

SEQUENCE OF OPERATION

WATER SOURCE HEAT PUMP SYSTEM
 A. TEMPERATURE CONTROL FOR THE CIRCULATING WATER LOOP SHALL BE AS FOLLOWS:

WATER SOURCE HEAT PUMP LOOP MONITOR - RUN CONDITIONS:
 THE LOOP MONITOR SHALL RUN WHENEVER:
 • ANY ZONE IS OCCUPIED.
 • OR A DEFINABLE NUMBER OF UNOCCUPIED ZONES NEED HEATING OR COOLING.
 THE FOLLOWING LOOP WATER CONDITIONS SHALL BE MONITORED:
 • FLOW STATUS.
 • SUPPLY TEMPERATURE.
 RETURN TEMPERATURE.
 ALARMS AND A HEAT PUMP SHUTDOWN SIGNAL SHALL BE GENERATED UPON ANY OF THE FOLLOWING LOOP WATER CONDITIONS:
 • NO LOOP FLOW.
 • HIGH LOOP WATER SUPPLY TEMP SHUTDOWN: IF THE LOOP WATER SUPPLY TEMPERATURE IS GREATER THAN 92°F (ADJ.).
 • LOW LOOP WATER SUPPLY TEMP SHUTDOWN: IF THE LOOP WATER SUPPLY TEMPERATURE IS LESS THAN 58°F (ADJ.).
 ALARMS SHALL BE PROVIDED AS FOLLOWS:
 • HIGH LOOP WATER SUPPLY TEMP: IF THE LOOP WATER SUPPLY TEMPERATURE IS GREATER THAN 90°F (ADJ.).
 • LOW LOOP WATER SUPPLY TEMP: IF THE LOOP WATER SUPPLY TEMPERATURE IS LESS THAN 60°F (ADJ.).
LOOP WATER PUMP LEAD/STANDBY OPERATION:
 THE TWO LOOP WATER PUMPS SHALL OPERATE IN A LEAD/STANDBY FASHION.
 • THE LEAD PUMP SHALL RUN FIRST.
 • ON FAILURE OF THE LEAD PUMP, THE STANDBY PUMP SHALL RUN AND THE LEAD PUMP SHALL TURN OFF.
 THE DESIGNATED LEAD PUMP SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):
 • MANUALLY THROUGH A SOFTWARE SWITCH.
 • IF PUMP RUNTIME (ADJ.) IS EXCEEDED.
 • DAILY.
 • WEEKLY.
 • MONTHLY.
 ALARMS SHALL BE PROVIDED AS FOLLOWS:
 • LOOP WATER PUMP 1
 1. FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
 2. RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
 3. RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
 • LOOP WATER PUMP 2
 1. FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
 2. RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
 3. RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.

