



# ENERGY STAR Qualified Homes, Version 3 (Rev. 05) HVAC System Quality Installation Contractor Checklist <sup>1</sup>

Home Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_

System Description <sup>2</sup> \_\_\_\_\_ Cooling system for temporary occupant load? <sup>3</sup> Yes  No

1. Whole-Building Mechanical Ventilation Design <sup>4</sup>	Builder Verified <sup>5</sup>	Cont. Verified <sup>6</sup>	N/A
1.1 Ventilation system installed that has been designed to meet ASHRAE 62.2-2010 requirements including, but not limited to, requirements in Items 1.2-1.5. <sup>7</sup>	<input type="checkbox"/>	<input type="checkbox"/>	-
1.2 Ventilation system does not utilize an intake duct to the return side of the HVAC system unless the system is designed to operate intermittently and automatically based on a timer and to restrict outdoor air intake when not in use (e.g., motorized damper).	<input type="checkbox"/>	<input type="checkbox"/>	-
1.3 Documentation is attached with ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.	<input type="checkbox"/>	<input type="checkbox"/>	-
1.4 If present, continuously-operating vent. & exhaust fans designed to operate during all occupiable hours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.5 If present, intermittently-operating whole-house ventilation system designed to automatically operate at least once per day and at least 10% of every 24 hours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>2. Heating &amp; Cooling System Design <sup>4,8</sup> - Parameters used in the design calculations shall reflect home to be built, specifically, outdoor design temperatures, home orientation, number of bedrooms, conditioned floor area, window area, predominant window performance and insulation levels, infiltration rate, mechanical ventilation rate, presence of MERV6 or better filter, and indoor temperature setpoints = 70° F for heating; 75° F for cooling.</b>			
2.1 Heat Loss / Gain Method: <input type="checkbox"/> Manual J v8 <input type="checkbox"/> 2009 ASHRAE <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	-
2.2 Duct Design Method: <input type="checkbox"/> Manual D <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.3 Equipment Selection Method: <input type="checkbox"/> Manual S <input type="checkbox"/> OEM Rec. <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	-
2.4 Outdoor Design Temperatures: <sup>9</sup> Location: _____ 1%: ____ °F 99%: ____ °F	<input type="checkbox"/>	<input type="checkbox"/>	-
2.5 Orientation of Rated Home (e.g., North, South): _____	<input type="checkbox"/>	<input type="checkbox"/>	-
2.6 Number of Occupants Served by System: <sup>10</sup> _____	<input type="checkbox"/>	<input type="checkbox"/>	-
2.7 Conditioned Floor Area in Rated Home: _____ Sq. Ft.	<input type="checkbox"/>	<input type="checkbox"/>	-
2.8 Window Area in Rated Home: _____ Sq. Ft.	<input type="checkbox"/>	<input type="checkbox"/>	-
2.9 Predominant Window SHGC in Rated Home: <sup>11</sup> _____	<input type="checkbox"/>	<input type="checkbox"/>	-
2.10 Infiltration Rate in Rated Home: <sup>12</sup> Summer: _____ Winter: _____	<input type="checkbox"/>	<input type="checkbox"/>	-
2.11 Mechanical Ventilation Rate in Rated Home: _____ CFM	<input type="checkbox"/>	<input type="checkbox"/>	-
2.12 Design Latent Heat Gain: _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	-
2.13 Design Sensible Heat Gain: _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	-
2.14 Design Total Heat Gain: _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	-
2.15 Design Total Heat Loss: _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	-
2.16 Design Airflow: <sup>13</sup> _____ CFM	<input type="checkbox"/>	<input type="checkbox"/>	-
2.17 Design Duct Static Pressure: <sup>14</sup> _____ In. Water Column	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.18 Full Load Calculations Report Attached	<input type="checkbox"/>	<input type="checkbox"/>	-
<b>3. Selected Cooling Equipment, If Cooling Equipment to be Installed</b>			
3.1 Condenser Manufacturer & Model: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2 Condenser Serial #: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3 Evaporator / Fan Coil Manufacturer & Model: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.4 Evaporator / Fan Coil Serial #: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.5 AHRI Reference #: <sup>15</sup> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.6 Listed Efficiency: _____ EER _____ SEER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7 Metering Device Type: <input type="checkbox"/> TXV <input type="checkbox"/> Fixed orifice <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.8 Refrigerant Type: <input type="checkbox"/> R-410a <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.9 Fan Speed Type: <sup>16</sup> <input type="checkbox"/> Fixed <input type="checkbox"/> Variable (ECM / ICM) <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.10 Listed Sys. Latent Capacity at Design Cond.: <sup>17</sup> _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.11 Listed Sys. Sensible Capacity at Design Cond.: <sup>17</sup> _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.12 Listed Sys. Total Capacity at Design Cond.: <sup>17</sup> _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.13 If Listed Sys. Latent Capacity (Value 3.10) ≤ Design Latent Heat Gain (Value 2.12), ENERGY STAR qualified dehumidifier installed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.14 Listed Total Cap. (Value 3.12) is 95-115% of Design Total Heat Gain (Value 2.14) or next nom. size <sup>8,18</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.15 AHRI Certificate Attached <sup>15</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>4. Selected Heat Pump Equipment, If Heatpump to be Installed</b>			
4.1 AHRI Listed Efficiency: _____ HSPF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2 Performance at 17°F: Capacity _____ BTUh Efficiency: _____ COP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3 Performance at 47°F: Capacity _____ BTUh Efficiency: _____ COP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



