

## Chapter 8 - Periodic Safety Test Procedure

### TMS SYSTEM 2000 BOILER AUTOMATION TEST PROCEDURE

SS EL YUNQUE

REVISED 2 / 26 / 99

EL FARO does not use the TMS system. The EL FARO was updated to a system designed and built by Nortech.

**NOTES:**

- 1) "Alarm energized" means that the appropriate light flashes, and the horn sounds, until the alarm acknowledge button is pressed, at which point the horn is silenced and the lamp remains on steady until alarm condition is clear.
- 2) Unless otherwise specified, all local manual bypass controls must be in the Auto position, the Burner Sequence in MANUAL sequence, and the Combustion Control in the normal operating mode.

### SECTION I – BOILER CONTROLS

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK	
				S	P
1.	<b>LAMP TEST</b>	This should be done at the operating console and at the local panel. Press the lamp test push button.	1) Horn sounds for a very short time. 2) All lamps light.		
2.	<b>MANUAL BOILER TRIP</b>	While tested boiler is on the line, at either panel push the BOILER TRIP button on the tested boiler	1) Main Oil Valve closed within 4 seconds. 2) All Burner Oil Valves closed within 4 seconds. 3) BOILER TRIPPED alarm energized. 4) Post purge cycle initiated, PURGE IN PROGRESS light illuminated.		
3.	<b>DRUM LEVEL HIGH/LOW ALARMS</b>	A) Place the feedwater control in MANUAL and raise the drum level to +6 inches.	Note HIGH DRUM LEVEL alarm is energized.		

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK	
				S	P
		B) Next, raise the drum level to +8 inches.	Note HI-HI DRUM LEVEL alarm is energized.		
		C) Next lower the drum level to -6 inches.	Note LOW DRUM LEVEL alarm is energized.		
4.	<b>LOW-LOW DRUM LEVEL ALARM AND TRIP</b>	While the tested boiler is on the line, put the feedwater system in MANUAL, and run the level down to -8 inches. The alarm and trip have a time delay of not more than 15 seconds.	<b>Note the following:</b> 1) LOW-LOW DRUM LEVEL alarm energized. 2) Main Oil Valve closed within 4 seconds. 3) All Burner Oil Valves closed within 4 seconds. 4) BOILER TRIPPED alarm energized. 5) All air registers close and no automatic post purge.		
5.	<b>FORCED DRAFT FAN FAIL ALARM AND TRIP</b>	While tested boiler is on the line, stop the Forced Draft Fan.	<b>Note the following</b> 1) FD FAN FAILURE alarm energized. 2) Main Oil Valve closed within 4 seconds. 3) All Burner Oil Valves closed within 4 seconds. 4) BOILER TRIPPED alarm energized. 5) No automatic post purge.		
6.	<b>LOW AIR FLOW ALARM</b>	While tested boiler has only one burner in operation, set boiler to minimum firing rate, put FD Fan on low speed, and close air damper all the way.  Note: If the FD Fan damper does not close sufficiently, it may be necessary to operate the Fuel / Air Ratio controller in MANUAL in order to "fake" a low air signal.	<b>Note the following:</b> 1) Flashing LOW AIR FLOW alarm on Burner Mgmt Local Panel. 2) Boiler trips after 15 sec. 3) All Burner Oil Valves closed within 4 seconds. 4) BOILER TRIPPED alarm energized. 5) All air registers close and no automatic post purge.		

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK	
				S	P
7.	<b>LAST FLAME OUT ALARM AND TRIP</b>	While tested boiler has only one burner in operation, close the manual fuel oil to burner root valve for the operating burner.	<b>Note the following:</b> 1) FLAME FAILURE alarm for particular burner. 2) Main Oil Valve closed. 3) Burner Oil Valve closed. 4) BOILER TRIPPED alarm energized. 5) All air registers close and no automatic post purge.		
8.	<b>BOILER CONTROL POWER</b>	While tested boiler is on the line, turn power off to Burner Management system via breaker CBB.	<b>Note the following:</b> 1) Main Oil Valve closed. 2) All Oil Valves closed. 3) All air registers close and no automatic post purge.		
9.	<b>BURNER SAFETY TRIP CONTROL</b>	Two burners must be operating for this test and the Burner Management must be in MANUAL SEQUENCE.  A) Close the manual fuel oil to burner root valve on the burner front of an operating burner on the tested boiler.	<b>Note the following:</b> 1) FLAME FAILURE alarm for that burner. 2) Burner Oil Valve closes. 3) Air Register for that burner closes.		
		B) Now press C) Burner Stop / Reset for the tested burner.	<b>Note the following:</b> 1) Flame Failure alarm light clears.		
		D) With boiler under test in manual sequence, operate the burner inserted mechanical interlock lever for an operating burner by any practical means.	<b>Note the following:</b> 1) Tested burner trips. 2) Burner out of service light illuminates for tested burner.		
10.	<b>TRIAL FOR IGNITION</b>	A) With boiler under test in Manual Sequence, and a PURGE COMPLETE is accomplished, press Burner Start for a burner. While that burner is sequencing, press Burner Start for another burner.	<b>Note the following:</b> The first burner started, but the second burner did not start.		

