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BLOWDOWN SEPARATOR

A NON-POTABLE WATER FLOW CONTROL VALVE SHALL MODULATE TO MAINTAIN LEAVING WATER TEMPERATURE SET POINT. SCADA SYSTEM SHALL MONITOR LEAVING (TEMPERED) WATER TEMPERATURE.

CONTINUOUS BLOWDOWN HEAT EXCHANGER

1. MANUALLY ADJUSTED CONTINUOUS BLOWDOWN METERING VALVE SHALL BE PROVIDED FOR EACH BOILER TO ADJUST CONTINUOUS BLOWDOWN RATE.
2. BALANCED FLOAT TRAP SHALL MAINTAIN CONSTANT TANK WATER LEVEL.
3. TEMPERATURE TRANSMITTERS SHALL COMMUNICATE WITH SCADA SYSTEM TO MONITOR SOFT WATER INLET AND OUTLET TEMPERATURES.
4. HIGH TANK LEVEL ALARM SWITCH PROVIDED WITH THE EQUIPMENT SHALL ALARM BUILDING AUTOMATION SYSTEM IN THE EVEN OF TANK WATER LEVEL ABOVE SET POINT.

CHEMICAL TREATMENT

1. THREE CAUSTIC AND THREE POLYMER PUMPS WILL INJECT CHEMICALS INTO THE MAIN FEEDWATER LINES, AS CONTROLLED BY THREE INDIVIDUAL BOILER BLOWDOWN CONTROLLERS. SULFITE PUMP WILL INJECT CHEMICALS INTO THE DEAERATOR BASED ON THE PLANT MAKE UP WATER METER, CONTROLLED BY BOILER B-1 BLOWDOWN CONTROLLER. AMINES WILL BE INJECTED INTO THE MAIN STEAM HEADER BASED ON PH SENSOR IN THE MAIN CONDENSATE RETURN PIPE, AND CONTROLLED BY BOILER B-2 BLOWDOWN CONTROLLER. REFER TO 235011 PARAGRAPH 2.13 FOR BOILER BLOWDOWN CONTROLLERS.
2. THE PACKAGED WATER SOFTENER FOR BOILER MAKE UP WILL CONSIST OF A BRINE TANK, AND INTEGRAL CONTROL PANEL, AND THREE WATER SOFTENER TANKS. A MECHANICAL FLOAT MAINTAINS THE WATER LEVEL IN THE BRINE TANK. SALT IS ADDED MANUALLY TO THE BRINE TANK. THE WATER SOFTENERS WILL ALTERNATE IN SERVICE. TWO WILL BE IN SERVICE WHILE THE THIRD UNIT IS IN REGENERATION/STANDBY MODE. THE CONTROL PANEL SEQUENCE WILL EMPLOY A METERING DEVICE TO PLACE THE SOFTENERS IN SERVICE MODE, STANDBY MODE, OR REGENERATION MODE.
3. A LOW LEVEL SIGNAL FROM THE CONDENSATE SURGE TANK SHALL OPEN THE CONTINUOUS BLOW-DOWN HEAT EXCHANGER BYPASS VALVE, SENDING SOFTENED WATER STRAIGHT TO THE SURGE TANK.
4. SOFTENER OPERATING AND ALARM STATUS SHALL BE COMMUNICATED TO THE SCADA SYSTEM FOR MONITORING.

FUEL OIL/DIESEL OIL STORAGE AND TRANSFER SYSTEMS

1. THE UNDERGROUND FUEL OIL TANKS ARE EQUIPPED WITH LEAK DETECTION, LEVEL SENSORS, AND HIGH AND LOW LEVEL ALARMS. TANK LEVEL SENSORS, TANK LEAK DETECTION SENSORS, PIPING LEAK DETECTION SENSORS, AND HIGH AND LOW LEVEL ALARMS SHALL BE MONITORED BY LEAK DETECTION SYSTEM, AND TANK FLUID LEVEL MONITORING AND ALARM SYSTEM.
2. FUEL OIL PUMPS ARE STARTED AND STOPPED MANUALLY AT THE PUMP SET. AUTOMATIC / REMOTE STARTING OF FUEL OIL PUMPS IS NOT ALLOWED.
3. DIFFERENTIAL PRESSURE TRANSMITTERS CONNECTED TO THE AUTOMATION SYSTEM SHALL MONITOR PRESSURE DROP ACROSS THE FUEL OIL AND DIESEL OIL STRAINERS. AN ALARM SHALL SOUND WHEN THE PRESSURE DROP IS IN EXCESS OF 1 INCH HG. (ADJUSTABLE)
4. THE FAILURE OF A FUEL OIL PUMP SHALL SOUND A LOCAL ALARM AND THE STANDBY FUEL OIL PUMP SHALL STARTED BY THE AUTOMATION SYSTEM.

