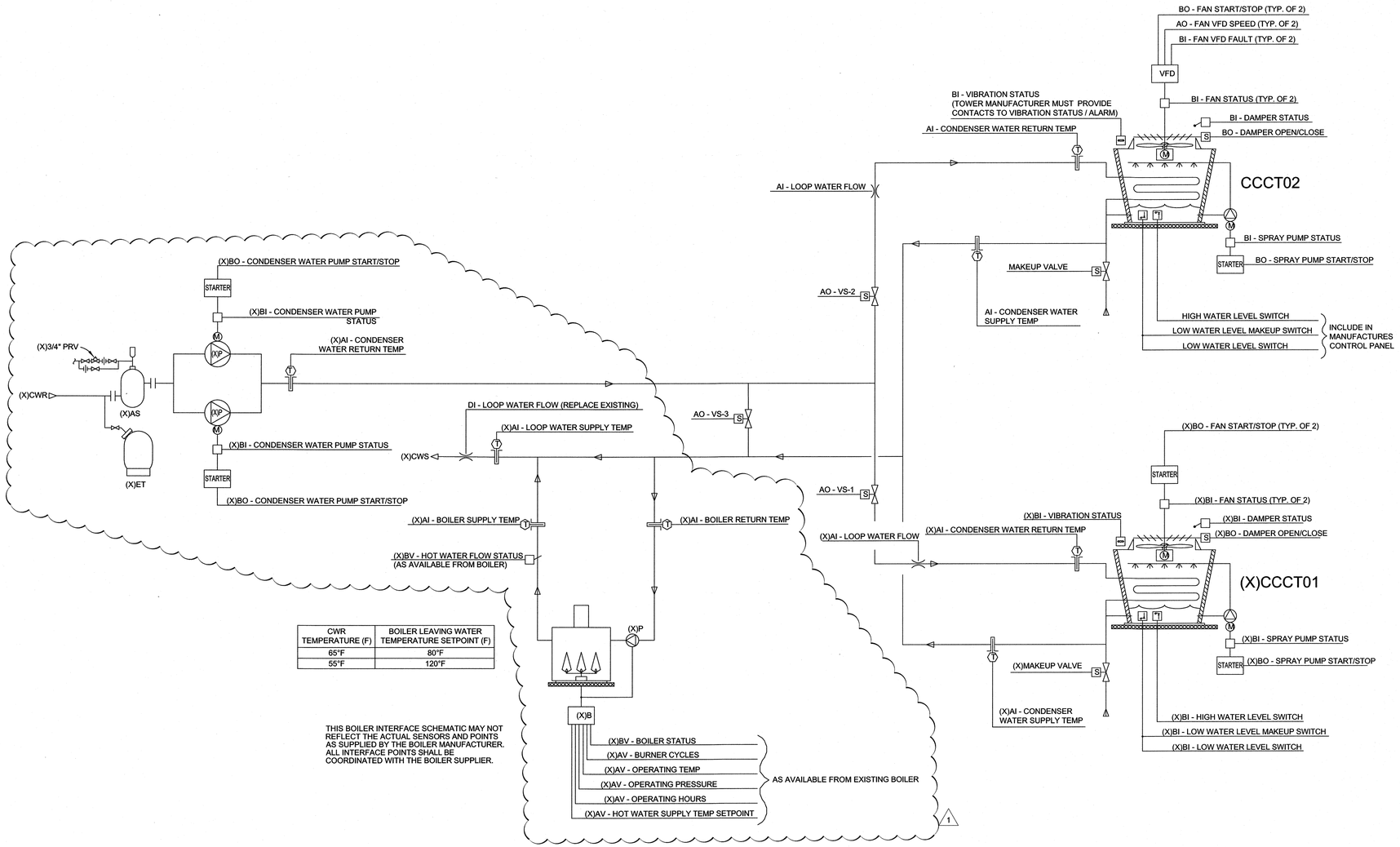

CWR TEMPERATURE (F)	BOILER LEAVING WATER TEMPERATURE SETPOINT (F)
65°F	80°F
55°F	120°F

THIS BOILER INTERFACE SCHEMATIC MAY NOT REFLECT THE ACTUAL SENSORS AND POINTS AS SUPPLIED BY THE BOILER MANUFACTURER. ALL INTERFACE POINTS SHALL BE COORDINATED WITH THE BOILER SUPPLIER.

B3 WATER LOOP CONTROL SCHEMATIC
NOT TO SCALE

DDC CONTRACTOR RESPONSIBLE FOR 120V POWER AND LOW VOLTAGE FOR CONTROL SYSTEM. REFER TO ELECTRICAL DRAWINGS FOR DEDICATED BREAKERS PROVIDING 120V POWER SOURCE.

