

# PLANT HEATING AND COOLING SEQUENCE OF OPERATION

THE LEAD BOILER AND PUMP START AS A FUNCTION OF THE "EMS/CPU" (ENERGY MANAGEMENT SYSTEM CENTRAL PROCESSING UNIT) WHICH IS PROGRAMMED TO CONSIDER TIME OF DAY AND OUTSIDE AIR TEMPERATURE (BELOW 65°). THE BOILER WILL NOT START UNTIL FLOW HAS BEEN ESTABLISHED THROUGH THE BOILER FLOW SWITCH. THE EMS/CPU WILL MONITOR THE LEAVING AND ENTERING WATER TEMPERATURES TO THE BOILER AND WILL PROVIDE A STRAIGHT-LINE HOT WATER RESET: WHEN THE 0.A. IS 30°, THE HWS TEMPERATURE SHALL BE 160°; AND WHEN THE 0.A. IS 65°, THE HWS TEMPERATURE OF LESS THAN 60° (SOFTWARE ADJUSTABLE) TO THE BOILER WILL CAUSE THE "BOILER LOOP MIXING VALVE", V-1 TO MODULATE OPEN AND BYPASS SUPPLY HOT WATER DIRECTLY BACK TO THE RETURN. THE BOILER PUMP WILL STAY ON FOR A MINIMUM OF 5 MINUTES AFTER THE BOILER HAS SHUT OFF (AS DETERMINED BY TEMPERATURE DIFFERENCE ACROSS THE BOILER), TYPICAL OF THE LEAD AND LAG BOILERS. THE LEAD
MANAGEMENT
TIME OF D
START UNTIL
EMS/CPU W

THE LAG BOILER AND PUMP WILL START WHEN THE SYSTEM HEATING DEMAND BTUH'S EQUALS 90% OF THE BOILER OUTPUT CAPACITY AND WILL SHUT OFF AT 75% CAPACITY OF ONE BOILER. A TIME DELAY ON THE LAG BOILER WILL ALLOW THE LEAD BOILER A 30 MINUTE HEAD START TO BRING THE SYSTEM UP TO 90% CAPACITY DURING MORNING WARMUP.

COOLING FROM THE CENTRAL SYSTEM CAN BE SUPPLIED UNDER ANY ONE OF THREE DIFFERENT MODES: 1) CHILLER ONLY, 2) ICE TANKS ONLY, AND 3) A COMBINATION OF BOTH. COOLING IS INITIATED BY OUTDOOR AIR TEMPERATURE AND BUILDING LOAD, BUT THE PARTICULAR MODE TO BE USED IS PRIMARILY DETERMINED BY TIME-OF-DAY AS ESTABLISHED BY THE PG&E RATE SCHEDULE, A-11, TIME-OF-USE METERING.

- INTENT OF THE SYSTEM DESIGN IS OPTIMIZE COOLING PERFORMANCE BY: NOT ALLOWING THE CHILLER AND CHILLER PUMP TO START DURING HOURS AS DEFINED BY PG&E RATE STRUCTURE A-11.
- RUNNING THE CHILLER AT FULL-LOAD DURING TANK CHARGING. "OFF-PEAK" HOURS TO MAXIMIZE
- MINIMIZE CHILLER USAGE THE NEXT DAY DURING "PARTIAL-PEAK" HOURS BY USING UP STORED ICE FROM THE NIGHT BEFORE. SOME OPERATION DURING "PARTIAL-PEAK" HOURS WILL OCCUR BUT IN NO CASE SHOULD THE ICE STORAGE CAPACITY AT THE END OF THE DAY EXCEED 20% OF TOTAL STORAGE CAPACITY.
- WHEN THE OUTSIDE AIR SENSOR SENSES A TEMPERATURE ABOVE 75°, THE CHILLED WATER PUMP, MARK 2, WILL START. WHEN FLOW HAS BEEN ESTABLISHED THROUGH THE CHILLED WATER LOOP FLOW SWITCH, THE AIR COOLED CHILLER WILL BE ABLE TO START UPON A SIGNAL FROM THE EMS/CPU. ALLOW SCHOOL PERSONNEL TO INTERACT WITH THE LOCAL EMS/CPU FOR SPECIAL PROGRAMMING THAT MAY BE REQUIRED ON ANY PARTICULAR DAY.
- A MIXING VALVE PLACED IN THE CHILLED WATER LOOP WILL BE CONTROLLED BY THE EMS/CPU AND WILL BYPASS SUPPLY WATER DIRECTLY BACK TO THE RETURN SO THAT WATER TEMPERATURE ENTERING THE CHILLER DOES NOT EXCEED 80°. IF THE SYSTEM WATER TEMPERATURE IS BELOW 80°, THE VALVE WILL BE FULLY OPEN. THE CHILLED WATER PUMP SHALL STAY ON AN ADDITIONAL 5 MINUTES AFTER SHUTDOWN OF THE

