# Circulating Domestic Water Heater-Hx Functional Performance Test

| | |
|---|---|
| Equipment ID | **[Equipment ID]** |
| Building | **[Building]** |
| Location | **[Room]** |

## System Description

**Description:**

**Operational Assumptions:**

Domestic water make up valve is open.

System hot water circulation pump is on.

The control valve is modulating to maintain set point temperature.

Domestic water heating unit is assumed to begin the test in the Idle Mode, with no load conditions and the water temperature at set point.

Associated Building Automated System (BAS) has been tested and is operating correctly.

| Initial Test | | Start Date | End Date | Initials |
|---|---|---|---|---|
| Results (Check one)<br>☐ Pass<br>☐ Fail<br>☐ Partial Test w/Corrective Actions<br>☐ Complete Test w/Corrective Actions<br>☐ Other | Explanation: | | | |

| Re-Test 1 | | Start Date | End Date | Initials |
|---|---|---|---|---|
| Results (Check one)<br>☐ Pass<br>☐ Fail<br>☐ Partial Test w/Corrective Actions<br>☐ Complete Test w/Corrective Actions<br>☐ Other | Explanation: | | | |

| Re-Test 2 | | Start Date | End Date | Initials |
|---|---|---|---|---|
| Results (Check one)<br>☐ Pass<br>☐ Fail<br>☐ Partial Test w/Corrective Actions<br>☐ Complete Test w/Corrective Actions<br>☐ Other | Explanation: | | | |

| Deferred/Seasonal Test | | Start Date | End Date | Initials |
|---|---|---|---|---|
| Results (Check one)<br>☐ Pass<br>☐ Fail<br>☐ Partial Test w/Corrective Actions<br>☐ Complete Test w/Corrective Actions<br>☐ Other | Explanation: | | | |

## Test Participants

| Organization | Required | Optional |
|---|---|---|
| General Contractor | ☐ | ☐ |
| Mechanical Contractor | ☐ | ☐ |
| Electrical Contractor | ☐ | ☐ |
| TAB Contractor | ☐ | ☐ |
| Controls Contractor | ☐ | ☐ |
| Owner's O&M Personnel | ☐ | ☐ |

## Supplies Required for Testing (To be provided by the contractor)

| Tools / Supplies | |
|---|---|
| Laptop with TC Program | Infrared Thermometer Gun |
| PID Loop Tuning Software | Humidity Tester |
| Aerosol for Smoke and Freeze stat Test | Basic Tool Pouch |
| Radio Communications | Flashlight |

## System Readiness Summary Checklist

| Description | Yes | No | Date |
|---|---|---|---|
| System Ready for Test | ☐ | ☐ | |
| Required Personnel Available | ☐ | ☐ | |
| Required Tools/Test Equipment/Supplies Available | ☐ | ☐ | |
| Required Safety Equipment Available | ☐ | ☐ | |

## Set-Points, Limits, and Schedules

☐ AHU can be assigned a schedule. ☐ Schedule can be programmed daily.
☐ If system runs 24 hours a day, check here. If not, fill in the occupied mode schedule below.

| | AM | | | | | | | | | | | | PM | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Day** | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| **Sun** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Mon** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Tues** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Wed** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Thurs** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Fri** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Sat** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Holi** | | | | | | | | | | | | | | | | | | | | | | | | |

| **Parameter** | **Setpoint** | | **Adjustable Range** | |
|---|---|---|---|---|
| | **Design** | **Actual** | **Design** | **Actual** |
| Outside Air Temperature (°F) | | | | |
| Preheat valve full open outside air temperature (°F) | | | | |
| Discharge Air Temperature (°F) | | | | |
| Night Setback Temperature (°F) | | | | |
| Night Setback Differential | | | | |
| Mixed Air Temperature (°F) | | | | |
| Minimum Start-up Fan Speed (%) | | | | |
| Time at Minimum Fan Speed for Start-up (min) | | | | |
| Average Zone Humidity (%RH) | | | | |
| Maximum supply air humidity (%RH) | | | | |
| Discharge Air Static Pressure (in $H_2O$) | | | | |
| High Static Alarm (in $H_2O$) | | | | |
| Low Static Alarm (in $H_2O$) | | | | |
| System Shutdown High Static Limit (in $H_2O$) | | | | |
| Damper Position | | | | |

