



# ENERGY STAR Single-Family New Homes, All Versions (Rev. 13) ENERGY STAR Multifamily New Construction, All Versions (Rev. 04) National HVAC Design Supplement to Std. 310 for Dwellings & Units <sup>1</sup>

<b>1. Design Basis</b>																																													
1.1 Design description (optional):																																													
1.2 Designer company:			Designer name:				Date:																																						
<b>2. Dwelling Unit Mechanical Ventilation System Design ("Vent System") &amp; Inlets in Return Duct</b> <sup>2, 3, 4</sup>									Verified <sup>5</sup>	N/A																																			
<b>Airflow:</b>																																													
2.1 Ventilation airflow design rate & run-time for each Vent System meets ASHRAE 62.2-2010 or later edition. <sup>6, 7</sup>									<input type="checkbox"/>																																				
2.2 Access point is specified for Rater to measure ventilation airflow rate and inspect any motorized / shutoff dampers. <sup>4, 8</sup>									<input type="checkbox"/>																																				
<b>System Controls:</b>																																													
2.3 Specified controls for each Vent System allow it to operate automatically, without occupant intervention.									<input type="checkbox"/>																																				
2.4 Specified controls for each Vent System include a readily-accessible override & a label has also been specified if its function is not obvious (e.g., a label is required for a toggle wall switch, but not for a switch that's on the vent. equip.). <sup>9</sup>									<input type="checkbox"/>																																				
2.5 For any outdoor air inlet designed to connect to a ducted return of the HVAC system, specified controls automatically restrict airflow using a motorized damper during ventilation off-cycle and occupant override. <sup>4, 10</sup>									<input type="checkbox"/>	<input type="checkbox"/>																																			
<b>Sound:</b> 2.6 Specified fan of each Vent System is rated ≤ 3 sones if intermittent and ≤ 1 sone if continuous, or exempted. <sup>11</sup>										<input type="checkbox"/>																																			
<b>Efficiency:</b> (Complete if Vent System controller operates HVAC fan or Vent System uses bath fans; otherwise, check "N/A")										<input type="checkbox"/>																																			
2.7 If Vent System controller operates the HVAC fan, then HVAC fan operation is intermittent and either fan type in HVAC design report is ECM or controls will reduce the run-time by accounting for HVAC system heating or cooling hours. <sup>12</sup>									<input type="checkbox"/>	<input type="checkbox"/>																																			
2.8 If bathroom fans are specified as part of any Vent System, then they are ENERGY STAR certified. <sup>13</sup>									<input type="checkbox"/>	<input type="checkbox"/>																																			
2.9 MFNC Only: <sup>14</sup> If central exhaust fans are specified as part of the Vent System, then if ≤ 1 HP, they are direct-drive, ECM, with variable speed controllers; and if > 1 HP, they are specified with NEMA Premium™ Motors or equivalent. <sup>15</sup>									<input type="checkbox"/>	<input type="checkbox"/>																																			
<b>Air Inlet Location:</b> (Complete this section if system has a specified air inlet location; otherwise check "N/A") <sup>16</sup>										<input type="checkbox"/>																																			
2.10 Inlet(s) pull ventilation air directly from outdoors and not from attic, crawlspace, garage, or adjacent dwelling unit.									<input type="checkbox"/>																																				
2.11 Inlet(s) are ≥ 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. <sup>17</sup>									<input type="checkbox"/>																																				
2.12 Inlet(s) are provided with rodent / insect screen with ≤ 0.5 inch mesh.									<input type="checkbox"/>																																				
<b>3. Dwelling Unit Local Mechanical Exhaust Design</b>																																													
3.1 System(s) are designed that mechanically exhaust air from each dwelling unit kitchen and bathroom directly to the outdoors or to ventilation risers and meet the requirements in Table 1. <sup>18</sup>									<input type="checkbox"/>																																				
<b>Kitchens:</b> Runtime: <sup>19</sup> <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent <sup>20</sup> Dwelling Units Served by Fan: <sup>21</sup> <input type="checkbox"/> Single Unit <input type="checkbox"/> Multiple Units																																													
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<b>4. Heating Equipment, Cooling Equipment, &amp; Equipment Controls Selection</b>																																													
4.1 MFNC Only: <sup>14</sup> If using Prescriptive Path, equipment serving dwelling units meet the efficiency levels specified in Exhibit X of the National Rater Field Checklist, have programmable thermostatic controls, & do not use electric resistance heating. <sup>22</sup>									<input type="checkbox"/>	<input type="checkbox"/>																																			
4.2 MFNC Only: <sup>14</sup> Thermostatic controls for systems serving a dwelling unit are within the unit and not located on exterior walls. If more than one system provides heating or cooling to the same space, controls prevent simultaneous operation.									<input type="checkbox"/>	<input type="checkbox"/>																																			
<b>Air Conditioners &amp; Heat Pumps</b> If none will be installed, check N/A <input type="checkbox"/>																																													
<table border="1"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>4.3 Unique name or ID for each system:</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.4 Maximum sensible and total heat gain load of zone served (kBtuh):</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.5 Sensible, latent, &amp; total cooling capacity at design conditions (kBtuh): <sup>23</sup></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.6 If HP, heating capacity at 17°F and at 47°F (kBtuh):</td> <td>N/A <input type="checkbox"/></td> <td>N/A <input type="checkbox"/></td> <td>N/A <input type="checkbox"/></td> </tr> <tr> <td>4.7 Compressor speed type:</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.8 Cooling sizing % &amp; applicable sizing limit key from Table 2: <sup>24, 25</sup></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.9 If C2 chosen in Item 4.8, load sensible heat ratio &amp; HDD / CDD ratio: <sup>26</sup></td> <td>N/A <input type="checkbox"/></td> <td>N/A <input type="checkbox"/></td> <td>N/A <input type="checkbox"/></td> </tr> <tr> <td>4.10 Affirm that cooling sizing % is within cooling sizing limit (4.8):</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>											1	2	3	4.3 Unique name or ID for each system:				4.4 Maximum sensible and total heat gain load of zone served (kBtuh):				4.5 Sensible, latent, & total cooling capacity at design conditions (kBtuh): <sup>23</sup>				4.6 If HP, heating capacity at 17°F and at 47°F (kBtuh):	N/A <input type="checkbox"/>	N/A <input type="checkbox"/>	N/A <input type="checkbox"/>	4.7 Compressor speed type:				4.8 Cooling sizing % & applicable sizing limit key from Table 2: <sup>24, 25</sup>				4.9 If C2 chosen in Item 4.8, load sensible heat ratio & HDD / CDD ratio: <sup>26</sup>	N/A <input type="checkbox"/>	N/A <input type="checkbox"/>	N/A <input type="checkbox"/>	4.10 Affirm that cooling sizing % is within cooling sizing limit (4.8):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<b>Furnaces</b> If none will be installed, check N/A <input type="checkbox"/>																																													
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<b>5. Duct Design</b> 5.1 All duct requirements in Table 4 have been included in the design, where applicable.									<input type="checkbox"/>	<input type="checkbox"/>																																			



