



SEQUENCE OF OPERATION:
 THE THERMAL WATER HEAT EXCHANGER AND HEATING WATER BOILERS WILL BE SEQUENCED IN ORDER TO MAINTAIN THE HEATING WATER SUPPLY TEMPERATURE SET POINT.

HEATING WATER BOILERS SHALL HAVE UNIT MOUNTED CONTROLS PROVIDED BY THE BOILER MANUFACTURER. TCC SHALL INTERFACE WITH BOILER MANUFACTURER CONTROLS AS DESCRIBED IN THIS SEQUENCE OF OPERATION.

THERMAL WATER HEAT EXCHANGER SEQUENCE OF OPERATION:
 ON A CALL FOR HEATING, AS DETERMINED BY THE FMCS, THE THERMAL WATER SUPPLY VALVE WILL BE MODULATED OPEN TO MAINTAIN THE HEATING WATER SUPPLY TEMPERATURE SETPOINT. THE BOILER BYPASS VALVE WILL BE COMMANDED OPEN AND THE LEAD HEATING WATER PUMP WILL BE STARTED ONCE PROVEN OPEN.

IF THE HEATING WATER SETPOINT CAN NOT BE MAINTAINED AFTER A 10 MINUTE (ADJ.) TIME DELAY, THE FMCS WILL ENABLE THE BOILER PARENT CONTROLLER AND THE THERMAL WATER SUPPLY VALVE WILL REMAIN OPEN.

IF THE THERMAL WATER SUPPLY TEMPERATURE IS LESS THAN THE HEATING WATER RETURN TEMPERATURE, THE THERMAL WATER CONTROL VALVE SHALL BE CLOSED.

WHEN THERE IS NO CALL FOR HEAT, THE THERMAL WATER SUPPLY VALVE SHALL CLOSE.

THERMAL WATER FLOW INFORMATION IN GPM AND GALLONS WILL ALSO NEED TO BE TRANSMITTED TO THE THERMAL SPRINGS MONITORING SYSTEM AT: 101 RESERVE STREET, HOT SPRINGS, AR 71901

BOILER CONTROL PANEL SEQUENCE OF OPERATION:
 WHEN THE FMCS ENABLES THE BOILER PARENT CONTROLLER TO RUN, THE BOILER PARENT CONTROLLER SHALL ENABLE THE LEAD BOILER, OPEN THE ASSOCIATED TWO-POSITION ISOLATION VALVE, AND ENERGIZE THE LEAD PUMP IF NOT ALREADY RUNNING AND SLOWLY CLOSE THE BOILER BYPASS VALVE.

THE ON BOARD BOILER SEQUENCING CONTROLLER SHALL STAGE AND MODULATE THE BOILER PLANT TO MAINTAIN THE HIGHEST PLANT EFFICIENCY THAT WILL PROVIDE THE REQUIRED SUPPLY WATER TEMPERATURE. THE ON BOARD BOILER SEQUENCING CONTROLLER SHALL OPEN AND CLOSE BOILER ISOLATION VALVES IN SUCH A WAY AS TO PROVIDE PRE AND POST FLOW. THE ON BOARD BOILER SEQUENCING CONTROLLER SHALL VERIFY PROOF OF WATER FLOW BEFORE FIRING BOILERS. THE BOILER SEQUENCING CONTROLLER CAN STAGE ON MULTIPLE BOILERS AT PART LOAD TO INCREASE THE EFFICIENCY OF THE PLANT. BOILER SEQUENCING CONTROLLER PANEL SHALL START/STOP BOILERS ON A FIRST ON/FIRST OFF BASIS TO EQUALIZE RUN TIME BETWEEN BOILERS. TWO-POSITION ISOLATION VALVE OPERATION SHALL BE CONTROLLED BY THE BOILER CONTROL PANEL OF THE RESPECTIVE BOILER THEY SERVE. BOILERS SHALL BE CYCLED OFF WHEN HEAT EXCHANGER HWS TEMPERATURE IS EQUAL TO THE BUILDING SYSTEM HEATING WATER SUPPLY SETPOINT TEMPERATURE.

