Functional Test

Project _____

FT- BOILER SYSTEM

HW Boilers B-1 & 2 (condensing) and B-3, 4; 5, Including Associated Primary HW Pumps 1, 2, 3, 4; 5 and Secondary Pumps 6, 7; 8 and Their Variable Speed Drives

1. Participants

Party	Participation

Party filling out this form and witnessing testing _____
Dates of tests _____
Dates of tests _____
Dates of tests _____

2. Test Prerequisites

a. __ The following have been started up and startup reports and prefunctional checklists submitted and approved ready for functional testing:
   __ Boilers
   __ Heating water pumps
   __ Heating water piping and valves
   __ Variable speed drives

b. __ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules and with debugging, loop tuning and sensor and device calibrations completed. _____ _____
   Controls Contractor Signature or Verbal Date

c. __ Piping system flushing complete and required report approved.
d. __ Water treatment system complete and operational.
e. __ Vibration control report approved (if required).
f. __ Test and balance (TAB) complete and approved for the hydronic system.
g. __ All A/E punchlist items for this equipment corrected.
h. __ These functional test procedures reviewed and approved by installing contractor.
i. __ Safeties and operating ranges reviewed.
j. __ Test requirements and sequences of operation attached.
k. __ Schedules and setpoints attached.
l. __ Sufficient clearance around equipment for servicing.
m. __ Have all energy savings control strategies, setpoints and schedules been incorporated that this boiler and control system are capable of? If not, list recommendations below.

Notes:

n. __ **BAS Program Review.** Review the BAS software control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.

o. __ **Packaged Control Program Review.** Review the packaged control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.

p. __ Record made of All Values for Current Setpoints (SPt), Control Parameters, Limits, Delays, Lockouts, Schedules, Etc. Changed to Accomodate Testing:

Parameter	Pre-Test Values	Returned to Pre-Test Values √
Space Temp. Setpts		
Boiler enable OSAT setpoint		
Capacity (%) on lead condensing boiler when lag condensing boiler will start:		
Capacity (%) on HWB 1 & 2 at which time HWB-3; 4 or 5 stage up		
Time delay between stages		
Setpoint range for condensing boilers:	120F-180F	
Differential pressure setpoint: Basement: Penthouse:		
Supply temp. reset schedule:	OSAT HWST 25F 180F 65F 140F	
Changes for False Loading:		

3. Sensor Calibration Checks. Check the sensors listed below for calibration and adequate location. This is a sampling check of calibrations done during prefunctional checklisting.

"In calibration" means making a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) compared to the test instrument-measured value is within the tolerances specified in the prefunctional checklist requirements (_____). If not, install offset in BAS, calibrate or replace sensor. Use the same test instruments as used for the original calibration, if possible.

Sensor & Location	Location OK[1]	**1st** Gage or BAS Value	Instrument Measured Value	**Final** Gage or BAS Value	Pass Y/N?
OSAT					
HWST (bldg loop)					
HWRT (bldg loop)					

Notes:

Sensor & Location	Location OK[1]	**1st** Gage or BAS Value	Instrument Measured Value	**Final** Gage or BAS Value	Pass Y/N?
HWB-1 & 2		B-1 B-2	B-1 B-2	B-1 B-2	
Gage supply temperature					
BAS supply temperature					
Main HW supply temp (HWS-T-1)					
HWB-3; 4; 5		B-3 B-4 B-5	B-3 B-4 B-5	B-3 B-4 B-5	
Gage supply temperature					
BAS supply temperature					
Main HWS temp. (HWS-T)					
Main HWR temp. (HWR-T)					
HW-DP in Boiler Rm.		BAS:	[3]TAB:		
HW DP in Penthouse		BAS:	[3]TAB:		
HW DP in Basement		BAS:	[3]TAB:		
HW Flow		BAS:	[3]TAB:		
[2]VFD HWP-6		BAS:	VFD Panel:		
[2]VFD HWP-7		BAS:	VFD Panel:		
[2]VFD HWP-8		BAS:	VFD Panel:		

[1]Sensor location is appropriate and away from causes of erratic operation.
[2]At any speed.
[3]During TAB, the TAB contractor shall compare their instrument readings with BAS readings.