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5. Selected Furnace, If Furnace to be Installed	Builder Verified <sup>5</sup>	Cont. Verified <sup>6</sup>	N/A
5.1 Furnace Manufacturer & Model: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2 Furnace Serial #: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.3 Listed Efficiency: _____ AFUE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.4 Listed Output Heating Capacity: _____ BTUh	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.5 Listed Output Heat. Cap. (Value 5.4) is 100-140% of Design Total Heat Loss (Value 2.15) or next nom. size <sup>8,19</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>6. Refrigerant Tests - Run system for 15 minutes before testing</b>			
Note: If outdoor ambient temperature at the condenser is ≤ 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, and the contractor shall mark "N/A" on the Checklist for Section 6 & 7. <sup>20</sup>			
6.1 Outdoor ambient temperature at condenser: _____ °F DB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.2 Return-side air temperature inside duct near evaporator, during cooling mode: _____ °F WB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.3 Liquid line pressure: _____ psig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4 Liquid line temperature: _____ °F DB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.5 Suction line pressure: _____ psig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.6 Suction line temperature: _____ °F DB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>7. Refrigerant Calculations</b>			
For System with Thermal Expansion Valve (TXV):			
7.1 Condenser saturation temperature: _____ °F DB (Using Value 6.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.2 Subcooling value: _____ °F DB (Value 7.1 - Value 6.4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.3 OEM subcooling goal: _____ °F DB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.4 Subcooling deviation: _____ °F DB (Value 7.2 – Value 7.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For System with Fixed Orifice:			
7.5 Evaporator saturation temperature: _____ °F DB (Using Value 6.5)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.6 Superheat value: _____ °F DB (Value 6.6 – Value 7.5)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.7 OEM superheat goal: _____ °F DB (Using superheat tables and Values 6.1 & 6.2)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.8 Superheat deviation: _____ °F DB (Value 7.6 – Value 7.7)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.9 Value 7.4 is ± 3°F or Value 7.8 is ± 5°F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.10 An OEM test procedure has been used in place of sub-cooling or super-heat process and documentation has been attached that defines this procedure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>8. Electrical Measurements – Taken at electrical disconnect while component is in operation</b>			
8.1 Evaporator / air handler fan: _____ amperage _____ line voltage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.2 Condenser unit: _____ amperage _____ line voltage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.3 Electrical measurements within OEM-specified tolerance of nameplate value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>9. Air Flow Tests</b>			
9.1 Air volume at evaporator: _____ CFM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.2 Test performed in which mode? <input type="checkbox"/> Heating <input type="checkbox"/> Cooling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.3 Return duct static pressure: _____ IWC Test Hole Location: <sup>21</sup> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.4 Supply duct static pressure: _____ IWC Test Hole Location: <sup>21</sup> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.5 Test hole locations are well-marked and accessible <sup>21</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.6 Measurement method used: <input type="checkbox"/> Flow grid <input type="checkbox"/> Anemometer <input type="checkbox"/> Pressure matching <sup>22</sup> <input type="checkbox"/> Fan curve <input type="checkbox"/> Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.7 Airflow volume at evaporator (Value 9.1), at fan design speed and full operating load, ± 15% of the airflow required per system design (Value 2.16) or within range recommended by OEM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>10. Air Balance</b>			
10.1 Individual room airflows within the greater of ± 20% or 25 CFM of the design / application for the supply & return ducts <sup>23</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.2 Balancing report indicating, for each supply and return register: room name, design airflow, and final measured airflow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>11. System Controls</b>			
11.1 Operating and safety controls meet OEM requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>12. Drain pan</b>			
12.1 Corrosion-resistant drain pan, properly sloped to drainage system, included with each HVAC component that produces condensate <sup>24</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HVAC Contractor Name: _____		HVAC Contractor Signature: _____ Date: _____	
Builder Name: <sup>25</sup> _____		Builder Signature: <sup>25</sup> _____ Date: _____	



