

## Chapter 1

**101.1 Title.** These regulations shall be known as the North Carolina Energy Conservation Code as adopted by the North Carolina Building Code Council on March 11, 2008, to be effective January 1, 2009. References to the International Codes shall mean the North Carolina Codes. The North Carolina amendments to the International Codes are underlined.

**101.6 Requirements of other State agencies, occupational licensing boards, or commissions.** The North Carolina State Building Codes do not include all additional requirements for buildings and structures that may be imposed by other State agencies, occupational licensing boards, and commissions. It shall be the responsibility of a permit holder, design professional, contractor, or occupational license holder to determine whether any additional requirements exist.

**103.1.1 Above code programs.** Deleted.

## Chapter 2

**APPROVED.** Acceptable to the code official for compliance with the provisions of the applicable Code or referenced Standard.

**CLOSED CRAWL SPACE.** A foundation without wall vents that uses air sealed walls, ground and foundation moisture control, and mechanical drying potential to control crawl space moisture. Insulation may be located at the floor level or at the exterior walls.

**CONDITIONED CRAWL SPACE.** A foundation without wall vents that encloses an intentionally heated or cooled space. Insulation is located at the exterior walls.

**PROCESS ENERGY.** Energy consumed in support of manufacturing, industrial, or commercial process other than conditioning spaces and maintaining comfort and amenities for the occupants of a building.

**REGISTERED DESIGN PROFESSIONAL.** An individual who is registered or licensed to practice his respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed. Design by a Registered Design Professional is not required where exempt under the registration or licensure laws.

**WALL VENTED CRAWL SPACE.** A foundation that uses foundation wall vents as a primary means to control space moisture. Insulation is located at the floor level.

## Chapter 3

**301.1 General.** Climate zones from Figure 301.1 or Table 301.1 shall be used in determining the applicable requirements from Chapters 4 and 5.

**301.3 International climate zones.** Deleted.

**301.3.1 Warm humid criteria.** Deleted.

### TABLE 301.1

#### CLIMATE ZONES BY COUNTY

*(Remove all states except NC and list the Zone 3 NC counties.)*

#### Zone 3

Anson  
Beaufort  
Bladen  
Brunswick  
Cabarrus  
Camden  
Carteret

Chowan  
Columbus  
Craven  
Cumberland  
Currituck  
Dare  
Davidson  
Duplin  
Edgecombe  
Gaston  
Greene  
Hoke  
Hyde  
Johnston  
Jones  
Lenoir  
Martin  
Mecklenburg  
Montgomery  
Moore  
New Hanover  
Onslow  
Pamlico  
Pasquotank  
Pender  
Perquimans  
Pitt  
Randolph  
Richmond  
Robeson  
Rowan  
Sampson  
Scotland  
Stanly  
Tyrrell  
Union  
Washington  
Wayne  
Wilson

**TABLE 301.2**  
**WARM HUMID COUNTIES**  
***(Remove all states except NC)***

**TABLE 301.3(1)**  
**INTERNATIONAL CLIMATE ZONE DEFINITIONS**  
**Deleted.**

**TABLE 301.3(2)**  
**INTERNATIONAL CLIMATE ZONE DEFINITIONS**  
**Deleted.**

## Chapter 4

**401.2 Compliance.** Projects shall comply with Sections 401, 402.4, 402.5, 402.6, and 403 (referred to as the mandatory provisions) and either:

- a. Sections 402.1 through 402.3 (prescriptive); or
- b. Section 404 (performance).

REScheck 4.0.0 for the 2006 IECC shall be permitted to demonstrate compliance, except that a SHGC of 0.4 is required for all zones and that envelope requirements may not be traded off against the use of high efficiency heating and cooling equipment. No trade-off calculations are required for termite inspection and treatment gaps required for slabs and basement walls.

**401.3 Certificate.** A permanent certificate shall be posted on or in the electrical distribution panel, inside the kitchen cabinet or other approved location. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and floor) and ducts outside conditioned spaces; *U* -factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area.

**Table 402.1.1 Insulation and Fenestration Requirements by Component<sup>a</sup>**

CLIMATE ZONE	FENESTRATION <i>U</i> -Factor	SKYLIGHT <sup>b</sup> <i>U</i> -FACTOR	GLAZED FENESTRATION SHGC	CEILING <i>R</i> -VALUE	WOOD FRAME WALL <i>R</i> -VALUE	MASS WALL <i>R</i> -VALUE	FLOOR <i>R</i> -VALUE	BASEMENT <sup>c</sup> WALL <i>R</i> -VALUE	SLAB <sup>d</sup> <i>R</i> -VALUE AND DEPTH	CRAWL SPACE <sup>e</sup> WALL <i>R</i> -VALUE
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	<u>0.40</u>	0.65	0.40	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	<u>0.40</u>	38	13	5	19	10/13	<u>5</u> , 2 ft	10/13
5 and Marine 4	<u>0.40</u>	0.60	<u>0.40</u>	38	19 or 13+5 <sup>g</sup>	13	30 <sup>f</sup>	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5 <sup>g</sup>	15	30 <sup>f</sup>	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30 <sup>f</sup>	10/13	10, 4 ft	10/13