4. Device Calibration Checks. The actuators or devices listed below checked for calibration. This is a spot check on a sample of the calibrations done during prefunctional checklisting and startup.

"In calibration" means observing a readout in the BAS and going to the actuator or controlled device and verifying that the BAS reading is correct. For items out of calibration or adjustment, fix now if easy, via an offset in the BAS, or a mechanical fix.

Device or Actuator & Location	**Procedure / State**	Expected Value	Site Observation	**Final Values**	Pass Y/N

5. Verification of Misc. Prefunctional Checks.

Misc. site checks of the prefunctional checklist and startup reports completed successfully. Pass? Y / N _____

Notes:

General Conditions of Test and Seasonal Testing

The primary testing will occur during typical winter weather with significant heating loads. Because the boiler will be operated year-round, the trends described in Procedures 19 and 28a will be repeated during warmer weather to ensure that boiler use is minimized during the off-season.

False Loading. Be prepared to raise the space temperature setpoints to cause a real load on the heating system. Also, be prepared to manually lock the economizers in full open position and to lock the minimum OSA fan dampers in full open position to increase the heating load.

Trending During Testing. Prior to beginning testing, set up the following trends:
1. Secondary Pumping: HWP 6, 7; 8 speed, HW-DP setpoint, HW-DP pressure, penthouse loop DP, basement loop DP, all heating coil valve positions for AHU-5, 6, 11 and 12, and heating water flow (HW-F). Trend at 5 minute intervals during testing.
2. HWS-T Control. Trend the HWS-T and OSAT at 5 minute intervals during the testing to verify constancy of HWS-T.

Notes:

6. Testing Procedures and Record

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
Staging Up					
1 Seq. 1-4		1) During OSAT < 65F, manually shut OFF boilers and keep pumps running on manual to lower boiler water temperature to < 120F. 2) With the boilers OFF, and boiler water temperature < 120F, overwrite the OSAT to be 66F and turn all systems to auto. 3) Overwrite the OSAT to be 64F.	2) Boilers and all pumps should remain OFF. 3) A secondary pump should start. After _____ [_____] minutes delay, SF-3, HWP-1 AND HWP-2 and B-1 or B-2 start.		
2 Seq. 5		Observe the command to the condensing boilers. Release the overwritten OSAT to be actual.	The command should be between 120F and 180F [_____].		
3 Seq. 6, 7; 8		Lower the delay time between all stages to 3 minutes. Observe the staging of the condensing boilers.	When the lead condensing boiler reaches 68% [_____%], the lag condensing boiler starts. When both condensing boilers reach 95% [_____%], for 3 minutes [_____], the lead main HW boiler pump starts [B-____ and HWP-____] and the lead boiler fires at low [_____] fire. Just prior to the main lead boiler starting the loop HWS temp. (HWS-T) is [_____F] & the return (HWR-T) is [_____F].		
4 Seq. 9		Observe the modulation of the condensing boilers.	Just after the lead main boiler starts, the condensing boilers should reduce from 95% loading [_____]. Two minutes after the lead main boiler starts, the loop HWS temp. (HWS-T) is [_____F] & the return (HWR-T) is [_____F]. By this time HWS-T should be within 3F of the temp. prior to the boiler staging.		
5 Seq. 10; 12		Continue observing during staging. Increase building load, as necessary, using methods above (list): _____ _____ _____ _____ _____	When both condensing boilers reach 95% [_____%] for 3 minutes [_____], the lead main boiler stages up to high [_____] fire. The condensing boilers modulate back. If both boilers are < 68% loaded [_____%] for _____ minutes [_____], one stages OFF.		
6 Seq. 11; 12		First lag boiler, low fire.	When both condensing boilers reach 95% [_____%] for 3 minutes [_____], the first lag main boiler starts at low [_____] fire. The condensing boilers modulate back. If both boilers are < 68% loaded [_____%] for _____ minutes [_____], one stages OFF.		