POWER WIRING , DISCONNECK BY SPEC. SECT. 1600

THE SYSTEM PUMP, MARK 4, WILL BE DIRECTED TO START BY THE EMS/CPU UPON A CALL FOR EITHER HEATING OR COOLING. IT WILL STAY ON FOR THE DURATION OF THE DAY AND WILL STAY ON AN ADDITIONAL 5 MINUTES AT THE END OF THE DAY TO MATCH THE DELAY OF THE BOILER OR CHILLER LOOP PUMP. THE SECOND SYSTEM PUMP, ALSO MARK 4, WILL COME ON AT ANY TIME DURING THE DAY AS REQUIRED BY THE COOLING OR HEATING "BTUH" REQUIREMENTS OF THE SYSTEM.

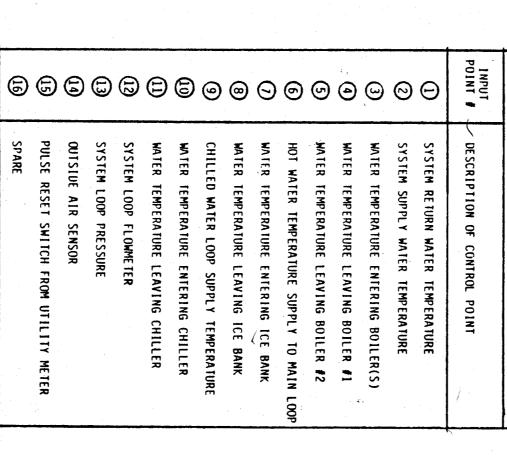
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EMS" SINGL

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A SYSTEM PRESSURE TRANSMITTER IS LOCATED IN THE LOOP PIPING TO SENSE SYSPRESSURIZATION. SYSTEM PRESSURE SHALL BE NOTED AND RECORDED AT LOOP WATEMPERATURE OF APPROXIMATELY 60°. THE SYSTEM PRESSURE SHALL BE CHECKECH MORNING, PRIOR TO STARTUP, BY THE EMS/CPU. IF SYSTEM PRESSURE SHOW FALL MORE THAN 15% BELOW THIS INITIAL VALUE, THE EMS/CPU SHALL ISSUMBRING MESSAGE: "SYSTEM PRESSURE IS xx % BELOW INITIAL FILL VALUE POSSIBLE SYSTEM LEAK. SYSTEM LOOP MAY NEED TO BE MANUALLY REFILLED GLYCOL LEVEL RECHECKED."



