

## CHAPTER C3

# GENERAL REQUIREMENTS

### SECTION C301 CLIMATE ZONE

**14N-C3-C301** The provisions of Section C301 of IECC-CE are not adopted. The following is adopted as Section C301:

Added Coun. J. 9-21-2022, p. 52080.

**C301.1 General.** *Climate zone 5A* shall be used to determine the applicable requirements in Chapter C4.

### SECTION C302 DESIGN CONDITIONS

**14N-C3-C302** The provisions of Section C302 of IECC-CE are adopted by reference without modification.

Added Coun. J. 9-21-2022, p. 52080.

**C302.1 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.

### SECTION C303 MATERIALS, SYSTEMS AND EQUIPMENT

**14N-C3-C303** The provisions of Section C303 of IECC-CE are adopted by reference with the following modification:

Added Coun. J. 9-21-2022, p. 52080.

**C303.1 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.

**C303.1.1 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. Alternatively, 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-in or sprayed fiberglass and cellulose insulation, the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be indicated on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be indicated on the certification. For *insulated siding*, the *R*-value shall be labeled on the product's package and shall be indicated on the certification. The insula-

tion installer shall sign, date and post the certification in a conspicuous location on the job site.

**Exception:** For roof insulation installed above the deck, the *R*-value shall be labeled as required by the material standards specified in Table 1508.2 of the *Chicago Building Code*.

**C303.1.1.1 Blown-in or sprayed roof/ceiling insulation.** The thickness of blown-in or sprayed fiberglass and cellulose roof/ceiling insulation shall be written in inches (mm) on markers and one or more of such markers shall be installed for every 300 square feet (28 m<sup>2</sup>) of attic area 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 indicated on certification provided by the insulation installer.

**C303.1.2 Insulation mark installation.** Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection. For insulation materials that are installed without an observable manufacturer's *R*-value mark, such as blown or draped products, an insulation certificate complying with Section C303.1.1 shall be left immediately after installation by the installer, in a conspicuous location within the building, to certify the installed *R*-value of the insulation material.

**C303.1.3 Fenestration product rating.** *U*-factors of fenestration products shall be determined as follows:

1. For windows, doors and skylights, *U*-factor ratings shall be determined in accordance with NFRC 100.
2. Where required for garage doors and rolling doors, *U*-factor ratings 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 C303.1.3(1) or Table C303.1.3(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 C303.1.3(3). For Tubular Daylighting Devices, VT<sub>annual</sub> shall be measured and rated in accordance with NFRC 203.

GENERAL REQUIREMENTS

**TABLE C303.1.3(1)  
DEFAULT GLAZED WINDOW, GLASS DOOR  
AND SKYLIGHT U-FACTORS**

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT	
	Single	Double	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 C303.1.3(2)  
DEFAULT OPAQUE DOOR U-FACTORS**

DOOR TYPE	OPAQUE U-FACTOR
Uninsulated Metal	1.20
Insulated Metal (Rolling)	0.90
Insulated Metal (Other)	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

**TABLE C303.1.3(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

**C303.1.4 Insulation product rating.** The thermal resistance (*R*-value) of insulation shall be determined in accordance with the US Federal Trade Commission *R*-value rule (CFR Title 16, Part 460) in units of  $h \times ft^2 \times ^\circ F/Btu$  at a mean temperature of 75°F (24°C).

**C303.1.4.1 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 instructions.

**C303.2 Installation.** Materials, systems and equipment shall be installed in accordance with the manufacturer’s instructions and the *Chicago Building Code*.

**C303.2.1 Protection of exposed foundation insulation.** Insulation applied to the exterior of *below-grade walls*, *crawl space 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.

**C303.2.2 Multiple layers of continuous insulation board.** Where two or more layers of continuous insulation board are used in a construction assembly, the continuous insulation boards shall be installed in accordance with Section C303.2. Where the continuous insulation board manufacturer’s instructions do not address installation of two or more layers, the edge joints between each layer of continuous insulation boards shall be staggered.

