

Part IV—Energy Conservation

CHAPTER 11 [RE]

ENERGY EFFICIENCY

SECTION N1101 GENERAL

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

Note: The text of the following Sections N1101.2 through N1105 is extracted from the 2012 edition of the International Energy Conservation Code—Residential Provisions and has been editorially revised to conform to the scope and application of this code. The section numbers appearing in parenthesis after each section number are the section numbers of the corresponding text in the International Energy Conservation Code—Residential Provisions.

|| **N1101.2 (R101.3) Intent.** Deleted.

| **N1101.3 (R101.5.1) Compliance materials.** The *building official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.

| **N1101.4 (R102.1.1) Above code programs.** The *building official* or other authority having jurisdiction 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. The requirements identified as “mandatory” in this chapter, as applicable, shall be met.

|| **N1101.5 (R103.2) Information on construction documents.** Deleted.

| **N1101.5.1 (R103.2.1) Thermal envelope depiction.** The building’s thermal envelope shall be represented on the construction drawings.

| **N1101.6 (R202) Defined terms.** The following words and terms shall, for the purposes of this chapter, have the meanings shown herein.

ABOVE-GRADE WALL. A wall more than 50 percent above grade and enclosing *conditioned space*. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

ACCESSIBLE. Admitting close approach as a result of not being guarded by locked doors, elevation or other effective means (see “Readily *accessible*”).

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials.

AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some impersonal influence, as, for example, a change in current strength, pressure, temperature or mechanical configuration (see “Manual”).

BASEMENT WALL. A wall 50 percent or more below grade and enclosing *conditioned space*.

BUILDING SITE. A contiguous area of land that is under the ownership or control of one entity.

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.

C-FACTOR (THERMAL CONDUCTANCE). The coefficient of heat transmission (surface to surface) through a building component or assembly, equal to the time rate of heat flow per unit area and the unit temperature difference between the warm side and cold side surfaces (Btu/h · ft² · °F) [W/(m² · K)].

CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment.

CLIMATE ZONE. A geographical region based on climatic criteria as specified in this code.

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the *conditioned space*.

CONDITIONED SPACE. An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.

CONTINUOUS AIR BARRIER. A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

CONTINUOUS INSULATION (ci). Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior, or is integral to any opaque surface, of the building envelope.

CRAWL SPACE WALL. The opaque portion of a wall that encloses a crawl space and is partially or totally below grade.

ENERGY EFFICIENCY

CURTAIN WALL. Fenestration products used to create an external nonload-bearing wall that is designed to separate the exterior and interior environments.

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service hot water piping with heated water upon demand for hot water.

DUCT. A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

DUCT SYSTEM. A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

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*.

EXTERIOR WALL. Walls including both above-grade walls and basement walls.

FENESTRATION. Products classified as either *vertical fenestration* or *skylights*.

FENESTRATION PRODUCT, SITE-BUILT. A fenestration designed to be made up of field-glazed or field-assembled units using specific factory cut or otherwise factory-formed framing and glazing units. Examples of site-built fenestration include storefront systems, curtain walls, and atrium roof systems.

FENESTRATION, VERTICAL. Windows (fixed or moveable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of a least 60 degrees (1.05 rad) from horizontal.

HEATED SLAB. Slab-on-grade construction in which the heating elements, hydronic tubing, or hot air distribution system is in contact with, or placed within or under, the slab.

HIGH-EFFICACY LAMPS. Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy of:

1. 60 lumens per watt for lamps over 40 watts;
2. 50 lumens per watt for lamps over 15 watts to 40 watts; and
3. 40 lumens per watt for lamps 15 watts or less.

INFILTRATION. The uncontrolled inward air leakage into a building caused by the pressure effects of wind or the effect of differences in the indoor and outdoor air density or both.

INSULATED SIDING. A type of continuous insulation with manufacturer-installed insulating material as an integral part of the cladding product having a minimum *R*-value of R-2.

INSULATING SHEATHING. An insulating board with a core material having a minimum *R*-value of R-2.

LOW-VOLTAGE LIGHTING. Lighting equipment powered through a transformer such as a cable conductor, a rail conductor and track lighting.

MANUAL. Capable of being operated by personal intervention (see “Automatic”).

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.

READILY ACCESSIBLE. Capable of being reached quickly for operation, renewal or inspection without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders or access equipment (see “Accessible”).

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 ($h \cdot \text{ft}^2 \cdot ^\circ\text{F}/\text{Btu}$) [$(\text{m}^2 \cdot \text{K})/\text{W}$].

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

SKYLIGHT. Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal. Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls is included in this definition.

SOLAR HEAT GAIN COEFFICIENT (SHGC). The ratio of the solar heat gain entering the space through the fenestration assembly to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation that is then reradiated, conducted or convected into the space.

STANDARD REFERENCE DESIGN. A version of the *proposed design* that meets the minimum requirements of this code and is used to determine the maximum annual energy use requirement for compliance based on total building performance.

SUNROOM. A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure’s exterior walls and roof.

THERMAL ISOLATION. Physical and space conditioning separation from *conditioned space(s)*. The *conditioned space(s)* shall be controlled as separate zones for heating and cooling or conditioned by separate equipment.

THERMOSTAT. An automatic control device used to maintain temperature at a fixed or adjustable set point.

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 (Btu/h · ft² · °F) [W/(m² · K)].

VENTILATION AIR. That portion of supply air that comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

VISIBLE TRANSMITTANCE [VT]. The ratio of visible light entering the space through the fenestration product assembly to the incident visible light, Visible Transmittance, includes the effects of glazing material and frame and is expressed as a number between 0 and 1.

WHOLE HOUSE MECHANICAL VENTILATION SYSTEM. An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air when operating continuously or through a programmed intermittent schedule to satisfy the whole house ventilation rates.

ZONE. A space or group of spaces within a building with heating or cooling requirements that are sufficiently similar so that desired conditions can be maintained throughout using a single controlling device.

N1101.7 (R301.1) Climate zones. Climate zones from Figure N1101.7 or Table N1101.7 shall be used in determining the applicable requirements in Sections N1101 through N1111. Locations not in Table N1101.7 (outside the United States) shall be assigned a climate zone based on Section N101.10.2.

N1101.7.1 (R301.2) Warm humid counties. Warm humid counties are identified in Table N1101.7 by an asterisk.

N1101.7.2 (R301.3) International climate zones. The climate zone for any location outside the United States shall be determined by applying Table N1101.7.2(1) and then Table N1101.7.2(2).

N1101.8 (R301.4) Tropical climate zone. The tropical climate zone shall be defined as:

1. Hawaii, Puerto Rico, Guam, American Samoa, US Virgin Islands, Commonwealth of Northern Mariana Islands; and
2. Islands in the area between the Tropic of Cancer and the Tropic of Capricorn.

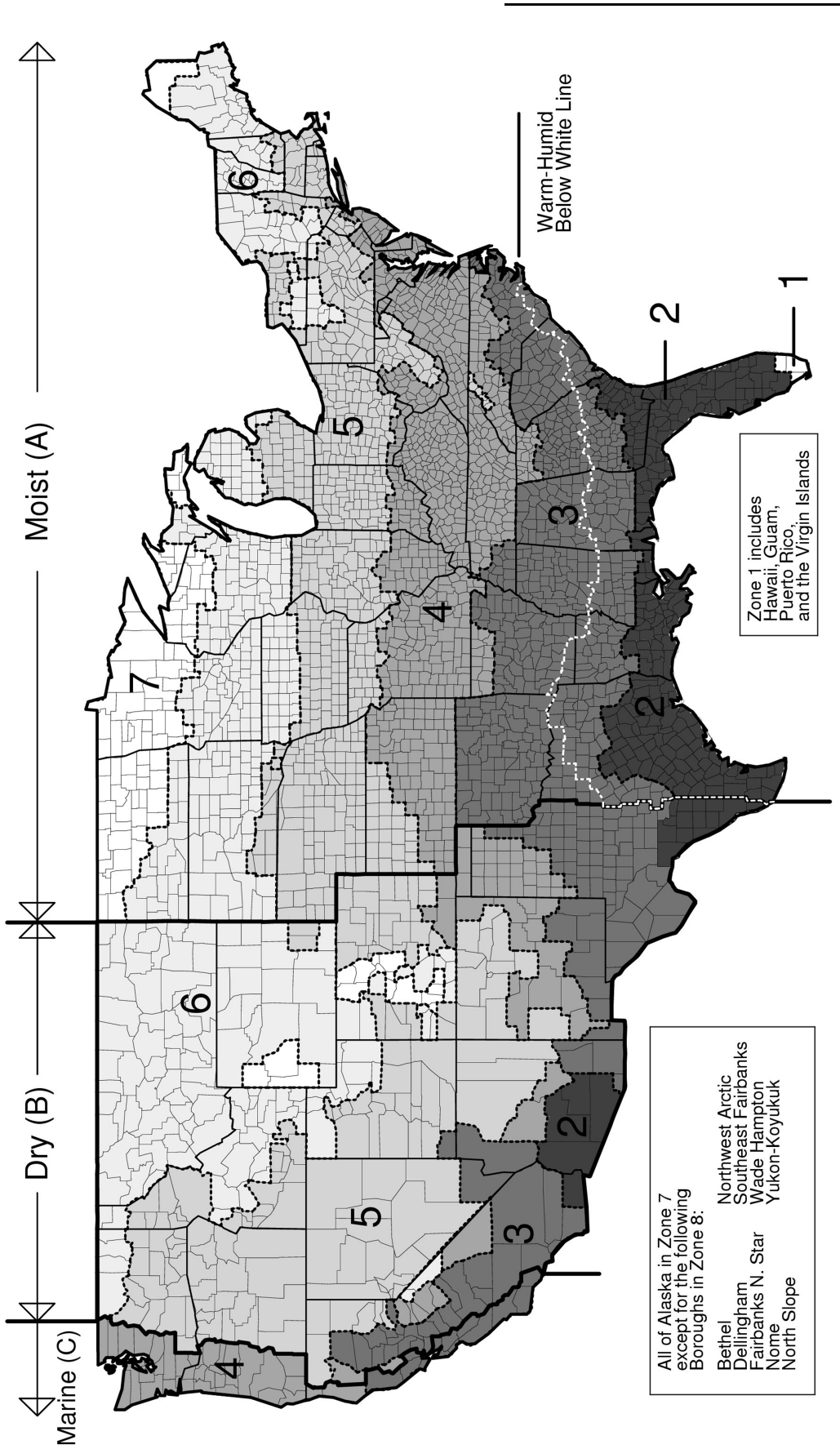


FIGURE N1101.7 (R301.1)
CLIMATE ZONES

TABLE N1101.7 (R301.1)
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

Key: A – Moist, B – Dry, C – Marine. Absence of moisture designation indicates moisture regime is irrelevant. Asterisk (*) indicates a warm-humid location.

