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ENERGY STAR REV 7 OVERVIEW WITH DETAIL EMPHASIS ON THE HVAC CONTRACTOR & RATER CHECKLIST

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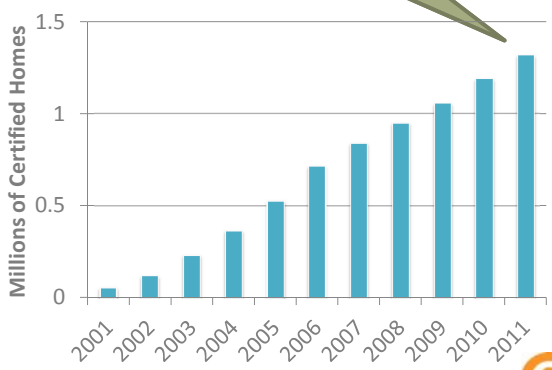
The Power of ENERGY STAR

- 80% brand recognition
- 92% influence on purchasing

1.3 million homes
> 30% of 2011 new homes

> 4,500 builders



Market Realities

WASHINGTON

- The U.S. Environmental Protection Agency (EPA) announced that of all single-family homes built nationally
- 21% in 2009
- 25% in 2010
- 26% in 2011

- Colorado Market share of ESNHs
  - 2004 - 4.2%
  - 2009 - 28%
  - 2010 – 45%
  - 2011 – 43%
  - 2012 – Going down?
  - 2013 going back up

What's in ENERGY STAR?

Core Energy Efficiency Features +

Thermal Enclosure System Checklist	High-quality insulation & fenestration Proper installation & air sealing Reduced thermal bridging
HVAC Contractor and Rater Checklists	Fully-engineered design Best practice installation Fresh air & exhaust
Water Management System Checklist	Water-managed site, foundation, walls, and roof

Use the correct checklist

ENERGY STAR Qualified Homes
ENERGY STAR Qualified Homes, Version 3 (Rev. 01)
ENERGY STAR Qualified Homes, Version 3 (Rev. 02)
ENERGY STAR Qualified Homes, Version 3 (Rev. 03)
ENERGY STAR Qualified Homes, Version 3 (Rev. 04)
ENERGY STAR Qualified Homes, Version 3 (Rev. 05)
ENERGY STAR Qualified Homes, Version 3 (Rev. 06)
ENERGY STAR Certified Homes, Version 3 (Rev. 07)
National Program Requirements

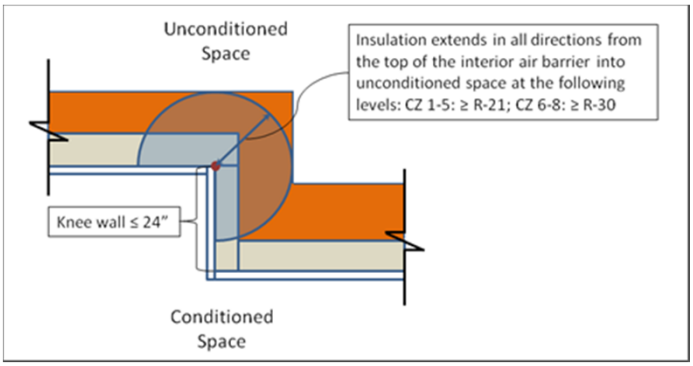
Certifying Homes

The following homes are eligible to earn the ENERGY STAR:

- Detached dwelling units [1] (e.g. single family homes); OR
- Dwelling units [1] in any multifamily building with 4 units or fewer; OR
- Dwelling units [1] in multifamily buildings with 3 stories or fewer above-grade [2,3]; OR
- Dwelling units [1] in multifamily buildings with 4 or 5 stories above-grade [2,3] that have their own heating, cooling, and hot w

Rev 7 Thermal Enclosure Checklist

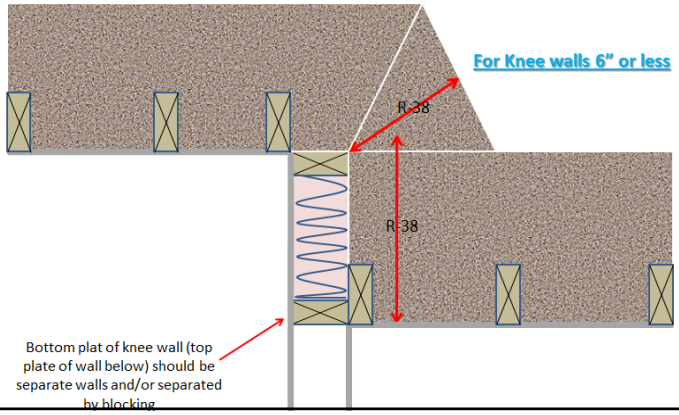
- ESv3 - Knee wall air barrier
  - Missing attic side air barrier
  - R-21 in all direction



EnergyLogic's knee wall requirement

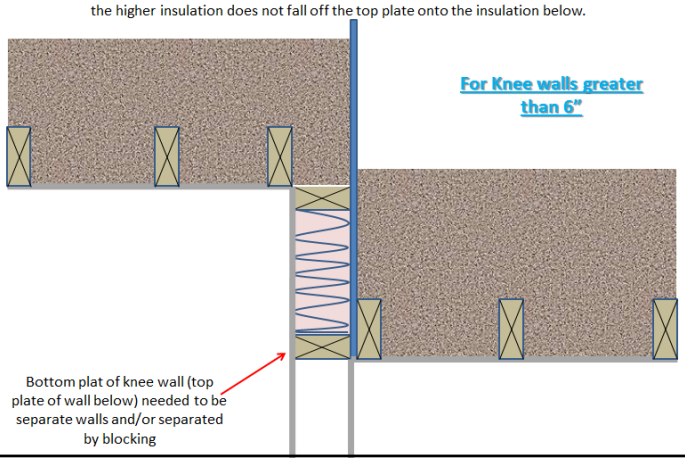
- Knee walls 6" or Less

The installed depth of the insulation must be equal to or greater than the height of the kneewall in order to forego kneewall backing. The installed insulation angle should not exceed 45 degrees to ensure that the mounded insulation provides a minimum acceptable insulation depth over the corner of such structures and to ensure that it will not slide off. The depth of the insulation as illustrated by the two red arrows shall be equal hence ensuring at least and R-38 over the outside edge of the knee wall.



- Knee wall greater than 6"

For short knee walls and for raised ceilings that are higher than 6" and or the the ceiling below, the best practice is to install a full attic side air barrier and six sided enclosed cavity insulation. The air barrier should extend above the raised ceiling, to act as an insulation dam, to ensure that the higher insulation does not fall off the top plate onto the insulation below.



Small Knee Wall Done Right

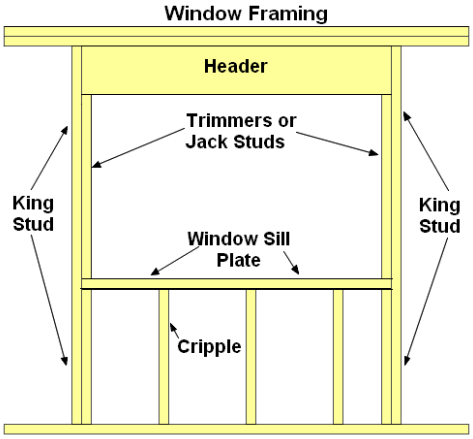
Insulated Headers: R-5: Intent vs. Exception

Exception – Where framing plan indicates that full depth solid headers are used

Insulation over the Top Plate:

Baffle and Minimum R-21 in CZ-5

Framing limited at all windows and doors



- Framing at windows shall be limited to a maximum
  - One pair of king studs per window opening
  - One pair jack studs per window opening to support the header and window sill
    - Additional jack studs shall be used only as needed for structural support
  - Cripple studs only as needed to maintain on-center spacing of studs

Footnote #21 (Exception)

- **"In Climate Zones 5 - 8, a minimum stud spacing of 16 in. o.c. is permitted to be used with 2x6 framing if ≥ R-20.0 wall insulation is installed"**
- Regardless, all vertical framing members shall either be on-center or have an alternative structural purpose (e.g., framing members at the edge of pre-fabricated panels) that is apparent to the Rater or documented in a framing plan…
- The Rater need not evaluate the structural necessity of the framing plan to qualify the home.
- However, all 2x6 framing with stud spacing of 16 in. o.c. in Climate Zones 5 - 8 shall have ≥ R-20.0 wall insulation installed regardless of any framing plan or alternative equivalent total UA calculation."

HVAC Contractors Checklist

HVAC System Quality Installation Rater Checklist - page one

- Collect and Review
  - HVAC Contractor Checklist
  - Ventilation System Design
  - Full Load calculations
  - AHRI Certificates
  - Balancing report

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Review of HVAC System Quality Installation Contractor Checklist [2]	Must Correct	Rater Verified	N/A
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), and AHRI certificate (3.13).	☐	☐	☐
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor Checklist (Contractor Checklist item # indicated in parenthesis): [3]			
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location [4]	☐	☐	☐
1.2.2 Home orientation (2.5) matches orientation of rated home	☐	☐	☐
1.2.3 Number of occupants (2.6) equals number of occupants in rated home [5]	☐	☐	☐
1.2.4 Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home	☐	☐	☐
1.2.5 Window area (2.8) is within ±10% of calculated window area of rated home	☐	☐	☐
1.2.6 Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home [6]	☐	☐	☐
1.2.7 Listed latent cooling capacity (3.8) exceeds design latent heat gain (2.12)	☐	☐	☐
1.2.8 Listed sensible cooling capacity (3.9) exceeds design sensible heat gain (2.13)	☐	☐	☐
1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.2, 5.1), and AHRI certificate or OEM catalog data all match [7]	☐	☐	☐
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temperature (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [8]	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 6.4) value is within ±3 °F of the reported target temperature (7.3) or calculated superheat (6.6 minus 7.5) value is within ±5 °F of the reported target temperature (7.7). [9]	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure ± 110% of contractor values (9.3, 9.4)	☐	☐	☐
1.4 Contractor-prepared balancing report indicating the room name and design airflow for each supply and return register collected by Rater for records. In addition, final individual room airflows measured and documented on balancing report through one of the following options:			
1.4.1 Measured and documented by contractor (10.1.1), OR;	☐	☐	☐
1.4.2 Measured by Rater using Section 804.2 of the Mortgage Industry National HERS Standard, documented by Rater, & verified by Rater to be within the greater of a 20% or 25 CFM of design airflow (10.1.2)	☐	☐	☐
1.5 HVAC contractor holds credentials necessary to complete the HVAC System QI Contractor Checklist [10]	☐	☐	☐
2. Duct Quality Installation - *Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts* [11]			
2.1 Connections and routing of ductwork completed without kinks or sharp bends. [12]	☐	☐	☐
2.2 No excessive coiled or looped flexible ductwork. [13]	☐	☐	☐
2.3 Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter	☐	☐	☐
2.4 Flexible ducts supported at intervals as recommended by mfr. but at a distance ≤ 5 ft.	☐	☐	☐
2.5 Building cavities not used as supply or return ducts unless they meet items 3.2, 3.3, 4.1, and 4.2 of this Checklist	☐	☐	☐
2.6 HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Rater Checklist.	☐	☐	☐
2.7 Quantity & location of supply and return duct terminals match contractor balancing report. [14]	☐	☐	☐
2.8 Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and / or undercut doors to either: a) provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported on the contractor-provided balancing report; or b) achieve a Rater-measured pressure differential ≤ 3 Pa with respect to the main body of the house when all bedroom doors are closed and all air handlers are operating [15] [16]	☐	☐	☐
3. Duct Insulation - *Applies to All Heating, Cooling, Supply Ventilation, and Pressure Balancing Ducts* [17]			
3.1 All connections to trunk ducts in unconditioned space are insulated.	☐	☐	☐
3.2 *Prescriptive Path*: Supply ducts in unconditioned attic have insulation ≥ R-8. *Performance Path*: Supply ducts in unconditioned attic have insulation ≥ R-6.	☐	☐	☐
3.3 All other supply ducts and all return ducts in unconditioned space have insulation ≥ R-6.	☐	☐	☐

HVAC System Contractor Checklist Section

Footnote #1

Footnote: #1

- This Checklist is designed to :
  - ASHRAE 62.2-2010 and ANSI / ACCA's 5 QI2007 protocol
  - Improving the performance of HVAC equipment in new homes when compared to homes built to minimum code
- However, these features alone cannot prevent all 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, are 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.
- The Checklist CANNOT be used to demonstrate compliance with the Indoor airPLUS specifications

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

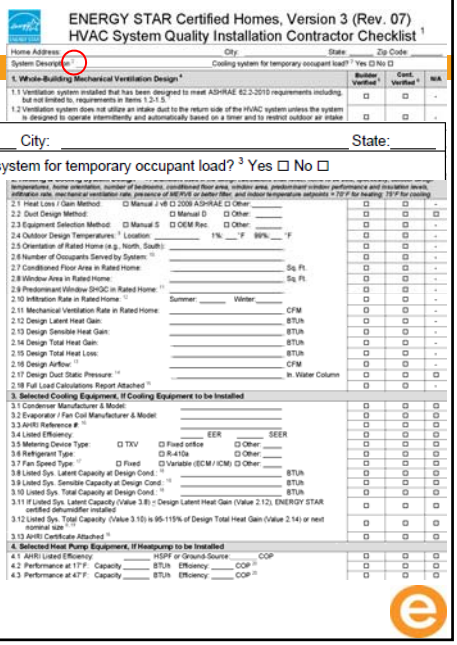
Home Address: _____ City: _____ State: _____ Zip Code: _____

System Description [1] _____ Cooling system for temporary occupant load? [1] ☐ Yes ☐ No

1. Whole-Building Mechanical Ventilation Design [2]	Builder Verified [1]	Cont. Verified [1]	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. [3]	☐	☐	-
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).	☐	☐	-
1.3 Documentation is attached with ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.	☐	☐	-
1.4 If present, continuously-operating vent. & exhaust fans designed to operate during all occupiable hours.	☐	☐	☐
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.	☐	☐	☐
2. Heating & Cooling System Design [4] - *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 insolation levels, infiltration rate, mechanical ventilation rate, presence of MERV 6 or better filter, and indoor temperature setpoints = 75°F for heating, 75°F for cooling.*			
2.1 Heat Loss / Gain Method: ☐ Manual J v8 ☐ 2009 ASHRAE HOF ☐ Other: _____	☐	☐	-
2.2 Duct Design Method ☐ Manual D ☐ Other: _____	☐	☐	☐
2.3 Equipment Selection Method: ☐ Manual S ☐ OEM Rec. ☐ Other: _____	☐	☐	-
2.4 Outdoor Design Temperatures [5] Location: _____ 1% ___ °F 99% ___ °F	☐	☐	-
2.5 Orientation of Rated Home (e.g., North, South): _____	☐	☐	-
2.6 Number of Occupants Served by System: [6] _____	☐	☐	-
2.7 Conditioned Floor Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.8 Window Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.9 Predominant Window SHGC in Rated Home: [7] _____	☐	☐	-
2.10 Infiltration Rate in Rated Home: [8] Summer: _____ Winter: _____	☐	☐	-
2.11 Mechanical Ventilation Rate in Rated Home: _____ CFM	☐	☐	-
2.12 Design Latent Heat Gain: _____ BTUh	☐	☐	-
2.13 Design Sensible Heat Gain: _____ BTUh	☐	☐	-
2.14 Design Total Heat Gain: _____ BTUh	☐	☐	-
2.15 Design Total Heat Loss: _____ BTUh	☐	☐	-
2.16 Design Airflow: [9] _____ CFM	☐	☐	-
2.17 Design Duct Static Pressure: [10] _____ In. Water Column	☐	☐	☐
2.18 Full Load Calculations Report Attached [11]	☐	☐	-
3. Selected Cooling Equipment, If Cooling Equipment to be Installed			
3.1 Condenser Manufacturer & Model: _____	☐	☐	☐
3.2 Evaporator / Fan Coil Manufacturer & Model: _____	☐	☐	☐
3.3 AHRI Reference # [12] _____	☐	☐	☐
3.4 Listed Efficiency: _____ EER _____ SEER	☐	☐	☐
3.5 Metering Device Type: ☐ TXV ☐ Fixed orifice ☐ Other: _____	☐	☐	☐
3.6 Refrigerant Type: ☐ R-410a ☐ Other: _____	☐	☐	☐
3.7 Fan Speed Type: [13] ☐ Fixed ☐ Variable (ECM / ICM) ☐ Other: _____	☐	☐	☐
3.8 Listed Sys. Latent Capacity at Design Cond: [14] _____ BTUh	☐	☐	☐
3.9 Listed Sys. Sensible Capacity at Design Cond: [14] _____ BTUh	☐	☐	☐
3.10 Listed Sys. Total Capacity at Design Cond: [14] _____ BTUh	☐	☐	☐
3.11 If Listed Sys. Latent Capacity (Value 3.8) ≥ Design Latent Heat Gain (Value 2.12), ENERGY STAR certified dehumidifier installed	☐	☐	☐
3.12 Listed Sys. Total Capacity (Value 3.10) is 95-115% of Design Total Heat Gain (Value 2.14) or next nominal size [15] [16]	☐	☐	☐
3.13 AHRI Certificate Attached [17]	☐	☐	☐
4. Selected Heat Pump Equipment, If Heatpump to be Installed			
4.1 AHRI Listed Efficiency: _____ HSPF or Ground-Source: _____ COP	☐	☐	☐
4.2 Performance at 17°F Capacity: _____ BTUh Efficiency: _____ COP [18]	☐	☐	☐
4.3 Performance at 47°F Capacity: _____ BTUh Efficiency: _____ COP [19]	☐	☐	☐

HVAC System Contractor Checklist Section

Footnote #2


ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

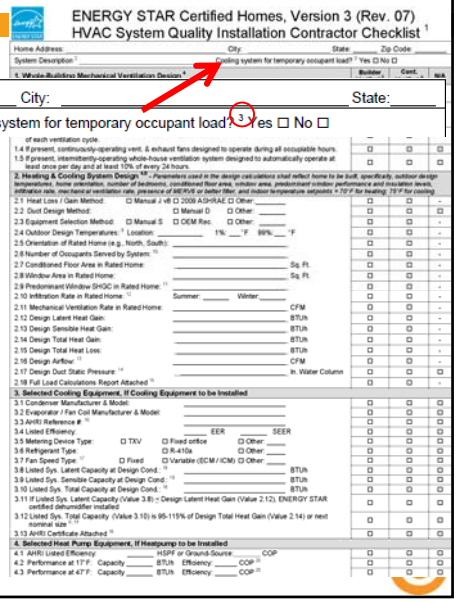
Home Address: _____ City: _____ State: _____