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## Notes:

1. This Checklist is designed to align with the requirements of ASHRAE 62.2-2010 and published addenda and ANSI / ACCA's 5 QI-2007 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes 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 by occupants). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

This Checklist applies to ventilation systems, split air conditioners, unitary air conditioners, air-source / water-source (i.e., geothermal) heat pumps up to 65,000 Btu / h and furnaces up to 225,000 Btu / h. All other equipment, including boilers, is exempt. If the ventilation system is the only applicable system installed in the home, then only Section 1 shall be completed.

One Checklist shall be completed for each system and provided to the Rater. This Checklist with supporting documents may also be used to demonstrate compliance with Indoor airPLUS specifications 4.1, 4.2, 4.5, 4.6, and 7.1.

2. Description of HVAC system location or area served (e.g., "whole house", "upper level", "lower level").
3. Check "Yes" if this system is to handle temporary occupant loads. Such a system may be required to accommodate a significant number of guests on a regular or sporadic basis and shall be handled by a supplemental cooling system (e.g., a small, single-package unit or split-coil unit) or by a system that can shift capacity from zone to zone (e.g., a variable volume system).
4. The person responsible for the heating, cooling, and ventilation design shall be responsible for completing Sections 1 and 2 of this Checklist.
5. The 'Builder Verified' column shall be used to indicate items verified by the builder (or a firm or HERS Rater hired by the builder). The builder is responsible for these items and must sign the bottom of this Checklist if any items in Sections 1 through 5 on this Checklist have been marked 'Builder Verified'. Only credentialed contractors may complete items in Sections 6-10.
6. The 'Cont. Verified' column shall be used to indicate items verified by the credentialed HVAC contractor (or a firm or HERS Rater hired by the contractor). The credentialed contractor is responsible for these items and shall sign the bottom of this Checklist.
7. For proper procedures, exceptions, and selection methods see ASHRAE 62.2-2010 and published addenda. All components shall be designed and installed per local codes, manufacturers' installation instructions, engineering documents, and regional ENERGY STAR program requirements.

The system shall have at least one supply or exhaust fan with associated ducts and controls. Local exhaust fans are allowed to be part of an exhaust ventilation system. Outdoor air ducts connected to the return side of an air handler are allowed to be part of a supply ventilation system if manufacturer requirements for return air temperature are met.

8. Heating and cooling loads shall be calculated, equipment shall be selected, and duct systems shall be sized according to the latest editions of ACCA Manuals J, S, & D, respectively, 2009 ASHRAE Handbook of Fundamentals, or a substantively equivalent procedure. The HVAC system design shall be completed for the specific configuration (e.g., plan, elevation, option, and orientation) of the home to be built except as permitted herein.

### For homes with a date of final inspection through 12/31/2012:

For each house plan with multiple configurations (e.g., orientations, elevations, options), the loads shall be permitted to be calculated for the configuration that will result in the largest load. The largest load shall be permitted to be used for equipment selection for all configurations, subject to the over-sizing limits of ACCA Manual S.

For each house plan with multiple configurations, the room-level design airflows shall be permitted to be calculated using the configuration that resulted in the largest load.