- a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 insulation shall be permitted to be compressed into a 2 x 6 cavity.
- b. The fenestration *U*-factor column excluded skylights. The solar heat gain coefficient (SHGC) column applies to all glazed fenestration.
- c. The first *R*-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
- d. R-5 shall be added to the required slab edge *R*-values for heated slabs.
- e. Deleted.
- f. Or insulation sufficient to fill the framing cavity. R-19 minimum. There is no requirement to exceed R-30.
- g. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25% or less of the exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

**402.1.3 *U*-factor alternative.** An assembly with *U*-factor equal to or less than that specified in Table 402.1.3 shall be permitted as an alternative to the *R*-value in Table 402.1.1.

**Exception:** For mass walls not meeting the criterion for insulation location in Section 402.2.3, the *U*-factor shall be permitted to be:

1. *U*-factor of 0.17 in Climate Zone 1
2. *U*-factor of 0.14 in Climate Zone 2.
3. *U*-factor of 0.12 in Climate Zone 3.
4. *U*-factor of 0.10 in Climate Zone 4 except in Marine.
5. *U*-factor of 0.082 in Climate Zone 5 and Marine 4.

**Table 402.1.3 Equivalent *U*-Factors<sup>a</sup>**

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT <sup>b</sup> U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	<u>0.40</u>	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	<u>0.40</u>	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.06	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

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

**402.2.3 Mass walls.** Mass walls for the purposes of this Chapter shall be considered walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs. The provisions of Section 402.1.1 for mass walls shall be applicable when at least 50 percent of the required insulation *R*-value is on the exterior of, or integral to, the wall. Walls that do not meet this criterion for insulation placement shall meet the wood frame wall insulation requirements of Section 402.1.1.

**Exception:** For walls that do not meet the criterion for insulation placement, the minimum added insulation *R*-value shall be permitted to be:

1. *R*-value of 4 in Climate Zone 1.
2. *R*-value of 6 in Climate Zone 2.
3. *R*-value of 8 in Climate Zone 3.
4. *R*-value of 10 in Climate Zone 4 except Marine.
5. *R*-value of 13 in Climate Zone 5 and Marine 4.

**402.2.5 Floors.** Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

**Exception:** Enclosed floor cavity such as garage ceiling, cantilevers or building on pilings with enclosed floor cavity. Band boards shall be insulated to maintain thermal envelope continuity.

**402.2.7 Slab-on-grade floors.** Slab-on-grade floors with a floor surface less than 23 inches below grade shall be insulated in accordance with Table N1102.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table N1102.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation. Slab edge insulation may be eliminated if trade-off calculations are performed.

**402.2.8 Closed crawl space walls.** Where the floor above a closed crawl space is not insulated, the exterior crawl space walls shall be insulated in accordance with Table 402.1.1.

Wall insulation may be located on any combination of the outside and inside wall surfaces and within the structural cavities or materials of the wall system. Wall insulation requires that the exterior wall band joist area of the floor frame be insulated. Wall insulation shall begin 3 inches below the top of the masonry foundation wall and shall extend down to 3 inches above the top of the footing or concrete floor, 3 inches above the interior ground surface or 24-inches below the outside finished ground level, whichever is less. [See Appendix Details].

Termite inspection, clearance and wicking gaps are allowed in wall insulation systems [see Appendix Details]. Insulation may be deleted in the gap area without energy penalty. The allowable insulation gap widths are listed in Table 402.2.8. If gap widths exceed the allowances, one of the following energy compliance options shall be met:

1. Wall insulation is not allowed and the required insulation value shall be provided in the floor system.
2. Compliance shall be demonstrated with energy trade-off methods provided REScheck 4.0.0 for the 2006 International Energy Conservation Code.

Table 402.2.8  
Wall Insulation Allowances for Termite Treatment and Inspection Gaps

<u>Maximum Gap Width (inches)</u>	<u>Insulation Location</u>	<u>Gap Description</u>
<u>3</u>	<u>Outside</u>	<u>Above-grade inspection between top of insulation and bottom of siding.</u>
<u>6</u>	<u>Outside</u>	<u>Below-grade treatment.</u>
<u>4<sup>a</sup></u>	<u>Inside</u>	<u>Wall Inspection between top of insulation and bottom of sill.</u>
<u>4<sup>a</sup></u>	<u>Inside</u>	<u>Clearance/wicking space between bottom of insulation and top of ground surface, footing or concrete floor.</u>

For SI: 1 inch=25.4 mm.

a. No insulation shall be required on masonry wall of 9 inches height or less.