System Description [2] _____ Cooling system for temporary occupant load? [3] Yes ☐ No ☐

- Description of HVAC system location or area served e.g
  - Whole house
  - Upper level
  - lower level

HVAC System Contractor Checklist Section

Footnote #3


ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

Home Address: _____ City: _____ State: _____

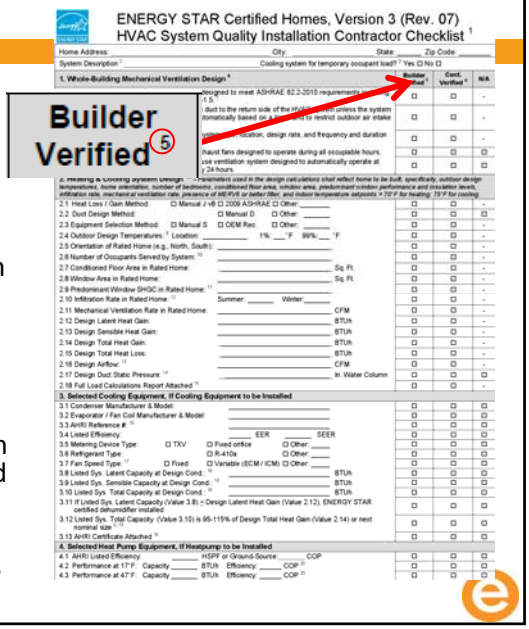
System Description [2] _____ Cooling system for temporary occupant load? [3] Yes ☐ No ☐

- 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)

We should hardly ever see this

HVAC System Contractor Checklist Section

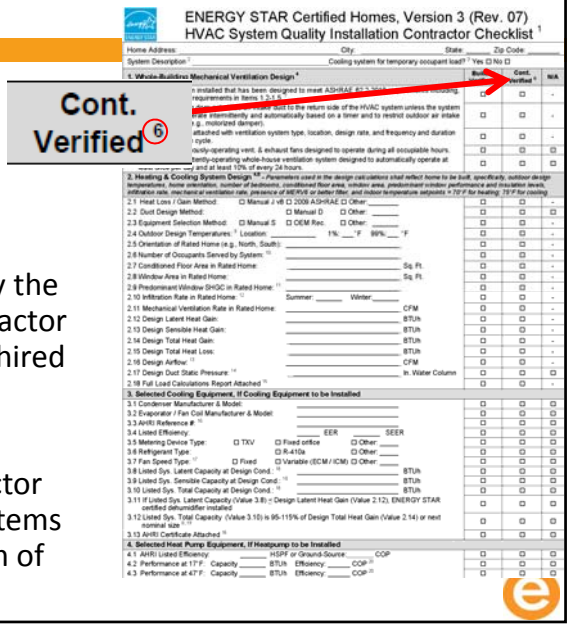
Footnote #5



- 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

HVAC System Contractor Checklist Section

Footnote #6

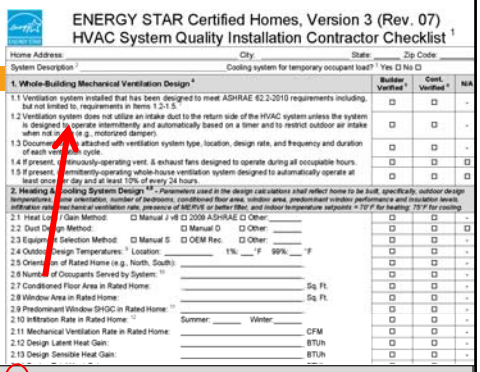


- The 'Contractor Verified' column shall be used to indicate items verified by the credentialed HVAC contractor (or a firm or HERS Rater hired by the contractor)
- The credentialed contractor is responsible for these Items and shall sign the bottom of this Checklist

HVAC System Contractor Checklist Section #1

Footnote #4

- The person responsible for the heating, cooling, and ventilation design shall be responsible for completing Sections 1 and 2 of this Checklist



ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

Home Address: City: State: Zip Code:
System Description [2] Cooling system for temporary occupant load? [3] Yes ☐ No ☐

1. Whole-Building Mechanical Ventilation Design [4]	Builder Verified [5]	Cont. Verified [6]	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	☐	☐	-
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).	☐	☐	-
1.3 Documentation is attached with ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.	☐	☐	-
1.4 If present, continuously-operating vent. & exhaust fans designed to operate during all occupiable hours.	☐	☐	☐
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.	☐	☐	☐
2. Heating & Cooling System Design [4] — *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 MERV8 or better filter, and indoor temperature setpoints = 75°F for heating; 75°F for cooling*			
2.1 Heat Loss / Gain Method: ☐ Manual J v8 ☐ 2009 ASHRAE ☐ Other: _____	☐	☐	-
2.2 Duct Design Method: ☐ Manual D ☐ Other: _____	☐	☐	☐
2.3 Equipment Selection Method: ☐ Manual S ☐ OEM Rec. ☐ Other: _____	☐	☐	-
2.4 Outdoor Design Temperatures: [7] Location: _____ 1%: ___°F 99%: ___°F	☐	☐	-
2.5 Orientation of Rated Home (e.g., North, South): _____	☐	☐	-
2.6 Number of Occupants Served by System: [8] _____	☐	☐	-
2.7 Conditioned Floor Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.8 Window Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.9 Predominant Window SHGC in Rated Home: [9] _____	☐	☐	-
2.10 Infiltration Rate in Rated Home: [7] Summer: _____ Winter: _____	☐	☐	-
2.11 Mechanical Ventilation Rate in Rated Home: _____ CFM	☐	☐	-
2.12 Design Latent Heat Gain: _____ BTUh	☐	☐	-
2.13 Design Sensible Heat Gain: _____ BTUh	☐	☐	-

1. Whole-Building Mechanical Ventilation Design [4]

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. [7]

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).

1.3 Documentation is attached with ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.

1.4 If present, continuously-operating vent. & exhaust fans designed to operate during all occupiable hours.

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.

HVAC Contractor Checklist

1. Whole-Building Mechanical Ventilation

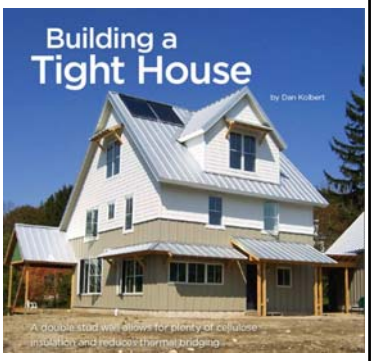
1.1Ventilation system installed has been designed to meet ASHRAE 62.2-2010 requirements including, but not limited to, requirements in Items 1.2-1.5

- Footnote: #7
  - 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

Can a House Be Too Tight?

NO!

- Wrong question
- Control **air flow**
- In order to control the air



Real question .....

- Can houses be under-ventilated?

YES!

Build Tight and Ventilate Right

ASHRAE
Advancing HVAC&R to serve humanity and promote a sustainable world

American Society of Heating, Refrigerating, and Air-Conditioning Engineers

Whole-Building Mechanical Ventilation Design

ASHRAE Standard 62.2 - 2010

- Standard for establishing consistent ventilation in a house
- Both Whole House **Controlled Mechanical Ventilation** and **Spot ventilation** standard
- This standard applies to spaces intended for human occupancy within **single-family houses and multifamily structures of three stories or fewer** above grade, including manufactured and modular houses

Local Exhaust or "Spot Ventilation" *Ventilation* Removes pollutants, Moisture, and odors at their source

- **Baths:**
  - **50 CFM intermittent**
  - **20 CFM continuous**

- **Kitchens:**
  - **100 CFM intermittent**
  - **25 CFM continuous**
  - **Ducted to outside**

WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW RATE REQUIREMENTS

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0 – 1	2 – 3	4 – 5	6 – 7	> 7
	Airflow in CFM				
< 1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

- ASHRAE 62.2 Table or Formula:
- Ventilation calculated by formula:

Fan flow (CFM) = 0.01 CFM x your floor area + 7.5 x (your number of bedrooms + 1)

- For a 1,510 square foot 4-bedroom home,

(0.01 X 1510) + (7.5 times 5)
Formula Result: 52.5 CFM
Chart Result: 75 CFM

EnergyLogic Use the Formula:

Rater-measured ventilation rate is within 100-120% of design value

Pick Your Ventilation Strategy Carefully to Maximize Performance

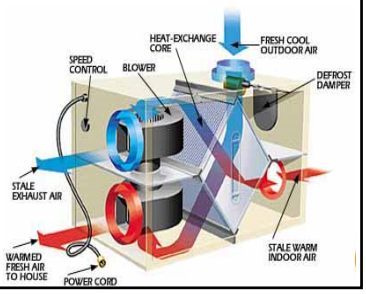
Built Tight Ventilate Right

ULTRAGREEN DC MOTOR TECHNOLOGY

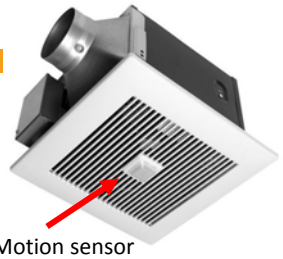
WhisperGreen

Three Strategies

- Supply Ventilation
  (Furnace blower must be ECM/ICM)
- Exhaust Ventilation
  - Possible configuration with reversed dampered designed opening to outside
- Balanced Ventilation



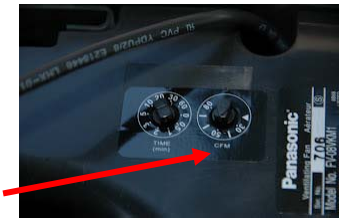
There must be a control



Motion sensor

This controls the ventilation system

Recommend not turning off



Adjustable fan control highly recommended

HVAC Contractor Checklist

1. Whole-Building Mechanical Ventilation

Supply side ventilation:

- 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**)
- Footnote: #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 cycler) that reduces the ventilation run time by accounting for hours when HVAC system is heating or cooling the home

HVAC Contractor Checklist

1. Whole-Building Mechanical Ventilation

- 1.3 **Documentation is attached with ventilation system type:**
  - Location
  - design rate,
  - Frequency and duration of each ventilation cycle
- 1.4 If present, continuously-operating vent. & exhaust fans designed to operate during all occupiable hours
- 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 hour period

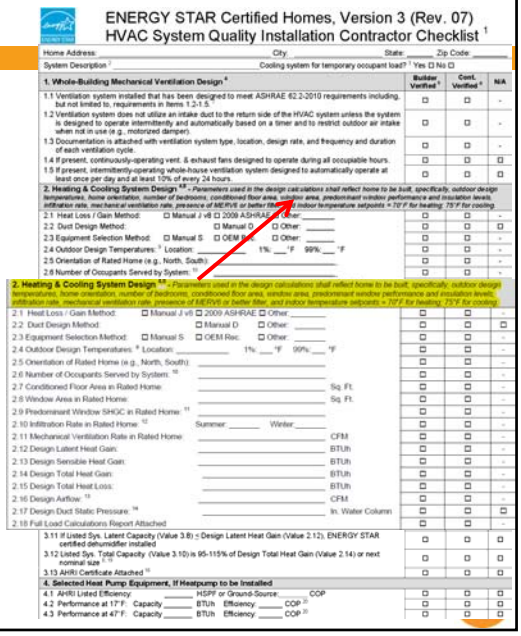
Ventilation's Impact on the HERS Index

- The Home will not receive the energy benefit of building tighter than .35 NACH unless the house also has a controlled whole house mechanical ventilation
  - This is do to the RESNET and Energy Code Reference home which the Rated home is compared to
  - Fan energy (watts) impacts the ability to fully take advantage of the trade offs for code and compliance for ESv3
    - Consider low watt draw ventilation strategies to lower the HERS Index
      - Furnace blowers are not low watt draw fans

HVAC System Contractor Checklist Section #2

2. Heating & Cooling System Design

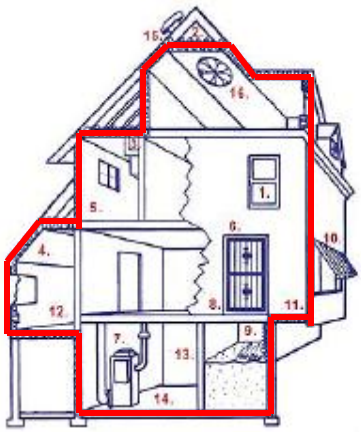
- Parameters used in the design calculations shall reflect home to be built – specifically:
  - Outdoor design temperatures
  - Home orientation
  - Number of bedrooms
  - Conditioned floor area
  - Window area
  - Predominant window U-value and SHGC
  - Insulation R-values
  - Infiltration rate
  - Mechanical ventilation rate
  - Presence of MERV6 or better filter
  - Indoor temperature set-points
    - 70°F for heating; 75°F for cooling


ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist

Thermal Enclosure Systems Rater Checklist

Giving the HVAC Contractor something they have never had before

- Defined Thermal Boundary
  - Air barrier and thermal barrier alignment
- RESNET Grade 1 insulation
  - Use the actual R-values
  - U-values and SHHC
- Air sealing
  - Tight Envelopes
- Control
  - **Air Flow**
  - **Moisture Flow**
  - **Thermal Flow**



ESv3 Design for House Plans with Multiple Configurations: (e.g., plan, elevation, option, and orientation)

2. **Heating & Cooling System Design**[8] - *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.*

Footnote #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
  - 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:

Footnote: #8 ESv3 Design for House Plans with Multiple Configurations: (e.g., plan, elevation, option, and orientation)

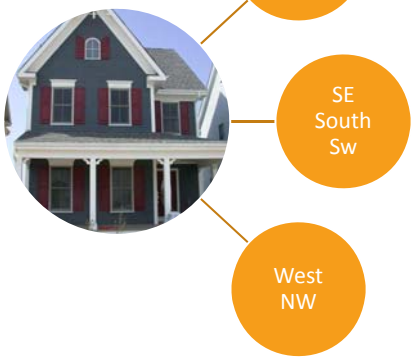
- The **load shall be competed for each configuration**
- If the loads across configurations vary by ≤ 25% then the largest load can be used subject to oversize rules established by Manual S
- Otherwise, the contractor shall group the load for each configuration into a set with ≤ 25% variation and equipment selection shall be completed for each set of loads

- Designed air flow
  - Room level designed air flows shall be done for each configuration unless air flows across configurations vary by ≤ 25% or 25 CFM then the average shall be permitted
  - Otherwise, the contractor shall group the room-level design airflow for each configuration into a set with ≤ 25% or 25 CFM variation and the duct design shall be completed for the average airflow of that set.

What does this mean?

Foundation Types	Full Basement	Base / Crawl	Walkout	Crawl / Walkout	Full Crawl		Elevations that change SQ or volume
Orientations	**How many potential configurations are there?**					Options	
North						3 bedroom	Elev. A
NE						4 Bedroom	Elev. B
East						Office/bed room	Elev. C
SE							Elev. D
South							
SW							
West							
NW							

Batching in set that at ≤ 25%

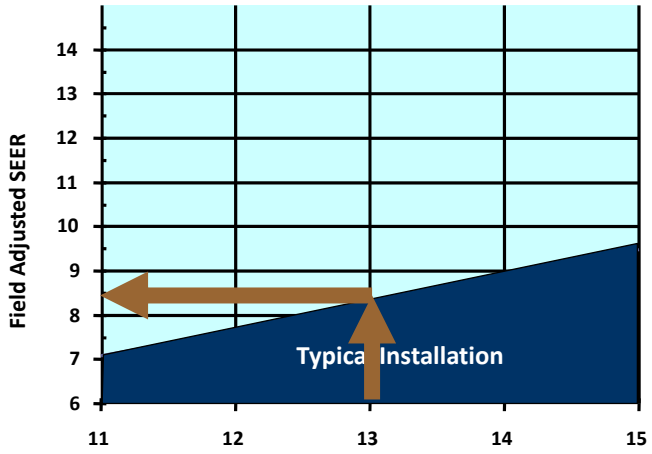


Start with Template
Mover to Sit Specific ……

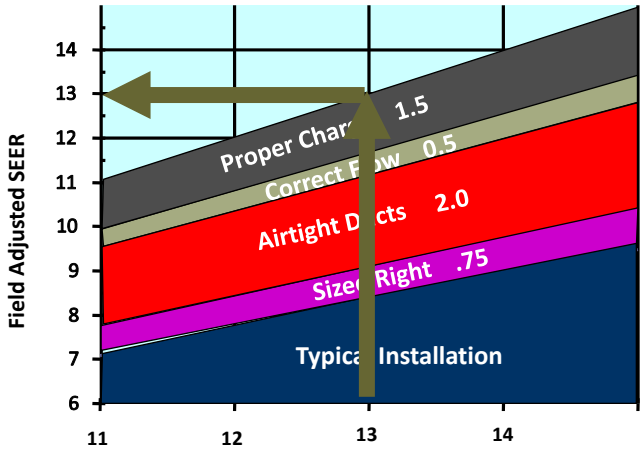
Site Specific Design

- Rater Checklist
- For each house plan with multiple configurations (e.g., orientations, elevations, options)
- The Rater shall confirm that the parameters listed in Items 1.2.2 to 1.2.6 are aligned with the rated home

HVAC SYSTEM QUALITY INSTALLATION
Checklist is AC Centric



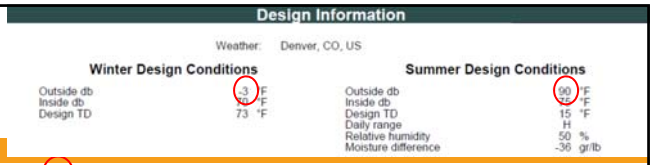
HVAC SYSTEM QUALITY INSTALLATION



HVAC Contractor's Checklist

2. Heating & Cooling System Design [4,8] - *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.*			
2.1 Heat Loss / Gain Method: ☐ Manual J v8 ☐ 2009 ASHRAE ☐ Other:_____	☐	☐	-
2.2 Duct Design Method: ☐ Manual D ☐ Other: _____	☐	☐	☐
2.3 Equipment Selection Method: ☐ Manual S ☐ OEM Rec. ☐ Other: _____	☐	☐	-
2.4 Outdoor Design Temperatures: [9] Location: _____ 1%: ___ °F 99%: ___ °F	☐	☐	-
2.5 Orientation of Rated Home (e.g., North, South): _____	☐	☐	-
2.6 Number of Occupants Served by System: [10] _____	☐	☐	-
2.7 Conditioned Floor Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.8 Window Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.9 Predominant Window SHGC in Rated Home: [11] _____	☐	☐	-
2.10 Infiltration Rate in Rated Home: [12] Summer: _____ Winter:_____	☐	☐	-
2.11 Mechanical Ventilation Rate in Rated Home: _____ CFM	☐	☐	-
2.12 Design Latent Heat Gain: _____ BTUh	☐	☐	-
2.13 Design Sensible Heat Gain: _____ BTUh	☐	☐	-
2.14 Design Total Heat Gain: _____ BTUh	☐	☐	-
2.15 Design Total Heat Loss: _____ BTUh	☐	☐	-
2.16 Design Airflow: [13] _____ CFM	☐	☐	-
2.17 Design Duct Static Pressure: [14] _____ In. Water Column	☐	☐	☐
2.18 Full Load Calculations Report Attached	☐	☐	-

Footnote: #9



2.4 Outdoor Design Temperatures: (9) Location: _____ 1%: ___ °F 99%: ___ °F

- If the design conditions are dictated by a code, then code requirements rule **(We are getting better at recognizing this)**
- 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

Location	Elevation	Latitude	Winter	Summer					
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
Colorado									
Alamosa AP	7543	37	-11	82	55	-53	-46	-40	H
Boulder	5358	40	0	91	59	-47	-40	-34	H
Colorado Springs AP	6171	38	4	87	58	-46	-39	-33	H
Craig	6283	40	-12	85	56	-52	-45	-39	H
Denver AP	5283	39	-3	90	59	-46	-39	-33	H

Footnotes: #10

2.6 Number of Occupants Served by System: (10)

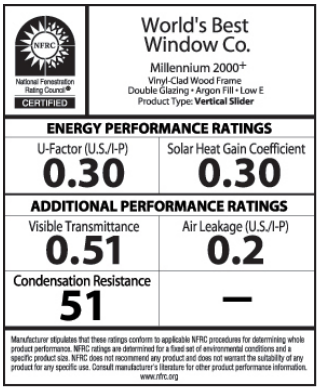
- The number of occupants among all HVAC systems in the home must be equal to the number of bedrooms, as defined below, plus one (a Ventilation issue)
- Occupants listed for systems serving temporary occupant loads, as described in Footnote 3, shall be permitted to exceed this limit (Discussed before)

- **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 shall:
  - have a sill height of not more than 44 inches above the floor; AND
  - 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 te inside of the room without the use of keys, tools or special knowledge

Footnotes: #11

2.9 Predominant Window SHGC in Rated Home: (11)

"Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.