## CHAPTER C4

# COMMERCIAL ENERGY EFFICIENCY

### SECTION C401 GENERAL

**14N-C4-C401** The provisions of Section C401 of IECC-CE are adopted by reference with the following modifications:

Added Coun. J. 9-21-2022, p. 52080.

**C401.1 Scope.** The provisions in this chapter are applicable to *commercial buildings* and their *building sites*.

**C401.2 Application.** *Commercial buildings* shall comply with Chapter C6 and either Section C401.2.1, C401.2.2, C401.2.3 or C401.2.4.

**C401.2.1 Chicago Energy Transformation Code.** *Commercial buildings* shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with Sections C402 through C406 and Section C408. *Dwelling units* and *sleeping units* in Group R-2 occupancies without systems serving multiple units shall be deemed to be in compliance with this chapter, provided that they comply with Section R406.
2. Total Building Performance. The Total Building Performance option requires compliance with Section C407.

**Exception:** *Additions, alterations, repairs and changes of occupancy to existing buildings* complying with Chapter C5.

**C401.2.2 ASHRAE 90.1.** *Commercial buildings* shall comply with the requirements of ANSI/ASHRAE/IESNA 90.1.

**C401.2.3 Phius certification.** *Commercial buildings* shall obtain certification in accordance with Sections 401.2.3.1 and 403.2.3.2.

**C401.2.3.1 Construction documents.** The construction documents submitted to the *building official* shall establish that the project is eligible for certification in accordance with the *PHIUS Passive Building Standard Certification Guidebook*, including all co-requisite programs applicable to the project type. Such documentation shall include:

1. A design certification letter issued by an *approved* third-party certification organization.
2. A list of compliance features.

**C401.2.3.2 Certification.** Within 180 days of project completion, as evidenced by passing the last required final inspection or issuance of a certificate of occupancy, as applicable in accordance with the *Chicago Construction Codes Administrative Provisions*, the owner shall submit to the *building official* a written

certification establishing that the project has been certified in accordance with the *PHIUS Passive Building Standard Certification Guidebook*, including all co-requisite programs applicable to the project type.

**C401.2.4 National Green Building Standard certification.** Eligible *commercial buildings* shall obtain certification in accordance with Sections 401.2.4.1 and 401.2.4.2.

**C401.2.4.1 Construction documents.** The construction documents submitted to the *building official* shall establish that the project is eligible for certification at the gold or emerald level in accordance with ICC 700. Such documentation shall include:

1. Evidence that the project has been registered with an *approved* third-party certification organization that certifies compliance with ICC 700.
2. Evidence that the project, as designed, is eligible for certification at the gold or emerald level.
3. A list of compliance features.

**C401.2.4.2 Certification.** Within 180 days of project completion, as evidenced by passing the last required final inspection or issuance of a certificate of occupancy, as applicable in accordance with the *Chicago Construction Codes Administrative Provisions*, the owner shall submit to the *building official* a written certification that the project has achieved certification at the gold or emerald level under ICC 700. The written certification shall be issued by an *approved* third-party certification organization.

**C401.3 Thermal envelope certificate.** A permanent thermal envelope certificate shall be completed by the builder. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility room or other *approved* location. If 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. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include the following:

1. *R-values* of insulation installed in or on ceilings, roofs, walls, foundations and slabs, *below-grade walls*, *crawl space walls* and floors and ducts outside *conditioned spaces*.
2. *U-factors* and *solar heat gain coefficients* (SHGC) of fenestrations.
3. Results from any *building* envelope air leakage testing performed on the *building*.

Where there is more than one value for any component of the building envelope, the certificate shall indicate the area-

weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10 percent or more of the total component area.

**SECTION C402  
BUILDING ENVELOPE REQUIREMENTS**

**14N-C4-C402** The provisions of Section C402 of IECC-CE are adopted by reference with the following modifications:

Added Coun. J. 9-21-2022, p. 52080.

