Part IV — Energy Conservation

CHAPTER 11

ENERGY EFFICIENCY

There are no margin bars shown in this chapter due to its substantial revision.

SECTION N1101
GENERAL

N1101.1 Scope. This chapter regulates the energy efficiency for the design and construction of buildings regulated by this code.

Exceptions:

1. Portions of the building envelope that do not enclose conditioned space.
2. The provisions of this chapter shall not be applicable to building systems which are demonstrated to derive energy solely from renewable energy sources.

N1101.2 Compliance. Compliance shall be demonstrated by:

1. Meeting the requirements of Chapter 4 of the Energy Conservation Construction Code of New York State, or
2. Meeting the requirements of this chapter; or
3. The use of computer software developed by the United States Department of Energy (DOE) that has an allowance for HVAC tradeoffs, worksheets/compliance material based on this software and other building energy modeling or home energy rating(HERS) software approved by the Secretary of State.

Climate zones from Table N1101.2 shall be used in determining the applicable requirements from this chapter.

N1101.2.1 Additions and Alterations. Additions and alterations shall conform with Sections N1101.2.1.1 through N1101.2.1.3.

N1101.2.1.1 Additions. Additions shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions shall not create unsafe or hazardous condition or overload existing building systems. For the purposes of this chapter, an extension or increase in the conditioned space shall be regulated as an addition.

N1101.2.1.2 Substantial alterations. Where 50 percent or more of a building system or subsystem, measured in units appropriate to that system or subsystem, is replaced within any twelve month period, that portion of the system or subsystem shall conform with the provisions of this code as they relate to new construction. Substantial alterations shall not create an unsafe or hazardous condition or overload existing building systems or subsystems. For the purposes of this chapter, alterations shall include any construction or renovation to an existing structure other than repair or addition that requires a permit; also, a change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit.

Exceptions: The following need not comply, provided the energy use of the building is not increased.

1. Storm windows over existing glazing.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.

N1101.2.1.3 Other alterations. Where less than 50 percent of a building system subsystem, measured in units appropriate to that system, is replaced or repaired in any twelve-month period, alterations to that portion of the system shall not create an unsafe or hazardous condition or overload existing building systems.

N1101.2.1.4 Historic buildings. Any building or structure that is listed in the State or National Register of Historic Places; designated as an historic property under local or state designation law or survey; certified as a contributing resource within a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Register of Historic Places, either individually or as a contributing building to an historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.

N1101.3 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

N1101.4 Building thermal envelope insulation. An R-value identification mark shall be applied by the manufacturer to each piece of building thermal envelope insulation 12 inches (305 mm) or greater in width. Alternatively, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the

TABLE N1101.2
NEW YORK STATE RESIDENTIAL CLIMATE ZONES

COUNTY	WINTER DESIGN DRY-BULB TEMPERATURE	SUMMER DESIGN DRY-BULB TEMPERATURE	COINCIDENT WET-BULB TEMPERATURE	HEATING DEGREE DAYS	CLIMATE ZONE
Albany	-7	86	70	6894	5
Allegany	1	86	71	7484	6
Bronx	13	89	73	4910	4
Broome	-2	82	69	7273	6
Cattaraugus	2	85	73	6747	6
Cayuga	-3	85	71	6834	5
Chautauqua	2	85	73	6747	5
Chemung	-2	87	71	6845	5
Chenango	-2	82	69	7273	6
Clinton	-9	83	69	7837	6
Columbia	-7	86	70	6894	5
Cortland	-2	82	69	7273	5
Delaware	-5	86	70	7244	6
Dutchess	2	88	72	6391	5
Erie	2	85	73	6747	5
Essex	-15	84	71	8255	6
Franklin	-15	84	71	8255	6
Fulton	-7	86	70	6894	6
Genessee	1	86	71	6734	5
Greene	-7	86	70	6894	5
Hamilton	-10	85	71	7635	6
Herkimer	-5	86	70	7244	6
Jefferson	-12	83	70	7540	6
Kings	13	89	73	4910	4
Lewis	-12	83	70	7540	6
Livingston	1	86	71	6734	5
Madison	-5	86	70	7244	6
Monroe	1	86	71	6734	5
Montgomery	-7	86	70	6894	6
Nassau	13	89	73	4910	4
New York	13	89	73	4910	4
Niagara	2	85	73	6747	5
Oneida	-5	86	70	7244	6
Onondaga	-3	85	71	6834	5
Ontario	1	86	71	6734	5
Orange	6	83	73	5750	5
Orleans	1	86	71	6734	5
Oswego	-3	85	71	6834	5
Otsego	-5	86	70	7244	6
Putnam	6	83	73	5750	5
Queens	13	89	73	4910	4
Rensselaer	-7	86	70	6894	5
Richmond	13	89	73	4910	4
Rockland	13	89	73	4910	5
St. Lawrence	-15	84	70	8255	6
Saratoga	-5	86	70	7244	5
Schenectady	-7	86	70	6894	5
Schoharie	-7	86	70	6894	6
Schuyler	-2	87	71	6845	6
Seneca	1	86	71	6734	5
Steuben	1	86	71	6734	6
Suffolk	11	83	74	5750	4
Sullivan	6	83	73	6750	6
Tioga	-2	87	71	6845	5
Tompkins	-2	82	69	7273	6
Ulster	6	83	73	6750	6
Warren	-10	85	71	7635	6
Washington	-10	85	71	7635	5
Wayne	1	86	71	6734	5
Westchester	7	84	73	5750	4
Wyoming	1	86	71	6734	6
Yates	1	86	71	6734	5

