Notify WEDECO if other than a fuse problem, or if problem occurs frequently.

LOW OXYGEN FLOW

1. Insure gas flow is above 10 scfm. Adjust valves as required to increase flow rate.
2. Check that safety relief valve is closed.
3. Check for piping leaks upstream of the ozone generator.
4. Check oxygen flowmeter operation and insure it is setup properly. Recalibrate if required.

SHELL WATER FLOW LOW

1. Check manual isolation valves for proper position.
2. Check piping for leaks.
3. Check the flow switch for proper operation and insure that the setting is setup properly. Readjust if required.

WATER OUT TEMP HIGH

1. Check for proper oxygen flow rate to maintain an ozone concentration below 13%.
2. Check to insure that the gas pressure at the shell is between 10-17 psig.
3. Insure cooling water temperature is below 80 °F and the flow rate is above 200 gpm.
4. Check temperature transmitter for proper operation and insure that the setting is setup properly. Recalibrate if required.

CWS PRESS HIGH

1. Check for proper water flow rate.
2. Check to insure water system is at proper pressure.
3. Verify operation of relief valve.

OZONE TEMP HIGH

4.5.2 General

The cooling water system is an essential part of the ozone generation system and consists of a primary loop cooling system which cools the ozone generators directly and the Power Supply Units (PSUs) indirectly via a heat exchanger and a secondary loop mineral oil coolant system.

The ozone generation system produces large quantities of excess heat, which must be extracted for the safe operation of the equipment, but also to assist in the efficient production of ozone, as temperature is an important factor in the conversion of oxygen to ozone. The ozone cooling water system provides two major functions necessary to allow the generation of ozone feed gas:

- Cools ozone dielectric tubes and their contents in the three generators
- Cools the electrical equipment in the three power supply units

4.5.3 Description

Typical Set of Ozone Cooling Water Pumps
(OCWP-1 to 4)

The ozone cooling water pumps (OCWP-1 to 4) draw suction from the backwash water wet wells. The pumps provide water to the Ozone Generator Room for cooling the generators and PSUs. The return cooling water is discharged into the ozonated water channel. The four ozone cooling water pumps are located in the area of the Central Pipe Gallery near the backwash supply pumps. Two pumps are located on each side of the gallery. A common 12-inch diameter suction header reduces to 8-inch diameter after the first pump. The 8-inch discharge line is common for each set of pumps and combines to create a single header along the top wall of the gallery directly below the ozone generators. The header reduces to 6-inch diameter as it approaches the fourth slot for a future generator. Each generator has an isolation valve on the 6-inch diameter inlet side of the cooling water loop.

Typical Ozone Generator Cooling Water Flow Meter Gauge

Typical Ozone Generator Cooling Water Flow Control Valve

Flow through the generator needs to be monitored and controlled. The magnetic flowmeter located on the discharge line has a local gauge that reads in percent, but is converted to gallons per minute through SCADA. The motorized control valve is also located on the discharge line. The motorized control valve is an intricate part of the Ozone Generator Control Logic.

The PSU cooling loops are cooling water lines that are also intricate to the Ozone Generator Control Logic. The lines have flow meters and a motorized flow control valve. The supply

cooling water is connected to a plate heat exchanger that cools mineral oil. The cooled mineral oil along with internal air conditioning units is what cools the PSUs.

Typical Cooling Water Air Break Assembly

The cooling water discharge lines run to an air break assembly adjacent to the associated ozone generator.

Ozone Cooling Water Return Valves (OCWD-BFV-1 and 2)

The collected water drops into a common 12-inch diameter header (reduced at the fourth generator slot) that splits again to allow discharge flow into either the north or the south ozonated water channel. The channel can be separated by a stop log assembly in the event that one side of the plant is offline. Each side of the discharge header has a motorized isolation butterfly valve (OCWD-BFV-1 and 2).

Table 4.5-1 provides system data for the ozone cooling water system.