BOILER COMBUSTION CONTROL

THE COMBUSTION INSTRUMENTATION AND CONTROL IS A PARALLEL POSITIONING COMBUSTION CONTROL SYSTEM WITH BURNER MANAGEMENT SYSTEM, FLUE GAS RECIRCULATION, AND AUTOMATIC OXYGEN TRIM. DEMAND FROM THE BOILER MASTER SHALL SERVE AS A DEMAND FOR BOTH FUEL AND AIR CONTROL DEVICES. WHEN THE LOAD INCREASES, AIR SUPPLY LEADS THE FUEL SUPPLY. DURING A LOAD DECREASE, FUEL SUPPLY LEADS THE AIR SUPPLY. THE FOLLOWING DESCRIBES THE FUNCTION AND CONTROL ACTIONS WHICH OCCUR IN RESPONSE TO CHANGES IN PLANT STEAM PRESSURE.

1. ONE ACTUATOR SHALL POSITION THE FUEL FLOW CONTROL VALVES. ONE ACTUATOR SHALL POSITION THE FD FAN AIR DAMPER. THE FD FAN SPEED SHALL BE CONTROLLED BY ITS VFD TO ADJUST AIR FLOW IN SERIES WITH THE FD DAMPER. ACTUATORS SHALL BE EQUIPPED WITH A POSITION FEED-BACK TRANSMITTER. THE VFD AND AIR DAMPER SHALL PROVIDE SPEED FEEDBACK SIGNAL TO CONTROLLER. FUEL-AIR RATIO SHALL BE ESTABLISHED BY AND ADJUSTED BY USE OF A "SOFT [illegible] CURVE" OF FUEL VALVE POSITION VERSUS FD FAN SPEED.
2. THE FUEL FLOW CONTROLLER SHALL BE "POSITION CROSS-LIMITED" WITH THE AIR FLOW CONTROLLER SO THAT FUEL DEMAND CANNOT BE INCREASED UNTIL AN AIR FLOW INCREASE IS PROVEN BY THE FD FAN VFD SPEED AND FD FAN AIR DAMPER POSITION FEEDBACK SIGNAL. AIR DEMAND CANNOT BE DECREASED UNTIL [illegible] FLOW VALVE POSITION DECREASE IS PROVEN BY THE FUEL FLOW CONTROL VALVE POSITION FEEDBACK SIGNAL.
3. THE FUEL CONTROLLER SHALL BE CONFIGURED TO PROVIDE FOR CONTROL OF [illegible] AND / OR FUEL [illegible] CONTROL VALVE AS SELECTED MANUALLY.
4. THE BOILER MASTER SHALL USE A STEAM FLOW FEED-FORWARD INDEX TO THE STEAM [illegible] PRESSURE FEEDBACK [illegible] IMPROVED RESPONSE. FUEL CONTROL AND AIR CONTROL SHALL BE MODULATED IN RESPONSE TO THE BOILER MASTER OR THE EXTERNAL [illegible] MASTER CONTROL SIGNAL.
5. THE FLUE GAS OXYGEN ANALYZER SHALL MEASURE OXYGEN CONCENTRATION IN THE BOILER OUTLET [illegible] GAS AND ADJUST THE FUEL / AIR RATIO TO MAINTAIN SETPOINT.
6. ALL CONTROL LOGIC REQUIRED TO AUTOMATE PRE-PURGE, POST-PURGE, LIGHT-OFF, AND BURNER MODULATION SHALL BE PROVIDED BY THE BMS.
7. CALCULATE AND DISPLAY REAL TIME BOILER EFFICIENCY AS CALCULATED BY ASME "LOSSES" METHOD USING REAL TIME INPUTS OF BOILER FIRING RATE, FLUE GAS OXYGEN LEVELS, FLUE GAS TEMPERATURE AND SELECTED [illegible] ME OF FIRING. SOFTWARE SHALL BE CAPABLE OF USING FLUE GAS TEMPERATURE AT ECONOMIZER INLET AND ECONOMIZER OUTLET AS MANUALLY SELECTED BY OPERATOR. RADIATION LOSSES SHALL BE INDEXED TO FIRING RATES FOR MAXIMUM ACCURACY. TWO SETS OF ADJUSTABLE FUEL CHEMISTRY DATA SHALL BE INCLUDED.
8. THE FOLLOWING POINTS FOR EACH BOILER FORCED DRAFT FAN VFD SHALL BE MONITORED BY THE SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA):
   - A. VFD FAULT/FAILURE
   - B. PROOF OF OPERATION
   - C. START/STOP
   - D. FAN SPEED OUTPUT SIGNAL
   - E. FAN SPEED FEEDBACK FROM VFD
   - F. MOTOR CURRENT
   - G. DRIVE TEMPERATURE
   - H. HAND OPERATION INDICATE START/STOP
   - I. [illegible] OUTPUT SIGNAL
   - J. FAN SPEED FEEDBACK FROM VFD
   - K. MOTOR CURRENT
   - L. DRIVE TEMPERATURE
   - M. HAND OPERATION INDICATE

