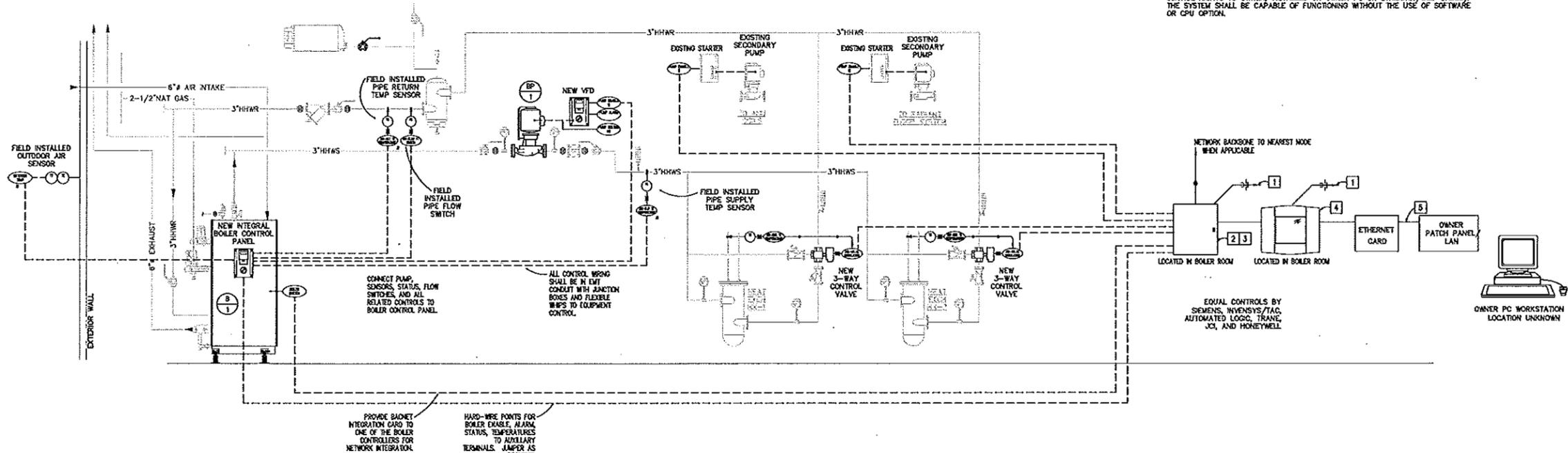
- A. THE SECONDARY PUMPS SHALL BE ENABLED WHENEVER THE BOILER PLANT IS IN OPERATION AND THERE IS A CALL FOR HEATING FROM THE SYSTEM.
- B. THE SECONDARY LOOPS SHALL BE ALLOWED TO COME ONLINE WHEN OUTSIDE AIR TEMPERATURE IS BELOW 55 DEG F (ADJ.)
- C. PROVIDE INTEGRATION INTO NEW CONTROL SYSTEM FOR ANY DEVICES THAT NEED INTEGRATED FOR FULL SYSTEM CONTROL.

2.4 SECONDARY HEAT EXCHANGERS

- A. THE SECONDARY HEAT EXCHANGERS SHALL BE PROVIDED WITH 3-WAY MODULATING CONTROL FOR CONTROL OF SECONDARY LOOP TEMPERATURES. PROVIDE NEW TEMPERATURE SENSORS IN SECONDARY PIPING FOR BYPASSING PRIMARY PIPING AROUND HEAT EXCHANGERS FOR PROPER LOOP TEMPERATURE CONTROL.
- B. NO WORK IS REQUIRED DOWNSTREAM AT AIR HANDLING UNITS, RADIANT LOOP MANIFOLDS, ETC. THESE SYSTEMS TO REMAIN STAND-ALONE WITH NO DIGITAL CONTROL OR MONITORING.

INSTRUMENTATION SIGNALS

- INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- ELECTRIC SIGNAL
- PNEUMATIC BINARY SIGNAL
- ELECTRIC BINARY SIGNAL
- INTERNAL SYSTEM LINK

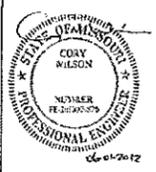


1 P&ID CONTROLS
SCALE: NONE

2 CONTROL ENCLOSURE
SCALE: NONE

NOTES

- 1) 120 VAC PROVIDED BY E.C. CONTROLS CONTRACTOR TO COORDINATE WITH E.C. ON ALL NEW ENCLOSURE LOCATIONS.
- 2) CONTRACTOR TO PROVIDE ALL NEW CONTROL ENCLOSURES. NO EXISTING ENCLOSURES ARE TO BE REUSED. ENCLOSURE SHALL BE HOFFMAN OR EQUAL. IT IS THE CONTRACTORS RESPONSIBILITY TO PROVIDE AND INSTALL NEW ENCLOSURES.
- 3) ALL VALVES, SENSORS, A.S.C.'S, ETC ARE TO BE POWERED FROM TRANSFORMERS HOUSED IN NEW ENCLOSURES. MULTIPLE CONTROLLERS CAN BE POWERED OFF OF A SINGLE TRANSFORMER. IT IS THE CONTRACTORS RESPONSIBILITY TO PROVIDE ENCLOSURES, TRANSFORMERS, AND ALL LOW VOLTAGE WIRING INCLUDING 24 VAC, NETWORK, AND CONTROL WIRING (IN CONDUIT).
- 4) STAND-ALONE SYSTEM CONTROLLER FOR PROGRAMMING, CONTROL, ADJUSTABLE OVERRIDES, AND LAN CONTROL OPTION. CONTROL PANEL SHALL HAVE RJ TYPE CAT 5 CONNECTION, LCD GRAPHICAL USER INTERFACE, AND SOFTWARE (WITH FULL SERVICE RIGHTS TO OWNER, INSTALLED ON OWNER PC OR ETHERNET/MED-BASED). THE SYSTEM SHALL BE CAPABLE OF FUNCTIONING WITHOUT THE USE OF SOFTWARE OR CPU OPTION.



