

# Proposal Summary

## Nonresidential High-Performance Envelope

Updated: Monday, February 6, 2023

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### Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on February 14, 2023. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email [info@title24stakeholders.com](mailto:info@title24stakeholders.com) by February 28, 2023.

### Measure Description

#### 1. Opaque Assemblies: Walls, roof and ceiling

This proposal would impose a 20 percent (+/-) reduction of the existing mandatory U-factor values for opaque envelope assemblies in both new construction and alterations. Opaque assemblies currently identified in the code include roof/ceiling and walls.

This measure would also reduce the existing prescriptive U-factor values for opaque assemblies. Based on the modeling outcomes, some building types may be excluded. To justify the feasibility, an energy simulation with all California climate zones will be completed. The exact U-factor values for each assembly will be based on the simulation analytics.

As clean-up measures, we propose to merge the prescriptive envelope requirements for hotel/motel guest rooms with the nonresidential envelope requirements, and to reduce the number of U-factors per assembly type for mass walls and wood-framed walls.

#### 2. Vestibules

The proposed code change would establish a mandatory requirement for vestibules in mixed-used and nonresidential buildings (both new construction and additions) with high-traffic main entrances. These would include colleges, schools, grocery stores, hospitals, hotel/motel, industrial facilities, offices, refrigerated warehouses, restaurants, and retail. The climate zones for which this measure would be mandatory, as well as specific building types and sizes, will be determined via modeling. Exceptions to the requirement will parallel those identified in ASHRAE 90.1 and in IECC.

#### 3. Windows

This proposal would set a new mandatory requirement establishing U-factor and Solar Heat Gain Coefficient (SHGC) for vertical fenestration assemblies for all non-residential buildings. It would affect Alterations and New Construction, where cost effective, as determined by energy modeling.

Currently, Title 24, Part 6 includes prescriptive U-factor and SHGC requirements for exterior vertical fenestration, but these values can be traded away for higher efficiency HVAC equipment when a designer uses the performance path to achieve code compliance. This measure, by establishing minimum mandatory U-factor and SHGC values for vertical fenestration, would ensure that there is a backstop to how much window efficiency can be replaced by a non-envelope system that typically has a much shorter lifespan.

Because of the values intended to be used for mandatory requirements, this measure would also require that most vertical fenestration, regardless of materials used, would be thermally broken, adding to the effectiveness of the building's thermal envelope.

## Data Needs/Stakeholder Information Requests

The Statewide CASE Team would appreciate information and data from stakeholders on the following topics:

- **Technical Feasibility**
  1. Are there issues with adding insulation value to roof/ceilings and walls?
- **Market Readiness**
  1. Are there issues with improved U-factors for opaque assemblies? What is the availability of products?
  2. What is the availability of thermally broken window assemblies for all commercial window types? Impacts on wall framing?
  3. What are the potential downsides to requiring vestibules in certain buildings?
- **Non-energy Benefits** – Any studies or data on improved health benefits of improved building envelope (in terms of U-factor and air leakage)?
- **Costs** – For all proposed measures, what are the:
  - life cycle costs?
  - first costs?
  - operational costs?
- **Economic Impacts** – For all measures: Are there studies or data on job creation, environment and social justice, or equity on improved health benefits of improved building envelope (in terms of U-factor and air leakage)?

Data may be provided anonymously. To participate or provide information, please email Maureen Guttman, [mguttman@energy-solution.com](mailto:mguttman@energy-solution.com) directly and cc [info@title24stakeholders.com](mailto:info@title24stakeholders.com).

## Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2022 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions). Expected sections or tables of the proposed code (but not specific changes at this time) are highlighted in **yellow**. Sections not modified are not shown for clarity.

## Standards

### SECTION 120.7 – MANDATORY ~~INSULATION~~ THERMAL ENVELOPE REQUIREMENTS

Nonresidential and hotel/motel buildings shall comply with the applicable requirements in Sections 120.7(a) through 120.7~~(e)~~(e).

