



National HVAC Functional Testing Checklist ¹

ENERGY STAR Multifamily New Construction, Version 1 / 1.1 / 1.2 (Rev.01) .

HVAC Functional Testing Agent Responsibilities:

- The entity performing Functional Testing, the Functional Testing Agent ("FT Agent"), must either be a contractor credentialed by an HVAC Quality Installation Training and Oversight organization (H-QUITO), or must hold an approved credential, as listed at www.energystar.gov/mfnc/ftagentfast, or must ~~BCCB Certified Commissioning Professional (CCP), an AEE Certified Building Commissioning Professional (CBCP), an ASHRAE Building Commissioning Professional (BCxP, formerly the Commissioning Process Management Professional (CPMP)), a NEBB Building System Commissioning (BSC) Certified Technician (BSC-CxCT) or Certified Professional (BSC-CP), a NEBB Commissioning Process Professional (Certified Professional (BSC-CP or CxPP)),~~ be a representative of the Original Equipment Manufacturer (OEM) to complete this checklist. A contractor credentialed by an HVAC Quality Installation Training and Oversight organization (H-QUITO) is only permitted to complete Sections 1-5 of this checklist. ²
- Functional Testing checklists must be completed and signed by an FT Agent. ¹ An FT Agent is permitted to complete just the specific sections of this checklist that pertain to their area of expertise. However, all applicable sections must be completed by an FT Agent, which may result in multiple checklists signed by multiple FT Agents. FT Agents shall only sign checklists that contain items that they have verified. An FT Agent may conduct the test or inspection themselves, or witness the test or inspection being conducted by the installing contractor or other HVAC professional. Multiple FT Agents may be needed for one project.
- Functional Testing checklists must include all HVAC systems in the building / project that serve the dwelling units, ~~or~~ common spaces, and where applicable, parking garages, but may exclude systems solely serving commercial / retail spaces. Multiple checklists will be needed to document all HVAC systems in the building / project. Only ~~the~~ Rater-verified items on the Functional Testing Checklist are permitted to be verified using a sampling protocol.
- The completed checklists, along with the corresponding National HVAC Design Report, shall be retained by the FT Agent for quality assurance purposes. Furthermore, if the FT Agent is not a credentialed contractor, they shall provide the completed and signed checklists to the builder / developer and the Rater ³ responsible for certifying the units / building, prior to the project's certification. Credentialed contractors shall provide the checklist upon request.

1. Functional Testing Overview

- 1.1 Company performing Functional Testing: _____ - FT Agent name: _____ - Date: _____
- 1.2 ~~If applicable, Functional Testing Agent Credential:~~
If a credentialed contractor, fill out applicable H-QUITO that your company is credentialed with and ID Number: ACCA - Advanced Energy ID Number: _____
- 1.3 Builder / developer client name: _____
- 1.4 Project address: _____ City: _____ State: _____ Zip code: _____
- 1.5 National HVAC Design Report corresponding to this project has been collected from designer or builder.
- 1.6 Checklist applies to the following equipment: _____

2. Refrigerant Charge - Run system for 15 minutes before testing. If outdoor ambient temperature at the condenser is $\leq 55^{\circ}\text{F}$ or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, the outdoor temperature shall be recorded in Item 2.1, and the contractor shall check "N/A" in this Section. ⁴ This section must be completed for split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal or water-loop) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts > 0 ft.), whether serving dwelling units or other common spaces in the building. All other permutations of refrigerant-based systems such as ducted or non-ducted mini-split / multi-split systems are exempt from this section. ⁵