**402.3.3 Glazed fenestration exemption.** Up to 15 square feet (1.4 m<sup>2</sup>) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and solar heat gain coefficient (SHGC) requirements in Section 402.1.1. In addition, all door glazing shall be exempt from the SHGC requirement. In addition, impact glazing in windborne debris regions meeting the requirements of the Large Missile Test of ASTM E 1996 and of ASTM E 1886 shall be exempt from the *U*-factor requirement.

**402.3.4 Opaque door exemption.** Opaque doors separating conditioned and unconditioned space shall have a maximum *U*-factor of 0.35. One opaque door assembly is exempted from the *U*-factor requirement.

**402.3.5 Thermally isolated sunroom *U*-factor.** The maximum fenestration *U*-factor shall be 0.50 and the maximum skylight *U*-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements. Conditioned sunroom additions shall maintain thermal isolation; shall not be used as kitchens or sleeping rooms; and shall be served by a separate heating or cooling system, or be thermostatically controlled as a separate zone of the existing system.

**402.3.6 Replacement fenestration.** Where an entire existing fenestration unit is replaced with a new fenestration product, including frame, sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and solar heat gain coefficient (SHGC) in Table 402.1.1.

**402.4.1 Building thermal envelope.** The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. Deleted.
2. Site-built windows, doors and skylights.
3. Opening between window and door assemblies and their respective jambs and framings.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Floor framing under knee walls.
7. Walls and ceilings separating the garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Other sources of infiltration.

**402.5 Moisture control. (Mandatory).** The building design shall not create conditions of accelerated deterioration from moisture condensation. Above-grade frame walls, floors and ceiling not ventilated to allow moisture to escape shall be provided with an approved vapor retarder. The vapor retarder shall be installed on the warm-in-winter side of the thermal insulation.

**Exceptions:**

1. In construction where moisture or its freezing will not damage the materials.
2. Frame walls, floors and ceiling in jurisdictions in Zones 3 and 4A. (Crawl space floor vapor retarders are not exempted.)
3. Where other approved means to avoid condensation are provided.

**403.2.2 Sealing.** Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with the North Carolina Mechanical Code.

Exception: Ducts exposed within the conditioned space they serve shall not be required to be sealed.

**403.6 Equipment sizing.** Heating and cooling equipment shall be sized as specified in the North Carolina Mechanical Code.

**404.1 Scope.** This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling and service water heating energy only. A registered design professional is required to perform the analysis.

**404.6.1 Minimum capabilities.** Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

1. Computer generation of the standard reference design using only the input for the proposed design. The calculation procedure shall not allow the user to directly modify the building component characteristics of the standard reference design.
2. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence in accordance with the North Carolina Mechanical Code.

(remainder same)

**T A B L E 4 0 4 . 5 . 2 ( 1 )**  
**SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS—continued**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	Specific Leakage Area (SLA) <sup>d</sup> = 0.00036 assuming no energy recovery	<p>For residences that are not tested, the same as the standard reference design</p> <p>For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5. 1, the measured air exchange rate<sup>e</sup> but not less than 0.35 ACH</p> <p>For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5. 1, the measured air exchange rate<sup>e</sup> combined with the mechanical ventilation rate,<sup>f</sup> which shall not be less than <math>0.01 \times CFA + 7.5 \times (N_{br} + 1)</math> where:  <i>CFA</i> = conditioned floor area  <i>N<sub>br</sub></i> = number of bedrooms</p>
Mechanical ventilation	<p>None, except where mechanical ventilation is specified by the proposed design, in which case:  Annual vent fan energy use: kWh/yr = <math>0.03942 \times CFA + 29.565 \times (N_{br} + 1)</math>  where:  <i>CFA</i> = conditioned floor area  <i>N<sub>br</sub></i> = number of bedrooms</p>	As proposed
Internal gains	IGain = $17,900 + 23.8 \times CFA + 4104 \times N_{br}$ (Btu/day per dwelling unit)	Same as standard reference design
Internal mass	An internal mass for furniture and contents of 8 pounds per square foot of floor area	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element <sup>g</sup> but not integral to the building envelope or structure
Structural mass	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air	As proposed
	For masonry basement walls, as proposed, but with insulation required by Table 402.1.3 located on the interior side of the walls	As proposed
	For other walls, for ceilings, floors, and interior walls, wood frame construction	As proposed
Heating systems <sup>h,i</sup>	Fuel type: same as proposed design	As proposed
	Efficiencies: Electric: air-source heat pump with prevailing federal minimum efficiency	As proposed
	Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency	As proposed
	Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency	As proposed
	Capacity: sized in accordance with the <i>International Mechanical Code</i>	As proposed
Cooling systems <sup>h,j</sup>	Fuel type: Electric	As proposed
	Efficiency: in accordance with prevailing federal minimum standards	As proposed
	Capacity: sized in accordance with the <i>International Mechanical Code</i>	As proposed

## Chapter 5

**502.4.6 Vestibules.** A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices.

**Exceptions:**

1. Buildings in Climate Zones 1 and 2 as indicated in Figure 301.1 and Table 301.1.
2. Doors not intended to be used as a building entrance door, such as doors to mechanical or electrical equipment rooms.
3. Doors opening directly from a sleeping unit or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m<sup>2</sup>) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. Doors in buildings less than four stories above grade.

