HVAC Design Report [1]
ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

HVAC Designer Responsibilities:

- Complete one HVAC Design Report for each system design for a house plan, created for either the specific plan configuration (i.e., elevation, option, orientation, & county) of the home to be certified or for a plan that is intended to be built with potentially different configurations (i.e., different elevations, options, and/or orientations). Visit www.energystar.gov/newhomeshvacdesign and see Footnote 2 for more information. [2]
- Obtain efficiency features (e.g., window performance, insulation levels, and infiltration rate) from the builder or Home Energy Rater.
- Provide the completed HVAC Design Report to the builder or credentialed HVAC contractor and to the Home Energy Rater.

1. Design Overview

1.1 Designer name: _____ Designer company: _____ Date: _____

1.2 Select which party you are providing these design services to: ☐ Builder or ☐ Credentialed HVAC contractor

1.3 Name of company you are providing these design services to (if different than Item 1.1): _____

1.4 Area that system serves: ☐ Whole-house ☐ Upper-level ☐ Lower-level ☐ Other _____

1.5 Is cooling system for a temporary occupant load? [3] ☐ Yes ☐ No

1.6 House plan: _____ Check box to indicate whether the system design is site-specific or part of a group: [2]

☐ Site-specific design. Option(s) & elevation(s) modeled: _____

☐ Group design. Group #: _____ out of _____ total groups for this house plan. Configuration modeled: _____

2. Whole-House Mechanical Ventilation Design [4, 5]	**Designer Verified**
Airflow:	
2.1 Ventilation airflow design rate & run-time meet the requirements of ASHRAE 62.2-2010 or 2013 [6]	☐
2.2 Ventilation airflow rate required by 62.2 for a continuous system _____ CFM	-
2.3 Design for this system: Vent. airflow rate: _____ CFM Run-time per cycle: _____ minutes Cycle time: _____ minutes	-
System Type & Controls:	
2.4 Specified system type: ☐ Supply ☐ Exhaust ☐ Balanced	-
2.5 Specified control location: _____ (e.g., Master bath, utility room)	-
2.6 Specified controls allow the system to operate automatically, without occupant intervention	☐
2.7 Specified controls include a readily-accessible ventilation override and a label has also been specified if its function is not obvious (e.g., a label is required for a standalone wall switch, but not for a switch that's on the ventilation equipment)	☐
2.8 No outdoor air intakes designed to connect to the return side of the HVAC system, unless specified controls operate intermittently and automatically based on a timer and restrict intake when not in use (e.g., motorized damper) [7]	☐
Sound: 2.9 The fan of the specified system is rated ≤ 3 sones if intermittent and ≤ 1 sone if continuous, or exempted [8]	☐
Efficiency:	
2.10 If system utilizes the HVAC fan, then the specified fan type in Item 4.7 is ECM / ICM, or the specified controls will reduce the standalone ventilation run-time by accounting for hours when the HVAC system is heating or cooling	☐
2.11 If bathroom fans are specified as part of the system, then they are ENERGY STAR certified [9]	☐
Air Inlet Location: (Complete this section if system has a specified air inlet location; otherwise check "N/A") [10] ☐ N/A	
2.12 Inlet pulls ventilation air directly from outdoors and not from attic, crawlspace, garage, or adjacent dwelling unit	☐
2.13 Inlet is ≥ 2 ft. above grade or roof deck; ≥ 10 ft. of stretched-string distance from known contamination sources (e.g., stack, vent, exhaust, vehicles) not exiting the roof, and ≥ 3 ft. from known sources exiting the roof	☐

3. Room-by-Room Heating & Cooling Loads

3.1 Room-by-room loads calculated using: ☐ Unabridged ACCA Manual J v8 ☑ 2013 ASHRAE Fundamentals ☐ Other per AHJ [11]	-
3.2 Indoor design temperatures used in loads are 70°F for heating and 75°F for cooling	☐
3.3 Outdoor design temperatures used in loads: (See Footnote 12 and energystar.gov/hvacdesigntemps) [12] County & State selected: _____ Cooling season: _____°F Heating season: _____°F	-
3.4 Number of occupants used in loads: [13] _____	-
3.5 Conditioned floor area used in loads: _____ Sq. Ft.	-
3.6 Window area used in loads: _____ Sq. Ft.	-
3.7 Predominant window SHGC used in loads: [14] _____	-
3.8 Infiltration rate used in loads: [15] Summer: _____ Winter: _____	-
3.9 Mechanical ventilation rate used in loads: _____ CFM	-

