



# Functional Test Procedure

## VAV w/Reheat

**PROJECT:** Sample FPT

**PROJECT NUMBER:**

**REPORT ID:** FPT-XXXXXXX

**SYSTEM DESCRIPTION:**

**DATE OF TEST:** \_\_\_\_\_

Equipment Identification	
Unit Identification	Location
VAV w/ HW Reheat	

**Test Participant List:**

Participant	Company / Agency
	Performance Assurance Contractor
	General Contractor
	Mechanical Contractor
	Controls Contractor
	TAB Contractor
	Owner Representative

**Functional Performance Test Prerequisites:**

Prerequisite	Yes	No	Comments
1. Hot Water hydronic piping system has been cleaned, flushed and pressure tested as required. Test reports submitted to CxA for review.			
2. Test & Balance is complete. TAB report submitted to CxA for review.			
3. Construction Checklists are complete and have been submitted to CxA for review. VAV, AHU, VFD & BMS			
4. All sensors have been calibrated with certified instruments.			
5. Operations & Maintenance Manuals submitted to CxA for review.			
6. Pre-FPT trend logs submitted to CxA for review. Refer to test procedure #3 below for list of specific trend logs to be submitted.			
7. Control programming, interlocks, safeties, alarms, set points, schedules and loop tuning are complete. Control sequences have been tested and debugged.			
8. Central plant is operating and providing both Chilled and Heating Water. If the central boiler plant is not in operation, then the circulation pumps should be turned on to provide pressure.			
9. System is ready for Functional Performance Testing.			



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### Test Equipment Required:

Equipment	Responsible
Infrared Thermometer	Mechanical Contractor
Digital Thermometer	Mechanical Contractor
Water Differential Pressure Gauge	Mechanical Contractor
Laptop Computer	Controls Contractor
Duct Airflow Instruments	TAB Contractor
Magnahelic / Manometer (0" to 5")	TAB Contractor

### Setpoints, Limits, and Schedules:

OCCUPANCY SCHEDULE			
Monday-Friday	Saturday	Sunday	Holiday

### Sampling ( Specifications call for the following percentage of terminal units be tested)

Type	Project Quantity	% To Test	# To Test
VAV w/ Reheat	4 – 1 New, 3 Existing	50	2 – 1 New, 1 Existing

### Functional Test Procedures:

Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
<b>GENERAL SYSTEM READINESS</b>			
	1	Verify system has been operating at stable, normal conditions. All test pre-requisites have been satisfied.	
		<b>Field Notes:</b>	
	2	Verify adequate access is provided to all components that require periodic maintenance.	1. Record any problems that interfere with equipment access.



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Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		<b>Field Notes:</b>	
	<b>3</b>	<p>Review trends for each point listed below. Trend data is required for a minimum of 3 consecutive business days sampled at five minute intervals.</p> <ol style="list-style-type: none"> <li>1. T1-AH-12 Supply Air Temp</li> <li>2. T1-AH-12 Supply Air Temp Setpoint</li> <li>3. Room Temp AH-E12-18</li> <li>4. Room Temp Setpoint AH-E12-18</li> <li>5. AH-E12-18 Supply Air Temp</li> <li>6. AH-E12-18 Supply Air CFM</li> <li>7. AH-E12-18 Hot Water Valve Position</li> <li>8. Hot Water Supply Temp</li> <li>9. Hot Water Return Temp</li> <li>10. Room Temp AH-E12-___</li> <li>11. Room Temp Setpoint AH-E12-___</li> <li>12. AH-E12-___ Supply Air Temp</li> <li>13. AH-E12-___ Supply Air CFM</li> <li>14. AH-E12-___ Hot Water Valve Position</li> </ol>	<ol style="list-style-type: none"> <li>1 Controlled variables are stable and void of excess hunting.</li> <li>2 System appears to be ready for FPT</li> <li>3 Note variables not under control in notes.</li> </ol>
		<b>Field Notes:</b>	
	<b>4</b>	<p>Verify Terminal Unit addresses match the Terminal Unit location and ID on the plan drawings and BAS drawings.</p>	<p>Addresses match.</p>
		<b>Field Notes:</b>	