CHILLER	ICE BU	ICE BUI	CHILLER	C007/W	C001W	
CHILLER & ICE BUILDER COOLING	ICE BUILDING MODE	ICE BUILDER ONLY COOLING	CHILLER ONLY COOLING	COOLING MODE		
MOD MOO CL	CL	MOO MOO CL	OP	4	VALVE	,
OOW	00	MOD	22	O	€ V-2	(
7.2	æ	<i>CL</i>	CL	7	VALV	(
OOM	CZ	90	90	B	E-13	1110
8	CL	CL_	90		VALVE V-2 VALVE V-3 VALVE V-5	7111
W	W	NO	0/5/5	© BUILDER		
NO	OFF	<b>N</b> 0	NO	<b>BYSTEM</b>	PUMPS	
NO	00	OFF	o <sub>N</sub>	@BUILDER @SYSTEM (S)CHILLER		

MODULATING VALVES.

- GCM-84211 "GLOBAL CONTROL MODULE".
- O D NOTES DUMB TERMINAL CONSISTING OF WYSE-85. CONNECT TO (1). MONOCHROME SCREEN VIEWING TERMINAL AND KEYBOARD;
- (A) (A)
- DEDICATED TELEPHONE LINE TO BE FURNISHED BY OWNER, INCLUDING ALL COSTS. BARBER-COLMAN MODEL GCS 81000 POWER LINE CARRIER COMMAND SYNTHESIZER FURNISHED UNDER SPECIFICATION SECTION 15900. INSTALL AT LOCATION TO PROVIDE BEST SIGNAL DISTRIBUTION.

(F)

- NOTE! CONTRACTOR FURNISHING POWER LINE CARRIER EQUIPMENT SHALL COORDINATE THE INSTALLATION WITH LIGHT DIMMING SYSTEM AS SPECIFICIED ON THE ELECTRICAL PLANS AND PROVIDE EQUIPMENT THAT WILL NOT BE AFFECTED BY SIGNALS GENERATED THROUGH THE LIGHT DIMMING SYSTEM.
- BARBER-COLMAN COMMAND TRANSMITTER RECIEVER.

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- INTERCONNECTING WIRING BETWEEN GLOBAL CONTROL MODULE AND POWER LINE COMMAND SYNTHESIZER BY SPECIFICATION SECTION 15900.
- EXISTING A.C. WIRING
- **(4)** (6) BARBER - COLMAN NETWORK 8000 LCM CONTROLER AT MECHANICAL EQUIPMENT ENCLOSURE

AL SETPOINT PROGRAMMABLE CONTROLLER

DAI TEMPERATURE SENSOR (IK BALCO @ 70°F)

ED AIR LOW LIMIT SENSOR (IK BALCO @ 70°F)

I SPEED RELAY

WPER ACTUATOR (24 VAC HYDRAULIC)

VE ACTUATOR (24VAC HYDRAULIC MITH AV-601 E

VAC, 55% 1/4 W, MF, TC=100 RESISTOR

RESISTOR

RT RELAY (**a**)

VAC HYDRAULIC) : HYDRAULIC MTH AV-601 E RMER

AN COIL CONTROLS AND SEQUENCE OF OPERATION SINILAR TO UNIT VENTILATOR: PROVIDE WALL MOUNTED TEMPERATURE CONTROLS IN LIEU OF CABINET MOUNTED FOR ROOM TEMPERATURE SENSING. OMIT ECOMMIZER CONTROLS. SET MINIMUM O.A. AS INDICATED ON PLANS. AN COIL SEQUENCE OF OPERATION

SOLID STATE SENSOR LOCATED IN THE UNIT VENTILATOR SAMPLING CHAMBER (SAMPLING CHAMBER ROVIDED AS AN INTEGRAL PART OF THE UNIT VENTILATOR) SHALL INPUT TO A DUAL SET-POINT CONTROLLER; HEATING SET AT 70° AND COOLING SET AT 78°. EACH SET-POINT SHALL BE ADJUSTABLIVER A RANGE OF 45-75 DEGREES FOR HEATING AND 40-90 DEGREES FOR COOLING. SET-POINTS ARE ACTORY SET WITH A FIELD ADJUSTABLE THROTTLING RANGE. ED AND STOPPED BY GROUPS (WINGS, USE, ETC.) FROM THE ENERGY ROCESSING UNIT (EMS/CPU). THE START-STOP SIGNAL SHALL BE SENT VIJOG MODULES AT THE UNIT VENTILATORS. THE CENTRAL PLANT SHALL BE OF UNIT VENTILATORS IS IN OPERATION. Percentage of General Services