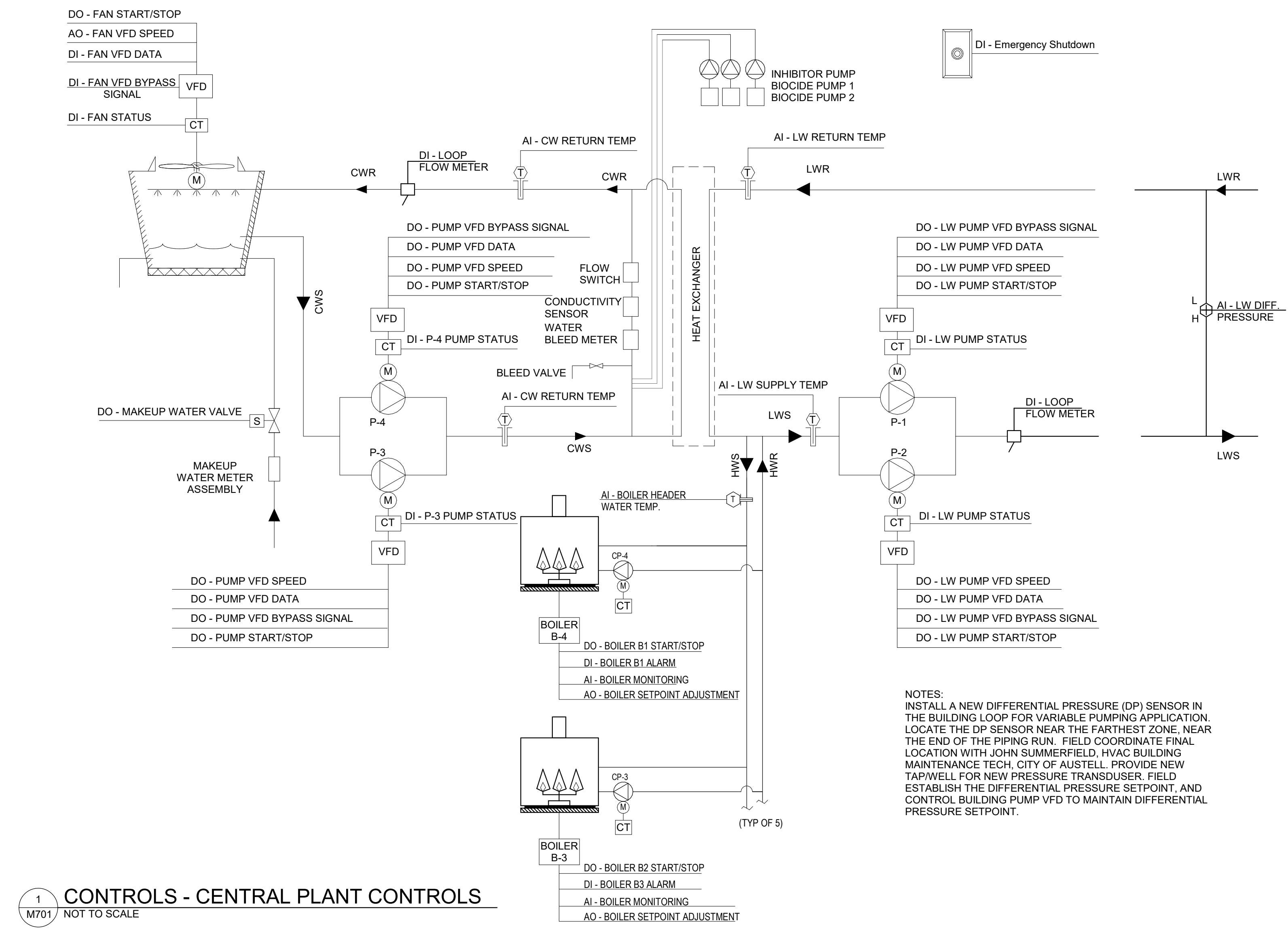
COOLING TOWER SYSTEM - RUN CONDITIONS:
 THE COOLING TOWER SYSTEM SHALL BE ENABLED TO RUN WHENEVER:
 • THE LOOP MONITOR IS ENABLED BY ZONE REQUIREMENTS.
 • AND OUTSIDE AIR TEMPERATURE IS GREATER THAN 37°F (ADJ.).
OPEN SYSTEM COOLING TOWER LOOP WATER TEMPERATURE CONTROL:
 • THE CONTROLLER SHALL MEASURE THE LOOP WATER SUPPLY TEMPERATURE AND ENABLE THE CONDENSER WATER PUMP STAGE THE FANS ON IN SEQUENCE TO MAINTAIN SETPOINTS.
 • BUILDING LOOP WATER LOOP TEMPERATURE SHALL BE MAINTAINED ON THE SUPPLY SIDE BETWEEN 81°F AND 91°F. WHEN THE LOOP SUPPLY WATER TEMPERATURE RISES ABOVE 86°F THE PRIMARY COOLING TOWER PUMP P-3 SHALL START AND RAMP UP TO FULL SPEED. STANDBY PUMP P-4 SHALL RUN ON ALTERNATING DAYS TO EQUALIZE WEAR. SHOULD EITHER PUMP FAIL TO OPERATE THE OTHER PUMP SHALL START.
 • ON A FURTHER RISE ABOVE 86°F THE COOLING TOWER FANS SHALL START. ONCE STARTED THE TOWER FAN SPEED SHALL BE VARIED BY A VARIABLE FREQUENCY DRIVE. A TEMPERATURE SENSOR IN THE LOOP WATER SUPPLY LINE SHALL PROVIDE A SIGNAL TO THE VFD'S. FANS SHALL REACH FULL SPEED AT A WATER TEMPERATURE OF 90°F.
 • ON A FURTHER RISE ABOVE 86°F, COOLING TOWER FANS SHALL START AND RAMP UP FROM ZERO RPM/LW VIA VFD'S TO 25% (ADJ.) OF FULL SPEED. THEREAFTER VFD'S SHALL MODULATE COOLING TOWER FANS, TO MAINTAIN 90°F CONDENSER WATER SUPPLY TEMPERATURE. FAN VFD SHALL REACH FULL SPEED AT 90° VFD SHALL.

BOILER SYSTEM - RUN CONDITIONS:
 THE BOILER SYSTEM SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE BOILER SYSTEM SHALL BE ENABLED TO RUN WHENEVER:
 • THE LOOP MONITOR IS ENABLED BY ZONE REQUIREMENTS.
 • AND OUTSIDE AIR TEMPERATURE IS LESS THAN 68°F (ADJ.).
 THE BOILER SYSTEM SHALL ALSO RUN FOR FREEZE PROTECTION WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 38°F (ADJ.).

BOILER LOOP WATER TEMPERATURE CONTROL:
 • THE BMS SHALL MEASURE THE LOOP WATER SUPPLY TEMPERATURE AND STAGE THE BOILER, ITS CIRCULATION PUMP AND HEATING STAGES ON IN SEQUENCE TO MAINTAIN SETPOINTS. THE BOILER SYSTEM SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.
 • ON DROPPING LOOP WATER SUPPLY TEMPERATURE BELOW 60°F, THE BOILER AND ITS CIRCULATION PUMP SHALL STAGE ON. WHEN THE LOOP WATER SUPPLY TEMPERATURE RISES BACK ABOVE THE SETPOINT, THE BOILER SHALL THEN STAGE OFF.
 • TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
 • BMS WILL ALTERNATE BOILER LEAD/AG ON ALTERNATING DAYS. THE BOILER CONTROLS WILL SEQUENCE THE INDIVIDUAL BOILER'S STAGES.