Footnotes: #12

2.10 Infiltration Rate in Rated Home: (12)

- Infiltration rate shall reflect value used in confirmed or projected HERS rating for rated home
- Alternatively, use "Average" or "Semiloose" 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

Infiltration:

Method	Simplified
Construction quality	Average
Fireplaces	0

Footnotes: #13

2.16 Design Airflow: (13)

Cooling Equipment Summary

Make	Carrier		
Trade	Base 13 Puron AC		
Cond	24ABA324A30		
Coil	CAP**2414A**++TDR		
ARI ref no.	738723		
Efficiency	11.6 EER, 13 SEER		
Sensible cooling		18148	Btuh
Latent cooling		3203	Btuh
Total cooling		21350	Btuh
Actual air flow		995	cfm
Air flow factor		0.063	cfm/Btuh
Static pressure		0.70	in H2O
Load sensible heat ratio		1.00	

- 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.

Footnotes: #14

2.17 Design Duct Static Pressure: (14)

Cooling Equipment Summary

Make	Carrier		
Trade	Base 13 Puron AC		
Cond	24ABA324A30		
Coil	CAP**2414A**++TDR		
ARI ref no.	738723		
Efficiency	11.6 EER, 13 SEER		
Sensible cooling		18148	Btuh
Latent cooling		3203	Btuh
Total cooling		21350	Btuh
Actual air flow		995	cfm
Air flow factor		0.063	cfm/Btuh
Static pressure		0.70	in H2O
Load sensible heat ratio		1.00	

- Design duct static pressure shall account for the installation of a MERV 6 or higher filter.

HVAC Rater's Checklist

Raters are required to review the following

1. Review of HVAC System Quality Installation Contractor Checklist [2]			
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), AHRI certificate (3.15), and balancing report (10.2).	☐	☐	☐
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor Checklist (Contractor Checklist Item # indicated in parenthesis):[3]			
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location [4]	☐	☐	☐
1.2.2 Home orientation (2.5) matches orientation of rated home	☐	☐	☐
1.2.3 Number of occupants (2.6) equals number of occupants in rated home [5]	☐	☐	☐
1.2.4 Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home	☐	☐	☐
1.2.5 Window area (2.8) is within ±10% of calculated window area of rated home	☐	☐	☐
1.2.6 Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home [6]	☐	☐	☐
1.2.7 Listed latent cooling capacity (3.10) exceeds design latent heat gain (2.12)	☐	☐	☐
1.2.8 Listed sensible cooling capacity (3.11) exceeds design sensible heat gain (2.13)	☐	☐	☐
1.2.9 Listed total cooling capacity (3.12) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [7]	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.3, 5.1), and AHRI certificate or OEM catalog data all match [8]	☐	☐	☐
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temp. (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [9]	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 6.4) or superheat (6.6 minus 7.5) value equals reported target subcooling (7.3) or superheat (7.7) temperature [9]	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure ≤ 110% of contractor values (9.3, 9.4)	☐	☐	☐

HVAC Contractor Checklist Section #3

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

Home Address: City: State: Zip Code:
System Description [2] Cooling system for temporary occupant load? [3] Yes ☐ No ☐

3. Selected Cooling Equipment, If Cooling Equipment to be Installed			
3.1 Condenser Manufacturer & Model: _____	☐	☐	☐
3.2 Evaporator / Fan Coil Manufacturer & Model: _____	☐	☐	☐
3.3 AHRI Reference #: [16] _____	☐	☐	☐
3.4 Listed Efficiency: _____ EER _____ SEER	☐	☐	☐
3.5 Metering Device Type: ☐ TXV ☐ Fixed orifice ☐ Other: _____	☐	☐	☐
3.6 Refrigerant Type: ☐ R-410a ☐ Other: _____	☐	☐	☐
3.7 Fan Speed Type: [17] ☐ Fixed ☐ Variable (ECM / ICM) ☐ Other: _____	☐	☐	☐
3.8 Listed Sys. Latent Capacity at Design Cond.: [18] _____ BTUh	☐	☐	☐
3.9 Listed Sys. Sensible Capacity at Design Cond.: [18] _____ BTUh	☐	☐	☐
3.10 Listed Sys. Total Capacity at Design Cond.: [18] _____ BTUh	☐	☐	☐
3.11 If Listed Sys. Latent Capacity (Value 3.8) ≤ Design Latent Heat Gain (Value 2.12), ENERGY STAR certified dehumidifier installed	☐	☐	☐
3.12 Listed Sys. Total Capacity (Value 3.10) is 95-115% of Design Total Heat Gain (Value 2.14) or next nominal size [6, 19]	☐	☐	☐
3.13 AHRI Certificate Attached [16]	☐	☐	☐

- Selected Cooling Equipment if installed

Footnotes: #16

3.3 AHRI Reference #: [16]

3.13 AHRI Certificate Attached [16]


AHRI CERTIFIED

Certificate of Product Ratings

- 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

Footnotes: #17

3.7 Fan Speed Type: [17] ☐ Fixed ☐ Variable (ECM / ICM) ☐ Other: _____

- **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 cycler) that reduces the ventilation run time by accounting for hours when HVAC system is heating or cooling the home

Footnotes: #18

3.8 Listed Sys. Latent Capacity at Design Cond.: (18) _____ BTUh
3.9 Listed Sys. Sensible Capacity at Design Cond.: (18) _____ BTUh
3.10 Listed Sys. Total Capacity at Design Cond.: (18) _____ BTUh

Cooling Equipment Summary

Make	Carrier	
Trade	Base 13 Puron AC	
Cond	24ABA324A30	
Coil	CAP**2414A**++TDR	
ARI ref no.	738723	
Efficiency	11.6 EER, 13 SEER	
Sensible cooling	18148	Btuh
Latent cooling	3203	Btuh
Total cooling	21350	Btuh
Actual air flow	995	cfm
Air flow factor	0.063	cfm/Btuh
Static pressure	0.70	in H2O
Load sensible heat ratio	1.00	

- Listed system capacity at design conditions is to be obtained from the OEM expanded performance data

Footnotes: #8, #19

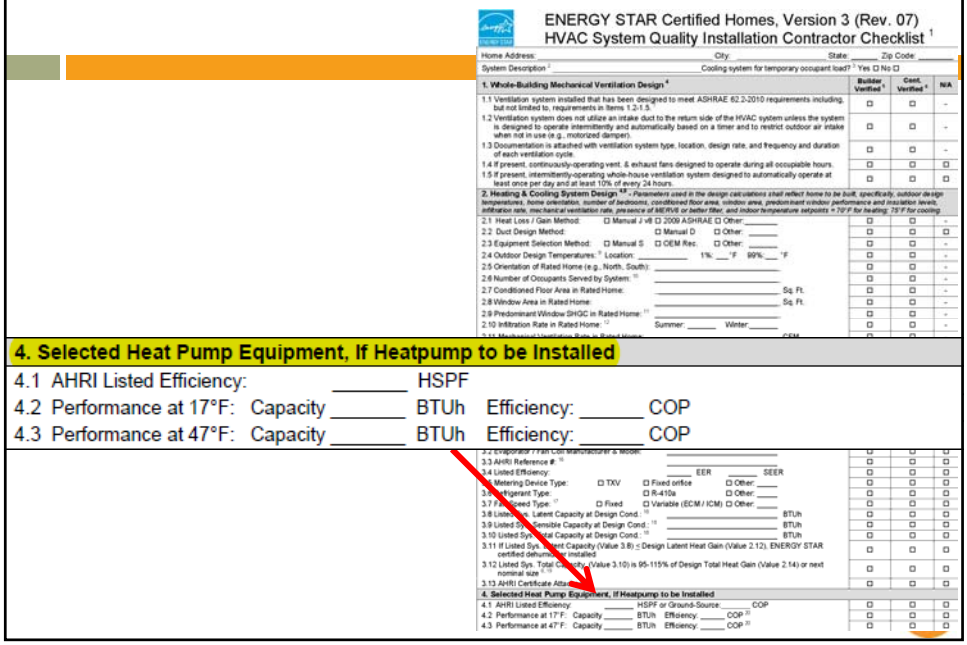
3.12 Listed Sys. Total Capacity (Value 3.10) is 95-115% of Design Total Heat Gain (Value 2.14) or next nominal size (8,19)

#8 – Sizing requirements for houses with multiple orientations

#19 - 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

HVAC System Contractor Checklist Section #4



ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

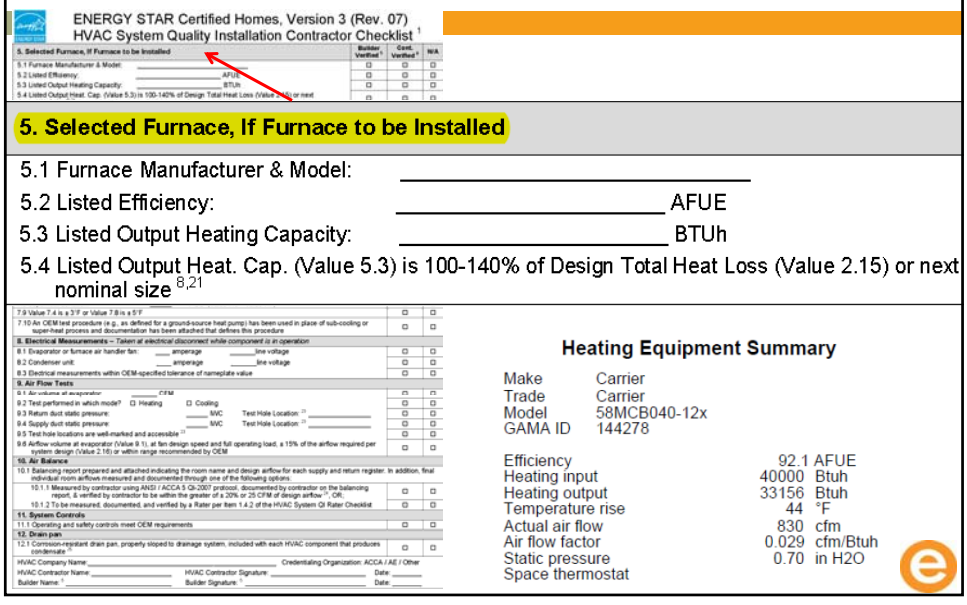
4. Selected Heat Pump Equipment, If Heatpump to be Installed

4.1 AHRI Listed Efficiency: _____ HSPF

4.2 Performance at 17°F: Capacity _____ BTUh Efficiency: _____ COP

4.3 Performance at 47°F: Capacity _____ BTUh Efficiency: _____ COP

HVAC Contractor Checklist Section #5



ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

5. Selected Furnace, If Furnace to be Installed

5.1 Furnace Manufacturer & Model: _____

5.2 Listed Efficiency: _____ AFUE

5.3 Listed Output Heating Capacity: _____ BTUh

5.4 Listed Output Heat. Cap. (Value 5.3) is 100-140% of Design Total Heat Loss (Value 2.15) or next nominal size [8,21]

Heating Equipment Summary

Make	Carrier
Trade	Carrier
Model	58MCB040-12x
GAMA ID	144278

Efficiency	92.1	AFUE
Heating input	40000	Btuh
Heating output	33156	Btuh
Temperature rise	44	°F
Actual air flow	830	cfm
Air flow factor	0.029	cfm/Btuh
Static pressure	0.70	in H2O
Space thermostat		

Gas Furnace OEM Specs

Temperature Rise: Not required but good idea to measure!

Carrier 58MCB

SPECIFICATIONS (CONTINUED)

UNIT SIZE			080–16	080–20
Shipping Weight – Lb. (KG)			193 (88)	201 (91)
RATINGS AND PERFORMANCE				
Input Btuh*			80,000	80,000
Output Capacity BTUH* (ICS) (Shaded capacities are specified on rating plate)	Direct Vent (2–Pipe)	Upflow	74,000	74,000
		Downflow	74,000	74,000
		Horizontal	74,000	74,000
	Non–Direct Vent (1–Pipe)	Upflow	74,000	74,000
		Downflow	74,000	74,000
		Horizontal	74,000	74,000
AFUE%† Nonweatherized ICS	Direct Vent (2–Pipe)	Upflow	92.3	92.3
		Downflow	91.2	91.2
		Horizontal	92.1	92.1
	Non–Direct Vent (1–Pipe)	Upflow		
		Downflow		
		Horizontal		
Certified Temperature Rise Range °F (°C)			30–60 (17–33)	20–50 (11–28)
Certified External Static Pressure		Heating	0.15	0.15
		Cooling	0.50	0.50
Airflow CFM‡		Heating	1285	1785
		Cooling	1525	1925

Temp rise

30 to 60 F

Footnotes: #8,#21

5.4 Listed Output Heat. Cap. (Value 5.3) is 100-140% of Design Total Heat Loss (Value 2.15) or next nominal size 8,21

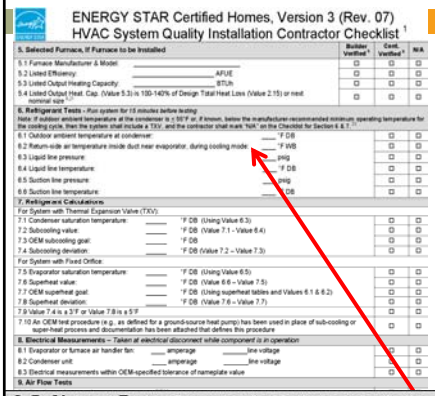
#8 – Sizing requirements for houses with multiple orientations

Heating Equipment Summary

Make	Carrier	
Trade	Carrier	
Model	58MCB040-12x	
GAMA ID	144278	
Efficiency	92.1	AFUE
Heating input	40000	Btuh
Heating output	33156	Btuh
Temperature rise	44	°F
Actual air flow	830	cfm
Air flow factor	0.029	cfm/Btuh
Static pressure	0.70	in H2O
Space thermostat		

#21 - 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

HVAC Contractor Checklist Section #6



ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

5. Selected Furnace, If Furnace to be Installed	Builder Verified [2]	Cont. Verified [2]	N/A
5.1 Furnace Manufacturer & Model: _____	☐	☐	☐
5.2 Listed Efficiency: _____ AFUE	☐	☐	☐
5.3 Listed Output Heating Capacity: _____ BTUh	☐	☐	☐
5.4 Listed Output Heat. Cap. (Value 5.3) is 100-140% of Design Total Heat Loss (Value 2.15) or next nominal size [21]	☐	☐	☐
6. Refrigerant Tests - *Run system for 15 minutes before testing* 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 [22]			
6.1 Outdoor ambient temperature at condenser: ____ °F DB	☐	☐	
6.2 Return-side air temperature inside duct near evaporator, during cooling mode: ____ °F WB	☐	☐	
6.3 Liquid line pressure: ____ psig	☐	☐	
6.4 Liquid line temperature: ____ °F DB	☐	☐	
6.5 Suction line pressure: ____ psig	☐	☐	
6.6 Suction line temperature: ____ °F DB	☐	☐	
7. Refrigerant Calculations			
For System with Thermal Expansion Valve (TXV):			
7.1 Condenser saturation temperature: ____ °F DB (Using Value 6.3)	☐	☐	
7.2 Subcooling value: ____ °F DB (Value 7.1 – Value 6.4)	☐	☐	
7.3 OEM subcooling goal: ____ °F DB	☐	☐	
7.4 Subcooling deviation: ____ °F DB (Value 7.2 – Value 7.3)	☐	☐	
For System with Fixed Orifice:			
7.5 Evaporator saturation temperature: ____ °F DB (Using Value 6.5)	☐	☐	
7.6 Superheat value: ____ °F DB (Value 6.6 – Value 7.5)	☐	☐	
7.7 OEM superheat goal: ____ °F DB (Using superheat tables and Values 6.1 & 6.2)	☐	☐	
7.8 Superheat deviation: ____ °F DB (Value 7.6 – Value 7.7)	☐	☐	
7.9 Value 7.4 is ≤ 3°F or Value 7.8 is ≤ 5°F	☐	☐	
7.10 An OEM test procedure (e.g., as defined for a ground-source heat pump) has been used in place of sub-cooling or superheat process and documentation has been attached that defines this procedure	☐	☐	
8. Electrical Measurements – *Taken at electrical disconnect while component is in operation*			
8.1 Evaporator or furnace air handler fan: ____ amperage ____ line voltage	☐	☐	
8.2 Condenser unit: ____ amperage ____ line voltage	☐	☐	
8.3 Electrical measurements within OEM-specified tolerance of nameplate value	☐	☐	
9. Air Flow Tests			