US STATES

ALABAMA	3A Lee	7 Kodiak Island	4A Boone	3A Mississippi
3A Autauga*	3A Limestone	7 Lake and Peninsula	3A Bradley	3A Monroe
2A Baldwin*	3A Lowndes*	7 Matanuska-Susitna	3A Calhoun	3A Montgomery
3A Barbour*	3A Macon*	8 Nome	4A Carroll	3A Nevada
3A Bibb	3A Madison	8 North Slope	3A Chicot	4A Newton
3A Blount	3A Marengo*	8 Northwest Arctic	3A Clark	3A Ouachita
3A Bullock*	3A Marion	7 Prince of Wales Outer Ketchikan	3A Clay	3A Perry
3A Butler*	3A Marshall	7 Sitka	3A Cleburne	3A Phillips
3A Calhoun	2A Mobile*	7 Skagway-Hoonah-Angoon	3A Cleveland	3A Pike
3A Chambers	3A Monroe*	8 Southeast Fairbanks	3A Columbia*	3A Poinsett
3A Cherokee	3A Montgomery*	7 Valdez-Cordova	3A Conway	3A Polk
3A Chilton	3A Morgan	8 Wade Hampton	3A Craighead	3A Pope
3A Choctaw*	3A Perry*	7 Wrangell-Petersburg	3A Crawford	3A Prairie
3A Clarke*	3A Pickens	7 Yakutat	3A Crittenden	3A Pulaski
3A Clay	3A Pike*	8 Yukon-Koyukuk	3A Cross	3A Randolph
3A Cleburne	3A Randolph	ARIZONA	3A Dallas	3A Saline
3A Coffee*	3A Russell*	5B Apache	3A Desha	3A Scott
3A Colbert	3A Shelby	3B Cochise	3A Drew	4A Searcy
3A Conecuh*	3A St. Clair	5B Coconino	3A Faulkner	3A Sebastian
3A Coosa	3A Sumter	4B Gila	3A Franklin	3A Sevier*
3A Covington*	3A Talladega	3B Graham	4A Fulton	3A Sharp
3A Crenshaw*	3A Tallapoosa	3B Greenlee	3A Garland	3A St. Francis
3A Cullman	3A Tuscaloosa	2B La Paz	3A Grant	4A Stone
3A Dale*	3A Walker	2B Maricopa	3A Greene	3A Union*
3A Dallas*	3A Washington*	3B Mohave	3A Hempstead*	3A Van Buren
3A DeKalb	3A Wilcox*	5B Navajo	3A Hot Spring	4A Washington
3A Elmore*	3A Winston	2B Pima	3A Howard	3A White
3A Escambia*	ALASKA	2B Pinal	3A Independence	3A Woodruff
3A Etowah	7 Aleutians East	3B Santa Cruz	4A IZARD	3A Yell
3A Fayette	7 Aleutians West	4B Yavapai	3A Jackson	CALIFORNIA
3A Franklin	7 Anchorage	2B Yuma	3A Jefferson	3C Alameda
3A Geneva*	8 Bethel	ARKANSAS	3A Johnson	6B Alpine
3A Greene	7 Bristol Bay	3A Arkansas	3A Lafayette*	4B Amador
3A Hale	7 Denali	3A Ashley	3A Lawrence	3B Butte
3A Henry*	8 Dillingham	4A Baxter	3A Lee	4B Calaveras
3A Houston*	8 Fairbanks North Star	4A Benton	3A Lincoln	3B Colusa
3A Jackson	7 Haines		3A Little River*	3B Contra Costa
3A Jefferson	7 Juneau		3A Logan	4C Del Norte
3A Lamar	7 Kenai Peninsula		3A Lonoke	4B El Dorado
3A Lauderdale	7 Ketchikan Gateway		4A Madison	3B Fresno
3A Lawrence			4A Marion	3B Glenn
			3A Miller*	

(continued)

TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

4C Humboldt	3B Yuba	5B Morgan	2A Flagler*	2A Union*
2B Imperial		4B Otero	2A Franklin*	2A Volusia*
4B Inyo	COLORADO	6B Ouray	2A Gadsden*	2A Wakulla*
3B Kern	5B Adams	7 Park	2A Gilchrist*	2A Walton*
3B Kings	6B Alamosa	5B Phillips	2A Glades*	2A Washington*
4B Lake	5B Arapahoe	7 Pitkin	2A Gulf*	
5B Lassen	6B Archuleta	5B Prowers	2A Hamilton*	GEORGIA
3B Los Angeles	4B Baca	5B Pueblo	2A Hardee*	2A Appling*
3B Madera	5B Bent	6B Rio Blanco	2A Hendry*	2A Atkinson*
3C Marin	5B Boulder	7 Rio Grande	2A Hernando*	2A Bacon*
4B Mariposa	5B Broomfield	7 Routt	2A Highlands*	2A Baker*
3C Mendocino	6B Chaffee	6B Saguache	2A Hillsborough*	3A Baldwin
3B Merced	5B Cheyenne	7 San Juan	2A Holmes*	4A Banks
5B Modoc	7 Clear Creek	6B San Miguel	2A Indian River*	3A Barrow
6B Mono	6B Conejos	5B Sedgwick	2A Jackson*	3A Bartow
3C Monterey	6B Costilla	7 Summit	2A Jefferson*	3A Ben Hill*
3C Napa	5B Crowley	5B Teller	2A Lafayette*	2A Berrien*
5B Nevada	6B Custer	5B Washington	2A Lake*	3A Bibb
3B Orange	5B Delta	5B Weld	2A Lee*	3A Bleckley*
3B Placer	5B Denver	5B Yuma	2A Leon*	2A Brantley*
5B Plumas	6B Dolores		2A Levy*	2A Brooks*
3B Riverside	5B Douglas	CONNECTICUT	2A Liberty*	2A Bryan*
3B Sacramento	6B Eagle	5A (all)	2A Madison*	3A Bulloch*
3C San Benito	5B Elbert	DELAWARE	2A Manatee*	3A Burke
3B San Bernardino	5B El Paso	4A (all)	2A Marion*	3A Butts
3B San Diego	5B Fremont	DISTRICT OF	2A Martin*	3A Calhoun*
3C San Francisco	5B Garfield	COLUMBIA	1A Miami-Dade*	2A Camden*
3B San Joaquin	5B Gilpin	4A (all)	1A Monroe*	3A Candler*
3C San Luis Obispo	7 Grand	FLORIDA	2A Nassau*	3A Carroll
3C San Mateo	7 Gunnison	2A Alachua*	2A Okaloosa*	4A Catoosa
3C Santa Barbara	7 Hinsdale	2A Baker*	2A Okeechobee*	2A Charlton*
3C Santa Clara	5B Huerfano	2A Bay*	2A Orange*	2A Chatham*
3C Santa Cruz	7 Jackson	2A Bradford*	2A Osceola*	3A Chattahoochee*
3B Shasta	5B Jefferson	2A Broward*	2A Palm Beach*	4A Chattooga
5B Sierra	5B Kiowa	1A Broward*	2A Pasco*	3A Cherokee
5B Siskiyou	5B Kit Carson	2A Calhoun*	2A Pinellas*	3A Clarke
3B Solano	7 Lake	2A Charlotte*	2A Polk*	3A Clay*
3C Sonoma	5B La Plata	2A Citrus*	2A Putnam*	3A Clayton
3B Stanislaus	5B Larimer	2A Clay*	2A Santa Rosa*	2A Clinch*
3B Sutter	4B Las Animas	2A Collier*	2A Sarasota*	3A Cobb
3B Tehama	5B Lincoln	2A Columbia*	2A Seminole*	3A Coffee*
4B Trinity	5B Logan	2A Collier*	2A St. Johns*	2A Colquitt*
3B Tulare	5B Mesa	2A DeSoto*	2A St. Lucie*	3A Columbia
4B Tuolumne	7 Mineral	2A Dixie*	2A Sumter*	2A Cook*
3C Ventura	6B Moffat	2A Duval*	2A Suwannee*	3A Coweta
3B Yolo	5B Montezuma	2A Escambia*	2A Taylor*	
	5B Montrose			

(continued)

TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

3A Crawford	2A Lanier*	3A Taylor*	5B Cassia	4A Crawford
3A Crisp*	3A Laurens*	3A Telfair*	6B Clark	5A Cumberland
4A Dade	3A Lee*	3A Terrell*	5B Clearwater	5A DeKalb
4A Dawson	2A Liberty*	2A Thomas*	6B Custer	5A De Witt
2A Decatur*	3A Lincoln	3A Tift*	5B Elmore	5A Douglas
3A DeKalb	2A Long*	2A Toombs*	6B Franklin	5A DuPage
3A Dodge*	2A Lowndes*	4A Towns	6B Fremont	5A Edgar
3A Dooly*	4A Lumpkin	3A Treutlen*	5B Gem	4A Edwards
3A Dougherty*	3A Macon*	3A Troup	5B Gooding	4A Effingham
3A Douglas	3A Madison	3A Turner*	5B Idaho	4A Fayette
3A Early*	3A Marion*	3A Twiggs*	6B Jefferson	5A Ford
2A Echols*	3A McDuffie	4A Union	5B Jerome	4A Franklin
2A Effingham*	2A McIntosh*	3A Upson	5B Kootenai	5A Fulton
3A Elbert	3A Meriwether	4A Walker	5B Latah	4A Gallatin
3A Emanuel*	2A Miller*	3A Walton	6B Lemhi	5A Greene
2A Evans*	2A Mitchell*	2A Ware*	5B Lewis	5A Grundy
4A Fannin	3A Monroe	3A Warren	5B Lincoln	4A Hamilton
3A Fayette	3A Montgomery*	3A Washington	6B Madison	5A Hancock
4A Floyd	3A Morgan	2A Wayne*	5B Minidoka	4A Hardin
3A Forsyth	4A Murray	3A Webster*	5B Nez Perce	5A Henderson
4A Franklin	3A Muscogee	3A Wheeler*	6B Oneida	5A Henry
3A Fulton	3A Newton	4A White	5B Owyhee	5A Iroquois
4A Gilmer	3A Oconee	4A Whitfield	5B Payette	4A Jackson
3A Glascock	3A Oglethorpe	3A Wilcox*	5B Power	4A Jasper
2A Glynn*	3A Paulding	3A Wilkes	5B Shoshone	4A Jefferson
4A Gordon	3A Peach*	3A Wilkinson	6B Teton	5A Jersey
2A Grady*	4A Pickens	3A Worth*	5B Twin Falls	5A Jo Daviess
3A Greene	2A Pierce*		6B Valley	4A Johnson
3A Gwinnett	3A Pike	HAWAII	5B Washington	5A Kane
4A Habersham	3A Polk	1A (all)*		5A Kankakee
4A Hall	3A Pulaski*	IDAHO	ILLINOIS	5A Kendall
3A Hancock	3A Putnam	5B Ada	5A Adams	5A Knox
3A Haralson	3A Quitman*	6B Adams	4A Alexander	5A Lake
3A Harris	4A Rabun	6B Bannock	4A Bond	5A La Salle
3A Hart	3A Randolph*	6B Bear Lake	5A Boone	4A Lawrence
3A Heard	3A Richmond	5B Benewah	5A Brown	5A Lee
3A Henry	3A Rockdale	6B Bingham	5A Bureau	5A Livingston
3A Houston*	3A Schley*	6B Blaine	5A Calhoun	5A Logan
3A Irwin*	3A Screven*	6B Boise	5A Carroll	5A Macon
3A Jackson	2A Seminole*	6B Bonner	5A Cass	4A Macoupin
3A Jasper	3A Spalding	6B Bonneville	5A Champaign	4A Madison
2A Jeff Davis*	4A Stephens	6B Boundary	4A Christian	4A Marion
3A Jefferson	3A Stewart*	6B Butte	5A Clark	5A Marshall
3A Jenkins*	3A Sumter*	6B Camas	4A Clay	5A Mason
3A Johnson*	3A Talbot	5B Canyon	4A Clinton	4A Massac
3A Jones	3A Taliaferro	6B Caribou	5A Coles	5A McDonough
3A Lamar	2A Tattnell*		5A Cook	5A McHenry

(continued)

**TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY**

5A McLean	5A Boone	5A Miami	5A Appanoose	5A Jasper
5A Menard	4A Brown	4A Monroe	5A Audubon	5A Jefferson
5A Mercer	5A Carroll	5A Montgomery	5A Benton	5A Johnson
4A Monroe	5A Cass	5A Morgan	6A Black Hawk	5A Jones
4A Montgomery	4A Clark	5A Newton	5A Boone	5A Keokuk
5A Morgan	5A Clay	5A Noble	6A Bremer	6A Kossuth
5A Moultrie	5A Clinton	4A Ohio	6A Buchanan	5A Lee
5A Ogle	4A Crawford	4A Orange	6A Buena Vista	5A Linn
5A Peoria	4A Daviess	5A Owen	6A Butler	5A Louisa
4A Perry	4A Dearborn	5A Parke	6A Calhoun	5A Lucas
5A Piatt	5A Decatur	4A Perry	5A Carroll	6A Lyon
5A Pike	5A De Kalb	4A Pike	5A Cass	5A Madison
4A Pope	5A Delaware	5A Porter	5A Cedar	5A Mahaska
4A Pulaski	4A Dubois	4A Posey	6A Cerro Gordo	5A Marion
5A Putnam	5A Elkhart	5A Pulaski	6A Cherokee	5A Marshall
4A Randolph	5A Fayette	5A Putnam	6A Chickasaw	5A Mills
4A Richland	4A Floyd	5A Randolph	5A Clarke	6A Mitchell
5A Rock Island	5A Fountain	4A Ripley	6A Clay	5A Monona
4A Saline	5A Franklin	5A Rush	6A Clayton	5A Monroe
5A Sangamon	5A Fulton	4A Scott	5A Clinton	5A Montgomery
5A Schuyler	4A Gibson	5A Shelby	5A Crawford	5A Muscatine
5A Scott	5A Grant	4A Spencer	5A Dallas	6A O'Brien
4A Shelby	4A Greene	5A Starke	5A Davis	6A Osceola
5A Stark	5A Hamilton	5A Steuben	5A Decatur	5A Page
4A St. Clair	5A Hancock	5A St. Joseph	6A Delaware	6A Palo Alto
5A Stephenson	4A Harrison	4A Sullivan	5A Des Moines	6A Plymouth
5A Tazewell	5A Hendricks	4A Switzerland	6A Dickinson	6A Pocahontas
4A Union	5A Henry	5A Tippecanoe	5A Dubuque	5A Polk
5A Vermilion	5A Howard	5A Tipton	6A Emmet	5A Pottawattamie
4A Wabash	5A Huntington	5A Union	6A Fayette	5A Poweshiek
5A Warren	4A Jackson	4A Vanderburgh	6A Floyd	5A Ringgold
4A Washington	5A Jasper	5A Vermillion	6A Franklin	6A Sac
4A Wayne	5A Jay	5A Vigo	5A Fremont	5A Scott
4A White	4A Jefferson	5A Wabash	5A Greene	5A Shelby
5A Whiteside	4A Jennings	5A Warren	6A Grundy	6A Sioux
5A Will	5A Johnson	4A Warrick	5A Guthrie	5A Story
4A Williamson	4A Knox	4A Washington	6A Hamilton	5A Tama
5A Winnebago	5A Kosciusko	5A Wayne	6A Hancock	5A Taylor
5A Woodford	5A Lagrange	5A Wells	6A Hardin	5A Union
INDIANA	5A Lake	5A White	5A Harrison	5A Van Buren
5A Adams	5A La Porte	5A Whitley	5A Henry	5A Wapello
5A Allen	4A Lawrence	IOWA	6A Howard	5A Warren
5A Bartholomew	5A Madison	5A Adair	6A Humboldt	5A Washington
5A Benton	5A Marion	5A Adams	6A Ida	5A Wayne
5A Blackford	5A Marshall	6A Allamakee	5A Iowa	6A Webster
	4A Martin		5A Jackson	6A Winnebago

(continued)

TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

6A Winneshiek	4A Hodgeman	4A Seward	2A Iberville*	6A Cumberland
5A Woodbury	4A Jackson	4A Shawnee	3A Jackson*	6A Franklin
6A Worth	4A Jefferson	5A Sheridan	2A Jefferson*	6A Hancock
6A Wright	5A Jewell	5A Sherman	2A Jefferson Davis*	6A Kennebec
KANSAS	4A Johnson	5A Smith	2A Lafayette*	6A Knox
4A Allen	4A Kearny	4A Stafford	2A Lafourche*	6A Lincoln
4A Anderson	4A Kingman	4A Stanton	3A La Salle*	6A Oxford
4A Atchison	4A Kiowa	4A Stevens	3A Lincoln*	6A Penobscot
4A Barber	4A Labette	4A Sumner	2A Livingston*	6A Piscataquis
4A Barton	5A Lane	5A Thomas	3A Madison*	6A Sagadahoc
4A Bourbon	4A Leavenworth	5A Trego	3A Morehouse	6A Somerset
4A Brown	4A Lincoln	4A Wabaunsee	3A Natchitoches*	6A Waldo
4A Butler	4A Linn	5A Wallace	2A Orleans*	6A Washington
4A Chase	5A Logan	4A Washington	3A Ouachita*	6A York
4A Chautauqua	4A Lyon	5A Wichita	2A Plaquemines*	MARYLAND
4A Cherokee	4A Marion	4A Wilson	2A Pointe Coupee*	4A Allegany
5A Cheyenne	4A Marshall	4A Woodson	2A Rapides*	4A Anne Arundel
4A Clark	4A McPherson	4A Wyandotte	3A Red River*	4A Baltimore
4A Clay	4A Meade	KENTUCKY	3A Richland*	4A Baltimore (city)
5A Cloud	4A Miami	4A (all)	3A Sabine*	4A Calvert
4A Coffey	5A Mitchell	LOUISIANA	2A St. Bernard*	4A Caroline
4A Comanche	4A Montgomery	2A Acadia*	2A St. Charles*	4A Carroll
4A Cowley	4A Morris	2A Allen*	2A St. Helena*	4A Cecil
4A Crawford	4A Morton	2A Ascension*	2A St. James*	4A Charles
5A Decatur	4A Nemaha	2A Assumption*	2A St. John the Baptist*	4A Dorchester
4A Dickinson	4A Neosho	2A Avoyelles*	2A St. Landry*	4A Frederick
4A Doniphan	5A Ness	2A Beauregard*	2A St. Martin*	5A Garrett
4A Douglas	4A Osage	3A Bienville*	2A St. Mary*	4A Harford
4A Edwards	5A Osborne	3A Bossier*	2A St. Tammany*	4A Howard
4A Elk	4A Ottawa	3A Caddo*	2A Tangipahoa*	4A Kent
5A Ellis	4A Pawnee	2A Calcasieu*	3A Tensas*	4A Montgomery
4A Ellsworth	5A Phillips	3A Caldwell*	2A Terrebonne*	4A Prince George's
4A Finney	4A Pottawatomie	2A Cameron*	3A Union*	4A Queen Anne's
4A Ford	4A Pratt	3A Catahoula*	2A Vermilion*	4A Somerset
4A Franklin	5A Rawlins	3A Claiborne*	3A Vernon*	4A St. Mary's
4A Geary	4A Reno	3A Concordia*	2A Washington*	4A Talbot
5A Gove	5A Republic	3A De Soto*	3A Webster*	4A Washington
5A Graham	4A Rice	2A East Baton Rouge*	2A West Baton Rouge*	4A Wicomico
4A Grant	4A Riley	3A East Carroll	3A West Carroll	4A Worcester
4A Gray	5A Rooks	2A East Feliciana*	2A West Feliciana*	MASSACHUSETTS
5A Greeley	4A Rush	2A Evangeline*	3A Winn*	5A (all)
4A Greenwood	4A Russell	3A Franklin*	MAINE	MICHIGAN
5A Hamilton	4A Saline	3A Grant*	6A Androscoggin	6A Alcona
4A Harper	5A Scott	2A Iberia*	7 Aroostook	6A Alger
4A Harvey	4A Sedgwick			
4A Haskell				

(continued)

TABLE N1101.7 (R301.1)—continued
 CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
 DESIGNATIONS BY STATE, COUNTY AND TERRITORY

5A Allegan	7 Mackinac	6A Carver	7 Otter Tail	3A Clay
6A Alpena	5A Macomb	7 Cass	7 Pennington	3A Coahoma
6A Antrim	6A Manistee	6A Chippewa	7 Pine	3A Copiah*
6A Arenac	6A Marquette	6A Chisago	6A Pipestone	3A Covington*
7 Baraga	6A Mason	7 Clay	7 Polk	3A DeSoto
5A Barry	6A Mecosta	7 Clearwater	6A Pope	3A Forrest*
5A Bay	6A Menominee	7 Cook	6A Ramsey	3A Franklin*
6A Benzie	5A Midland	6A Cottonwood	7 Red Lake	3A George*
5A Berrien	6A Missaukee	7 Crow Wing	6A Redwood	3A Greene*
5A Branch	5A Monroe	6A Dakota	6A Renville	3A Grenada
5A Calhoun	5A Montcalm	6A Dodge	6A Rice	2A Hancock*
5A Cass	6A Montmorency	6A Douglas	6A Rock	2A Harrison*
6A Charlevoix	5A Muskegon	6A Faribault	7 Roseau	3A Hinds*
6A Cheboygan	6A Newaygo	6A Fillmore	6A Scott	3A Holmes
7 Chippewa	5A Oakland	6A Freeborn	6A Sherburne	3A Humphreys
6A Clare	6A Oceana	6A Goodhue	6A Sibley	3A Issaquena
5A Clinton	6A Ogemaw	7 Grant	6A Stearns	3A Itawamba
6A Crawford	7 Ontonagon	6A Hennepin	6A Steele	2A Jackson*
6A Delta	6A Osceola	6A Houston	6A Stevens	3A Jasper
6A Dickinson	6A Oscoda	7 Hubbard	7 St. Louis	3A Jefferson*
5A Eaton	6A Otsego	6A Isanti	6A Swift	3A Jefferson Davis*
6A Emmet	5A Ottawa	7 Itasca	6A Todd	3A Jones*
5A Genesee	6A Presque Isle	6A Jackson	6A Traverse	3A Kemper
6A Gladwin	6A Roscommon	7 Kanabec	6A Wabasha	3A Lafayette
7 Gogebic	5A Saginaw	6A Kandiyohi	7 Wadena	3A Lamar*
6A Grand Traverse	6A Sanilac	7 Kittson	6A Waseca	3A Lauderdale
5A Gratiot	7 Schoolcraft	7 Koochiching	6A Washington	3A Lawrence*
5A Hillsdale	5A Shiawassee	6A Lac qui Parle	6A Watonwan	3A Leake
7 Houghton	5A St. Clair	7 Lake	7 Wilkin	3A Lee
6A Huron	5A St. Joseph	7 Lake of the Woods	6A Winona	3A Leflore
5A Ingham	5A Tuscola	6A Le Sueur	6A Wright	3A Lincoln*
5A Ionia	5A Van Buren	6A Lincoln	6A Yellow Medicine	3A Lowndes
6A Iosco	5A Washtenaw	6A Lyon		3A Madison
7 Iron	5A Wayne	7 Mahanomen	MISSISSIPPI	3A Marion*
6A Isabella	6A Wexford	7 Marshall	3A Adams*	3A Marshall
5A Jackson	MINNESOTA	6A Martin	3A Alcorn	3A Monroe
5A Kalamazoo	7 Aitkin	6A McLeod	3A Amite*	3A Montgomery
6A Kalkaska	6A Anoka	6A Meeker	3A Attala	3A Neshoba
5A Kent	7 Becker	7 Mille Lacs	3A Benton	3A Newton
7 Keweenaw	7 Beltrami	6A Morrison	3A Bolivar	3A Noxubee
6A Lake	6A Benton	6A Mower	3A Calhoun	3A Oktibbeha
5A Lapeer	6A Big Stone	6A Murray	3A Carroll	3A Panola
6A Leelanau	6A Blue Earth	6A Nicollet	3A Chickasaw	2A Pearl River*
5A Lenawee	6A Brown	6A Nobles	3A Choctaw	3A Perry*
5A Livingston	7 Carlton	7 Norman	3A Claiborne*	3A Pike*
7 Luce		6A Olmsted	3A Clarke	

(continued)

TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

3A Pontotoc	5A Chariton	4A Mississippi	4A Webster	4A Cumberland
3A Prentiss	4A Christian	4A Moniteau	5A Worth	4A Essex
3A Quitman	5A Clark	4A Monroe	4A Wright	4A Gloucester
3A Rankin*	4A Clay	4A Montgomery	MONTANA	4A Hudson
3A Scott	5A Clinton	4A Morgan	6B (all)	5A Hunterdon
3A Sharkey	4A Cole	4A New Madrid	NEBRASKA	5A Mercer
3A Simpson*	4A Cooper	4A Newton	5A (all)	4A Middlesex
3A Smith*	4A Crawford	5A Nodaway	NEVADA	4A Monmouth
2A Stone*	4A Dade	4A Oregon	5B Carson City (city)	5A Morris
3A Sunflower	4A Dallas	4A Osage	5B Churchill	4A Ocean
3A Tallahatchie	5A Daviess	4A Ozark	3B Clark	5A Passaic
3A Tate	5A DeKalb	4A Pemiscot	5B Douglas	4A Salem
3A Tippah	4A Dent	4A Perry	5B Elko	5A Somerset
3A Tishomingo	4A Douglas	4A Pettis	5B Esmeralda	5A Sussex
3A Tunica	4A Dunklin	4A Phelps	5B Eureka	4A Union
3A Union	4A Franklin	5A Pike	5B Humboldt	5A Warren
3A Walthall*	4A Gasconade	4A Platte	5B Lander	NEW MEXICO
3A Warren*	5A Gentry	4A Polk	5B Lincoln	4B Bernalillo
3A Washington	4A Greene	4A Pulaski	5B Lyon	5B Catron
3A Wayne*	5A Grundy	5A Putnam	5B Mineral	3B Chaves
3A Webster	5A Harrison	5A Ralls	5B Nye	4B Cibola
3A Wilkinson*	4A Henry	4A Randolph	5B Pershing	5B Colfax
3A Winston	4A Hickory	4A Ray	5B Storey	4B Curry
3A Yalobusha	5A Holt	4A Reynolds	5B Washoe	4B DeBaca
3A Yazoo	4A Howard	4A Ripley	5B White Pine	3B Dona Ana
MISSOURI	4A Howell	4A Saline	NEW	3B Eddy
5A Adair	4A Iron	5A Schuyler	HAMPSHIRE	4B Grant
5A Andrew	4A Jackson	5A Scotland	6A Belknap	4B Guadalupe
5A Atchison	4A Jasper	4A Scott	6A Carroll	5B Harding
4A Audrain	4A Jefferson	4A Shannon	5A Cheshire	3B Hidalgo
4A Barry	4A Johnson	5A Shelby	6A Coos	3B Lea
4A Barton	5A Knox	4A St. Charles	6A Grafton	4B Lincoln
4A Bates	4A Laclede	4A St. Clair	5A Hillsborough	5B Los Alamos
4A Benton	4A Lafayette	4A Ste. Genevieve	6A Merrimack	3B Luna
4A Bollinger	4A Lawrence	4A St. Francois	5A Rockingham	5B McKinley
4A Boone	5A Lewis	4A St. Louis	5A Strafford	5B Mora
5A Buchanan	4A Lincoln	4A St. Louis (city)	6A Sullivan	3B Otero
4A Butler	5A Linn	4A Stoddard	4A Atlantic	4B Quay
5A Caldwell	5A Livingston	4A Stone	5A Bergen	5B Rio Arriba
4A Callaway	5A Macon	5A Sullivan	4A Burlington	4B Roosevelt
4A Camden	4A Madison	4A Taney	4A Camden	5B Sandoval
4A Cape Girardeau	4A Maries	4A Texas	4A Cape May	5B San Juan
4A Carroll	5A Marion	4A Vernon		5B San Miguel
4A Carter	4A McDonald	4A Warren		5B Santa Fe
4A Cass	5A Mercer	4A Washington		4B Sierra
4A Cedar	4A Miller	4A Wayne		4B Socorro

(continued)

TABLE N1101.7 (R301.1)—continued
 CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
 DESIGNATIONS BY STATE, COUNTY AND TERRITORY

5B Taos	4A Queens	4A Clay	4A Orange	7 Divide
5B Tarrant	5A Rensselaer	4A Cleveland	3A Pamlico	6A Dunn
4B Union	4A Richmond	3A Columbus*	3A Pasquotank	7 Eddy
4B Valencia	5A Rockland	3A Craven	3A Pender*	6A Emmons
NEW YORK	5A Saratoga	3A Cumberland	3A Perquimans	7 Foster
5A Albany	5A Schenectady	3A Currituck	4A Person	6A Golden Valley
6A Allegany	6A Schoharie	3A Dare	3A Pitt	7 Grand Forks
4A Bronx	6A Schuylar	3A Davidson	4A Polk	6A Grant
6A Broome	5A Seneca	4A Davie	3A Randolph	7 Griggs
6A Cattaraugus	6A Steuben	3A Duplin	3A Richmond	6A Hettinger
5A Cayuga	6A St. Lawrence	4A Durham	3A Robeson	7 Kidder
5A Chautauqua	4A Suffolk	3A Edgecombe	4A Rockingham	6A LaMoure
5A Chemung	6A Sullivan	4A Forsyth	3A Rowan	6A Logan
6A Chenango	5A Tioga	4A Franklin	4A Rutherford	7 McHenry
6A Clinton	6A Tompkins	3A Gaston	3A Sampson	6A McIntosh
5A Columbia	6A Ulster	4A Gates	3A Scotland	6A McKenzie
5A Cortland	6A Warren	4A Graham	3A Stanly	7 McLean
6A Delaware	5A Washington	4A Granville	4A Stokes	6A Mercer
5A Dutchess	5A Wayne	3A Greene	4A Surry	6A Morton
5A Erie	4A Westchester	4A Guilford	4A Swain	7 Mountrail
6A Essex	6A Wyoming	4A Halifax	4A Transylvania	7 Nelson
6A Franklin	5A Yates	4A Harnett	3A Tyrrell	6A Oliver
6A Fulton	NORTH	4A Haywood	3A Union	7 Pembina
5A Genesee	CAROLINA	4A Henderson	4A Vance	7 Pierce
5A Greene	4A Alamance	4A Hertford	4A Wake	7 Ramsey
6A Hamilton	4A Alexander	3A Hoke	4A Warren	6A Ransom
6A Herkimer	5A Alleghany	3A Hyde	3A Washington	7 Renville
6A Jefferson	3A Anson	4A Iredell	5A Watauga	6A Richland
4A Kings	5A Ashe	4A Jackson	3A Wayne	7 Rolette
6A Lewis	5A Avery	3A Johnston	4A Wilkes	6A Sargent
5A Livingston	3A Beaufort	4A Lee	3A Wilson	7 Sheridan
6A Madison	4A Bertie	3A Lenoir	4A Yadkin	6A Sioux
5A Monroe	3A Bladen	4A Lincoln	5A Yancey	6A Slope
6A Montgomery	3A Brunswick*	4A Macon	NORTH DAKOTA	6A Stark
4A Nassau	4A Buncombe	4A Madison	6A Adams	7 Steele
4A New York	4A Burke	3A Martin	7 Barnes	7 Stutsman
5A Niagara	3A Cabarrus	4A McDowell	7 Benson	7 Towner
6A Oneida	4A Caldwell	3A Mecklenburg	6A Billings	7 Traill
5A Onondaga	3A Camden	5A Mitchell	7 Bottineau	7 Walsh
5A Ontario	3A Carteret*	3A Montgomery	6A Bowman	7 Ward
5A Orange	4A Caswell	3A Moore	7 Burke	7 Wells
5A Orleans	4A Catawba	4A Nash	6A Burleigh	7 Williams
5A Oswego	4A Chatham	3A New Hanover*	7 Cass	OHIO
6A Otsego	4A Cherokee	4A Northampton	7 Cavalier	4A Adams
5A Putnam	3A Chowan	3A Onslow*	6A Dickey	5A Allen

(continued)

TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

5A Ashland	5A Mahoning	3A Bryan	3A Okfuskee	4C Linn
5A Ashtabula	5A Marion	3A Caddo	3A Oklahoma	5B Malheur
5A Athens	5A Medina	3A Canadian	3A Okmulgee	4C Marion
5A Auglaize	5A Meigs	3A Carter	3A Osage	5B Morrow
5A Belmont	5A Mercer	3A Cherokee	3A Ottawa	4C Multnomah
4A Brown	5A Miami	3A Choctaw	3A Pawnee	4C Polk
5A Butler	5A Monroe	4B Cimarron	3A Payne	5B Sherman
5A Carroll	5A Montgomery	3A Cleveland	3A Pittsburg	4C Tillamook
5A Champaign	5A Morgan	3A Coal	3A Pontotoc	5B Umatilla
5A Clark	5A Morrow	3A Comanche	3A Pottawatomie	5B Union
4A Clermont	5A Muskingum	3A Cotton	3A Pushmataha	5B Wallowa
5A Clinton	5A Noble	3A Craig	3A Roger Mills	5B Wasco
5A Columbiana	5A Ottawa	3A Creek	3A Rogers	4C Washington
5A Coshocton	5A Paulding	3A Custer	3A Seminole	5B Wheeler
5A Crawford	5A Perry	3A Delaware	3A Sequoyah	4C Yamhill
5A Cuyahoga	5A Pickaway	3A Dewey	3A Stephens	
5A Darke	4A Pike	3A Ellis	4B Texas	PENNSYLVANIA
5A Defiance	5A Portage	3A Garfield	3A Tillman	5A Adams
5A Delaware	5A Preble	3A Garvin	3A Tulsa	5A Allegheny
5A Erie	5A Putnam	3A Grady	3A Wagoner	5A Armstrong
5A Fairfield	5A Richland	3A Grant	3A Washington	5A Beaver
5A Fayette	5A Ross	3A Greer	3A Washita	5A Bedford
5A Franklin	5A Sandusky	3A Harmon	3A Woods	5A Berks
5A Fulton	4A Scioto	3A Harper	3A Woodward	5A Blair
4A Gallia	5A Seneca	3A Haskell		5A Bradford
5A Geauga	5A Shelby	3A Hughes	OREGON	4A Bucks
5A Greene	5A Stark	3A Jackson	5B Baker	5A Butler
5A Guernsey	5A Summit	3A Jefferson	4C Benton	5A Cambria
4A Hamilton	5A Trumbull	3A Johnston	4C Clackamas	6A Cameron
5A Hancock	5A Tuscarawas	3A Kay	4C Clatsop	5A Carbon
5A Hardin	5A Union	3A Kingfisher	4C Columbia	5A Centre
5A Harrison	5A Van Wert	3A Kiowa	4C Coos	4A Chester
5A Henry	5A Vinton	3A Latimer	5B Crook	5A Clarion
5A Highland	5A Warren	3A Le Flore	4C Curry	6A Clearfield
5A Hocking	4A Washington	3A Lincoln	5B Deschutes	5A Clinton
5A Holmes	5A Wayne	3A Logan	4C Douglas	5A Columbia
5A Huron	5A Williams	3A Love	5B Gilliam	5A Crawford
5A Jackson	5A Wood	3A Major	5B Grant	5A Cumberland
5A Jefferson	5A Wyandot	3A Marshall	5B Harney	5A Dauphin
5A Knox		3A Mayes	5B Hood River	4A Delaware
5A Lake	OKLAHOMA	3A McClain	4C Jackson	6A Elk
4A Lawrence	3A Adair	3A McCurtain	5B Jefferson	5A Erie
5A Licking	3A Alfalfa	3A McIntosh	4C Josephine	5A Fayette
5A Logan	3A Atoka	3A Murray	5B Klamath	5A Forest
5A Lorain	4B Beaver	3A Muskogee	5B Lake	5A Franklin
5A Lucas	3A Beckham	3A Noble	4C Lane	5A Fulton
5A Madison	3A Blaine	3A Nowata	4C Lincoln	5A Greene

(continued)

TABLE N1101.7 (R301.1)—continued
 CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
 DESIGNATIONS BY STATE, COUNTY AND TERRITORY