building thermal envelope. For blown or sprayed insulation, the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification. The insulation installer shall sign, date and post the certification in a conspicuous place on the job site.

N1101.4.1 Blown or sprayed roof/ceiling insulation. The thickness of blown in or sprayed roof/ceiling insulation shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m^2) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) in height. Each marker shall face the attic access opening.

N1101.4.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer's R-value mark is readily observable upon inspection.

N1101.5 Fenestration product rating. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default U-factor from Tables N1101.5(1) or 1101.5(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table N1101.5(3).

N1101.6 Installation. All materials, systems and equipment shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.

N1101.6.1 Protection of exposed foundation insulation. Insulation applied to the exterior of basement walls, crawlspace walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (153 mm) below grade.

N1101.7 Above code programs. The code enforcement official shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy efficiency program shall be considered in compliance with this code.

N1101.8 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall not cover or obstruct visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall be completed by the building 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/or floor) and ducts outside conditioned spaces and U-factors for fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the type and efficiency of heating, cooling and service water heating equipment.

N1101.9 Electrical energy consumption. Provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.

N1101.10 Fireplaces. Fireplaces shall be installed with tight-fitting noncombustible fireplace doors to control infiltration losses in the construction types listed:

1. Masonry fireplaces or fireplace units designed to allow an open burn.
2. Decorative appliances (ANSI Standard Z21.60 gas-log style unit) installed in a vented solid fuel fireplace.

TABLE N1101.5(1)
DEFAULT GLAZED FENESTRATION U-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			SINGLE	DOUBLE
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE N1101.5(2)
DEFAULT DOOR U-FACTORS

Door Type	U-factor
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

TABLE N1101.5(3)
DEFAULT GLAZED FENESTRATION SHGC

Single Glazed		Double Glazed		Glazed Block
Clear	Tinted	Clear	Tinted	
0.7	0.6	0.6	0.5	0.6

3. Vented decorative gas fireplace appliances (ANSI Standard Z21.50 unit).

Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of this code.

SECTION N1102
BUILDING THERMAL ENVELOPE

N1102.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Table N1102.1 based on the climate zone specified in Table N1101.2.

Exceptions:

1. When compliance is demonstrated by computer software, as provided in Section N1101.2(3).
2. When a sunroom or addition complies with Section N1102.2.10.
3. The building thermal envelope shall be permitted to meet the requirements of Table N1102.1(2) if:
   - 3.1. Tested infiltration is demonstrated to conform with Section N1102.4.4; or
   - 3.2. Tested duct leakage is demonstrated to conform with Section N1103.2.4; or
   - 3.3. Mechanical equipment conforms with Section N1103.7.

N1102.1.1 R-value computation. Insulation material used layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component

TABLE N1102.1(2)
ALTERNATIVE INSULATION REQUIREMENTS BY COMPONENT[a]
(See Section N1102.1 exception 3)

CLIMATE ZONE	CEILING R-VALUE	WOOD FRAME WALL R-VALUE
4	30	13
5	38	13
6	38	13

For SI: 1 foot = 304.8 mm
a. R-values are minimums.

TABLE N1102.1(1)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE, DEPTH	CRAWL SPACE[e] WALL R-VALUE
4	0.40	0.60	NR	38	15	5	19	10/13	10, 2 ft.	10/13
5	0.35	0.60	NR	38	21 or 15 + 5[g]	13	30[f]	10/13	10, 4 ft.	10/13
6	0.35	0.60	NR	49	21 or 15 + 5[g]	13	30[f]	10/13	10, 4 ft.	10/13

For SI: 1 foot = 304.8 mm
a. R-values are minimums. U-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 x 6 cavity.
b. The fenestration U-factor column excludes skylights. The 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. Reserved.
f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
g. "13 + 5" means R-15 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

TABLE N1102.1.2
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT 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
4	0.40	0.60	0.030	0.082 0.075	0.141	0.047	0.059	0.065
5	0.35	0.60	0.030	0.060 0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060 0.057	0.060	0.033	0.059	0.065

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

R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

N1102.1.2 U-factor alternative. An assembly with a U-factor equal to or less than that specified in Table N1102.1.2 shall be permitted as an alternative to the R-value in Table N1102.1.