Refrigerant Tests

- Run system for 15 minutes before testing
- 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**

6. Refrigerant Tests - *Run system for 15 minutes before testing*

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 [22]

6.1 Outdoor ambient temperature at condenser:	____ °F DB	☐	☐
6.2 Return-side air temperature inside duct near evaporator, during cooling mode:	____ °F WB	☐	☐
6.3 Liquid line pressure:	____ psig	☐	☐
6.4 Liquid line temperature:	____ °F DB	☐	☐
6.5 Suction line pressure:	____ psig	☐	☐
6.6 Suction line temperature:	____ °F DB	☐	☐

Footnotes: #22

- 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

HVAC Contractor Checklist Section #7

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist

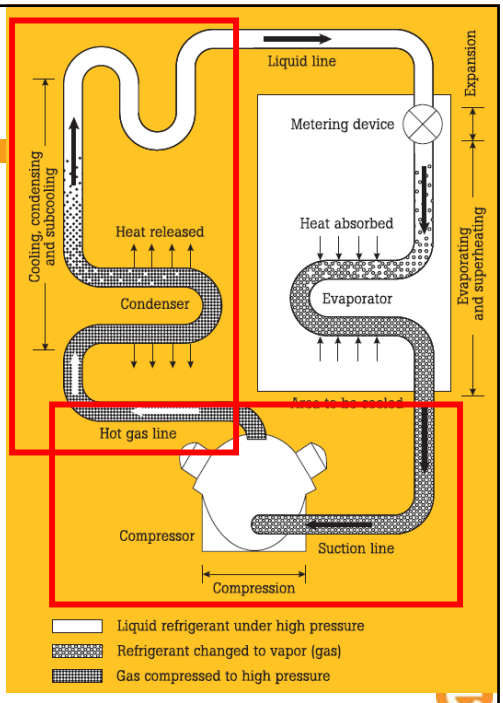
7. Refrigerant Calculations		
For System with Thermal Expansion Valve (TXV):		
7.1 Condenser saturation temperature:	____	°F DB (Using Value 6.3)
7.2 Subcooling value:	____	°F DB (Value 7.1 - Value 6.4)
7.3 OEM subcooling goal:	____	°F DB
7.4 Subcooling deviation:	____	°F DB (Value 7.2 – Value 7.3)
For System with Fixed Orifice:		
7.5 Evaporator saturation temperature:	____	°F DB (Using Value 6.5)
7.6 Superheat value:	____	°F DB (Value 6.6 – Value 7.5)
7.7 OEM superheat goal:	____	°F DB (Using superheat tables and Values 6.1 & 6.2)
7.8 Superheat deviation:	____	°F DB (Value 7.6 – Value 7.7)
7.9 Value 7.4 is ± 3°F or Value 7.8 is ± 5°F		
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		

Same notes as Section 6:

- Run system for 15 minutes before testing
- 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.

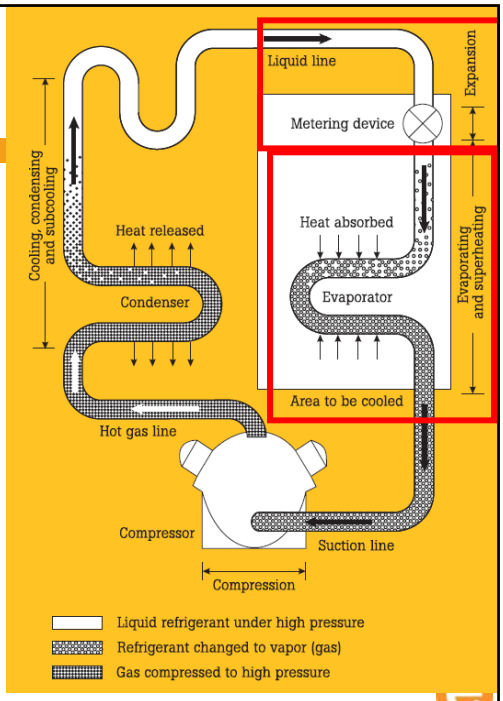
Subcooling

- Compressor elevates refrigerant vapor pressure to higher boiling point
- Boiling point higher than outdoor air temperature
- Air across condenser causes refrigerant to condense
- Additional passes in condenser coil cool liquid refrigerant below its boiling point, **to ensure 100% liquid at metering device**
- Subcooling = amount of refrigerant temperature drop below boiling point to ensure 100% liquid



Superheat

- Metering device restricts refrigerant flow, drops refrigerant pressure to new, lower boiling point
- Boiling point lower than indoor air temperature
- Air across evaporator causes refrigerant to boil
- Additional passes in evaporator coil warm gas above its boiling point → ensures 100% gas at compressor
- Superheat = amount of refrigerant temperature rise above boiling point to ensure 100% gas



HVAC Contractor Checklist Section #8

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

8. Electrical Measurements – *Taken at electrical disconnect while component is in operation*

8.1 Evaporator or furnace air handler fan: ____ amperage _____line voltage

8.2 Condenser unit: ____ amperage _____line voltage

8.3 Electrical measurements within OEM-specified tolerance of nameplate value

HVAC Contractor Checklist Section #9

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

9. Air Flow Tests

9.1 Air volume at evaporator: _____ CFM

9.2 Test performed in which mode? ☐ Heating ☐ Cooling

9.3 Return duct static pressure: _____ IWC Test Hole Location: [23] _____

9.4 Supply duct static pressure: _____ IWC Test Hole Location: [23] _____

9.5 Test hole locations are well-marked and accessible [23]

9.6 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

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**

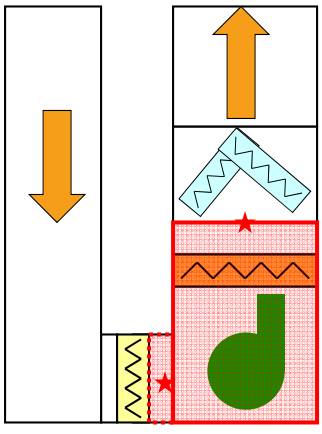
Static Pressure Measurements

External Static Pressure (EPS)

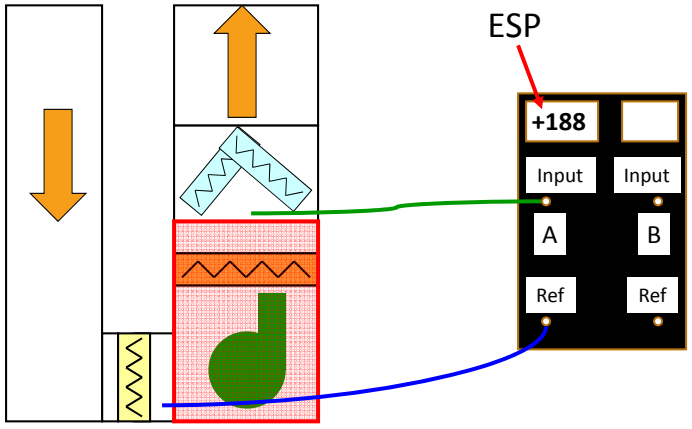
- The measurement of the resistance to the flow of air in the duct system that the furnace fan has to work against
- Everything external of the furnace cabinet
  - Resistance to flow on the Supply side:
    - AC Coil
    - Supply duct
    - Register covers
  - Resistance to flow on the Return side:
    - Filter
    - Return duct
    - return grills
- ESP is the sum of the return pressure (-) and the supply pressure (+) created by the blower

External Static Pressure (EPS)

- ESP is measured using a manometer and is expressed in inches of water column (i.e., #" WC)
- Return side readings are taken at the inlet to the furnace blower after the filter
- Supply side readings are taken as the air is exiting the furnace cabinet before the evaporator coil
- The sum of the two measurements are added together regardless of + or – signs to express the total ESP



External Static Pressure



Design Targets

Find targets in design submittal

- Static pressures
- Airflows through air handler
  - Heating
  - Cooling
- Control strategy

Cooling Equipment Summary

Make	Carrier	
Trade	BASE 13 PURON AC	
Cond	24ABB324C30	
Coil	CNPV*2414A**	
AHRI ref no.	3040365	
Efficiency	11.7 EER, 14 SEER	
Sensible cooling	20205	Btuh
Latent cooling	2755	Btuh
Total cooling	22960	Btuh
Actual air flow	1340	cfm
Air flow factor	0.076	cfm/Btuh
Static pressure	0.70	in H2O
Load sensible heat ratio	1.00	

The only test done both by the Rater and the HVAC Contractor

Between the filter and the blower

Test hole locations shall be well marked and accessible

Between the cabinet and the AC Coil

9.6

- 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

9.1 Air volume at evaporator: _____ CFM

2.16 Design Airflow:

- Energy Star is no longer telling you how to test air flow

Flow Grid/plate: option

- The Flow grid temporarily replaces the filter in the air handler distribution system
- If the filter location is directly adjacent to the air handler, the Flow grid will measure the total air handler flow
  - i.e. flow across the heat exchanger and coil
- If the filter is located remotely at a central return, the Flow grid will measure airflow through the central return

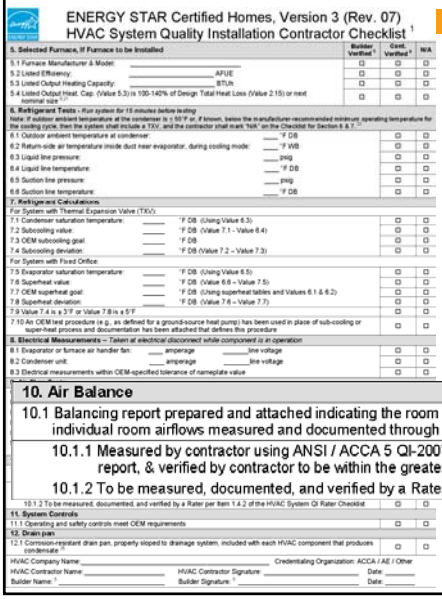
Air Handler OEM Specs option

Blower Performance

AIR DELIVERY-CFM (WITH FILTER)* Carrier 58MCB

UNIT SIZE	RETURN-AIR SUPPLY	SPEED	EXTERNAL STATIC PRESSURE (In. wc)							
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
040-08	1 side or bottom	High	1075	1040	995	945	895	840	760	670
		Med-Low	850	825	780	740	685	635	560	480
		Low	740	700	650	620	565	515	455	385
040-12	1 side or bottom	High	1470	1415	1400	1285	1215	1120	995	890
		Med-High	1315	1280	1235	1180	1115	1035	930	825
		Med-Low	1125	1110	1085	1045	990	915	830	740
		Low	930	925	910	850	830	770	705	635
060-08	1 side or bottom	High	1100	1065	1005	945	900	805	730	610
		Med-Low	890	865	810	765	705	620	540	475
		Low	745	710	670	625	565	505	425	360
060-12	1 side or bottom	High	1430	1375	1325	1275	1200	1135	1040	935
		Med-High	1270	1260	1215	1160	1105	1035	950	850
		Med-Low	1070	1055	1045	1015	975	920	850	750
		Low	915	895	885	865	840	800	720	650
060-16	1 side or bottom	High	1700	1695	1640	1580	1545	1450	1380	1310
		Med-High	1500	1465	1435	1385	1355	1300	1250	1185
		Med-Low	1325	1295	1265	1230	1190	1150	1105	1050
		Low	1205	1170	1145	1110	1080	1035	990	950
080-12	1 side or bottom	High	1535	1470	1405	1330	1245	1160	1065	935
		Med-High	1395	1350	1300	1225	1155	1080	985	880
		Med-Low	1200	1175	1125	1065	1030	970	890	780
		Low	1040	1020	990	960	910	860	785	680
080-16	1 side or bottom	High	1750	1685	1635	1575	1525	1445	1380	1310
		Med-High	1495	1455	1405	1355	1305	1250	1185	1120
		Med-Low	1310	1260	1225	1170	1125	1095	1040	980
		Low	1135	1105	1075	1040	995	995	910	860

HVAC Contractor Checklist Section #10



ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

10. Air Balance

10.1 Balancing report prepared and attached indicating the room name and design airflow for each supply and return register. In addition, final individual room airflows measured and documented through one of the following options:

10.1.1 Measured by contractor using ANSI / ACCA 5 QI-2007 protocol, documented by contractor on the balancing report, & verified by contractor to be within the greater of ± 20% or 25 CFM of design airflow [24]. OR; ☐ ☐

10.1.2 To be measured, documented, and verified by a Rater per Item 1.4.2 of the HVAC System QI Rater Checklist ☐ ☐

Footnote: #24 Ducts shall not include coiled or looped ductwork except to the extent needed for acoustical control

- Aurora – 2 soft bends

- 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

Balancing Report 10.2

- Includes supply and return register location
  - Room name
- Design flow
- Actual measured flow
- Altitude adjustment

Result Summary

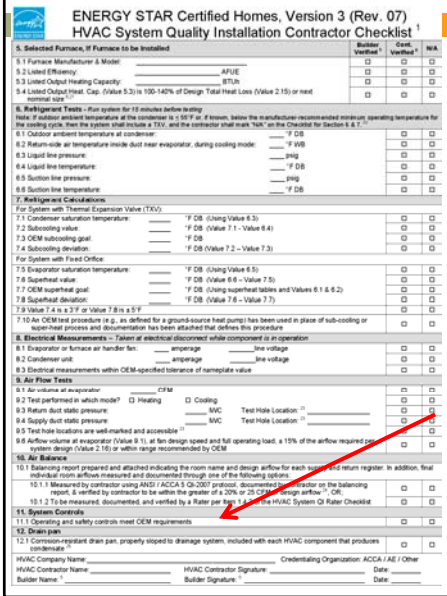
Total System Flow	Main floor		Upper level		Total System Flow	Main	Upper	
	Static pres	CFM	Static pres	CFM		CFM	CFM	
Cooling Speed	0.5 IWC	740	0.5 IWC		Cooling Speed	773		A/C tons = 2
Heating Speed					Heating Speed	↑	↑	

Based on Manufacturers Blower Performance Specifications

Duct Flow Testing	All Rooms + or - 20% of design				Ahlnor flow hood cfm					All Rooms < 3 pascals
1st Floor system + basement	S	R	Measured CFM Cool Speed	Designed CFM (Heat/Cool)	Measured CFM % DIFFERENCE	1st Floor Rooms	S	R	Measured CFM Cool Speed	Designed CFM (Heat/Cool)	Measured CFM % DIFFERENCE
UNFINISHED					#DIV/0!	PDR	S		15	21	-29%
BASE	S		250	314	-20%	KITCHEN	S		57	61	-7%
	S				#DIV/0!	DINING	S		100	120	-17%

Flow hoods

HVAC Contractor Checklist Section #11



ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

	Builder Verified [2]	Cont. Verified [2]	N/A
5. Selected Furnace, If Furnace to be Installed			
5.1 Furnace Manufacturer & Model: _____	☐	☐	☐
5.2 Listed Efficiency: _____ AFUE	☐	☐	☐
5.3 Listed Output Heating Capacity: _____ BTUh	☐	☐	☐
5.4 Listed Output Heat. Cap. (Value 5.3) is 100-140% of Design Total Heat Loss (Value 2.15) or next nominal size [3,21]	☐	☐	☐
6. Refrigerant Tests - *Run system for 15 minutes before testing*			
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. [4]			
6.1 Outdoor ambient temperature at condenser: ___ °F DB		☐	☐
6.2 Return-side air temperature inside duct near evaporator, during cooling mode: ___ °F WB		☐	☐
6.3 Liquid line pressure: ___ psig		☐	☐
6.4 Liquid line temperature: ___ °F DB		☐	☐
6.5 Suction line pressure: ___ psig		☐	☐
6.6 Suction line temperature: ___ °F DB		☐	☐
7. Refrigerant Calculations			
For System with Thermal Expansion Valve (TXV):			
7.1 Condenser saturation temperature: ___ °F DB (Using Value 6.3)		☐	☐
7.2 Subcooling value: ___ °F DB (Value 7.1 - Value 6.4)		☐	☐
7.3 OEM subcooling goal: ___ °F DB		☐	☐
7.4 Subcooling deviation: ___ °F DB (Value 7.2 – Value 7.3)		☐	☐
For System with Fixed Orifice:			
7.5 Evaporator saturation temperature: ___ °F DB (Using Value 6.5)		☐	☐
7.6 Superheat value: ___ °F DB (Value 6.6 – Value 7.5)		☐	☐
7.7 OEM superheat goal: ___ °F DB (Using superheat tables and Values 6.1 & 6.2)		☐	☐
7.8 Superheat deviation: ___ °F DB (Value 7.6 – Value 7.7)		☐	☐
7.9 Value 7.4 is ± 3°F or Value 7.8 is ± 5°F		☐	☐
7.10 An OEM test procedure (e.g., as defined for a ground-source heat pump) has been used in place of sub-cooling or superheat process and documentation has been attached that defines this procedure		☐	☐
8. Electrical Measurements – *Taken at electrical disconnect while component is in operation*			
8.1 Evaporator or furnace air handler fan: ___ amperage _____line voltage		☐	☐
8.2 Condenser unit: ___ amperage _____line voltage		☐	☐
8.3 Electrical measurements within OEM-specified tolerance of nameplate value		☐	☐
9. Air Flow Tests			
9.1 Air volume at evaporator: _____ CFM		☐	☐
9.2 Test performed in which mode? ☐ Heating ☐ Cooling		☐	☐
9.3 Return duct static pressure: _____ IWC Test Hole Location: [23] _____		☐	☐
9.4 Supply duct static pressure: _____ IWC Test Hole Location: [23] _____		☐	☐
9.5 Test hole locations are well-marked and accessible [22]		☐	☐
9.6 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		☐	☐
10. Air Balance			
10.1 Balancing report prepared and attached indicating the room name and design airflow for each supply and return register. In addition, final individual room airflows measured and documented through one of the following options:			
10.1.1 Measured by contractor using ANSI / ACCA 5 QI-2007 protocol, documented by contractor on the balancing report, & verified by contractor to be within the greater of a 20% or 25 CFM of design airflow [24]; OR;		☐	☐
10.1.2 To be measured, documented, and verified by a Rater per Item 1.4 of the HVAC System QI Rater Checklist		☐	☐
11. System Controls			
11.1 Operating and safety controls meet OEM requirements		☐	☐
12. Drain pan			
12.1 Corrosion-resistant drain pan, properly sloped to drainage system, included with each HVAC component that produces condensate [25]		☐	☐
HVAC Company Name: _____ Credentialing Organization: ACCA / AE / Other			
HVAC Contractor Name: _____ HVAC Contractor Signature: _____ Date: _____			
Builder Name: [5] _____ Builder Signature: [5] _____ Date: _____			

