

CALIFORNIA ENERGY CODE REFERENCES

Nonresidential, High-Rise Residential and Hotel/Motel Occupancies

Related to Concrete Masonry

- **CEC:** 2016 California Energy Code
- **NRCM:** 2016 Nonresidential Compliance Manual (CEC-400-2015-033-CMF)
- **RA:** 2016 Reference Appendices (CEC-400-2015-038-CMF)

NOTE: This code reference document is specific to California, the 2016 California Energy Code (CEC), and its supplementary manuals and appendices. In many respects, the CEC is more advanced in treatment of material performance than the International Energy Conservation Code (IECC) used in other states. The purpose of this code reference document is to highlight sections in the CEC related to concrete masonry and how they present the inherent benefits of the system for energy design.

The CEC has mandatory provisions, and two optional paths to compliance:

Performance approach, where approved compliance software calculates the energy budgets for both the baseline standard design building and the proposed design building.

Prescriptive approach, where the provisions of CEC Section 140.2 must be met for the project's climate zone.

The performance approach is by far the most utilized in California as it offers greater flexibility in design, more accurately accounts for systems (including concrete masonry walls), and maximizes potential credits for green rating systems such as LEED®. The prescriptive requirements are very conservative and come into play in establishing the baseline.

The code references below are from mandatory and prescriptive sections of the CEC. Again, though prescriptive requirements are typically used for a design baseline as part of the performance approach, they are useful in demonstrating the energy effectiveness of concrete masonry.

In particular, the high R-values in mandatory and prescriptive requirements for *framed* walls do NOT correlate to concrete masonry, which is a heavy mass wall. Unlike framed walls, **concrete masonry has no mandatory insulation requirement**, as the CEC recognizes the substantial benefit in heavy mass walls.

SUBCHAPTER 1 – ALL OCCUPANCIES—GENERAL PROVISION - SCOPE

CEC: 100.0(e)2

Sections applicable to particular buildings. Newly constructed buildings.

- A. **All newly constructed buildings.** Sections 110 through 110.10 apply [*in CEC Subchapter 2; these sections are not related to concrete masonry*].
- B. **Nonresidential, high-rise residential and hotel/motel buildings.** Mechanically heated or cooled.
 - i. **Sections applicable.** Sections 120.0 through 140.8 [*Only sections related to concrete masonry are noted below.*]
 - ii. **Compliance approaches.** [*Only sections related to concrete masonry are noted below.*]
 - a. **Mandatory measures:** Sections 120.0 through 130.5; and
 - b. **Either:**
 - (i). Performance approach: Section 140.1; or
 - (ii). Prescriptive approach: Sections 140.2 through 140.8

SUBCHAPTER 3 – NONRESIDENTIAL, HIGH-RISE RESIDENTIAL HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES-MANDATORY REQUIREMENTS

CEC: 120.0	GENERAL. Sections 120.1 through 120.9; requirements for building envelopes, ventilation, space-conditioning, and service water-heating systems.
CEC: 120.7(b) NRCM: 3.2.3.1 A.4.	MANDATORY INSULATION REQUIREMENTS. Wall insulation. Opaque portions of walls that separate conditioned spaces from unconditioned spaces or ambient air 4. Heavy mass walls. 8-inch or greater hollow core concrete masonry unit shall have a <i>U</i> -factor not to exceed 0.690. <i>[For heavy mass walls, insulation is not mandatory.]</i>
NRCM: 3.2.1.1 E.	Mandatory Insulation Requirements (Newly Constructed Buildings) Refers to Reference Joint Appendix JA4 for heavy mass wall <i>U</i> -factors.
NRCM: 3.1.2.4 G.	HC (heat capacity – thermal mass): Note: by storing heat, materials with a high heat capacity, or thermal mass, dampen temperature swings throughout the day; therefore, <i>U</i> -factor criteria are less stringent for mass walls than for framed construction.

SUBCHAPTER 5 – NONRESIDENTIAL, HIGH-RISE RESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES— PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

CEC: 140.0	PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES. Meet all of the following: (a) Sections 100.0 through 110.10 (mandatory measures) <i>[these sections are not applicable to concrete masonry]</i> (b) Sections 120.0 through 130.5 (mandatory measures) <i>[these sections are not applicable to concrete masonry except 120.7(b); see above for Subchapter 3]</i> (c) Either the performance compliance approach (energy budgets) in Section 140.1 OR the prescriptive compliance approach in Section 140.2 for the climate zone in which the building will be located.
CEC: 140.1	PERFORMANCE APPROACH: ENERGY BUDGETS. Standard vs. proposed design building using certified compliance software.
CEC: 140.2(a)	PRESCRIPTIVE APPROACH. A building envelope that complies with Section 140.3(a).
CEC: 140.3(a)	PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES. Meet either Subsection (a) for each individual component, or Subsection (b) for the envelope meeting overall requirements; either must meet applicable requirements of Subsection (c). (a) Envelope component requirements 2. Exterior walls. Have an overall assembly <i>U</i> -factor no greater than the applicable value in Table 140.3-B or C. <i>[Table 140.3-D not applicable to cmu.]</i> 9. Air barrier. <i>[Required for Climate Zones 10 – 16 per table 140.3-B.]</i> Continuous air barrier to control air leakage into and out of conditioned space. To meet Table 140.3-A, air barrier shall be composed of: A. Materials shall have an air permeance not exceeding 0.004 cfm/ft ² Exception to Section 140.3(a)9A: Materials in Table 140.3-A (Item 14 – Fully grouted concrete block masonry) B. Assemblies that have an average air leakage not exceeding 0.04 cfm/ft ² Exception to Section 140.3(a)9B: Materials deemed to comply if all joints sealed: 1. Concrete masonry walls that have at least two coatings of paint or sealer. NOTE: ‘9.B Exception’ refers to concrete masonry walls that are partially grouted, or have no grout. Solid grouted walls meet ‘9.A Exception’.

NRCM: 3.2.3.2
NRCM: 3.2.4.1
CEC: Table 140.3-B

Prescriptive Envelope Requirements. Exterior Walls. U-factors from Reference Joint Appendix JA4 must be used; Standards no longer allow using the R-value; only U-factors may be used to demonstrate compliance.

Demising Walls. Mandatory Insulation for Demising Walls. Only framed assemblies have the insulation requirement. If it is not framed [i.e., concrete masonry] then no insulation is required.

TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS
[Excerpts where minimum 8-inch wide solid grouted concrete masonry wall meets requirement with no additional insulation.]

				CLIMATE ZONE									
				2	3	4	5	6	7	8	9	10	
ENVELOPE	Max U-factor	Walls	Mass Heavy ¹	0.65	0.65	0.65	0.65	0.69	0.69	0.69	0.69	0.69	0.65

1. Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/h-ft². [See excerpt from appendices below]

CEC: Table 140.3-C

TABLE 140.3-C – PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS
[Excerpts where minimum 8-inch wide solid grouted concrete masonry wall meets requirement with no additional insulation.]

				CLIMATE ZONE				
				6	7	8	9	10
ENVELOPE	Max U-factor	Walls	Mass Heavy ¹	0.69	0.69	0.69	0.69	0.69

1. Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/h-ft². [See excerpt from appendices below]

Note: As shown above in Tables 140.3-B and C, 8-inch solid grouted concrete masonry meets the prescriptive requirement for U-factor in many Climate Zones (Figure 1). In the other Zones with prescriptive requirements for lower U-factors, only nominal additional insulation is needed to lower the U_{Total} to required values; typically significantly less than would be required for framed walls. See 2016 Joint Appendices, JA4.1.4 below.

2016 REFERENCE APPENDICES, 2016 Joint Appendices, Appendix JA-4

RA: JA4.1.4

Insulating Layers on Mass and Other Walls

The data in Table 4.3.14 (*Effective R-values for Interior or Exterior Insulation Layers*) may be used to modify the U-factors from Table 4.3.5 [below] when an additional layer is added to the inside or outside of the mass wall. The following equation calculates the total U-factor, where U_{mass} is selected from Table 4.3.5, and R_{Outside} and R_{Inside} are selected from Table 4.3.14. R_{Outside} is selected from row 26 while R_{Inside} is selected from rows 1 through 25.

$$U_{Total} = \frac{1}{R_{Outside} + \left(\frac{1}{U_{Mass}}\right) + R_{Inside}} \quad \text{Equation 4-4}$$

RA: Table 4.3.5

Table 4.3.5 Properties of Hollow Unit Masonry Walls

[Excerpts for Medium Weight, solid grouted. Column and row numbers from Table 4.3.5.]

Thickness	Type	Solid Grout		
		A		
		1	U-factor	HC
12"	MW CMU	3	0.54	23.9
10"	MW CMU	6	0.59	19.7
8"	MW CMU	9	0.65	15.7

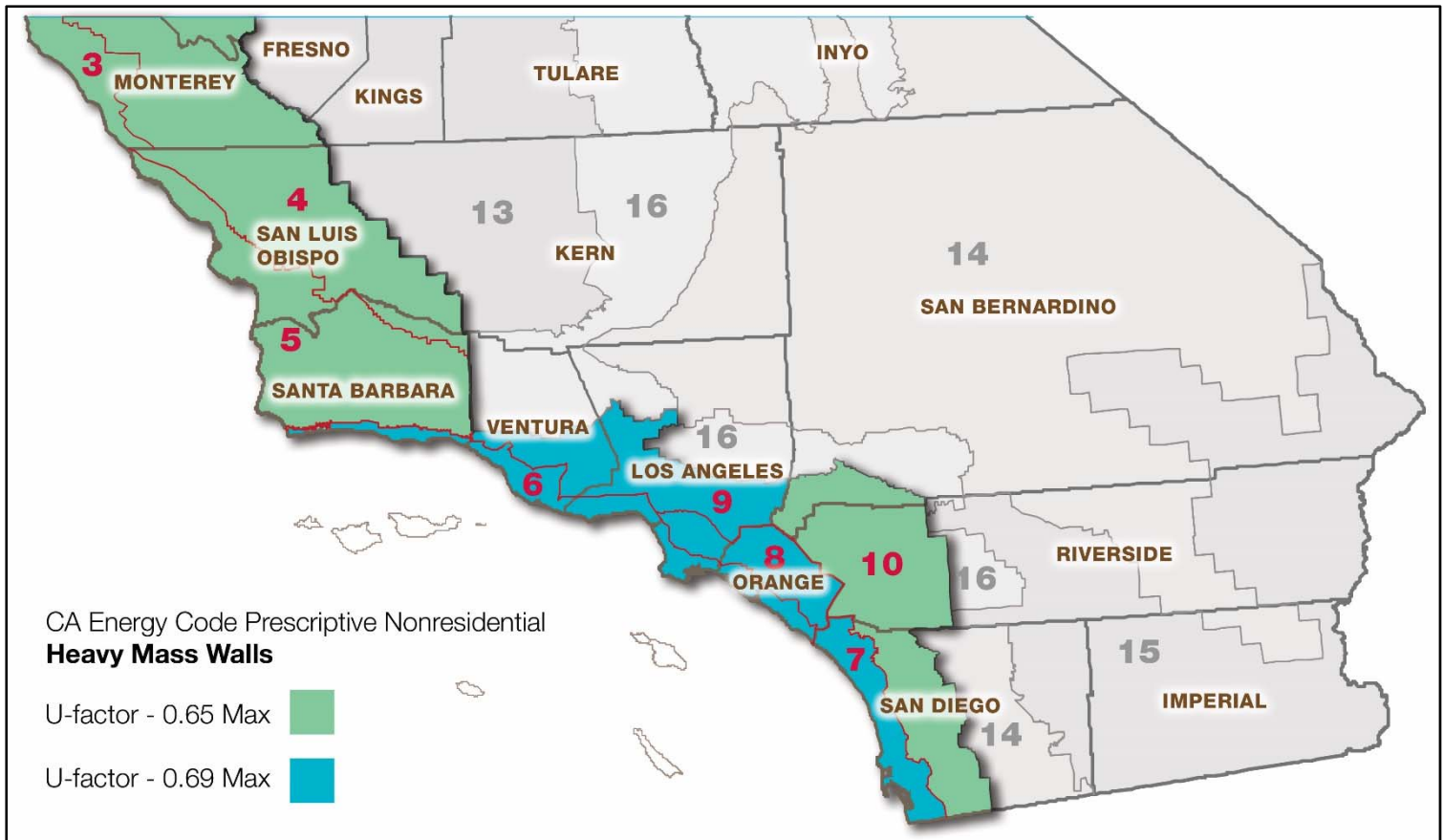


Figure 1 – Southern California Climate Zones with Concrete Masonry Heavy Mass Wall Overlay

An 8-inch wide or greater concrete masonry wall, with Medium Weight cmu, solid grouted, meets the prescriptive requirements for the Southern and Central California coastal areas, including the major metropolitan regions, **without any mandatory insulation.**