MIXED AIR LOW-LIMIT SENSOR (LOCATED IN THE UNIT VENTILATOR MIXED AIR) SHALL INPUT TO TH NIT CONTROLLER AND PROVIDE AN ADJUSTABLE SET-POINT FROM 40-90 DEGREES. FACTORY SET TO 60 ND ADJUSTABLE MINIMUM SET-POINT TO 20% OUTSIDE AIR. HEN THE SAMPLING CHAMBER TEMPERATURE IS BELOW THE HEATING SET-POINT THE OUTSIDE AIR DAMPER IS LOSED, THE RETURN AIR DAMPER IS OPEN AND THE COLL VALVE IS OPEN. AS THE TEMPERATURE RISES OWARD SET-POINT (THROTTLING RANGE 3°) THE OUTSIDE AIR DAMPER OPENS TO THE ADJUSTABLE INIMUM POSITION AND THE COIL VALVE BEGINS TO MODULATE CLOSED. AT SET-POINT THE OUTSIDE AIR AMPER IS AT MINIMUM AND THE COIL VALVE IS CLOSED. AS THE TEMPERATURE CONTINUES TO RISE THE UTSIDE AIR DAMPER MODULATES OPEN. THE LEAVING AIR TEMPERATURE FROM THE UNIT VENTILATOR IS IMITED TO A MINIMUM OF 60° (ADJUSTABLE) BY THE LOW LIMIT SENSOR AND CONTROLLER SET-POINT.

HEN THE SAMPLING CHAMBER SET-POINT IS ABOVE THE COOLING SET-POINT, THE OUTSIDE AIR DAMPER LOSES TO THE MINIMUM POSITION AND THE GOIL VALVE MODULATES OPEN. THE THROTTLING RANGE ON OOLING START-UP IS 4 DEGREES. ATTING/COOLING MODE SELECTION: (ASHRAE CYCLE 1):

THE UNIT VENTILATOR HEATING OR COOLING MODE IS SELECTED FROM THE SIGNAL FROM THE "EMS/CPU" TO EACH UNIT VENTILATOR CONTROLLER. THE UNIT CONTROLLER SHALL BE IN THE HEATING MODE UNTIL THE SYSTEM LOOP WATER TEMPERATURE IS LESS THAN 60 DEGREES.

NOOM SENSOR FOR TEMPERATURE

PHONE 175-3399 FRESNO,

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JOHN FRANK MITCHELL, INC. CONSULTING MECHANICAL ENGINEERS 4644 WEST JEHNWER, SUITE 107

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LEGEND

HEATING COOLING COIL

ONLY

ntmemt of Censial Services lice of the Signe Architect

PIPING SYMBOLIZED WITH \* INDICATES PIPING TO BE ROUTED DOWN TO NEAREST FLOOR SURFACE + 6". PIPING SO ROUTED FROM PRESSURE RELIEF VALVES SHALL BE FULL SIZE AND SHALL BE SUPPORTED INDEPENDENTLY SO THAT NO WEIGHT IS APPLIED TO THE PRV.

MANUAL FILL VALVE WITH LABEL TO READ: "MANUAL FILL VALVE IS ONLY TO BE USED TO FILL SYSTEM UPON START-UP OR LOSS OF SYSTEM FLUTO-AS DETERMINED BY SYSTEM PRESSURE: VALVE SHALL BE LEFT IN THE NORMALLY CLOSED POSITION."

PENN SCHOOL MODERNIZATION BAKERSFIELD CITY SCHOOL DISTRICT