11. System Controls

11.1 Operating and safety controls meet OEM requirements

HVAC Contractor Checklist Section #12

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Contractor Checklist [1]

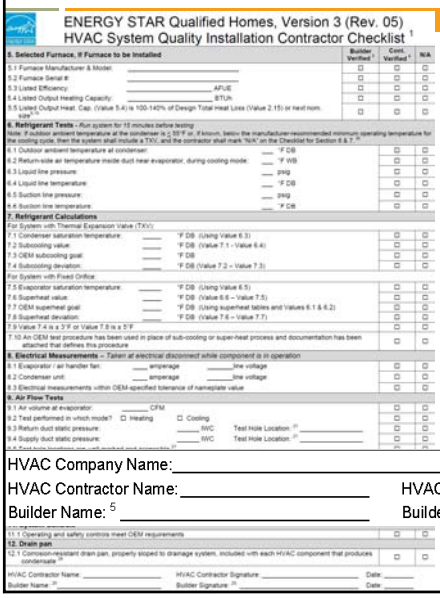
12. Drain pan

12.1 Corrosion-resistant drain pan, properly sloped to drainage system, included with each HVAC component that produces condensate [25]

Footnote: 25

- Condensate pan shall be made of corrosion-resistant materials
  - Galvanized steel / 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

Signature

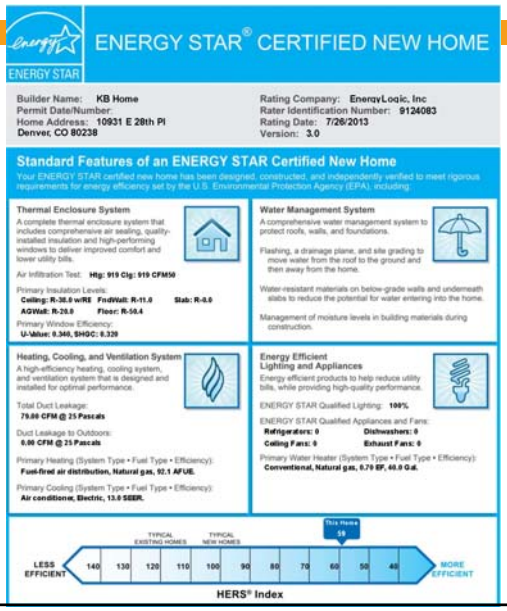


ENERGY STAR Qualified Homes, Version 3 (Rev. 05)
HVAC System Quality Installation Contractor Checklist [1]

HVAC Company Name: _____ Credentialing Organization: ACCA / AE / Other
HVAC Contractor Name: _____ HVAC Contractor Signature: _____ Date: _____
Builder Name: [5] _____ Builder Signature: [5] _____ Date: _____

- New
- A line has been added to the signature block For contractors to indicate their credentialing organization

HVAC Rater's Checklist



ENERGY STAR® CERTIFIED NEW HOME

Builder Name: KB Home
Permit Date/Number:
Home Address: 10931 E 28th Pl
Denver, CO 80238

Rating Company: EnergyLogic, Inc
Rater Identification Number: 9124083
Rating Date: 7/26/2013
Version: 3.0

Standard Features of an ENERGY STAR Certified New Home

Your ENERGY STAR certified new home has been designed, constructed, and independently verified to meet rigorous requirements for energy efficiency set by the U.S. Environmental Protection Agency (EPA), including:

Thermal Enclosure System
A complete thermal enclosure system that includes comprehensive air sealing, quality-installed insulation and high-performing windows to deliver improved comfort and lower utility bills.
Air Infiltration Test: Htg: 919 Clg: 919 CFM50
Primary Insulation Levels:
Ceiling: R-38.0 w/RE FndWall: R-11.0 Slab: R-0.0
AGWall: R-20.0 Floor: R-50.4
Primary Window Efficiency:
U-Value: 0.340, SHGC: 0.320

Water Management System
A comprehensive water management system to protect roofs, walls, and foundations.
Flashing, a drainage plane, and site grading to move water from the roof to the ground and then away from the home.
Water-resistant materials on below-grade walls and underneath slabs to reduce the potential for water entering into the home.
Management of moisture levels in building materials during construction.

Heating, Cooling, and Ventilation System
A high-efficiency heating, cooling system, and ventilation system that is designed and installed for optimal performance.
Total Duct Leakage:
79.00 CFM @ 25 Pascals
Duct Leakage to Outdoors:
0.00 CFM @ 25 Pascals
Primary Heating (System Type • Fuel Type • Efficiency):
Fuel-fired air distribution, Natural gas, 92.1 AFUE
Primary Cooling (System Type • Fuel Type • Efficiency):
Air conditioner, Electric, 13.0 SEER

Energy Efficient Lighting and Appliances
Energy efficient products to help reduce utility bills, while providing high-quality performance.
ENERGY STAR Qualified Lighting: 100%
ENERGY STAR Qualified Appliances and Fans:
Refrigerators: 0 Dishwashers: 0
Ceiling Fans: 0 Exhaust Fans: 0
Primary Water Heater (System Type • Fuel Type • Efficiency):
Conventional, Natural gas, 0.70 EF, 40.0 Gal.

This Home 59
TYPICAL EXISTING HOMES
TYPICAL NEW HOMES
LESS EFFICIENT 140 130 120 110 100 90 80 70 60 50 40 MORE EFFICIENT
HERS® Index

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Review of HVAC System Quality Installation Contractor Checklist [2]	Must Correct	Rater Verified	N/A
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), and AHRI certificate (3.13).	☐	☐	☐
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor Checklist (Contractor Checklist Item # indicated in parenthesis): [3]			
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location [4]	☐	☐	☐
1.2.2 Home orientation (2.5) matches orientation of rated home	☐	☐	☐

- Checklist designed to align with ASHRAE 62.2 & ANSI/ACCA's 5 QI 2007 Protocol
- **The Rater is only responsible for ensuring** that the Contractor has **completed** the Contractor Checklist **in its entirety** and **verifying** the discrete objective parameters referenced in **Section 1 of this Checklist**
- The Rater is not responsible for assessing the accuracy of the load calculations or field verifications included or for verifying the accuracy of every input on the Contractor Checklist

Raters are required to review the following

1. Review of HVAC System Quality Installation Contractor Checklist [2]	Must Correct	Rater Verified	N/A
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), and AHRI certificate (3.13).	☐	☐	☐
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor Checklist (Contractor Checklist Item # indicated in parenthesis): [3]			
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location [4]	☐	☐	☐
1.2.2 Home orientation (2.5) matches orientation of rated home	☐	☐	☐
1.2.3 Number of occupants (2.6) equals number of occupants in rated home [5]	☐	☐	☐
1.2.4 Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home	☐	☐	☐
1.2.5 Window area (2.8) is within ±10% of calculated window area of rated home	☐	☐	☐
1.2.6 Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home [6]	☐	☐	☐
1.2.7 Listed latent cooling capacity (3.8) exceeds design latent heat gain (2.12)	☐	☐	☐
1.2.8 Listed sensible cooling capacity (3.9) exceeds design sensible heat gain (2.13)	☐	☐	☐
1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [7]	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.2, 5.1), and AHRI certificate or OEM catalog data all match [8]	☐	☐	☐
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temperature (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [9]	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 6.4) value is within ±3 °F of the reported target temperature (7.3) or calculated superheat (6.6 minus 7.5) value is within ±5 °F of the reported target temperature (7.7). [9]	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure ≤ 110% of contractor values (9.3, 9.4)	☐	☐	☐
1.4 Contractor-prepared balancing report indicating the room name and design airflow for each supply and return register collected by Rater for records. In addition, final individual room airflows measured and documented on balancing report through one of the following options:			
1.4.1 Measured and documented by contractor (10.1.1), OR;	☐	☐	☐
1.4.2 Measured by Rater using Section 804.2 of the Mortgage Industry National HERS Standard, documented by Rater, & verified by Rater to be within the greater of ± 20% or 25 CFM of design airflow (10.1.2)	☐	☐	☐
1.5 HVAC contractor holds credentials necessary to complete the HVAC System QI Contractor Checklist [10]	☐	☐	☐

1.2.7 Listed latent cooling capacity (3.8) exceeds design latent heat gain (2.12)

1.2.8 Listed sensible cooling capacity (3.9) exceeds design sensible heat gain (2.13)

Section 2 HVAC Contractor Checklist Heating and Cooling Design

2.12 Design Latent Heat Gain:	0
2.13 Design Sensible Heat Gain:	16376
2.14 Design Total Heat Gain:	16376
2.15 Design Total Heat Loss:	34274
2.16 Design Airflow: [13]	740
2.17 Design Duct Static Pressure: [14]	.8

Section 3 HVAC Contractor Checklist: Cooling Equipment

3.8 Listed Sys. Latent Capacity at Design Cond.: [18]	3860	BTUh
3.9 Listed Sys. Sensible Capacity at Design Cond.: [18]	19140	BTUh
3.10 Listed Sys. Total Capacity at Design Cond.: [18]	23000	BTUh

- 1.2.7 --- (3.8) 3860 > (2.12) 0 = Pass
- 1.2.8 --- (3.9) 19140 > (2.13) 16376 = Pass

1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size

Section 2 HVAC Contractor Checklist Heating and Cooling Design

2.12 Design Latent Heat Gain:	0
2.13 Design Sensible Heat Gain:	16376
2.14 Design Total Heat Gain:	16376
2.15 Design Total Heat Loss:	34274
2.16 Design Airflow: [13]	740
2.17 Design Duct Static Pressure: [14]	.8

Section 3 HVAC Contractor Checklist: Cooling Equipment

3.8 Listed Sys. Latent Capacity at Design Cond.: [18]	3860	BTUh
3.9 Listed Sys. Sensible Capacity at Design Cond.: [18]	19140	BTUh
3.10 Listed Sys. Total Capacity at Design Cond.: [18]	23000	BTUh

- (3.10) 23000 (2.14) 16376

16376 x 1.15 = 18832.4 Next nominal size 24000

Footnote #7

1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size[7]

- 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.

1. Review of HVAC System Quality Installation Contractor Checklist [2]	Must Correct	Rater Verified	N/A
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), and AHRI certificate (3.13).	☐	☐	☐

Footnote #8

- **In cases where the condenser unit is installed after the time of inspection:**
  - **The HVAC manufacturer and model numbers on installed equipment can be documented through the use of photographs provided by the HVAC Contractor after installation is complete**

1.2.8 Listed sensible cooling capacity (3.9) exceeds design sensible heat gain (2.13)	☐	☐	☐
1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [7]	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.2, 5.1), and AHRI certificate or OEM catalog data all match [8]	☐	☐	☐
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temperature (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [9]	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 6.4) value is within ±3 °F of the reported target temperature (7.3) or calculated superheat (6.6 minus 7.5) value is within ±5 °F of the reported target temperature (7.7). [9]	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure ≤ 110% of contractor values (9.3, 9.4)	☐	☐	☐
1.4 Contractor-prepared balancing report indicating the room name and design airflow for each supply and return register collected by Rater for records. In addition, final individual room airflows measured and documented on balancing report through one of the following options:			
1.4.1 Measured and documented by contractor (10.1.1), OR;	☐	☐	☐
1.4.2 Measured by Rater using Section 804.2 of the Mortgage Industry National HERS Standard, documented by Rater, & verified by Rater to be within the greater of ± 20% or 25 CFM of design airflow (10.1.2)	☐	☐	☐
1.5 HVAC contractor holds credentials necessary to complete the HVAC System QI Contractor Checklist [10]	☐	☐	☐

1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temperature (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees)

Section 6: Refrigerant Tests

6.1 Outdoor ambient temperature at condenser:	85	°F DB
6.2 Return-side air temperature inside duct near evaporator, during cooling mode:	75	°F WB
6.3 Liquid line pressure:	350	psig
6.4 Liquid line temperature:	100	°F DB
6.5 Suction line pressure:	135	psig
6.6 Suction line temperature:	52	°F DB

Section 7; Refrigerant Calculation

For System with Thermal Expansion Valve (TXV):

7.1 Condenser saturation temperature:	107	°F DB (Using Value 6.3)
7.2 Subcooling value:	7	°F DB (Value 7.1 - Value 6.4)
7.3 OEM subcooling goal:	10	°F DB
7.4 Subcooling deviation:	3	°F DB (Value 7.2 – Value 7.3)

- (6.3) 350 (7.1) 107

Sat. Temp (°F)	R-22	R-407C Liquid Pressure	R-407C Vapor Pressure	R-410A Liquid Pressure	R-11	R-123
100	198.4	224.1	194.6	318.9	11.3	8.6
105	213.2	241.0	210.3	342.4	13.4	10.6
110	228.8	258.9	226.9	367.1	15.7	12.8

HVAC Rater's Checklist

1. Review of HVAC System Quality Installation Contractor Checklist [2]			
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), AHRI certificate (3.15), and balancing report (10.2).	☐	☐	☐

Footnote #9

- If contractor has indicated that an OEM test procedure has been used in place of a sub-cooling or super-heat process and documentation has been attached that defines this procedure, then the box for "N/A" shall be checked for this Item

1.2.8 Listed sensible cooling capacity (3.11) exceeds design sensible heat gain (2.13)	☐	☐	☐
1.2.9 Listed total cooling capacity (3.12) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [7]	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.3, 5.1), and AHRI certificate or OEM catalog data all match [8]	☐	☐	☐
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temp. (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [9]	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 6.4) or superheat (6.6 minus 7.5) value equals reported target subcooling (7.3) or superheat (7.7) temperature [9]	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure ≤ 110% of contractor values (9.3, 9.4)	☐	☐	☐

1.2.12 Calculated **subcooling** (7.1 minus 6.4) value is **within ±3** °F of the reported target temperature (7.3) or calculated superheat (6.6 minus 7.5) value is within ±5 °F of the reported target temperature (7.7). 9

Section 6: Refrigerant Tests

6.1 Outdoor ambient temperature at condenser:	85	°F DB
6.2 Return-side air temperature inside duct near evaporator, during cooling mode:	75	°F WB
6.3 Liquid line pressure:	350	psig
6.4 Liquid line temperature:	100	°F DB
6.5 Suction line pressure:	135	psig
6.6 Suction line temperature:	52	°F DB

Section 7; Refrigerant Calculation

For System with Thermal Expansion Valve (TXV):

7.1 Condenser saturation temperature:	107	°F DB (Using Value 6.3)
7.2 Subcooling value:	7	°F DB (Value 7.1 - Value 6.4)
7.3 OEM subcooling goal:	10	°F DB
7.4 Subcooling deviation:	3	°F DB (Value 7.2 – Value 7.3)

(7.1) 107 - (6.4) 100 = 7°

Footnote #9:

If contractor has indicated that an OEM test procedure has been used in place of a sub-cooling or super-heat process and documentation has been attached that defines this procedure, then the box for "N/A" shall be checked for this Item.