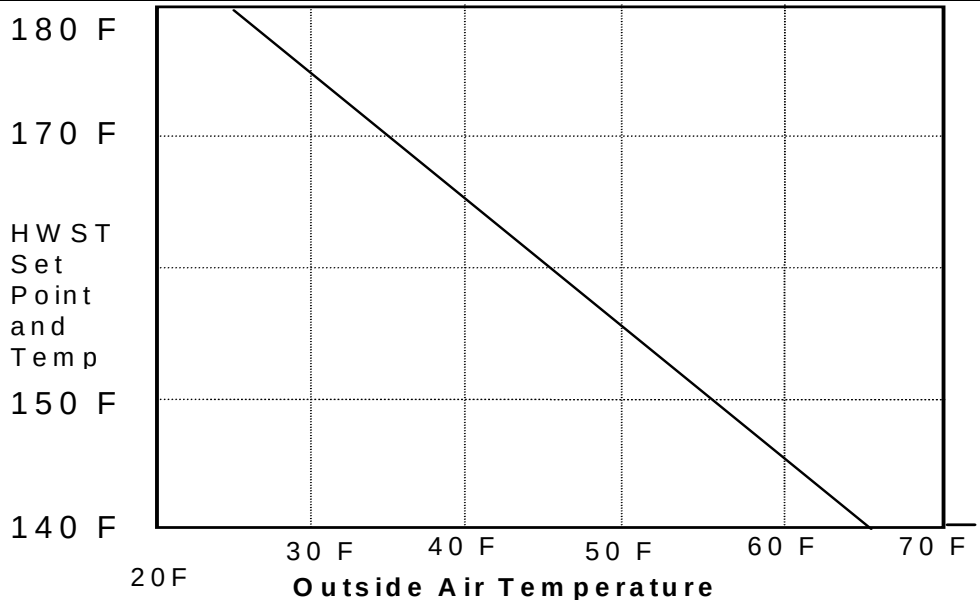
Notes:

Proced. No. & Spec. Seq. ID[1]	**Req ID No.[2]**	**Test Procedure[3] (including special conditions)**	**Expected and Actual Response[4]** [Write ACTUAL response in brackets or circle]	**Pass Y/N**	**Note #**
7 Seq. 11; 12		First lag boiler, high fire.	When both condensing boilers reach 95% [_____%] for 3 minutes [_____], the first lag main boiler stages up to high [_____] fire. The condensing boilers modulate back. If both boilers are < 68% loaded [_____%] for _____ minutes [_____], one stages OFF.		
8 Seq. 11; 12		Second lag boiler, low fire.	When both condensing boilers reach 95% [_____%] for 3 minutes [_____], the second lag main boiler starts at low [_____] fire. The condensing boilers modulate back. If both boilers are < 68% loaded [_____%] for _____ minutes [_____], one stages OFF.		
9 Seq. 11; 12		Second lag boiler, high fire.	When both condensing boilers reach 95% [_____%] for 3 minutes [_____], the second lag main boiler stages up to high [_____] fire. The condensing boilers modulate back. If both boilers are < 68% loaded [_____%] for _____ minutes [_____], one stages OFF.		
Staging Down Remove all false loading to cause no call for heating. (explain procedures)					
10 Seq. 13; 14		Second lag main boiler drops to low fire.	When condensing boiler setpoint drops to 120F [_____F] for 3 minutes [_____], the second lag main boiler drops to low fire. The condensing boilers modulate up to maintain their setpoint.		
11 Seq. 13; 14		Second lag main boiler drops OFF.	When condensing boiler setpoint drops to 120F [_____F] for 3 minutes [_____], the second lag main boiler drops OFF line. The condensing boilers modulate up to maintain their setpoint.		
12 Seq. 13; 14		First lag main boiler drops to low fire.	When condensing boiler setpoint drops to 120F [_____F] for 3 minutes [_____], the first lag main boiler drops to low fire. The condensing boilers modulate up to maintain their setpoint.		
13 Seq. 13; 14		First lag main boiler drops OFF.	When condensing boiler setpoint drops to 120F [_____F] for 3 minutes [_____], the first lag main boiler drops OFF line. The condensing boilers modulate up to maintain their setpoint.		