Table 4.5-1
System Data - Ozone Cooling Water System

Component / Criteria	Value
Cooling Water Pumps	
Tag	OCWP-1 to 4
Number	4
Manufacturer	Crane/Deming
Model	3031
Size	4x3x10
Type	Horizontal end suction, centrifugal
Capacity	300 gpm @ 65ft TDH
Horsepower, hp	10

4.5.4 Operation

Prestart Checks

1. Verify that cooling water is available.
2. Verify that the sodium hypochlorite feed line to the Backwash Wet Well is closed and that the wet well is chlorine free.
   Note: Chlorinated water may be harmful to the cooling water loop and the ozone generation equipment being cooled.
3. Check that it is safe to discharge cooling water to the ozonated water channel.
4. Check that all cooling water pumps and piping to the ozone generators and PSU's are in service and that all valves are in the appropriate position.

5. Confirm internal PSU cooling circuits are in service.
6. Instruments associated with the ozone system, both process and safety devices are on and functioning properly. Note that some instruments will have an extended "warm-up" period.
7. Reset all alarms.

Startup

1. At the MCC controls place the "Hand/Off/Remote" selector switch in the "Remote" position for the in-service pumps.
2. At the HMI place the cycle select to "Manual" and select the desired pump to be called as "Lead." Place the cycle select back to "Auto."
3. Verify that the cooling water pumps to be available for automatic cycle control indicate that they are in "Remote" and "Auto."
4. When an ozone generator/PSU is called to run the selected pump will start.

Normal Operation

A cooling water pumps run automatically when a generator/PSU is called to run. An additional pump will be called to run as each generator/PSU is called to run. One pump should prove an adequate supply of cooling water for each ozone generation system.

ozone concentration value, ozone percent by weight (%03), by the OGCP PLC software concentration controller AIC-4075-1, -2, -3. The ozone concentration SP (Operator entered) signal is sent to each ozonator control panel from the OSCP via the network.

Discharge ozonated oxygen temperature of each ozonator is continuously monitored by its respective temperature transmitters, TIT-4070-1, -2, -3. Each transmitter sends a 4-20 mA DC signal to the OGCP PLC and the signal are sent to the OSCP and PSS for display. The OGCP PLC logic provides an OZONE OUTLET TEMP HIGH alarm that will shutdown its respective ozonator. The alarm will be displayed at the OGCP and sent to the OSCP and PSS for display.

Automatic isolation valves (CV-4080-1, -2, -3) are provided at the outlet of each unit. The valves are signaled to open whenever their respective ozonator is selected to start or purge.

The ozonator shells and PSUs are water cooled to remove heat that is produced during the generation of ozone. There are no control functions for the shell and PSU cooling water, except for alarms.

Cooling water from each PSU is continuously monitored for flow and temperature by its respective transmitters FIT-4110-1, -2, -3 and TIT-4105-1, -2, -3. Each transmitter sends a 4-20 mA DC signal to the OGCP PLC and the signal is sent to the OSCP and PSS for display. The PSU outlet water temperature also is monitored by the outlet water high temperature switch TSHH4105-1, -2, -3. The OGCP PLC logic provides a CW OUTLET TEMP HIGH alarm that will shutdown its respective ozonator. The alarm will be displayed at the OGCP and sent to the OSCP and PSS for display. The PSU outlet water flow also is monitored by the outlet water low flow switch FSL4110-1, -2, -3. The OGCP PLC logic provides a CW OUTLET FLOW LOW alarm that will shutdown its respective ozonator. The alarm will be displayed at the OGCP and sent to the OSCP and PSS for display.

Cooling water from each ozonator shell is continuously monitored for flow and temperature by its respective transmitters FIT-4095-1, -2, -3 and TIT-4090-1, -2, -3. Each transmitter sends a 4-20 mA DC signal to the OGCP PLC and the signal is sent to the OSCP and PSS for display. The PSU outlet water temperature also is monitored by the outlet water high temperature switch TSHH4090-1, -2, -3. The OGCP PLC logic provides a SHELL CW OUTLET TEMP HIGH alarm that will shutdown its respective ozonator. The alarm will be displayed at the OGCP and sent to the OSCP and PSS for display. The PSU outlet water flow also is monitored by the outlet water low flow switch FSL4095-1, -2, -3. The OGCP PLC logic provides a SHELL CW OUTLET FLOW LOW alarm that will shutdown its respective ozonator. The alarm will be displayed at the OGCP and sent to the OSCP and PSS for display.

