Note to Ad Hoc Committee Members:
This ICC text is color coded with;
For 2018 ICC code changes (to the 2015 IECC language) are highlighted in yellow.
For 2021 ICC code changes the changed text (from the 2018 ICC code) the changed text is highlighted in green.
Changes that occurred as amendments by the NC Building code Council during the 2018 NC Code cycle appear as purple.
Sections that presently have NCDOI interpretations are shown with sky blue.
Changes made to this model code language to represent the Energy Ad Hoc committee's desired language for the 2024 NC Energy Code appear as red text, either ~~strike throughs~~ or underlines as appropriate.

"fine print notes" are in this document for informational purposes only to the ad hoc members and to myself – (Dan Dittman, DED) for editing purposes. They will be removed when they are resolved or no longer needed.

Started Here on 2/17/2022

CHAPTER 4 [RE]
RESIDENTIAL ENERGY EFFICIENCY

User note:

About this chapter: *Chapter 4 presents the paths and options for compliance with the energy efficiency provisions. Chapter 4 contains energy efficiency provisions for the building envelope, mechanical and water heating systems, lighting and additional efficiency requirements. A performance alternative, energy rating alternative, and tropical regional alternative are also provided to allow for energy code compliance other than by the prescriptive method.*

SECTION R401
GENERAL

R401.1 Scope. This chapter applies to residential buildings.

R401.2 Application. Residential buildings shall comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 ~~or~~ , R401.2.4~~.~~ or R401.2.6. (This addition (or R401.2.6) was made by DED during the editing after the meeting, it can be discussed during next meeting – if the Rescheck does not include the items in R401.2.5, they will not be picked up, and a lesser-than code minimum path would inadvertently be created) This will be revisited in future meetings and discussions.

Exception: Additions, *alterations*, repairs and changes of occupancy to existing buildings complying with Chapter 5.

R401.2.1 Prescriptive Compliance Option. The Prescriptive Compliance Option requires compliance with Sections R401 through R404.

R401.2.2 Total Building Performance Option. The Total Building Performance Option requires compliance with Section R405.

R401.2.3 Energy Rating Index Option. The Energy Rating Index (ERI) Option requires compliance with Section R406.

R401.2.4 Tropical Climate Region Option. Deleted. ~~The Tropical Climate Region Option requires compliance with Section R407~~.

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 R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.
2. For buildings complying with Section R401.2.2, the building shall meet one of the following:
   2.1. One of the additional efficiency package options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or
   2.2. The proposed design of the building under Section R405.3 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 R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.

The option selected for compliance shall be identified in the certificate required by Section R401.3. *

R401.2.6 North Carolina specific REScheck shall be permitted to demonstrate compliance with this code. Envelope requirements may not be traded off against the use of high efficiency heating or cooling equipment. No tradeoff calculations are needed for required termite inspection and treatment gaps.

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This was inserted to indicate an amendment to the 2018 NCECC

2018 NC Energy Conservation Code
R401.2 Application. (191210 Item B-3)
R401.2 Compliance.
Projects shall comply with one of the following:
1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 labeled “Mandatory.”
3. An energy rating index (ERI) approach in Section R406.
4. ~~North Carolina specific~~ REScheck keyed to the 2018 IECC shall be permitted to demonstrate compliance with this code. Envelope requirements may not be traded off against the use of high efficiency
heating or cooling equipment. No tradeoff calculations are needed for required termite inspection and treatment gaps.
The delayed effective date of this Rule is January 1, 2021.
The Statutory authority for Rule-making is G. S. 143-136; 143-138.

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NCDOI Web Interpretation (2018 NCECC) R401.2 - Options for Residential Building Energy Code Compliance

R401.3 Certificate. A permanent certificate shall be completed by the builder, permit holder, registered design professional or other *approved* party . ~~and posted on a wall in the space where the furnace is located, a utility room or an *approved*~~ The permanent certificate shall be posted in a *readily accessible* location on the electrical distribution panel, in the attic next to the attic insulation card, in a utility room or other *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and ducts outside *conditioned spaces*.
2. *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.

3. The results from any required duct system and building envelope air leakage testing performed on the building.
4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. Where on-site *photovoltaic panel* systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.
6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted, and the compliance path used.

R401.4 Additional voluntary criteria for increasing residential energy efficiency. Appendix R4 contains additional voluntary measures for increasing residential energy efficiency beyond code minimums. Implementation of the increased energy efficiency measures is strictly voluntary at the option of the permit holder. The sole purpose of the appendix is to provide guidance for achieving additional residential energy efficiency improvements that have been evaluated to be those that are most cost effective for achieving an additional 10- to 15-percent improvement in energy efficiency beyond code minimums.

SECTION R402
BUILDING THERMAL ENVELOPE

R402.1 General. The *building thermal envelope* shall comply with the requirements of Sections R402.1.1 through R402.1.5.

Exceptions:

1. The following low-energy *buildings*, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section R402.
   1.1. Those with a peak design rate of energy usage less than 3.4 Btu/h × ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 of floor area for space-conditioning purposes.
   1.2. Those that do not contain *conditioned space*.

