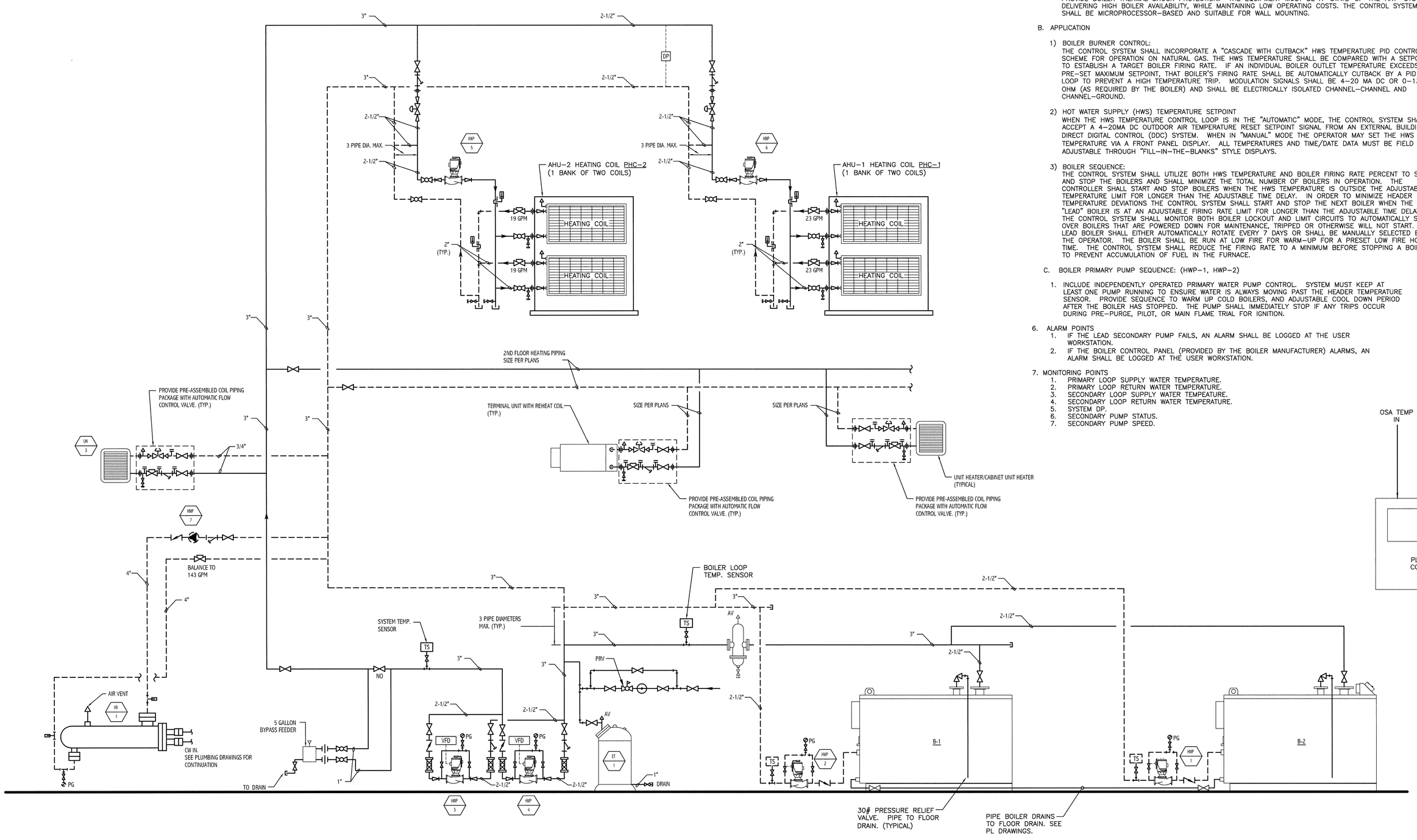


BOILER PLANT SEQUENCE OF OPERATION:

1. REFER TO SECTION 235216, "CONDENSING BOILERS" FOR CONTROL OF: BOILERS, LINKED VALVES, PRIMARY BOILER PUMPS (HWP 1 & 2). PROVIDE READ ONLY AND READ/WRITE COMMUNICATION AS OUTLINED IN THIS SPECIFICATION SECTION.