WHEN THE HEAT EXCHANGER HWS DISCHARGE TEMPERATURE IS AT OR HIGHER THAN THE SYSTEM HEATING WATER SUPPLY SETPOINT, THE BOILER BYPASS VALVE SHALL OPEN AND ONCE PROVEN OPEN THE OPERATING BOILER ISOLATION VALVE SHALL CLOSE.

THE FOLLOWING BOILER SEQUENCING CONTROLLER POINTS (TO INCLUDE BUT NOT LIMITED TO) SHALL BE CONTROLLED BY THE FMCS AND DISPLAYED ON THE OPERATOR WORKSTATION GRAPHICAL SCREEN:

- BOILER SYSTEM STATUS: ENABLE/DISABLE
- BOILER OUTLET WATER TEMPERATURE SETPOINT: [°F]

THE FOLLOWING BOILER SEQUENCING CONTROLLER POINTS (TO INCLUDE BUT NOT LIMITED TO) SHALL BE MONITORED BY THE FMCS AND DISPLAYED ON THE OPERATOR WORKSTATION GRAPHICAL SCREEN:

- BOILER STATUS: DISABLED/STANDBY/MANUAL OPERATION/REMOTE OPERATION/AUTO/FAULT
- FIRING RATE INPUT: [0 - 100%]
- FIRING RATE OUTPUT: [0 - 100%]
- ACTIVE SETPOINT: [°F]
- SYSTEM HWR TEMP: [°F]
- SYSTEM HWS TEMP: [°F]
- FAULT MESSAGE DISPLAY CODE: [NUMERICAL]
- RUN CYCLES: [NUMERICAL]
- RUN HOURS: [NUMERICAL]

ALARMS, INTERLOCKS & SAFETIES:
 BOILER CONTROLS SHALL BE PROGRAMMED TO MAINTAIN CONSTANT SETPOINT (LAST KNOWN VALUE) IN THE EVENT THE FMCS NETWORK COMMUNICATION SIGNAL IS LOST.

HEATING WATER SYSTEM SEQUENCE OF OPERATION:
 FMCS SHALL OPERATE HEATING WATER SYSTEM 24 HOURS/DAY, 365 DAYS/YEAR.

ON A CALL FOR HEATING THE LEAD PUMP WILL BE STARTED. FMCS SHALL AUTOMATICALLY ROTATE THE LEAD HEATING WATER PUMP ONCE/WEEK (10:00 AM EACH TUESDAY, ADJ.) TO EQUALIZE RUN TIME BETWEEN PUMPS. PROVIDE GRAPHICAL BUTTON ON OPERATOR WORKSTATION GRAPHICAL SCREEN TO ALLOW FMCS OPERATOR TO SWITCH LEAD PUMP TO NEXT ROTATION IN THE EVENT THE CURRENT LEAD PUMP REQUIRES MAINTENANCE.

FMCS SHALL MODULATE SIGNAL TO LEAD PUMP VFD AS REQUIRED TO MAINTAIN HEATING WATER DIFFERENTIAL PRESSURE (DP) SETPOINT. IF THE LEAD PUMP VFD REACHES 90% SPEED FOR 10 MINUTES (ADJ.) AND THE HEATING WATER DIFFERENTIAL IS BELOW SETPOINT, THE SECOND HEATING WATER PUMP WILL BE STARTED AND SHALL HAVE A MINIMUM RAMP SPEED OF 60 SECONDS (ADJ.). THE TWO PUMPS WILL RAMP TOGETHER USING THE SAME RAMP INPUT SIGNAL. THE SECOND CHILLED WATER PUMP WILL BE STAGED OFF IF THE SPEED OF BOTH PUMPS VFD'S DROP BELOW 40% FOR 10 MINUTES (ADJ.). FMCS SHALL RESET HEATING WATER DIFFERENTIAL PRESSURE (DP) SETPOINT AS REQUIRED TO MAINTAIN AT LEAST ONE HEATING WATER VALVE 95% (ADJ.) OPEN. FMCS SHALL UTILIZE COMMAND TO ALL HEATING WATER VALVE POSITIONS TO RESET THE HEATING WATER DIFFERENTIAL PRESSURE. IN NO EVENT SHALL THE FMCS DECREASE THE HEATING WATER (DP) SETPOINT BELOW 4 PSI (ADJ.) OR ABOVE 10 PSI (ADJ.).