## Initial Ambient Conditions

| **Ambient Conditions** | | | |
|---|---|---|---|
| Outside Air Temp | | Outside Air RH % | |
| Observations | | | |

## Trend Data Required To Support Testing

Check if trend point chart(s) and Frequency Graph(s) are provided per trend requirements shown below.

| **Trend Log Setup #1 - Temperature** | | | | | |
|---|---|---|---|---|---|
| **Pre-Testing** | **Post Testing** | **Point** | **Frequency** | **Duration** | **Provided** |
| ☐ | ☐ | System Flow Rate | | | ☐ Yes ☐ No |
| ☐ | ☐ | Flow Rate Set Point | | | ☐ Yes ☐ No |
| ☐ | ☐ | Water Quality | | | ☐ Yes ☐ No |

| Trend Log Setup #1 - Temperature | | | | | |
|---|---|---|---|---|---|
| **Pre-Testing** | **Post Testing** | **Point** | **Frequency** | **Duration** | **Provided** |
| ☐ | ☐ | Damper Position | | | ☐ Yes ☐ No |
| ☐ | ☐ | System Pressure | | | ☐ Yes ☐ No |
| ☐ | ☐ | Pressure Set Point | | | ☐ Yes ☐ No |
| Record Issues | | | | Issue Log Item Number: | |

## Functional Performance Test -- **(Verify all components are ready before energizing or operating the system.)**

The Commissioning Authority will make and document any changes/addition/deletions to this test procedure required by current system conditions (i.e. weather, system load, utility availability, etc.).

R = Retest (Check (✓) retest required)
C = Corrected (Check (✓) when correction verified)
Y= Checked and Passed
N = Not Passed

| ACTION | REQUIRED REACTION | Y (✓) | N (✓) | COMMENTS | R (✓) | C (✓) |
|---|---|---|---|---|---|---|
| **PRE-TEST VISUAL MECHANICAL INSPECTION** | | | | | | |
| 1. Record the start time | Recorded. | ☐ | ☐ | Time: (am / pm) | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| 2. Observe initial operating conditions | The fan is on and the discharge damper is open. | ☐ | ☐ | | ☐ | ☐ |
| | The HOA switch is in the auto position. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| **HEATING OPERATION** | | | | | | |
| 3. Record initial position of each immersion thermostat and hot water temperature at sink. | Record temperature dial positions & temperature. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |

| ACTION | REQUIRED REACTION | Y (✓) | N (✓) | COMMENTS | R (✓) | C (✓) |
|---|---|---|---|---|---|---|
| 4. Adjust thermostat to be just shy of the high setting. | Record temperature leaving at adjacent sink. | ☐ | ☐ | | ☐ | ☐ |
| | Change in temperature is accurate based on direction of change in thermostat. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| 5. Adjust thermostat to be just shy of the low setting. | Record temperature leaving at adjacent sink. | ☐ | ☐ | | ☐ | ☐ |
| | Change in temperature is accurate based on direction of change in thermostat. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| 6. Override the discharge water temperature set point to 10ºF higher than the current discharge temperature. | The control valve is to modulate open to maintain set point temp. | ☐ | ☐ | Water temp. at start of test: _____ºF<br><br>New water temp. set point: _____ºF | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| 7. Return thermostat to its original settings. | System returns to normal operation. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |

| ACTION | REQUIRED REACTION | Y (✓) | N (✓) | COMMENTS | R (✓) | C (✓) |
|---|---|---|---|---|---|---|
| **IDLING CONTROL** | | | | | | |
| 8. Override the unit discharge temperature set point to 10ºF lower than the current discharge water temperature. | The control valve modulates closed to maintain the unit discharge temperature. | ☐ | ☐ | Discharge water temp at start of action: _____ºF<br><br>New DWT set point: _____ºF | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| 9. Override the discharge water temperature set point to a value equal to the design water temperature. Measure entering and leaving water temperatures. | Control valve modulates opens to maintain the set point temperature. | ☐ | ☐ | Entering water temperature: _____ºF<br><br>Leaving water temperature: _____ºF<br><br>Percent schedule capacity: _____% | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| 10. Release the discharge water temperature set point overrides. | Control valve modulates to maintain their respective discharge water temperature set points. | ☐ | ☐ | Note: Wait until discharge water temperatures are satisfied, before proceeding. | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| **HEATER STATUS ALARM AT BAS** | | | | | | |
| 11. Close the supply valve. | Alarm is received at BAS. | ☐ | ☐ | | ☐ | ☐ |
| | Control valve closes. | ☐ | ☐ | | ☐ | ☐ |
| | Return pump stops. | ☐ | ☐ | | ☐ | ☐ |

