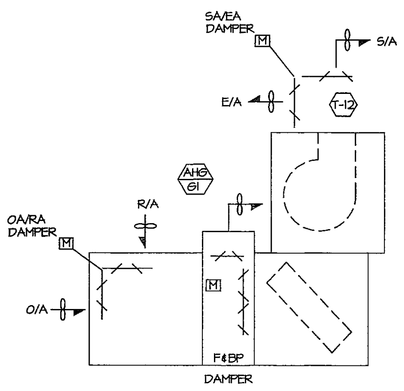
FIELD MOUNTED MECHANICAL ROOM INSTRUMENTATION

MARK	DESCRIPTION	FURNISHED BY: 15541	FURNISHED BY: 15400	FURNISHED BY: OTHERS	WIRED BY: 15541	WIRED BY: 15400	WIRED BY: DTV, 16	TRANSFER SIGNAL TO * (6): 15541	TRANSFER SIGNAL TO * (6): 15400	TRANSFER SIGNAL TO * (6): OTHERS	REMARKS
T-1	OUTSIDE AIR TEMP.		●			●					2-PROBE, SELECT LOWER
T-2	HWS TEMP.	●			●				●		
T-3	HWR TEMP.	●			●				●		
T-4	BOILER INLET TEMP.	●			●				●		
T-5	CHS TEMP.	●			●				●		
T-6	CHR TEMP.	●			●				●		
T-7	CHILLER INLET TEMP.	●			●				●		
T-8	CHL-HR OUTLET TEMP.		●			●					
T-9	CHL-1 OUTLET TEMP.		●			●					
T-10	CHL-2 OUTLET TEMP.		●			●					
T-11	P-HR LWT	●			●				●		ACTIVATES "HT REJECTION"
T-12	AHU-G1 LAT		●			●			●		
T-13	HT. RECOVERY COND. INLET TEMP.	●			●				●		
T-14	HT. RECOVERY COND. OUTLET TEMP.	●			●				●		
T-15	2-PIPE INLET TEMP.		●			●					
T-16	DTS TEMP. (2-PIPE)		●			●					
T-17	DTR TEMP. (2-PIPE)		●			●					
T-BR	BOILER ROOM TEMP.		●			●					DUAL SET POINT
F-1	HOT WATER FLOW	●			●				●		
F-2	CHILLED WATER FLOW	●			●				●		
F-3	HOT WATER MAKE-UP			●		●					PROVIDED BY 15181
F-4	CHILLED WATER MAKE-UP			●		●					PROVIDED BY 15181
F-5	CHL-1 FLOW SWITCH	●			●					●	CHILLER PERMISSIVE
F-6	CHL-2 FLOW SWITCH	●			●					●	CHILLER PERMISSIVE
F-7	CHL-HR FLOW SWITCH	●			●					●	CHILLER PERMISSIVE
F-8	CHL-HR FLOW SWITCH COND.	●			●					●	CHILLER PERMISSIVE
V-1	HOT WATER MIN. FLOW	●			●						
V-2	CHILLED WATER MIN. FLOW	●			●						
V-3	HT RECOVERY	●			●						
V-4	DT SYS. INLET		●			●					
V-5	DT SUPPLY TEMP. VLV	●				●					VALVE BY 15541, OPERATOR BY 15400
V-6	DT SYS OUTLET		●			●					
V-7	AHU-G1 ENERG HT		●			●					SHUT OFF MIN. 45# PSID
V-CHR	CHILLER HR INLET	●			●						
V-C1	CHILLER 1 INLET	●			●						
V-C2	CHILLER 2 INLET	●			●						
PT-1	DIFF. PRESS XMTR BOILERS	●			●						CONTROLS V-1
PT-2	DIFF. PRESS XMTR CH-1	●			●						CONTROLS V-2
PT-3	DIFF. PRESS XMTR CH-2	●			●						CONTROLS V-2
PT-4	DIFF. PRESS XMTR CH-HR	●			●						CONTROLS V-2
PT-5	BLR. RM. DIFF PRESS		●			●					
PT-6	GM DIFF PRESS, AHU - G2	●			●						CONTROLS P-3 & P-4
PT-7	GM DIFF PRESS, AHU - F2	●			●						CONTROLS P-3 & P-4
PT-8	GM DIFF PRESS, AHU- H1	●			●						CONTROLS P-3 & P-4
PT-9	HM DIFF PRESS, AHU - G2	●			●						CONTROLS P-1 & P-2
PT-10	HM DIFF PRESS, AHU - F2	●			●						CONTROLS P-1 & P-2
PT-11	HM DIFF PRESS, TU - 2021	●			●						CONTROLS P-1 & P-2
PT-12	P-HR STATUS	●			●				●		
---	BOILER SEQUENCER		●			●		●			HWS RESET TEMP. TO 15541
---	CHILLER SEQUENCER	●			●				●		STATUS & FAILURE OF PUMPS & CHL'S
---	HEAT RECOVERY INITIATE	●			●				●		STATUS & FAILURE OF P-HR & CHL-HR
---	AHU-G1 SEQUENCE		●			●					
---	WINTER/SUMMER MODE SELECTOR		●			●		●			