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**Table 1 – Local Mechanical Exhaust Airflow and Sound Limits**

Location		Continuous Rate	Intermittent Rate
Kitchen	Airflow	≥ 5 ACH, based on kitchen volume <sup>30, 31, 32</sup> (Alternative in Fn. 30)	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume <sup>30, 31, 33</sup>
	Sound <sup>34</sup>	Recommended: ≤ 1 sone	Recommended: ≤ 3 sones
Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM
	Sound <sup>34</sup>	Required: ≤ 1 sone	Recommended: ≤ 3 sones

**Table 2 – Air Conditioner and Heat Pump Cooling Sizing Limits**

Limit Key	Criteria for Limit Type	Sizing Limits by Compressor Type		
		Single-Speed	Two-Speed	Variable-Speed
C1	Cooling-only equipment or Cooling mode of HP in Condition A Climate	Recommended: 90 – 115% Allowed: 90 – 130%	Recommended: 90 – 120% Allowed: 90 – 140%	Recommended: 90 – 130% Allowed: 90 – 160%
C2	Cooling mode of HP in Condition B Climate	90% - 100%, plus 15 kBtuh	90% - 100%, plus 15 kBtuh	90% - 100%, plus 15 kBtuh
C3	Low-load: Total heat gain load ≤ 15 kBtuh	≤ 20 kBtuh	N/A	N/A
C4	Low-load: Total heat gain load ≤ 18 kBtuh	N/A	≤ 25 kBtuh	≤ 25 kBtuh

