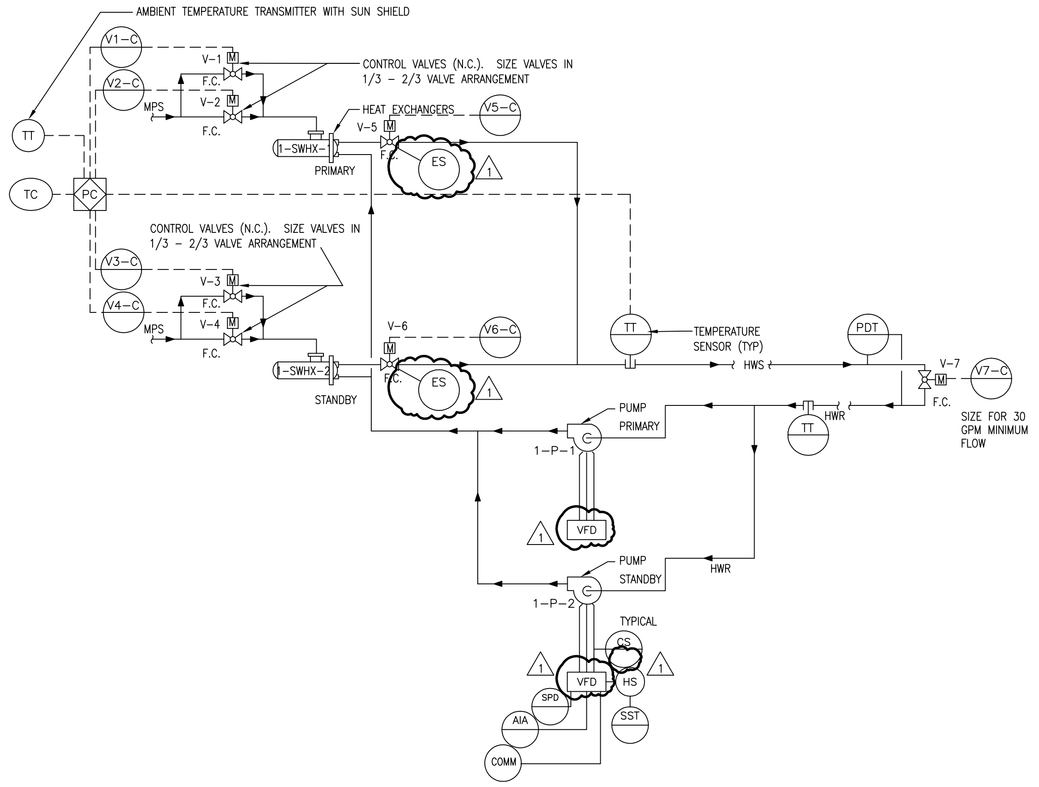


SEQUENCE OF OPERATION:

GENERAL:

1. STEAM-TO-HOT WATER HEAT EXCHANGERS PROVIDE THE HEAT SOURCE FOR REHEAT HOT WATER LOOP SYSTEM.
2. ONE HEAT EXCHANGER AND ONE PUMP SHALL OPERATE DURING NORMAL CONDITIONS.
3. EACH HEAT EXCHANGER SHALL BE PROVIDED WITH A VALVE STATION WHICH CONSISTS OF A 1/3 CONTROL VALVE, 2/3 CONTROL VALVE AND A MANUAL BYPASS VALVE.
4. EACH HEAT EXCHANGER SHALL BE PROVIDED WITH AN ISOLATION VALVE CONTROLLED THROUGH DDC. ONCE SYSTEM HAS BEEN PLACED INTO OPERATION AND PRIOR TO A PUMP BEING INDEXED ON, PRIMARY HEAT EXCHANGER ISOLATION VALVE SHALL BE INDEXED OPEN.
5. DDC SHALL MONITOR SYSTEM RETURN TEMPERATURE AND ALARM ON HIGH/LOW SIGNALS.
6. DDC SHALL MONITOR EACH HEAT EXCHANGER SUPPLY TEMPERATURE AND ALARM UPON HIGH/LOW SIGNALS.

