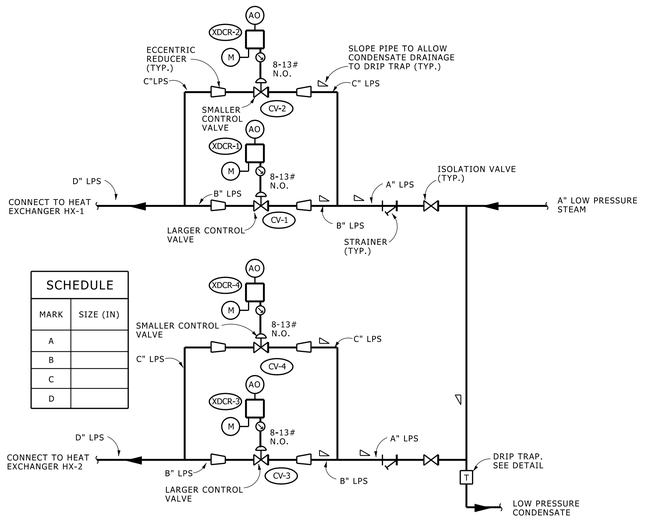


SCHEDULE	
MARK	SIZE (IN)
A	
B	
C	
D	

CRITICAL HEAT EXCHANGER STEAM CONTROL STATION DETAIL

NO SCALE

CRITICAL HEAT EXCHANGER SYSTEM

DESIGN INTENT:

EACH HEAT EXCHANGER, STEAM CONTROL VALVE STATION, AND PUMP ARE SIZED TO HANDLE APPROXIMATELY <FILL IN PERCENT> OF THE PEAK DIVERSIFIED HWH LOAD.

ONE HEAT EXCHANGER, ONE STEAM CONTROL VALVE STATION, OR ONE PUMP CAN BE OUT OF SERVICE WHILE MEETING THE PEAK DIVERSIFIED HWH LOAD.

MINIMUM <FILL IN GPM> HWH FLOW IS ATTAINED BY <BYPASS? THREE-WAY VALVES? INCLUDE IN SEQUENCE IF REQUIRED.>

SEQUENCE OF OPERATION:

SUMMARY
1. ONE PUMP AND ONE HEAT EXCHANGER WILL OPERATE WHILE THE OTHER PUMP AND HEAT EXCHANGER ARE IDLE.
2. BOTH PUMPS AND BOTH HEAT EXCHANGERS SHALL HAVE THEIR MANUAL ISOLATION VALVES OPEN.
3. THE MANUAL VALVE IN THE COMMON PUMP CROSS-OVER HEADER SHALL BE CLOSED.
4. THE SYSTEM SHALL OPERATE CONTINUOUSLY.
5. THE DDC SHALL SEQUENTIALLY CONTROL THE STEAM VALVES OF THE LEAD HEAT EXCHANGER TO ACHIEVE THE SUPPLY WATER SETPOINT AT THE HEAT EXCHANGER'S LEAVING TEMPERATURE SENSOR. THE SPEED OF THE ASSOCIATED LEAD PUMP SHALL BE MODULATED TO ACHIEVE DPT-1 SETPOINT.
6. THE DDC SHALL ROTATE TO THE OTHER HEAT EXCHANGER/PUMP SET IF THE DIFFERENTIAL PRESSURE OR TEMPERATURE SETPOINT CAN'T BE MAINTAINED.