REV. NO.	DATE	REVISIONS DESCRIPTION

MECHANICAL DIAGRAMS
MISSOURI DEPARTMENT OF TRANSPORTATION
DISTRICT 7 MAINTENANCE OFFICE BOILER REPLACEMENT
JOPLIN, MISSOURI

Drawn by:	NAL
Checked by:	NAL
Approved by:	CAW
Design by:	CAW
Project No.:	012002
Drawing No.:	M212A.dwg
Date:	6.12.12

SECTION 1616 - HYDRONIC SPECIALTIES

- A. QUALIFIED MANUFACTURERS SHALL BE LIMITED TO FIRMS REGULARLY ENGAGED IN THE MANUFACTURE OF EQUIPMENT SPECIFIED WITHIN THIS SECTION OF TYPES AND CAPACITIES REQUIRED, WHOSE PRODUCTS HAVE BEEN IN SATISFACTORY USE IN SIMILAR SERVICE FOR A MINIMUM OF 5 YEARS.
B. SUCTION DIFFUSERS SHALL BE PROVIDED WHERE SHOWN ON DRAWINGS. SUCTION DIFFUSER SHALL BE OF CAST IRON CONSTRUCTION WITH FLANGED SYSTEM CONNECTION AND PUMP CONNECTION TO MATCH PLANT. THE DIFFUSER SHALL HAVE A STAINLESS STEEL COMBINATION DIFFUSER-STRAINER-ORFICE CYLINDER. THE STRAIGHTENING VANES SHALL BE STAINLESS STEEL. THE START-UP STRAINER SHALL BE OF 18 MESH BRONZE.
B.1 UNITS SHALL CONSIST OF ANGLE TYPE BODY WITH FLOW STRAIGHTENING VANES AND COMBINATION DIFFUSER-STRAINER-ORFICE CYLINDER WITH 3/16" DIAMETER OPENINGS FOR PUMP PROTECTION. A PERMANENT MAGNET SHALL BE LOCATED WITHIN THE FLOW STREAM AND SHALL BE REMOVABLE FOR CLEANING. THE ORFICE CYLINDER SHALL BE EQUIPPED WITH A DISPOSABLE FINE MESH STRAINER WHICH SHALL BE REMOVED AFTER SYSTEM START-UP. CYLINDER SHALL HAVE A FREE AREA EQUAL TO FIVE TIMES THE CROSS SECTION AREA OF PUMP SUCTION OPENING. UNIT SHALL BE PROVIDED WITH ADJUSTABLE SUPPORT FOOT TO CARRY WEIGHT OF SUCTION PIPING.
C. AIR AND DIRT SEPARATORS SHALL BE CONDENSING TYPE AIR ELIMINATOR AND DIRT SEPARATOR AND CHILLED WATER SYSTEMS. ALL COMBINATION UNITS SHALL BE FABRICATED STEEL, RATED FOR 150 PSIG WORKING PRESSURE WITH ENTERING VELOCITIES NOT TO EXCEED 4 FEET PER SECOND AT SPECIFIED GPM. UNITS SPECIFICALLY DESIGNED FOR HIGH VELOCITY SYSTEMS MAY HAVE AN ENTERING VELOCITY OF UP TO 10 FEET PER SECOND.
C.1 UNITS SHALL INCLUDE AN INTERNAL BRANDELL FILLING THE ENTIRE VESSEL TO SUPPRESS TURBULENCE AND PROVIDE HIGH EFFICIENCY. THE BUNDLE MUST CONSIST OF A COPPER CORE TUBE WITH CONTINUOUS WOUND COPPER MEDIUM PERMANENTLY ATTACHED TO THE CORE. A SEPARATE COPPER MEDIUM IS TO BE WOUND COMPLETELY AROUND AND PERMANENTLY AFFIXED TO THE INTERNAL ELEMENT. EACH ELIMINATOR SHALL HAVE A SEPARATE VENTING CHAMBER TO PREVENT SYSTEM CONTAMINANT FROM HARMING THE FLOAT AND VENTING VALVE OPERATION. AT THE TOP OF THE VENTING CHAMBER IS AN INTEGRAL OVERFLOW PORT FLOAT ACTUATED BRASS VENTING MECHANISM.
C.2 UNITS SHALL INCLUDE A VALVE SIDE TAP TO FLUSH FLOATING DIRT AND LIQUID AND FOR QUICK BLEEDING OF LARGE AMOUNTS OF AIR OR GPM SYSTEM. A REFILL SEPARATOR SHALL HAVE THE VESSEL EXTENDED BELOW THE PIPE CONNECTION AN EQUAL DISTANCE FOR DIRT SEPARATION.
C.3 AIR ELIMINATORS SHALL BE CAPABLE OF REMOVING 100% OF THE FREE AIR, 100% OF THE ENTRAINED AIR AND UP TO 60% OF THE DISSOLVED AIR IN SYSTEM FLUID. DIRT SEPARATOR SHALL REMOVE AT LEAST 80% OF ALL PARTICLE 30 MICRON AND LARGER WITHIN 100 PASSES.
D. PROVIDE BALANCING VALVES WHERE SHOWN ON PLANS OR WHERE REQUIRED FOR SYSTEM BALANCING. VALVES USED FOR FLOW CONTROL (BALANCING) OF WATER IN HYDRONIC SYSTEMS SHALL BE GLOBE STYLE DESIGN, UNLESS OTHERWISE NOTED. BALANCING VALVES SHALL BE RATED FOR NOT LESS THAN 125 PSI AT 250°F. VALVES 2" AND LARGER SHALL HAVE FLANGED CONNECTIONS. VALVES 2" AND SMALLER SHALL HAVE NPT THREADED CONNECTIONS.
D.1 AFTER THE FINAL BALANCING OF THE SYSTEM IS APPROVED BY THE ENGINEER, EACH VALVE BALANCE SETPOINT SHALL BE PERMANENTLY MARKED ON THE REGISTER SO AS TO BE CLEARLY VISIBLE. VALVES SHALL BE INSTALLED WITH METER CONNECTIONS POINTING UPWARD AND AT AN ANGLE NOT GREATER THAN 45 DEGREES FROM VERTICAL. INDICATOR POINTER SHALL NOT BE ABOVE THE HORIZONTAL. THE BALANCING VALVE SHALL BE LOCATED FOR EASY USE AND VIEWING.
D.2 BALANCING VALVE SHALL HAVE A HIDDEN MEMORY FEATURE TO PROGRAM VALVE WITH PRECISION TAMPER-PROOF BALANCING SETTING. BALANCING VALVE SHALL BE FURNISHED WITH DUAL PRESSURE/TEMPERATURE TEST PORTS WITH 1/8" NPT THREADED CAPS AND BUILT-IN CHECK VALVES OR CUT-OFF COCKS. VALVES SHALL HAVE 1/2" NPT DRAIN HOSE SOCKET WITH DRAIN CAP. EACH VALVE SHALL BE FURNISHED WITH A FACTORY PRE-MOLDED TWO-PIECE INSULATING COVER THAT IS REMOVABLE AND THAT WILL SEAL-OFF VAPOR TIGHT WHEN INSTALLED ON THE VALVE.
D.3 FURNISH AND INSTALL, AS SHOWN ON PLANS AND IN ACCORDANCE TO MANUFACTURER'S INSTALLATION INSTRUCTIONS EACH VALVE SHALL HAVE TWO 1/4" NPT BRASS METERING PORTS WITH CHECK VALVES AND GASKETTED CAPS LOCATED ON BOTH SIDES OF VALVE SEAT. TWO ADDITIONAL 1/4" NPT CONNECTIONS WITH BRASS PLUGS ARE TO BE PROVIDED ON THE OPPOSITE SIDE OF THE METERING PORTS FOR USE AS DRAIN CONNECTIONS. DRAIN CONNECTIONS AND METERING PORTS ARE TO BE INTERCHANGEABLE TO ALLOW FOR MEASUREMENT FLEXIBILITY WHEN VALVES ARE INSTALLED IN TIGHT LOCATIONS.
D.4 VALVE SHALL PROVIDE MULTI-TURN ADJUSTMENT WITH A MICRO-METER TYPE INDICATOR LOCATED ON VALVE HANDWHEEL. VALVE HANDWHEEL SHALL HAVE HIDDEN MEMORY FEATURE, WHICH WILL PROVIDE MEANS FOR LOCKING THE VALVE POSITION AFTER THE SYSTEM IS BALANCED. 90° TURN ADJUSTABLE VALVES ARE NOT ACCEPTABLE.
D.5 VALVES SHALL BE OF CAST IRON CONSTRUCTION WITH NONFERROUS COPPER ALLOY TRIM.
D.6 THE VALVE SHALL BE INSTALLED WITH FLOW IN THE DIRECTION OF THE ARROW ON THE VALVE BODY AND INSTALLED AT LEAST FIVE PIPE DIAMETERS DOWNSTREAM FROM ANY FITTING, AND AT LEAST TEN PIPE DIAMETERS DOWNSTREAM FROM ANY PUMP. TWO PIPE DIAMETERS DOWNSTREAM FROM THE BALANCE VALVE SHALL BE FREE OF ANY FITTINGS. INSTALL UNOBSTRUCTED ACCESS TO THE VALVE HANDWHEEL AND METERING PORTS FOR ADJUSTMENT AND MEASUREMENT. MOUNTING OF VALVE IN PIPING MUST PREVENT SEDIMENT BUILD-UP IN METERING PORTS.
D.7 EACH VALVE SHALL BE FURNISHED WITH PRE-FORMED REMOVABLE PVC INSULATION JACKET TO MEET ASTM D 1784/CLASS 14253-C, MEATP-87, ASTM-E-84 AND ASTM-136 WITH FLAME SPREAD RATING OF 50 OR LESS. THERE WILL BE PROVIDED SUFFICIENT MINERAL FIBERGLASS INSULATION TO MEET ASHRAE 90.1-1989 SPECIFICATIONS IN OPERATING CONDITIONS WITH MAXIMUM FLUID DESIGN OPERATING TEMPERATURE RANGE OF 141-200°F AND MEAN RATING TEMPERATURE OF 125°F.
E. PROVIDE AIR VENT VALVES IN WATER SYSTEMS AT ALL HIGH POINTS AND AT ALL LOCATIONS AS REQUIRED TO PREVENT THE ACCUMULATION OF AIR IN THE SYSTEM. VENT VALVES SHALL BE MANUAL KEY TYPE EXCEPT WHERE SHOWN ON DRAWINGS TO BE AUTOMATIC. AUTOMATIC AIR VENT VALVES SHALL BE RATED FOR WATER WORKING PRESSURE OF NOT LESS THAN 250 PSIG.
E.1 VENT VALVES SHALL BE ALL BRASS WITH COPPER TUBE PIG-TAIL. TURN PIG-TAIL DOWNWARD FOR MANUAL VENT VALVES.
E.2 EXTEND DRAIN LINE FROM AUTOMATIC VENT VALVES TO FLOOR DRAIN. INSTALL VENT VALVE IN LOCATIONS TO BE ACCESSIBLE WITHOUT REQUIRING REMOVAL OF EQUIPMENT OR CABINETS.
F. PROVIDE CAPPED TEST PLUGS IN PIPING SYSTEMS AT ALL LOCATIONS WHERE TESTING AND BALANCING IS REQUIRED AND WHERE SHOWN ON DRAWINGS. AT A MINIMUM, TEST PLUGS SHALL BE INSTALLED IN PIPING SYSTEM WHEREVER THERE IS A CHANGE IN TEMPERATURE OR PRESSURE DUE TO INSTALLED EQUIPMENT. THIS INCLUDES BUT NOT LIMITED TO HEAT EXCHANGERS, COILS, CHILERS, BOILERS AND PUMPS. PROVIDE TEST PLUGS ON BOTH THE INLET AND OUTLET OF THE EQUIPMENT.
F.1 PROVIDE TEST PLUGS FOR ALL DIFFERENTIAL PRESSURE TRANSMITTERS FOR THAT PRESSURE DIFFERENCE CAN BE MEASURED WITHOUT THE REMOVAL OF PIPING.
F.2 PLUGS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. INCLUDING APPROACH AND DEPART DISTANCES FROM PIPE FITTINGS, VALVES, ETC.
F.3 PLUG SHALL HAVE A 1/4" NPT BRASS FITTING WITH NORGEL VALVE CORE SEALS RATED UP TO 1000 PSI AT -40°F AND 276°F AND SHALL ALLOW INSERTION OF A PRESSURE OR TEMPERATURE PROBE WHILE THE PIPE OR EQUIPMENT IS UNDER PRESSURE. EACH PLUG FITTING SHALL HAVE A THREADED BRASS CAP.
F.4 PROVIDE A BALL VALVE UPSTREAM OF EACH PLUG FOR SERVICE.