B. TEMPERATURE CONTROL:

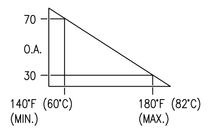
1. ELECTRONIC TEMPERATURE TRANSMITTER, LOCATED IN THE HOT WATER SUPPLY LINE, SHALL GENERATE A LINEAR 4-20 MA DC INPUT SIGNAL TO THE DDC SYSTEM.
2. DDC SHALL COMPARE INPUT SIGNAL TO SET POINT OF 180 DEGREES F AND PROVIDE AN OUTPUT TO MODULATE THE COMMON CONTROL VALVE STATION. A SEPARATE SIGNAL SHALL BE SENT TO EACH CONTROL VALVE.
3. AS THE HOT WATER SUPPLY TEMPERATURE BEGINS TO DROP BELOW SET POINT, THE 1/3 CONTROL VALVE SHALL BEGIN TO MODULATE OPEN. IF 1/3 CONTROL VALVE IS 100 PERCENT OPEN AND THE TEMPERATURE CONTINUES TO DROP, THE 2/3 CONTROL VALVE SHALL BEGIN TO MODULATE OPEN TO MAINTAIN SET POINT. THE REVERSE SEQUENCE SHALL OCCUR UPON A RISE IN THE HOT WATER SUPPLY TEMPERATURE.
4. WHEN THE SUPPLY TEMPERATURE DROPS 10 DEGREES F BELOW SET POINT FOR MORE THAN 30 MINUTES, THE DDC SYSTEM SHALL BE ALARMED, INDICATING A POTENTIAL PROBLEM.
5. WHEN THE TEMPERATURE CONTROL LOOP IS DISABLED, THE STEAM CONTROL VALVES AND ISOLATION VALVES SHALL MODULATE TO THEIR NORMALLY CLOSED POSITION.
6. HEAT EXCHANGER TEMPERATURE CONTROL LOOPS SHALL BE DISABLED AND VALVES CLOSE, WHEN BOTH PUMP STATUS VIA ASD CONTROL PANEL SIGNAL IS NOT PROVEN.

C. PUMP CONTROL:

1. ONCE SYSTEM IS COMMANDED 'ON' BY DDC SYSTEM OPERATOR, REHEAT SYSTEM SHALL OPERATE CONTINUOUSLY 24 HOURS A DAY. ONCE COMMANDED 'ON', THE DDC SYSTEM SHALL COMMAND THE PRIMARY HEAT EXCHANGER ISOLATION VALVE OPEN. ONCE VALVE HAS BEEN PROVEN OPEN, THROUGH VALVE POSITION END SWITCH, DDC SHALL START THE PRIMARY PUMP.
2. AFTER A PUMP BECOMES OPERATIONAL AND FLOW IS PROVEN VIA SIGNAL FROM VFD, THE HEAT EXCHANGER TEMPERATURE CONTROL LOOP SHALL BE ENABLED BY THE DDC.
3. AFTER BEING INDEXED ON, SHOULD PUMP FLOW NOT BE PROVEN FROM VFD AFTER AN ADJUSTABLE TIME FRAME, OR FAILS DURING OPERATION, AN ALARM SHALL BE INITIATED AT THE OPERATOR WORKSTATION. DDC SYSTEM SHALL AUTOMATICALLY INDEX THE FAILED PUMP OFF AND START THE STANDBY PUMP.
4. DDC SYSTEM SHALL VARY PUMPS SPEED TO MAINTAIN HEATING SYSTEM DIFFERENTIAL PRESSURE SETPOINT.
5. SYSTEM SHALL BE FURNISHED BY DDC WITH AN END-OF-THE-LINE BYPASS FLOW CONTROL VALVE. AS SYSTEM LOAD IS REDUCED, AND PUMP SPEED IS REDUCED THROUGH THE VFD BY DDC SYSTEM, SYSTEM SHALL MODULATE THIS MINIMUM FLOW CONTROL VALVE OPEN TO SATISFY THE SYSTEM MINIMUM SPEED, WHILE KEEPING THE FLOW SUPPLIED TO THE LOOPS AT THE PUMPS MINIMUM FLOW LIMIT OF 20 PERCENT SPEED (ADJUSTABLE). PUMPS SPEED SIGNAL FROM DDC SYSTEM TO VFD SHALL GO NO LOWER THAN THE PUMPS MINIMUM SPEED REQUIREMENT I.E. 20 PERCENT (ADJUSTABLE), CONVERSELY, AS THE SYSTEM DEMAND INCREASES, THE MINIMUM BYPASS FLOW CONTROL VALVE SHALL CLOSE. AS THE VALVE GOES CLOSED AND THE SYSTEM DEMAND CONTINUES TO INCREASE, THE PUMP SPEED SHALL AGAIN BE INCREASED BY DDC SYSTEM TO MEET THE DEMAND.

D. ALTERNATING EQUIPMENT CONTROL:

1. DDC SYSTEM SHALL ALTERNATE MECHANICAL EQUIPMENT TO ALLOW FOR EQUAL WEAR.
2. SYSTEM SHALL ALTERNATE BOTH THE HEAT EXCHANGERS AND PUMPS.
3. ALTERNATING SOFTWARE SHALL BE IN ACCORDANCE WITH AN OWNER DEFINED SCHEDULE. SOFTWARE SHALL ALTERNATE EQUIPMENT DURING LIGHT LOAD CONDITIONS TO ENSURE A SMOOTH AND BUMPLESS TRANSFER TO PRIMARY EQUIPMENT.