* INTERCONNECT WIRING BY SECTION TO WHOM SIGNAL IS SENT. (6)



SEQUENCE OF OPERATIONS AHU-G1

1. AHU-G1 SHALL SERVE TWO PURPOSES: BOILER ROOM HEAT, AND HEAT RECOVERY SYSTEM HEAT REJECTION. AHU-G1 SHALL NOT BE REQUIRED WHEN HR SYSTEM IS IN SUMMER REHEAT MODE.
2. WHEN HR SYSTEM IS IN WINTER COOLING MODE, AHU-G1 SHALL OPERATE IN LOW SPEED WITH OA/RA DAMPER AT MINIMUM AND THE SA/EA DAMPER IN THE SUPPLY AIR POSITION. THE ROOM THERMOSTAT SHALL CONTROL THE F&BP DAMPER.
3. IF HR-EHT (T-11) EXCEEDS 128°F. THE AHU SHALL SWITCH TO HEAT REJECTION MODE.
   A. FAN SHALL SWITCH TO HIGH SPEED.
   B. F&BP DAMPER SHALL REVERT TO 100% FACE.
   C. ROOM THERMOSTAT SHALL CONTROL THE SA/EA DAMPER.
   D. THE OA/RA DAMPER SHALL MODULATE TO CONTROL THE AHU LAT (T-12) AT 105°F.
4. THE RELIEF HOOD SHALL OPERATE AS REQUIRED TO MAINTAIN BOILER ROOM DIFFERENTIAL PRESSURE BETWEEN MINUS 0.02" AND PLUS 0.05" H.G.
5. IF THE REFRIGERANT LEAK DETECTOR SENSES A LEAK, AHU-G1 SHALL OPERATE ON HIGH SPEED WITH THE OA/RA DAMPER IN THE 100% RA POSITION AND THE SA/EA DAMPER IN THE 100% EA POSITION.
6. IF EITHER CHL-HR OR P-HR IS OFF AND OAT (T-1) IS BELOW 60°F, V-7 SHALL OPEN AND AHU-G1 SHALL OPERATE PER ITEM #2, ABOVE.