- G. WATER PRESSURE REGULATING VALVES FOR MAKE-UP WATER CONNECTIONS TO HEATING OR COOLING SYSTEMS SHALL BE ADJUSTABLE TYPE, OF BRONZE CONSTRUCTION WITH REPLACEABLE NUTS. UNLESS OTHERWISE NOTED, VALVES SHALL HAVE A INSTANT PRESSURE GAUGE ON DISCHARGE SIDE OF VALVE.
H. EXPANSION TANK FOR CHILLED AND HOT WATER SYSTEMS SHALL BE CAPTIVE TYPE EXPANSION TANK WITH STEEL SHELL, HEAVY DUTY ELASTOMERIC DIAPHRAGM (BLADDER), PIPING CONNECTIONS, AIR CHARGE, AND ASME RATED CONSTRUCTION FOR 100 PSI WORKING PRESSURE.
H.1 EXPANSION TANKS SHALL BE COMPLETE WITH AUTOMATIC FILL AND MAKEUP WATER CONTROL VALVE WITH REMOVABLE STRAINER. AIR CHARGE VALVE WITH INLET AND OUTLET WATER CONNECTIONS, AND AUTOMATIC AIR VENT VALVE COMPLETE WITH CONNECTOR FOR EXTENDING FILL LINE TO DRAIN. TANK SHALL BE PRESURE CHARGED AS REQUIRED BY SYSTEM. EXTEND VENT PIPING FROM AUTOMATIC VENT VALVE AND CONNECT TO CONDENSATE DRAIN PIPE ABOVE CEILING.
J. STRAINER BODY SHALL BE CAST IRON WITH STAINLESS STEEL SCREEN. SCREEN SIZE SHALL BE SELECTED FOR APPLICATION.
J.1 PROVIDE STRAINERS 2" AND LARGER WITH OFF CENTER BLOWDOWN TO ALLOW FOR NEAR COMPLETE CLEANOUT. PROVIDE A SHUTOFF VALVE ON THE BLOWDOWN AND EXTEND A BLOWDOWN LINE TO THE NEAREST FLOOR DRAIN. PROVIDE A BALL VALVE UPSTREAM OF ALL STRAINERS FOR SERVICE. UNLESS OTHERWISE NOTED, STRAINERS SHALL BE RATED FOR NOT LESS THAN 125 PSI AT 250°F. STRAINERS 2" AND LARGER SHALL HAVE FLANGED CONNECTIONS. 2" AND SMALLER SHALL HAVE NPT THREADED CONNECTIONS.

