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# INTERNATIONAL ENERGY CONSERVATION CODE®

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TABLE 301.1—continued  
CLIMATE ZONES BY STATE, COUNTY AND TERRITORIES

St Clair	Clay	Sherman	<b>MICHIGAN</b>	<b>Zone 7</b>
Union	Clayton	Smith	<b>Zone 5 except</b>	Aitkin
Wabash	Delaware	Thomas	<b>Zone 6</b>	Becker
Washington	Dickinson	Trego	Alcona	Beltrami
Wayne	Emmet	Wallace	Alger	Carlton
White	Fayette	Wichita	Alpena	Cass
Williamson	Floyd		Antrim	Clay
	Franklin		Arenac	Clearwater
<b>INDIANA</b>	Grundy	<b>KENTUCKY</b>	Benzie	Cook
<b>Zone 5 except</b>	Hamilton	<b>Zone 4</b>	Charlevoix	Crow Wing
<b>Zone 4</b>	Hancock		Cheboygan	Grant
Brown	Hardin	<b>LOUISIANA</b>	Clare	Hubbard
Clark	Howard	<b>Zone 2 except</b>	Crawford	Itasca
Crawford	Humboldt	<b>Zone 3</b>	Delta	Kanabec
Daviess	Ida	Bienville	Dickinson	Kittson
Dearborn	Kossuth	Bossier	Emmet	Koochiching
Dubois	Lyon	Caddo	Gladwin	Lake Of The Woods
Floyd	Mitchell	Caldwell	Grand Traverse	Mahnomen
Gibson	O'Brien	Catahoula	Huron	Marshall
Greene	Osceola	Claiborne	Iosco	Mille Lacs
Harrison	Palo Alto	Concordia	Isabella	Norman
Jackson	Plymouth	De Soto	Kalkaska	Otter Tail
Jefferson	Pocahontas	East Carroll	Lake	Pennington
Jennings	Sac	Franklin	Leelanau	Pine
Knox	Sioux	Grant	Manistee	Polk
Lawrence	Webster	Jackson	Marquette	Red Lake
Martin	Winnebago	La Salle	Mason	Roseau
Monroe	Winneshiek	Lincoln	Mecosta	St Louis
Ohio	Worth	Madison	Menominee	Wadena
Orange	Wright	Morehouse	Missaukee	Wilkin
Perry		Natchitoches	Montmorency	
Pike	<b>KANSAS</b>	Ouachita	Newaygo	<b>MISSISSIPPI</b>
Posey	<b>Zone 4 except</b>	Red River	Oceana	<b>Zone 3 except</b>
Ripley	<b>Zone 5</b>	Richland	Ogemaw	<b>Zone 2</b>
Scott	Cheyenne	Sabine	Osceola	Hancock
Spencer	Cloud	Tensas	Oscoda	Harrison
Sullivan	Decatur	Union	Otsego	Jackson
Switzerland	Ellis	Vernon	Presque Isle	Pearl River
Vanderburgh	Gove	Webster	Roscommon	Stone
Warrick	Graham	West Carroll	Sanilac	
Washington	Greeley	Winn	Wexford	<b>MISSOURI</b>
	Hamilton		<b>Zone 7</b>	<b>Zone 4 except</b>
<b>IOWA</b>	Jewell	<b>MAINE</b>	Baraga	<b>Zone 5</b>
<b>Zone 5 except</b>	Lane	<b>Zone 6 except</b>	Chippewa	Adair
<b>Zone 6</b>	Logan	<b>Zone 7</b>	Gogebic	Andrew
Allamakee	Mitchell	Aroostook	Houghton	Atchison
Black Hawk	Ness		Iron	Buchanan
Bremer	Norton	<b>MARYLAND</b>	Keweenaw	Caldwell
Buchanan	Osborne	<b>Zone 4 except</b>	Luce	Chariton
Buena Vista	Phillips	<b>Zone 5</b>	Mackinac	Clark
Butler	Rawlins	Garrett	Ontonagon	Clinton
Calhoun	Republic		Schoolcraft	Daviess
Cerro Gordo	Rooks	<b>MASSACHUSETTS</b>		De Kalb
Cherokee	Scott	<b>Zone 5</b>	<b>MINNESOTA</b>	Gentry
Chickasaw	Sheridan		<b>Zone 6 except</b>	Grundy

(continued)

# CHAPTER 4

## RESIDENTIAL ENERGY EFFICIENCY

*This chapter has been revised in its entirety; there will be no marginal markings.*

### SECTION 401 GENERAL

**401.1 Scope.** This chapter applies to residential buildings.

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

1. Sections 402.1 through 402.3 (prescriptive); or
2. Section 404 (performance).

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

### SECTION 402 BUILDING THERMAL ENVELOPE

**402.1 General. (Prescriptive).**

**402.1.1 Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Table 402.1.1 based on the climate zone specified in Chapter 3.

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

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

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

1. *U*-factor of 0.17 in Climate Zone 1.
2. *U*-factor of 0.14 in Climate Zone 2.
3. *U*-factor of 0.12 in Climate Zone 3.

**TABLE 402.1.1  
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT<sup>a</sup>**

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

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. *R*-19 shall be permitted to be compressed into a 2 × 6 cavity.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. The first *R*-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

d. *R*-5 shall be added to the required slab edge *R*-values for heated slabs.

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

f. Or insulation sufficient to fill the framing cavity, *R*-19 minimum.

g. "13+5" means *R*-13 cavity insulation plus *R*-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least *R*-2.

TABLE 402.1.3  
EQUIVALENT U-FACTORS<sup>a</sup>

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.2	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.06	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

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

**402.1.4 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 402.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table 402.1.1. The UA calculation shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance.

**402.2 Specific insulation requirements. (Prescriptive).**

**402.2.1 Ceilings with attic spaces.** When Section 402.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.

**402.2.2 Ceilings without attic spaces.** Where Section 402.1.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1 shall be limited to 500 square feet (46 m<sup>2</sup>) of ceiling area.

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

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

1. R-value of 4 in Climate Zone 1.
2. R-value of 6 in Climate Zone 2.
3. R-value of 8 in Climate Zone 3.

**402.2.4 Steel-frame ceilings, walls and floors.** Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table 402.2.4 or shall meet the U-factor requirements in Table 402.1.3. The calculation of the U-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

TABLE 402.2.4  
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION  
(R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE <sup>a</sup>
<b>Steel Truss Ceilings<sup>b</sup></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
<b>Steel Joist Ceilings<sup>b</sup></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
<b>Steel Framed Wall</b>	
R-13	R - 13 + 5 or R - 15 + 4 or R - 21 + 3
R-19	R - 13 + 9 or R - 19 + 8 or R - 25 + 7
R-21	R - 13 + 10 or R - 19 + 9 or R - 25 + 8
<b>Steel Joist Floor</b>	
R-13	R - 19 in 2×6 R - 19 + 6 in 2×8 or 2×10
R-19	R - 19 + 6 in 2×6 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.