TYP OSA RESET SCHEDULE

SYSTEM COMPONENT:	ANALOG INPUT	ANALOG OUTPUT	BINARY INPUT	BINARY OUTPUT	CALCULATED VALUE	NOTES
1-P-1						BACNET COMMUNICATION
PUMP START/STOP				●		
PUMP STATUS			●			
PUMP RUNTIME					●	
PUMP SPEED COMMAND		●				
VFD TROUBLE ALARM			●			
1-P-2						BACNET COMMUNICATION
PUMP START/STOP				●		
PUMP STATUS			●			
PUMP RUNTIME					●	
PUMP SPEED COMMAND		●				
VFD TROUBLE ALARM			●			
1-SWHX-1						
HEAT EXCHANGER ISOLATION VALVE OPEN				●		
HEAT EXCHANGER 1/3 VALVE		●				
HEAT EXCHANGER 2/3 VALVE		●				
1-SWHX-2						
HEAT EXCHANGER ISOLATION VALVE OPEN				●		
HEAT EXCHANGER 1/3 VALVE		●				
HEAT EXCHANGER 2/3 VALVE		●				
HWS SUPPLY TEMPERATURE	●					
HWS RETURN TEMPERATURE	●					
SYSTEM DIFFERENTIAL PRESSURE	●					
BYPASS VALVE CONTROL		●				

1 HEAT EXCHANGER (HEATING SYSTEM) CONTROL DIAGRAM

NTS

2 TYPICAL SMOKE + COMBINATION FIRE/SMOKE DAMPER

SCALE: NTS

NOTES:

1. DETAIL APPLIES TO ALL SMOKE AND COMBINATION FIRE/SMOKE DAMPERS ASSOCIATED WITH THE FOLLOWING SYSTEMS: 103-AHU-5-1 AND 103-CF-2-1.
2. FIRE ALARM RELAY SHALL BE MOUNTED LOCALLY NEAR THE DAMPER BEING CONTROLLED.
3. DAMPER AND ACTUATOR SHALL BE PROVIDED AS A UL LISTED ASSEMBLY. ACTUATOR SHALL ACCEPT 120VAC POWER.
4. COORDINATE TERMINATIONS WITH DIV 28.
5. SMOKE DAMPERS SHALL BE POWERED FROM 102 V CIRCUIT PROVIDED BY ELECTRICAL IN VACINTIY OF FSD. BAS SHALL RUN POWER CIRCUIT TO THE AHU/EF VFD OR STARTER LOCATION.
6. REFER TO MECHANICAL DRAWINGS FOR QUANTITIES AND LOCATIONS.
7. DETAIL APPLIES TO ALL SMOKE AND COMBINATION SMOKE DAMPERS UNLESS NOTED OTHERWISE ON THE SPECIFIC SYSTEM CONTROL DIAGRAMS.
8. LIMIT SWITCHES PROVIDED BY DIV 25.

3 TYPICAL SUPPLY AND RETURN FAN VFD CONTROL (FOR NON-MANIFOLDED AHUS)

SCALE: NTS

NOTES:

1. THE USE OF RELAYS AS INTERMEDIATE DEVICES BETWEEN A SAFETY AND THE VFD IS UNACCEPTABLE
2. ALL CONTACTS SHOWN IN THE DE-ENERGIZED STATE.
3. REFER TO SYSTEM CONTROL DIAGRAM FOR AHUS WITH SUPPLY AND RETURN SMOKE DAMPERS.
4. AT A MINIMUM THE BAS SHALL MONITOR THE FOLLOWING POINTS IN THE VFD: KWH OUTPUT, HOA OUT OF "AUTO" POSITION, DRIVE FAULT, SPEED FEEDBACK, BYPASS MODE.
5. ALL INTERCONNECTING WIRING BETWEEN VFDs SHALL BE PROVIDED SO THAT ALL BAS INPUTS/OUTPUTS, HARDWIRE INTERLOCKS, AND COMMUNICATION INTERFACES OPERATE AS SPECIFIED VFDs.
6. THE DDC CONTROLLING THE FANS SHALL BE UUKL OR UL864 LISTED FOR SMOKE CONTROL.
7. THE SHAFT FIRE/SMOKE DAMPERS SHALL OPEN IN THE EVENT ANY OF THE ASSOCIATED AHUs ARE ENABLED THROUGH THE BAS OR THE VFD HOA SWITCH.
8. REFER TO SYSTEM CONTROL DIAGRAM FOR AHUS WITH DUCT SMOKE AND FIRE/SMOKE DAMPERS.

4 DELETED.

SCALE: NTS

5 MISCELLANEOUS MONITORING

SCALE: NTS

TYPICAL FOR:
ELEVATOR ROOM SUMP PIT ALARM

BID DOCUMENTS
FULLY SPRINKLERED

Revisions	Date
1 REVISION 1	06/11/12

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Date: 05/14/2012
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Drawn: RS
Project Number: 595-10-105
Building Number: 1-2
Drawing Number: M-802
Dwg. 78 of 101

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