N1102.1.3 Total UA alternative. If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table N1102.1.2 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table N1102.1. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials.

N1102.1.4 Electric resistance heat. Regardless of climate zone, thermal envelopes of residential buildings which use electric resistance heat as the primary heat source shall use DOE software for envelope compliance, or shall conform with Table N1102.1.4.

TABLE N1102.1.4
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT FOR RESIDENCES USING ELECTRIC RESISTANCE HEATING

Building Element	Component R-value or U-factor
Roof, ceiling or floor over open space	R-49
Wall above grade	R-26
Fenestration[a, b]	0.31
Floor over unheated space or crawl space	R-30
Basement wall	R-19[c]
Slab edge	R-15, 4 ft.

a. Maximum glazing area shall not exceed 15 percent of wall area
b. U-factor for opaque doors shall not exceed 0.35.
c. Basement wall insulation shall extend 7 feet or to top of slab, whichever is less.

N1102.2 Specific insulation requirements.

N1102.2.1 Ceilings with attic spaces. When Section N1102.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly, R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.

N1102.2.2 Ceilings without attic spaces. Where Section N1102.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section N1102.1 shall be limited to 500 square feet of ceiling area.

N1102.2.3 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 N1102.1 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 N1102.1.

N1102.2.4 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table N1102.2.4 or shall meet the wall U-factor requirements in Table N1102.1.2. The calculation of the U-factor for a steel-frame wall shall use a series-parallel path calculation method.

N1102.2.5 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

N1102.2.6 Basement walls. Walls associated with conditioned basements shall be insulated from the top of the basement wall to a depth of 24 (610 mm) inches below grade, where the heating degree days are less than or equal to 6,000; to a depth of 48 inches (1220 mm) below grade, where the heating degree days are greater than 6,000 but are not greater than 8,000; and to a depth of 84 inches (2,135 mm) or to the level of the basement floor, whichever is less, where the heating degree days are greater than 8,000. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections N1102.1 and N1102.2.5.

N1102.2.7 Slab-on-grade floors. Slab-on-grade floors with a floor surface less than 12 inches (305 mm) 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 angle (0.79 rad) away from the exterior wall.

N1102.2.8 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous vapor retarder. All joints of the vapor retarder shall overlap by 6 inches (153 mm) and be

TABLE N1102.2.4
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE[a]
Steel Truss Ceilings[b]	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings[b]	
R-30	R-38 in 2x4, 2x6 or 2x8 R-49 in any framing
R-38	R-49 in 2x4, 2x6, 2x8 or 2x10
Steel Framed Walls	
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
Steel Joist Floors	
R-19	R-19 + 6 in 2x6 R-19 + 12 in 2x8 or 2x10

a. Cavity insulation R-value is listed first, followed by continuous insulation R-value.
b. Insulation exceeding the height of the framing shall cover the framing.

sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

N1102.2.9 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

N1102.2.10 Thermally isolated rooms insulation. In sunrooms and in additions not exceeding 500 square feet in area, the minimum ceiling insulation R-values shall be R-19 zone 4 and R-24 in zones 5 and 6. The minimum wall R-value shall be R-13 in all zones. New wall(s) separating the room from conditioned space and new floor assemblies shall meet the building thermal envelope requirements.

N1102.3 Fenestration.

N1102.3.1 U-factor. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements.

N1102.3.2 Glazed fenestration exemption. Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from U-factor and SHGC requirements in Section N1102.1.

N1102.3.3 Opaque door exemption. One opaque door assembly is exempted from the U-factor requirement in Section N1102.1.

N1102.3.4 Thermally isolated sunroom U-factor. For zones 4 through 8 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 room from conditioned space shall meet the building thermal envelope requirements.

N1102.3.5 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for U-factor in Table N1102.1, where required by Section N1101.2.1.2.

N1102.4 Air leakage.

N1102.4.1 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. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Other sources of infiltration.

N1102.4.2 Fenestration air leakage. Windows, skylights and sliding-glass doors shall have an air infiltration rate of no more than 0.3 cfm/ft^2 (1.5 L/s/m^2), and swinging doors

no more than 0.5 cfm/ft^2 (2.6 L/s/m^2), when tested according to NFRC 400, 101/I.S.2, or AAMA/NAFS 101/I.S.2 by an accredited, independent laboratory, and listed and labeled by the manufacturer.

Exception: Site-built windows, skylights and doors.