BOILER FEEDWATER LEVEL CONTROL

STEAM DRUM LEVEL SHALL BE MAINTAINED BY MODULATING BOILER FEEDWATER INLET CONTROL VALVE THROUGH THREE ELEMENT CONTROL SYSTEM: DRUM LEVEL, FEED WATER FLOW AND STEAM FLOW.

CONDENSATE STORAGE TANK CONTROL

1. LEVEL CONTROLLER SHALL MAINTAIN SET POINT BY MODULATING SOFTENED WATER FLOW CONTROL VALVE. THROUGH A LOW LEVEL SWITCH A DROP BELOW SET POINT SHALL SOUND A LOCAL ALARM AND OPEN NON-POTABLE WATER SYSTEM CONTROL VALVE TO MAINTAIN LEVEL.
2. A LOW-LOW LEVEL SWITCH SHALL SOUND A LOCAL ALARM ON A DROP BELOW LOW-LOW SET POINT.
3. A HIGH LEVEL SWITCH SHALL SOUND A LOCAL ALARM ON A RISE ABOVE SET POINT.
4. LEAD CONDENSATE PUMP SHALL RUN CONTINUOUSLY TO MAINTAIN DA TANK OPERATING LEVEL. WHEN DA TANK OPERATING LEVEL DROPS BELOW SET-POINT, THE LAG CONDENSATE PUMP SHALL BE ENERGIZED. WHEN THE DA TANK OPERATING LEVEL RISES ABOVE THE SET-POINT, THE LAG PUMP SHALL BE DE-ENERGIZED. A PUMP FAILURE SHALL ENERGIZE THE STANDBY PUMP AND SOUND A LOCAL ALARM.
5. A FAILURE OF THE STANDBY PUMP SHALL SOUND A LOCAL ALARM.
6. LEAD, LAG AND STANDBY PUMPS SHALL BE SELECTABLE.

DEAERATOR CONTROL

1. A PNEUMATICALLY OPERATED CONTROL VALVE IN THE HIGH PRESSURE STEAM SYSTEM SHALL MAINTAIN DESIGN HEAD PRESSURE IN THE DEAERATOR SHELL.
2. LEVEL CONTROLLER SHALL MAINTAIN WATER LEVEL SET POINT BY MODULATING PUMPED CONDENSATE INLET VALVE.
3. A LOW LEVEL SWITCH AND A LOW-LOW LEVEL SWITCH SHALL SOUND A LOCAL ALARM.
4. ON A RISE ABOVE SET POINT OVERFLOW WILL RELIEVE EXCESS THROUGH THE OVERFLOW VALVE TO THE CONDENSATE RECEIVER. ON A FURTHER RISE A HIGH LEVEL SWITCH SHALL SOUND A LOCAL ALARM.
5. BOILER FEEDWATER PUMPS SHALL PROVIDE CONTINUOUS FLOW TO THE BOILER FEEDWATER SYSTEM. THE PUMPS SHALL BE STAGED TO MAINTAIN FEEDWATER HEADER SET-POINT AS FOLLOWS:
   - a. LEAD PUMP SHALL BE ENERGIZED WHEN [illegible] BOILER IS OPERATING. LEAD PUMP SPEED SHALL BE MODULATED TO MAINTAIN HEADER PRESSURE SET-POINT.
   - b. WHEN PRESSURE IN HEADER DROPS BELOW SET-POINT FOR A PERIOD OF 15 MINUTES (ADJUSTABLE), THE LAG PUMP SHALL BE STARTED. LEAD AND LAG PUMP SPEED SHALL BE MODULATED TO MAINTAIN HEADER SET-POINT.
   - c. WHEN SPEED OF OPERATING PUMPS DROP BELOW 40% (ADJUSTABLE) AND HEADER PRESSURE CONTINUES TO RISE ABOVE THE SET-POINT FOR A PERIOD OF 15 MINUTES (ADJUSTABLE), THE LAG PUMP SHALL BE DE-ENERGIZED.
6. THE FAILURE OF ANY PUMP SHALL SOUND A LOCAL ALARM AND ENERGIZE THE STANDBY PUMP.
7. THE LEAD, LAG AND STANDBY PUMPS SHALL BE MANUALLY SELECTABLE THROUGH MAIN INSTRUMENTATION AND CONTROL PANEL TOUCH SCREEN.
8. THE FOLLOWING POINTS FOR EACH BOILER FEEDWATER PUMP VFD SHALL BE MONITORED BY THE SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA):
   - A. VFD FAULT/FAILURE
   - B. PROOF OF OPERATION
   - C. START/STOP
   - D. FAN SPEED OUTPUT SIGNAL
   - E. FAN SPEED FEEDBACK FROM VFD
   - F. MOTOR CURRENT
   - G. DRIVE TEMPERATURE
   - H. HAND OPERATION INDICATE