DETAILED SEQUENCE

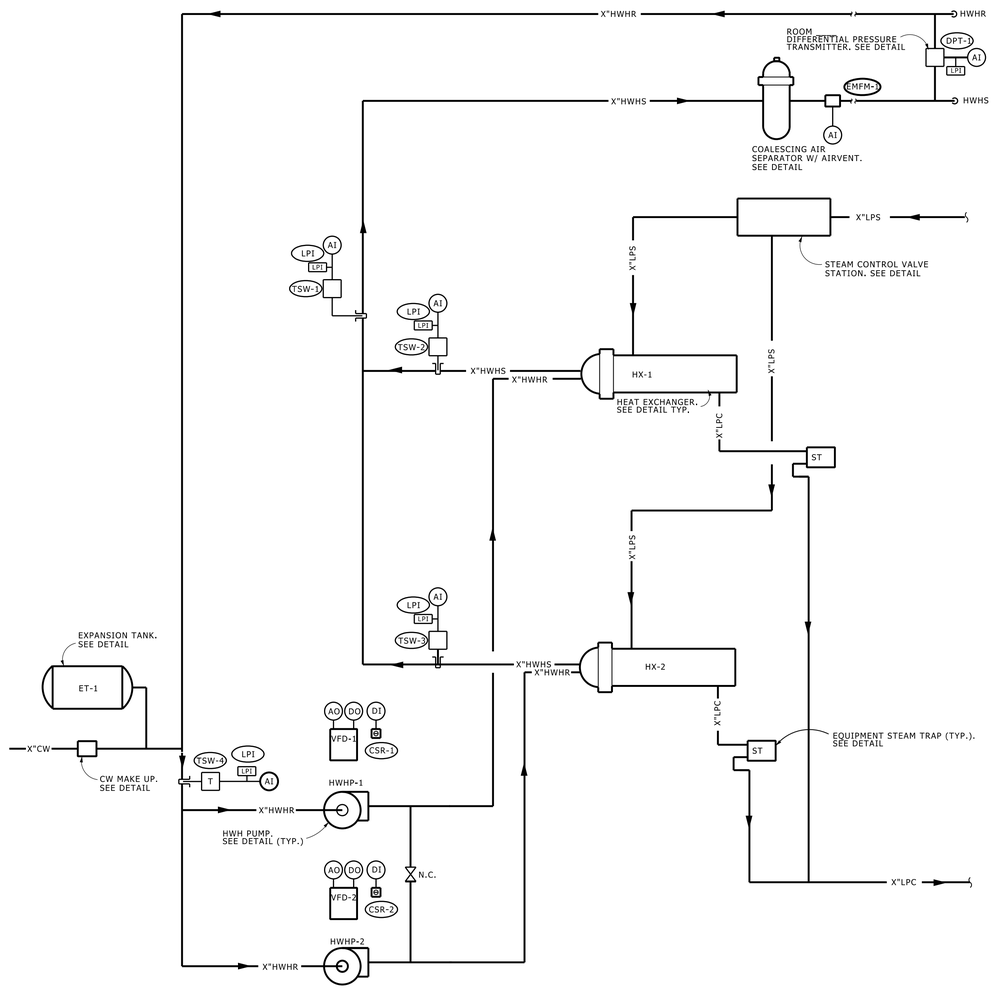
7.ROTATING HEAT EXCHANGER OPERATION
- A. EACH HEAT EXCHANGER, STEAM CONTROL VALVE STATION, AND PUMP SHALL BE ROTATED WEEKLY IN OR OUT OF SERVICE BY THE DDC TO EQUALIZE RUN TIME. HEAT EXCHANGER ROTATION SHALL ALSO OCCUR WHEN INITIATED BY AN OPERATING CONDITION DESCRIBED IN OTHER SEQUENCE PARAGRAPHS.
- B. TO ROTATE OPERATION, DDC SHALL FIRST START THE LAG PUMP. THE SPEED OF THE LAG PUMP WILL RAMP UP GRADUALLY (AS SET IN THE VFD) UNTIL IT MATCHES THE LEAD PUMP'S SPEED AND THEN THE SPEED OF BOTH PUMPS WILL BE CONTROLLED TO MAINTAIN THE DPT-1 SETPOINT. THE DDC SHALL CONTROL THE LAG HX STEAM VALVES TO MAINTAIN THE CURRENT HWH SETPOINT BY CONTROLLING TO THE LAG HX'S RESPECTIVE DISCHARGE TEMPERATURE TRANSMITTER (TSW-2 OR TSW-3). AFTER A 5 MINUTE TIME DELAY (ADJ) TO ALLOW THE LAG HEAT EXCHANGER TEMPERATURE CONTROL TO STABILIZE, DDC SHALL CLOSE THE LEAD HX'S STEAM VALVES. 5 MINUTES LATER, LEAD PUMP SHALL STOP.
- C. AFTER THE 5 MINUTE TIME DELAY (ADJ), IF DPT-1 IS NOT WITHIN 2PSI OF SETPOINT OR THE LEAVING WATER TEMPERATURE AT THE LAG HX TRANSMITTER IS NOT WITHIN ±10°F OF SETPOINT DDC SHALL ALARM AND SWITCH BACK TO LEAD HEAT EXCHANGER OPERATION.

8. STEAM VALVE CONTROL
- A. THE DDC SHALL SEQUENTIALLY MODULATE THE STEAM CONTROL VALVES OF THE OPERATING HEAT EXCHANGER TO PRODUCE THE REQUIRED SETPOINT AT THE HX'S RESPECTIVE LEAVING TEMPERATURE TRANSMITTER TSW-2 OR TSW-3. THE SETPOINT CHANGES BASED ON THE INDICATED RESET SCHEDULE.
- B. UPON AN INCREASE IN LOAD, FIRST MODULATE OPEN THE SMALLEST CONTROL VALVE. UPON CONTINUED INCREASE IN LOAD, MODULATE OPEN THE NEXT LARGER CONTROL VALVE. UPON A DECREASE IN LOAD, THE OPPOSITE SHALL OCCUR, FIRST MODULATING CLOSED THE LARGEST CONTROL VALVE.
- C. IF THE SETPOINT VARIES MORE THAN ±10°F FROM SETPOINT, AFTER TIME DELAY, DDC SHALL ROTATE HEAT EXCHANGER OPERATION. DDC SHALL ALSO ALARM AT BAS. ALARM MESSAGE SHALL STATE "ROTATING TO BACK-UP HX DUE TO TEMPERATURE PROBLEM. INVESTIGATE CAUSE OF CRITICAL HX PROBLEM." AFTER THE HX ROTATION AND A TIME DELAY IF THE WATER TEMPERATURE SETPOINT IS NOT ACHIEVED, THE DDC SHALL GENERATE AN ALARM MESSAGE AT BAS "HX ROTATED, TEMPERATURE STILL NOT AT SETPOINT".
- D. IF THE TEMPERATURE AT THE OPERATING HX'S RESPECTIVE LEAVING TEMPERATURE TRANSMITTER EXCEEDS 220°F, DDC SHALL ALARM AT BAS (NO TIME DELAY).