~~2. Log homes designed in accordance with ICC 400.~~ Revisit in future meeting - DED

R402.1.1 Vapor retarder. Wall assemblies in the *building thermal envelope* shall comply with the vapor retarder requirements of Section R702.7 of the *International Residential Code* or Section 1404.3 of the *International Building Code*, as applicable.

R402.1.2 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table R402.1.2, based on the *climate zone* specified in Chapter 3. Assemblies shall have a *U*-factor equal to or less than that specified in Table R402.1.2. Fenestration shall have a *U*-factor and glazed fenestration SHGC equal to or less than that specified in Table R402.1.2.

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2018 NC Energy Conservation Code
R402.1.2, R402.1.4, R & U-Value Tables. (170613 Item B-13)
The Agency withdrew this item due to RRC February 15, 2018 objection.
The Statutory authority for Rule-making is G. S. 143-136; 143-138.
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NCDOI Web Interpretation (2018 NCECC) R402.1.2 - Air Films and Simplified R-Value for Walls in One- and Two-Family Dwellings

NCDOI Web Interpretation (2018 NCECC) R402.1.2 - Ceilings R-30 vs R-38

NCDOI Web Interpretation (2018 NCECC) R402.1.2 Classification of pre-cast concrete panel walls

R402.1.3 *R*-value alternative. Assemblies with *R*-value of insulation materials equal to or greater than that specified in Table R402.1.3 shall be an alternative to the *U*-factor in Table R402.1.2 •

NCDOI Web Interpretation (2018 NCECC) R402.1.4 - Calculating Wall U-Factors for Compliance with Table R402.1.4

R402.1.4 *R*-value computation. Cavity insulation alone shall be used to determine compliance with the cavity insulation *R*-value requirements in Table R402.1.3. Where cavity insulation is installed in multiple layers, the *R*-values of the cavity insulation layers shall be summed to determine compliance with the cavity insulation *R*-value requirements. The manufacturer's settled *R*-value shall be used for blown-in insulation. Continuous insulation (ci) alone shall be used to determine compliance with the continuous insulation *R*-value requirements in Table R402.1.3. Where continuous insulation is installed in multiple layers, the *R*-values of the continuous insulation layers shall be summed to determine compliance with the continuous insulation *R*-value requirements. Cavity insulation *R*-values shall not be used to determine compliance with the continuous insulation *R*-value requirements in Table R402.1.3. Computed *R*-values shall not include an *R*-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Table R402.1.3, the manufacturer's labeled *R*-value for the insulated siding shall be reduced by R-0.6.

R402.1.5 Total UA alternative. Where the total *building thermal envelope* UA, the sum of *U*-factor times assembly area, is less than or equal to the total UA resulting from multiplying the *U*-factors in Table R402.1.2 by the same assembly area as in the proposed *building*, the *building* shall be considered to be in compliance with Table R402.1.2. The UA calculation shall be performed using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. In addition to UA compliance, the SHGC requirements of Table R402.1.2 and the maximum fenestration *U*-factors of Section R402.5 shall be met.

R402.2 Specific insulation requirements. In addition to the requirements of Section R402.1, insulation shall meet the specific requirements of Sections R402.2.1 through R402.2.12.

R402.2.1 Ceilings with attic spaces. Where Section R402.1.3 requires R-49 insulation in the ceiling or attic, installing R-38 over 100 percent of the ceiling or attic area requiring insulation shall satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. Where Section R402.1.3 requires R-60 insulation in the ceiling, installing R-49 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the insulation and fenestration criteria in Section R402.1.2 and the Total UA alternative in Section R402.1.5.

Exception. In roof edge and other details such as bay windows, dormers, and similar areas where the space is limited, the insulation must fill the space up to the air baffle.

(Dan's Note: A portion of this exception creates a direct conflict with the main code section. The exception "in roof edge" if taken as written, there is an argument that this could apply to the entire roof, which is negating what Section R402.2.1 is trying to provide. This argument came up several times in the existing code, and it is only by interpretation that the whole of this section is not negated. Can this be revisited so it meets what the ad hoc committee wants, without using this conflicting language?)

TABLE R402.1.2

MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
~~0~~	~~0.50~~	~~0.75~~	~~0.25~~	~~0.035~~	~~0.084~~	~~0.197~~	~~0.064~~	~~0.360~~	~~0.477~~
~~1~~	~~0.50~~	~~0.75~~	~~0.25~~	~~0.035~~	~~0.084~~	~~0.197~~	~~0.064~~	~~0.360~~	~~0.477~~
~~2~~	~~0.40~~	~~0.65~~	~~0.25~~	~~0.026~~	~~0.084~~	~~0.165~~	~~0.064~~	~~0.360~~	~~0.477~~
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	NR	0.024	0.045	0.082	0.033	0.050	0.055
~~6~~	~~0.30~~	~~0.55~~	~~NR~~	~~0.024~~	~~0.045~~	~~0.060~~	~~0.033~~	~~0.050~~	~~0.055~~
~~7 and 8~~	~~0.30~~	~~0.55~~	~~NR~~	~~0.024~~	~~0.045~~	~~0.057~~	~~0.028~~	~~0.050~~	~~0.055~~

For SI: 1 foot = 304.8 mm.