Ambient air in the Ozone Generator Room is continuously monitored by two (2) ambient ozone analyzers (AIT-4003-1, -2). AIT-4003-1, -2 displays and transmits the amount of ozone in the room. Its range is 0-10 ppm/v. Should the ozone concentration exceed 0.1 ppm/v, the analyzer high switch will activate an AMBIENT OZONE HIGH alarm relay in the OAP and send a signal to the OSCP. The AMBIENT OZONE HIGH alarm will shutdown the ozone generators. Starting of the ozone generators is disabled until this alarm is inactive.

The room is also continuously monitored for oxygen level via two (2) ambient oxygen analyzer (AIT-4002-1, -2). In the event of an oxygen leak, should the oxygen concentration exceed 22%, the analyzer high switch will activate an AMBIENT OXYGEN HIGH alarm relay in the OAP and send a signal to the OSCP. The AMBIENT OXYGEN HIGH alarm will shutdown the ozone generators. Starting of the ozone generators is disabled until this alarm is inactive.

Scoot Candler WTP Ozone System Alarm List

INSTRUMENT / CONTROL LOOP	DESCRIPTION	Panel	SWD SHEET	P&ID SHEET	SETPOINTS / ACTION					Comment
					Alarm	Normal Shutdown	Emergency Shutdown	Operator Adjustable	Adjustable in Program	
FALL-4095-1	GEN #1 CWR FLOW LOW-LOW	OGCP	GEN-07	4		100 GPM				
PAL-409-1	PSU #1 COOLANT PRESSURE LOW	OGCP	GEN-09	5		X				
TAH-408-1	PSU #1 HV TRANS TEMP HIGH	OGCP	GEN-09	5		X				
TAH-403-1	PSU #1 12-PULSE TRANS TEMP HIGH	OGCP	GEN-09	5		X				
TAH-404-1	PSU #1 INVERTER TEMP HIGH	OGCP	GEN-09	5		X				
PAH-405-1	PSU #1 CAP BANK PRESSURE HIGH	OGCP	GEN-09	5						
TAH-405-1	PSU #1 DIODE BRIDGE TEMP HIGH	OGCP	GEN-09	5		X				
TAH-406-1	PSU #1 12-PULSE TRANS CAB TEMP HIGH	OGCP	GEN-09	5		X				
TAH-407-1	PSU #1 INVERTER CAB TEMP HIGH	OGCP	GEN-09	5		X				
JA-410-1	PSU #1 INVERTER FAULT	OGCP	GEN-08	5		X				INCLUDES DIELECTRIC TUBE FAILURE.
SAH-406-1	PSU #1 OUTPUT FREQUENCY HIGH	OGCP	GEN-12	5	>1000 HZ	900 HZ				Range 1-1000 HZ from Digital Controller
ZA-40X-1	PSU #1 CABINET DOOR(S) AJAR	OGCP	GEN-08	5		X				
JA-400-1	PSU #1 EMERGENCY STOP	OGCP	GEN-08	5		X				
XA-400-1	PSU #1 EXTERNAL INTERLOCK SHUTDOWN	OGCP	GEN-07	5			X			
EAH-400-1	PSU #1 VOLTAGE HIGH	OGCP	GEN-02	5		495 VAC				From C-H IQ Analyzer Power Monitor JT-400-1
IAH-400-1	PSU #1 CURRENT HIGH	OGCP	GEN-02	5		750 A				From C-H IQ Analyzer Power Monitor JT-400-1
FAL-4110-1	PSU #1 COOLING WATER FLOW LOW	OGCP	GEN-12	5	3 GPM					Operator Setpoint Range: 2 - 5 GPM