ALL CONTROLLED AND MONITORED POINTS LISTED IN THE BOILER CONTROL PANEL SEQUENCE ABOVE SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION GRAPHICAL SCREEN.

ALARMS, INTERLOCKS & SAFETIES:
 TCC SHALL COORDINATE ALL SAFETY AND INTERLOCK REQUIREMENTS WITH BOILER MANUFACTURER. CONTRACTOR SHALL COORDINATE AND PROVIDE THE INSTALLATION AND WIRING OF BOILER WATER DIFFERENTIAL PRESSURE/FLOW SWITCHES AND OTHER COMPONENTS PROVIDED WITH THE BOILER AS REQUIRED FOR PROPER OPERATION. CONTRACTOR SHALL PROVIDE AND TERMINATE ALL SAFETY AND INTERLOCK WIRING WITH BOILER CONTROL PANELS AS REQUIRED.

FMCS SHALL AUTOMATICALLY ENABLE THE LEAD HEATING WATER PUMP TO RUN IN THE EVENT THE LEAD HEATING WATER PUMP FAILS TO OPERATE.

CONTRACTOR SHALL VERIFY THE ACCEPTABLE TEMPERATURE RANGES THE BOILERS ARE APPROVED TO OPERATE AT AS PUBLISHED IN THE BOILER MANUFACTURER'S LITERATURE. IF THE TEMPERATURE RANGES LISTED IN THE MANUFACTURER'S LITERATURE DIFFER FROM THOSE IN THIS SEQUENCE OF OPERATION, CONTACT CONTRACTING OFFICER FOR DIRECTION.

AN ALARM SHALL BE INDICATED TO THE FMCS OPERATOR WORKSTATION IN THE EVENT ANY OF THE FOLLOWING OCCUR:

- HWR TEMPERATURE DROPS BELOW 50°F (ADJ.) FOR 5 MINUTES (ADJ.) (AUTO RESET).
- HWS TEMPERATURE RISES MORE THAN 10°F (ADJ.) ABOVE SETPOINT (AUTO RESET).
- HWS TEMPERATURE DROPS MORE THAN 10°F (ADJ.) BELOW SETPOINT (AUTO RESET).
- AN ALARM IS INDICATED AT ANY BOILER ALARM PANEL.
- AN ALARM IS INDICATED AT ANY PUMP VFD
- SHOULD THE FMCS COMMAND THE LEAD HEATING WATER PUMP TO OPERATE AND THE PUMP FAILS TO DO SO AS DETERMINED BY THE VFD STATUS, AN ALARM SHALL BE INDICATED AT THE FMCS OPERATOR WORKSTATION AND THE LEAD HW PUMP SHALL AUTOMATICALLY START.

HEATING PLANT - HEATING CONTROL - CONDENSING BOILER VARIABLE PRIMARY

1 NO SCALE

ALARMS, INTERLOCKS, AND SAFETIES:
 TCC SHALL PROVIDE EMERGENCY BOILER SHUTDOWN SWITCH AT EACH BOILER ROOM EXIT MEETING CSD-1 REQUIREMENTS. ACTIVATION OF ANY SWITCH SHALL INTERRUPT POWER TO ALL BOILER CONTROLS VIA BOILER SAFETY SHUTDOWN CONTACTS.

TYPICAL FOR B-1 & B-2

EMERGENCY BOILER SHUTDOWN



A/E FIRMS PRIME/ARCH: STRATA ARCHITECTURE 1703 OAK STREET, SUITE 100 KANSAS CITY, MO T: 816.474.0900	DESIGNED:	SUB SHEET NO. 01	TITLE OF SHEET MAURICE BATHHOUSE TEMPERATURE CONTROLS	DRAWING NO. 626 180065
	CADD:			
MEP/ENG: IMEG CORP. 1400 BALTIMORE STREET, SUITE 300 KANSAS CITY, MO T: 816.842.8437	TECH. REVIEW:	ME8.1	REHABILITATE BATHHOUSES HOT SPRINGS NATIONAL PARK	PMIS/PKG NO. 318674
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