WATER LOOP SEQUENCE OF OPERATION

SYSTEM START/STOP CONTROL:

START/STOP SYSTEM BASED ON (1) USER-DEFINED "ON/OFF" SCHEDULE, (2) DEMAND FOR HEATING OR COOLING BY SECONDARY SYSTEMS AS USER-DEFINED, OR (3) OPERATOR COMMAND, AS FOLLOWS:

"OFF" PERIOD:
COMMAND LOOP PUMPS, BOILERS, AND CLOSED CIRCUIT COOLERS "OFF" UNLESS FIVE (ADJ.) OR MORE WSHP UNITS ARE COMMANDED "ON." IF OFF PLANT CONTROL IS REQUIRED, STARTUP AND CONTROL SEQUENCE WILL BE THE SAME AS THE ON SEQUENCE BELOW

"ON" PERIOD:
COMMAND ONE CONDENSER WATER LOOP PUMP, (X)P01 OR (X)P02 "ON". CONFIRM PUMP STATUS.

CONFIRM LOOP FLOW VIA DIFFERENTIAL PRESSURE INDICATION, MONITORED FROM THE DIFFERENTIAL PRESSURE TRANSMITTED INSTALLED IN THE MAIN MECHANICAL ROOM THAT THE PUMPS ARE LOCATED IN.

IF PUMP FAILS TO START OR LOOP FLOW IS NOT CONFIRMED WITHIN 2 MINUTES, COMMAND PUMP "OFF," INITIATE ALARM, AND COMMAND SECOND PUMP "ON."

THE LEAD/LAG OPERATION SHALL ALTERNATE THE PUMPS BASED ON RUNTIME WHENEVER THE SYSTEM IS ENABLED FROM A DISABLED STATE. A TRANSITION FROM A DISABLED TO ENABLED STATED WILL OCCUR ANYTIME THE PLANT IS REQUIRED TO RUN, BASED ON THE START/STOP SEQUENCE ABOVE. THE CONDENSER WATER PUMP WITH THE LOWEST RUNTIME WILL BECOME THE LEAD.

EACH PUMP SHALL HAVE A MAINTENANCE SWITCH, P#-MS, WHICH CAN BE SET TO "DISABLED" TO REMOVE THAT PUMP FROM THE STAGING LOGIC IN THE EVENT OF A MECHANICAL FAILURE. DEFAULT VALUE FOR THE MAINTENANCE SWITCH IS ENABLED.

"ON" PERIOD CONDENSER WATER TEMPERATURE CONTROL:

MAINTAIN CWR TEMPERATURE AT HEATING SETPOINT OF 70 DEG F:
IF CWR TEMPERATURE FALLS BELOW 60°F SETPOINT, MODULATE LOOP BYPASS VALVE TO DIVERT FLOW TO BOILERS AND ENABLE BOILER(S) OPERATION PER BOILER STAGING SEQUENCE BELOW. WHEN CONDENSER WATER LOOP RETURN TEMPERATURE RISES TO 75°F, DISABLE BOILER(S) OPERATION.

MAINTAIN CWR TEMPERATURE AT COOLING SETPOINT OF 75 DEG F:
IF CWR TEMPERATURE RISES ABOVE 85°F SETPOINT, MODULATE LOOP BYPASS VALVE TO DIVERT FLOW TO CLOSED CIRCUIT COOLERS AND ENABLE CLOSED CIRCUIT COOLER OPERATION PER CLOSED CIRCUIT COOLERS STAGING SEQUENCE BELOW. WHEN CONDENSER WATER LOOP RETURN TEMPERATURE FALLS TO 70°F, DISABLE CLOSED CIRCUIT COOLER OPERATION.

CONDENSER WATER LOOP RETURN HEATING SETPOINT "CWRHT-SP"
CONDENSER WATER LOOP RETURN COOLING SETPOINT "CWRCT-SP"

START/STOP BOILER AS FOLLOWS:

COMMAND BOILER ISOLATION VALVE "OPEN".

COMMAND BOILER HOT WATER PUMP "ON".
CONFIRM PUMP STATUS.
CONFIRM HOT WATER FLOW THROUGH BOILER VIA DIFFERENTIAL PRESSURE FLOW SENSOR.
IF EITHER THE BOILER PUMP STATUS OR THE DIFFERENTIAL PRESSURE SWITCH DOES NOT CONFIRM PUMP OPERATION AND/OR FLOW, THE BOILER PUMP, AND THE BOILER WILL BE SHUTDOWN, AN ALARM WILL BE GENERATED THAT WILL REQUIRE AN OPERATOR RESET THROUGH THE DDC SYSTEM. THIS INCLUDES CLOSING THE ISOLATION VALVE.