Notes:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
14 Seq. 13; 14		Lead main boiler drops to low fire.	When condensing boiler setpoint drops to 120F [_____F] for 3 minutes [_____], the lead main boiler drops to low fire. The condensing boilers modulate up to maintain their setpoint.		
15 Seq. 13; 14		Lead main boiler drops OFF.	When condensing boiler setpoint drops to 120F [_____F] for 3 minutes [_____], the lead main boiler drops OFF line. The condensing boilers modulate up to maintain their setpoint.		
16 Seq. 12; 15		Condensing boilers cycling OFF. Continue dropping the load or overwrite the HWS-T to be just high enough for the loop to be satisfied and no need for boilers.	When the condensing boilers are at 68% [_____%], one condensing boiler drops OFF line. When the condensing boiler setpoint drops to 120F [_____F] for 3 minutes [_____], the last condensing boiler and HWP-1; 2 drop OFF [_____] and SF-3 shuts OFF [_____].		
17 Seq. 16		Return the sytems to normal, keeping the delay time at 3 minutes. Let boilers start. Overwrite the OSAT to be 67F and the HWS-T to be 5F greater than the current setpoint of _____F.	After _____ minutes [_____], all boilers shut OFF.		
Misc. Sequences					
18 Seq. 17		HWST Reset. Overwrite the OSAT to be 15F, 25F, 40F; 65F. For each, record the HWS-T setpoint command on the graph below with a small box on the graph below.	All values should fall within 2F of the reset line.		
19 Seq. 17		**Trend Log.** Trend (not during testing) the OSAT, the HWS-T, HWS-T setpoint and the HWS-T minus HWS-T setpoint (the variance from setpoint), at 15 minute intervals from Thursday noon to Saturday noon.	All the (HWS-T minus HWS-T setpoint) values should be + or - 2F. Largest undershoot: [_____F]. Largest overshoot [_____F]. Number of values out of desired range (+/-2F): [_____data points] out of [_____] total points = [_____%] outside specified range.		
HWST Reset Chart. For each observation, mark the HWS-T setpoint with a box.			All values should fall within 2F of the reset line specified in the sequences.		

Notes:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
					
20 Seq. 18-19		Loop DP Control via Trending. Observe the Seconary Pumping trend logs performed during testing, specified in the General Conditions of Test section above.	The running secondary pump ramps up in speed to maintain the loop DP setpoint farthest from setpoint (bsmt or penthouse sensors). Observe that overshoot or undershoot of the two loop differential pressures (DP) is within +/- 10% of the setpoint magnitude. Bsmt greatest undershoot: [____psi = ____%]. Bsmt greatest overshoot: [____psi = _____%]. Penthouse greatest undershoot: [_____psi = _____%]. Penthouse greatest overshoot: [_____psi = _____%]. Number of values out of desired range (+/- 10%): [_____data points] out of [_____] total points = [_____%] outside specified range.		