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	5	<p>Verify for ½ of the tested Terminal Units For autoflow control valves, with water system in normal, check pressure drop across valve. Compare with valve requirements.</p> <p>With non-autoflow valves, with the valve fully open, measure dP across coil and from coil chart determine flow.</p>	<p>Pressure drop should be in the range of ____ to ____psi. If out of range investigate.</p> <p>Design flow = _____. Actual = _____. Must be within 10%.</p>																														
		<b>Field Notes:</b>																															
	6	<p>Verify for ½ of the tested Terminal Units that didn't have pressure drops checked. Valve of Terminal Unit. Remove and check strainer for cleanliness.</p>	<p>To pass, basket strainers must have an unclogged area &gt;= 80% of the strainer area. In-line strainers with area = pipe cross section must be 90% clean.</p>																														
		<b>Field Notes:</b>																															
SENSOR & ACTUATOR VERIFICATION																																	
	7	<p>Verify the values shown at the BAS Workstation for all sensors and actuators/control valves in expected results column are within the acceptable tolerance of the temperature shown on the calibrated test instrument.</p> <p>Verify sensors and actuators/control valves are accessible for future maintenance.</p>	<table border="1"> <thead> <tr> <th>Sensor</th> <th>BAS Value</th> <th>Measured Value</th> </tr> </thead> <tbody> <tr> <td>Supply Air Temp (SAT) (°F)</td> <td></td> <td></td> </tr> <tr> <td>SAT AH-E12-18 (°F)</td> <td></td> <td></td> </tr> <tr> <td>Room Temp AH-E12-18 (°F)</td> <td></td> <td></td> </tr> <tr> <td>SAT AH-E12-____ (°F)</td> <td></td> <td></td> </tr> <tr> <td>Room Temp AH-E12-____ (°F)</td> <td></td> <td></td> </tr> <tr> <td>Supply Airflow AH-E12-18 (CFM)</td> <td></td> <td></td> </tr> <tr> <td>Supply Airflow AH-E12-____ (CFM)</td> <td></td> <td></td> </tr> <tr> <td>Valve Position AH-E12-18 (%)</td> <td></td> <td></td> </tr> <tr> <td>Valve Position AH-E12-____ (%)</td> <td></td> <td></td> </tr> </tbody> </table>	Sensor	BAS Value	Measured Value	Supply Air Temp (SAT) (°F)			SAT AH-E12-18 (°F)			Room Temp AH-E12-18 (°F)			SAT AH-E12-____ (°F)			Room Temp AH-E12-____ (°F)			Supply Airflow AH-E12-18 (CFM)			Supply Airflow AH-E12-____ (CFM)			Valve Position AH-E12-18 (%)			Valve Position AH-E12-____ (%)		
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TIME OF DAY SCHEDULING																																	



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	8	Schedule the unit to be in the UNOCCUPIED mode.	1. The air handler is in the UNOCCUPIED mode. 2. The air handler is ON. <ul style="list-style-type: none"> <li>a. The outside air damper is CLOSED.</li> <li>b. The exhaust damper is CLOSED.</li> <li>c. The mixed air damper is OPEN.</li> <li>d. The supply fan is ON.</li> <li>e. The return fan is ON</li> <li>f. AH-E12-18 is in UNOCCUPIED MODE:.                Heating Temperature Setpoint: _____                Cooling Temperature Setpoint: _____</li> <li>g. AH-E12-___ is in UNOCCUPIED MODE:.                Heating Temperature Setpoint: _____                Cooling Temperature Setpoint: _____</li> </ul>
		<b>Field Notes:</b>	
<b>SUPPLY AIR TEMPERATURE CONTROL</b>			



