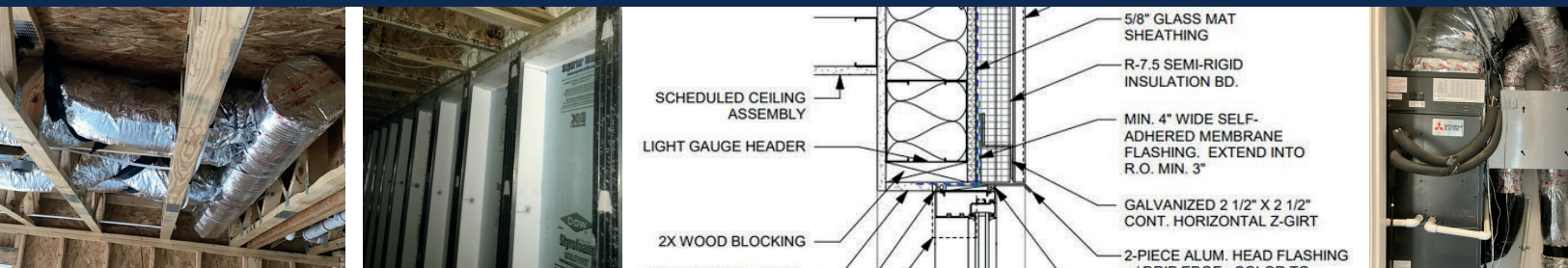


Additional Efficiency Packages

2021 VRC/VECC Update Guide



Options for Required Additional Energy Efficiency Measures:

Summary: The additional efficiency options package requirement is new in the 2021 Virginia Residential Code. For each of the three energy compliance pathways (Prescriptive, Total Building Performance, ERI), builders must include an additional measure to reduce energy demand. The available options vary depending on the compliance pathway being followed.

Why: The new Additional Energy Efficiency section is intended to increase energy savings and reduce utility costs to occupants over the life cycle of the building. Designers may select the option that works best for the project, both in terms of implementation and budget.

Meeting 1101.13.5 (R401.2.5) Additional Efficiency Option

Prescriptive Compliance Pathway

In addition to meeting all of the requirements of N1101 – N1104, the home must include *one* of the following:

- ***A better thermal envelope*** – at least 5% higher performing building envelope (as calculated by the total average R-Value) achieved via some combination of increased insulation and/or better insulating doors/windows. The area-weighted average SHGC for glazed windows and doors must be at least 5% better than what is listed in Table 1102.1.2.
- ***Better HVAC equipment*** – install equipment that is better than federal minimums.
 - Furnace/AC combos must be at least 95 AFUE and 16 SEER*
 - Heat pumps must be at least 10 HSPF* and 16 SEER*
 - Ground source/geothermal heat pumps must have a 3.5 COP or higher
- ***Reduced water heating energy usage*** – install better than standard water heating equipment.
 - Gas, propane, or other fossil fuel fired water heaters must have a .82 EF** or higher
 - Electric water heaters must be 2.0 EF** or higher. Only heat pump water heaters currently obtain that efficiency.
 - Solar water heating with a .4 solar fraction or better.
- ***More efficient duct system*** – reduce heating and cooling losses from installing ducts outside of conditioned space. All heating/cooling ducts must be installed in conditioned space (see N1103.3.2 (R403.3.2) for the definition of “conditioned space”). Hydronic distribution system equipment also must be located within conditioned space.
- ***Improved air sealing and ventilation*** – improve air sealing to achieve 3ACH50 or less, plus obtain more efficient mechanical ventilation by installing a heat recovery ventilator (HRV) or energy recovery ventilator (ERV).

*HVAC equipment ratings changed to SEER2 and HSPF2 in 2023 – after the publication of the 2021 model energy codes. The Residential Energy Services Network (RESNET), which provides energy ratings for homes, has provided the following conversion factors. The SEER2 or HSPF2 is divided by the conversion factor to obtain the equivalent SEER or HSPF.

Equipment Type	SEER2/SEER	HSPF2/HSPF
Ductless Systems	1.00	0.90
Ducted Split System	0.95	0.85
Ducted Packaged System	0.95	0.84
Small Duct High Velocity System	1.00	0.85
Ducted Space-Constrained Air Conditioner	0.97	Not Applicable
Ducted Space-Constrained Heat Pump	0.99	0.85

RESNET Addendum 71f: https://www.resnet.us/wp-content/uploads/FS_Adndm71fSEER2_webpost.pdf

Example: A 14.5 SEER2 ducted split heat pump is 15.26 SEER ($14.5/.95 = 15.26$)

**Water heaters are now rated in UEF. The equivalent UEF for 2.0 EF is 2.15 UEF.

Total Building Performance Compliance Pathway

Homes using this pathway must include one of the following:

- the proposed home design obtains an annual energy cost at least 5 percent less than the standard reference design or
- the home is equipped with at least one of the additional efficiency package options listed above for the prescriptive path – and – that additional element must not be included in the calculations for annual energy costs demonstrating savings relative to the reference design.

Energy Rating Index Option

For the Energy Rating Index (ERI) energy compliance path, the requirement is simply that the home must achieve a score 5 percent better than the code's target for that climate zone.