SEQUENCE OF OPERATION HEAT RECOVERY

1. IN THE "SUMMER OCCUPIED MODE" THE HEAT RECOVERY SYSTEM SHALL BE ENERGIZED.
2. WHENEVER SYSTEM IS IN "WINTER MODE" AND IF THERE ARE SIMULATANEOUS HEATING AND COOLING DEMANDS, THE HEAT RECOVERY SYSTEM SHALL BE ENERGIZED.
3. PUMP P-HR SHALL START, AND ONCE FLOW THOUGH CHILLER IS VERIFIED, CHILLER CHL-HR SHALL START.
   A. 3-WAY VALVE V-3 SHALL OPERATE VIA "LOW SELECT" TO TAKE HR SUPPLY WATER FROM THE COOLER OF EITHER; HM RETURN TEMP (T-3) OR CHL-HR CGN OUTLET (T-14).
   B. IF T-11 IS ABOVE 128°F, AHU-G1 SHALL SWITCH TO HEAT REJECTION MODE. WHEN T-11 DROPS BELOW 110°F, HEAT REJECTION MODE SHALL STOP.
   C. IF BOTH T-3 AND T-14 ARE ABOVE THE HM SUPPLY SETPOINT (CALCULATED), THEN THE CONTROL SYSTEM WILL DETERMINE THAT HEAT RECOVERY IS NOT FEASIBLE. CHL-HR WILL SHUT DOWN AND AFTER AN APPROPRIATE TIME DELAY, PUMP P-HR WILL SHUT DOWN.
4. CHL-HR RUNNING FOR SUMMER MODE (OAT ABOVE 60°F)
   A. 2-WAY VALVE V-7 SHALL BE CLOSED.
   B. AHU-G1 SHALL NOT BE REQUIRED.
   C. CHILLER SHALL OPERATE ON ITS INTERNAL CONTROLS, CONDENSER EHT FOR CAPACITY CONTROL SHALL BE 128°F.
5. CHL-HR RUNNING FOR WINTER MODE (OAT BELOW 60°F).
   A. CHW SETPOINT SHALL BE ALLOWED TO RISE TO 50°F.
   B. AHU-G1 SHALL BE ON.
   C. CHILLER SHALL OPERATE IN ITS INTERNAL CONTROLS.
   D. VALVE V-7 SHALL BE CLOSED. UNLESS CHL-HR IS OFF.

SEQUENCE OF OPERATIONS CENTRAL SYSTEM

1. THE LEAD HOT WATER AND CHILLED WATER PUMPS SHALL RUN DURNING ALL OCCUPIED TIMES.
   A. ANY BUILDING ZONE IN "OCCUPIED" SHALL SIGNAL THE CENTRAL SYSTEM TO START.
   B. THE LEAD HOT WATER PUMP SHALL RUN AT ALL OAT BELOW 35°F.
   C. THE LAG HOT WATER OR CHILLED WATER PUMP SHALL START ON A FAILURE OF THE LEAD PUMP, OR AS REQUIRED TO SATISFY THE REMOTE DPT SET POINTS.
   D. CHILLER CHL-HR SHALL BE THE LEAD CHILLER, AND SHALL OPERATE DURING ALL OCCUPIED HOURS.
2. THE BOILERS SHALL FIRE IN SERIES AS REQUIRED TO MAINTAIN THE FOLLOWING RESET SCHEDULE:
   A. OAT OF 60°F AND ABOVE, HWS SHALL BE 100°F, TO BE RESET LINERALLY DOWN TO OAT OF 0°F AND BELOW, HWS SHALL BE 160°F.
3. THE CHILLERS SHALL OPERATE IN SEQUENCE TO MAINTAIN 42° CHS TEMPERATURE.
   A. WHEN OAT IS BELOW 55°F, CHS SHALL BE ALLOWED TO RISE TO 50°F (WINTER MODE).
   B. WHEN THE SYSTEM IS IN THE "WINTER MODE", ALL CHW CONTROL VALVES SHALL BE CLOSED EXCEPT DESIGNATED VALVES SERVING INTERNAL ZONES. CHL-HR ONLY WILL OPERATE.
   C. WHEN IN "SUMMER MODE", THE LEAD AIR COOLED CHILLER AND CHL-HR WILL OPERATE TOGETHER.