Loads At Design Conditions (kBtuh)		**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**	
Cooling	3.10 Sensible heat gain (By orientation [16])									-
	3.11 Latent heat gain (Not by orientation)									-
	3.12 Total heat gain (By orientation [16])									-
	3.13 Maximum – minimum total heat gain (Item 3.12) across orientations = ewr kBtuh						Variation is ≤ 6 kBtuh [16, 17]			☐
Heating	3.14 Total heat loss (Not by orientation)									-

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4. Heating & Cooling Equipment Selection	
4.1 Equipment selected per ACCA Manual S (see Footnote 19 & 20) [19, 20]	☐
Air Conditioner / Heat Pump (Complete if air conditioner or heat pump will be installed; otherwise check "N/A")	☐ N/A
4.2 Equipment type: ☐ Cooling-only air conditioner or ☐ Cooling & heating heat pump	-
4.3 Condenser manufacturer & model: _____	-
4.4 Evaporator / fan coil manufacturer & model: _____	-
4.5 AHRI reference #: [21] _____	-
4.6 AHRI listed efficiency: _____ / _____ EER / SEER Air-source heat pump: _____ HSPF Ground-source heat pump: _____	-
4.7 Evaporator fan type: ☐ PSC ☐ ECM / ICM ☐ Other: _____	-
4.8 Compressor type: ☐ Single-speed ☐ Two-speed ☐ Variable-speed	-
4.9 Latent capacity at design conditions, from OEM expanded performance data: _____ kBtuh	-
4.10 Sensible capacity at design conditions, from OEM expanded performance data: _____ kBtuh	-
4.11 Total capacity at design conditions, from OEM expanded performance data: _____ kBtuh	-
4.12 Air-source heat pump capacity: At 17°F: _____ kBtuh At 47°F: _____ kBtuh ☐ N/A	-
4.13 Cooling sizing % = Total capacity (Item 4.11) divided by maximum total heat gain (Item 3.12): _____ %	-
4.14 Complete this Item if Condition B Climate will be used to select sizing limit in Item 4.15. Otherwise, check "N/A": [22] ☐ N/A	-
4.14.1 Load sensible heat ratio = Max. sensible heat gain (Item 3.10) / Max. total heat gain (Item 3.12) = _____ %	
4.14.2 HDD / CDD ratio (Visit energystar.gov/hvacdesigntemps to determine this value for the design location) = _____	
4.15 Check box of applicable cooling sizing limit from chart below: [19, 20]	-

Equipment Type (Per Item 4.2) & Climate Condition (Per Item 4.14)	Compressor Type (Per Item 4.8)		
	Single-Speed	Two-Speed	Variable-Speed
For Cooling-Only Equipment or For Cooling Mode of Heat Pump in Condition A Climate	☐ Recommended: 90 – 115% Allowed: 90 – 130%	☐ Recommended: 90 – 120% Allowed: 90 – 140%	☐ Recommended: 90 – 130% Allowed: 90 – 160%
For Cooling Mode of Heat Pump in Condition B Climate	☐ 90% - 100%, plus 15 kBtuh	☐ 90% - 100%, plus 15 kBtuh	☐ 90% - 100%, plus 15 kBtuh

4.16 Cooling sizing % (4.13) is within cooling sizing limit (4.15)	☐
Furnace (Complete if furnace will be installed; otherwise check "N/A")	☐ N/A
4.17 Furnace manufacturer & model: _____	-
4.18 Listed efficiency: _____ AFUE	-
4.19 Total capacity: _____ kBtuh	-
4.20 Heating sizing % = Total capacity (Item 4.19) divided by total heat loss (Item 3.14): _____ %	-
4.21 Check box of applicable heating sizing limit from chart below:	-

When Used for Heating Only	When Paired With Cooling
☐ 100 – 140%	☐ Recommended: 100 – 140% Allowed: 100 – 200%