COMMAND BOILER "ON" THROUGH HARDWIRED COMMAND TO BOILER.
IF BOILER FAILS TO START WITHIN 3 MINUTES, IF THE BOILER LEAVING WATER TEMPERATURE DOES NOT INCREASE, OR IF THE BOILER INDICATES AN INTERNAL ALARM/FAULT THE BOILER WILL BE SHUTDOWN, AN ALARM WILL BE GENERATED THAT WILL REQUIRE AN OPERATOR RESET THROUGH THE DDC SYSTEM. THIS INCLUDES COMMAND IN THE BOILER PUMP AND THE ISOLATION VALVE CLOSED.

CLOSED CIRCUIT COOLERS STAGING SEQUENCE:

MAINTAIN CONDENSER WATER SUPPLY TEMPERATURE AT 75°F SETPOINT

START/STOP EACH STAGE OF CLOSED CIRCUIT COOLERS IN SEQUENCE, AS REQUIRED TO MAINTAIN CWS TEMPERATURE AT SETPOINT, AS FOLLOWS:

STAGE 1: ON A RISE OF CWS WATER TEMPERATURE ABOVE SETPOINT, OPEN DISCHARGE AIR DAMPERS AND ISOLATION VALVES ON BOTH CLOSED CIRCUIT COOLERS.

STAGE 2: ON A CONTINUED RISE OF CWS TEMPERATURE ABOVE SETPOINT, COMMAND EVAPORATIVE COOLING SPRAY PUMP ON BOTH CIRCUIT COOLERS "ON."

STAGE 3: ON A CONTINUED RISE OF CWS TEMPERATURE ABOVE SETPOINT, COMMAND FAN ON BOTH CIRCUIT COOLERS "ON" ACCORDINGLY. COMMAND SMALL FAN ON (X) CCCT01 TO MAINTAIN CWS TEMPERATURE AND MODULATE THRU VFD FOR CCCT02 TO MAINTAIN CWS TEMPERATURE.

STAGE 4: ON A CONTINUED RISE OF CWS TEMPERATURE ABOVE SETPOINT, COMMAND LARGE FAN ON (X) CCCT01 TO MAINTAIN CWS TEMPERATURE.

CLOSED CIRCUIT COOLING TOWER FREEZE PROTECTION:

WHEN OUTSIDE AIR TEMPERATURES ARE BELOW 38 DEG F (ADJ.), AUXILIARY HEAT LOAD AND MINIMUM FLOW RATE AS DETERMINED BY MANUFACTURER MUST BE MAINTAINED ON THE COIL AT ALL TIMES SO THAT THE WATER TEMPERATURE DOES NOT DROP BELOW 50 DEG F WHEN THE COOLER IS SHUT DOWN.

WHEN THE UNIT IS OFF AND OUTSIDE AIR TEMPERATURE ARE BELOW 38 DEG F (ADJ.), ENERGIZE BASIN HEATER.

ROTATE CLOSED CIRCUIT COOLER "ON/OFF" SEQUENCE TO EQUALIZE RUNTIME BETWEEN CLOSED CIRCUIT COOLERS:

THE LEAD/LAG OPERATION WILL ALTERNATE THE CLOSED CIRCUIT COOLERS BASED ON RUNTIME WHENEVER THE SYSTEM IS ENABLED FROM A DISABLED STATE. A TRANSITION FROM A DISABLED TO ENABLED STATED WILL OCCUR ANYTIME THE PLANT IS REQUIRED TO RUN, BASED ON THE START/STOP SEQUENCE ABOVE. THE CLOSED CIRCUIT COOLER WITH THE LOWEST RUNTIME WILL BECOME THE LEAD.

EACH CLOSED CIRCUIT COOLERS WILL ALSO HAVE A MAINTENANCE SWITCH, CCCT#-MS, WHICH CAN BE SET TO "DISABLED" TO REMOVE THAT CLOSED CIRCUIT COOLER FROM THE STAGING LOGIC IN THE EVENT OF A MECHANICAL FAILURE. DEFAULT VALUE FOR THE MAINTENANCE SWITCH IS ENABLED.

Revision No	DESCRIPTION:	Date:
1	ADDENDUM #1	12.13.19
A	ISSUED FOR CONSTRUCTION	11.14.19
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MECHANICAL CONTROLS

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DESIGNED:	RWC
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