Notes:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	**Test Procedure[3] (including special conditions)**	**Expected and Actual Response[4]** [Write ACTUAL response in brackets or circle]	**Pass Y/N**	**Note #**
21 Seq. 20		**Variable Speed Drive (VFD) on HWP-6.** (Note: VFD operation with multiple HW pumps operating is tested in procedures ____ and ____. 1. Carefully go over prefunctional checklist and programming record and identify anomalies. Record the low limits. 2. With only boiler associated with HWP-6 running and other boilers manually OFF, reduce all heating load or manually lower pump and remote differential pressure setpoints. See how low VFD will go. (This could be done during the Staging Down procedures above.) 3. Call for moderate heating or increase differential pressure setpoints. 4. Call for maximum cooling or increase differential pressure setpoints (keeping only 1 boiler ON). 5. Switch VFD into bypass operation, if feature available.	Motor manufacturer's recommended speed low limit = [_____% of max.]. 1. Low limit setting in drive: [_____Hz, rpm = _____% of maximum]. Provide reasons for low limit not being at motor mfr's low limit. List any anomalies noticed in programming: Also review any BAS software low limiting parameters. Verify that they are not unecessarily preventing pumps to modulate down to their safe minimum. 2. Lowest speed drive will go: [_____Hz, rpm]. Is this within 3 Hz of the low limit setting (or within a range equal to 5% of maximum speed)? Is pump and remote dP SP maintained without hunting? 3. Does VFD motor ramp up accordingly in a reasonable time? Is pump and remote dP SPt maintained without hunting? (This is verified in Procedure 20.) 4. Does VFD motor ramp to full speed in a reasonable time? Is pump and remote dP SPt maintained without hunting? (This is verified in Procedure 20.) 5. Verify that pump works in bypass mode.		

Notes:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
22 Seq. 20		**Variable Speed Drive (VFD) on HWP-7.** (Note: VFD operation with multiple HW pumps operating is tested in procedures ____ and ____. 1. Carefully go over prefunctional checklist and programming record and identify anomalies. Record the low limits. 2. With only boiler associated with HWP-7 running and other boilers manually OFF, reduce all heating load or manually lower pump and remote differential pressure setpoints. See how low VFD will go. (This could be done during the Staging Down procedures above.) 3. Call for moderate heating or increase differential pressure setpoints. 4. Call for maximum cooling or increase differential pressure setpoints (keeping only 1 boiler ON). 5. Switch VFD into bypass operation, if feature available.	Motor manufacturer's recommended speed low limit = [_____% of max.]. 1. Low limit setting in drive: [_____Hz, rpm = _____% of maximum]. Provide reasons for low limit not being at motor mfr's low limit. List any anomalies noticed in programming: Also review any BAS software low limiting parameters. Verify that they are not unecessarily preventing pumps to modulate down to their safe minimum. 2. Lowest speed drive will go: [_____Hz, rpm]. Is this within 3 Hz of the low limit setting (or within a range equal to 5% of maximum speed)? Is pump and remote dP SP maintained without hunting? 3. Does VFD motor ramp up accordingly in a reasonable time? Is pump and remote dP SPt maintained without hunting? (This is verified in Procedure 20.) 4. Does VFD motor ramp to full speed in a reasonable time? Is pump and remote dP SPt maintained without hunting? (This is verified in Procedure 20.) 5. Verify that pump works in bypass mode.		

Notes:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	**Test Procedure[3] (including special conditions)**	**Expected and Actual Response[4]** [Write ACTUAL response in brackets or circle]	**Pass Y/N**	**Note #**
23 Seq. 20		**Variable Speed Drive (VFD) on HWP-8.** (Note: VFD operation with multiple HW pumps operating is tested in procedures ____ and ____. 1. Carefully go over prefunctional checklist and programming record and identify anomalies. Record the low limits. 2. With only boiler associated with HWP-8 running and other boilers manually OFF, reduce all heating load or manually lower pump and remote differential pressure setpoints. See how low VFD will go. (This could be done during the Staging Down procedures above.) 3. Call for moderate heating or increase differential pressure setpoints. 4. Call for maximum cooling or increase differential pressure setpoints (keeping only 1 boiler ON). 5. Switch VFD into bypass operation, if feature available.	Motor manufacturer's recommended speed low limit = [_____% of max.]. 1. Low limit setting in drive: [_____Hz, rpm = _____% of maximum]. Provide reasons for low limit not being at motor mfr's low limit. List any anomalies noticed in programming: Also review any BAS software low limiting parameters. Verify that they are not unecessarily preventing pumps to modulate down to their safe minimum. 2. Lowest speed drive will go: [_____Hz, rpm]. Is this within 3 Hz of the low limit setting (or within a range equal to 5% of maximum speed)? Is pump and remote dP SP maintained without hunting? 3. Does VFD motor ramp up accordingly in a reasonable time? Is pump and remote dP SPt maintained without hunting? (This is verified in Procedure 20.) 4. Does VFD motor ramp to full speed in a reasonable time? Is pump and remote dP SPt maintained without hunting? (This is verified in Procedure 20.) 5. Verify that pump works in bypass mode.		