	FT Agent Verified	N/A <input type="checkbox"/>
2.1 Outdoor ambient temperature at condenser: _____ °F DB	-	-
2.2 Return-side air temperature inside duct near evaporator, during cooling mode: _____ °F WB	-	<input type="checkbox"/>
2.3 Liquid line pressure: _____ psig	-	<input type="checkbox"/>
2.4 Liquid line temperature: _____ °F DB	-	<input type="checkbox"/>
2.5 Suction line pressure: _____ psig	-	<input type="checkbox"/>
2.6 Suction line temperature: _____ °F DB	-	<input type="checkbox"/>
For System with Thermal Expansion Valve (TXV):		
2.7 Condenser saturation temperature: _____ °F DB (Using Item 2.3)	-	<input type="checkbox"/>
2.8 Subcooling value: _____ °F DB (Item 2.7 – Item 2.4)	-	<input type="checkbox"/>
2.9 OEM subcooling goal: _____ °F DB	-	<input type="checkbox"/>
2.10 Subcooling deviation: _____ °F DB (Item 2.8 – Item 2.9)	-	<input type="checkbox"/>
For System with Fixed Orifice:		
2.11 Evaporator saturation temperature: _____ °F DB (Using Item 2.5)	-	<input type="checkbox"/>
2.12 Superheat value: _____ °F DB (Item 2.6 – Item 2.11)	-	<input type="checkbox"/>
2.13 OEM superheat goal: _____ °F DB (Using superheat tables and Items 2.1 & 2.2)	-	<input type="checkbox"/>
2.14 Superheat deviation: _____ °F DB (Item 2.12 – Item 2.13)	-	<input type="checkbox"/>



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2.15 Item 2.10 is $\pm 3^\circ\text{F}$ or Item 2.14 is $\pm 5^\circ\text{F}$.	<input type="checkbox"/>	<input type="checkbox"/>
2.16 An OEM test procedure (e.g., as defined for a ground-source heat pump) has been used in place of the sub-cooling or super-heat process and documentation has been attached that defines this procedure.	<input type="checkbox"/>	<input type="checkbox"/>

3. Indoor HVAC Fan Airflow - This section must be completed for split air conditioners, unitary air conditioners, air-source heat pumps (including multi-splits), and water-source (i.e., geothermal or water-loop) heat pumps up to 65 kBtu/h with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtu/h with forced-air distribution systems (i.e., ducts > 0 ft.), whether serving dwelling units or other common spaces in the building. Mini-splits, ducted or non-ducted, are exempt, however multi-split systems such as central VRF systems, where indoor HVAC fans with forced-air distribution are connected to a shared outdoor unit that exceeds 65 kBtu/h, are not exempt. ⁵	FT Agent Verified	N/A
3.1 The mode with the higher design HVAC fan airflow used, per Item 5.2 of National HVAC Design Report: <input type="checkbox"/> Heating <input type="checkbox"/> Cooling	<input type="checkbox"/>	-
3.2 Static pressure test holes have been created, and test hole locations are well-marked and accessible. Test hole location for return external static pressure: <input type="checkbox"/> Plenum <input type="checkbox"/> Cabinet <input type="checkbox"/> Transition <input type="checkbox"/> Other: _____ Test hole location for supply external static pressure: <input type="checkbox"/> Plenum <input type="checkbox"/> Cabinet <input type="checkbox"/> Transition <input type="checkbox"/> Other: _____	<input type="checkbox"/>	-
3.3 Measured return external static pressure (Enter value only, without negative sign): _____ IWC	-	-
3.4 Measured supply external static pressure (Enter value only, without positive sign): _____ IWC	-	-
3.5 Measured total external static pressure = Value-only from Item 3.3 + Value-only from Item 3.4 = _____ IWC	-	-
3.6 Measured (Item 3.5) - Design (Item 5.2 on National HVAC Design Report) total external static pressure = _____ IWC	-	-
3.7 Measured HVAC fan airflow, using Item 3.5 and fan speed setting: _____ CFM	-	-
3.8 Measured HVAC fan airflow (Item 3.7) is $\pm 15\%$ of design HVAC fan airflow (Item 5.2 on National HVAC Design Report).	<input type="checkbox"/>	-

4. Air Balancing of Supply Registers & Return Grilles (Recommended, but not Required) ⁶		
4.1 Balancing report attached with room-by-room design airflows from Item 5.2 on National HVAC Design Report, and contractor-measured airflow using ANSI / ACCA 5 QI-2015 protocol.	<input type="checkbox"/>	<input type="checkbox"/>
4.2 Room-by-room airflows verified by contractor to be within the greater of $\pm 20\%$ or 25 CFM of design airflow.	<input type="checkbox"/>	<input type="checkbox"/>