NOTES:

1. BLOWDOWN VALVES ARE REQUIRED ON ALL STRAINERS 2" AND LARGER.
2. BALANCE NOTE: SET VALVE LIMITS IN CONJUNCTION WITH SECTION 15541 START-UP TO ENSURE EQUAL FLOW.
3. BOILER HEADERS SHALL BE PIPED WITH "REVERSE RETURN" AS SHOWN.
4. SEE PLUMING DRAWINGS FOR TUBE SIDE PIPING.
5. AT CONTRACTOR'S OPTION, FLOW SWITCHES OR CURRENT TRANSFORMERS MAY BE SUBSTITUTED FOR DIFFERENTIAL PRESSURE SWITCHES TO ASCERTAIN PUMP STATUS.
6. REFER TO SECTIONS 15400 AND 15541 FOR ADDITONAL COMMUNICATIONS, STATUS AND ALARMS.

EQUIPMENT SPECIFICATIONS

- (A) CHEMICAL SHOT FEEDER. *
- (EX) TANGENTIAL AIR SEPERATOR EQUAL TO B&G R-6 W SCREEN.
- (EH) TANGENTIAL AIR SEPERATOR EQUAL TO B&G R-6 W SCREEN.
- (EX) VERTICAL HYDRO-PNEUMATIC EXPANSION TANK. ASME RATED, 370 GALLON ACCEPTANCE. EQUAL TO EXTROL MODEL 1400-L.
- (CH) VERTICAL HYDRO-PNEUMATIC EXPANSION TANK. ASME RATED, 370 GALLON ACCEPTANCE. EQUAL TO EXTROL MODEL 1400-L.
- (D) WATTS SERIES 009Q REDUCED PRESSURE ZONE BACKFLOW PREVENTER.
- (E) AUTOMATIC AIR VENT, EQUAL TO HOFFMAN MODEL 74Z. PROVIDE BALL VALVE AT CONNECTION TO AIR SEPERATOR.
- (F) MAKE-UP WATER PRESSURE REGULATOR COMBINATION VALVE 1/2" N.P.T. EQUAL TO ARMSTRONG C11 SET AT 12 PSI MAKE-UP, 30 PSI RELIEF.
- (GX) WATER METER, THERMOPLASTIC OR BRONZE DISC TYPE WITH TOTALIZING REGISTER AND REED SWITCH FOR EMS
- (GH) CONNECTION EQUAL TO BADGER METER.
- (H) PRESSING RELIEF VALVE CAPABLE OF RELIEVING THE FULL CAPACITY OF HX. EQUAL TO B&G MODEL #740-125, 125 PSIG SET POINT.
- (BLR 1-6) NEW BOILERS 1 - 6 EQUAL TO AERCO - BENCHMARK MODEL BMK-2.0, 2000 MBH INPUT, 1840 MBH OUTPUT, HIGH-EFFICIENCY, CONDENSING TYPE BOILER, 480V, 3 PHASE.
- (CHL 1&2) NEW WATER CHILLER EQUAL TO TRANE R SERIES RTAA 240 WITH REMOTE CONDENSER, CAPACITY 232 TON AT 85° AMBIENT, 45° LWT. MIN E.E.R. OF 9.2. 480 V, 3Ø. 303/224 MCA; TWO (2) 120V, 1Ø, 20A.
- (P 5) VERTICAL IN-LINE PUMP CAPABLE OF 182 GPM AT 31 FT. TDH. 480V, 3Ø, 1200 RPM, 3 HP. EQUAL TO BELL & GOSSETT SERIES 80 SIZE 3x3x9 1/2B.
- (P 6) VERTICAL IN-LINE PUMP CAPABLE OF 273 GPM AT 70 FT. TDH. 480V, 3Ø, 1750 RPM, 7.5 HP. EQUAL TO BELL & GOSSETT SERIES 80 SIZE 3x3x9 1/2B.
- (PPS) NEW PUMPS P-1, P-2, P-3, & P-4 465 GPM AT 115 FT TDH. 20 HP, 480V, 3Ø. PUMPS TO BE PRE-MOUNTED & WIRED ON FACTORY BUILT PACKAGED SKID. SEE SECTION 15541. PUMP CURVE MAY EXCEED RATED HP BY 5% (SERVICE FACTOR 1.05%), PUMP DESIGN POINT SHALL NOT EXCEED RATED HP.
- (CL CF) CLOSED LOOP CARTRIDGE FILTER: EQUAL TO PROCESS EFFICIENCY PRODUCTS INC. MODEL " SCF-120" CAPABLE OF FILTERING 120 GPM. THOUGH DISPOSABLE CARTRIDGES OF 10.0 MICRON RAINSTANK SHALL BE 304 SS W/ CORROSION RISISTANT PIPING AND INTERNALS. FURNISH AND INSTALL REPLACMENT CARTRIDGES AT CONCLUSION OF THE JOB.
- (HX 1) DUAL WALL SHELL AND TUBE HEAT EXCHANGER, SUITABLE FOR DOMESTIC WATER USE, EQUAL TO B&G MODEL GDW-145-4, CAPABLE OF HEATING 40 GPM FROM 50° TO 110°F, USING 135#DF CONDENSER WATER AT MINIMUM 11° DELTA T.
- (P HR) VERTICAL IN-LINE PUMP CAPABLE OF 141 GPM AT 60 FT. TDH. 480V, 3Ø, 1750 RPM, 5 HP. EQUAL TO PEERLESS MODEL PV 3x3x10B. SHIPPED LOOSE BY PPS HFTR.
- (CHL HR) HEAT RECOVERY CHILLER, 40 TON CAPACITY IN WINTER MODE, AT 50°F LWT (EVAP) AND 128°F EWT (COND). EQUAL TO MULTISTACK MODEL MS80C2H2H-V, 480V, 3Ø, 64.0 MCA.