**C402.1 General.** *Building thermal envelope* assemblies for buildings that are intended to comply with the code on a prescriptive basis in accordance with the compliance path described in Item 1 of Section C401.2.1 shall comply with the following:

1. The opaque portions of the *building thermal envelope* shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the *R*-value-based method of Section C402.1.3; the *U*-, *C*- and *F*-factor-based method of Section C402.1.4; or the component performance alternative of Section C402.1.5.
2. [Reserved]
3. *Fenestration* in building envelope assemblies shall comply with Section C402.4.
4. Air leakage of building envelope assemblies shall comply with Section C402.5.

Alternatively, where buildings have a *vertical fenestration area* or *skylight fenestration area* exceeding that allowed in Section C402.4, the building and *building thermal envelope* shall comply with Item 2 of Section C401.2.1 or Section C401.2.2.

*Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers* shall comply with Section C403.11.

**C402.1.1 Low-energy buildings and greenhouses.** 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 C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h × ft<sup>2</sup> (10.7 W/m<sup>2</sup>) or 1.0 watt per square foot (10.7 W/m<sup>2</sup>) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.

**C402.1.1.1 Greenhouses.** *Greenhouse* structures or areas that are mechanically heated or cooled and that comply with all of the following shall be exempt from the building envelope requirements of this code:

1. Exterior opaque envelope assemblies comply with Sections C402.2 and C402.4.5.

**Exception:** Low-energy *greenhouses* that comply with Section C402.1.1.

2. Interior partition *building thermal envelope* assemblies that separate the *greenhouse* from *conditioned space* comply with Sections C402.2, C402.4.3 and C402.4.5.
3. *Fenestration* assemblies that comply with the thermal envelope requirements in Table C402.1.1.1. The *U*-factor for a roof shall be for the *roof assembly* or a roof that includes the assembly and an *internal curtain system*.

**Exception:** Unconditioned *greenhouses*.

**TABLE C402.1.1.1  
FENESTRATION THERMAL ENVELOPE  
MAXIMUM REQUIREMENTS**

COMPONENT	U-FACTOR (BTU/h × ft <sup>2</sup> × °F)
Skylight	0.5
Vertical fenestration	0.7

**C402.1.2 Equipment buildings.** Buildings that comply with the following shall be exempt from the *building thermal envelope* provisions of this code:

1. Are separate buildings with floor area not more than 1,200 square feet (110 m<sup>2</sup>).
2. Are intended to house electric equipment with installed equipment power totaling not less than 7 watts per square foot (75 W/m<sup>2</sup>) and not intended for human occupancy.
3. Have a heating system capacity not greater than (17,000 Btu/hr) (5 kW) and a heating *thermostat* set-point that is restricted to not more than 50°F (10°C).
4. Have an average wall and roof *U*-factor less than 0.200.

**C402.1.3 Insulation component R-value-based method.** *Building thermal envelope* opaque assemblies shall comply with the requirements of Sections C402.2 and C402.4 based on the *climate zone* specified in Chapter C3. For opaque portions of the *building thermal envelope* intended to comply on an insulation component *R*-value basis, the *R*-values for cavity insulation and *continuous insulation* shall be not less than that specified in Table C402.1.3. Where cavity insulation is installed in multiple layers, the cavity insulation *R*-values shall be summed to determine compliance with the cavity insulation *R*-value requirements. Where *continuous insulation* is installed in multiple layers, the *continuous insulation R*-values shall be summed to determine compliance with the *continuous insulation R*-value requirements. Cavity insulation *R*-values shall not be used to determine compliance with the *continuous insulation R*-value requirements in Table C402.1.3. *Commercial buildings* or portions of *commercial buildings* enclosing Group R occupancies shall use the *R*-values from the “Group R” column of Table C402.1.3. *Commercial buildings* or portions of *commercial buildings* enclosing occupancies other than Group R shall use the *R*-values from the “All other” column of Table C402.1.3.

