

## Functional Performance Test

**[Project Name]**

System: **Heating Water**

Service: **Heating Water Loop**

<i>Functional Performance Test</i>	<i>Pass</i>	<i>Fail</i>	<i>Remarks</i>
<b>FPT Test Prerequisites</b>	-----	-----	-----
Occupied schedule is 24/7			
<b>Pump Lead/Lag and alarms</b>	-----	-----	-----
Record lead pump			HWP-1/HWP-2
Record lag pump			HWP-1/HWP-2
Record HWP-1 run time hours			___ Hrs
Record HWP-2 run time hours			___ Hrs
Record lead/lag switch over set point			750 Hrs
Verify status of lead HW pump			
Shut off lead HW pump at disconnect			
Verify rotation as pump slows down			
Verify lead pump loses status			
Record time until alarm is generated			
Record time until lag pump starts			
Verify status of lag HW pump			
Lag HW pump ramps up and maintains DP			
Turn on lead HW pump at disconnect			
Rotate lead/lag			
Verify status of lead HW pump			
Shut off lead HW pump at disconnect			
Verify rotation as pump slows down			
Verify lead pump loses status			
Record time until alarm is generated			
Record time until lag pump starts			
Verify status of lag HW pump			
Lag HW pump ramps up and maintains DP			
Turn on lead HW pump at disconnect			
<b>Pump Control</b>	-----	-----	-----
Record HW system DP			___ PSI
Record HW system DP set point			3 PSI
Record VFD speed			___ Hz
HW bypass valve position			___ % Bypass
Raise the HW DP set point by 1 PSI			
HW maintains new DP set point			
Record VFD speed			___ Hz
Reduce the HW DP set point by 2 PSI			

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HW maintains new DP set point			
Record VFD speed			___ Hz
Reduce DP set point until VFD is at 17 Hz			
HW bypass valve modulates to 18 Hz			
Return HW DP set point to original setting			
<b>WWHP Operation</b>			
Simulate the OA-T to 40°F	----	----	-----
Simulate the HWR-T > 122°F			
Verify WWHP is disabled			
Record LHW-T set point (BT-3)			130°F (Max 135°F)
Record LCHW-T set point (HPLCHW-T)			50°F
Record minimum on time			40 Min
Record minimum off time			40 Min
Record WWHP isolation valve position			Open/Closed
Adjust HWS-T set point to 105°F			
WWHP isolation valve opens			
WWHP condenser pump starts			30 Sec DOM after ISO valve
WWHP evaporator pump starts			30 Sec DOM after ISO valve
WWHP enables and maintains set point			
Adjust CHWS-T set < 52°F			
Simulate the OA-T < 20°F			
WWHP is disabled			
HRP-3 shuts off			
WWHP isolation valve closes immediately			
<b>WWHP Backup Operation</b>			
Simulate the CHWS-T > 52°F	----	----	-----
WWHP isolation valve opens			
WWHP condenser pump starts			30 Sec DOM after ISO valve
WWHP evaporator pump starts			30 Sec DOM after ISO valve
WWHP enables and maintains set point			
Adjust CHWS-T set < 52°F			
WWHP is disabled			
HRP-3 shuts off			
WWHP isolation valve closes immediately			
Simulate the HWS-T < 100°F			
WWHP isolation valve opens			

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WWHP condenser pump starts			30 Sec DOM after ISO valve
WWHP evaporator pump starts			30 Sec DOM after ISO valve
WWHP enables and maintains set point			
Simulate the HWS-T > 100°F			
WWHP is disabled			
HRP-3 shuts off			
WWHP isolation valve closes immediately			
<b>LPR Heat Recovery</b>			
	----	----	-----
Record LPR-T			___ °F
Record HWR-T			___ °F
Record the HEX inlet valve position			Open/Closed
Simulate the LPR-T > HWR-T			
HEX inlet valve opens			
HEX bypass valve closes			
Simulate the LPR-T < HWR-T			
HEX bypass valve opens			
HEX inlet valve closes			
Release overrides			
<b>Boiler Operation</b>			
	----	----	-----
Record OA-T			___ °F
Min HWS-T when OA-T < 40°F			110°F
Min HWS-T when OA-T < 50°F			100°F
Max HWS-T except for warm-up			120°F
Max HWS-T during warm-up			140°F (0600-0900 M-F)
Verify heating valves sending binary signal			(Met/Not met) (Not RAD's)
Simulate (1) heating valve < 75% (Not Met)			
Reset the variable set point control loop			
Boiler(s) maintain 120°F HWS-T for 20 Min			
Simulate the HWS-T <95°F for 10 Min			(One boiler running)
Enable another boiler and alarms OWS			
HWS-T set point decreases 1°F every 20 Min			
Simulate a HW valve > 75% for 120 min			
Rooms displayed on graphic with > 75% open valves			
HWS-T set point increases 1°F every 10 Min			
Simulate the HWS-T set point at max value			