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In Warm Humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

d. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

e. There are no SHGC requirements in the Marine Zone.

f. A maximum *U*-factor of 0.32 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4,000 feet in elevation above sea level, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

TABLE R402.1.3

INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[h] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
~~0~~	~~NR~~	~~0.75~~	~~0.25~~	~~30~~	~~13 or 0 + 10~~	~~3/4~~	~~13~~	~~0~~	~~0~~	~~0~~
~~1~~	~~NR~~	~~0.75~~	~~0.25~~	~~30~~	~~13 or 0 + 10~~	~~3/4~~	~~13~~	~~0~~	~~0~~	~~0~~
~~2~~	~~0.40~~	~~0.65~~	~~0.25~~	~~49~~	~~13 or 0 + 10~~	~~4/6~~	~~13~~	~~0~~	~~0~~	~~0~~
3	.30	0.55	0.25	49	20 or 13 + 5ci or 0 + 15	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]

4 except Marine	.30	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	13/17	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
~~6~~	~~0.30[i]~~	~~0.55~~	~~NR~~	~~60~~	~~20 + 5ci or 13 + 10ci or 0 + 20~~	~~15/20~~	~~30~~	~~15ci or 19 or 13 + 5ci~~	~~10ci, 4 ft~~	~~15ci or 19 or 13 + 5ci~~
~~7 and 8~~	~~0.30[i]~~	~~0.55~~	~~NR~~	~~60~~	~~20 + 5ci or 13 + 10ci or 0 + 20~~	~~19/21~~	~~38~~	~~15ci or 19 or 13 + 5ci~~	~~10ci, 4 ft~~	~~15ci or 19 or 13 + 5ci~~

For SI: 1 foot = 304.8 mm.
NR = Not Required.

ci = continuous insulation.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
Exception: In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "5ci or 13" means R-5 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "10ci or 13" means R-10 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "15ci or 19 or 13 + 5ci" means R-15 continuous insulation (ci) on the interior or exterior surface of the wall; or R-19 cavity insulation on the interior side of the wall; or R-13 cavity insulation on the interior of the wall in addition to R-5 continuous insulation on the interior or exterior surface of the wall.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab-edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in Warm Humid locations as defined by Figure R301.1 and Table R301.1.

g. The first value is cavity insulation; the second value is continuous insulation. Therefore, as an example, "13 + 5" means R-13 cavity insulation plus R-5 continuous insulation.

h. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

i. A maximum *U*-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:
1. Above 4,000 feet in elevation, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

Note: The U-factor Table and R-Value tables were discussed, but are intended to be further discussed in future meetings.- DED

R402.2.2 Ceilings without attics. Where Section R402.1.3 requires insulation *R*-values greater than R-30 in the interstitial space above a ceiling and below the structural roof deck, and the design of the roof/ceiling assembly including cathedral ceilings, dormers, bay windows and other similar areas, does not allow sufficient space for the required insulation, the minimum required insulation *R*-value for such roof/ceiling assemblies shall be R-30. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402.1.3 shall be limited to 500 square feet (46 m^2) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the Total UA alternative in Section R402.1.5.

R402.2.3 ~~Eave~~ Soffit baffle. For air-permeable insulation in vented attics, a baffle shall be installed adjacent to soffit ~~and eave~~ vents. Baffles shall maintain a net free area opening equal to or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material. The baffle shall be installed to the outer edge of the *exterior wall* top plate so as to provide maximum space for attic insulation coverage over the top plate. Where soffit venting is not continuous, baffles shall be installed continuously to prevent ventilation air in the eave /soffit from bypassing the baffle.

Start back here on 3/10/2022 - DED

R402.2.4 Access hatches and doors. Access hatches and doors from conditioned to unconditioned spaces such as attics and crawl spaces shall be insulated to the same *R*-value required by Table R402.1.3 for the wall or ceiling in which they are installed.

Exceptions:

1. Vertical doors providing access from conditioned spaces to unconditioned spaces that comply with the fenestration requirements of Table R402.1.3 based on the applicable climate zone specified in Chapter 3.
2. Horizontal pull-down, stair-type access hatches in ceiling assemblies that provide access from conditioned to unconditioned spaces in Climate Zones 0 through 4 shall not be required to comply with the insulation level of the surrounding surfaces provided the hatch meets all of the following:
    2.1. The average *U*-factor of the hatch shall be less than or equal to U-0.10 or have an average insulation *R*-value of R-10 or greater.
    2.2. Not less than 75 percent of the panel area shall have an insulation *R*-value of R-13 or greater.
    2.3. The net area of the framed opening shall be less than or equal to 13.5 square feet (1.25 m^2).
    2.4. The perimeter of the hatch edge shall be weatherstripped.

The reduction shall not apply to the total UA alternative in Section R402.1.5.

This section (R402.2.4) was discussed, but not resolved – End of 2-17-2022 Meeting