SENSORS IN THE PIPING SHALL BE PROVIDED AS REQUIRED BY THE SEQUENCES DESCRIBED HEREIN. WELLS SHALL BE FURNISHED BY THE CONTROLS CONTRACTOR AND INSTALLED BY THE DIVISION 23 CONTRACTOR.

CURRENT SENSOR SHALL BE USED TO CONFIRM PUMP OPERATION. THE CONTROLS, USING THE FLOW MEASUREMENT STATION IN THE PRIMARY LOOP PIPING, SHALL STOP ALL WATER SOURCE HEAT PUMPS WHEN THERE IS NO FLOW.
 THE CONTROL OF THE COOLING TOWER WATER AND CHEMICAL TREATMENT SHALL BE INDEPENDENT OF THE BMS SYSTEM.
 • A FLOAT SWITCH SHALL CONTROL THE TOWER WATER LEVEL.
 • THE CHEMICAL FEED SYSTEM SHALL MONITOR CONDUCTIVITY OF THE COOLING TOWER WATER. WHEN THE LOOP IS RUNNING AND THE CONDUCTIVITY RISES ABOVE THE SET POINT (ADJ.), THE TOWER WATER BLEED VALVE IS OPENED PROVIDED THAT THE SET MINIMUM LOCK-OUT TIMES (ADJ.) FOR THE INHIBITOR AND BIOCIDES HAVE PASSES SINCE THE CHEMICALS WERE OPERATED BY THE BMS SYSTEM. WHEN CONDUCTIVITY FALLS WITHIN THE SET POINT OR LOOP FLOW STOPS, THE BLEED VALVE IS CLOSED.
VIBRATION SWITCH:
 • THE COOLING TOWER SHALL SHUTDOWN AND GENERATE AN ALARM UPON RECEIVING A VIBRATION SWITCH STATUS.



1 CONTROLS - CENTRAL PLANT CONTROLS
 M701 / NOT TO SCALE

POINT NAME	HARDWARE POINTS					SOFTWARE POINTS				
	AI	AO	BI	BO	AV	LOOP	SCHED	TREND	ALARM	SHOW ON GRAPHIC
CT LOOP WATER RETURN TEMP.	X							X	X	
CT LOOP WATER SUPPLY TEMP.	X							X	X	
CT FAN START/STOP				X						X
CT FAN STATUS			X					X		X
CT FAN VFD SPEED			X							X
CT FAN VFD DATA				X						X
BOILER ALARM								X	X	
BOILER START/STOP			X							X
BOILER DATA				X						X
BOILER STATUS			X					X		X
EMERGENCY SHUTDOWN			X					X	X	X
LOOP WATER DIFFERENTIAL PRESSURE	X							X	X	
LOOP WATER RETURN TEMP.	X							X	X	
LOOP WATER SUPPLY TEMP.	X							X	X	
CT LOOP WATER PUMP P-3 VFD SPEED			X					X		X
CT LOOP WATER PUMP P-4 VFD SPEED			X					X		X
CT LOOP WATER PUMP P-3 STATUS			X					X		X
CT LOOP WATER PUMP P-4 STATUS			X					X		X
CT LOOP WATER PUMP P-3 FAILURE				X				X		X
CT LOOP WATER PUMP P-4 FAILURE				X				X		X
CT LOOP WATER PUMP P-3 RUNNING IN HAND								X		
CT LOOP WATER PUMP P-4 RUNNING IN HAND								X		
CT LOOP WATER PUMP P-3 RUN TIME EXCEEDED								X		
CT LOOP WATER PUMP P-4 RUN TIME EXCEEDED								X		
NO BUILDING LOOP FLOW								X		
BUILDING LOOP WATER FLOW STATUS			X							X
NO CONDENSER WATER FLOW								X		
CT WATER FLOW STATUS			X							X

NOTES:
 INSTALL A NEW DIFFERENTIAL PRESSURE (DP) SENSOR IN THE BUILDING LOOP FOR VARIABLE PUMPING APPLICATION. LOCATE THE DP SENSOR NEAR THE FARTHEST ZONE, NEAR THE END OF THE PIPING RUN. FIELD COORDINATE FINAL LOCATION WITH JOHN SUMMERFIELD, HVAC BUILDING MAINTENANCE TECH, CITY OF AUSTELL. PROVIDE NEW TAPWELL FOR NEW PRESSURE TRANSDUCER. FIELD ESTABLISH THE DIFFERENTIAL PRESSURE SETPOINT, AND CONTROL BUILDING PUMP VFD TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINT.

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REPLACEMENT OF COOLING TOWER & BOILER: THREADMILL COMPLEX 5000 AUSTELL POWDER SPRINGS ROAD THE CITY OF AUSTELL 5000 AUSTELL POWDER SPRINGS ROAD	
MECHANICAL EQUIPMENT CONTROLS	
STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS AND LAND SURVEYORS	DRAWING NUMBER
	M701