BOILER COMBUSTION AIR

1. BOILER COMBUSTION AIR IS PROVIDED BY CONSTANT HEATING AND VENTILATING UNITS INTERLOCKED WITH EACH BOILER. (HV-B-1 THROUGH HV-B-3)
2. WHEN A BOILER IS ENERGIZED THE ASSOCIATED VENTILATION UNIT SHALL ALSO BE ENERGIZED. IN THE EVENT OF AN HV UNIT FAN FAILURE AS SENSED BY CURRENT TRANSMITTER IN MOTOR STARTER, AN ALARM SHALL BE ANNUNCIATED. HV INTERLOCKS ARE ALARM ONLY, AND DO NOT LOCK OUT THE BOILER.
3. UPON RECEIVING THE SIGNAL TO START THE HV UNIT OUTDOOR AIR DAMPER SHALL OPEN AND WHEN DAMPER END SWITCHES ARE MADE, THE HV UNIT SUPPLY FAN SHALL BE ENERGIZED.
4. WINTER MODE: WHEN UNIT IS ENERGIZED AND OUTSIDE AIR TEMPERATURE BELOW 65 DEGREES (ADJUSTABLE). THE STEAM VALVE SHALL OPEN AND THE INTEGRAL FACE AND BY-PASS DAMPERS SHALL MODULATE TO MAINTAIN A SUPPLY AIR TEMPERATURE OF 65 DEGREE (ADJUSTABLE) AS SENSED BY SUPPLY AIR TEMPERATURE SENSOR.
5. SUMMER MODE: WHEN UNIT IS ENERGIZED AND OUTSIDE AIR TEMPERATURE SENSED IS ABOVE 65 DEGREES (ADJUSTABLE). THE STEAM COIL VALVE SHALL CLOSE AND THE INTEGRAL FACE AND BY-PASS DAMPER SHALL BE COMMANDED TO FULL BY-PASS.
6. HV UNITS MAY BE MANUALLY STARTED AND RUN IN HAND AT ANY TIME TO PROVIDE BOILER PLANT VENTILATION.
7. SUPPLY AIR IN EXCESS OF AIR REQUIRED FOR COMBUSTION SHALL BE RELIEVED THROUGH BAROMETRIC RELIEF PENTHOUSES ON THE PLANT ROOF.
8. DETECTION OF SMOKE IN SUPPLY DUCT SHALL SHUT DOWN HV UNIT AND CLOSE OA DAMPER.

ROOFTOP UNIT RTU-1

1. UNIT HAS ON-BOARD STANDALONE CONTROLLER.
2. MODULATE COOLING AND HEATING IN SEQUENCE TO MAINTAIN DISCHARGE AIR TEMPERATURE ABOVE 55F (FA).
3. INTERLOCK EF-1 TO RTU-1
4. UNIT RUNS 24 / 7.

NOTE: WHERE THERE IS A CONFLICT WITH THE SPECIFICATIONS, THE SPECIFICATIONS GOVERN.

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FINAL DESIGN
APPROVED FOR CONSTRUCTION

Revisions:	Date

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