HVAC System Quality Installation Rater Checklist

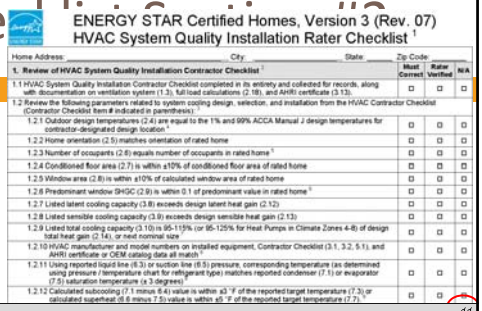
- Duct quality installation
- Duct insulation
- Duct leakage

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Review of HVAC System Quality Installation Contractor Checklist [1]	Must Correct [1]	Rater Verified	N/A
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), and AHRI certificate (3.13);	☐	☐	☐
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor Checklist (Contractor Checklist Item # indicated in parenthesis) [1]			
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location [4]	☐	☐	☐
1.2.2 Home orientation (2.5) matches orientation of rated home	☐	☐	☐
1.2.3 Number of occupants (2.6) equals number of occupants in rated home [5]	☐	☐	☐
1.2.4 Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home	☐	☐	☐
1.2.5 Window area (2.8) is within ±10% of calculated window area of rated home	☐	☐	☐
1.2.6 Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home [6]	☐	☐	☐
1.2.7 Listed latent cooling capacity (3.8) exceeds design latent heat gain (2.12)	☐	☐	☐
1.2.8 Listed sensible cooling capacity (3.9) exceeds design sensible heat gain (2.13)	☐	☐	☐
1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [7]	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.2, 5.1), and AHRI certificate or OEM catalog data all match [8]	☐	☐	☐
1.2.11 Using reported liquid line (8.3) or suction line (8.5) pressure, corresponding temperature (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [9]	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 8.4) value is within ±3 °F of the reported target temperature (7.3) or calculated superheat (8.6 minus 7.5) value is within ±5 °F of the reported target temperature (7.7) [9]	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure ≤ 110% of contractor values (9.3, 9.4)	☐	☐	☐
1.4 Contractor-prepared balancing report indicating the room name and design airflow for each supply and return register collected by Rater for records. In addition, final individual room airflows measured and documented on balancing report through one of the following options:			
1.4.1 Measured and documented by contractor (10.1.1), OR;	☐	☐	☐
1.4.2 Measured by Rater using Section 804.2 of the Mortgage Industry National HERS Standard, documented by Rater, & verified by Rater to be within the greater of ± 20% or 25 CFM of design airflow (10.1.2)	☐	☐	☐
1.5 HVAC contractor holds credentials necessary to complete the HVAC System QI Contractor Checklist [10]	☐	☐	☐
2. Duct Quality Installation - *Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts* [11]			
2.1 Connections and routing of ductwork completed without kinks or sharp bends. [12]	☐	☐	☐
2.2 No excessive coiled or looped flexible ductwork. [13]	☐	☐	☐
2.3 Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter	☐	☐	☐
2.4 Flexible ducts supported at intervals as recommended by mfr. but at a distance ≤ 5 ft.	☐	☐	☐
2.5 Building cavities not used as supply or return ducts unless they meet items 3.2, 3.3, 4.1, and 4.2 of this Checklist.	☐	☐	☐
2.6 HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Rater Checklist.	☐	☐	☐
2.7 Quantity & location of supply and return duct terminals match contractor balancing report. [14]	☐	☐	☐
2.8 Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and / or undercut doors to either: a) provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported on the contractor-provided balancing report; or b) achieve ≤ Rater-measured pressure differential ≤ 3 Pa with respect to the main body of the house when all bedroom doors are closed and all air handlers are operating. [15]	☐	☐	☐
3. Duct Insulation - *Applies to All Heating, Cooling, Supply Ventilation, and Pressure Balancing Ducts* [16]			
3.1 All connections to trunk ducts in unconditioned space are insulated.	☐	☐	☐
3.2 *Prescriptive Path*: Supply ducts in unconditioned attic have insulation ≥ R-8. *Performance Path*: Supply ducts in unconditioned attic have insulation ≥ R-6.	☐	☐	☐
3.3 All other supply ducts and all return ducts in unconditioned space have insulation ≥ R-6.	☐	☐	☐

HVAC Rater's Checklist Section #2

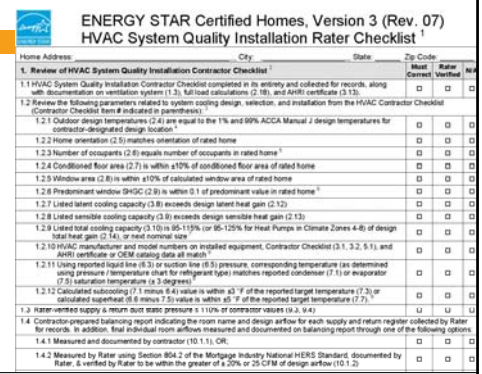

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Footnote #11

- Items 2.7 and 2.8 do not apply to ventilation ducts
- However duct sealing does apply to ventilation and transfer ducts

2. Duct Quality Installation - *Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts* [11]	
2.1 Connections and routing of ductwork completed without kinks or sharp bends. [12]	
2.2 No excessive coiled or looped flexible ductwork. [13]	
2.3 Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter	
2.4 Flexible ducts supported at intervals as recommended by mfr. but at a distance ≤ 5 ft.	
2.5 Building cavities not used as supply or return ducts unless they meet Items 3.2, 3.3, 4.1, and 4.2 of this Checklist.	
2.6 HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Rater Checklist.	
2.7 Quantity & location of supply and return duct terminals match contractor balancing report. [11]	
2.8 Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and / or undercut doors to either: a) provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported on the	

HVAC Rater's Checklist Section #2


ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Footnote #12

- Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members
- Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter

2. Duct Quality Installation - *Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts* [11]	
2.1 Connections and routing of ductwork completed without kinks or sharp bends. [12]	
2.2 No excessive coiled or looped flexible ductwork. [13]	
2.3 Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter	
2.4 Flexible ducts supported at intervals as recommended by mfr. but at a distance ≤ 5 ft.	
2.5 Building cavities not used as supply or return ducts unless they meet Items 3.2, 3.3, 4.1, and 4.2 of this Checklist.	
2.6 HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side	

Looking for better performance

HVAC Rater's Checklist Section #2

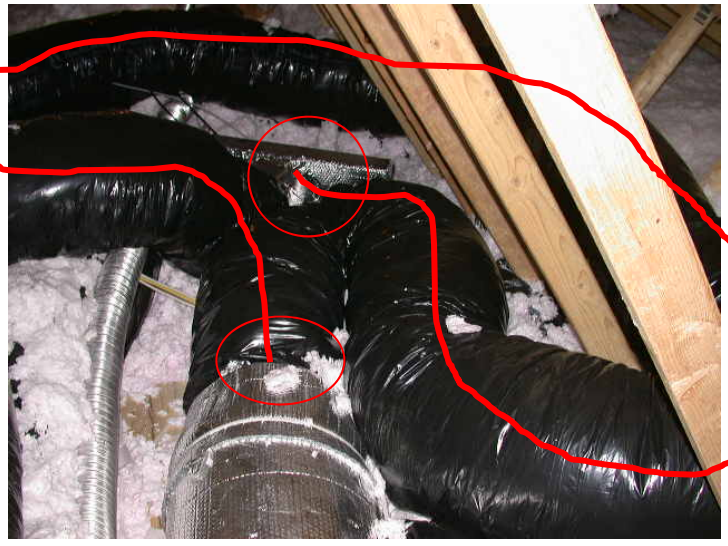
Footnote #12

- No coiled or looped ductwork except where needed for acoustical control
- Balancing dampers or proper duct sizing used instead of loops to limit flow
- Balancing dampers used shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing is conducted
- In such cases, Opposable Blade Dampers (OBD) or dampers that are located in the duct boot are permitted

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Review of HVAC System Quality Installation Contractor Checklist [1]	Must Correct	Rater Verified	N/A
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), and AHRI certificate (3.13).	☐	☐	☐
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor Checklist (Contractor Checklist Item # indicated in parenthesis):			
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location [1]	☐	☐	☐
1.2.2 Home orientation (2.5) matches orientation of rated home	☐	☐	☐
1.2.3 Number of occupants (2.6) equals number of occupants in rated home [1]	☐	☐	☐
1.2.4 Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home	☐	☐	☐
1.2.5 Window area (2.8) is within ±10% of calculated window area of rated home	☐	☐	☐
1.2.6 Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home [1]	☐	☐	☐
1.2.7 Listed latent cooling capacity (3.8) exceeds design latent heat gain (2.12)	☐	☐	☐
1.2.8 Listed sensible cooling capacity (3.9) exceeds design sensible heat gain (2.13)	☐	☐	☐
1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [1]	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.2, 5.1), and AHRI certificate or OEM catalog data all match [1]	☐	☐	☐
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temperature (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [1]	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 6.4) value is within ±3 °F of the reported target temperature (7.3) or calculated superheat (6.6 minus 7.5) value is within ±5 °F of the reported target temperature (7.7). [1]	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure ≤ 110% of contractor values (9.3, 9.4)	☐	☐	☐
1.4 Contractor-prepared balancing report indicating the room name and design airflow for each supply and return register collected by Rater for records. In addition, final individual room airflows measured and documented on balancing report through one of the following options:			
1.4.1 Measured and documented by contractor (10.1.1), OR,	☐	☐	☐
1.4.2 Measured by Rater using Section 804.2 of the Mortgage Industry National HERS Standard, documented by Rater, & verified by Rater to be within the greater of a 20% or 25 CFM of design airflow (10.1.2)	☐	☐	☐
1.5 HVAC contractor holds credentials necessary to complete the HVAC System QI Contractor Checklist [10]	☐	☐	☐
2. Duct Quality Installation - *Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts* [11]			
2.1 Connections and routing of ductwork completed without kinks or sharp bends. [12]	☐	☐	☐
2.2 No excessive coiled or looped flexible ductwork. [13]	☐	☐	☐
2.3 Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter	☐	☐	☐
2.4 Flexible ducts supported at intervals as recommended by mfr. but at a distance ≤ 5 ft.	☐	☐	☐
2.5 Building cavities not used as supply or return ducts unless they meet items 3.2, 3.3, 4.1, and 4.2 of this Checklist.	☐	☐	☐
2.6 HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Rater Checklist.	☐	☐	☐
2.7 Quantity & location of supply and return duct terminals match contractor balancing report. [11]	☐	☐	☐



2.6 HVAC ducts, **cavities used as ducts**, and combustion inlets and outlets may pass perpendicularly through exterior walls but **shall not be run within exterior walls** unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Rater Checklist.

- Either inside or outside of the buildings thermal envelope
  - Can't be in the middle of it unless you can achieve the needed R-value for the assembly

EnergyLogic will continue to require ≥ R-10 to the outside

HVAC Rater's Checklist Section #2

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Review of HVAC System Quality Installation Contractor Checklist [1]	Must Correct	Rater Verified	N/A
1.1 HVAC System Quality Installation Contractor Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), and AHRI certificate (3.13).	□	□	□
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor Checklist (Contractor Checklist item # indicated in parenthesis):			
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location [1]	□	□	□
1.2.2 Home orientation (2.5) matches orientation of rated home	□	□	□
1.2.3 Number of occupants (2.6) equals number of occupants in rated home [1]	□	□	□
1.2.4 Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home	□	□	□
1.2.5 Window area (2.8) is within ±10% of calculated window area of rated home	□	□	□
1.2.6 Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home [1]	□	□	□
1.2.7 Listed latent cooling capacity (3.8) exceeds design latent heat gain (2.12)	□	□	□
1.2.8 Listed sensible cooling capacity (3.9) exceeds design sensible heat gain (2.13)	□	□	□
1.2.9 Listed total cooling capacity (3.10) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [1]	□	□	□
1.2.10 HVAC manufacturer and model numbers on installed equipment, Contractor Checklist (3.1, 3.2, 5.1), and AHRI certificate or OEM catalog data all match [1]	□	□	□
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temperature (as determined using pressure / temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees) [1]	□	□	□
1.2.12 Calculated subcooling (7.1 minus 6.4) value is within ±3 °F of the reported target temperature (7.3) or calculated superheat (6.6 minus 7.5) value is within ±5 °F of the reported target temperature (7.7).	□	□	□
1.3 Rater-verified supply & return duct static pressure ≤ 110% of contractor values (9.3, 9.4)	□	□	□
1.4 Contractor-prepared balancing report indicating the room name and design airflow for each supply and return register collected by Rater for records. In addition, final individual room airflows measured and documented on balancing report through one of the following options:			
1.4.1 Measured and documented by contractor (10.1.1), OR,	□	□	□
1.4.2 Measured by Rater using Section 804.2 of the Mortgage Industry National HERS Standard, documented by			

Footnote #14

- For HVAC system with multi-speed fans, the highest design fan speed shall be used when verifying this requirement.
- Ventilation and Transfer duct work is required to be sealed with Mastic per Footnote 16 and all associated duct boots are sealed to floor, wall, or ceiling using caulk, foam, or mastic tape

2.8 Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and / or undercut doors to either: a) provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported on the contractor-provided balancing report; or b) achieve a Rater-measured pressure differential ≤ 3 Pa with respect to the main body of the house when all bedroom doors are closed and all air handlers are operating.[11](14)

HVAC Rater's Checklist Section #3

Footnote #15

- EPA recommends (not require) that all metal ductwork not covered by Section 3 (e.g., exhaust ducts, duct boots, ducts in conditioned space) also be insulated and that insulation be sealed to duct boots to prevent condensation.

3. Duct Insulation - *Applies to All Heating, Cooling, Supply Ventilation, and Pressure Balancing Ducts* [15]
3.1 All connections to trunk ducts in unconditioned space are insulated.
3.2 *Prescriptive Path*: Supply ducts in unconditioned attic have insulation ≥ R-8. *Performance Path*: Supply ducts in unconditioned attic have insulation ≥ R-6.
3.3 All other supply ducts and all return ducts in unconditioned space have insulation ≥ R-6.

HVAC Rater's Checklist Section #4

Footnote #16

- Duct leakage shall be determined and documented by a Rater using a RESNET-approved testing protocol only after all components of the system have been installed (e.g., air handler and register grilles)
- Leakage limits shall be assessed on a per-system, rather than per-home, basis

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

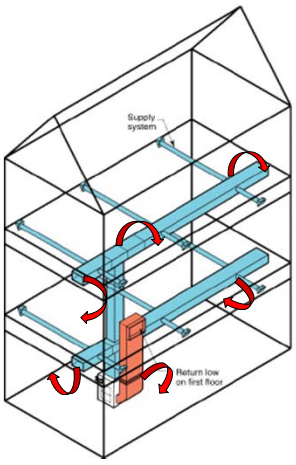
4. Duct Leakage - *Applies to All Heating, Cooling, and Balanced Ventilation Ducts*
4.1 Total Rater-measured duct leakage meets one of the following two options: [16]
4.1.1 Rough-in: ≤ 4 CFM25 per 100 sq. ft. of CFA with air handler and all ductwork, building cavities used as ductwork, & duct boots installed. In addition, all duct boots sealed to finished surface, Rater-verified at final. [17]
4.1.2 Final: ≤ 8 CFM25 per 100 sq. ft. of CFA with the air handler and all ductwork, building cavities used as ductwork, duct boots, & register grilles atop the finished surface (e.g., drywall, flooring) installed. [18]
4.2 Rater-measured duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area. [16,19]

Total Duct leakage target moving to 4 CFM/100sqft Consistent with the 2012 IECC target

- Tested at rough
  - 4≤ CFM 25 per 100 sqft of conditioned floor area
  - 2000 sqft house
  - 8 CFM = 160 CFM@25 max
  - 6CFM = 120 CFM@25 max
  - 4 CFM = 80 CFM@25 max

4. Duct Leakage - *Applies to All Heating, Cooling, and Balanced Ventilation Ducts*
4.1 Total Rater-measured duct leakage meets one of the following two options: [16]
4.1.1 Rough-in: ≤ 4 CFM25 per 100 sq. ft. of CFA with air handler and all ductwork, building cavities used as ductwork, & duct boots installed. In addition, all duct boots sealed to finished surface. Rater-verified at final. [17]
4.1.2 Final: ≤ 8 CFM25 per 100 sq. ft. of CFA with the air handler and all ductwork, building cavities used as ductwork, duct boots, & register grilles atop the finished surface (e.g., drywall, flooring) installed. [18]
4.2 Rater-measured duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area. [16,19]

Footnote 17

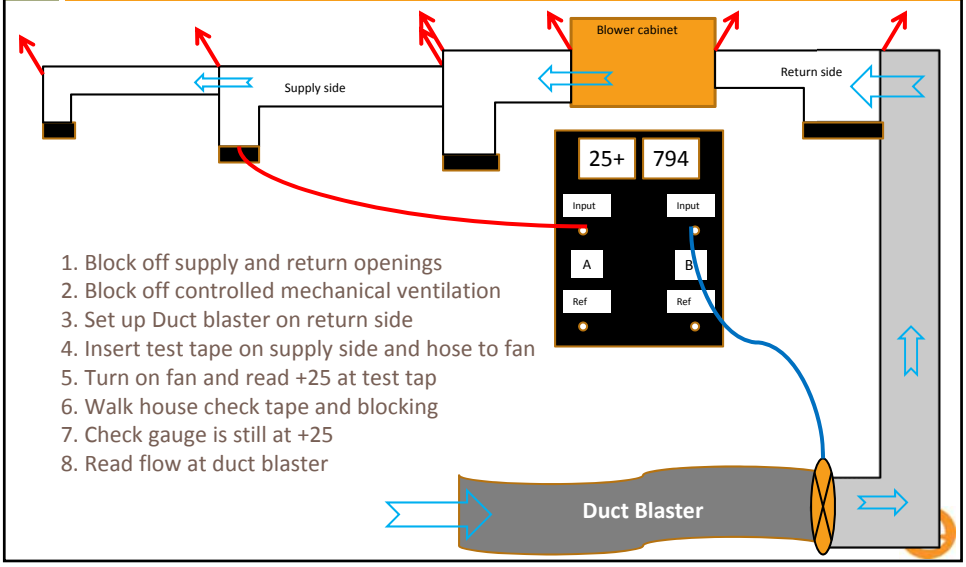


- Cabinets (e.g., kitchen, bath, multimedia) or ductwork that connect duct boots to toe-kick registers are not required to be in place during the 'rough-in' test
- Phased in Target
  - Home permitted in 2013 rough-in leakage target is ≤ 6 CFM@25 per 100 sq. ft. of CFA with air handler and all ductwork & duct boots installed
  - For Home permitted in 2014 target is 4 CFM@25

Rater must verify that HVAC supply and return register boots are sealed to subfloor and drywall throughout the house

Total Duct Leakage

Inside and outside the building envelope



1. Block off supply and return openings
2. Block off controlled mechanical ventilation
3. Set up Duct blaster on return side
4. Insert test tape on supply side and hose to fan
5. Turn on fan and read +25 at test tap
6. Walk house check tape and blocking
7. Check gauge is still at +25
8. Read flow at duct blaster

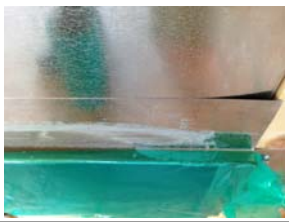
Total Duct leakage at Final

- Footnote 18
  - Registers atop carpets are permitted to be removed and the face of the duct boot temporarily sealed during testing.
  - In such cases, the Rater shall visually verify that the boot has been durably sealed to the subfloor (e.g., using duct mastic or caulk) to prevent leakage during normal operation.