2. SECONDARY PUMP CONTROL (HWP 3 & 4)
   THE LEAD SECONDARY CIRCULATING PUMP SHALL RUN CONTINUOUSLY. A REMOTE DIFFERENTIAL PRESSURE TRANSMITTER SHALL BE CONNECTED TO THE SUPPLY AND RETURN LINES AT THE MOST REMOTE ACCESSIBLE LOCATION IN THE SYSTEM. PUMP VFD SHALL MODULATE AS REQUIRED TO MAINTAIN SYSTEM DIFFERENTIAL PRESSURE AS 2-WAY VALVES OPEN AND CLOSE. IF THE LEAD PUMP CANNOT MAINTAIN SECONDARY SYSTEM PRESSURE DIFFERENTIAL, IT SHALL MODULATE OFF AND BOTH THE LEAD AND LAG PUMPS SHALL MODULATE ON SIMULTANEOUSLY TO MAINTAIN SYSTEM DP. IF BOTH PUMPS ARE AT MINIMUM VFD SPEED AND THE SYSTEM DP IS ABOVE SETPOINT, BOTH PUMPS SHALL BE DE-ENERGIZED AND THE LEAD PUMP SHALL BE MODULATED TO MAINTAIN SETPOINT. A SCHEDULE SHALL AUTOMATICALLY ROTATE THE LEAD/LAG PUMPS. THE PUMPS SHALL BE MONITORED AND ALARMED IF ONE OF THEM FAILS. THE CONTROL CONTRACTOR SHALL WORK WITH THE BALANCING CONTRACTOR TO DETERMINE THE APPROPRIATE DP SETPOINT FOR THE SYSTEM.

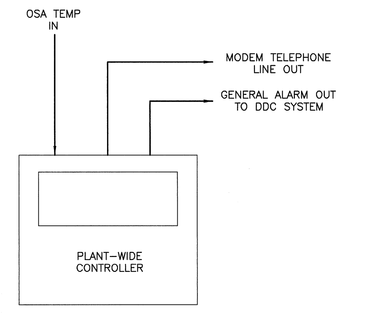
3. ON A CALL FOR HEAT BY THE BUILDING HEATING LOOP TEMPERATURE SENSOR, PROVIDED BY THE BMS CONTRACTOR, THE BOILERS SHALL BE STAGED ON AND MODULATED TO MAINTAIN LOOP TEMPERATURE. THE BUILDING HEATING LOOP SETPOINT SHALL BE RESET BASED ON BUILDING HEATING LOOP WATER TEMPERATURE VS. OUTSIDE AIR TEMPERATURE. RESET SCHEDULE SHALL BE AS FOLLOWS:
   1. HWS=150 DEG. F AT 0 DEG. F OUTSIDE AIR TEMPERATURE.
   2. HWS=130 DEG F AT 60 DEG. F OUTSIDE AIR TEMPERATURE.

4. ON A CALL FOR HEAT BY THE DOMESTIC WATER PREHEAT SYSTEM, PUMP P-7 SHALL BE ENERGIZED TO MAINTAIN DOMESTIC WATER TEMPERATURE.