SECTION 1640 - PUMPS

- A. QUALIFIED MANUFACTURERS SHALL BE LIMITED TO FIRMS REGULARLY ENGAGED IN THE MANUFACTURE OF EQUIPMENT SPECIFIED WITHIN THIS SECTION OF TYPES AND CAPACITIES REQUIRED, WHOSE PRODUCTS HAVE BEEN IN SATISFACTORY USE IN SIMILAR SERVICE FOR A MINIMUM OF 5 YEARS.
B. PUMP SHALL BE IN-LINE TYPE, OF BRONZE FITTED CONSTRUCTION WITH MACHINED BRASS OR BRONZE IMPELLER, STEEL SHAFT, LEAK-PROOF MECHANICAL SEALS, FLEXIBLE COUPLING DRIVE, DRIVE GUARD, BRONZE OR COPPER SHAFT SLEEVE, CAST IRON CASING, DESIGNED AND RATED FOR NOT LESS THAN 175 PSI AND 225°F. PROVIDE MOTOR WITH IDENTICAL OVERLOAD PROTECTION. MODEL NUMBER, CAPACITY, OPERATING HEAD, MINIMUM HORSEPOWER, AND VOLTAGE CHARACTERISTICS SHALL BE AS SHOWN ON DRAWINGS.
C. PUMPS SHALL BE INSTALLED WITH ADEQUATE SUPPORTS SO THAT STRAIN, VIBRATION, AND NOISE TRANSMISSION THROUGH PIPING AND SUPPORTS IS ELIMINATED. FURNISH WITH MOTOR CONTROLS AS SHOWN ON DRAWINGS.
D. EACH PUMP SHALL BE FURNISHED WITH CAPACITY, OPERATING HEAD AND HORSEPOWER NOT LESS THAN SHOWN ON DRAWINGS. VOLTAGE CHARACTERISTICS SHALL BE AS SCHEDULED ON DRAWINGS. MOTOR SHALL NOT OVERLOAD UNDER ANY CHANGE IN OPERATING HEAD.
E. PUMP MANUFACTURERS SHALL BE LIMITED TO AURORA, BELL & HOWELL AND EQUIVALENT MANUFACTURERS BY ENGINEER APPROVAL ONLY.

SECTION 1648 - CONDENSING HOT WATER BOILERS

- A. ALL BOILERS AND ASSOCIATED COMPONENTS, INSTALLATION, ETC. SHALL CONFORM TO THE FOLLOWING STANDARDS:
A.1 AMERICAN GAS ASSOCIATION AGA
A.2 AMERICAN SOCIETY OF MECHANICAL ENGINEERS, ASME
A.2.1 ASME CODE BOILER AND PRESSURE VESSEL
A.2.2 ASME CODE SAFETY (PRESSURE-RELIEF) VALVES COMPLYING WITH ASME CODE AND STAMPED WITH APPROPRIATE CODE SYMBOLS
A.2.3 SECTION 4: HEATING BOILERS
A.3 HYDROGENS INSTITUTE INSIGNIA:
A.3.1 INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS PERFORMANCE RATED WITH AFFIXED I-B-R IN SIGNIA
A.4 NATIONAL ELECTRICAL CODE, NEC:
A.4.1 COMPLY WITH NEC/NFPA NO. 70, FOR INSTALLATION OF ALL ELECTRICAL COMPONENTS OF GAS FIRED BOILERS.
A.5 UNDERWRITERS LABORATORIES, UL
A.5.1 GAS FIRED ROOM HEATING ELECTRICAL COMPONENTS LISTED AND LABELED BY UL
A.6 ANSI BOILER REQUIREMENTS.
B. QUALITY ASSURANCE:
B.1 FACTORY TESTS TO CHECK CONSTRUCTION, CONTROLS AND OPERATION OF UNIT. THE OWNER MAY ELECT TO WITNESS FACTORY TESTS. EXPENSES FOR TRAVEL SHALL BE PAID FOR BY THE OWNER.
B.2 AUTHORIZED BOILER INSPECTION PRIOR TO SHIPMENT AND SUBMIT COPY OF INSPECTION REPORT OF ARCHITECT/ENGINEER.
B.3 BOILERS GUARANTEED TO OPERATED AT MINIMUM EFFICIENCY OF SPECIFIED FROM 30 TO 100% OF FIRE RATE.
B.4 MANUFACTURER'S QUALIFICATIONS: FIRMS REGULARLY ENGAGED IN THE MANUFACTURING OF PULSE COMBUSTION, HIGH EFFICIENCY, CONDENSING BOILERS, OF TYPES AND SIZES REQUIRED, WHOSE PRODUCTS HAVE BEEN IN SATISFACTORY USE IN SIMILAR SERVICE FOR NOT LESS THAN 10 YEARS.
B.5 THE HOT WATER BOILER MAXIMUM WORKING PRESSURE WILL BE 180 PSIG.
B.6 FLAME SAFEGUARD CONTROL REQUIRES UL CERTIFICATION OR APPROVED EQUAL.
B.7 THE ENTIRE BOILER SYSTEM AND ITS INSTALLATION SHALL CONFORM TO THE MANUFACTURER'S INSTRUCTIONS, APPLICABLE CODES AND ASSOCIATED NATIONAL BOARD REQUIREMENTS.
B.8 THE EQUIPMENT SHALL, AS A MINIMUM, BE IN STRICT COMPLIANCE WITH THE REQUIREMENTS OF THIS SPECIFICATION AND SHALL BE THE MANUFACTURER'S STANDARD COMMERCIAL PRODUCT UNLESS SPECIFIED OTHERWISE. ADDITIONAL EQUIPMENT FEATURES, DETAILS, ACCESSORIES, ETC. WHICH ARE NOT SPECIFICALLY IDENTIFIED BUT WHICH ARE A PART OF THE MANUFACTURER'S STANDARD COMMERCIAL PRODUCT, SHALL BE INCLUDED IN THE EQUIPMENT BEING FURNISHED.
B.9 THE EQUIPMENT SHALL BE OF THE TYPE, DESIGN, AND SIZE THAT THE MANUFACTURER CURRENTLY OFFERS FOR SALE AND APPEARS IN THE MANUFACTURER'S CURRENT CATALOG.
B.10 THE EQUIPMENT SHALL BE ABLE TO BE RIGGED FIT WITHIN THE ALLOCATED SPACE, LEAVING AMPLE ALLOWANCE FOR MAINTENANCE AND INSPECTION.
B.11 THE EQUIPMENT SHALL BE NEW AND FABRICATED FROM NEW MATERIALS. THE EQUIPMENT SHALL BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP.
B.12 ALL UNITS OF EQUIPMENT SHALL BE CENTRAL TO THE EXTENT NECESSARY TO ENSURE INTERCHANGEABILITY OF PARTS, ASSEMBLIES, ACCESSORIES, AND SPARE PARTS WHEREVER POSSIBLE.
B.13 IN ORDER TO PROVIDE UNIT RESPONSIBILITY FOR THE SPECIFIED CAPACITIES, EFFICIENCIES, AND PERFORMANCE, THE BOILER MANUFACTURER SHALL CERTIFY IN WRITING THAT THE EQUIPMENT BEING SUBMITTED SHALL PERFORM AS SPECIFIED.