| ACTION | REQUIRED REACTION | Y (✓) | N (✓) | COMMENTS | R (✓) | C (✓) |
|---|---|---|---|---|---|---|
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| 12. Open the Supply Valve | Alarm is cleared at BAS. | ☐ | ☐ | | ☐ | ☐ |
| | All components resume normal operation. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| 13. Close the makeup water valve. | Alarm is received at central control station. | ☐ | ☐ | | ☐ | ☐ |
| | Control valve closes. | ☐ | ☐ | | ☐ | ☐ |
| | Return pump stops. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| 14. Open the makeup water valve | Alarm is cleared. | ☐ | ☐ | | ☐ | ☐ |
| | All components resume normal operation. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |
| **HEATER STATUS ALARM AT BAS** | | | | | | |
| 15. Open the hot water faucets to service sinks and toilet room sinks. | Control valve modulates to maintain set point temp. | ☐ | ☐ | Water temp. at start of test: _____ºF<br><br>Time portion of test is started: _____ | ☐ | ☐ |
| | Return pump is on. | ☐ | ☐ | | ☐ | ☐ |
| | Make-up valve is open. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial | Date | |

| ACTION | REQUIRED REACTION | Y (✓) | N (✓) | COMMENTS | R (✓) | C (✓) |
|---|---|---|---|---|---|---|
| 16. Verify flow at test sinks. | Estimate total flow. | ☐ | ☐ | Estimated flow (GPM.) _____ | ☐ | ☐ |
| | Measure leaving water temp. at remote test sink. | ☐ | ☐ | Water temp. : _____ºF | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| 17. Run hot water until discharge water temp. starts to drop. | Alarm is received at BAS. | ☐ | ☐ | Leaving Water temp.: _____ºF | ☐ | ☐ |
| | Control valve closes. | ☐ | ☐ | Time duration from when test was started: _____ | ☐ | ☐ |
| | Return pump stops. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| 18. Close hot water valves at test sinks and return to normal operating condition. | Alarm is cleared. | ☐ | ☐ | | ☐ | ☐ |
| | All components resume normal operation. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| **HIGH PRESSURE CUTOFF** | | | | | | |
| 19. Override pressure sensor to 10% higher than high pressure alarm set point. | High status alarm is received at the BAS control station. | ☐ | ☐ | | ☐ | ☐ |
| | The return pump stops. | ☐ | ☐ | | ☐ | ☐ |
| | The control valve is closed. | ☐ | ☐ | | ☐ | ☐ |
| | Domestic makeup water goes to 100%. | ☐ | ☐ | | ☐ | ☐ |

| ACTION | REQUIRED REACTION | Y (✓) | N (✓) | COMMENTS | R (✓) | C (✓) |
|---|---|---|---|---|---|---|
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| 20. Re-set the discharge high pressure cutout back to original set point. | Alarm is cleared. | ☐ | ☐ | Note: Need to verify which type of control set point will be adjustable from control panel. | ☐ | ☐ |
| | The system resumes normal operation. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| **RETURN TO INITIAL CONDITIONS** | | | | | | |
| 21. Reset all set-points and overrides to the initial values. | The system resumes initial operation. | ☐ | ☐ | | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |
| 22. Record End Time | Recorded. | ☐ | ☐ | Time: (am / pm) | ☐ | ☐ |
| Record issues | | | | Issue Log Item: | | |
| | | | | Initial / Date | | |

# Final Sign-Off

| Commissioning Agent | Printed Name | Initials | Date |
|---|---|---|---|
| | | | |

| CONTRACTOR | PRINTED NAME | INITIALS | DATE |
|---|---|---|---|
| General Contractor (GC) | | | |
| Mechanical Contractor (MC) | | | |
| Electrical Contractor (EC) | | | |
| TAB Contractor (TAB) | | | |
| Controls Contractor (CC) | | | |
| Owner's O&M Personnel | | | |