9. PUMP CONTROL
- A. THE MINIMUM PUMP OPERATING SPEED (PROGRAMMED INTO THE VFD) SHALL BE 12HZ.
- B. DDC SHALL MODULATE THE PUMP VFD AS REQUIRED TO MEET THE DIFFERENTIAL PRESSURE SETPOINT AT DPT-1. THE INITIAL SETPOINT SHALL BE <FILL IN PSI> PSI. THE FINAL SETPOINT SHALL BE DETERMINED WITH THE WATER BALANCER DURING TEST AND BALANCE.
- C. (DPT-1 SETPOINT CHANGES TO MAINTAIN WORST CASE TERMINAL VALVE AT 90% OF FULL OPENING. DESIGNER TO EXPAND UPON THIS PART OF THE SEQUENCE IF THE DPT-1 SETPOINT IS TO BE RESET IN SOME WAY.)
- D. IF DPT-1 FALLS MORE THAN 2 PSI BELOW SETPOINT AFTER A TIME DELAY, DDC SHALL ROTATE HEAT EXCHANGER OPERATION. DDC SHALL ALSO ALARM AT BAS. ALARM MESSAGE SHALL STATE "ROTATING TO BACK-UP HX DUE TO PRESSURE PROBLEM. INVESTIGATE CAUSE OF CRITICAL HX PROBLEM." AFTER THE HX ROTATION AND A TIME DELAY IF THE DPT-1 SETPOINT IS NOT ACHIEVED, THE DDC SHALL GENERATE AN ALARM MESSAGE AT BAS "HX ROTATED, DP STILL NOT AT SETPOINT".

10. ADDITIONAL BAS DDC ALARMS (AFTER AN APPROPRIATE TIME DELAY)
- A. PUMP STATUS DOES NOT MATCH DDC COMMAND (AS DETECTED BY CSR)
- B. DPT-1 MORE THAN 5 PSI ABOVE SETPOINT

11. BAS TREND LOGGING:
- A. BTU/HR, 30 MINUTE READING (EMFM-1, TSW-1, TSW-4)
- B. HWH GPM, 30 MINUTE READING (EMFM-1)
- C. TSW-1, 2, 3, 4, 30 MINUTE READING
- D. PUMP TOTAL RUN TIME, EACH PUMP



CRITICAL STEAM TO WATER HEAT EXCHANGER P & ID

NO SCALE

CONTROLS EQUIPMENT LIST	
ITEM NO.	DESCRIPTION
DPT	DIFF. PRESSURE TRANSMITTER
XDCR	E/P TRANSDUCER
CV	CONTROL VALVE
TSW *	TEMPERATURE SENSOR, WATER
EMFM	ELECTROMAGNETIC FLOW METER
CSR	CURRENT SENSING RELAY
LPI	LOOP POWERED INDICATOR

* TSW1 & TSW4 ARE HIGH PRECISION MATCHED TEMPERATURE SENSOR ASSEMBLIES FOR BTU MEASUREMENT.

RESET SCHEDULE	
OA TEMP (DEG. F)	HWH SUPPLY TEMP (DEG. F)
>65	
65	
55	
0	

NOTES:

1. ALL REQUIRED COMPONENTS AND ACCESSORIES ARE NOT IDENTIFIED. REFER TO CONSTRUCTION DOCUMENTS, INCLUDING PLANS, ELEVATIONS, DETAILS AND SPECIFICATIONS, FOR ADDITIONAL REQUIREMENTS.

DESIGNER NOTES:

1. COMPLETE ALL MISSING INFORMATION.
2. REVIEW STEAM TO WATER HEAT EXCHANGER SYSTEM DESIGN GUIDELINE DG 235716 AND MASTER SPECIFICATION MS 235716 FOR ADDITIONAL INFORMATION.

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APPROVED BY

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DESIGNED BY | REVIEWED BY

MARK	ISSUED FOR/REVISIONS	DATE
		07.08.15

Converter Standardization Committee

Steam to Water Heat Exchanger

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U OF M PROJECT NO. | BLDG NO.

SHEET TITLE **Mechanical**

Steam to Water Heat Exchangers P & ID - Critical

MD 235716 001

SHEET NO. 1 OF 1 SHEET FILE NO. MD 235716 001.dgn