5. PLANT-WIDE CONTROLLER
   A. GENERAL
      1) SUPPLY A FULLY INTEGRATED BOILER HOT WATER CONTROL SYSTEM TO COORDINATE THE OPERATION OF TWO FULLY MODULATING HOT WATER BOILERS, BOILER WATER CIRCULATING PUMPS AND BOILER WATER FLOW CONTROL VALVES IN ORDER TO MAINTAIN HOT WATER SUPPLY (HWS) TEMPERATURE AT SETPOINT AND PROVIDE BOILER THERMAL SHOCK PROTECTION. THE EQUIPMENT MUST BE A "STATE-OF-THE-ART" SYSTEM, DELIVERING HIGH BOILER AVAILABILITY, WHILE MAINTAINING LOW OPERATING COSTS. THE CONTROL SYSTEM SHALL BE MICROPROCESSOR-BASED AND SUITABLE FOR WALL MOUNTING.
   B. APPLICATION
      1) BOILER BURNER CONTROL:
         THE CONTROL SYSTEM SHALL INCORPORATE A "CASCADE WITH CUTBACK" HWS TEMPERATURE PID CONTROL SCHEME FOR OPERATION ON NATURAL GAS. THE HWS TEMPERATURE SHALL BE COMPARED WITH A SETPOINT TO ESTABLISH A TARGET BOILER FIRING RATE. IF AN INDIVIDUAL BOILER OUTLET TEMPERATURE EXCEEDS A PRE-SET MAXIMUM SETPOINT, THAT BOILER'S FIRING RATE SHALL BE AUTOMATICALLY CUTBACK BY A PID LOOP TO PREVENT A HIGH TEMPERATURE TRIP. MODULATION SIGNALS SHALL BE 4-20 MA DC OR 0-135 OHM (AS REQUIRED BY THE BOILER) AND SHALL BE ELECTRICALLY ISOLATED CHANNEL-CHANNEL AND CHANNEL-GROUND.
      2) HOT WATER SUPPLY (HWS) TEMPERATURE SETPOINT
         WHEN THE HWS TEMPERATURE CONTROL LOOP IS IN THE "AUTOMATIC" MODE, THE CONTROL SYSTEM SHALL ACCEPT A 4-20MA DC OUTDOOR AIR TEMPERATURE RESET SETPOINT SIGNAL FROM AN EXTERNAL BUILDING DIRECT DIGITAL CONTROL (DDC) SYSTEM. WHEN IN "MANUAL" MODE THE OPERATOR MAY SET THE HWS TEMPERATURE VIA A FRONT PANEL DISPLAY. ALL TEMPERATURES AND TIME/DATE DATA MUST BE FIELD ADJUSTABLE THROUGH "FILL-IN-THE-BLANKS" STYLE DISPLAYS.
      3) BOILER SEQUENCE:
         THE CONTROL SYSTEM SHALL UTILIZE BOTH HWS TEMPERATURE AND BOILER FIRING RATE PERCENT TO START AND STOP THE BOILERS AND SHALL MINIMIZE THE TOTAL NUMBER OF BOILERS IN OPERATION. THE CONTROLLER SHALL START AND STOP BOILERS WHEN THE HWS TEMPERATURE IS OUTSIDE THE ADJUSTABLE TEMPERATURE LIMIT FOR LONGER THAN THE ADJUSTABLE TIME DELAY. IN ORDER TO MINIMIZE HEADER TEMPERATURE DEVIATIONS THE CONTROL SYSTEM SHALL START AND STOP THE NEXT BOILER WHEN THE "LEAD" BOILER IS AT AN ADJUSTABLE FIRING RATE LIMIT FOR LONGER THAN THE ADJUSTABLE TIME DELAY. THE CONTROL SYSTEM SHALL MONITOR BOTH BOILER LOCKOUT AND LIMIT CIRCUITS TO AUTOMATICALLY SKIP OVER BOILERS THAT ARE POWERED DOWN FOR MAINTENANCE, TRIPPED OR OTHERWISE WILL NOT START. THE LEAD BOILER SHALL EITHER AUTOMATICALLY ROTATE EVERY 7 DAYS OR SHALL BE MANUALLY SELECTED BY THE OPERATOR. THE BOILER SHALL BE RUN AT LOW FIRE FOR WARM-UP FOR A PRESET LOW FIRE HOLD TIME. THE CONTROL SYSTEM SHALL REDUCE THE FIRING RATE TO A MINIMUM BEFORE STOPPING A BOILER TO PREVENT ACCUMULATION OF FUEL IN THE FURNACE.
   C. BOILER PRIMARY PUMP SEQUENCE: (HWP-1, HWP-2)
      1. INCLUDE INDEPENDENTLY OPERATED PRIMARY WATER PUMP CONTROL. SYSTEM MUST KEEP AT LEAST ONE PUMP RUNNING TO ENSURE WATER IS ALWAYS MOVING PAST THE HEADER TEMPERATURE SENSOR. PROVIDE SEQUENCE TO WARM UP COLD BOILERS, AND ADJUSTABLE COOL DOWN PERIOD AFTER THE BOILER HAS STOPPED. THE PUMP SHALL IMMEDIATELY STOP IF ANY TRIPS OCCUR DURING PRE-PURGE, PILOT, OR MAIN FLAME TRIAL FOR IGNITION.

6. ALARM POINTS
   1. IF THE LEAD SECONDARY PUMP FAILS, AN ALARM SHALL BE LOGGED AT THE USER WORKSTATION.
   2. IF THE BOILER CONTROL PANEL (PROVIDED BY THE BOILER MANUFACTURER) ALARMS, AN ALARM SHALL BE LOGGED AT THE USER WORKSTATION.

7. MONITORING POINTS
   1. PRIMARY LOOP SUPPLY WATER TEMPERATURE.
   2. PRIMARY LOOP RETURN WATER TEMPERATURE.
   3. SECONDARY LOOP SUPPLY WATER TEMPEATURE.
   4. SECONDARY LOOP RETURN WATER TEMPERATURE.
   5. SYSTEM DP.
   6. SECONDARY PUMP STATUS.
   7. SECONDARY PUMP SPEED.



NOTE:

1. SEE G001 FOR PROJECT GENERAL NOTES
2. SEE SHEET M-001 FOR LEGEND AND ABBREVIATIONS.

A1	BOILER PLANT SYSTEM SCHEMATIC
NOT TO SCALE	

REV.	DESCRIPTION	DATE

ISSUED FOR G.M.P. & PERMITTING
4-3-09
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MECHANICAL
HEATING SYSTEM SCHEMATIC

SHEET TITLE:	
SCALE:	AS NOTED
PROJECT MANAGER:	SLB
JOB CAP/DRAWN:	TCM/DIL
A/E OF RECORD:	TAC
SMRT CAD FILE:	M-651-08139
PROJECT No.	08139
DATE:	
GRAPHIC SCALE:	0" 1"
SHEET No.	M-651

PROGRESS PRINT