**Table 3 – Furnace Heating Sizing Limits**

Limit Key	Criteria for Limit Type	Sizing Limits
H1	Furnaces used for heating only	100 - 140%
H2	Furnaces when paired with cooling	Recommended: 100 – 140% Allowed: 100 – 400%
H3	Low-load: Total heat loss load ≤ 10 kBtuh	≤ 40 kBtuh

**Table 4 – Duct Quality Design & Installation Requirements**

- a) **Design:** SFNH and Townhouses Only: <sup>35</sup> Duct system designed per ACCA Manual D.
- b) **Insulation:** All supply and return ducts that are not in conditioned space, including connections to trunk ducts, specified to be insulated ≥ R-6. MFNC Only: <sup>14</sup> In addition, if using Prescriptive Path, then if certifying under Version 1.0 of the program, any dwelling unit supply ducts located in unconditioned attics specified to be insulated ≥ R-8; if Version 1.1, all ducts and air handlers specified to be within conditioned space; if Version OR-WA 1.2, any dwelling unit supply ducts located in unconditioned space specified to be insulated ≥ R-8.

- c) **Sealing:** Duct sealing specified to achieve Rater-measured total duct leakage that does not exceed ENERGY STAR limits:

# of Ducted Returns	Total Duct Leakage Limit in CFM at 25 Pa (Select the Largest Applicable Value)	
	If Tested at Rough-In:	If Tested at Final:
None <sup>36</sup>	≤ 3 per 100 ft <sup>2</sup> of Conditioned Floor Area or ≤ 30	≤ 6 per 100 ft <sup>2</sup> of Conditioned Floor Area or ≤ 60
1- 2	≤ 4 per 100 ft <sup>2</sup> of Conditioned Floor Area or ≤ 40	≤ 8 per 100 ft <sup>2</sup> of Conditioned Floor Area or ≤ 80
≥ 3	≤ 6 per 100 ft <sup>2</sup> of Conditioned Floor Area or ≤ 60	≤ 12 per 100 ft <sup>2</sup> of Conditioned Floor Area or ≤ 120

SFNH and Townhouses Only: <sup>35</sup> In addition, sealing specified to achieve Rater-measured duct leakage to outside, when tested at final, that is the greater of ≤ 4 CFM<sub>25</sub> per 100 sq. ft. of conditioned floor area or ≤ 40 CFM<sub>25</sub>.

- d) **Filtration:** MERV 6+ filter(s) specified for each ducted mechanical system serving an individual dwelling unit, designed so all return and mechanically supplied outdoor air passes through filter(s) prior to conditioning, and located to facilitate access & regular service by the occupant or building owner. Filter access panel specified with a gasket or comparable sealing mechanism.
- e) **Pressure Balancing:** Bedrooms with a design supply airflow ≥ 150 CFM are specified with any combination of transfer grilles, jump ducts, dedicated return ducts, and/or undercut doors to achieve a Rater-measured pressure differential ≥ - 5 Pa and ≤ +5 Pa with respect to the main body of the dwelling unit when all air handlers are operating. SFNH and Townhouses Only: <sup>35</sup> In addition, bedrooms with a design supply airflow < 150 CFM are specified to achieve a Rater-measured pressure differential ≥ - 3 Pa and ≤ +3 Pa.