#### (a) Roof/Ceiling Insulation.

The opaque portions of the roof/ceiling that separates conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Metal Building-** The weighted average U-factor of the roof assembly shall not exceed ~~0.098~~ xxxxx.
2. **Wood Framed and Others-** The weighted average U-factor of the roof assembly shall not exceed ~~0.075-xxxxx~~.
3. **Insulation Placement-** Insulation installed to limit heat loss and gain from conditioned spaces to unconditioned spaces shall comply with all of the following:
  - A. Insulation shall be installed in direct contact with a roof or ceiling that is sealed to limit infiltration and exfiltration as specified in Section 110.7. This may include, but is not limited to, placing insulation either above or below the roof deck or on top of the finished ceiling.
  - B. When insulation is installed at the roof in nonresidential buildings, fixed vents or openings to the outdoors or to unconditioned spaces shall not be installed. When the space between the ceiling and the roof is either directly or indirectly conditioned space, it shall not be considered an attic for the purposes of complying with CBC attic ventilation requirements.
  - C. Insulation placed on top of a suspended ceiling with removable ceiling panels shall not be used to meet the Roof/Ceiling requirement of Sections 140.3 and 141.0.

**EXCEPTION to Section 120.7(a)3:** When there are conditioned spaces with a combined floor area no greater than 2,000 square feet in an otherwise unconditioned building, and when the average height of the space between the ceiling and the roof over these spaces is greater than 12 feet, insulation placed in direct contact with a suspended ceiling with removable ceiling panels shall be an acceptable method of reducing heat loss from a conditioned space and shall be accounted for in heat loss calculations.

**NOTE:** Vents that do not penetrate the roof deck and are instead designed for wind resistance for roof membranes are not within the scope of Section 120.7(a)3B.

**(b) Wall Insulation.**

The opaque portions of walls that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 7 below:

1. **Metal Building.** The weighted average U-factor of the wall assembly shall not exceed ~~0.113~~ XXXXX.
2. **Metal Framed.** The weighted average U-factor of the wall assembly shall not exceed ~~0.151~~ XXXXX.
3. **Light Mass Walls.** A 6 inch or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed ~~0.440~~ XXXXX.
4. **Heavy Mass Walls.** An 8 inch or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed ~~0.690~~ XXXXX.
5. **Wood Framed and Others.** The weighted average U-factor of the wall assembly shall not exceed 0.110.
6. **Spandrel Panels and Curtain Wall.** The weighted average U-factor of the spandrel panels and curtain wall assembly shall not exceed 0.280.
7. **Demising Walls.** The opaque portions of framed demising walls shall meet the requirements of Item A or B below:
  - A. Wood framed walls shall be insulated to meet a U-factor not greater than 0.099.
  - B. Metal Framed walls shall be insulated to meet a U-factor not greater than 0.151.

**(c) Floor and Soffit Insulation.**

The opaque portions of floors and soffits that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 and 2 below:

1. **Raised Mass Floors.** Shall have a minimum of 3 inches of lightweight concrete over a metal deck or the weighted average U-factor of the floor assembly shall not exceed 0.269.
2. **Other Floors.** The weighted average U-factor of the floor assembly shall not exceed 0.071.

3. **Heated Slab On Grade Floor.** A heated slab on grade floor shall be insulated to meet the requirements of Section 110.8(g)

**(d) Exterior Windows.** Vertical fenestration assemblies shall:

1. Have an area-weighted average U-factor no greater than **XXXXX**.
2. Have an area-weighted average Solar Heat Gain Coefficient no greater than **XXXXX**.

**(e) Vestibules.** Building entrances shall be protected with an enclosed vestibule meeting the applicable requirements of Items 1 and 2 below:

1. All doors opening into and out of the vestibule shall be equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.
2. Where provided, the heating system for heated vestibules and air curtains with integral heating shall be provided with controls configured to shut off the source of heating when the outdoor air temperature is greater than 45°F. Vestibule heating and cooling systems shall be controlled by a thermostat located in the vestibule configured to limit heating to a temperature not greater than 60°F and cooling to a temperature not less than 85°F.

**EXCEPTION to Section 120.7(e):** Vestibules are not required for the following:

1. Buildings in Climate Zones **XXXXX**.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
3. Doors opening directly from a sleeping unit or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. Doors that have an air curtain with a velocity of not less than 6.56 feet per second at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer's instructions. Manual or automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with **XXXXXXX**.

## SECTION 140.3 – PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES

A building complies with this section by being designed with and constructed to meet all prescriptive requirements in Subsection (a) and the requirements of Subsection (c) and (d) where they apply.

### (a) Envelope Component Requirements.

#### 1. Exterior roofs and ceilings.

Exterior roofs and ceilings shall comply with each of the applicable requirements in this subsection:

A. **Roofing Products.** Shall meet the requirements of Section 110.8 and the applicable requirements of Subsections i through ii:

i. Nonresidential buildings:

a. Low-sloped roofs in Climate Zones 1 through 16 shall have:

1. A minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75; or
2. A minimum Solar Reflectance Index (SRI) of 75.

**EXCEPTION 1 to Section 140.3(a)1Aia:** Wood-framed roofs in Climate Zones 3 and 5 are exempt from the requirements of Section 140.3(a)1Aia if the roof assembly has a U-factor of 0.034 or lower.

**EXCEPTION 2 to Section 140.3(a)1Aia:** Roof constructions with a weight of at least 25 lb/ft<sup>2</sup> over the roof membrane are exempt from the requirements of Section 140.3(a)1Aia.

**EXCEPTION 3 to Section 140.3(a)1Aia:** An aged solar reflectance less than 0.63 is allowed provided the maximum roof/ceiling U-factor in TABLE 140.3 is not exceeded.

b. Steep-sloped roofs

1. In Climate Zones 1 and 3 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.
2. In Climate Zones 2 and 4 through 16 shall have a minimum aged solar reflectance of 0.25 and a minimum thermal emittance of 0.80, or a minimum SRI of 23.

~~ii.—Guest rooms of Hotel and motel buildings:~~

~~a. Low-sloped roofs in Climate Zones 9, 10, 11, 13, 14 and 15 shall have a minimum aged solar reflectance of 0.55 and a minimum thermal emittance of 0.75, or a minimum SRI of 64.~~

~~**EXCEPTION to Section 140.3(a)1Aia:** Roof constructions with a weight of at least 25 lb/ft<sup>2</sup> over the roof membrane.~~

~~b. Steep-sloped roofs in Climate Zones 2 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.~~

**EXCEPTION to Section 140.3(a)1A:** Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

B. **Roof Insulation.** Roofs shall have an overall assembly U-factor no greater than the applicable value in Table 140.3-B, ~~or C or D.~~, and where required by Section [110.8](#) and ), insulation shall be placed in direct contact with a roof or drywall ceiling.

## 2. Exterior Walls.

Exterior walls shall have an overall assembly U-factor no greater than the applicable value in Table 140.3-B, ~~or C or D.~~

## 3. Demising Walls.

Demising walls shall meet the requirements of Section 120.7(b)7. Vertical windows in demising walls between conditioned and unconditioned spaces shall have an area-weighted average U-factor no greater than the applicable value in Table 140.3-B, ~~or C or D.~~

## 4. Exterior Floors and Soffits.

Exterior floors and soffits shall have an overall assembly U-factor no greater than the applicable value in Table 140.3-B, ~~or C or D.~~

## 5. Exterior Windows.

Vertical windows in exterior walls shall:

- A. ~~Have a Percent~~ window area ~~percentage shall be~~ limited in accordance with the applicable requirements of i and ii below:
- i. a west-facing area no greater than 40 percent of the gross west-facing exterior wall area, or 6 feet times the west-facing display perimeter, whichever is greater; and
  - ii. a total area no greater than 40 percent of the gross exterior wall area, or 6 feet times the display perimeter, whichever is greater; and

**NOTE:** Demising walls are not exterior walls, and therefore demising wall area is not part of the gross exterior wall area or display perimeter, and windows in demising walls are not part of the window area.

**EXCEPTION to Section 140.3(a)5A:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

B. Have an area-weighted average U-factor no greater than the applicable value in Table 140.3-B ~~or C or D.~~

**EXCEPTION1 to Section 140.3(a)5B:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

**EXCEPTION 2 to Section 140.3(a)5B:** For vertical windows containing chromogenic type glazing:

- i. The lower-rated labeled U-factor shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and
- ii. Chromogenic glazing shall be considered separately from other glazing; and
- iii. Area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

C. Have an area-weighted average Relative Solar Heat Gain Coefficient, RSHGC, excluding the effects of interior shading, no greater than the applicable value in Table 140.3-B, or C or D.

For purposes of this paragraph, the Relative Solar Heat Gain Coefficient, RSHGC, of a vertical window is:

- i. The Solar Heat Gain Coefficient of the window; or
- ii. Relative Solar Heat Gain Coefficient is calculated using EQUATION 140.3-A, if the window has an overhang or series of exterior horizontal slats that extends beyond each side of the window jamb by a distance equal to the overhang's horizontal projection.

**EXCEPTION 1 to Section 140.3(a)5C:** An area-weighted average Relative Solar Heat Gain Coefficient of 0.56 or less shall be used for windows:

- a. That are in the first story of exterior walls that form a display perimeter; and
- b. For which codes restrict the use of overhangs to shade the windows.

**EXCEPTION 2 to Section 140.3(a)5C:** For vertical glazing containing chromogenic type glazing:

- i. the lower-rate labeled RSHGC shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and
- ii. chromogenic glazing shall be considered separately from other glazing; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

**EXCEPTION 3 to Section 140.3(a)5C:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

**NOTE:** Demising walls are not exterior walls, and therefore windows in demising walls are not subject to SHGC requirements.



D. Have an area-weighted average Visible Transmittance (VT) no less than the applicable value in TABLE 140.3-B ~~and C~~, or EQUATION 140.3-B, as applicable.

## 6. Skylights.

Skylights shall:

A. Have an area no greater than 5 percent of the gross exterior roof area Skylight Roof Ratio (SRR); and

**EXCEPTION 1 to Section 140.3(a)6A:** Buildings with an atria over 55 feet high shall have a skylight area no greater than 10 percent of the gross exterior roof area.

**EXCEPTION 2 to Section 140.3(a)6A:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

B. Have an Area-Weighted Performance Rating U-factor no greater than the applicable value in Table 140.3-B, or C ~~or D~~.

**EXCEPTION 1 to Section 140.3(a)6B:** For skylights containing chromogenic type glazing:

- i. the lower-rate labeled U-factor shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and
- ii. chromogenic glazing shall be considered separately from other glazing; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

**EXCEPTION 2 to Section 140.3(a)6B:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

C. Have an area-weighted performance rating Solar Heat Gain Coefficient no greater than the applicable value in Table 140.3-B, or C ~~or D~~.

**EXCEPTION 1 to Section 140.3(a)6C:** For skylights containing chromogenic type glazing:

- i. the lower-rated labeled SHGC shall be used to demonstrate compliance ~~compliance~~ with this section; and
- ii. chromogenic glazing shall be considered separately from other glazing; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

**EXCEPTION 2 to Section 140.3(a)6C:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

D. Have an Area-Weighted Performance Rating VT no less than the applicable value in Table 140.3-B, or C ~~or D~~; and

**EXCEPTION 1 to Section 140.3(a)6D:** For skylights containing chromogenic type glazing:

- i. the higher-rated labeled VT shall be used with automatic controls to modulate the amount of light transmitted into the space in multiple steps in response to daylight levels or solar intensity and;
- ii. chromogenic glazing shall be considered separately from other glazing; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

**EXCEPTION 2 to Section 140.3(a)6D:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

- E. Have a glazing material or diffuser that has a measured haze value greater than 90 percent, determined according to ASTM D1003, or other test method approved by the Energy Commission.

**EXCEPTION 1 to Section 140.3(a)6E:** Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of the skylight and light well.

**EXCEPTION 2 to Section 140.3(a)6E:** Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

## 7. Exterior doors.

All exterior doors that separate conditioned space from unconditioned space or from ambient air shall have a U-factor not greater than the applicable value in Table 140.3-B, ~~or C or D~~. Doors that are more than one-quarter glass in area are considered Glazed Doors.

## 8. Relocatable Public School Buildings

In complying with Sections 140.3(a)1A to 7 shall meet the following:

- A. Relocatable public school buildings shall comply with TABLE 140.3-B for a specific Climate Zone when the manufacturer or builder of the relocatable public school building certifies that the building is intended for use only in a specific Climate Zone; or
- B. Relocatable public school buildings shall comply with TABLE 140.3-~~CD~~ for any Climate Zone when the manufacturer or builder of the relocatable public school building certifies that the building is intended for use in any Climate Zone; and
- C. The manufacturer or builder of a relocatable public school building shall certify that components of the building comply with requirements of this section by:
  - i. The placement of two (2) metal identification labels on the building, one mechanically fastened and visible from the exterior and the other mechanically fastened to the interior frame above the ceiling at the end of the module, both labels stating

(in addition to any other information by the Division of the State Architect or other law) "Complies with Title 24, Part 6 for all Climate Zones"; and

- ii. Identification of the location of the 2 labels on the plans submitted to the enforcing agency.

**9. Air Barrier.** (not shown)

**TABLE 140.3-A MATERIALS DEEMED TO COMPLY WITH SECTION 140.3(a)9B**

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(not shown)

**TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS (WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; ~~NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS~~))**

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<u>Envelope</u>	Maximum U-factor	Roofs/Ceilings	Metal Building	0.041	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	
			Wood Framed and Other	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
	Walls	Metal Building	Metal Building	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	
			Metal-framed	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
			Mass Light <sup>1</sup>	0.119	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
		Mass Heavy <sup>1</sup>	Mass Heavy <sup>1</sup>	0.225	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
			Wood-framed and Other	0.095	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
			Other	0.048	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
	Floors/Soffits	Raised Mass	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	
		Other	0.048	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	
	Roofing Products	Low-sloped	Aged Solar Reflectance	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	
			Thermal Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
		Steep	Aged Solar Reflectance	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22

		<b>Sloped</b>	Thermal Emittance	0.75	0.80	0.75	0.80	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
	<b><u>Air Barrier</u></b>			REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	<b>Exterior Doors, Maximum U-factor</b>		Non-Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50
			Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

**CONTINUED: TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR  
NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL  
BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE  
ZONE; ~~NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS  
OF HOTEL/MOTEL BUILDINGS~~)**

Envel ope	Fenestra tion	Climate Zone																
		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16																
		Fixed Window																
Vertical	Area-weighted Performance Rating	Max U- factor	0	0	0	0	0.3	0	0	0.3	0	0	0	0.3	0	0	0	
			6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			3	3	3	3		3	3		3	3	3		3	3	3	
		Max RSHG C	0	0	0	0	0.2	0	0	0.2	0	0	0	0.2	0	0	0	
			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
			2	2	2	2		2	2		2	2	2		2	2	2	
		Min VT	0.42															
			Curtainwall or Storefront															
			0	0	0	0	0.4	0	0	0.4	0	0	0	0.4	0	0	0	0
		Max U- factor	.	.	.	.	1	.	.	1	.	.	.	1	.	.	.	
			3	4	4	4		4	3		4	4	4		4	4	4	
			8	1	1	1		1	8		1	1	1		1	1	1	
		Max RSHG C	0	0	0	0	0.2	0	0	0.2	0	0	0	0.2	0	0	0	
			5	6	6	6	6	6	5	6	6	6	6	6	6	6	6	
			2	2	2	2		2	2		2	2	2		2	2	2	
Min VT	0.46																	
	Operable Window																	
	Max U- factor	0.46																
Max RSHG C	0.22																	
Min VT	0.32																	
Glazed Doors																		
Max U- factor	0.45																	
Max RSHG C	0.23																	
Min VT	0.17																	
Max WWR%		40%																
Skylights	All Climate Zones																	
	Area-Weighted Performance R ating	Max U- factor	Glass, Curb Mounted				Glass, Deck Mounted				Plastic, Curb Mounted				Tubular Daylighting Devices (TDDs)			
			0.58				0.46				0.88				0.88			
Max SHGC	0.25				0.25				NR				NR					

				Min VT (Min VT <sub>annua</sub> for TDDs)	0.49	0.49	0.64	0.38
			Maximum SRR%		5%			



**TABLE 140.3 C — PRESCRIPTIVE ENVELOPE CRITERIA FOR GUEST ROOMS OF HOTEL/MOTEL BUILDINGS**

		Climate Zone															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<b>Envelope</b>	<b>Maximum U-factor</b>	<b>Roofs/Ceilings</b>	<b>Metal Building</b>	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
		<b>Wood Framed and Other</b>	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		<b>Metal Building</b>	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
		<b>Metal-framed</b>	0.06	0.06	0.06	0.06	0.06	0.06	0.10	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.04
		<b>Mass, Light<sup>†</sup></b>	0.17	0.17	0.17	0.17	0.17	0.22	0.22	0.22	0.19	0.17	0.17	0.17	0.17	0.17	0.17
		<b>Mass, Heavy<sup>†</sup></b>	0.16	0.16	0.16	0.18	0.21	0.23	0.23	0.23	0.23	0.23	0.18	0.25	0.21	0.18	0.18
		<b>Wood-framed and Other</b>	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.04
		<b>Floors/Soffits</b>	<b>Raised Mass<sup>‡</sup></b>	0.04	0.04	0.05	0.05	0.05	0.06	0.09	0.09	0.09	0.06	0.05	0.05	0.05	0.04
		<b>Other</b>	0.03	0.03	0.03	0.03	0.03	0.03	0.07	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
		<b>Roofing Products</b>	<b>Low-sloped</b>	<b>Aged Solar Reflectance</b>	NR	NR	NR	NR	NR	NR	NR	NR	0.55	0.55	0.55	NR	0.55
<b>Thermal Emittance</b>	NR		NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	
<b>Steep-sloped</b>	<b>Aged Solar Reflectance</b>		NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
<b>Thermal Emittance</b>	NR		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
<b>Air Barrier</b>	RE		RE	RE	RE	RE	RE	NR	RE	RE	RE	RE	RE	RE	RE	RE	

	-																
	Exterior Doors, Maximum U- factor	Non- Swingin g	0. 50	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	1. 45	0. 50
		Swingin g	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70	0. 70

**CONTINUED: TABLE 140.3 C — PRESCRIPTIVE ENVELOPE CRITERIA FOR GUEST ROOMS OF HOTEL/MOTEL BUILDINGS**

Envelope	Fenestrations	All Climate Zones				
			Fixed Window	Operable Window	Curtainwall/Storefront	Glazed Doors <sup>2</sup>
	Vertical	Area-Weighted Performance Rating	Max U-factor 0.36	0.46	0.41	0.45
			Max RSHGC 0.25	0.22	0.26	0.23
		Area-Weighted Performance Rating	Min VT 0.42	0.32	0.46	0.17
		Maximum WWR%	40%			
	Skylights			Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted
		Area-Weighted Performance Rating	Max U-factor 0.58	0.46	0.46	0.88
			Max SHGC 0.25	0.25	0.25	NR
		Area-Weighted Performance Rating	Min VT 0.49	0.49	0.49	0.64
		Maximum SRR%	5%			
	<b>Notes:</b> 1. As defined in Section 100.1, light mass walls are walls with a heat capacity of at least 7.0 Btu/ft <sup>2</sup> -oF and less than 15.0 Btu/ft <sup>2</sup> -oF. Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/ft <sup>2</sup> -oF. 2. Glazed Doors applies to both site-built and to factory-assembled glazed doors.					

**TABLE 140.3-~~CD~~ PRESCRIPTIVE ENVELOPE CRITERIA FOR RELOCATABLE PUBLIC SCHOOL BUILDINGS FOR USE IN ALL CLIMATE ZONES**

(not shown)

**SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS**

**(b) Alterations.**

Alterations to components of existing nonresidential, hotel/motel, or relocatable public school buildings, including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy shall meet item 1, and either Item 2 or 3 below:

**1. Mandatory Requirements.**

Altered components in a nonresidential, or hotel/motel building shall meet the minimum requirements in this Section.

A. **Roof/Ceiling Insulation.** The opaque portions of the roof/ceiling that separate conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Section 141.0(b)2Biii.

B. **Wall Insulation.** ~~For the~~ The altered opaque portion of walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 4 below:

1. **Metal Building.** A minimum of **R-13** insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed **U-0.113**.
2. **Metal Framed.** A minimum of **R-13** insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed **U-0.217**.
3. **Wood Framed and Others.** A minimum of **R-11** insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed **U-0.110**.
4. **Spandrel Panels and Glass Curtain Walls.** A minimum of **R-4**, or the area-weighted average U-factor of the wall assembly shall not exceed **U-0.280**.

**EXCEPTION to Section 141.0(b)1B:** Light and heavy mass walls.

C. **Floor Insulation.** (not shown)

D. **Fan Energy Index:** (not shown)

E. **Exterior Windows.** Fenestration alterations other than repair shall meet the requirements below:

1. Vertical fenestration alterations. Where over 150 square feet of the entire building's vertical fenestration is replaced, it shall meet the requirements of xxxxx

**NOTE:** Glass replaced in an existing sash and frame or sashes replaced in an existing frame are considered repairs. In these cases, Section 141.0(c) requires that the replacement be at least equivalent to the original in performance.

2. **Added vertical fenestration.** Where over 50 square feet of vertical fenestration is added, it shall meet the requirements of xxxx.