4.22 Heating sizing % (4.20) is within heating sizing limit (4.21)	☐
5. Duct Design (Complete if heating or cooling equipment will be installed with ducts; otherwise check "N/A")	☐ N/A
5.1 Duct system designed for the equipment selected in Section 4, per ACCA Manual D	☐
5.2 Design HVAC fan airflow: [23] Cooling mode _____ CFM Heating mode _____ CFM	-
5.3 Design HVAC fan speed setting (e.g., low, medium, high): [24] Cooling mode _____ Heating mode _____	-
5.4 Design total external static pressure (corresponding to the mode with the higher airflow in Item 5.2): [25] _____ IWC	-
5.5 Room-by-room design airflows documented below (which must sum to the mode with the higher airflow in Item 5.2) [26, 27]	-

	Room Name	Design Airflow (CFM)		Room Name	Design Airflow (CFM)
1			13		
2			14		
3			15		
4			16		
5			17		
6			18		
7			19		
8			20		
9			21		
10			22		
11			23		
12				Total for all rooms	

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Footnotes

1. This report is designed to meet ASHRAE 62.2-2010 / 2013 and ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems (e.g., those caused by a lack of maintenance by occupants). Therefore, system designs documented through the use of this report are not a guarantee of proper ventilation, indoor air quality, or HVAC performance.
2. The report shall represent a single system design for a house plan. Check the box for "site-specific design" if the design was created for the specific plan configuration (i.e., elevation, option, orientation, and county) of the home to be certified. Check the box for "group design" if the design was created for a plan that is intended to be built with potentially different configurations (i.e., different elevations, options, and/or orientations). Regardless of the box checked, the system design as documented on this HVAC Design Report must fall within the following tolerances for the home to be certified:
   - Item 3.3: The outdoor design temperature used in loads are within the limits defined at energystar.gov/hvacdesigntemps.
   - Item 3.4: The number of occupants used in loads is within ± 2 of the home to be certified.
   - Item 3.5: The conditioned floor area used in loads is between zero and 300 sq. ft. larger than the home to be certified.
   - Item 3.6: The window area used in loads is between zero and 60 sq. ft. larger than the home to be certified.
   - Item 3.7: The predominant window SHGC is within 0.1 of the predominant value in the home to be certified.
   - Items 3.10 - 3.12: The sensible, latent, & total heat gain are documented for the orientation of the home to be certified.
   - Item 3.13: The variation in total heat gain across orientations is ≤ 6 kBtuh.
   - Item 4.16: The cooling sizing % is within the cooling sizing limit selected.

   Provide the HVAC Design Report to the party you are providing these design services to (i.e., a builder or credentialed HVAC contractor) and to the Home Energy Rater. The report is only required to be provided once per system design, even if multiple homes are built using this design (e.g., in a production environment where the same plan is built multiple times, only one report is required). As long as a report has been provided that falls within these tolerances for the home to be certified, no additional work is required. However, if no report falls within these tolerances or if any aspect of the system design changes, then an additional report will need to be generated prior to certification.

   Visit energystar.gov/newhomeshvacdesign for a tool to assist with group designs and for more information.
3. Check "Yes" if this system is to handle temporary occupant loads. Such a system may be required to accommodate a significant number of guests on a regular or sporadic basis and shall be handled by a supplemental cooling system (e.g., a small, single-package unit or split-coil unit) or by a system that can shift capacity from zone to zone (e.g., a variable volume system).
4. The system shall have at least one supply or exhaust fan with associated ducts and controls. Local exhaust fans are allowed to be part of a whole-house ventilation system. Designers may provide supplemental documentation as needed to document the system design.
5. In "Warm-Humid" climates as defined by 2009 IECC Figure 301.1 (i.e., CZ 1 and portions of CZ 2 and 3A below the white line), it is recommended, but not required, that equipment be specified with sufficient latent capacity to maintain indoor relative humidity at ≤ 60%.
6. Airflow design rates and run-times shall be determined using ASHRAE 62.2-2010 or later. Designers are permitted, but not required, to use published addenda and/or the 2013 version of the standard to assess compliance.
7. In addition, consult manufacturer requirements to ensure return air temperature requirements are met.
8. Whole-house mechanical ventilation fans shall be rated for sound at no less than the airflow rate in Item 2.3. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated ≥ 400 CFM. 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. Bathroom fans with a rated flow rate ≥ 500 CFM are exempted from the requirement to be ENERGY STAR certified.
10. 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.
11. Select "2013 ASHRAE Fundamentals" if using Chapter 17 of the 2013 ASHRAE Handbook of Fundamentals. Select "Other per AHJ" if the Authority Having Jurisdiction where the home will be certified mandates the use of a load calculation methodology other than Unabridged ACCA Manual J v8 or 2013 ASHRAE Fundamentals.
12. Visit energystar.gov/hvacdesigntemps for the maximum cooling season design temperature and minimum heating season design temperature permitted for ENERGY STAR certified homes. For "County & State selected", select the County and State where the home is to be certified. The same design report is permitted to be used in other counties, as long as the design temperature limits in those other counties meet or exceed the cooling and heating season temperature limits for the county selected. For example, if Fauquier County, VA, is used for the load calculations, with a 1% cooling temperature limit of 93 F, then the same report could be used in Fairfax County (which has a higher limit of 94 F) but not in Arlington County (which has a lower limit of 92 F).
13. To determine the number of occupants among all HVAC systems in the home, calculate the number of bedrooms, as defined below, and add one. This number of occupants must be within ± 2 of the home to be certified, unless Item 1.5 indicates that the system is a cooling system for temporary occupant loads.