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK	
				S	P
		B) With boiler under test in Manual Sequence, and one burner firing, turn the air supply off to the igniter solenoid valve for another burner. Press Burner Start for this burner.	<p><b>Note the following:</b></p> <ol style="list-style-type: none"> <li>1) The igniter will not insert, the IGNITER INSERTED light remains off, and the igniter does not energize.</li> <li>2) BURNER TROUBLE alarm initiated.</li> <li>3) The fuel valve will not open because the igniter is not energized.</li> <li>4) After trial for ignition is completed, FLAME FAIL alarm will energize.</li> </ol>		
		C) With boiler under test in Manual Sequence, and one burner firing, turn off the circuit breaker to the igniter for another burner. The igniter circuit breakers are located in the Local Panels. Press Burner Start for this burner.	<p><b>Note the following:</b></p> <ol style="list-style-type: none"> <li>1) The igniter will insert, but does not energize.</li> <li>2) Since the igniter will not energize, the igniter inserted light will not flash fast as it does when it is energized and inserted.</li> <li>3) The fuel valve will not open because the igniter is not energized.</li> <li>4) After trial for ignition is completed, FLAME FAIL alarm will energize.</li> </ol> <p><i>Note: After alarm is silenced, press Burner Stop to reset FLAME FAIL alarm.</i></p>		
10.	TRIAL FOR IGNITION (cont)	D) With one burner firing for boiler under test, and boiler in Manual Sequence, shut the manual burner valve for another burner. Now press the Burner Start button for that burner.	<p><b>Note the following:</b></p> <ol style="list-style-type: none"> <li>1) Ignition cycle initiates as normal except no flame signal is present.</li> <li>2) After trial for ignition period (15 seconds) igniter de-energizes and retracts, fuel valve closes, air register closes and FLAME FAIL alarm energizes for the burner under test.</li> </ol> <p><i>Note: After alarm is silenced, press Burner Stop to reset FLAME FAIL alarm.</i></p>		

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK			
				S	P		
11.	PURGE CYCLE	To initiate a Purge cycle, the boiler must be tripped, the Forced Draft Fan must be operating, the Combustion Control Master must be in AUTO, the Air Controller must be in CASCADE, the boiler drum level must not be too low, and all Flame Failure alarms must be cleared by pressing the appropriate Burner Stop / Reset pushbuttons.					
		A) Now press any Burner Start button to initiate a purge.	<b>Note the following:</b> 1) WAITING FOR PURGE light illuminates 2) Air damper opens, and air flow increases to the purge setpoint. 3) PURGE IN PROGRESS light illuminates. 4) WAITING FOR PURGE light is extinguished.				
		B) Before the purge time is completed, close the fan damper manually from Air Controller.	<b>Note the following:</b> 1) PURGE IN PROGRESS light extinguished 2) WAITING FOR PURGE light illuminated.				
		C) Release the fan damper to Cascade.	Note the purge cycle resumes when sufficient air flow is restored.				
		D) Before the purge time is completed, manually open an automatic burner oil valve (be sure the stop valve is closed). There may be a time delay of up to 10 seconds for the alarm.	<b>Note the following:</b> 1) PURGE IN PROGRESS light extinguished 2) FLAME FAIL alarm energized 3) BURNER TROUBLE alarm energized.				
		E) Now close the burner valve, reset the flame fail, and start the purge cycle. Before the purge time is completed, manually close any air register.	<b>Note the following:</b> 1) PURGE IN PROGRESS light extinguished. 2) WAITING FOR PURGE light illuminated. 3) BURNER TROUBLE alarm energized.				