Climate Zone	Base ERI Target	5 Percent Improvement
3	51	48
4	54	51
5	55	52

Plan Review Focus: The home's construction documents are to note the home's planned energy compliance pathway. For TBP and ERI pathways, builders applying for permits must submit a compliance report (see N1105.3.2.1 (R405.3.2.1) and N1106.7.2.1 (R406.7.2.1)) showing the modeled home's energy costs/ERI as complying with program requirements. A second compliance report documenting how the as-built home meets program requirements is required when applying for a certificate of occupancy.

Additional Resources:

- <https://www.iccsafe.org/building-safety-journal/bsj-technical/residential-compliance-options-of-the-international-energy-conservation-code/>

2021 VRC/VECC Code References:

N1101.5 (R103.2) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted when approved by the code official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include the following as applicable:

1. Energy compliance path.
2. Insulation materials and their R-values.
3. Fenestration U-factors and solar heat gain coefficients (SHGC).
4. Area-weighted U-factor and solar heat gain coefficient (SHGC) calculations.
5. Mechanical system design criteria.
6. Mechanical and service water heating systems and equipment types, sizes and efficiencies.
7. Equipment and system controls.
8. Duct sealing, duct and pipe insulation and location.
9. Air sealing details.

N1101.13 (R401.2) Application. Residential buildings shall comply with Section N1101.13.5 and Section N1101.13.1, N1101.13.2, N1101.13.3 or N1101.13.4.

Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Section N1109.

N1101.13.1 (R401.2.1) Prescriptive Compliance Option. The Prescriptive Compliance Option requires compliance with Sections N1101 through N1104.

N1101.13.2 (R401.2.2) Total Building Performance Option. The Total Building Performance Compliance Path requires compliance with Section N1105.

N1101.13.3 (R401.2.3) Energy Rating Index Option. The Energy Rating Index (ERI) option requires compliance with Section N1106.

N1101.13.5 (R401.2.5) Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying with Section N1101.13.1, one of the additional efficiency package options shall be installed according to Section N1108.2.
2. For buildings complying with Section N1101.13.2, the building shall meet one of the following:
 - 2.1. One of the additional efficiency package options in Section N1108.2 shall be installed without including such measures in the proposed design under Section N1105.
 - 2.2. The proposed design of the building under Section N1105.2 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.
3. For buildings complying with the Energy Rating Index alternative Section N1101.13.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified.

The option selected for compliance shall be identified on the certificate required by Section N1101.14.

N1108.2 (R408.2) Additional efficiency package options. Additional efficiency package options for compliance with Section N1101.13.5 are set forth in Sections N1108.2.1 through N1108.2.5.

N1108.2.1 (R408.2.1) Enhanced envelope performance option. The total building thermal envelope UA, the sum of U-factor times assembly area, shall be less than or equal to 95 percent of the total UA resulting from multiplying the U-factors in Table N1102.1.2 by the same assembly area as in the proposed building. The UA calculation shall be performed in accordance with Section N1102.1.5. The area-weighted average SHGC of all glazed fenestration shall be less than or equal to 95 percent of the maximum glazed fenestration SHGC in Table N1102.1.2.

N1108.2.2 (R408.2.2) More efficient HVAC equipment performance option. Heating and cooling equipment shall meet one of the following efficiencies:

1. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner.
2. Greater than or equal to 10 HSPF/16 SEER air source heat pump.
3. Greater than or equal to 3.5 COP ground source heat pump. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

N1108.2.3 (R408.2.3) Reduced energy use in service water-heating option. The hot water system shall meet one of the following efficiencies:

1. Greater than or equal to 0.82 EF fossil fuel service water-heating system.
2. Greater than or equal to 2.0 EF electric service water-heating system.
3. Greater than or equal to 0.4 solar fraction solar water-heating system.

N1108.2.4 (R408.2.4) More efficient duct thermal distribution system option. The thermal distribution system shall meet one of the following efficiencies:

1. 100 percent of ducts and air handlers located entirely within the building thermal envelope.
2. 100 percent of ductless thermal distribution system or hydronic thermal distribution system located completely inside the building thermal envelope.
3. 100 percent of duct thermal distribution system located in conditioned space as defined by Section N1103.3.2.

N1108.2.5 (R408.2.5) Improved air sealing and efficient ventilation system option. The measured air leakage rate shall be less than or equal to 3.0 ACH50, with either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed. Minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT).

Definitions:

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floors, ceiling, roofs and any other building element assemblies that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

ENERGY ANALYSIS. A method for estimating the annual energy use of the proposed design and standard reference design based on estimates of energy use.

ENERGY COST. The total estimated annual cost for purchased energy for the building functions regulated by this code, including applicable demand charges.

ENERGY SIMULATION TOOL. An approved software program or calculation-based methodology that projects the annual energy use of a building.

ERI REFERENCE DESIGN. A version of the rated design that meets the minimum requirements of the 2006 International Energy Conservation Code.

PROPOSED DESIGN. A description of the proposed building used to estimate annual energy use for determining compliance based on total building performance.

RATED DESIGN. A description of the proposed building used to determine the energy rating index.

R-VALUE (THERMAL RESISTANCE). The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($\text{h} \times \text{ft}^2 \times ^\circ\text{F}/\text{Btu}$) [$(\text{m}^2 \times \text{K})/\text{W}$].

SERVICE WATER HEATING. Supply of hot water for purposes other than comfort heating.

U-FACTOR (THERMAL TRANSMITTANCE). The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($\text{Btu}/\text{h} \times \text{ft}^2 \times ^\circ\text{F}$) [$\text{W}/(\text{m}^2 \times \text{K})$].