**TABLE C402.1.3  
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT  
MINIMUM REQUIREMENTS, R-VALUE METHOD<sup>a</sup>**

CLIMATE ZONE	5	
	All other	Group R
<b>Roofs</b>		
Insulation entirely above roof deck	R-30ci	R-30ci
Metal buildings <sup>b</sup>	R-19 + R-11 LS	R-19 + R-11 LS
Attic and other	R-49	R-49
<b>Walls, above grade</b>		
Mass <sup>f</sup>	R-11.4ci	R-13.3ci
Metal building	R-13 + R-14ci	R-13 + R-14ci
Metal framed	R-13 + R-10ci	R-13 + R-10ci
Wood framed and other	R-13 + R-7.5ci or R20 + R3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci
<b>Walls, below grade</b>		
Below-grade wall <sup>d</sup>	R-7.5ci	R-10ci
<b>Floors</b>		
Mass <sup>e</sup>	R-14.6ci	R-16.7ci
Joist/framing	R-30	R-30
<b>Slab-on-grade floors</b>		
Unheated slabs	R-15 for 24" below	R-20 for 24" below
Heated slabs <sup>g</sup>	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m<sup>2</sup>, 1 pound per cubic foot = 16 kg/m<sup>3</sup>.

- ci = Continuous Insulation, NR = No Requirement, LS = Liner System.
- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 90.1 Appendix A.
- b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- c. [Reserved]
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. "Mass walls" shall be in accordance with Section C402.2.2.
- g. The first value is for perimeter insulation and the second value is for full, under-slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

**TABLE C402.1.4  
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM  
REQUIREMENTS, U-FACTOR METHOD<sup>a, b</sup>**

CLIMATE ZONE	5	
	All other	Group R
<b>Roofs</b>		
Insulation entirely above roof deck	U-0.032	U-0.032
Metal buildings	U-0.035	U-0.035
Attic and other	U-0.021	U-0.021
<b>Walls, above grade</b>		
Mass <sup>f</sup>	U-0.090	U-0.080
Metal building	U-0.050	U-0.050
Metal framed	U-0.055	U-0.055
Wood framed and other <sup>c</sup>	U-0.051	U-0.051
<b>Walls, below grade</b>		
Below-grade wall <sup>c</sup>	C-0.119	C-0.092
<b>Floors</b>		
Mass <sup>d</sup>	U-0.057	U-0.051
Joist/framing	U-0.033	U-0.033
<b>Slab-on-grade floors</b>		
Unheated slabs	F-0.52	F-0.51
Heated slabs	F-0.62	F-0.62
<b>Opaque doors</b>		
Nonswinging door	U-0.31	U-0.31
Swinging door <sup>e</sup>	U-0.37	U-0.37
Garage door < 14% glazing <sup>h</sup>	U-0.31	U-0.31

For SI: 1 pound per square foot = 4.88 kg/m<sup>2</sup>, 1 pound per cubic foot = 16 kg/m<sup>3</sup>.

- ci = Continuous Insulation, NR = No Requirement, LS = Liner System.
- a. Where assembly U-factors, C-factors and F-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.
- b. Where U-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The R-value of *continuous insulation* shall be allowed to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, *below-grade walls* shall comply with the U-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These C-, F- and U-factors are based on assemblies that are not required to contain insulation.
- f. "Mass walls" shall be in accordance with Section C402.2.2.
- g. Swinging door U-factors shall be determined in accordance with NFRC-100.
- h. Garage doors having a single row of *fenestration* shall have an assembly U-factor less than or equal to 0.44 provided that the *fenestration area* is not less than 14 percent and not more than 25 percent of the total door area.