- C. WARRANTIES:
C.1 EACH BOILER SHALL GUARANTEE IN WRITING EQUIPMENT TO BE FREE OF DEFECTS FOR ONE YEAR AFTER START-UP DATE OR 18 MONTHS FROM FACTORY SHIPMENT, AND TO REPAIR OR REPLACE AT MANUFACTURER'S EXPENSE ANY DEFECTIVE PARTS INCLUDING COST FOR LABOR. UNIT SHALL RECEIVE SUCH FACTORY TESTS AS ARE DEEMED ADVISABLE BY THE MANUFACTURER TO CHECK CONSTRUCTION AND OPERATION.
C.2 THE PRESSURE VESSEL SHALL BE GUARANTEED AGAINST THERMAL SHOCK FOR 10 YEARS WHEN UTILIZED IN A CLOSED LOOP HYDRONIC HEATING SYSTEM WITH A MAXIMUM TEMPERATURE DIFFERENTIAL RATING UP TO 170 °F. THE BOILER PRESSURE VESSEL SHALL BE GUARANTEED ACCORDINGLY WITHOUT A MINIMUM FLOW RATE OR RETURN WATER TEMPERATURE REQUIREMENT. THE BOILER SHALL NOT REQUIRE THE USE OF FLOW SWITCHES OR OTHER DEVICES TO ENSURE MINIMUM FLOW. THE PRESSURE VESSEL SHALL CARRY A 10-YEAR WARRANTY AGAINST MATERIAL AND WORKMANSHIP DEFECTS.
C.3 THE COMBUSTOR AND EXHAUST PIPES (HEAT EXCHANGER) SHALL BE GUARANTEED AGAINST FLUE GAS CORROSION FOR A PERIOD OF 10 YEARS FOR CARBON STEEL BOILERS.
D. PERFORMANCE TESTS AND GUARANTEES
D.1 THE PROPOSED BOILERS SHALL BE FACTORY RUN TESTED UNDER FULL LOAD CONDITIONS. CAPACITY, MAINTENANCE, OPERATING TEMPERATURES, SAFETY LOCKOUTS, PRIOR TO FINAL PAYMENT THE MANUFACTURER SHALL SUBMIT FIVE COPIES OF A CERTIFIED TEST REPORT TO CONFIRM THE PROPER OPERATION OF THE EQUIPMENT. FIELD PERFORMANCE TESTS WILL BE CONDUCTED AT THE JOBSITE BY THE OWNER'S REPRESENTATIVE AND THE MANUFACTURER'S REPRESENTATIVE TO VERIFY BOILER PERFORMANCE AFTER START UP.
D.2 THE EQUIPMENT WILL BE ACCEPTED IF THE FIELD TEST RESULTS MEET THE SPECIFIED PERFORMANCE. IF THE EQUIPMENT FAILS TO PERFORM WITHIN ALLOWABLE TOLERANCES, THE MANUFACTURE WILL BE ALLOWED TO MAKE NECESSARY REVISIONS TO HIS EQUIPMENT AND THE MANUFACTURER SHALL BE RESPONSIBLE FOR RETESTING SHALL BE PAID FOR BY THE MANUFACTURER.