5. Functional Testing: Indoor / Terminal Units - This section must be completed for all heating and cooling equipment located within dwelling units or common spaces, including systems identified in Sections 2 and 3, except where specifically noted. Indoor / terminal units include, but are not limited to, mini-splits, multi-splits, PTAC's, PTHP's, WLHP's, fan coils, and hydronic distribution systems. ⁵	Rater Verified	FT Agent Verified	N/A
5.1 Installation Checks			
5.1.1 Zone thermostat (or remote zone temperature sensor) in dwelling units installed in design location, within the zone being served, and not on an exterior wall.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.1.2 Where <u>specified by design</u> , external condensate pump <u>is</u> installed, <u>and</u> condensate drain pan drains to a conspicuous point of disposal in case of blockage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2 Functional Testing			
5.2.1 Zone temperature displayed on thermostat or sensor is within 5°F of measured zone temperature.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.2 System turns on when there is a call for heat and heating is provided. System turns off when the heating setpoint has been met. For forced air systems: Measured discharge air temperature _____ $^\circ\text{F}$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.3 System turns on when there is a call for cooling and cooling is provided. System turns off when the cooling setpoint has been met. For forced air systems: Measured discharge air temperature _____ $^\circ\text{F}$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.4 Measure and record the inlet and outlet condenser, chilled, or hot-water temperatures at the terminal unit. Cooling mode: Inlet _____ $^\circ\text{F}$ Outlet _____ $^\circ\text{F}$ Heating mode: Inlet _____ $^\circ\text{F}$ Outlet _____ $^\circ\text{F}$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.5 Where OA dampers are installed, the damper closes when there is no call for ventilation or when fan is off.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2.6 If more than one system provides heating or cooling to the same space, controls prevent simultaneous heating and cooling.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. VRF Outdoor Unit - This section must be completed for all VRF outdoor units serving dwelling units or common spaces.	FT Agent Verified	N/A
6.1 Installation Checks		
6.1.1 Pressure testing on refrigerant piping has been completed for this system. (indicate exact test in / test out pressure (psig) / time (hours)): _____ / _____ / _____	<input type="checkbox"/>	<input type="checkbox"/>
6.1.2 Vacuum testing has been completed. (indicate exact test in / test out pressure (psig) / time (hours)): _____ / _____ / _____	<input type="checkbox"/>	<input type="checkbox"/>
6.1.3 Refrigerant line lengths and height differences have been recorded from as-built shop drawings or field measured, and documentation of the measurement is available, if requested.	<input type="checkbox"/>	<input type="checkbox"/>
6.1.4 Indicate required additional charge amount (lbs): _____	<input type="checkbox"/>	<input type="checkbox"/>