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## Footnotes

1. This report must be completed for dwellings (e.g., single-family homes, duplexes), townhouses, and dwelling / sleeping units pursuing ENERGY STAR certification using Track A – HVAC Grading. It provides supplemental design information not captured in the ANSI / RESNET / ACCA / ICC 310 HVAC Design Report, which must also be collected for such projects.
2. As defined by ANSI / RESNET / ICC 301-2019, a Dwelling Unit Mechanical Ventilation System is a ventilation system consisting of powered ventilation equipment such as motor-driven fans and blowers and related mechanical components such as ducts, inlets, dampers, filters and associated control devices that provides dwelling unit ventilation at a known or measured airflow rate. Each Vent 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 Vent System. Designers may provide supplemental documentation as needed to document the system design.
3. 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  $\leq 60\%$ .
4. Item 2.5 applies to any outdoor air inlet connected to a ducted return of the dwelling unit HVAC system, regardless of its intended purpose (e.g., for ventilation air, make-up air, combustion air). This Item does not apply to HVAC systems without a ducted return.  
For example, if an outdoor air inlet connected to a ducted return is used as a dedicated source of outdoor air for an exhaust ventilation system (e.g., bath fan), the outdoor airflow must be automatically restricted when the exhaust fan is not running and in the event of an override of the exhaust ventilation system. In dwelling / sleeping units in multifamily buildings, but not townhouses, automatic restriction of airflow is exempted if a manual shutoff damper is used with a continuous exhaust ventilation system and is readily-accessible, labeled as the override, and not used as a balancing damper.  
Note that a Rater will generally measure the ventilation rate at the highest HVAC fan speed applicable to ventilation mode (e.g., if the inlet only opens when the HVAC is in ‘fan-only’ mode, it will be tested in this mode) to verify that it is  $\leq 15$  CFM or 15% above design value. As an alternative, measurement of the outdoor airflow can be waived if a Constant Airflow Regulating (CAR) damper with a manufacturer-specified maximum flow rate no higher than 15 CFM or 15% above the ventilation design value is installed on the inlet.
5. In Section 2 through 5, ‘Verified’ indicates designer has verified that all specified Vent Systems, inlets in return ducts, dwelling unit local mechanical exhaust systems, equipment controls, and duct systems in the dwelling, townhouse, or dwelling/sleeping unit, meet the applicable requirement.
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 more recent editions of the standard to assess compliance.
7. MFNC Prescriptive Path Only: Rates shall not exceed 2013 rates by more than 50%. Where the Exhaust Fan Type in Section 3 indicates “Continuous” for both Bathroom and Kitchen, the Rater may use this equation to determine the maximum ventilation rate allowed:  $30 \text{ CFM} \times \text{number of bathrooms} + 75 \text{ CFM}$ .
8. The term ‘Rater’ refers to the person(s) completing the third-party verification required for certification. Examples of access points for measuring ventilation airflow rate include a section of smooth-walled duct with a hole and removable plug to facilitate an in-duct measurement; the grille of an exhaust fan for an exhaust-only ventilation system; or a tool that is integrated into the ventilation equipment.
9. In dwellings (e.g., single-family homes, duplexes) and townhouses, this control must be readily accessible to the occupant. In all other multifamily dwelling units, the override control is not required to be readily accessible to the occupant. However, in such cases, EPA recommends but does not require that the control be readily accessible to others (e.g., building maintenance staff) in lieu of the occupant.
10. In addition, consult manufacturer requirements to ensure return air temperature requirements are met.
11. Dwelling Unit Mechanical Ventilation System fans shall be rated for sound at no less than the airflow rate(s) specified in the ANSI / RESNET / ACCA / ICC 310 HVAC Design Report. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated  $\geq 400$  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  $\geq 4$  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.
12. Note that the ‘fan-on’ setting of a thermostat would not be an acceptable controller because it would continuously operate the HVAC fan.
13. Bathroom fans with a rated flow rate  $\geq 500$  CFM are exempted from the requirement to be ENERGY STAR certified.
14. Complete this Item only if the project is being certified using the ENERGY STAR Multifamily New Construction (MFNC) program.
15. As an alternative to meeting or exceeding the efficiency standards for NEMA Premium motors, documentation that an exhaust fan motor has a fan energy index (FEI)  $\geq 1.2$  at the design point of operation OR a fan efficacy  $\geq 1.1$  CFM/Watt is permitted.
16. 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 occupant.
17. Two alternatives to the required 10 ft. distance are provided: 1) inlets providing outdoor air to a dwelling unit are permitted to be  $\geq 5$  ft. of stretched-string distance from outlets of both exhaust dwelling-unit mechanical ventilation systems and local mechanical exhaust systems, and 2) the outlet and inlet of ERV’s and HRV’s may use a smaller distance if allowed by the manufacturer of the system. If the second alternative is used, the manufacturer’s instructions shall be collected for documentation purposes.
18. 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.
19. If both continuous and intermittent fans are present in the design for the kitchen(s) or bathroom(s), then select both boxes.