**C402.1.4 Assembly U-factor, C-factor or F-factor-based method.** *Building thermal envelope* opaque assemblies shall meet the requirements of Sections C402.2 and C402.4 based on the climate zone specified in Chapter C3. *Building thermal envelope* opaque assemblies intended to comply on an assembly U-, C- or F-factor basis shall have a U-, C- or F-factor not greater than that specified in Table C402.1.4. *Commercial buildings* or portions of *commercial buildings* enclosing Group R occupancies shall use the U-, C- or F-factor from the “Group R” column of Table C402.1.4. *Commercial buildings* or portions of *commercial buildings* enclosing occupancies other than Group R shall use the U-, C- or F-factor from the “All other” column of Table C402.1.4

**C402.1.4.1 Roof/ceiling assembly.** The maximum roof/ceiling assembly U-factor shall not exceed that specified in Table C402.1.4 based on construction materials used in the roof/ceiling assembly.

**C402.1.4.1.1 Tapered, above-deck insulation based on thickness.** Where used as a component of a maximum roof/ceiling assembly U-factor calculation, the sloped roof insulation R-value contribution to that calculation shall use the average thickness in inches (mm) along with the material R-value-per-inch (per-mm) solely for U-factor compliance as prescribed in Section C402.1.4.

**C402.1.4.1.2 Suspended ceilings.** Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly U-factor of the roof/ceiling construction.

**C402.1.4.1.3 Joints staggered.** *Continuous insulation* board shall be installed in not less than two layers, and the edge joints between each layer of insulation shall be staggered, except where insulation tapers to the roof deck at a gutter edge, roof drain or scupper.

**C402.1.4.2 Thermal resistance of cold-formed steel assemblies.** U-factors of walls with cold-formed steel framed ceilings and walls shall be allowed to be determined in accordance with AISI S250 as modified herein.

1. Where the steel-framed wall contains no *cavity insulation* and uses *continuous insulation* to satisfy the U-factor maximum, the steel-framed wall member spacing is allowed to be installed at any on-center spacing.
2. Where the steel-framed wall contains framing at 24 inches (600 mm) on center with a 23-percent framing factor or framing at 16 inches (400 mm) on-center with a 25-percent framing factor, the next lower framing member spacing input values shall be used when calculating using AISI S250.
3. Where the steel-framed wall contains less than 23-percent framing factors the AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members the AISI

S250 calculation option for other than standard C-shape framing is allowed to be used.

**C402.1.5 Component performance alternative.** Building envelope values and *fenestration areas* determined in accordance with Equation 4-2 shall be an alternative to compliance with the U-, F- and C-factors in Tables C402.1.4 and C402.4 and the maximum allowable *fenestration areas* in Section C402.4.1. *Fenestration* shall meet the applicable SHGC requirements of Section C402.4.3.

$$A + B + C + D + E \leq \text{Zero} \quad \text{(Equation 4-2)}$$

where:

A = Sum of the (UA Dif) values for each distinct assembly type of the *building thermal envelope*, other than slabs on grade and *below-grade walls*.

UA Dif = UA Proposed – UA Table.

UA Proposed = Proposed U-value × Area.

UA Table = (U-factor from Table C402.1.3, C402.1.4 or C402.4) × Area.

B = Sum of the (FL Dif) values for each distinct slab-on-grade perimeter condition of the *building thermal envelope*.

FL Dif = FL Proposed – FL Table.

FL Proposed = Proposed F-value × Perimeter length.

FL Table = (F-factor specified in Table C402.1.4) × Perimeter length.

C = Sum of the (CA Dif) values for each distinct *below-grade wall* assembly type of the *building thermal envelope*.

CA Dif = CA Proposed – CA Table.

CA Proposed = Proposed C-value × Area.

CA Table = (Maximum allowable C-factor specified in Table C402.1.4) × Area.

Where the proposed vertical glazing area is less than or equal to the maximum vertical glazing area allowed by Section C402.4.1, the value of D (Excess Vertical Glazing Value) shall be zero. Otherwise:

D = (DA × UV) – (DA × U Wall), but not less than zero.

DA = (Proposed Vertical Glazing Area) – (Vertical Glazing Area allowed by Section C402.4.1).

UA Wall = Sum of the (UA Proposed) values for each opaque assembly of the *exterior wall*.

U Wall = Area-weighted average U-value of all *above-grade wall* assemblies.