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6.2 Functional Testing		
6.2.1 In cooling mode, the outdoor unit fan is ON and heat is being rejected. ⁷ Measure and verify that outdoor unit fan discharge air temperature is warmer than the ambient air temperature.	<input type="checkbox"/>	<input type="checkbox"/>
6.2.2 In heating mode, the outdoor unit fan is ON and heat is being absorbed. ⁷ Measure and verify that outdoor unit fan discharge air temperature is colder than the ambient air temperature.	<input type="checkbox"/>	<input type="checkbox"/>
6.2.3 Using the central maintenance tool or controller, none of the outdoor units or connected indoor units are showing an alarm.	<input type="checkbox"/>	<input type="checkbox"/>
6.2.4 Using the central maintenance tool, the manufacturer's representative confirmed refrigerant charge test per manufacturer's guidelines.	<input type="checkbox"/>	<input type="checkbox"/>
7. Central Boilers - This section must be completed for all central boilers serving dwelling units or common spaces.	FT Agent Verified	N/A
7.1 Installation Checks		
7.1.1 Piping pressure testing is completed and all accessible boiler piping, fittings, and accessories are free from leaks. FT agent may conduct the test or witness the test being conducted by the installing contractor	<input type="checkbox"/>	<input type="checkbox"/>
7.1.2 Boiler relief valves and discharge piping do not show signs of weeping or leakage.	<input type="checkbox"/>	<input type="checkbox"/>
7.1.3 No signs of blockage, leakage, or deterioration in the fresh air intake or flue gas vent piping.	<input type="checkbox"/>	<input type="checkbox"/>
7.1.4 Temperature, pressure gauges, air eliminator, expansion tank, check valves and all other piping components installed as specified by HVAC Designer.	<input type="checkbox"/>	<input type="checkbox"/>
7.1.5 Boiler supply / header temperature sensor and, where applicable, outdoor air temperature sensor, are located as specified by HVAC Designer.	<input type="checkbox"/>	<input type="checkbox"/>
7.1.6 Indicate boiler header / supply setpoint type: <input type="checkbox"/> Fixed <input type="checkbox"/> Seasonal <input type="checkbox"/> Outdoor temperature reset <input type="checkbox"/> Indoor temperature reset <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>
7.1.7 Where outdoor air temperature reset schedule is applicable, indicate reset schedule. (e.g., 180°F Supply @ 10°F outdoor, 120°F supply @ 55°F outdoor.) _____ @ _____, _____ @ _____	<input type="checkbox"/>	<input type="checkbox"/>
7.1.8 Where Warm Weather Shut Down (WWSD) is applicable, list temperature. (NA if boilers and system pumps also serve DHW.) _____ °F	<input type="checkbox"/>	<input type="checkbox"/>
7.2 Functional Testing: Boilers		
7.2.1 Measure the combustion gas efficiency at high fire and low fire for one of the boilers. Note which one and record information. _____% <input type="checkbox"/> high fire _____% <input type="checkbox"/> low fire	<input type="checkbox"/>	<input type="checkbox"/>
7.2.2 Boiler combustion air intake dampers open / close with boiler operation.	<input type="checkbox"/>	<input type="checkbox"/>
7.2.3 If each boiler has its own dedicated boiler circulator pump, it operates only when the respective boiler is firing. (Circulator pump may run for a short period of time before or after the boiler fires, as recommended by the equipment manufacturer.)	<input type="checkbox"/>	<input type="checkbox"/>
7.2.4 When there is a call for heating, the boiler(s) are enabled according to their design sequence of operation.	<input type="checkbox"/>	<input type="checkbox"/>
7.2.5 When multiple boilers are supposed to operate at the same time, they operate according to the Engineer of Record's sequence of operation and the on / off sequencing is observed.	<input type="checkbox"/>	<input type="checkbox"/>
7.2.6 Cycle the boilers on and off 3 times. Boiler(s) modulate / step down to the minimum firing rate before shutting off.	<input type="checkbox"/>	<input type="checkbox"/>
7.2.7 Boiler(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the boiler manufacturer to prevent short cycling).	<input type="checkbox"/>	<input type="checkbox"/>
7.2.8 Condensing Boiler: Return temperature enables condensing. Design / OEM temp: _____ °F Measured temp: _____ °F	<input type="checkbox"/>	<input type="checkbox"/>
7.2.9 Boiler supply / header temperature sensor is reading within 3°F of measured boiler supply / header temperature.	<input type="checkbox"/>	<input type="checkbox"/>
7.2.10 Boiler minimum flow rate and change in flow rate are maintained within the manufacturer's stated limits throughout the sequence of operation.	<input type="checkbox"/>	<input type="checkbox"/>
7.3: Functional Testing: Heating System Pumps		
7.3.1 Where heating system pumps (i.e., the pumps which are responsible for moving the water through the terminal units) are equipped with a VFD which is responding to a pressure sensor within the system or a sensorless pumping system, indicate which one: <input type="checkbox"/> VFD+Sensor <input type="checkbox"/> Sensorless	<input type="checkbox"/>	<input type="checkbox"/>
7.3.2 If a variable speed pumping system is installed, the VFD increases and decreases pump speed in response to changes in the system.	<input type="checkbox"/>	<input type="checkbox"/>
7.3.3 If a variable speed pumping system is installed, system prevents "dead-heading". (May be tested under real or simulated low flow conditions.) Select the method of water flow bypass: <input type="checkbox"/> Minimum Flow Bypass Valve <input type="checkbox"/> 3 way valves on specific terminal units <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>
7.3.4 Pumps are off when outside air temperature is above WWSD. (N/A if pumps serve DHW as well as heating.)	<input type="checkbox"/>	<input type="checkbox"/>