4. Duct Leakage - *Applies to All Heating, Cooling, and Balanced Ventilation Ducts*
4.1 Total Rater-measured duct leakage meets one of the following two options: [16]
4.1.1 Rough-in: ≤ 4 CFM25 per 100 sq. ft. of CFA with air handler and all ductwork, building cavities used as ductwork, & duct boots installed. In addition, all duct boots sealed to finished surface. Rater-verified at final. [17]
4.1.2 Final: ≤ 8 CFM25 per 100 sq. ft. of CFA with the air handler and all ductwork, building cavities used as ductwork, duct boots, & register grilles atop the finished surface (e.g., drywall, flooring) installed. [18]
4.2 Rater-measured duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area. [16,19]

Getting to 4 CFM

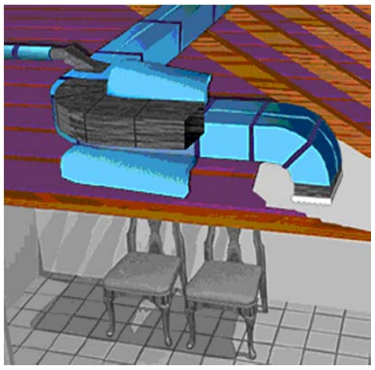
- We are seeing it now – Consistency is the issue
- Seal every seam



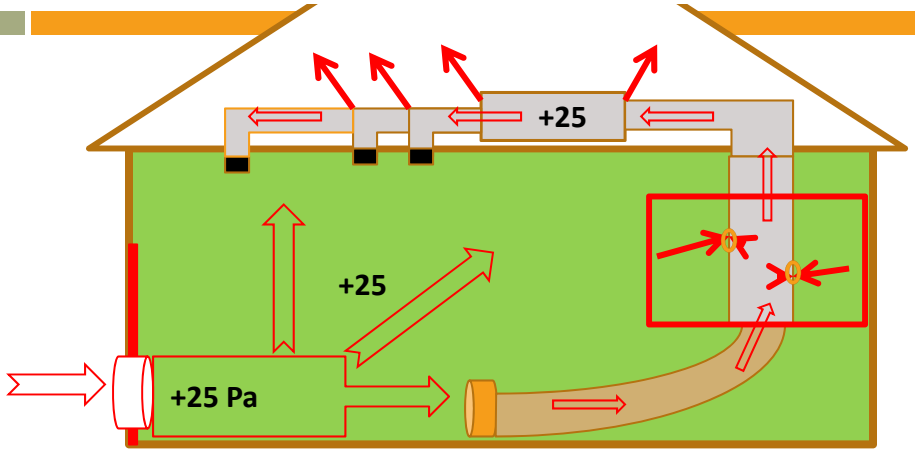
Duct Leakage to Outside

≤ 4 CFM 25 per 100 sqft of conditioned floor area

2000 sqft house ≤ 80 CFM 25 total

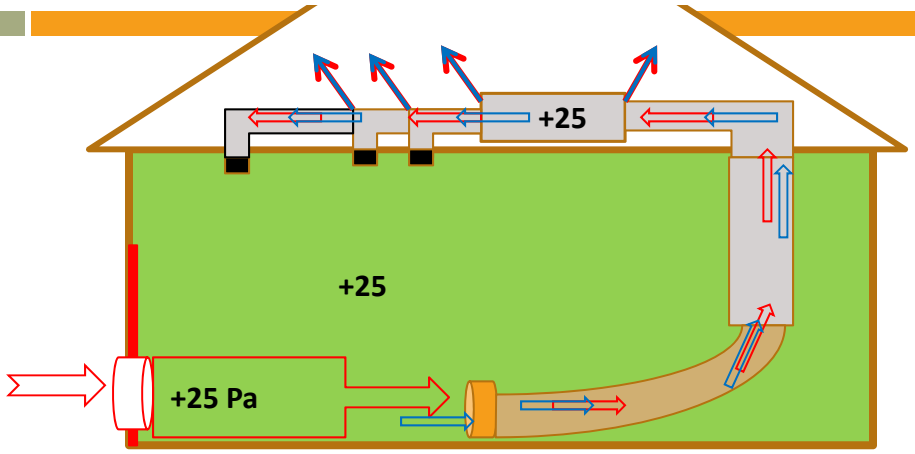


Duct Leakage to Outside



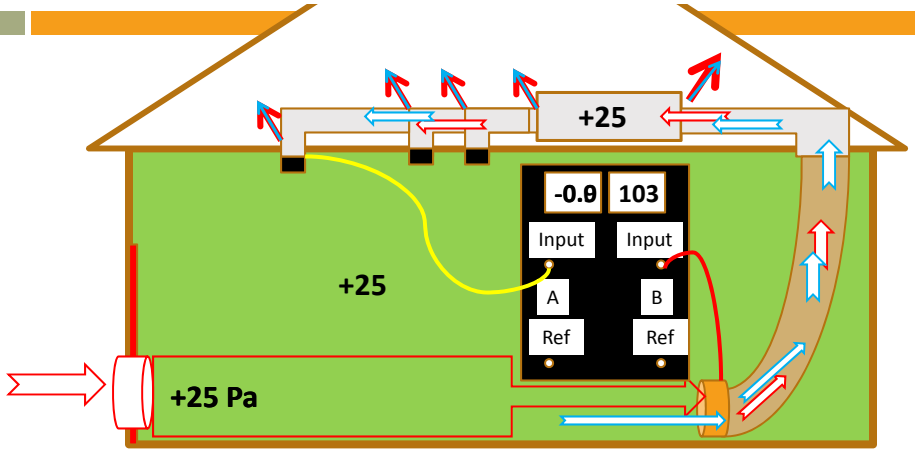
- Use blower door to pressurize house and ducts to +25 Pa wrt outside
- Duct leakage to indoors eliminated

Duct Leakage to Outside



- Turn on duct tester fan
- Goal: Match the CFM of the blower door air leaving the ducts

Duct Leakage to Outside



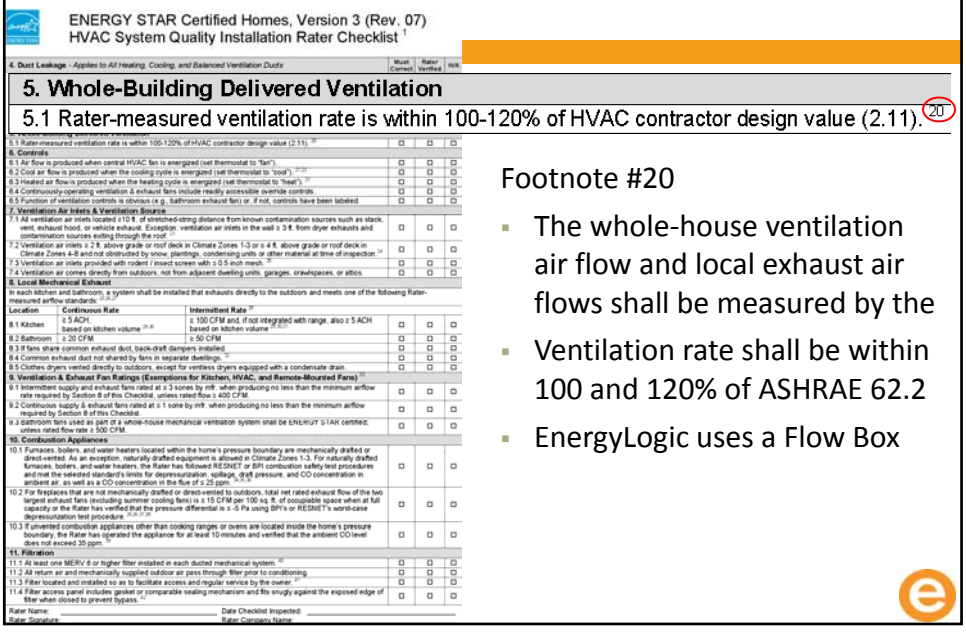
- Adjust duct tester to 0.0 Pa ductwork wrt house
- Measure duct tester airflow (CFM)
- Report as 103 CFM25 duct leakage to outdoors

HVAC Rater's Checklist Section #4

Footnote #19

- For homes that have ≤ 1,200 sq. ft. of conditioned floor area, measured duct leakage to outdoors shall be ≤ 5 CFM25 per 100 sq. ft. of conditioned floor area
- Testing of duct leakage to outside can be waived if:
  - All ducts & air handling equipment are located within the thermal envelope
  - Envelope leakage has been tested to be ≤ to half of the Prescriptive Path infiltration limit for the Climate Zone where the home is to be built (2 ACH50 in climate zone 5)
  - Total duct leakage is ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area, or ≤ 5 CFM25 per 100 sq. ft. of conditioned floor area for homes that have less than 1,200 sq. ft. of conditioned floor area

HVAC Rater Checklist Section #5



ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

5. Whole-Building Delivered Ventilation

5.1 Rater-measured ventilation rate is within 100-120% of HVAC contractor design value (2.11). [20]

Footnote #20

- The whole-house ventilation air flow and local exhaust air flows shall be measured by the
- Ventilation rate shall be within 100 and 120% of ASHRAE 62.2
- EnergyLogic uses a Flow Box

HVAC Rater Checklist Section #6

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

6. Controls			
6.1 Air flow is produced when central HVAC fan is energized (set thermostat to "fan").			
6.2 Cool air flow is produced when the cooling cycle is energized (set thermostat to "cool"). [21,22]			
6.3 Heated air flow is produced when the heating cycle is energized (set thermostat to "heat"). [21]			
6.4 Continuously-operating ventilation & exhaust fans include readily accessible override controls.			
6.5 Function of ventilation controls is obvious (e.g., bathroom exhaust fan) or, if not, controls have been labeled.			

Footnote #21

- In cases where the condenser unit is installed after the time of inspection by the Rater, the Rater is exempt from verifying Item 6.2 when the condenser is for an AC unit and also Item 6.3 when the condenser is for a heat pump unit

HVAC Rater Checklist Section #6

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

6. Controls			
6.1 Air flow is produced when central HVAC fan is energized (set thermostat to "fan").			
6.2 Cool air flow is produced when the cooling cycle is energized (set thermostat to "cool"). [21,22]			
6.3 Heated air flow is produced when the heating cycle is energized (set thermostat to "heat"). [21]			
6.4 Continuously-operating ventilation & exhaust fans include readily accessible override controls.			
6.5 Function of ventilation controls is obvious (e.g., bathroom exhaust fan) or, if not, controls have been labeled.			

Footnote #22

- To prevent potential equipment damage, the Rater shall not conduct this test if the outdoor temperature is ≤ 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle
- When this occurs, the Rater shall mark 'N/A' on the Checklist for this item

HVAC Rater Checklist Section #7

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

7. Ventilation Air Inlets & Ventilation Source
7.1 All ventilation air inlets located ≥10 ft. of stretched-string distance from known contamination sources such as stack, vent, exhaust hood, or vehicle exhaust. Exception: ventilation air inlets in the wall ≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof. [23]
7.2 Ventilation air inlets ≥ 2 ft. above grade or roof deck in Climate Zones 1-3 or ≥ 4 ft. above grade or roof deck in Climate Zones 4-8 and not obstructed by snow, plantings, condensing units or other material at time of inspection. [24]
7.3 Ventilation air inlets provided with rodent / insect screen with ≤ 0.5 inch mesh. [25]
7.4 Ventilation air comes directly from outdoors, not from adjacent dwelling units, garages, crawlspaces, or attics.

Footnote #23

- The outlet and inlet of balanced ventilation systems shall meet these spacing requirements unless manufacturer instructions indicate that a smaller distance may be used
- However, if this occurs the manufacturer's instructions shall be collected for documentation purposes.

HVAC Rater Checklist Section #7

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

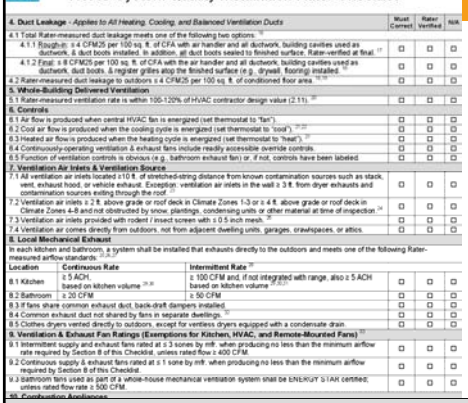
7. Ventilation Air Inlets & Ventilation Source
7.1 All ventilation air inlets located ≥10 ft. of stretched-string distance from known contamination sources such as stack, vent, exhaust hood, or vehicle exhaust. Exception: ventilation air inlets in the wall ≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof. [23]
7.2 Ventilation air inlets ≥ 2 ft. above grade or roof deck in Climate Zones 1-3 or ≥ 4 ft. above grade or roof deck in Climate Zones 4-8 and not obstructed by snow, plantings, condensing units or other material at time of inspection [24]
7.3 Ventilation air inlets provided with rodent / insect screen with ≤ 0.5 inch mesh. [25]
7.4 Ventilation air comes directly from outdoors, not from adjacent dwelling units, garages, crawlspaces, or attics.

Footnote #24

- The minimum required height in North Carolina for Climate Zone 4 will be reduced from 4 feet to 2 feet and in Climate Zone 5 from 4 feet to 2.5 feet based on historical snowfall data for this state
- Note that EPA is evaluating the potential to reduce inlet heights in other regions based upon historical snowfall data

HVAC Rater Checklist Section #7

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]



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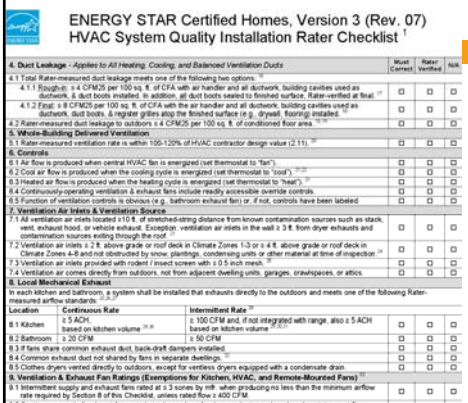
7.3 Ventilation air inlets provided with rodent / insect screen with ≤ 0.5 inch mesh. [25]	
7.4 Ventilation air comes directly from outdoors, not from adjacent dwelling units, garages, crawlspaces, or attics.	

Footnote #25

- Without proper maintenance, ventilation air inlet screens often become filled with debris
- Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the owner

HVAC Rater Checklist Section #8

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]



8. Local Mechanical Exhaust

In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,26,27]

Location	Continuous Rate	Intermittent Rate [28]	
8.1 Kitchen	≥ 5 ACH, based on kitchen volume [29,30]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [29,30,31]	☐
8.2 Bathroom	≥ 20 CFM	≥ 50 CFM	☐
8.3 If fans share common exhaust duct, back-draft dampers installed.			☐
8.4 Common exhaust duct not shared by fans in separate dwellings. [32]			☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain.			☐

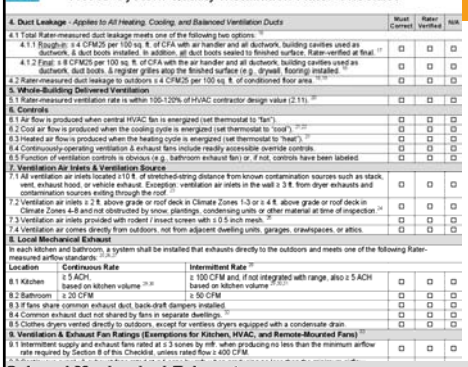
Rater Signature Rater Company Name

Footnote #26 & 27

- Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope (e.g., bath exhaust fans, range hoods, clothes dryers)
- Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture

HVAC Rater Checklist Section #8

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]



Footnote #28

- An intermittent mechanical exhaust system shall be designed to operate as needed by the occupant
- Control devices shall not impede occupant control in intermittent systems

8. Local Mechanical Exhaust

In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,26,27]

Location	Continuous Rate	Intermittent Rate [28]	
8.1 Kitchen	≥ 5 ACH, based on kitchen volume [29,30]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [29,30,31]	☐
8.2 Bathroom	≥ 20 CFM	≥ 50 CFM	☐
8.3 If fans share common exhaust duct, back-draft dampers installed.			☐
8.4 Common exhaust duct not shared by fans in separate dwellings. [32]			☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain.			☐

Rater Signature: Rater Company Name:

HVAC Rater Checklist Section #8

- *For homes permitted through 01/01/2014:*
- Homes are permitted to be certified without enforcement of this Item to provide partners with additional time to integrate this feature into their homes.

8. Local Mechanical Exhaust

In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,26,27]

Location	Continuous Rate	Intermittent Rate [28]	
8.1 Kitchen	≥ 5 ACH, based on kitchen volume [29,30]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [29,30,31]	☐
8.2 Bathroom	≥ 20 CFM	≥ 50 CFM	☐
8.3 If fans share common exhaust duct, back-draft dampers installed.			☐
8.4 Common exhaust duct not shared by fans in separate dwellings. [32]			☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain.			☐

HVAC Rater Checklist Section #8

For homes permitted on or after 01/01/2014:

- Homes shall meet this Item.
- Alternatively, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 are permitted to be used for kitchen exhaust fans based upon the rated airflow of the fan at 0.25 IWC.
- **If the rated airflow is unknown, ≥ 6 in. smooth duct shall be used, with a rectangular to round duct transition as needed.**
- Guidance to assist partners with these alternatives is available at www.energystar.gov/newhomesresources.
- As an alternative to Item 8.1, homes that are PHIUS+ certified are permitted to use a continuous kitchen exhaust rate of 25 CFM per 2009 IRC Table M1507.3.

8. Local Mechanical Exhaust

In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,26,27]

Location	Continuous Rate	Intermittent Rate [28]	
8.1 Kitchen	≥ 5 ACH, based on kitchen volume [29,30]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [29,30,31]	☐
8.2 Bathroom	≥ 20 CFM	≥ 50 CFM	☐
8.3 If fans share common exhaust duct, back-draft dampers installed.			☐
8.4 Common exhaust duct not shared by fans in separate dwellings. [32]			☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain.			☐

HVAC Rater Checklist Section #8

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

Footnote #31

- All intermittent kitchen exhaust fans must be capable of exhausting at least 100 CFM.
- In addition, if the fan is not part of a vented range hood or appliance-range hood combination (i.e., if the fan is not integrated with the range), then it must also be capable of exhausting ≥ 5 ACH, based on the kitchen volume.

8. Local Mechanical Exhaust

In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,26,27]

Location	Continuous Rate	Intermittent Rate [28]	
8.1 Kitchen	≥ 5 ACH, based on kitchen volume [29,30]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [29,30,31]	☐
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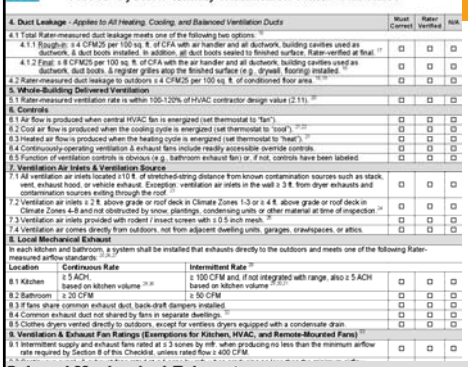
8.3 If fans share common exhaust duct, back-draft dampers installed.			☐
8.4 Common exhaust duct not shared by fans in separate dwellings. [32]			☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain.			☐

HVAC Rater Checklist Section #8

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]



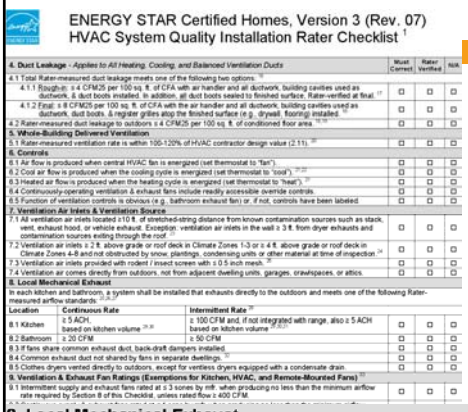
Footnote #29

- Kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, and peninsulas and multiplying by the average ceiling height for this area.
- Cabinet volume shall be included in the kitchen volume calculation.