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Set point decrease sequence starts again			
Simulate the H			
Verify boilers stage and associated BP's enable			Minimum 20 Min ON and OFF time
BP's run for 2 Min after boilers stops firing			
Simulate 10 PPM of CO2			
Alarm horn sounds			
Simulate 25 PPM of CO2			
Boilers are disabled			
Verify operation of emergency lockout switch			

<b>Record BAS Values</b>			
Allow unit to stabilize for temperature control			
Global Campus outside air temperature			___ °F
Outside air temperature			___ °F (OA-T)
System heating water supply temperature			___ °F (HWS-T)
System heating water return temperature			___ °F (HWR-T)
System differential pressure			___ °F (HW-DP)
Boiler B1 supply temperature			___ °F (B1-T)
Boiler B2 supply temperature			___ °F (B2-T)
Boiler B3 supply temperature			___ °F (B3-T)
Boiler B4 supply temperature			___ °F (B4-T)
Boiler mixed water entering temperature			___ °F (MX1-T)
WWHP leaving heating water temperature			___ °F (B3-T)
WWHP leaving chilled water temperature			___ °F (HPLCHW-T)
Chilled water system return temperature			___ °F (CHWRET-T)
LPR temperature			___ °F (LPR-T)
HWR temperature			___ °F (HEE-T)
Heat recovery temperature			___ °F (HEL-T)
Carbon monoxide level			___ PPM (CO-LVL)
WWHP entering heating water temperature			___ °F
Heating water pump HWP-1 VFD			___ Hz (HWP-VFD1-O)
Heating water pump HWP-2 VFD			___ Hz (HWP-VFD2-O)
Boiler burner firing rate			___ % (B1-FR)
Boiler burner firing rate			___ % (B2-FR)
Boiler burner firing rate			___ % (B3-FR)
Boiler burner firing rate			___ % (B4-FR)

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Record BAS Values		
Heating water bypass valve		___ % (BYP-VLV-O)
Heat recovery pump HRP-3 status		ON/OFF (HRP-C1)
Heat recovery pump HRP-4 status		ON/OFF (HRP-C2)
Boiler BI-1 Status		ON/OFF (B1-A)
Boiler BI-2 Status		ON/OFF (B2-A)
Boiler BI-3 Status		ON/OFF (B3-A)
Boiler BI-4 Status		ON/OFF (B4-A)
UPS low battery alarm		ALARM/NORMAL (UPS-A)
Boiler pump BP-1 status		ON/OFF (BP-C1)
Boiler pump BP-2 status		ON/OFF (BP-C2)
Boiler pump BP-3 status		ON/OFF (BP-C3)
Boiler pump BP-4 status		ON/OFF (BP-C4)
System pump HWP-1 status		ON/OFF (HWP-C1)
System pump HWP-2 status		ON/OFF (HWP-C2)
Boiler shutdown		ON/OFF (BLR-E-A)
WWHP-1 isolation valve		OPEN/CLOSED
Hot water pump HWP-1 start-stop		ON/OFF (HWP-C1)
Hot water pump HWP-2 start-stop		ON/OFF (HWP-C2)
WWHP-1 start-stop		ON/OFF (WWHP1-ENA)
Boiler B-1 enable/disable		ON/OFF (B1-ENA)
Boiler B-2 enable/disable		ON/OFF (B2-ENA)
Boiler B-3 enable/disable		ON/OFF (B3-ENA)
Boiler B-4 enable/disable		ON/OFF (B4-ENA)
Boiler pump BP-1 enable/disable		ON/OFF (BP-C1)
Boiler pump BP-2 enable/disable		ON/OFF (BP-C2)
Boiler pump BP-3 enable/disable		ON/OFF (BP-C3)
Boiler pump BP-4 enable/disable		ON/OFF (BP-C4)
HRP-3 start/stop		ON/OFF (HRP-C1)
HRP-4 start/stop		ON/OFF (HRP-C2)
Heat exchanger inlet valve		OPEN/CLOSED (HE-VLV1)
Heat exchanger bypass valve		OPEN/CLOSED (HE-VLV2)
Carbon monoxide alarm		ALARM/NORMAL (CO-HRN)
2/3 static pressure 1		___ IN WC
2/3 static pressure 2		___ IN WC
2/3 static pressure set point		___ IN WC
Average zone humidity		___ %RH
Zone humidity set point		___ %RH

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Number	Date	Remarks
1		Record participants and date

FCG Sample Document

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