5A Huntingdon	3A Bamberg*	5A Bennett	6A Minnehaha	4A Gibson
5A Indiana	3A Barnwell*	5A Bon Homme	6A Moody	4A Giles
5A Jefferson	3A Beaufort*	6A Brookings	6A Pennington	4A Grainger
5A Juniata	3A Berkeley*	6A Brown	6A Perkins	4A Greene
5A Lackawanna	3A Calhoun	6A Brule	6A Potter	4A Grundy
5A Lancaster	3A Charleston*	6A Buffalo	6A Roberts	4A Hamblen
5A Lawrence	3A Cherokee	6A Butte	6A Sanborn	4A Hamilton
5A Lebanon	3A Chester	6A Campbell	6A Shannon	4A Hancock
5A Lehigh	3A Chesterfield	5A Charles Mix	6A Spink	3A Hardeman
5A Luzerne	3A Clarendon	6A Clark	6A Stanley	3A Hardin
5A Lycoming	3A Colleton*	5A Clay	6A Sully	4A Hawkins
6A McKean	3A Darlington	6A Codrington	5A Todd	3A Haywood
5A Mercer	3A Dillon	6A Corson	5A Tripp	3A Henderson
5A Mifflin	3A Dorchester*	6A Custer	6A Turner	4A Henry
5A Monroe	3A Edgefield	6A Davison	5A Union	4A Hickman
4A Montgomery	3A Fairfield	6A Day	6A Walworth	4A Houston
5A Montour	3A Florence	6A Deuel	5A Yankton	4A Humphreys
5A Northampton	3A Georgetown*	6A Dewey	6A Ziebach	4A Jackson
5A Northumberland	3A Greenville	5A Douglas	TENNESSEE	4A Jefferson
5A Perry	3A Greenwood	6A Edmunds	4A Anderson	4A Johnson
4A Philadelphia	3A Hampton*	6A Fall River	4A Bedford	4A Knox
5A Pike	3A Horry*	6A Faulk	4A Benton	3A Lake
6A Potter	3A Jasper*	6A Grant	4A Bledsoe	3A Lauderdale
5A Schuylkill	3A Kershaw	5A Gregory	4A Blount	4A Lawrence
5A Snyder	3A Lancaster	6A Haakon	4A Bradley	4A Lewis
5A Somerset	3A Laurens	6A Hamlin	4A Campbell	4A Lincoln
5A Sullivan	3A Lee	6A Hand	4A Cannon	4A Loudon
6A Susquehanna	3A Lexington	6A Hanson	4A Carroll	4A Macon
6A Tioga	3A Marion	6A Harding	4A Carter	3A Madison
5A Union	3A Marlboro	6A Hughes	4A Cheatham	4A Marion
5A Venango	3A McCormick	5A Hutchinson	3A Chester	4A Marshall
5A Warren	3A Newberry	6A Hyde	4A Claiborne	4A Maury
5A Washington	3A Oconee	5A Jackson	4A Clay	4A McMinn
6A Wayne	3A Orangeburg	6A Jerauld	4A Cocke	3A McNairy
5A Westmoreland	3A Pickens	6A Jones	4A Coffee	4A Meigs
5A Wyoming	3A Richland	6A Kingsbury	3A Crockett	4A Monroe
4A York	3A Saluda	6A Lake	4A Cumberland	4A Montgomery
RHODE ISLAND	3A Spartanburg	6A Lawrence	4A Davidson	4A Moore
5A (all)	3A Sumter	6A Lincoln	4A Decatur	4A Morgan
SOUTH	3A Union	6A Lyman	4A DeKalb	4A Obion
CAROLINA	3A Williamsburg	6A Marshall	4A Dickson	4A Overton
3A Abbeville	3A York	6A McCook	3A Dyer	4A Perry
3A Aiken	SOUTH DAKOTA	6A McPherson	3A Fayette	4A Pickett
3A Allendale*	6A Aurora	6A Meade	4A Fentress	4A Polk
3A Anderson	6A Beadle	5A Mellette	4A Franklin	4A Putnam
		6A Miner		4A Rhea

(continued)

TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

4A Roane	3B Brewster	3B Ector	3B Howard	3B McCulloch
4A Robertson	4B Briscoe	2B Edwards	3B Hudspeth	2A McLennan*
4A Rutherford	2A Brooks*	3A Ellis*	3A Hunt*	2A McMullen*
4A Scott	3A Brown*	3B El Paso	4B Hutchinson	2B Medina
4A Sequatchie	2A Burleson*	3A Erath*	3B Irion	3B Menard
4A Sevier	3A Burnet*	2A Falls*	3A Jack	3B Midland
3A Shelby	2A Caldwell*	3A Fannin	2A Jackson*	2A Milam*
4A Smith	2A Calhoun*	2A Fayette*	2A Jasper*	3A Mills*
4A Stewart	3B Callahan	3B Fisher	3B Jeff Davis	3B Mitchell
4A Sullivan	2A Cameron*	4B Floyd	2A Jefferson*	3A Montague
4A Sumner	3A Camp*	3B Foard	2A Jim Hogg*	2A Montgomery*
3A Tipton	4B Carson	2A Fort Bend*	2A Jim Wells*	4B Moore
4A Trousdale	3A Cass*	3A Franklin*	3A Johnson*	3A Morris*
4A Unicoi	4B Castro	2A Freestone*	3B Jones	3B Motley
4A Union	2A Chambers*	2B Frio	2A Karnes*	3A Nacogdoches*
4A Van Buren	2A Cherokee*	3B Gaines	3A Kaufman*	3A Navarro*
4A Warren	3B Childress	2A Galveston*	3A Kendall*	2A Newton*
4A Washington	3A Clay	3B Garza	2A Kenedy*	3B Nolan
4A Wayne	4B Cochran	3A Gillespie*	3B Kent	2A Nueces*
4A Weakley	3B Coke	3B Glasscock	3B Kerr	4B Ochiltree
4A White	3B Coleman	2A Goliad*	3B Kimble	4B Oldham
4A Williamson	3A Collin*	2A Gonzales*	3B King	2A Orange*
4A Wilson	3B Collingsworth	4B Gray	2B Kinney	3A Palo Pinto*
TEXAS	2A Colorado*	3A Grayson	2A Kleberg*	3A Panola*
2A Anderson*	2A Comal*	3A Gregg*	3B Knox	3A Parker*
3B Andrews	3A Comanche*	2A Grimes*	3A Lamar*	4B Parmer
2A Angelina*	3B Concho	2A Guadalupe*	4B Lamb	3B Pecos
2A Aransas*	3A Cooke	4B Hale	3A Lampasas*	2A Polk*
3A Archer	2A Coryell*	3B Hall	2B La Salle	4B Potter
4B Armstrong	3B Cottle	3A Hamilton*	2A Lavaca*	3B Presidio
2A Atascosa*	3B Crane	4B Hansford	2A Lee*	3A Rains*
2A Austin*	3B Crockett	3B Hardeman	2A Leon*	4B Randall
4B Bailey	3B Crosby	2A Hardin*	2A Liberty*	3B Reagan
2B Bandera	3B Culberson	2A Harris*	2A Limestone*	2B Real
2A Bastrop*	4B Dallam	3A Harrison*	4B Lipscomb	3A Red River*
3B Baylor	3A Dallas*	4B Hartley	2A Live Oak*	3B Reeves
2A Bee*	3B Dawson	3B Haskell	3A Llano*	2A Refugio*
2A Bell*	4B Deaf Smith	2A Hays*	3B Loving	4B Roberts
2A Bexar*	3A Delta	3B Hemphill	3B Lubbock	2A Robertson*
3A Blanco*	3A Denton*	3A Henderson*	3B Lynn	3A Rockwall*
3B Borden	2A DeWitt*	2A Hidalgo*	2A Madison*	3B Runnels
2A Bosque*	3B Dickens	2A Hill*	3A Marion*	3A Rusk*
3A Bowie*	2B Dimmit	4B Hockley	3B Martin	3A Sabine*
2A Brazoria*	4B Donley	3A Hood*	3B Mason	3A San Augustine*
2A Brazos*	2A Duval*	3A Hopkins*	2A Matagorda*	2A San Jacinto*
	3A Eastland	2A Houston*	2B Maverick	2A San Patricio*

(continued)

TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY

3A San Saba*	3A Young	4C Clark	4A Gilmer	WISCONSIN
3B Schleicher	2B Zapata	5B Columbia	5A Grant	
3B Scurry	2B Zavala	4C Cowlitz	5A Greenbrier	
3B Shackelford		5B Douglas	5A Hampshire	
3A Shelby*	UTAH	6B Ferry	5A Hancock	
4B Sherman	5B Beaver	5B Franklin	5A Hardy	
3A Smith*	6B Box Elder	5B Garfield	5A Harrison	
3A Somervell*	6B Cache	5B Grant	4A Jackson	
2A Starr*	6B Carbon	4C Grays Harbor	4A Jefferson	
3A Stephens	6B Daggett	4C Island	4A Kanawha	
3B Sterling	5B Davis	4C Jefferson	5A Lewis	
3B Stonewall	6B Duchesne	4C King	4A Lincoln	
3B Sutton	5B Emery	4C Kitsap	4A Logan	
4B Swisher	5B Garfield	5B Kittitas	5A Marion	
3A Tarrant*	5B Grand	5B Klickitat	5A Marshall	
3B Taylor	5B Iron	4C Lewis	4A Mason	
3B Terrell	5B Juab	5B Lincoln	4A McDowell	
3B Terry	5B Kane	4C Mason	4A Mercer	
3B Throckmorton	5B Millard	6B Okanogan	5A Mineral	
3A Titus*	6B Morgan	4C Pacific	4A Mingo	
3B Tom Green	5B Piute	6B Pend Oreille	5A Monongalia	
2A Travis*	6B Rich	4C Pierce	4A Monroe	
2A Trinity*	5B Salt Lake	4C San Juan	4A Morgan	
2A Tyler*	5B San Juan	4C Skagit	5A Nicholas	
3A Upshur*	5B Sanpete	5B Skamania	5A Ohio	
3B Upton	5B Sevier	4C Snohomish	5A Pendleton	
2B Uvalde	6B Summit	5B Spokane	4A Pleasants	
2B Val Verde	5B Tooele	6B Stevens	5A Pocahontas	
3A Van Zandt*	6B Uintah	4C Thurston	5A Preston	
2A Victoria*	5B Utah	4C Wahkiakum	4A Putnam	
2A Walker*	6B Wasatch	5B Walla Walla	5A Raleigh	
2A Waller*	3B Washington	4C Whatcom	5A Randolph	
3B Ward	5B Wayne	5B Whitman	4A Ritchie	
2A Washington*	5B Weber	5B Yakima	4A Roane	
2B Webb	VERMONT	WEST VIRGINIA	5A Summers	
2A Wharton*	6A (all)	5A Barbour	5A Taylor	
3B Wheeler	VIRGINIA	4A Berkeley	5A Tucker	
3A Wichita	4A (all)	4A Boone	4A Tyler	
3B Wilbarger	WASHINGTON	4A Braxton	5A Upshur	
2A Willacy*	5B Adams	5A Brooke	4A Wayne	
2A Williamson*	5B Asotin	4A Cabell	5A Webster	
2A Wilson*	5B Benton	4A Calhoun	5A Wetzel	
3B Winkler	5B Benton	4A Clay	4A Wirt	
3A Wise	5B Chelan	5A Doddridge	4A Wood	
3A Wood*	4C Clallam	5A Fayette	4A Wyoming	
4B Yoakum				

(continued)

**TABLE N1101.7 (R301.1)—continued
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY**

6A Ozaukee	7 Taylor	6B Big Horn	6B Sheridan	NORTHERN MARIANA ISLANDS
6A Pepin	6A Trempealeau	6B Campbell	7 Sublette	
6A Pierce	6A Vernon	6B Carbon	6B Sweetwater	1A (all)*
6A Polk	7 Vilas	6B Converse	7 Teton	
6A Portage	6A Walworth	6B Crook	6B Uinta	PUERTO RICO
7 Price	7 Washburn	6B Fremont	6B Washakie	
6A Racine	6A Washington	5B Goshen	6B Weston	1A (all)*
6A Richland	6A Waukesha	6B Hot Springs	US TERRITORIES	VIRGIN ISLANDS
6A Rock	6A Waupaca	6B Johnson		
6A Rusk	6A Waushara	6B Laramie	AMERICAN SAMOA	1A (all)*
6A Sauk	6A Winnebago	7 Lincoln		
7 Sawyer	6A Wood	6B Natrona	GUAM	1A (all)*
6A Shawano	WYOMING	6B Niobrara		
6A Sheboygan		6B Albany	6B Park	
6A St. Croix		5B Platte		

**TABLE N1101.7.2(1) [R302.3(1)]
INTERNATIONAL CLIMATE ZONE DEFINITIONS**

MAJOR CLIMATE TYPE DEFINITIONS
<p>Marine (C) Definition—Locations meeting all four criteria:</p> <ol style="list-style-type: none"> 1. Mean temperature of coldest month between -3°C (27°F) and 18°C (65°F). 2. Warmest month mean < 22°C (72°F). 3. At least four months with mean temperatures over 10°C (50°F). 4. Dry season in summer. The month with the heaviest precipitation in the cold season has at least three times as much precipitation as the month with the least precipitation in the rest of the year. The cold season is October through March in the Northern Hemisphere and April through September in the Southern Hemisphere.
<p>Dry (B) Definition—Locations meeting the following criteria: Not marine and $P_{in} < 0.44 \times (TF - 19.5)$ [$P_{cm} < 2.0 \times (TC + 7)$ in SI units] where: P_{in} = Annual precipitation in inches (cm) T = Annual mean temperature in °F (°C)</p>
<p>Moist (A) Definition—Locations that are not marine and not dry.</p>
<p>Warm-humid Definition—Moist (A) locations where either of the following wet-bulb temperature conditions shall occur during the warmest six consecutive months of the year:</p> <ol style="list-style-type: none"> 1. 67°F (19.4°C) or higher for 3,000 or more hours; or 2. 73°F (22.8°C) or higher for 1,500 or more hours.