- E. EQUIPMENT
E.1 FACTORY-ASSEMBLED, FACTORY FIRE-TESTED, SELF-CONTAINED, READY TRANSPORTED UNIT READY FOR AUTOMATIC OPERATION EXCEPT FOR CONNECTION OF WATER, FUEL, ELECTRICAL AND VENT SERVICES. EACH FACTORY "PACKAGED" BOILER SHALL BE COMPLETE WITH ALL COMPONENTS, ACCESSORIES AND APPURTENANCES NECESSARY FOR A COMPLETE AND OPERABLE BOILER AS HEREINAFTER SPECIFIED. EACH UNIT SHALL BE FURNISHED FACTORY ASSEMBLED WITH REQUIRED WIRING AND PIPING AS A SELF-CONTAINED UNIT. EACH UNIT SHALL BE READY TRANSPORTED AND READY FOR INSTALLATION.
E.2 EACH FACTORY "PACKAGED" BOILER, INCLUDING PRESSURE VESSEL, TRIM, VALVE TRIMS, BURNER, CONTROL SYSTEM, AND ALL RELATED COMPONENTS, ACCESSORIES AND APPURTENANCES AS HEREIN SPECIFIED SHALL ALL BE ASSEMBLED AND FURNISHED BY THE BOILER MANUFACTURER. THE BOILER MANUFACTURER SHALL PROVIDE UNIT RESPONSIBILITY FOR THE ENGINEERING, COORDINATION, WORKMANSHIP, PERFORMANCE, WARRANTIES, AND ALL FIELD SERVICES FOR EACH FACTORY "PACKAGED" BOILER. THE BOILER MANUFACTURER SHALL BE FULLY RESPONSIBLE FOR ALL COMPONENTS ASSEMBLED AND FURNISHED BY HIM WHETHER OR NOT THEY ARE OF HIS OWN MANUFACTURE.
E.3 PROVIDE BOILERS WITH CAPACITY AND OPERATING CONDITIONS AS SCHEDULED ON DRAWINGS. EACH BOILER SHALL BE CAPABLE OF OPERATING CONTINUOUSLY AT THE CONDITIONS INDICATED WHILE MAINTAINING A CSA CERTIFIED EFFICIENCY OF NOT LESS THAN 92%
E.4 FUEL GAS SHALL BE NATURAL GAS, SUPPLIED AT A PRESSURE OF AT LEAST 3.5" W.C., MAXIMUM PRESSURE OF 14" W.C.
E.5 POWER REQUIREMENTS SHALL BE 120 VAC, 1 PHASE, 60 HZ. CONTROL VOLTAGE SHALL BE 24 VAC, WITH TRANSFORMER SUPPLIED BY THE BOILER MANUFACTURER.

- F. BOILER DESIGN
F.1 EACH HOT WATER BOILER SHALL CONSIST OF A HORIZONTAL CAST ALUMINUM HEAT EXCHANGER COMPLETE WITH TRIM, VALVE TRIMS, BURNER, AND BOILER CONTROL SYSTEM. THE BOILER MANUFACTURER SHALL FULLY COORDINATE THE BOILER AS TO THE INTEGRATION OF ITS ELEMENTS WITH THE BURNER AND THE BOILER CONTROL SYSTEM IN ORDER TO PROVIDE THE REQUIRED CAPACITIES, EFFICIENCIES, AND PERFORMANCE AS SPECIFIED.
F.2 EACH BOILER HEAT EXCHANGER SHALL BE CAST ALUMINUM, COUNTER-FLOW DESIGN FOR MAXIMUM HEAT TRANSFER WITH THE MULTIPLE SECTIONS ARRANGED IN A REVERSE RETURN CONFIGURATION TO ASSURE BALANCED FLOW THROUGH EACH SECTION.
F.3 ALL BOILER PRESSURE PARTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST REVISIONS OF THE ASME BOILER AND PRESSURE VESSEL CODE, SECTION IV, AND SHALL BE SO STAMPED. EACH FACTORY "PACKAGED" BOILER SHALL BE HYDROSTATICALLY TESTED AND BEAR THE ASME "H" STAMP.
F.4 BOILER HEAT EXCHANGER HEADERS SHALL BE FABRICATED STEEL AND BE COMPLETELY REMOVABLE FOR INSPECTION. SEALS SHALL BE EPDM, RATED FOR 400 DEG F SERVICE. PUSH NIPPLES OR GASKETS BETWEEN THE SECTIONS ARE NOT PERMITTED.
F.5 BOILER SHALL BE ENCLOSED WITH A SINGLE WALL OUTER CASING. IT SHALL BE FABRICATED FROM A MINIMUM 18 GAUGE CARBON STEEL. THE FRONT AND TOP WALL SHALL BE SECURED IN PLACE WITH 1/2" - 20 NC BOLTS (SHEET METAL SEALS ARE NOT ACCEPTABLE). THE COMPLETE OUTER CASING SHALL BE FINISHED, INSIDE AND OUT, WITH A POWDER COAT FINISH. THE COMPOSITE STRUCTURE OF THE BOILER COMBUSTION CHAMBER, INSULATING AIR GAP AND OUTER CASING SHALL BE OF SUCH THICKNESS AND MATERIALS TO ASSURE AN OUTER CASING TEMPERATURE OF NOT MORE THAN 500° ABOVE AMBIENT TEMPERATURE WHEN THE BOILER IS OPERATED AT FULL RATED LOAD.
F.6 AN OBSERVATION PORT SHALL BE LOCATED ON THE FRONT TO ALLOW FOR OBSERVATION OF THE BURNER FLAME.
F.7 FLUE GAS OUTLET SHALL BE LOCATED ON THE REAR OF THE BOILER. BOILER TO BE CERTIFIED FOR INSTALLATION WITH CATEGORY IV VENTING (STACK) AS DEFINED IN NFPA 54 (ANSI Z221), LATEST EDITION. CONTRACTOR MUST PROVIDE VENTING (STACK) CERTIFIED FOR INSTALLATION ON A CATEGORY IV APPLIANCE.