8. Local Mechanical Exhaust			
In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,26,27]			
9. Ventilation & Exhaust Fan Ratings (Exemptions for HVAC and Remote-Mounted Fans) [30]			
9.1 Intermittent supply and exhaust fans rated at ≤ 3 sones by mfr. when producing no less than the minimum airflow rate required by Section 8 of this Checklist, unless rated flow ≥ 400 CFM.			
9.2 Continuous supply & exhaust fans rated at ≤ 1 sone by mfr. when producing no less than the minimum airflow required by Section 8 of this Checklist.			
9.3 Bathroom fans used as part of a whole-house mechanical ventilation system shall be ENERGY STAR qualified; unless rated flow rate ≥ 500 CFM.			

HVAC Rater Checklist Section #8

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]



Footnote #32

- Exhaust outlets from more than one dwelling unit may be served by a single exhaust fan if the fan runs continuously or if each outlet has a back-draft damper to prevent cross-contamination when the fan is not running

8. Local Mechanical Exhaust			
In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,26,27]			
Location	**Continuous Rate**	**Intermittent Rate** [28]	
8.1 Kitchen	≥ 5 ACH, based on kitchen volume [29,30]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [29,30,31]	☐
8.2 Bathroom	≥ 20 CFM	≥ 50 CFM	☐
8.3 If fans share common exhaust duct, back-draft dampers installed.			☐
8.4 Common exhaust duct not shared by fans in separate dwellings. [32]			☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain.			☐

HVAC Rater Checklist Section #9

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
HVAC System Quality Installation Rater Checklist [1]

	Must Correct	Rater Verified	N/A
4. Duct Leakage - *Applies to All Heating, Cooling, and Balanced Ventilation Ducts*			
4.1 Total Rater-measured duct leakage meets one of the following two options: [16]			
4.1.1 Rough-in: ≤ 4 CFM25 per 100 sq. ft. of CFA with air handler and all ductwork, building cavities used as ductwork, & duct boots installed. In addition, all duct boots sealed to finished surface. Rater-verified at final. [17]	☐	☐	☐
4.1.2 Final: ≤ 8 CFM25 per 100 sq. ft. of CFA with the air handler and all ductwork, building cavities used as ductwork, duct boots, & register grilles atop the finished surface (e.g., drywall, flooring) installed. [17]	☐	☐	☐
4.2 Rater-measured duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area. [18,19]	☐	☐	☐
5. Whole-Building Delivered Ventilation			
5.1 Rater-measured ventilation rate is within 100-120% of HVAC contractor design value (2.11). [20]	☐	☐	☐
6. Controls			
6.1 Air flow is produced when central HVAC fan is energized (set thermostat to "fan").	☐	☐	☐
6.2 Cool air flow is produced when the cooling cycle is energized (set thermostat to "cool"). [21,22]	☐	☐	☐
6.3 Heated air flow is produced when the heating cycle is energized (set thermostat to "heat"). [21]	☐	☐	☐
6.4 Continuously-operating ventilation & exhaust fans include readily accessible override controls.	☐	☐	☐
6.5 Function of ventilation controls is obvious (e.g., bathroom exhaust fan) or, if not, controls have been labeled.	☐	☐	☐
7. Ventilation Air Inlets & Ventilation Source			
7.1 All ventilation air inlets located ≥ 10 ft. of stretched-string distance from known contamination sources such as stack, vent, exhaust hood, or vehicle exhaust. Exception: ventilation air inlets in the wall ≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof. [23]	☐	☐	☐
7.2 Ventilation air inlets ≥ 2 ft. above grade or roof deck in Climate Zones 1-3 or ≥ 4 ft. above grade or roof deck in Climate Zones 4-8 and not obstructed by snow, plantings, condensing units or other material at time of inspection. [24]	☐	☐	☐
7.3 Ventilation air inlets provided with rodent / insect screen with ≥ 0.5 inch mesh. [25]	☐	☐	☐
7.4 Ventilation air comes directly from outdoors, not from adjacent dwelling units, garages, crawlspaces, or attics.	☐	☐	☐
8. Local Mechanical Exhaust			
In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [26,27]			
Location / **Continuous Rate** / **Intermittent Rate** [28]			
8.1 Kitchen — ≥ 5 ACH, based on kitchen volume [29,30] / ≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [31,32,33]	☐	☐	☐
8.2 Bathroom — ≥ 20 CFM / ≥ 50 CFM	☐	☐	☐
8.3 If fans share common exhaust duct, back-draft dampers installed.	☐	☐	☐
8.4 Common exhaust duct not shared by fans in separate dwellings. [34]	☐	☐	☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain.	☐	☐	☐
9. Ventilation & Exhaust Fan Ratings (Exemptions for Kitchen, HVAC, and Remote-Mounted Fans) [33]			
9.1 Intermittent supply and exhaust fans rated at ≤ 3 sones by mfr. when producing no less than the minimum airflow rate required by Section 8 of this Checklist, unless rated flow ≥ 400 CFM.	☐	☐	☐
9.2 Continuous supply & exhaust fans rated at ≤ 1 sone by mfr. when producing no less than the minimum airflow required by Section 8 of this Checklist.	☐	☐	☐
9.3 Bathroom fans used as part of a whole-house mechanical ventilation system shall be ENERGY STAR certified; unless rated flow rate ≥ 500 CFM.	☐	☐	☐
10. Combustion Appliances			
10.1 Furnaces, boilers, and water heaters located within the home's pressure boundary are mechanically drafted or direct-vented. As an exception, naturally drafted equipment is allowed in Climate Zones 1-3. For naturally drafted furnaces, boilers, and water heaters, the Rater has followed RESNET or BPI combustion safety test procedures and met the selected standard's limits for depressurization, spillage, draft pressure, and CO concentration in ambient air, as well as a CO concentration in the flue of ≤ 25 ppm. [34,35,36]	☐	☐	☐
10.2 For fireplaces that are not mechanically drafted or direct-vented to outdoors, total net rated exhaust flow of the two largest exhaust fans (excluding summer cooling fans) is ≤ 15 CFM per 100 sq. ft. of occupiable space when at full capacity or the Rater has verified that the pressure differential is ≤ -5 Pa using BPI's or RESNET's worst-case depressurization test procedure. [26,36,37,38]	☐	☐	☐
10.3 If unvented combustion appliances other than cooking ranges or ovens are located inside the home's pressure boundary, the Rater has operated the appliance for at least 10 minutes and verified that the ambient CO level does not exceed 35 ppm. [39]	☐	☐	☐
11. Filtration			
11.1 At least one MERV 6 or higher filter installed in each ducted mechanical system. [40]	☐	☐	☐
11.2 All return air and mechanically supplied outdoor air pass through filter prior to conditioning.	☐	☐	☐
11.3 Filter located and installed so as to facilitate access and regular service by the owner. [41]	☐	☐	☐
11.4 Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass. [42]	☐	☐	☐

Rater Name: _____ Date Checklist Inspected: _____
Rater Signature: _____ Rater Company Name: _____

Footnote #33

- Fans exempted from this requirement include HVAC air handlers and remote-mounted fans
- To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be ≥ 4 ft. ductwork between the fan and intake grill
- Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms

9. Ventilation & Exhaust Fan Ratings (Exemptions for Kitchen, HVAC, and Remote-Mounted Fans) [33]

9.1 Intermittent supply and exhaust fans rated at ≤ 3 sones by mfr. when producing no less than the minimum airflow rate required by Section 8 of this Checklist, unless rated flow ≥ 400 CFM.

9.2 Continuous supply & exhaust fans rated at ≤ 1 sone by mfr. when producing no less than the minimum airflow required by Section 8 of this Checklist.

9.3 Bathroom fans used as part of a whole-house mechanical ventilation system shall be ENERGY STAR certified; unless rated flow rate ≥ 500 CFM.

HVAC Rater Checklist Section #10

10. Combustion Appliances

10.1 Furnaces, boilers, and water heaters located within the home's pressure boundary are mechanically drafted or direct-vented. As an exception, naturally drafted equipment is allowed in Climate Zones 1-3. For naturally drafted furnaces, boilers, and water heaters, the Rater has followed RESNET or BPI combustion safety test procedures and met the selected standard's limits for depressurization, spillage, draft pressure, and CO concentration in ambient air, as well as a CO concentration in the flue of ≤ 25 ppm. [34,35,36]

10.2 For fireplaces that are not mechanically drafted or direct-vented to outdoors, total net rated exhaust flow of the two largest exhaust fans (excluding summer cooling fans) is ≤ 15 CFM per 100 sq. ft. of occupiable space when at full capacity or the Rater has verified that the pressure differential is ≤ -5 Pa using BPI's or RESNET's worst-case depressurization test procedure. [26,36,37,38]

10.3 If unvented combustion appliances other than cooking ranges or ovens are located inside the home's pressure boundary, the Rater has operated the appliance for at least 10 minutes and verified that the ambient CO level does not exceed 35 ppm. [39]

Footnote #34

- Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere
- A mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure
- A natural draft system is a venting system designed to remove flue or vent gases under non-positive static vent pressure entirely by natural draft

HVAC Rater Checklist Section #11

11. Filtration	
11.1 At least one MERV 6 or higher filter installed in each ducted mechanical system. [40]	
11.2 All return air and mechanically supplied outdoor air pass through filter prior to conditioning.	
11.3 Filter located and installed so as to facilitate access and regular service by the owner. [41]	
11.4 Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass. [42]	

Footnote #40

- Per ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space through ductwork exceeding 10 ft. in length and through a thermal conditioning component, except for evaporative coolers
- Systems that do not meet this definition are exempt from this requirement
- Also, mini-split systems typically do not have MERV-rated filters available for use and are, therefore, exempted under this version of the guidelines

HVAC Rater Checklist Section #11

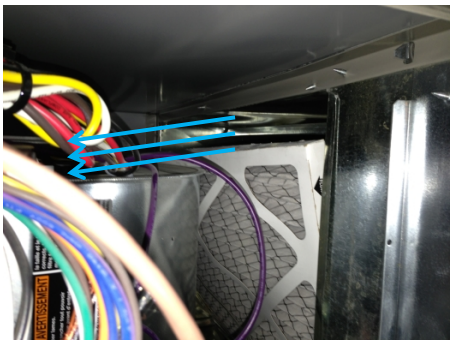
11. Filtration	
11.1 At least one MERV 6 or higher filter installed in each ducted mechanical system. [40]	
11.2 All return air and mechanically supplied outdoor air pass through filter prior to conditioning.	
11.3 Filter located and installed so as to facilitate access and regular service by the owner. [41]	
11.4 Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass. [42]	

Footnote #41

- HVAC filters located in the attic shall be considered accessible to the owner if drop-down stairs provide access to attic and a permanently installed walkway has been provided between the attic access location and the filter

HVAC Rater Checklist Section #11

11. Filtration	
11.1	At least one MERV 6 or higher filter installed in each ducted mechanical system. [40]
11.2	All return air and mechanically supplied outdoor air pass through filter prior to conditioning.
11.3	Filter located and installed so as to facilitate access and regular service by the owner. [41]
11.4	Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass. [42]



Footnote #42

- The filter media box (i.e., the component in the HVAC system that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement
- These requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the return grill

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H-QUITO

- Currently ACCA and Advanced Energy are the only national EPA–recognized third–party training and oversight organization

http://www.advancedenergy.org/qap/how_to_participate.php

http://qacontractors.org/new-homes/

Water Management Checklist

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
Water Management System Builder Checklist [1,2]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Water-Managed Site and Foundation	Must Correct	Builder Verified	Rater Verified	N/A
1.1 Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less. [3]	☐	☐	☐	☐
1.2 Back-fill has been tamped and final grade sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. See Footnote for alternatives. [4]	☐	☐	☐	☐
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1 in. extruded polystyrene insulation with taped joints. [4,5,6]	☐	☐	☐	☐
1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., & installed using one of the following opt's: [4,5,6]				
1.4.1 Placed beneath a concrete slab; OR,	☐	☐	☐	☐
1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,	☐	☐	☐	☐
1.4.3 Secured in the ground at the perimeter using stakes.	☐	☐	☐	☐
1.5 Exterior surface of below-grade walls of basements & unvented crawlspaces finished as follows: [7] a) For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating. [7] b) For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.	☐	☐	☐	☐
1.6 Class 1 vapor retarder not installed on interior side of air permeable insulation in ext. below-grade walls. [8]	☐	☐	☐	☐
1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.	☐	☐	☐	☐
1.8 Drain tile installed at the exterior side of footings of basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of ½ to ¾ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. [9]	☐	☐	☐	☐
2. Water-Managed Wall Assembly				
2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system. [10]	☐	☐	☐	☐
2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1 and fully sealed at all penetrations. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. [10,11]	☐	☐	☐	☐
2.3 Window and door openings fully flashed. [12]	☐	☐	☐	☐
3. Water-Managed Roof Assembly				
3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated shingle-style with drainage plane above; boot / collar flashing at all roof penetrations. [13]	☐	☐	☐	☐
3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that discharges water on sloping final grade ≥ 5 ft. from foundation, or to underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation. See Footnote for alternatives & exemptions. [4,14]	☐	☐	☐	☐
3.3 Self-sealing bituminous membrane or equivalent at all valleys & roof deck penetrations. [4]	☐	☐	☐	☐
3.4 In 2009 IECC Climate Zones 5 & higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall. [4]	☐	☐	☐	☐
4. Water-Managed Building Materials				
4.1 Wall-to-wall carpet not installed within 2.5 ft. of toilets, tubs, and showers.	☐	☐	☐	☐
4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. [15]	☐	☐	☐	☐
4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. [8]	☐	☐	☐	☐
4.4 Building materials with visible signs of water damage or mold *not* installed or allowed to remain. [16]	☐	☐	☐	☐
4.5 Framing members & insulation products having high moisture content *not* enclosed (e.g., with drywall) [17]	☐	☐	☐	☐

Builder Employee: _____ Date: _____
Builder Signature: _____

Builder has completed Builder Checklist in its entirety, except for items that are checked in the Rater Verified column (if any). [1]
Rater Signature: _____ Date: _____

Water Management Checklist

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
Water Management System Builder Checklist [1,2]

1.8 Drain tile installed at the exterior side of footings of basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of ½ to ¾ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. [9]

- We have asked Energy Star for clarification but have not heard back yet.

Water Management Checklist

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
Water Management System Builder Checklist [1,2]

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    - **Drainage, Capillary break, damp proofed, Etc.**
  - **Water managed Wall assemblies**
    - **Drainage plane, flashing details**
  - **Water managed Roof assemblies**
    - **Gutters and flashing**
  - **Interior water management**
    - **Moisture resistant materials**
- **Radon control**
  - Radon resistant features including at least a passive radon system
- **Pest Barriers**
  - Minimize pathway for pests
- **HVAC Systems**
  - **Heating & Cooling equipment**
    - **Sizing and design**
  - **Ventilation**
    - **ASHREA 62.2**
  - **Air cleaning and filtration**
  - **Dehumidification**
- **Combustion pollutant control**
  - **Combustion source Controls**
    - **Sealed or power vented equipment**
  - Attached garages
    - Insolated
- **Low emission materials**
  - Engineered woods, Paints, Carpets
- **Home commissioning**
  - **Duct testing, Pressure balancing, Flows, Etc.**

Water Management Checklist

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
Water Management System Builder Checklist [1,2]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Water-Managed Site and Foundation	Must Correct	Builder Verified	Rater Verified	N/A
1.1 Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less. [3]	☐	☐	☐	☐
1.2 Back-fill has been tamped and final grade sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. See Footnote for alternatives. [4]	☐	☐	☐	☐
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1 in. extruded polystyrene insulation with taped joints. [4,5,6]	☐	☐	☐	☐
1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., & installed using one of the following opt's: [4,5,6]				
1.4.1 Placed beneath a concrete slab; OR,	☐	☐	☐	☐
1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,	☐	☐	☐	☐
1.4.3 Secured in the ground at the perimeter using stakes.	☐	☐	☐	☐
1.5 Exterior surface of below-grade walls of basements & unvented crawlspaces finished as follows: a) For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating. b) For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.	☐	☐	☐	☐
1.6 Class 1 vapor retarder not installed on interior side of air permeable insulation in ext. below-grade walls. [7]	☐	☐	☐	☐
1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.	☐	☐	☐	☐
1.8 Drain tile installed at the exterior side of footings of basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of ½ to ¾ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. [8]	☐	☐	☐	☐
2. Water-Managed Wall Assembly				
2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system. [10]	☐	☐	☐	☐
2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in item 2.1 and fully sealed at all penetrations. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. [10,11]	☐	☐	☐	☐
2.3 Window and door openings fully flashed. [12]	☐	☐	☐	☐
3. Water-Managed Roof Assembly				
3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated shingle-style with drainage plane above; boot / collar flashing at all roof penetrations. [13]	☐	☐	☐	☐
3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that discharges water on sloping final grade ≥ 5 ft. from foundation, or to underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation. See Footnote for alternatives & exemptions. [4,14]	☐	☐	☐	☐
3.3 Self-sealing bituminous membrane or equivalent at all valleys & roof deck penetrations. [4]	☐	☐	☐	☐
3.4 In 2009 IECC Climate Zones 5 & higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall. [4]	☐	☐	☐	☐
4. Water-Managed Building Materials				
4.1 Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers.	☐	☐	☐	☐
4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. [15]	☐	☐	☐	☐
4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. [7]	☐	☐	☐	☐
4.4 Building materials with visible signs of water damage or mold not installed or allowed to remain. [16]	☐	☐	☐	☐
4.5 Framing members & insulation products having high moisture content not enclosed (e.g., with drywall) [17]	☐	☐	☐	☐

Builder Employee: _____
Builder Signature: _____ Date: _____

Builder has completed Builder Checklist in its entirety, except for items that are checked in the Rater Verified column (if any). [2]
Rater Signature: _____ Date: _____

Difficult items on the checklist:

- Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers.
- Class 1 vapor retarder not installed on interior side of air permeable insulation in ext. below-grade walls

Energy Star V3 HVAC Checklists

Thank you!

Robby@nrglogic.com
www.nrglogic.com

720-838-0677

Upside down house Szymbark Poland