FALL-4110-1	PSU #1 COOLING WATER FLOW LOW-LOW	OGCP	GEN-08	5		2 GPM				
TAH-4105-1	PSU #1 COOLING WATER TEMP HIGH	OGCP	GEN-12	5	100° F					Operator Setpoint Range: 90°F to 110°F
TAHH-4105-1	PSU #1 COOLING WATER TEMP HIGH-HIGH	OGCP	GEN-08	5		110° F				ADJUSTABLE ON DEVICE.
XA-202-2	GEN #2 SHELL DOOR(S) AJAR	OGCP	GEN-09	4	X	X				DISCRETE FIELD SWITCH. .
FAL-4050-2	GEN #2 O2 INLET FLOW LOW	OGCP	GEN-13	4		5 SCFM			X	Operator Setpoint Range: 5 - 20 SCFM
FAH-4050-2	GEN #2 O2 INLET FLOW HIGH	OGCP	GEN-13	4	225 SCFM				X	Operator Setpoint Range: 200 - 225 SCFM
TAL-4050-2	GEN #2 O2 INLET TEMP LOW	OGCP	GEN-13	4		40° F			X	Operator Setpoint Range: 50°F to 60°F
TAH-4050-2	GEN #2 O2 INLET TEMP HIGH	OGCP	GEN-13	4		95° F			X	Operator Setpoint Range: 90°F to 100°F
PAL-4060-2	GEN #2 O2 INLET PRESSURE LOW	OGCP	GEN-12	4		10 PSIG				ADJUSTABLE ON DEVICE.
PAH-4060-2	GEN #2 O2 INLET PRESSURE HIGH	OGCP	GEN-12	4		20 PSIG				ADJUSTABLE ON DEVICE.
TAH-4070-2	GEN #2 O3 OUTLET TEMP HIGH	OGCP	GEN-07	4		120° F				
AAL-4075-2	GEN #2 O3 OUTLET CONC LOW	OGCP	GEN-13	4	<90% OF SP			X	X	Operator Setpoint Range: 2 - 4% O3
AAH-4075-2	GEN #2 O3 OUTLET CONC HIGH	OGCP	GEN-13	4	>110% OF SP			X	X	Operator Setpoint Range: 12 - 16% O3
YA-4075-2	GEN #2 O3 OUTLET CONC FAILURE									
TAH-4090-2	GEN #2 CWR TEMP HIGH	OGCP	GEN-12	4	100° F			X	X	Operator Setpoint Range: 90°F to 110°F
TAHH-4090-2	GEN #2 CWR TEMP HIGH-HIGH	OGCP	GEN-07	4		110° F				ADJUSTABLE ON DEVICE.
FAL-4095-2	GEN #2 CWR FLOW LOW	OGCP	GEN-13	4	150 GPM				X	Operator Setpoint Range: 150 - 170 GPM
FALL-4095-2	GEN #2 CWR FLOW LOW-LOW	OGCP	GEN-07	4		100 GPM				
PAL-409-2	PSU #2 COOLANT PRESSURE LOW	OGCP	GEN-09	5		X				
TAH-408-2	PSU #2 HV TRANS TEMP HIGH	OGCP	GEN-09	5		X				
TAH-403-2	PSU #2 12-PULSE TRANS TEMP HIGH	OGCP	GEN-09	5		X				
TAH-404-2	PSU #2 INVERTER TEMP HIGH	OGCP	GEN-09	5		X				
PAH-405-2	PSU #1 CAP BANK PRESSURE HIGH	OGCP	GEN-09	5		X				
TAH-405-2	PSU #2 DIODE BRIDGE TEMP HIGH	OGCP	GEN-09	5		X				
TAH-406-2	PSU #2 12-PULSE TRANS CAB TEMP HIGH	OGCP	GEN-09	5		X				
TAH-407-2	PSU #2 INVERTER CAB TEMP HIGH	OGCP	GEN-09	5		X				
JA-410-2	PSU #2 INVERTER FAULT	OGCP	GEN-08	5		X				INCLUDES DIELECTRIC TUBE FAILURE.
SAH-406-2	PSU #2 OUTPUT FREQUENCY HIGH	OGCP	GEN-12	5	>1000 HZ	900 HZ				Range 1-1000 HZ from Digital Controller
ZA-40X-2	PSU #2 CABINET DOOR(S) AJAR	OGCP	GEN-08	5		X				
JA-400-2	PSU #2 EMERGENCY STOP	OGCP	GEN-08	5		X				
XA-400-2	PSU #2 EXTERNAL INTERLOCK	OGCP	GEN-07	5			X			