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8. Cooling Towers - This section must be completed for all cooling towers serving dwelling units or common spaces.	FT Agent Verified	N/A
8.1 Installation Checks		
8.1.1 Cooling Tower piping and all components are free from leaks.	<input type="checkbox"/>	<input type="checkbox"/>
8.1.2 Temperature gauges, check valves, tower bypass valve and all other piping components installed as specified by HVAC Designer.	<input type="checkbox"/>	<input type="checkbox"/>
8.1.3 Condenser Water Supply setpoint type: <input type="checkbox"/> Fixed <input type="checkbox"/> Outdoor temperature reset <input type="checkbox"/> Seasonal / based on free cooling	-	<input type="checkbox"/>
8.1.4 All control sensors (condenser water supply temperature, outdoor air humidity, etc.) are located as specified by HVAC Designer.	<input type="checkbox"/>	<input type="checkbox"/>
8.2: Functional Testing: Tower Fans		
8.2.1 Tower fan(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the manufacturer to prevent short cycling).	<input type="checkbox"/>	<input type="checkbox"/>
8.2.2 Cooling Tower fan(s) do not run unless associated cooling tower pump(s) are running.	<input type="checkbox"/>	<input type="checkbox"/>
8.2.3 If installed, basin heater is not enabled when the basin water temperature is above the setpoint.	<input type="checkbox"/>	<input type="checkbox"/>
8.2.4 Condenser Water Supply Sensor is reading within 3°F of measured temperature.	<input type="checkbox"/>	<input type="checkbox"/>
8.3: Functional Testing: Cooling Tower Pumps		
8.3.1 Cycle the cooling tower pumps on and off 3 times. Cooling tower pumps only operate when controls call for operation. (N/A if tower pumps are set to run year round.)	<input type="checkbox"/>	<input type="checkbox"/>
9. Chillers - This section must be completed for all chillers serving dwelling units or common spaces.		
9.1 Installation Checks		
9.1.1 Chiller piping and all components are free from leaks.	<input type="checkbox"/>	<input type="checkbox"/>
9.1.2 If multiple chillers, water flow is balanced across chillers using (indicate which one): <input type="checkbox"/> Balancing valves <input type="checkbox"/> Reverse return piping <input type="checkbox"/> Individual chiller pumps <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>
9.1.3 Temperature, pressure gauges, air eliminator, expansion tank, check valves and all other piping components installed as specified by HVAC Designer.	<input type="checkbox"/>	<input type="checkbox"/>
9.1.4 Chilled Water Supply temperature sensor (and outdoor air temperature sensor where applicable) are located as specified by HVAC Designer.	<input type="checkbox"/>	<input type="checkbox"/>
9.2 Functional Testing: Chillers		
9.2.1 When there is a call for cooling, chillers are operating and maintaining chilled water setpoint.	<input type="checkbox"/>	<input type="checkbox"/>
9.2.2 When multiple chillers are supposed to operate at the same time, they operate according to the Engineer of Record's sequence of operations and the on / off sequencing is observed.	<input type="checkbox"/>	<input type="checkbox"/>
9.2.3 Chiller(s) do not short cycle (i.e., the minimum on time is 5 minutes and the minimum off time is 5 minutes, or as recommended by the chiller manufacturer to prevent short cycling).	<input type="checkbox"/>	<input type="checkbox"/>
9.2.4 Chilled Water Supply Sensor is reading within 3°F of measured chiller temperature.	<input type="checkbox"/>	<input type="checkbox"/>
9.2.5 Chiller minimum flow rate and change in flow rate are maintained within the manufacturer's stated limits throughout the sequence of operation.	<input type="checkbox"/>	<input type="checkbox"/>
9.3: Functional Testing: Chilled Water System Pumps		
9.3.1 Where Chilled Water System pumps (i.e., the pumps which are responsible for moving the chilled water through the terminal units) are equipped with a VFD, which is responding to a pressure sensor within the system or a sensorless VFD system, indicate which one: <input type="checkbox"/> VFD+Sensor <input type="checkbox"/> Sensorless	<input type="checkbox"/>	<input type="checkbox"/>
9.3.2 If a variable speed pumping system is installed, confirm that the VFD increases and decreases pump speed in response to changes in the system.	<input type="checkbox"/>	<input type="checkbox"/>
9.3.3 If a variable speed pumping system is installed, system prevents "dead-heading". (May be tested under real or simulated low flow conditions.) Select the method of water flow bypass: <input type="checkbox"/> Minimum Flow Bypass Valve <input type="checkbox"/> 3 way valves on specific terminal units <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>
9.3.4 Pumps are off when cooling is not required. (N/A if chilled water is required year round.)	<input type="checkbox"/>	<input type="checkbox"/>
FT Agent Name: _____ Date: _____		
FT Agent Signature: _____ Company Name: _____		
Rater Name (if applicable): _____ Date: _____		
Rater Signature: _____ Company Name: _____		