N1102.4.3 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces by being:

1. IC-rated and labeled with enclosures that are sealed or gasketed to prevent air leakage to the ceiling cavity or unconditioned space; or
2. IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity; or
3. Located inside an airtight sealed box with clearances of at least 0.5 inches (12.7 mm) from combustible material and 3 inches (76 mm) from insulation.

N1102.4.4 Building envelope infiltration. The building thermal envelope shall be permitted to meet the requirements of Table N1102.1(2) where tested ACH50 does not exceed 5.5, as verified using instruments and procedures specified in ASHRAE/ASTM E 779–1999. The test shall be conducted by a qualified person who shall demonstrate competence, to the satisfaction of the code enforcement official, for the conduct of such tests. For the purpose of this section, ACH50 shall mean air changes per hour of infiltration into a house as measured with a blower door at 50 pascals of pressure in accordance with ASHRAE/ASTM standard E 779. Test results shall be provided to the code enforcement official and shall include:

1. Name and place of business of the tester;
2. Address of the building which was tested;
3. Conditioned floor area of dwelling, calculated in accordance with ANSI Z65-1996, except that conditioned floor area shall include areas where the ceiling height is than 5 feet (1524 mm);
4. Measurement of ACH50; and
5. Certification of accuracy of test results and signature of tester.

N1102.5 Moisture control. The building design shall not create conditions of accelerated deterioration from moisture condensation. Above-grade frame walls, floors and ceilings 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 ceilings in jurisdictions in zone 4. (Crawl space floor vapor retarders are not exempted.)
3. Where other approved means to avoid condensation are provided.

N1102.5.1 Maximum fenestration U-factor. The area weighted average maximum fenestration U-factor permitted using trade offs from Section N1102.1.3 or Section 404 in zones 4 through 6 shall be 0.40.

SECTION N1103
SYSTEMS

N1103.1 Controls. At least one thermostat shall be provided for each separate heating and cooling system.

N1103.1.1 Dwelling units. Each dwelling unit shall have at least one programable thermostat having the capability to set back or shut down the system based on time of day.

N1103.2 Ducts.

N1103.2.1 Insulation. Supply and return ducts shall be insulated to a minimum of R -8. Ducts in floor trusses shall be insulated to a minimum of R-6.

Exception: Ducts or portions thereof located completely inside the building thermal envelope.

N1103.2.2 Sealing. All ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3.1 of this code.

N1103.2.3 Building cavities. Building framing cavities shall not be used as supply ducts.

N1103.2.4 Duct leakage. The building thermal envelope shall be permitted to meet the requirements of Table N1102.1(2) where tested CFM25 does not exceed 6 percent of conditioned floor area, as verified using instruments and procedures specified in ANSI/ASHRAE 152–2004 and ASTM E 1554–2005 Test Method A. Tests at other test pressures are permitted to be used if they are converted to equivalent leakage at 25 pascals (Pa) of pressure, and such equivalence is demonstrated to the satisfaction of the code enforcement official. The test shall be conducted by a qualified person who shall demonstrate competence, to the satisfaction of the code enforcement official, for the conduct of such tests. For the purpose of this Section, CFM25 shall mean the leakage from all ducts and plenums in cubic feet per minute measured at 25 pascals of pressure in accordance with ASHRAE Standard 152 or ASTM E 1554. Test results shall be provided to the code enforcement official and shall include:

1. Name and place of business of the tester;
2. Address of the building which was tested;
3. Conditioned floor area of dwelling, calculated in accordance with ANSI Z65, except that conditioned floor area shall include areas where the ceiling height is less than 5 feet (1524 mm);
4. Measurement of CFM25; and
5. Certification of accuracy of test results and signature of tester.

N1103.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-2.

Exception: Heating piping located entirely within the building thermal envelope.

N1103.4 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-2. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

N1103.5 Mechanical ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

N1103.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with Section M1401.3 of this code.

N1103.7 Mechanical equipment efficiency. The building thermal envelope shall be permitted to meet the requirements of Table N1102.1(2) where the building mechanical system conforms with the requirements of Table N1103.7.

TABLE N1103.7
OPTIONAL MECHANICAL EQUIPMENT EFFICIENCY REQUIREMENTS

Heating system type	Efficiency	Units
Gas furnace	90%	AFUE
Oil furnace[a]	82%	AFUE
Gas boiler[b]	82%	AFUE
Oil boiler[b]	82%	AFUE
Heat pump	8.5	HSPF

a. Air handler for oil furnace shall have EUR ≤7 for inputs over 94,000 Btu/hour, and EUR≤6 for inputs not exceeding 94,000 Btu/hour.

b. All boilers shall be provided with a modulating aquastat or an alternative control sequence which modulates boiler water temperature in response to outdoor temperature or demand. Alternative control sequences shall be approved.