UAV = Sum of the (UA Proposed) values for each vertical glazing assembly.

UV = UAV/total vertical glazing area.

Where the proposed *skylight* area is less than or equal to the *skylight* area allowed by Section C402.4.1, the value of E (Excess *Skylight* Value) shall be zero. Otherwise:

E = (EA × US) – (EA × U Roof), but not less than zero.

- EA = (Proposed *Skylight Area*) – (Allowable *Skylight Area* as specified in Section C402.4.1).
- U Roof = Area-weighted average *U*-value of all roof assemblies.
- UAS = Sum of the (UA Proposed) values for each *skylight* assembly.
- US = UAS/total *skylight* area.

**C402.2 Specific building thermal envelope insulation requirements.** Insulation in *building thermal envelope* opaque assemblies shall comply with Sections C402.2.1 through C402.2.7 and Table C402.1.3.

**C402.2.1 Roof assembly.** The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the *roof assembly* shall be as specified in Table C402.1.3, based on construction materials used in the *roof assembly*.

**C402.2.1.1 Tapered, above-deck insulation based on thickness.** Where used as a component of a roof/ceiling assembly *R*-value calculation, the sloped roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) solely for *R*-value compliance as prescribed in Section 402.1.3.

**C402.2.1.2 Minimum thickness, lowest point.** The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be not less than 1 inch (25 mm).

**C402.2.1.3 Suspended ceilings.** Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling construction.

**C402.2.1.4 Joints staggered.** *Continuous insulation* board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered, except where insulation tapers to the roof deck at a gutter edge, roof drain or scupper.

**C402.2.1.5 Skylight curbs.** *Skylight* curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-5, whichever is less.

**Exception:** Unit *skylight* curbs included as a component of a *skylight* listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

**C402.2.2 Above-grade walls.** The minimum thermal resistance (*R*-value) of materials installed in the wall cavity between framing members and continuously on the walls shall be as specified in Table C402.1.3, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units shall not be used in determining compliance with Table C402.1.3 except as otherwise noted in the table. In determining compliance with Table C402.1.4, the use of the *U*-factor of concrete masonry units with integral insulation shall be allowed.

“Mass walls” where used as a component in the thermal envelope of a building shall comply with one of the following:

1. Weigh not less than 35 pounds per square foot (171 kg/m<sup>2</sup>) of wall surface area.
2. Weigh not less than 25 pounds per square foot (122 kg/m<sup>2</sup>) of wall surface area where the material weight is not more than 120 pcf (1900 kg/m<sup>3</sup>).
3. Have a heat capacity exceeding 7 Btu/ft<sup>2</sup> × °F (144 kJ/m<sup>2</sup> × K).
4. Have a heat capacity exceeding 5 Btu/ft<sup>2</sup> × °F (103 kJ/m<sup>2</sup> × K), where the material weight is not more than 120 pcf (1900 kg/m<sup>3</sup>).

**C402.2.3 Floors.** The thermal properties (component *R*-values or assembly *U*-, *C*- or *F*-factors) of floor assemblies over outdoor air or unconditioned space shall be as specified in Table C402.1.3 or C402.1.4 based on the construction materials used in the floor assembly. Floor framing *cavity insulation* or structural slab insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or structural slabs.

“Mass floors” where used as a component of the thermal envelope of a building shall provide one of the following weights:

1. 35 pounds per square foot (171 kg/m<sup>2</sup>) of floor surface area.
2. 25 pounds per square foot (122 kg/m<sup>2</sup>) of floor surface area where the material weight is not more than 120 pounds per cubic foot (1923 kg/m<sup>3</sup>).

**Exceptions:**

1. The floor framing *cavity insulation* or structural slab insulation shall be allowed to be in contact with the top side of sheathing or *continuous insulation* installed on the bottom side of floor assemblies where combined with insulation that meets or exceeds the minimum *R*-value in Table C402.1.3 for “Metal framed” or “Wood framed and other” values for “Walls, above grade” and extends from the bottom to the top of all perimeter floor framing or floor assembly members.
2. Insulation applied to the underside of concrete floor slabs shall be allowed an airspace of not more than 1 inch (25 mm) where it turns up and is in contact with the underside of the floor under walls associated with the *building thermal envelope*.