### For homes with a date of final inspection on or after 01/01/2013:

For each house plan with multiple configurations (e.g., orientations, elevations, options), the loads shall be calculated for each potential configuration. If the loads across all configurations vary by  $\leq 25\%$ , then the largest load shall be permitted to be used for equipment selection for all configurations, subject to the over-sizing limits of ACCA Manual S. Otherwise, the contractor shall group the load for each configuration into a set with  $\leq 25\%$  variation and equipment selection shall be completed for each set of loads.

For each house plan with multiple configurations, the room-level design airflows shall be calculated for each potential configuration. If the design airflows for each room vary across all configurations by  $\leq 25\%$  or 25 CFM, then the average room-level design airflow shall be permitted to be used when designing the duct system. Otherwise, the contractor shall group the room-level design airflow for each configuration into a set with  $\leq 25\%$  or 25 CFM variation and the duct design shall be completed for the average airflow of that set.

9. If the design conditions are dictated by a code or regulation, then the requirements of the lawful or controlling authority supersede the Manual J or ASHRAE default design values. Otherwise, the default values shall be used. The values for the geographically closest location shall be selected or a justification provided for the selected location.
10. The number of occupants among all HVAC systems in the home must be equal to the number of bedrooms, as defined below, plus one. Occupants listed for systems that are indicated in the header as a cooling system for temporary occupant loads, as described in Footnote 3, shall be permitted to exceed this limit.

A bedroom is defined by RESNET as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 sq. ft. or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

An egress window, as defined in 2009 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

- have a sill height of not more than 44 inches above the floor; AND



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- have a minimum net clear opening of 5.7 sq. ft.; AND
  - have a minimum net clear opening height of 24 in.; AND
  - have a minimum net clear opening width of 20 in.; AND
  - be operational from the inside of the room without the use of keys, tools or special knowledge.
11. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.
  12. Infiltration rate shall reflect value used in confirmed or projected HERS rating for rated home. Alternatively, use "Average" or "Semi-loose" values for the cooling season infiltration rates and "Semi-tight" or "Average" values for the heating season infiltration rates, as defined by ACCA Manual J, Eighth Edition, Version Two.
  13. Design airflow is the design value(s) for the blower in CFM, as determined by using the manufacturer's expanded performance data to select equipment, per ACCA Manual S procedures.
  14. Design duct static pressure shall account for the installation of a MERV 6 or higher filter.
  15. All evaporators and condensing units shall be properly matched as demonstrated by an attached AHRI certificate. If an AHRI certificate is not available, a copy of OEM-provided catalog data indicating acceptable combination selection and performance data shall be attached.
  16. If the whole-house ventilation system utilizes the HVAC air handler, then the fan speed type shall be ECM / ICM, variable speed, and run at a reduced speed during ventilation, or include a controller (e.g., smart cyclor) that reduces the ventilation run time by accounting for hours when HVAC system is heating or cooling the home.
  17. Listed system capacity at design conditions is to be obtained from the OEM expanded performance data.
  18. For cooling systems, the next largest nominal piece of equipment may be used that is available to satisfy the latent and sensible requirements. Single-speed systems generally have OEM nominal size increments of ½ ton. Multi-speed or multi-stage equipment may have OEM nominal size increments of one ton. Therefore, the use of these advanced system types can provide extra flexibility to meet the equipment sizing requirements.
  19. For warm air heating systems, the output capacity must be between 100% and 140% of calculated system load unless a larger size is dictated by the cooling equipment selection.
  20. 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.
  21. Examples of return or supply duct static pressure measurement locations are: plenum, cabinet, trunk duct, as well as front, back, left or right side. Test hole locations shall be well marked and accessible.
  22. The pressure matching method uses a calibrated fan to match the supply plenum pressure produced when the HVAC air handler fan is in operation. The airflow through the calibrated fan that produces the same pressure is assumed to match the HVAC air handler fan airflow.
  23. Ducts shall not include coiled or looped ductwork except to the extent needed for acoustical control. Balancing dampers or proper duct sizing shall be used instead of loops 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.
  24. Condensate pan shall be made of corrosion-resistant materials, to include galvanized steel and plastic. Drain pan shall drain condensate to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drainage system; and shall be equipped with a backflow prevention valve when drained to a shared drainage system, such as a storm water management system.
  25. Builder name, signature, and signature date are required if any items in Sections 1 through 5 have been marked 'Builder Verified'.