- G. BOILER TRIM SHALL BE AS FOLLOWS:
G.1 SAFETY RELIEF VALVE SHALL BE PROVIDED IN COMPLIANCE WITH THE ASME CODE. CONTRACTOR TO PIPE TO ADJUSTABLE DRAIN.
G.2 WATER PRESSURE GAUGE.
G.3 PRIMARY LOW WATER FLOW FUEL CUTOFF (PROBE TYPE WITH MANUAL RESET).
G.4 DUAL RESET HIGH LIMIT WATER TEMPERATURE CONTROLLER.
G.5 OPERATING TEMPERATURE CONTROL TO CONTROL THE SEQUENTIAL OPERATION OF THE BURNER.
G.6 SEPARATE INLET AND OUTLET WATER TEMPERATURE SENSORS CAPABLE OF MONITORING FLOW.
G.7 EXHAUST TEMPERATURE SENSOR.
H. BOILER FUEL BURNING SYSTEM
H.1 THE BOILER MANUFACTURER SHALL FURNISH EACH BOILER WITH AN INTEGRAL, POWER TYPE, STRAIGHT GAS, FULLY AUTOMATIC FUEL BURNER. THE BURNER SHALL BE AN ASSEMBLY OF GAS BURNER, COMBUSTION AIR BLOWER, VALVE TRIM, AND IGNITION SYSTEM. THE BURNER MANUFACTURER SHALL FULLY COORDINATE THE BURNER AS TO THE INTEGRATION OF ITS ELEMENTS WITH THE BOILER HEAT EXCHANGER AND THE BOILER CONTROL SYSTEM IN ORDER TO PROVIDE THE REQUIRED CAPACITIES, EFFICIENCIES, AND PERFORMANCE AS SPECIFIED.
H.2 EACH BURNER SHALL BE PROVIDED WITH AN INTEGRAL GAS FIRING COMBUSTION HEAD.
H.3 EACH BURNER SHALL PROVIDE ADEQUATE TURBULENCE AND MIXING TO ACHIEVE PROPER COMBUSTION WITHOUT PRODUCING SMOKE OR PRODUCING COMBUSTIBLES IN THE FLUE GASES.
H.4 EACH BURNER SHALL BE PROVIDED WITH AN INTEGRAL VARIABLE SPEED POWER BLOWER TO PREHEAT COMBUSTION AIR AND FUEL WITHIN THE BLOWER. THE COMBUSTION AIR BLOWER SHALL HAVE SUFFICIENT CAPACITY AT THE RATED FIRING RATE TO PROVIDE AIR FOR STOICHIOMETRIC COMBUSTION PLUS THE NECESSARY EXCESS AIR. STATO AND TOTAL PRESSURE CAPABILITY SHALL CONFORM WITH THE REQUIREMENTS OF THE BOILER. THE BLOWER SHALL BE A MAXIMUM OF 300 WATTS AND OPERATE AT 6000 RPM MAXIMUM WITHOUT UNWARRANTED VIBRATION AND NOISE AND SHALL BE DESIGNED AND CONSTRUCTED FOR EXPOSURE TO TEMPERATURES NORMAL TO ITS LOCATION ON THE BOILER. THE OPERATING FAN SPEED WILL BE TACHOMETER MONITORED AND CAPABLE OF BEING DISPLAYED AT THE LED DISPLAY.
H.5 EACH BURNER SHALL OF THE RADIAL-FRIM (DOWN-FRIM) TYPE AND CONSTRUCTED OF STEEL WITH A STAINLESS STEEL BASE AND STAINLESS STEEL MESH OUTER SCREEN.
H.6 EACH BOILER SHALL BE PROVIDED WITH A "FULL MODULATING" FURNACE FURNACE TO PREHEAT THE FIRING RATE IS INFINITELY PROPORTIONAL AT ANY FIRING RATE BETWEEN 20% AND 100% AS DETERMINED BY THE PULSE WIDTH MODULATING INPUT CONTROL SIGNAL AND FUEL INLET AIR INPUT MUST BE SEQUENCED IN UNISON TO THE APPROPRIATE FIRING RATE WITHOUT THE USE OF MECHANICAL LINKAGE.
H.7 THE BURNER SHALL USE A PROPORTIONAL INTEGRAL ALGORITHM TO DETERMINE THE FIRING RATE. THE CONTROL MUST HAVE THE FOLLOWING CAPABILITIES:
H.7.1 MAINTAIN A CONSTANT FIRING RATE.
H.7.2 RESET THE SET POINT BASED ON OUTDOOR AIR TEMPERATURE.
H.7.3 BOILER SHUTDOWN BASED ON OUTDOOR AIR TEMPERATURE.
H.7.4 INTERNAL DUAL SET POINT PROGRAM WITH AN EXTERNAL SWITCHOVER. (E.G. - NIGHT SETBACK, W/EXTERNAL CLOCK, SUPPLIED BY OTHERS)
H.7.5 ALARM RELAY FOR ANY FOR ANY MANUAL RESET ALARM FUNCTION.
H.7.6 PROGRAMMABLE LOW FIRE DELAY TO PREVENT SHORT CYCLING BASED ON A TIME AND TEMPERATURE FACTOR FOR RELEASE TO MODULATING.
H.7.7 LED DISPLAY SHOWING CURRENT SUPPLY AND RETURN TEMPERATURES, CURRENT SET POINTS AS DETERMINED BY THE BURNER. THE DISPLAY MUST ALSO DISPLAY ANY FAULT CODES WHETHER AUTOMATICALLY RESET OR MANUALLY RESET.
H.7.8 LOCAL MANUAL OPERATION.
H.7.9 REMOTE BURNER CONTROL (BUILDING MANAGEMENT / SEQUENCED CONTROL) - THE BOILER CONTROL SHALL BE CAPABLE OF ACCEPTING 0-10VDC REMOTE EXTERNAL ANALOG SIGNAL TO CONTROL THE FIRING RATE ON BOARD DOMESTIC HOT WATER PRIORITY CAPABLE OF CHANGING THE HEATING PUMP TO THE DHW PUMP AS WELL AS CHANGING THE BOILER SET POINT FROM A HEATING TEMPERATURE TO A HIGHER SET POINT TEMPERATURE TO SATISFY THE DHW SYSTEM AND THEN RETURN TO THE HEATING MODE.
H.7.10 COMPUTER (PC) INTERFACE FOR PROGRAMMING AND MONITORING ALL FUNCTIONS.
J. MAIN GAS VALVE TRAIN
J.1 EACH BOILER SHALL BE PROVIDED WITH AN INTEGRAL MAIN GAS VALVE TRAIN. THE MAIN GAS VALVE TRAINS SHALL BE FACTORY ASSEMBLED, PIPED, AND WREDED. EACH GAS VALVE TRAIN SHALL INCLUDE AT LEAST THE FOLLOWING:
J.1.1 ONE OR TWO MANUAL SHUTOFF VALVES
J.1.2 TWO SAFETY SHUTOFF VALVES EQUIPPED WITH DUAL SOLENOIDS THAT CAN INDEPENDENTLY ENERGIZE OR DEENERGIZE THE VALVE.
J.1.3 AIR - GAS RATIO CONTROL (MAXIMUM INLET PRESSURE 14 IN.W.C.)
J.1.4 ONE LOW GAS PRESSURE SWITCH (MANUAL RESET)
J.1.5 ONE HIGH GAS PRESSURE SWITCH (MANUAL RESET)
J.1.6 TWO PRESSURE TEST PORTS.
K. IGNITION SYSTEM
K.1 EACH BOILER SHALL BE EQUIPPED FOR DIRECT SPARK IGNITION.
L. COMBUSTION AIR CONTROL SYSTEM
L.1 EACH BOILER SHALL BE PROVIDED WITH AN INTEGRAL COMBUSTION AIR CONTROL SYSTEM. THE COMBUSTION AIR SYSTEM SHALL BE FACTORY ASSEMBLED. EACH COMBUSTION AIR CONTROL SYSTEM SHALL INCLUDE AT LEAST THE FOLLOWING:
L.1.1 THE PRIMARY CONTROL SHALL VARY THE SPEED OF THE BLOWER BASED ON LOAD DEMAND. THE BLOWER SHALL APPLY A VARYING NEGATIVE PRESSURE ON THE GAS VALVE WHICH WILL OPEN OR CLOSE TO MAINTAIN ZERO PRESSURE AT THE VALVE ORIFICE, THEREBY INCREASING OR DECREASING THE FIRING RATE. BOTH THE AIR AND GAS SHALL BE PREMIXED IN THE BLOWER.
L.1.2 ONE LOW AIRFLOW DIFFERENTIAL PRESSURE SWITCH TO INSURE THAT COMBUSTION AIR IS SUPPLIED.
L.1.3 HIGH EXHAUST BACK PRESSURE SWITCH.
M. BURNER CONTROL SYSTEM
M.1 THE CONTROL SYSTEM SHALL BE SUPPLIED WITH A 24 VAC TRANSFORMER (120 VAC, SINGLE PHASE, 60 HERTZ PRIMARY). THE 120/180 POWER SUPPLY TO EACH BOILER SHALL BE PROTECTED BY A 15 AMP CIRCUIT BREAKER.
M.2 THE BOILER SHALL INCLUDE AN ELECTRIC SPARK IGNITION SYSTEM. MAIN FLOW SWITCH SHALL BE MONITORED AND CONTROLLED BY FLAME ROD (RECTIFICATION) SYSTEM. EACH BOILER SHALL BE PROVIDED WITH ALL NECESSARY CONTROLS, ALL NECESSARY PROGRAMMING SEQUENCES, AND ALL SAFETY INTERLOCKS. EACH BOILER CONTROL SYSTEM SHALL BE PROPERLY INTERLOCKED WITH ALL SAFETIES.
M.3 EACH BOILER CONTROL SYSTEM SHALL PROVIDE TIMED SEQUENCE PRE-IGNITION AIR PURGE OF BOILER COMBUSTION CHAMBER. THE COMBUSTION AIRFLOW SENSOR SHALL MONITOR AND PROVE THE AIRFLOW PURGE.