For SI: °C = [(°F)-32]/1.8, 1 inch = 2.54 cm.

**TABLE N1101.7.2(2) [R301.3(2)]
INTERNATIONAL CLIMATE ZONE DEFINITIONS**

ZONE NUMBER	THERMAL CRITERIA	
	IP Units	SI Units
1	9000 < CDD50°F	5000 < CDD10°C
2	6300 < CDD50°F ≤ 9000	3500 < CDD10°C ≤ 5000
3A and 3B	4500 < CDD50°F ≤ 6300 AND HDD65°F ≤ 5400	2500 < CDD10°C ≤ 3500 AND HDD18°C ≤ 3000
4A and 4B	CDD50°F ≤ 4500 AND HDD65°F ≤ 5400	CDD10°C ≤ 2500 AND HDD18°C ≤ 3000
3C	HDD65°F ≤ 3600	HDD18°C ≤ 2000
4C	3600 < HDD65°F ≤ 5400	2000 < HDD18°C ≤ 3000
5	5400 < HDD65°F ≤ 7200	3000 < HDD18°C ≤ 4000
6	7200 < HDD65°F ≤ 9000	4000 < HDD18°C ≤ 5000
7	9000 < HDD65°F ≤ 12600	5000 < HDD18°C ≤ 7000
8	12600 < HDD65°F	7000 < HDD18°C

For SI: °C = [(°F)-32]/1.8.

N1101.9 (R302.1) Interior design conditions. The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

N1101.10 (R303.1) 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.

N1101.10.1 (R303.1.1) 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. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For insulated siding, the *R*-value shall be labeled on the product's package and shall be *listed* on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

N1101.10.1.1 (R303.1.1.1) Blown or sprayed roof/ceiling insulation. The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m²) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers not less than 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed *R*-value shall be *listed* on certification provided by the insulation installer.

N1101.10.2 (R303.1.2) Insulation mark installation. Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection.

N1101.10.3 (R303.1.3) Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100.

Exception: Where required, garage door *U*-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors shall be determined 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 Table N1101.10.3(1) or N1101.10.3(2). The solar heat gain coefficient (SHGC) and visible transmittance (VT) 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 or VT shall be assigned a default SHGC or VT from Table N1101.10.3(3).

**TABLE N1101.10.3(1) [R303.1.3(1)]
DEFAULT GLAZED FENESTRATION U-FACTORS**

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 N1101.10.3(2) [R303.1.3(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 N1101.10.3(3) [R303.1.3(3)]
DEFAULT GLAZED FENESTRATION SHGC AND VT**

	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6
VT	0.6	0.3	0.6	0.3	0.6

N1101.10.4 (R303.1.4) Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (CFR Title 16, Part 460) in units of $h \times ft^2 \times \text{°F/Btu}$ at a mean temperature of 75°F (24°C).

N1101.10.4.1 (R303.1.4.1) Insulated siding. The thermal resistance (*R*-value) of insulated siding shall be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's installation instructions.

N1101.11 (R303.2) Installation. All materials, systems and equipment shall be installed in accordance with the manufacturer's instructions and this code.

N1101.11.1 (R303.2.1) 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 not less than 6 inches (153 mm) below grade.

N1101.12 (R303.3) Maintenance information. Deleted.

N1101.13 (R401.2) Compliance. Projects shall comply with one of the following:

1. Sections N1101.14 through N1104.
2. Section N1105 and the provisions of Sections N1101.14 through N1104 labeled "Mandatory."
3. An energy rating index (ERI) approach in Section N1106.

N1101.13.1 (R401.2.1) Tropical zone. *Residential buildings* in the tropical zone at elevations below 2,400 feet (731.5 m) above sea level shall be deemed to comply with this chapter where the following conditions are met:

1. Not more than one-half of the *occupied* space is air conditioned.
2. The *occupied* space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
4. Glazing in *conditioned* space has a *solar heat gain coefficient* of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section N1104.
6. The exterior roof surface complies with one of the options in Table C402.2.1.1 of the *International Energy Conservation Code*, or the roof/ceiling has

insulation with an *R*-value of R-15 or greater. If present, attics above the insulation are vented and attics below the insulation are unvented.

7. Roof surfaces have a minimum slope of $\frac{1}{4}$ inch (6.4 mm) per foot of run. The finished roof does not have water accumulation areas.
8. Operable fenestration provides ventilation area equal to not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

N1101.14 (R401.3) Certificate (Mandatory). A permanent certificate shall be completed by the builder or registered design professional and posted on a wall in the space where the furnace is located, a utility room or an 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 list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawl space wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration, and the results from any required duct system and building envelope air leakage testing done on the building. 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 types 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 list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

SECTION N1102 (R402) BUILDING THERMAL ENVELOPE

N1102.1 (R402.1) General (Prescriptive). The *building thermal envelope* shall meet the requirements of Sections N1102.1.1 through N1102.1.4.

Exception: 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 N1102.

1. Those with a peak design rate of energy usage less than $3.4 \text{ Btu/h} \cdot \text{ft}^2$ (10.7 W/m^2) or 1.0 watt/ft^2 of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.

N1102.1.1 (R402.1.1) Vapor retarder. Wall assemblies in the *building thermal envelope* shall comply with the vapor retarder requirements of Section R702.7.

N1102.1.2 (R402.1.2) Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table N1102.1.2 based on the climate zone specified in Section N1101.7.

N1102.1.3 (R402.1.3) R-value computation. Insulation material used in layers, such as framing cavity insulation, or continuous insulation shall be summed to compute the corresponding component *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. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Table N1102.1.2, the manufacturer's labeled *R*-Value for insulated siding shall be reduced by R-0.6.

N1102.1.4 (R402.1.4) U-factor alternative. An assembly with a *U*-factor equal to or less than that specified in Table N1102.1.4 shall be permitted as an alternative to the *R*-value in Table N1102.1.2.

TABLE N1102.1.2 (R402.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b,e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^e WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13 + 5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13 + 5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13 + 5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20 + 5 or 13 + 10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20 + 5 or 13 + 10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

- R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.
- The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.
- "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
- R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.
- There are no SHGC requirements in the Marine Zone.
- Basement wall insulation is not required in warm-humid locations as defined by Figure N1101.10 and Table N1101.10.
- Or insulation sufficient to fill the framing cavity, R-19 minimum.
- The first value is cavity insulation, the second value is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

TABLE N1102.1.4 (R402.1.4)
EQUIVALENT U-FACTORS^a

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.35	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.35	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.32	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.32	0.55	0.026	0.045	0.057	0.028	0.050	0.055

- Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.087 in Zone 4 except Marine, 0.065 in Zone 5 and Marine 4, and 0.057 in Zones 6 through 8.
- Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure N1101.10 (R301.1) and Table N1101.10 (R301.1).

N1102.1.5 (R402.1.5) 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 N1102.1.4 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table N1102.1.2. 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. The SHGC requirements shall be met in addition to UA compliance.

N1102.2 (R402.2) Specific insulation requirements (Prescriptive). In addition to the requirements of Section N1102.1, insulation shall meet the specific requirements of Sections N1102.2.1 through N1102.2.13.

N1102.2.1 (R402.2.1) Ceilings with attic spaces. Where Section R1102.1.2 would require R-38 insulation in the ceiling, installing R-30 over 100 percent of the ceiling area requiring insulation 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, where Section R1102.1.2 would require R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall be deemed to 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. This reduction shall not apply to the *U*-factor alternative approach in Section R1102.1.4 and the total UA alternative in Section R1102.1.5.

N1102.2.2 (R402.2.2) Ceilings without attic spaces. Where Section N1102.1.2 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 N1102.1.2 shall be limited to 500 square feet (46 m²) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the *U*-factor alternative approach in Section N1102.1.4 and the total UA alternative in Section N1102.1.5.

N1102.2.3 (R402.2.3) Eave baffle. For air-permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal 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.

N1102.2.4 (R402.2.4) Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment that prevents damaging or compressing the insulation. A wood-framed or equivalent baffle or retainer is required to be provided when loose-fill insulation is installed, the purpose of which is to prevent the loose-fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed *R*-value of the loose-fill insulation.

Exception: Vertical doors that provide access from conditioned to unconditioned spaces shall be permitted to meet the fenestration requirements of Table R1102.1.2 based on the applicable climate zone specified in Chapter 3.

N1102.2.5 (R402.2.5) Mass walls. Mass walls for the purposes of this chapter shall be considered above-grade 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, or any other walls having a heat capacity greater than or equal to 6 Btu/ft² × °F (123 kJ/m² × K).

N1102.2.6 (R402.2.6) Steel-frame ceilings, walls, and floors. Steel-frame ceilings, walls, and floors shall meet the insulation requirements of Table N1102.2.6 or shall meet the *U*-factor requirements of Table N1102.1.4. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

N1102.2.7 (R402.2.7) Walls with partial structural sheathing. Where Section R1102.1.2 would require continuous insulation on exterior walls and structural sheathing covers 40 percent or less of the gross area of all exterior walls, the continuous insulation *R*-value shall be permitted to be reduced by an amount necessary to result in a consistent total sheathing thickness, but not more than R-3, on areas of the walls covered by structural sheathing. This reduction shall not apply to the *U*-factor alternative approach in Section R1102.1.4 and the total UA alternative in Section R1102.1.5.

N1102.2.8 (R402.2.8) Floors. Floor framing-cavity insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

Exception: The floor framing-cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing where combined with insulation that meets or exceeds the minimum wood frame wall *R*-value in Table 1102.1.2 and that extends from the bottom to the top of all perimeter floor framing members.

N1102.2.9 (R402.2.9) Basement walls. Walls associated with conditioned basements shall be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections N1102.1.2 and N1102.2.8.

N1102.2.10 (R402.2.10) 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 N1102.1.2. 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 N1102.1.2 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 not less than 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 *building official* as having a very heavy termite infestation.

TABLE N1102.2.6 (R402.2.6)
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 2 × 4 or 2 × 6 or 2 × 8 R-49 in any framing
R-38	R-49 in 2 × 4 or 2 × 6 or 2 × 8 or 2 × 10
Steel-Framed Wall, 16" on center	
R-13	R-13 + 4.2 or R-19 + 2.1 or R-21 + 2.8 or R-0 + 9.3 or R-15 + 3.8 or R-21 + 3.1
R-13 + 3	R-0 + 11.2 or R-13 + 6.1 or R-15 + 5.7 or R-19 + 5.0 or R-21 + 4.7
R-20	R-0 + 14.0 or R-13 + 8.9 or R-15 + 8.5 or R-19 + 7.8 or R-19 + 6.2 or R-21 + 7.5
R-20 + 5	R-13 + 12.7 or R-15 + 12.3 or R-19 + 11.6 or R-21 + 11.3 or R-25 + 10.9
R-21	R-0 + 14.6 or R-13 + 9.5 or R-15 + 9.1 or R-19 + 8.4 or R-21 + 8.1 or R-25 + 7.7
Steel-Framed Wall, 24" on center	
R-13	R-0 + 9.3 or R-13 + 3.0 or R-15 + 2.4
R-13 + 3	R-0 + 11.2 or R-13 + 4.9 or R-15 + 4.3 or R-19 + 3.5 or R-21 + 3.1
R-20	R-0 + 14.0 or R-13 + 7.7 or R-15 + 7.1 or R-19 + 6.3 or R-21 + 5.9
R-20 + 5	R-13 + 11.5 or R-15 + 10.9 or R-19 + 10.1 or R-21 + 9.7 or R-25 + 9.1
R-21	R-0 + 14.6 or R-13 + 8.3 or R-15 + 7.7 or R-19 + 6.9 or R-21 + 6.5 or R-25 + 5.9
Steel Joist Floor	
R-13	R-19 in 2 × 6, or R-19 + 6 in 2 × 8 or 2 × 10
R-19	R-19 + 6 in 2 × 6, or R-19 + 12 in 2 × 8 or 2 × 10

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.