**C402.2.4 Slabs-on-grade.** The minimum thermal resistance (*R*-value) of the insulation for unheated or heated slab-on-grade floors designed in accordance with the *R*-value method of Section C402.1.3 shall be as specified in Table C402.1.3.

**C402.2.4.1 Insulation installation.** Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation

wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.

**Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

**C402.2.5 Below-grade walls.** The *C*-factor for the *below-grade walls* shall be in accordance with Table C402.1.4. The *R*-value of the insulating material installed continuously within or on the *below-grade walls* of the building envelope shall be in accordance with Table C402.1.3. The *C*-factor or *R*-value required shall extend to a depth of not less than 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor of the *conditioned space* enclosed by the *below-grade wall*, whichever is less.

**C402.2.6 Insulation of radiant heating systems.** *Radiant heating system* panels, and their associated components that are installed in interior or exterior assemblies, shall be insulated to an *R*-value of not less than R-3.5 on all surfaces not facing the space being heated. *Radiant heating system* panels that are installed in the *building thermal envelope* shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the *R*-value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with Section C402.1.4.

**Exception:** Heated slabs on grade insulated in accordance with Section C402.2.4.

**C402.2.7 Airspaces.** Where the *R*-value of an airspace is used for compliance in accordance with Section C402.1, the airspace shall be enclosed in an unventilated cavity constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is located on the interior side of the continuous *air barrier* and is bounded on all sides by building components.

**Exception:** The thermal resistance of airspaces located on the exterior side of the continuous *air barrier* and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

**C402.2.8 Balconies and parapets.** See Section C605.

**C402.3 Roof solar reflectance.** See Section 1515 of the *Chicago Building Code*.

**C402.4 Fenestration.** *Fenestration* shall comply with Sections C402.4.1 through C402.4.5 and Table C402.4. *Daylight responsive controls* shall comply with this section and Section C405.2.4.

**TABLE C402.4  
BUILDING ENVELOPE FENESTRATION MAXIMUM  
U-FACTOR AND SHGC REQUIREMENTS**

CLIMATE ZONE	5	
<b>Vertical fenestration</b>		
<b>U-factor</b>		
Fixed fenestration	0.38	
Operable fenestration	0.45	
Entrance doors	0.77	
<b>SHGC</b>		
	Fixed	Operable
PF < 0.2	0.38	0.51
0.2 ≤ PF < 0.5	0.46	0.56
PF ≥ 0.5	0.61	0.61
<b>Skylights</b>		
U-factor	0.50	
SHGC	0.40	

PF = Projection Favor

**C402.4.1 Maximum area.** The *vertical fenestration area*, not including *opaque doors* and opaque spandrel panels, shall be not greater than 30 percent of the gross *above-grade wall area*. The *skylight fenestration area* shall be not greater than 3 percent of the gross roof area.

**C402.4.1.1 Increased vertical fenestration area with daylight responsive controls.** Not more than 40 percent of the gross *above-grade wall area* shall be *vertical fenestration*, provided that all of the following requirements are met:

1. In *buildings* with no more than two *stories above grade plane*: not less than 50 percent of the *net floor area* is within a *daylight zone*.
2. In *buildings* with three or more *stories above grade plane*: not less than 25 percent of the *net floor area* is within a *daylight zone*.
3. *Daylight responsive controls* are installed in *daylight zones*.
4. *Visible transmittance (VT)* of *vertical fenestration* is not less than 1.1 times *solar heat gain coefficient (SHGC)*.

**Exception:** *Fenestration* that is outside the scope of NFRC 200 is not required to comply with Item 4.

**C402.4.1.2 Increased skylight area with daylight responsive controls.** The *skylight area* shall be not more than 6 percent of the roof area provided that