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK			
				S	P		
		F) Now open the air register to resume the Purge cycle.	<b>Note the following:</b> 1) After 30 seconds, the PURGE COMPLETE light illuminates. 2) The PURGE IN PROGRESS light is extinguished. 3) After the air flow has come down to the lightoff flow rate the BURNER READY lights will illuminate.				
		G) Wait 3 minutes.	<b>Note the following:</b> 1) The PURGE COMPLETE light will extinguish. 2) The BURNER READY lights will extinguish				
12.	<b>BOILER IN BYPASS INDICATION</b>	At the Local Panel for the tested boiler, first be sure that all selector switches are in the AUTO position and the BOILER IN BYPASS indicator light is off, then turn any selector switch out of the AUTO position.	Observe the BOILER IN BYPASS light is illuminated and flashing on both the Local Panel and in the Engineers Operating Console.				
13.	<b>POWER FAILURE ALARMS</b>	A) Open circuit breaker PCBB10 that supplies 120VAC to the Port Igniter actuator circuit.	Note the BURNER MANAGEMENT 120VAC FAIL alarm activated.				
		Reset breaker.	Note alarm is cleared.				
		<b>Note: During the following procedures the boiler will trip if it is online.</b>					
		B) Open port burner mgmt circuit breaker PCBB1 that supplies 120VAC to the Port PLC.	Observe among other alarms, that the BURNER MANAGEMENT PLC FAIL alarm is activated.				

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK	
				S	P
		C) While the boiler is in operation but off line, open circuit breaker PCBB7 which supplies the Port burner solenoid valve circuits with 120VAC . Boiler will trip.	Observe among other alarms, the BURNER MANAGEMENT 120VAC FAIL alarm activated.		
		Reset breaker.	Note alarm is cleared.		
		D) Restart boiler. Open circuit breaker PCBB8 which supplies 120VAC to the Main and Recirc oil valves. Boiler will trip.	Observe among other alarms, the BURNER MANAGEMENT 120VAC FAIL alarm activated.		
		Reset breaker.	Note alarm is cleared.		
		E) While the boiler is in operation, open circuit breaker 24VP43-1 which supplies 120 volt power to the port Combustion Control. Boiler will trip.	Observe among other alarms, the COMBUSTION CONTROL 120VAC FAIL alarm activated.		
		Reset breaker.	Note alarm is cleared.		
		Repeat (A) through (E) for Stbd circuits, substituting breaker 23VP43-1 for 24VP43-1 in item (E).			
14.	<b>ATOMIZING STEAM LOW PRESSURE ALARM</b>	Make sure the burner to be tested has a burner in place and that the Burner Out of Service switch is in the IN position so the BURNER OUT OF SERVICE indicator light is not on. Shut the valve to the pressure switch and bleed off the pressure until less than setpoint.	Observe ATOMIZING STEAM LOW PRESSURE alarm.		
		Repeat for all burners.			

STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK	
				S	P
15.	<b>FUEL OIL LOW PRESSURE ALARM</b>	Put the Burner Fuel Controller in MANUAL, and adjust the fuel pressure down to below the minimum fuel setpoint (about 30 PSI).	Observe F.O. LOW PRESSURE alarm energized.		
16.	<b>PROCESS CONTROLLER OPERATION</b>	Proper operation in the MANUAL and AUTOMATIC (or CASCADE as required) modes for all process controllers must be proven. This is to be done by observing proper response in the AUTOMATIC (or CASCADE) mode, and watching the process change in the MANUAL mode. Test manual operation first, then change to AUTO or CASCADE as required and note proper operation. The controllers and correct modes are indicated below:			
		A) P & S Master Controllers. M and A modes.  <i>Note: Select INDIVIDUAL mode on the Boiler Master selector switch for this test.</i>	Observe proper operation.		
		B) P & S Furl / Air Ratio Controllers. Test MANUAL mode only as AUTO mode is only available at higher plant loads.	Observe proper operation.		
		C) P & S Air Controllers. M and C modes.	Observe proper operation.		
		D) P & S Fuel Controllers. M and C modes.	Observe proper operation.		
		E) P & S Drum Level Controllers. M, or A modes.	Observe proper operation.		
		F) #1 Feedpump Controller. M and C modes.	Observe proper operation.		
		F) #2 / In Port Feedpump Controller.  M and C modes.	Observe proper operation.		



STEP	OBJECTIVE	PROCEDURE	RESULT	CHECK	
				S	P
		G) DC Heater Level Controller. M and A modes.	Note: If the controller is in automatic, a normal level results in a 50% signal from the controller which closes both the Dump and Makeup valves. A 0% output results in a 100% makeup signal, and a 100% output results in a 100% dump signal.		
		H) Hotwell Level Controller. M and A modes..	It may be impossible to affect the process while at hotel load		
		I) Fuel Oil Pressure Controller. M and C modes.	Observe proper operation.		
		J) Fuel Oil Temperature Controller. M and C modes.	Observe proper operation.		
		K) Auxiliary Exhaust Makeup Controller. M and A modes.	Observe proper operation. This controller operates as the "master" unit, and sends setpoint and other signals to the following "slave" unit.		
		L) Auxiliary Exhaust I.P. Bleed / Dump Controller. M and C modes.	Observe proper operation. This controller operates as two separate "slave" units which respond to signals from the previous "master" unit. Each unit controls one valve – the I.P. Bleed or Dump valves.		