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20. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.
21. Select "Single Unit" if the kitchen or bathroom exhaust fan serves a single dwelling unit and select "Multiple Units" if the fan serves multiple dwelling units (e.g., a central or shared fan). If both types are present in the design, then select both boxes.
22. Electric resistance limitations do not apply to heat pumps with integral supplemental or emergency electric resistance heating. EPA recommends but does not require that heat pumps have controls to limit the use of emergency or supplemental heat to heat pump failures or when the heat pump cannot meet the heating load. EPA also recommends but does not require that heat pumps in CZ 5-8 are ENERGY STAR certified cold-climate heat pumps. Electric resistance limitations do not apply to systems dedicated to heating outdoor air supplied by a mechanical ventilation system, as long as the space served is primarily heated by a non-electric-resistance system that meets the efficiency requirements noted in Exhibit X.
23. The full system capacity at design conditions, from OEM expanded performance data, shall be listed. For two-speed equipment, the full system capacity shall reflect the capacity at the maximum available compressor speed. For variable-speed equipment, it shall reflect the capacity when the compressor operates at the AHRI rating speed.
24. Cooling sizing % = Total capacity (Item 4.5) divided by maximum total heat gain (Item 4.4).
25. Select the cooling sizing limit key from Table 2, either C1, C2, C3, or C4, based upon the equipment type and the compressor type. If selecting limit key C1 or C2, then also use the climate condition. If selecting limit key C3 or C4, then also use the total heat gain load of the zone.
26. Per ACCA Manual S, Second Edition, if the load sensible heat ratio is  $\geq 95\%$  and the HDD / CDD ratio is  $\geq 2.0$ , then the Climate is Condition B, otherwise it is Condition A. The load sensible heat ratio = maximum sensible heat gain (Item 4.4) / maximum total heat gain (Item 4.4). For the HDD / CDD ratio, see Appendix A of ANSI / RESNET / ACCA / ICC 310 to determine this value for the design location.
27. The full system capacity shall be listed. For two-stage and modulating furnaces, the full system capacity shall reflect the maximum output available.
28. Heating sizing % = total heating capacity (Item 4.13) divided by total heat loss (Item 4.12).
29. Select the heating sizing limit key from Table 3, either H1, H2, or H3, based upon whether the equipment is a furnace used for heating only or a furnace paired with cooling. If selecting limit key H3, then also use the total heat loss load of the zone.
30. Where 5 ACH is selected, kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, peninsulas, ranges / ovens, and the kitchen exhaust fan, and multiplying by the average ceiling height for this area. In addition, the continuous kitchen exhaust rate shall be  $\geq 25$  CFM, per 2009 IRC Table M1507.3, regardless of the rate calculated using the kitchen volume. Cabinet volume shall be included in the kitchen volume. MFNC Only: As an alternative to 5 ACH for Dwelling Units and Sleeping Units (but not Townhouses), 50 CFM of continuous exhaust is permitted to be used, regardless of kitchen volume. In such cases, the edge of the exhaust fan or intake grille shall be located within 10 ft of the edge of the range, as measured horizontally on the floor plan.
31. While not required, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 or later are recommended to be used for kitchen exhaust.
32. As an alternative, projects are permitted to use a continuous kitchen exhaust rate of 25 CFM per 2009 IRC Table M1507.3, if they are either a) Phius or PHI certified, or b) provide both dwelling unit ventilation and local mechanical kitchen exhaust using a balanced system, and have a Rater-verified whole-building infiltration rate  $\leq 1.0$  ACH50 or  $\leq 0.05$  CFM50 per sq. ft. of Enclosure Area, and a Rater-verified dwelling unit compartmentalization rate  $\leq 0.30$  CFM50 per sq. ft. of Enclosure Area if multiple dwelling units are present in the building. 'Enclosure Area' is defined as the area of the surfaces that bound the volume being pressurized / depressurized during the test.
33. 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  $\geq 5$  ACH, based on the kitchen volume.
34. Continuous bathroom local mechanical exhaust fans shall be rated for sound at no less than the design airflow rate. Intermittent bathroom and both intermittent and continuous kitchen local mechanical exhaust fans are recommended, but not required, to be rated for sound at no less than the design airflow rate.
35. Complete this Item only if the project is a townhouse or is certified using the ENERGY STAR Single-Family New Homes (SFNH) program.
36. If project is certified using the ENERGY STAR Single-Family New Homes (SFNH) program and has no ducted return, then the leakage limit for 1-2 returns applies.