N1102.2.11 (R402.2.11) 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 Class I vapor retarder in accordance with this code. All joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

N1102.2.12 (R402.2.12) Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

N1102.2.13 (R402.2.13) Sunroom insulation. *Sunrooms* enclosing conditioned spaces shall meet the insulation requirements of this code.

Exception: For *sunrooms* with *thermal isolation*, and enclosing conditioned spaces, the following exceptions to the insulation requirements of this code shall apply:

1. The minimum ceiling insulation R-values shall be R-19 in Zones 1 through 4 and R-24 in Zones 5 through 8.
2. The minimum wall R-value shall be R-13 in all *climate zones*. Walls separating a *sunroom* with a *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

N1102.3 (R402.3) Fenestration (Prescriptive). In addition to the requirements of Section N1102, fenestration shall comply with Sections N1102.3.1 through N1102.4.5.

N1102.3.1 (R402.3.1) U-factor. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements.

N1102.3.2 (R402.3.2) Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50-percent glazed shall be permitted to satisfy the SHGC requirements.

Dynamic glazing shall be permitted to satisfy the SHGC requirements of Table R1102.1.2 provided the ratio of the higher to lower labeled SHGC is greater than or equal to 2.4, and the *dynamic glazing* is automatically controlled to modulate the amount of solar gain into the space in multiple steps. *Dynamic glazing* shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

Exception: *Dynamic glazing* is not required to comply with this section when both the lower and higher labeled SHGC already comply with the requirements of Table N1102.1.2.

N1102.3.3 (R402.3.3) Glazed fenestration exemption. Up to 15 square feet (1.4 m²) of glazed fenestration per dwelling unit shall be permitted to be exempt from U-factor and SHGC requirements in Section N1102.1.2. This exemption shall not apply to the U-factor alternative approach in Section N1102.1.4 and the total UA alternative in Section N1102.1.5.

N1102.3.4 (R402.3.4) Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (2.22 m²) in area is exempted from the *U*-factor requirement in Section N1102.1.2. This exemption shall not apply to the *U*-factor alternative approach in Section N1102.1.4 and the total UA alternative in Section N1102.1.5.

N1102.3.5 (R402.3.5) Sunroom fenestration. *Sunrooms* enclosing *conditioned space* shall meet the fenestration requirements of this code.

Exception: For *sunrooms* with *thermal isolation* and enclosing *conditioned space* in *Climate Zones* 2 through 8, the maximum fenestration *U*-factor shall be 0.45 and the maximum skylight *U*-factor shall be 0.70.

New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

N1102.4 (R402.4) Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R1102.4.1 through R1102.4.4.

N1102.4.1 (R402.4.1) Building thermal envelope. The *building thermal envelope* shall comply with Sections N1102.4.1.1 or N1102.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

N1102.4.1.1 (R402.4.1.1) Installation. The components of the *building thermal envelope* as listed in Table N1102.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.1.1, as applicable to the method of construction. Where required by the *building official*, an *approved* third party shall inspect all components and verify compliance.

N1102.4.1.2 (R402.4.1.2) Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.

2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

N1102.4.2 (R402.4.2) Fireplaces. New wood-burning fireplaces shall have tight-fitting flue dampers or doors, and outdoor combustion air. Where using tight-fitting doors on factory-built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907.

N1102.4.3 (R402.4.3) Fenestration air leakage. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m²), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m²), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and *listed* and *labeled* by the manufacturer.

Exception: Site-built windows, skylights and doors.

N1102.4.4 (R402.4.4) Rooms containing fuel-burning appliances. In *Climate Zones* 3 through 8, where open combustion air ducts provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening shall be located outside the building thermal envelope or enclosed in a room, isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table N1102.1.2, where the walls, floors and ceilings shall meet a minimum of the basement wall *R*-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section N1103. The combustion air duct shall be insulated where it passes through conditioned space to a minimum of *R*-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Sections N1102.4.2 and R1006.

**TABLE N1102.4.1.1 (402.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing, and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and extends from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawl space walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air-sealed boxes shall be installed.	
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC 400.

N1102.4.5 (R402.4.5) Recessed lighting. Recessed luminaires installed in the *building thermal envelope* shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and *labeled* as having an air leakage rate not more than 2.0 cfm (0.944 L/s) when tested in accordance with ASTM E283 at a 1.57 psf (75 Pa) pressure differential. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

N1102.5 (R402.5) Maximum fenestration U-factor and SHGC (Mandatory). The area-weighted average maximum fenestration U-factor permitted using tradeoffs from Section N1102.1.5 or N1105 shall be 0.48 in climate zones 4 and 5 and 0.40 in climate zones 6 through 8 for vertical fenestration, and 0.75 in climate zones 4 through 8 for skylights. The area-weighted average maximum fenestration SHGC permitted using tradeoffs from Section N1105 in climate zones 1 through 3 shall be 0.50.

SECTION N1103 (R403) SYSTEMS

N1103.1 (R403.1) Controls (Mandatory). At least one thermostat shall be provided for each separate heating and cooling system.

N1103.1.1 (R403.1.1) Programmable thermostat. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C).

N1103.1.2 (R403.1.2) Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

N1103.2 (R403.2) Hot water boiler outdoor temperature setback. Deleted.

N1103.3 (R403.3) Ducts. Ducts and air handlers shall be in accordance with Sections N1103.3.1 through N1103.3.5.

N1103.3.1 (R403.3.1) Insulation (Prescriptive). Supply and return ducts in attics shall be insulated to a minimum of R-8 where 3 inches (76.2 mm) in diameter and greater and R-6 where less than 3 inches (76.2 mm) in diameter. Supply and return ducts in other portions of the building shall be insulated to a minimum of R-6 where 3 inches (76.2 mm) in diameter or greater and R-4.2 where less than 3 inches (76.2 mm) in diameter.

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

N1103.3.2 (R403.3.2) Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or Section M1601.4.1 of this code, as applicable.

Exceptions:

1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.
2. For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams, and locking-type joints and seams of other than the snap-lock and button-lock types.

N1103.3.2.1 (R403.3.2.1) Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

N1103.3.3 (R403.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exception: A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

N1103.3.4 (R403.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

N1103.3.5 (R403.3.5) Building cavities (Mandatory). Building framing cavities shall not be used as ducts or plenums.

N1103.4 (R403.4) Mechanical system piping insulation (Mandatory). 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-3.

N1103.4.1 (R403.4.1) Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind, and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

N1103.5 (R403.5) Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections N1103.5.1 and N1103.5.4.

N1103.5.1 (R403.5.1) Heated water circulation and temperature maintenance systems (Mandatory). Heated water circulation systems shall be in accordance with Section R1103.5.1.1. Heat trace temperature maintenance systems shall be in accordance with Section R1103.5.1.2. Automatic controls, temperature sensors and pumps shall be accessible. Manual controls shall be readily *accessible*.

N1103.5.1.1 (R403.5.1.1) Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

N1103.5.1.2 (R403.5.1.2) Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1 or UL 515. Controls for such systems shall automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

N1103.5.2 (R403.5.2) Demand recirculation systems. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a *demand recirculation water system*. Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appli-

ance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The control shall limit the temperature of the water entering the cold water piping to 104°F (40°C).

N1103.5.3 (R403.5.3) Hot water pipe insulation (Prescriptive). Insulation for hot water pipe with a minimum thermal resistance (*R*-value) of R-3 shall be applied to the following:

1. Piping $\frac{3}{4}$ inch (19 mm) and larger in nominal diameter.
2. Piping serving more than one dwelling unit.
3. Piping located outside the conditioned space.
4. Piping from the water heater to a distribution manifold.
5. Piping located under a floor slab.
6. Buried piping.
7. Supply and return piping in recirculation systems other than demand recirculation systems.

N1103.5.4 (R403.5.4) Drain water heat recovery units. Drain water heat recovery units shall comply with CSA 55.2. Drain water heat recovery units shall be tested in accordance with CSA 55.1. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi (20.7 kPa) for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi (13.8 kPa) for individual units connected to three or more showers.

N1103.6 (R403.6) Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of this code or the *International Mechanical Code*, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

N1103.6.1 (R403.6.1) Whole-house mechanical ventilation system fan efficacy. Mechanical ventilation system fans shall meet the efficacy requirements of Table N1103.6.1.

Exception: Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

TABLE N1103.6.1 (R403.6.1)
MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cubic foot per minute = 28.3 L/min.

N1103.7 (R403.7) Equipment sizing and efficiency rating (Mandatory). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies. New heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

N1103.8 (R403.8) Systems serving multiple dwelling units (Mandatory). Systems serving multiple dwelling units shall comply with Chapters 6 and 7 of the ASHRAE Standard 90.1-2013 in lieu of Section N1103.

N1103.9 (R403.9) Snow melt system controls (Mandatory). Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C), and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (4.8°C).

N1103.10 (R403.10) Pools and permanent spa energy consumption (Mandatory). The energy consumption of pools and permanent spas shall be in accordance with Sections N1103.10.1 through N1103.10.3.

N1103.10.1 (R403.10.1) Heaters. The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

N1103.10.2 (R403.10.2) Time switches. Time switches or other control methods that can automatically turn off and on according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.

N1103.10.3 (R403.10.3) Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than 70 percent of the energy for heating, computed over an operation season, is from site-recovered energy, such as from a heat pump or solar energy source, covers or other vapor-retardant means shall not be required.

N1103.11 (R403.11) Portable spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14.

N1103.12 (R403.12) Residential pools and permanent residential spas. Residential swimming pools and permanent

residential spas that are accessory to detached one- and two-family dwellings and townhouses 3 stories or less in height above grade plane and that are available only to the household and its guests shall be in accordance with APSP-15.

SECTION N1104 (R404) ELECTRICAL POWER AND LIGHTING SYSTEMS (MANDATORY)

N1104.1 (R404.1) Lighting equipment (Mandatory). Not less than 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps or not less than 75 percent of the permanently installed lighting fixtures shall contain only high-efficacy lamps.

Exception: Low-voltage lighting.

N1104.1.1 (R404.1.1) Lighting equipment (Mandatory). Fuel gas lighting systems shall not have continuously burning pilot lights.

SECTION N1105 (R405) SIMULATED PERFORMANCE ALTERNATIVE (PERFORMANCE)

N1105.1 (R405.1) Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling and service water heating energy only.

N1105.2 (R405.2) Mandatory requirements. Compliance with this section requires that the mandatory provisions identified in Section N1101.13 be met. All supply and return ducts not completely inside the *building thermal envelope* shall be insulated to a minimum of R-6.

N1105.3 (R405.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *building official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Building officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exception: The energy use based on source energy expressed in Btu (J) or Btu per square foot (J/m^2) of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.

N1105.4 (R405.4) Documentation. Documentation of the software used for the performance design and the parameters for the building shall be in accordance with Sections N1105.4.1 through N1105.4.3.

N1105.4.1 (R405.4.1) Compliance software tools. Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the *building official*.

N1105.4.2 (R405.4.2) Compliance report. Compliance software tools shall generate a report that documents that the *proposed design* complies with Section N1105.3. A compliance report on the *proposed design* shall be submitted with the application for the building permit. Upon completion of the building, a compliance report based on the as-built condition of the building shall be submitted to the *code official* before a certificate of occupancy is issued. Batch sampling of buildings to determine energy code compliance for all buildings in the batch shall be prohibited.

Compliance reports shall include information in accordance with Sections N1105.4.2.1 and N1105.4.2.2. Where the *proposed design* of a building could be built on different sites where the cardinal orientation of the building on each site is different, compliance of the *proposed design* for the purposes of the application for the building permit shall be based on the worst-case orientation, worst-case configuration, worst-case building air leakage and worst-case duct leakage. Such worst-case parameters shall be used as inputs to the compliance software for energy analysis.

N1105.4.2.1 (R405.4.2.1) Compliance report for permit application. A compliance report submitted with the application for building permit shall include the following:

1. Building street address, or other building site identification.
2. A statement indicating that the *proposed design* complies with Section N1105.3.
3. An inspection checklist documenting the building component characteristics of the *proposed design* as indicated in Table N1105.5.2(1). The inspection checklist shall show results for both the *standard reference design* and the *proposed design* with user inputs to the compliance software to generate the results.
4. A site-specific energy analysis report that is in compliance with Section N1105.3.
5. The name of the individual performing the analysis and generating the report.
6. The name and version of the compliance software tool.

N1105.4.2.2 (R405.4.2.2) Compliance report for certificate of occupancy. A compliance report submitted for obtaining the certificate of occupancy shall include the following:

1. Building street address, or other building site identification.
2. A statement indicating that the as-built building complies with Section N1105.3.
3. A certificate indicating that the building passes the performance matrix for code compliance and listing the energy saving features of the buildings.
4. A site-specific energy analysis report that is in compliance with Section N1105.3.

5. The name of the individual performing the analysis and generating the report.
6. The name and version of the compliance software tool.

N1105.4.3 (R405.4.3) Additional documentation. The *building official* shall be permitted to require the following documents:

1. Documentation of the building component characteristics of the *standard reference design*.
2. A certification signed by the builder providing the building component characteristics of the *proposed design* as given in Table N1105.5.2(1).
3. Documentation of the actual values used in the software calculations for the *proposed design*.

N1105.5 (R405.5) Calculation procedure. Calculations of the performance design shall be in accordance with Sections N1105.5.1 and N1105.5.2.

N1105.5.1 (R405.5.1) General. Except as specified by this section, the *standard reference design* and *proposed design* shall be configured and analyzed using identical methods and techniques.

N1105.5.2 (R405.5.2) Residence specifications. The *standard reference design* and *proposed design* shall be configured and analyzed as specified by Table N1105.5.2(1). Table N1105.5.2(1) shall include, by reference, all notes contained in Table N1102.1.2.

N1105.6 (R405.6) Calculation software tools. Calculation software, where used, shall be in accordance with Sections N1105.6.1 through N1105.6.3.

N1105.6.1 (R405.6.1) 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 Section N1103.6.
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.
4. Printed *building official* inspection checklist listing each of the *proposed design* component characteristics from Table N1105.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (*R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER, EF are some examples).

**TABLE N1105.5.2(1) [R405.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame.	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: as specified in Table N1102.1.4	As proposed
	Solar absorptance = 0.75	As proposed
	Emittance = 0.90	As proposed
Basement and crawl space walls	Type: same as proposed	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: from Table N1102.1.4, with insulation layer on interior side of walls	As proposed
Above-grade floors	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: as specified in Table N1102.1.4	As proposed
Ceilings	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	<i>U</i> -factor: as specified in Table N1102.1.4	As proposed
Roofs	Type: composition shingle on wood sheathing	As proposed
	Gross area: same as proposed	As proposed
	Solar absorptance = 0.75	As proposed
	Emittance = 0.90	As proposed
Attics	Type: vented with aperture = 1 ft ² per 300 ft ² ceiling area	As proposed
Foundations	Type: same as proposed	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed	As proposed
Opaque doors	Area: 40 ft ²	As proposed
	Orientation: North	As proposed
	<i>U</i> -factor: same as fenestration from Table N1102.1.4	As proposed
Vertical fenestration other than opaque doors	Total area ^b = (a) The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area (b) 15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	<i>U</i> -factor: as specified in Table N1102.1.4	As proposed
	SHGC: as specified in Table N1102.1.2 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
	Interior shade fraction: 0.92-(0.21 × SHGC for the standard reference design)	0.92-(0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
Air exchange rate	Air leakage rate of 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8 at a pressure of 0.2 inches w.g (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where: <i>CFA</i> = conditioned floor area <i>N_{br}</i> = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	For residences that are not tested, the same air leakage rate as the standard reference design. For tested residences, the measured air exchange rate ^a . The mechanical ventilation rate ^b shall be in addition to the air leakage rate and shall be as proposed.

(continued)

TABLE N1105.5.2(1) [R405.5.2(1)]—continued
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Mechanical ventilation	None, except where mechanical ventilation is specified by the proposed design, in which case: Annual vent fan energy use: $\text{kWh/yr} = 0.03942 \times CFA + 29.565 \times (N_{br} + 1)$ where: CFA = conditioned floor area N_{br} = number of bedrooms	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 ^e but not integral to the building envelope or structure.
Structural mass	For masonry floor slabs, 80 percent of floor area covered by R-2 carpet and pad, and 20 percent of floor directly exposed to room air.	As proposed
	For masonry basement walls, as proposed, but with insulation required by Table R402.1.4 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 ^{d, e}	As proposed for other than electric heating without a heat pump, where the proposed design utilizes electric heating without a heat pump the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC-Commercial Provisions. Capacity: sized in accordance with Section N1103.7	As proposed
Cooling systems ^{d, f}	As proposed Capacity: sized in accordance with Section N1103.7.	As proposed
Service water heating ^{d, e, f}	As proposed Use: same as proposed design	As proposed $\text{gal/day} = 30 + (10 \times N_{br})$
Thermal distribution systems	Duct insulation: From Section N1103.2.1 A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems. For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft ² (9.29 m ²) of <i>conditioned floor area</i> at a pressure of differential of 0.1 inches w.g. (25 Pa).	As tested or as specified in Table R405.5.2(2) if not tested. Duct insulation shall be as proposed.
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; Heating temperature setpoint = 72°F	Same as standard reference

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

- Where required by the *code official*, testing shall be conducted by an *approved party*. Hourly calculations as specified in the *ASHRAE Handbook of Fundamentals*, or the equivalent shall be used to determine the energy loads resulting from infiltration.
- The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 *ASHRAE Handbook of Fundamentals*, page 26.24 and the “Whole-house Ventilation” provisions of 2001 *ASHRAE Handbook of Fundamentals*, page 26.19 for intermittent mechanical ventilation.
- Thermal storage element shall mean a component not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.
- For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

**TABLE N1105.5.2(2) [R405.5.2(2)]
DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS^a**

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS ^b
Distribution system components located in unconditioned space	—	0.95
Untested distribution systems entirely located in conditioned space ^c	0.88	1
“Ductless” systems ^d	1	—

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093m², 1 pound per square inch = 6895 Pa, 1 inch water gauge = 1250 Pa.

- a. Default values given by this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.
- b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.
- c. Entire system in conditioned space shall mean that no component of the distribution system, including the air handler unit, is located outside of the conditioned space.
- d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer’s air handler enclosure.

N1105.6.2 (R405.6.2) Specific approval. Performance analysis tools meeting the applicable provisions of Section N1105 shall be permitted to be *approved*. Tools are permitted to be *approved* based on meeting a specified threshold for a jurisdiction. The *building official* shall be permitted to approve tools for a specified application or limited scope.

N1105.6.3 (R405.6.3) Input values. When calculations require input values not specified by Sections N1102, N1103, N1104 and N1105, those input values shall be taken from an *approved* source.

SECTION N1106 (R406) ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

N1106.1 (R406.1) Scope. This section establishes criteria for compliance using an Energy Rating Index (ERI) analysis.

N1106.2 (R406.2) Mandatory requirements. Compliance with this section requires that the mandatory provisions identified in Sections N1101.2 and N1103.5.3 be met. The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.2 or 402.1.4 of the 2009 *International Energy Conservation Code*.

Exception: Supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-6.

N1106.3 (R406.3) Energy rating index. The Energy Rating Index (ERI) shall be a numerical integer value that is based on a linear scale constructed such that the *ERI reference design* has an Index value of 100 and a *residential building* that uses no net purchased energy has an Index value of 0. Each integer value on the scale shall represent a one percent change in the total energy use of the rated design relative to the total energy use of the *ERI reference design*. The ERI shall consider all energy used in the *residential building*.

N1106.3.1 (R406.3.1) ERI reference design. The *ERI reference design* shall be configured such that it meets the minimum requirements of the 2006 *International Energy Conservation Code* prescriptive requirements.

The proposed *residential building* shall be shown to have an annual total normalized modified load less than or equal to the annual total loads of the *ERI reference design*.

N1106.4 (R406.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI less than or equal to the appropriate value listed in Table N1106.4 when compared to the *ERI reference design*.

**TABLE N1106.4 (R406.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

N1106.5 (R406.5) Verification by approved agency. Verification of compliance with Section N1106 shall be completed by an *approved* third party.

N1106.6 (R406.6) Documentation. Documentation of the software used to determine the ERI and the parameters for the residential building shall be in accordance with Sections N1106.6.1 through N1106.6.3.

N1106.6.1 (R406.6.1) Compliance software tools. Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the *code official*.

N1106.6.2 (R406.6.2) Compliance report. Compliance software tools shall generate a report that documents that the ERI of the *rated design* complies with Sections N1106.3 and N1106.4. The compliance documentation shall include the following information:

1. Address or other identification of the residential building.

2. An inspection checklist documenting the building component characteristics of the *rated design*. The inspection checklist shall show results for both the *ERI reference design* and the *rated design*, and shall document all inputs entered by the user necessary to reproduce the results.
3. Name of individual completing the compliance report.
4. Name and version of the compliance software tool.

Exception: Multiple orientations. Where an otherwise identical building model is offered in multiple orientations, compliance for any orientation shall be permitted by documenting that the building meets the performance requirements in each of the four (north, east, south and west) cardinal orientations.

N1106.6.3 (R406.6.3) Additional documentation. The *code official* shall be permitted to require the following documents:

1. Documentation of the building component characteristics of the *ERI reference design*.
2. A certification signed by the builder providing the building component characteristics of the *rated design*.
3. Documentation of the actual values used in the software calculations for the *rated design*.

N1106.7 (R406.7) Calculation software tools. Calculation software, where used, shall be in accordance with Sections N1106.7.1 through N1106.7.3.

N1106.7.1 R(406.7.1) Minimum capabilities. Calculation procedures used to comply with this section shall be software tools capable of calculating the ERI as described in Section N1106.3, and shall include the following capabilities:

1. Computer generation of the *ERI reference design* using only the input for the *rated design*.

The calculation procedure shall not allow the user to directly modify the building component characteristics of the *ERI reference design*.

2. Calculation of whole-building, as a single *zone*, sizing for the heating and cooling equipment in the *ERI reference design* residence in accordance with Section N1103.7.
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.
4. Printed *code official* inspection checklist listing each of the *rated design* component characteristics determined by the analysis to provide compliance, along with their respective performance ratings.

N1106.7.2 (406.7.2) Specific approval. Performance analysis tools meeting the applicable sections of Section N1106 shall be *approved*. Tools are permitted to be *approved* based on meeting a specified threshold for a jurisdiction. The *code official* shall approve tools for a specified application or limited scope.

N1106.7.3 (R406.7.3) Input values. When calculations require input values not specified by Sections N1102, N1103, N1104 and N1105, those input values shall be taken from an approved source.

**SECTION 1107 (R501)
EXISTING BUILDINGS—GENERAL
DELETED**

**SECTION N1108 (R502)
ADDITIONS
DELETED**

**SECTION N1109 (R503)
ALTERATIONS
DELETED**

**SECTION N1110 (R504)
REPAIRS
DELETED**

**SECTION N1111 (R505)
CHANGE OF OCCUPANCY OR USE
DELETED**