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Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
	9	<p>Enable occupied mode via the BMS.</p> <p>Supply air temperature control is operating in fixed setpoint mode.</p> <p>NOTE: Lock out economizer mode for this portion of the test.</p>	<ol style="list-style-type: none"> <li>1. The air handling unit is in the OCCUPIED mode.</li> <li>2. The air handling unit is ON.               <ol style="list-style-type: none"> <li>a. The outside air damper modulates to the MINIMUM.</li> <li>b. The exhaust air damper modulates to maintain equal airflow – SUPPLY= RETURN.</li> <li>c. The mixed air damper remains OPEN.</li> <li>d. The supply fan modulates to maintain the supply duct static pressure setpoint.</li> <li>e. The chilled water control valve modulates open as needed to maintain the supply air temperature setpoint.</li> <li>f. The Supply Fan VFD modulates to maintain the Static Pressure setpoint.</li> <li>h. The Return fan modulates to track the supply fan with measured volume of Return = Supply.</li> <li>i. AH-E12-18 is in OCCUPIED MODE:.                    Heating Temperature Setpoint: _____                    Cooling Temperature Setpoint: _____</li> <li>j. AH-E12-___ is in OCCUPIED MODE:.                    Heating Temperature Setpoint: _____                    g. Cooling Temperature Setpoint: _____</li> </ol> </li> </ol>
		<p><b>Field Notes:</b></p>	





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Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		<b>Field Notes:</b>	
	<b>12</b>	<p>Check for hot water valve leakage.</p> <p>Allow fan to run for at least five minutes with hot water valve closed.</p> <p>Measure water temp drop across the coil to check for hot water leak-by.</p>	<p>1. Hot water valve is closed.</p> <p>AH-E12-18 Water <math>\Delta T</math>: ____ °F</p> <p>AH-E12-__ Water <math>\Delta T</math>: ____ °F</p> <p>If water delta T is greater than 2°F, leakage may be occurring.</p>
	<b>13</b>	<p>Raise the supply air temperature set point 15°F above the current room temperature.</p> <p>Allow system to achieve equilibrium.</p>	<p>1. VAV modulates to minimum CFM and opens hot water valve to achieve room temperature set point.</p> <p>New Room Temp. Setpoint: ____ °F AH-E12-18</p> <p>AH-E12-18 VAV Supply Air Temp.: ____ °F</p> <p>AH-E12-18 Hot Water Valve Position: ____ %</p> <p>AH-E12-18 CFM: _____</p> <p>AH-E12-__ VAV Supply Air Temp.: ____ °F</p> <p>AH-E12-__ Hot Water Valve Position: ____ %</p> <p>AH-E12-__ CFM: _____</p>





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Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		Field Notes:	
	14	Return supply air temperature setpoint to original value.	<p>2. VAV Hot Water Valve is closed and VAV achieves maximum airflow to achieve room temperature set point.</p> <p>New Room Temp. Setpoint: ____°F AH-E12-18            AH-E12-18 VAV Supply Air Temp.: ____°F            AH-E12-18 Hot Water Valve Position: ____%            AH-E12-18 CFM: _____</p> <p>AH-E12-__ VAV Supply Air Temp.: ____°F            AH-E12-__ Hot Water Valve Position: ____%            AH-E12-__ CFM: _____</p> <p>Upon attaining the setpoint, VAV's modulate to maintain the setpoint.</p> <p>AH-E12-18 VAV Supply Air Temp.: ____°F            AH-E12-18 Hot Water Valve Position: ____%            AH-E12-18 CFM: _____</p> <p>AH-E12-__ VAV Supply Air Temp.: ____°F            AH-E12-__ Hot Water Valve Position: ____%            AH-E12-__ CFM: _____</p>
		Field Notes: See Above	
<b>SUPPLY AIR TEMPERATURE RESET</b>			





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Pass Y/N	No	TEST PROCEDURE	EXPECTED RESULTS
		Field Notes:	

Note: This will test the new VAV and one of the existing VAV Boxes that have been modified by this project. Issues need to be reviewed with both the contractor and the facility staff to determine the proper action party for correcting the problem(s) on the modified VAV box.

**END OF TEST**



## Functional Test Procedure

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**DATE:**

**SUMMARY OF RESULTS:**

**LESSONS LEARNED:**

- 
- 
- 

**CORRECTIVE ISSUES:**

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***Acceptance of Test:***

- This test cannot be accepted at this time due to the Corrective Issues noted above.
- This test is accepted by the Commissioning Authority identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

Witnessed \_\_\_\_\_  
Commissioning Authority

Date \_\_\_\_\_