Notes:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
24 Seq. 20-21		Staging Up of Secondary Pumps (via Trending.) Observe the Seconary Pumping trend logs performed during testing, specified in the General Conditions of Test section above. Three pumps ON.	From the trends, with only one secondary pump ON, when the flow at HW-F exceeds the rated gpm, _____ of one pump [_____gpm; _____rpm or Hz], for _____ minutes [_____], the first lag pump starts [_____] and both equalize in rpm or Hz [_____, _____]. With two secondary pumps ON, when the flow at HW-F exceeds the rated gpm of both ON pumps, _____ [_____ gpm; _____rpm or Hz], for _____ minutes [_____], the last lag pump starts [_____] and all three equalize in rpm or Hz [_____, _____, _____].		
25 Seq. 22		Staging Down of Secondary Pumps (via Trending.) Observe the Seconary Pumping trend logs performed during testing, specified in the General Conditions of Test section above. Staging from two to one pump.	From the trends, with three secondary pumps ON, when the flow at HW-F is less than the rated gpm of all ON pumps, _____ [_____gpm; _____rpm or Hz], by _____ gpm [_____], for _____ minutes [_____], the last lag pump stops [_____] and the remaining equalize in rpm or Hz [_____, _____]. With two secondary pumps ON, when the flow at HW-F is less than the rated gpm of both ON pumps, _____ [_____ gpm; _____rpm or Hz], by _____gpm [_____], for _____ minutes [_____], the last lag pump stops [_____].		
Unoccupied Mode					
26 Seq. 24		Change the current time to be unoccupied. Manually shut OFF AHU-5, 6, 11; 12. Overwrite the OSAT to be 50F. Set the boilers and pumps to normal.	Boilers and pumps should not come ON.		
27 Seq. 25		NLL. Continuing from Procedure 26, in the unoccupied mode, manually start one of the heating AHU's (_____).	Secondary pump(s) start [_____], EF-3 starts [_____], B-1 or B-2 start [_____] and the HWS-T setpoint is at 180F [_____F].		
28 Seq. 25		NLL. Continuing from Procedure 27, in the unoccupied mode, manually shut OFF the ON heating AHU(s) (_____).	All boilers stop [_____], secondary pump(s) stop [_____], EF-3 stops [_____].		

Notes:

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
28a Seq. 25		**Trend Log.** Trend (not during testing) the OSAT, the status of each boiler, rpm of each secondary HW pump, and the status of AHU-5, 6, 11; 12, at 15 minute intervals from Thursday noon to Saturday noon. Combine trend with that of Procedure 19 if desired.	Verify that the boilers are going ON and OFF according to the sequences and above criteria during unoccupied periods.		
Alarms and Safeties					
29	15555 .3.3.D	With at least one boiler ON in auto mode, manually shut OFF SF-3.	Boilers and primary pumps should shut down and an alarm should be registered in the BAS.		
30 Seq. 26	15555 .3.3.D	With the B-1 or B-2 ON, manually shut it OFF.	Lag B-1 or B-2 shall start and an alarm is generated in the BAS.		
31 Seq. 26	15555 .3.3.D	With each main boiler at a time ON and acting as lead, manually shut it OFF.	Lag boiler and pump shall start and an alarm is generated in the BAS. B-3_____, B-4_____, B-5_____		
32 Seq. 26	15555 .3.3.D	With each main boiler at a time ON and acting as lead, manually shut its pump OFF.	Lag boiler and pump shall start and an alarm is generated in the BAS. HWP-3_____, HWP-4_____, HWP-5_____		
33 Seq. 27	15555 .3.3.D	With boilers in auto., shut OFF one of the ON secondary HW pumps.	The lag secondary pump is started and an alarm is generated in the BAS.		
34 Seq. 28	15555 .3.3.D	Low water. For each boiler when ON, unhook the wire to the low water sensor to initiate an alarm. Manually reset.	Boiler burners shut OFF and an alarm is generated in the BAS. B-1_____ B-3_____ B-2_____ B-4_____ B-5_____		
35 Seq. 28	15555 .3.3.D	High limit. For each boiler when ON, lower the high limit setting to the current water temperature to initiate an alarm and shutdown. Manually reset.	Boiler burners shut OFF and an alarm is generated in the BAS. B-1_____ B-3_____ B-2_____ B-4_____ B-5_____		
36	15555 .3.3.D	Low draft safety switch. Tested in Procedure ____ below.			
37	15555 .3.3.D	Fuel system safety. For each boiler, when ON, jump or remove wires or close gas valve, as appropriate, to simulate an unsafe gas condition.	Boiler shuts OFF and an alarm is generated in BAS. B-1_____ B-3_____ B-2_____ B-4_____ B-5_____		
38	15555 .3.3.D	Flame safety controls. For each boiler, when ON, demonstrate the function of the flame safety controls by simulating an alarm condition.	Boiler shuts OFF and an alarm is generated in BAS. B-1_____ B-3_____ B-2_____ B-4_____ B-5_____		
39	15555 .3.3.D	Lift lever of each pressure relief valve.	Each releases water.		
40	15555 2.2.K	Demonstrate the function of the smoke density indicator and transmittter.	Functions per spec.		
41 Seq. 29		Tested above.			

Notes:

Proced. No. & Spec. Seq. ID[1]	**Req ID No.[2]**	**Test Procedure[3] (including special conditions)**	**Expected and Actual Response[4]** [Write ACTUAL response in brackets or circle]	**Pass Y/N**	**Note #**
42 Seq. 30		Tested with safeties above.			
43 Seq. 31		Tested with fire alarm test.			
44	15555 .3.3.E	Boiler efficiency tests specified shall be conducted by the supplier and full procedures and documentation of results attached.	Procedures documented and approved?____ Results of tests documented sufficiently?____ Results of tests within specified tolerances? (list)		
45	15555 .3.3.E	Combustion efficiency and analysis tests specified shall be conducted by the supplier and full procedures and documentation of results attached.	Procedures documented and approved?____ Results of tests documented sufficiently?____ Results of tests within specified tolerances? (list)		
46	15555 2.2.H. 4	Flue draft control. The function and performance of the flue draft controls, safeties, annunciators and alarms for the main boilers shall be demonstrated (with owner witnesses) and documented by the supplier. Full procedures and documentation of results should be attached.	Procedures documented and approved?____ Results of tests documented sufficiently?____ Results of tests within tolerances? (list)		
47	**--**	**Return all changed control parameters and conditions to their pre-test values[5]**	**Check off in table of Section 2 above when completed**		

Notes:

MONITORING AND TREND LOGGING. Monitoring via BAS trend logs are required per General Test Conditions and test Procedures 19, 20, 24, 25, 28a. Attach representative graphs or columnar data and explanatory analysis to this test report. Columnar and electronic data shall have time in the left column and 4 to 6 columns of different parameters to the right. All abbreviations shall have definitions provided and all setpoints and schedules for each parameter shall be attached.

**Abbreviations: HWS-T = hot water supply temperature to the building, SPt = setpoint, BAS = building automation system.

[1]Sequences of operation attached to this test.
[2]Mode or function ID being tested from testing requirements section of the project Specifications.
[3]Step-by-step procedures for manual testing, trend logging or data-logger monitoring.
[4]Include tolerances for a passing condition. Fill-in spaces or lines not in brackets denote sequence parameters still to be specified by the A/E, conrols contractor or vendor. Write "Via BAS" for verifications of device position from BAS readout or "Via obs" for actual observation or from test instrument reading.
[5]Record any permanently changed parameter values and submit changes to Owner.

A summary of deficiencies identified during testing is attached

-- END OF TEST --

Notes: