

CHAPTER 3 [CE]

GENERAL REQUIREMENTS

User note:

***About this chapter:** Chapter 3 addresses broadly applicable requirements that would not be at home in other chapters having more specific coverage of subject matter. This chapter establishes climate zone by US counties and territories and includes methodology for determining climate zones elsewhere. It also contains product rating, marking and installation requirements for materials such as insulation, windows, doors and siding.*

SECTION C301 CLIMATE ZONES

C301.1 General. *Climate zones* from Table C301.1 shall be used for determining the applicable requirements from Chapter 4.

>

**Table C301.1
CLIMATE ZONES AND MOISTURE REGIMES
DESIGNATIONS BY STATE AND COUNTY**

Key: A - Moist, B - Dry, C - Marine. Absence of moisture designation indicates moisture regime is irrelevant.
WASHINGTON
5B Adams
5B Asotin
5B Benton
5B Chelan
4C Clallam
4C Clark
5B Columbia
4C Cowlitz
5B Douglas
5B Ferry
5B Franklin
5B Garfield
5B Grant
4C Grays Harbor
4C Island
4C Jefferson
4C King
4C Kitsap
5B Kittitas
5B Klickitat
4C Lewis
5B Lincoln
4C Mason
5B Okanogan
4C Pacific
5B Pend Oreille
4C Pierce
4C San Juan
4C Skagit
5B Skamania
4C Snohomish
5B Spokane
5B Stevens
4C Thurston
4C Wahkiakum
5B Walla Walla
4C Whatcom
5B Whitman
5B Yakima

**SECTION C302
DESIGN CONDITIONS**

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.

C302.2 Exterior design conditions. The heating or cooling outdoor design temperatures shall be selected from Appendix CC.

**SECTION C303
MATERIALS, SYSTEMS AND EQUIPMENT**

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 insulation 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 *International 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 m²) 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), Table C303.1.3(2) or Table C303.1.3(4). 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_{annual} shall be measured and rated in accordance with NFRC 203.

Exception: Units without NFRC ratings produced by a small business may be assigned default *U*-factors from Table C303.1.3(5) for vertical fenestration.

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

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT
	Single Pane	Double Pane	
Metal	1.20	0.80	See Table C303.1.3(4)
Metal with Thermal Break ^a	1.10	0.65	
Nonmetal or Metal Clad	0.95	0.55	
Glazed Block	0.60		

**TABLE C303.1.3(2)
DEFAULT OPAQUE DOOR *U*-FACTORS
See Appendix CA, Section A107**

**TABLE C303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC AND VT**

	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.4	0.4	0.4	0.4	0.4
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 × ft² × °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.

C303.1.5 Spandrel panels in glass curtain walls. Table C303.1.5 provides default *U*-factors for the spandrel section of glass and other curtain wall systems. Design factors that affect performance are the type of framing, the type of spandrel panel and the *R*-value of insulation. Four framing conditions are considered in the table. The first is the common case where standard aluminum mullions are used. Standard mullions provide a thermal bridge through the insulation, reducing its effectiveness. The second case is for metal framing members that have a thermal break. A thermal break frame uses a urethane or other nonmetallic element to separate the metal exposed to outside conditions from the metal that is exposed to interior conditions. The third case is for structural glazing or systems where there are no exposed mullions on the exterior. The fourth case is for the condition where there is no framing or the insulation is continuous and uninterrupted by framing. The columns in the table can be used for any specified level of insulation between framing members installed in framed curtain walls or spandrel panels.

C303.1.5.1 Window wall application. Where “window wall” or similar assembly that is discontinuous at intermediate slab edges is used, the slab edge *U*-value shall be as listed in Appendix Table CA103.3.7.2 or as determined using an approved calculation.

C303.1.5.2 Table value assumptions. In addition to the spandrel panel assembly, the construction assembly *U*-factors assume an air gap between the spandrel panel (with an *R*-value of 1.39) and one layer of 5/8-inch gypsum board (with an *R*-value of 0.56) that provides the interior finish. The gypsum board is assumed to span between the window sill and a channel at the floor. For assemblies that differ from these assumptions, custom *U*-factors can be calculated to account for any amount of continuous insulation or for unusual construction assemblies using Equations 3-1, 3-2 or 3-3 where appropriate. Spandrel panel *U*-factors for assemblies other than those covered by Table

GENERAL REQUIREMENTS

C303.1.5 or Equations 3-1 through 3-3 may be determined using an alternate approved methodology. Equations 3-1 through 3-3 do not calculate the value of any insulation inboard of the curtain wall assembly.

**Aluminum without Thermal Break
(Equation 3-1)**

$$U_{\text{overall}} = \left[(R_{\text{gypsum}} + R_{\text{airgap}}) + \left[\frac{1}{0.2798 + \left(\frac{1}{R_{\text{addedinsulation}} + \frac{0.8929}{\left(\frac{1}{U_{\text{centerofglass}}} \right)} \right)} \right] \right]$$

**Aluminum with Thermal Break
(Equation 3-2)**

$$U_{\text{overall}} = \left[(R_{\text{gypsum}} + R_{\text{airgap}}) + \left[\frac{1}{0.1808 + \left(\frac{1}{R_{\text{addedinsulation}} + \frac{0.8874}{\left(\frac{1}{U_{\text{centerofglass}}} \right)} \right)} \right] \right]$$

**Structural Glazing
(Equation 3-3)**

$$U_{\text{overall}} = \left[(R_{\text{gypsum}} + R_{\text{airgap}}) + \left[\frac{1}{0.1151 + \left(\frac{1}{R_{\text{addedinsulation}} + \frac{0.9487}{\left(\frac{1}{U_{\text{centerofglass}}} \right)} \right)} \right] \right]$$

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

C303.2.1 Protection of exposed foundation insulation.

Insulation applied to the exterior of basement 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.

**TABLE C303.1.3(4)
DEFAULT U-FACTORS FOR SKYLIGHTS**

FENESTRATION TYPE	FRAME TYPE			
	Aluminum Without Thermal Break	Aluminum With Thermal Break	Reinforced Vinyl/ Aluminum-Clad Wood or Vinyl	Wood or Vinyl-Clad Wood/ Vinyl without Reinforcing
Single Glazing glass acrylic/polycarb	U-1.58	U-1.51	U-1.40	U-1.18
	U-1.52	U-1.45	U-1.34	U-1.11
Double Glazing air argon	U-1.05	U-0.89	U-0.84	U-0.67
	U-1.02	U-0.86	U-0.80	U-0.64
Double Glazing, e = 0.20 air argon	U-0.96	U-0.80	U-0.75	U-0.59
	U-0.91	U-0.75	U-0.70	U-0.54
Double Glazing, e = 0.10 air argon	U-0.94	U-0.79	U-0.74	U-0.58
	U-0.89	U-0.73	U-0.68	U-0.52
Double Glazing, e = 0.05 air argon	U-0.93	U-0.78	U-0.73	U-0.56
	U-0.87	U-0.71	U-0.66	U-0.50
Triple Glazing air argon	U-0.90	U-0.70	U-0.67	U-0.51
	U-0.87	U-0.69	U-0.64	U-0.48
Triple Glazing, e = 0.20 air argon	U-0.86	U-0.68	U-0.63	U-0.47
	U-0.82	U-0.63	U-0.59	U-0.43
Triple Glazing, e = 0.20 on 2 surfaces air argon	U-0.82	U-0.64	U-0.60	U-0.44
	U-0.79	U-0.60	U-0.56	U-0.40
Triple Glazing, e = 0.10 on 2 surfaces air argon	U-0.81	U-0.62	U-0.58	U-0.42
	U-0.77	U-0.58	U-0.54	U-0.38
Quadruple Glazing, e = 0.10 on 2 surfaces air argon krypton	U-0.78	U-0.59	U-0.55	U-0.39
	U-0.74	U-0.56	U-0.52	U-0.36
	U-0.70	U-0.52	U-0.48	U-0.32

Notes for Table C303.1.3(4)

1. U-factors are applicable to both glass and plastic, flat and domed units, all spacers and gaps.
2. Emissivities shall be less than or equal to the value specified.
3. Gap fill shall be assumed to be air unless there is a minimum of 90% argon or krypton.
4. Aluminum frame with thermal break is as defined in footnote 1 to Table C303.1.3(1).

**TABLE C303.1.5
U-FACTORS FOR SPANDREL PANELS AND GLASS CURTAIN WALLS**

			RATED R-VALUE OF INSULATION BETWEEN FRAMING MEMBERS							
			None	R-4	R-7	R-10	R-15	R-20	R-25	R-30
FRAME TYPE	SPANDREL PANEL		A	B	C	D	E	F	G	H
Aluminum without Thermal Break	Single glass pane, stone or metal panel	1	0.360	0.242	0.222	0.212	0.203	0.198	0.195	0.193
	Double glass with no low- <i>e</i> coatings	2	0.297	0.233	0.218	0.209	0.202	0.197	0.194	0.192
	Triple or low- <i>e</i> glass	3	0.267	0.226	0.214	0.207	0.200	0.196	0.194	0.192
Aluminum with Thermal Break	Single glass pane, stone or metal panel	4	0.350	0.211	0.186	0.173	0.162	0.155	0.151	0.149
	Double glass with no low- <i>e</i> coatings	5	0.278	0.200	0.180	0.170	0.160	0.154	0.151	0.148
	Triple or low- <i>e</i> glass	6	0.241	0.191	0.176	0.167	0.159	0.153	0.150	0.148
Structural Glazing	Single glass pane, stone or metal panel	7	0.354	0.195	0.163	0.147	0.132	0.123	0.118	0.114
	Double glass with no low- <i>e</i> coatings	8	0.274	0.180	0.156	0.142	0.129	0.122	0.117	0.114
	Triple or low- <i>e</i> glass	9	0.231	0.169	0.150	0.138	0.127	0.121	0.116	0.113
No Framing, or Insulation is Continuous	Single glass pane, stone or metal panel	10	0.360	0.148	0.102	0.078	0.056	0.044	0.036	0.031
	Double glass with no low- <i>e</i> coatings	11	0.297	0.136	0.097	0.075	0.054	0.043	0.035	0.030
	Triple or low- <i>e</i> glass	12	0.267	0.129	0.093	0.073	0.053	0.042	0.035	0.030