- N. BOILER CONTROL PANEL
N.1 THE BOILER MANUFACTURER SHALL PROVIDE EACH BOILER WITH AN INTEGRAL FACTORY PREMIXED CONTROL PANEL. THE CONTROL PANEL SHALL CONTAIN AT LEAST THE FOLLOWING COMPONENTS, ALL PREWired TO A NUMBERED TERMINAL STRIP:
N.1.1 ONE BURNER "ON-OFF" SWITCH.
N.1.2 ONE ELECTRONIC COMBINATION TEMPERATURE CONTROL, FLAME SAFEGUARD AND SYSTEM CONTROL.
N.1.3 CONTROL CIRCUIT BREAKER, 5 AMP.
N.1.4 ALL NECESSARY CONTROL SWITCHES, PUSHBUTTONS, RELAYS, THERMS, TERMINAL STRIPS, ETC.
N.1.5 LED DISPLAY PANEL TO ADJUST SET POINTS AND CONTROL OPERATING PARAMETERS, LED DISPLAY TO INDICATE BURNER SEQUENCE, ALL SERVICE CODES (0-85), FAN SPEED, BOILER SET POINT, SENSOR VALUES SUCH AS INLET, OUTLET, FLUE GAS AND OUTDOOR AIR.
P. APPROVED MANUFACTURERS SHALL BE LIMITED TO FOLLOWING:
P.1 FULTON
P.2 AERCO
P.3 LAARS
P.4 PATTERSON KELSEY
P.5 LOCHVAIR
P.6 ADDITIONAL EQUIVALENTS BY ENGINEER APPROVAL ONLY. APPROVAL SHALL BE SOUGHT PRIOR TO BID.
Q. METHOD OF INSTALLATION
Q.1 COORDINATE WITH PLUMBER, HEATING AND GAS PIPING TO INTERFACE INSTALLATION OF PACKAGED GAS FIRED BOILERS WITH OTHER COMPONENTS OF BOILER SYSTEM. COMPLETE STRUCTURAL, MECHANICAL, AND ELECTRICAL INSTALLATION INSTRUCTIONS.
Q.2 FLUSH AND CURE PACKAGED GAS FIRED BOILERS UPON COMPLETION OF INSTALLATION IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
R. TESTING
R.1 TEST ASSEMBLED BOILER, BOILER PIPING, AND ACCESSORIES, INCLUDING BUT NOT LIMITED TO, SAFETY RELIEF VALVES AND GAUGES, IN ACCORDANCE WITH ANSI-ASME BOILER AND PRESSURE VESSEL CODE.
R.2 ARRANGE WITH STATE BOILER INSPECTOR FOR INSPECTION OF BOILER PIPING, OBSERVATION OF HYDROSTATIC TEST, AND CERTIFICATION OF COMPLETED BOILER UNIT.
S. START-UP AND TRAINING
S.1 PROVIDE START-UP SERVICE, MAKE ADJUSTMENTS AND EFFICIENCY TEST, AND INSTRUCT OPERATORS.
S.2 TRAIN OWNER'S BOILER OPERATORS IN PROPER OPERATION AND MAINTENANCE OF PACKAGED BOILERS.

- H.1.1 THE BOILER MANUFACTURER SHALL FURNISH EACH BOILER WITH AN INTEGRAL, POWER TYPE, STRAIGHT GAS, FULLY AUTOMATIC FUEL BURNER. THE BURNER SHALL BE AN ASSEMBLY OF GAS BURNER, COMBUSTION AIR BLOWER, VALVE TRIM, AND IGNITION SYSTEM. THE BURNER MANUFACTURER SHALL FULLY COORDINATE THE BURNER AS TO THE INTEGRATION OF ITS ELEMENTS WITH THE BOILER HEAT EXCHANGER AND THE BOILER CONTROL SYSTEM IN ORDER TO PROVIDE THE REQUIRED CAPACITIES, EFFICIENCIES, AND PERFORMANCE AS SPECIFIED.
H.1.2 EACH BURNER SHALL BE PROVIDED WITH AN INTEGRAL GAS FIRING COMBUSTION HEAD.
H.1.3 EACH BURNER SHALL PROVIDE ADEQUATE TURBULENCE AND MIXING TO ACHIEVE PROPER COMBUSTION WITHOUT PRODUCING SMOKE OR PRODUCING COMBUSTIBLES IN THE FLUE GASES.
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OLSSON ASSOCIATES



Table with 2 columns: REV. NO., DATE. Contains revision information.

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