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

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

- have a sill height of not more than 44 inches above the floor; AND
- have a minimum net clear opening of 5.7 sq. ft.; AND
- have a minimum net clear opening height of 24 in.; AND
- have a minimum net clear opening width of 20 in.; AND
- be operational from the inside of the room without the use of keys, tools or special knowledge.

14. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.
15. Infiltration rate shall reflect the value used in the confirmed or projected HERS rating for home to be certified. Alternatively, use "Average" or "Semi-loose" values for the cooling season infiltration rate and "Semi-tight" or "Average" values for the heating season infiltration rate, as defined by ACCA Manual J, Eighth Edition, Version Two.
16. Orientation represents the direction that the front door of the house is facing. The designer is only required to document the loads for the orientation(s) that the house might be built in. For example, if a house plan will only be built one time in a specific orientation (e.g., a site-specific design), then the designer only needs to document the loads for this one orientation.
17. Determine the orientation with the largest and smallest Total Heat Gain. Verify that the difference in Total Heat Gain between the orientation with the largest and smallest value is ≤ 6 kBtuh. If not, then assign the orientations into one or more groups until the difference is ≤ 6 kBtuh and then complete a separate HVAC Design Report for each group.
18. This Revision of the HVAC Design Report is required to certify all homes permitted after 07/01/2016, but is allowed to be used for any home permitted or completed prior to this date. The Home Energy Rater certifying the home may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases where permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors.
19. Equipment shall be selected using the maximum total heat gain in Item 3.12 and the total heat loss in Item 3.14 per ACCA Manual S, Second Edition, except that cooling ranges above ACCA Manual S limits are temporarily allowed, per Item 4.15.
20. As an alternative for low-load spaces, a system match-up including a single-speed compressor with a total capacity ≤ 20 kBtuh is permitted to be used in spaces with a total cooling load ≤ 15 kBtuh. A system match-up including a two-speed or variable-speed compressor with a total capacity ≤ 25 kBtuh is permitted to be used in spaces with a total cooling load ≤ 18 kBtuh.
21. Evaporators and condensing units shall be properly matched as demonstrated by an AHRI Reference #. If an AHRI Reference # is not available, a copy of OEM-provided catalog data indicating acceptable combination selection and performance data shall be attached.
22. Per ACCA Manual S, Second Edition, if the load sensible heat ratio is ≥ 95% <u>and</u> the HDD/CDD ratio is ≥ 2.0, then the Climate is Condition B, otherwise it is Condition A.
23. Design HVAC fan airflow is the design airflow for the blower in CFM, as determined using the manufacturer's expanded performance data.
24. Design HVAC fan speed setting is the fan speed setting on the control board (e.g., low, medium, high) that corresponds with the Design HVAC fan airflow.
25. Design total external static pressure is the pressure corresponding to the Design HVAC fan airflow, inclusive of external components (e.g., evaporator coil, whole-house humidifier, or ≥ MERV 6 filter).
26. Designers may provide supplemental documentation with room-by-room and total design airflows in lieu of completing Item 5.5.
27. Orientation-specific room-by-room design airflows are recommended, but not required, to distribute airflow proportional to load, thereby improving comfort and efficiency.