SYSTEM FLUSH & CHEMICAL TREATMENT:

- ON INITIAL SYSTEM FILL, PROVIDE A PRETREATMENT CHEMICAL PROGRAM THAT INCLUDES INORGANIC PHOSPHATE, AN ORGANIC CORROSION INHIBITOR, A DISPERSANT, AND 2% OIL EMULSIFIER, SUCH AS NALCO "NALPREP III".
- CIRCULATE SYSTEM FOR 24 HOURS MINIMUM WITH START-UP STRAINERS IN PUMPS.
- DRAIN SYSTEM. BLOW-DOWN ALL STRAINERS.
- REFILL SYSTEM THROUGH WATER METER AND RECORD SYSTEM VOLUME.
- PROVIDE NITRITE BASE SCALE AND CORROSION INHIBITOR SUCH AS NALCO "2833". ENSURE 400-1000 PPM THROUGHOUT SYSTEM.
- REMOVE START-UP STRAINERS AFTER ONE WEEK OF PUMP OPERATION.

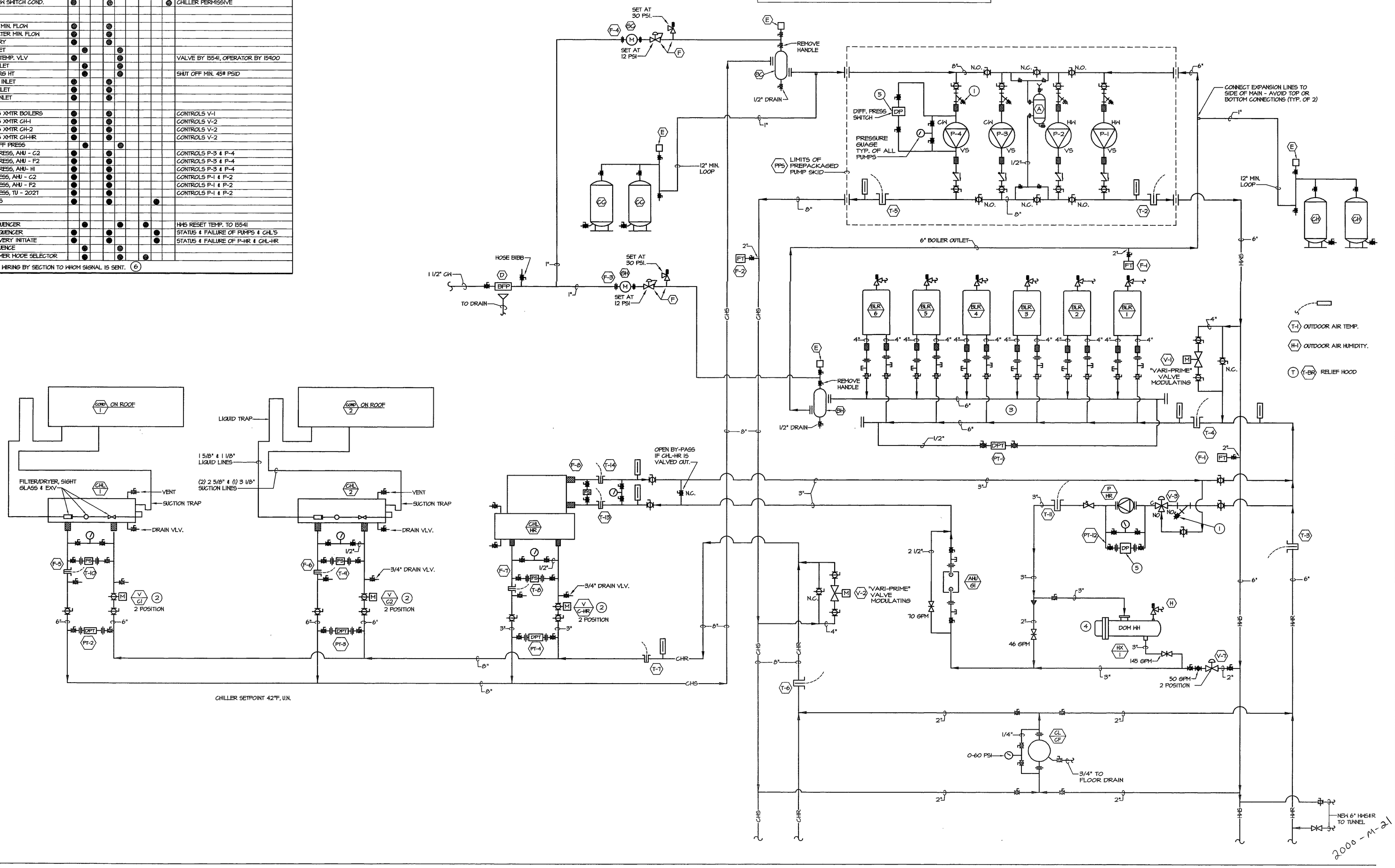
Sheet M3.1

a. The mechanical schematic indicates Boilers B1 through B6 to be Aerco Model boilers as the Basis of Design Lochinvar is also an acceptable manufacturer of boilers. See the attached schematic for Lochinvar boilers B1 through B6 Note that the boiler circulating pumps are included within the boilers Power and control circuits to these pumps shall be included in the mechanical contract

Sheet M3 1.

a. The mechanical schematic indicates Boilers B1 through B6 to be Aerco Model boilers as the Basis of Design. Fulton and Weben-Jarco are also acceptable manufacturers of boilers. See the attached schematic for Fulton boilers B1 through B9 and Weben-Jarco boilers B1 through B6 Note that the boiler circulating pumps required with Weben-Jarco boilers, including power and control circuits to these pumps, shall be included in the mechanical contract.

b. Change Aerco boilers B1 through B6 from 480v/3 phase to 208v/3 phase.



ENGINEERS PLANNERS

VEAZEY PARROTT DURKIN & SHOULDERS

3850 Priority Way S. Dr. Suite 118 Indianapolis, In 46240

RENOVATION PROJECT FOR:
DUNELAND SCHOOL CORPORATION
CHESTERTON MIDDLE SCHOOL
CHESTERTON, INDIANA

Drawing Title:
MECHANICAL SCHEMATIC

Project No:	9980.00
Project Date:	06-12-00
Drawn By:	RLW
Approved By:	THD
Drawing No:	M 3.1

THOMAS H. DURKIN REGISTERED No. 19257 STATE OF INDIANA PROFESSIONAL ENGINEER