**502.5 Moisture control. (Mandatory).** All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm ( $5.7 \times 10^{-11}$  kg/Pa · s · m<sup>2</sup>) or less, when tested in accordance with the desiccant method using Procedure A of ASTM E 96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.

**Exceptions:**

1. Buildings located in Climate Zones 1 through 4 as indicated in Figure 301.1 and Table 301.1.
2. In construction where moisture or its freezing will not damage the materials.
3. Where other approved means to avoid condensation in unventilated framed wall, floor, roof and ceiling cavities are provided.

**503.2.2 Equipment and system sizing.** Equipment and system sizing. Heating and cooling equipment and systems capacity shall not exceed the loads calculated in accordance with Section 503.2.1. A single piece of equipment providing both heating and cooling must satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

**Exceptions:**

1. Required standby equipment and systems provided with controls and devices that allow such systems or equipment to operate automatically only when the primary equipment is not operating.
2. Multiple units of the same equipment type with combined capacities exceeding the design load and provided with controls that have the capability to sequence the operation of each unit based on load.
3. When the equipment selected is the smallest size needed to meet the load within available options of the desired equipment line.

**503.2.4.3 Off-hour controls.** Each zone shall be provided with thermostatic setback controls that are controlled by either an automatic time clock or programmable control system.

**Exceptions:**

1. Zones that will be operated continuously.
2. Zones with a full HVAC load demand not exceeding 6,800 Btu/h (2 kW) and having a readily accessible manual shutoff switch.
3. HVAC systems serving hotel/motel guestrooms or other residential units complying with Section 403.1 requirements.
4. Packaged terminal air conditioners, packaged terminal heat pumps and room air conditioner systems.

**503.2.7 Duct and plenum insulation and sealing.** All supply and return air ducts and plenums shall be insulated with a minimum of R-5 insulation when located in unconditioned spaces and with a minimum of R-8 insulation when located outside the building. When located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

**Exceptions:**

1. When located within equipment.
2. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

All joints, longitudinal and transverse seams and connections in ductwork, shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes. Tapes and mastics used to seal ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181A-P" for pressure-sensitive tape, "181A-M" for mastic or "181A-H" for heat-sensitive tape. Tapes and mastics used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked 181B-C. Unlisted duct tape is not permitted as a sealant on any duct.

**Exception:** Ducts exposed within the conditioned space they serve shall not be required to be sealed.

**503.2.9 HVAC system completion.** Prior to the issuance of a certificate of occupancy the following shall be completed.

**503.4.4 Heat rejection equipment fan speed control.** Deleted.

**505.2.2.2 Automatic lighting shutoff.** Buildings larger than 5,000 square feet (465 m<sup>2</sup>) shall be equipped with an automatic control device to shut off lighting in those areas. This automatic control device shall function on either:

1. A scheduled basis, using time-of-day, with an independent program schedule that controls the interior lighting in areas that do not exceed 25,000 square feet (2323 m<sup>2</sup>) and are not more than one floor; or
2. An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space; or
3. A signal from another control or alarm system that indicates the area is unoccupied.

**Exception:** The following shall not require an automatic control device:

1. Sleeping unit (see Section 505.2.3).
2. Lighting in spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for 24-hour operation.

## Appendix

*(Add the Appendix from the 2006 NC Energy Conservation Code. Delete the lined through wording and add the underlined wording. Keep the two drawings on page 103 of the 2006 NC Energy Conservation Code and delete the remaining drawings in the Appendix. Correct the drawings to show 3" minimum from the top of the masonry wall.)*

~~The sections and construction details in Details 502.2.1.5(1), 502.2.1.5(2), 502.2.1.5(3), 502.2.1.5(4), and 502.2.1.5(5), and Tables 502.2.3.1(1), 502.2.3.1(2), 502.2.3.1(3), 502.2.3.2, 502.2.3.3, 502.2.3.5 and 502.2.3.6 are intended to be representative and not all inclusive. Adopting agencies are encouraged to add construction details and sections appropriate to their specific areas. Utilization of these tables should be correlated with local industry group practices and model code research recommendations. The provisions contained in this appendix are adopted as part of this code.~~