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Footnotes:

1. This Checklist is designed to align with the requirements of ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new multifamily buildings when compared to new multifamily buildings built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems (e.g., those caused by a lack of maintenance or occupant behavior). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

The checklist may be completed and signed by a Rater, rather than a Functional Testing Agent, if only Section 5 is applicable. For units following Path A, a Functional Testing Agent is not needed to complete Sections 2 and 3 for unitary HVAC systems serving dwelling units that will be verified and graded by the Rater. Path A – Dwelling Unit HVAC Grading shall not be used until an Effective Date has been defined by RESNET for ANSI / RESNET / ACCA Std. 310. Path A – Dwelling Unit HVAC Grading shall then use ANSI / RESNET / ACCA Std. 310 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the Effective Date and Transition Period End Date defined by RESNET. RESNET interpretations of Standard 310 shall also be followed.

Sections 2, 3, and 4 of this Checklist generally apply to split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air distribution systems (i.e., ducts). See specific sections for exemptions. If exempted, a Rater may complete those sections as N/A.

Where the term 'dwelling unit' is used in this Checklist, the requirement is also required of 'sleeping' units. The term 'sleeping unit' refers to a room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both.

The term 'common space' refers to any spaces ~~in the building being certified on the property~~ that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, ~~and dining halls, as well as or parking garages used exclusively by residents, building staff, and their guests. This also includes~~ offices ~~or other spaces~~ used by building management, administration or maintenance ~~and all special use areas located on the property to serve and in~~ support ~~of~~ the residents ~~such as day care facilities, gyms, dining halls, etc.~~

2. An explanation of the credentialing process and links to H-QUITOs, which maintain lists of credentialed contractors, can be found at www.energystar.gov/findhvac. FT Agents may not be the installing contractor unless they are a credentialed contractor. All FT Agents that are not credentialed contractors must sign up online in EPA's online database as an FT Agent and watch the online FT Agent orientation. See www.energystar.gov/ftas.
3. The term 'Rater' refers to the person(s) completing the third-party ~~verification inspections~~ required for certification. ~~Theis~~ person(s) shall: a) be a Certified Rater, Approved Inspector, or an equivalent designation as determined by a Verification Oversight Organization or "Multifamily Review Oversight Organization" and, b) have attended and successfully completed an EPA-recognized training class. See www.energystar.gov/mftraining.
4. Either factory-installed or field-installed TXV's may be used. For field-installed TXV's, ensure that sensing bulbs are insulated and tightly clamped to the vapor line with good linear thermal contact at the recommended orientation, usually 4 or 8 o'clock.
5. The term "mini-split" refers to air conditioners and heat pumps that have variable refrigerant flow and distributed refrigerant technology with a single outdoor section serving a single indoor section. The indoor section is typically, but not exclusively, mounted on room walls and/or ceilings and designed to heat or cool air within the conditioned space either directly or through limited duct runs. The term "multi-split" refers to air conditioners and heat pumps that have variable refrigerant flow and distributed refrigerant technology with the capability of serving multiple indoor sections with a single outdoor section. The indoor sections are typically, but not exclusively, mounted on room walls and/or ceilings and designed to heat or cool air within the conditioned space either directly or through a ducted system. A single outdoor section can serve one or more dwelling units. The length of the duct system is not a determinant for meeting either of these definitions.
6. Air balancing of supply registers and return grilles is highly recommended to improve the performance of the HVAC system and comfort of the occupants, but is not required at this time for certification. When air balancing is completed, balancing dampers or proper duct sizing shall be used instead of looped or coiled ductwork to limit flow to diffusers. When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, Opposable Blade Dampers (OBD) or dampers located in the duct boot are permitted to be used.
7. When manually testing outdoor unit heating or cooling mode of operation, at least 25% of associated indoor / terminal units connected to the outdoor unit(s) shall be controlled to the same heating or cooling mode being tested. The FT Agent shall increase the number of indoor / terminal units as needed in order to verify the discharge temperature is warmer / colder than ambient.