

SUBCHAPTER 5

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

SECTION 140.0 PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

Nonresidential, high-rise residential and hotel/motel buildings shall comply with all of the following:

- (a) The requirements of Sections 100.0 through 110.10 applicable to the building project (mandatory measures for all buildings).
- (b) The requirements of Sections 120.0 through 130.5 (mandatory measures for nonresidential, high-rise residential and hotel/motel buildings).
- (c) Either the performance compliance approach (energy budgets) specified in Section 140.1 or the prescriptive compliance approach specified in Section 140.2 for the climate zone in which the building will be located. Climate zones are shown in Figure 100.1-A.

Note to Section 140.0(c): The Commission periodically updates, publishes and makes available to interested persons and local enforcement agencies precise descriptions of the climate zones, which is available by zip code boundaries depicted in the Reference Joint Appendices along with a list of the communities in each zone.

Note to Section 140.0: The requirements of Sections 140.1 through 140.9 apply to newly constructed buildings. Section 141.0 specifies which requirements of Sections 140.1 through 140.9 also apply to additions or alterations to existing buildings.

SECTION 140.1 PERFORMANCE APPROACH: ENERGY BUDGETS

A building complies with the performance approach if the energy budget calculated for the proposed design building under Subsection (b) is no greater than the energy budget calculated for the standard design building under Subsection (a).

(a) **Energy budget for the standard design building.** The energy budget for a proposed building is determined by applying the mandatory and prescriptive requirements to the proposed design building. The energy budget is the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation, service water heating and covered process loads.

(b) **Energy budget for the proposed design building.** The energy budget for a proposed design building is determined by calculating the TDV energy for the proposed design building. The energy budget is the sum of the TDV energy for

space-conditioning, indoor lighting, mechanical ventilation and service water heating and covered process loads.

(c) **Calculation of energy budget.** The TDV energy for both the standard design building and the proposed design building shall be computed by compliance software certified for this use by the Commission. The processes for compliance software approval by the Commission are documented in the Nonresidential ACM Approval Manual.

SECTION 140.2 PRESCRIPTIVE APPROACH

In order to comply with the prescriptive approach under this section, a building shall be designed with and shall have constructed and installed:

- (a) A building envelope that complies with Section 140.3(a);
- (b) A minimum daylighting requirement for large enclosed spaces complying with Section 140.3(c);
- (c) A space-conditioning system that complies with Section 140.4;
- (d) A service water-heating system that complies with Section 140.5;
- (e) An indoor lighting system that complies with Section 140.6;
- (f) An outdoor lighting system that complies with Section 140.7;
- (g) Interior and exterior signs that comply with Section 140.8; and
- (h) Covered processes that comply with Section 140.9.

SECTION 140.3 PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES

A building complies with this section by being designed with and having constructed to meet all prescriptive requirements in Subsection (a) and the requirements of Subsection (c) 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 that have thermal mass with a weight of at least 25 lb/ft² 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 in climate zones 1 through 16 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.
- ii. High-rise residential buildings and hotels and motels:
 - 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 that have thermal mass with a weight of at least 25 lb/ft² 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, C or D, and where required by Section 110.8(e), insulation shall be placed in direct contact with a continuous 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, C or D.
- 3. **Demising walls.** Demising walls shall meet the requirements of Section 120.7(b)7.
- 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, C or D.
- 5. **Fenestration.** Vertical windows shall:
 - A. Have (1) 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 (2) 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

Exception to Section 140.3(a)5A: Window area in demising walls is not counted as part of the window area for this requirement. Demising wall area is not counted as part of the gross exterior wall area or display perimeter for this requirement.

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

Exception to Section 140.3(a)5B: For vertical fenestration 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 fenestration; and
- iii. Area-weighted averaging with other fenestration that is not chromogenic shall not be permitted.

**TABLE 140.3
ROOF/CEILING INSULATION TRADEOFF FOR AGED SOLAR REFLECTANCE**

NONRESIDENTIAL					
Aged Solar Reflectance	Metal Building Climate Zone 1-16 <i>U</i> -factor	Wood framed and Other Climate Zone 6 & 7 <i>U</i> -factor	Wood Framed and Other All Other Climate Zones <i>U</i> -factor	Wood Framed and Other, Climate Zone 6 <i>U</i> -factor	Wood Framed and Other Climate Zone 7 & 8 <i>U</i> -factor
0.62-0.56	0.038	0.045	0.032	0.065	0.059
0.55-0.46	0.035	0.042	0.030	0.058	0.053
0.45-0.36	0.033	0.039	0.029	0.052	0.048
0.35-0.25	0.031	0.037	0.028	0.047	0.044

- 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, 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 windows; or
- ii. Relative solar heat gain coefficient is calculated using Equation 140.3-A, if the window has an overhang that extends beyond each side of the window jamb by a distance equal to the overhang's horizontal projection.

Exception 1 to Section 143(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 fenestration 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 to demonstrate compliance with this section; and
- ii. chromogenic glazing shall be considered separately from other fenestration; and
- iii. area-weighted averaging with other fenestration that is not chromogenic shall not be permitted.

- D. Have an area-weighted average visible transmittance (VT), no less than the applicable value in Tables 140.33-B and C, or Equation 140.3-B, as applicable.

Exception 1 to Section 140.3(a)5D: When the fenestration's primary and secondary sidelit daylight zones are completely overlapped by one or more skylit daylight zones, then the fenestration need not comply with Section 140.3(a)5D.

Exception 2 to Section 140.3(a)5D: If the fenestration's visible transmittance is not within the scope of NFRC 200, or ASTM E972, then the VT shall be calculated according to Reference Nonresidential Appendix NA6.

Exception 3 to Section 140.3(a)5D: For vertical fenestration containing chromogenic type glazing:

- i. the higher-rate 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 fenestration; and
- iii. area-weighted averaging with other fenestration that is not chromogenic shall not be permitted.

**EQUATION 140.3-A
RELATIVE SOLAR HEAT GAIN, COEFFICIENT, RSHGC**

$$RSHGC = SHGC_{win} \times \left[1 + \frac{aH}{V} + b \left(\frac{H}{V} \right)^2 \right]$$

where:

- RSHGC = Relative Solar Heat Gain Coefficient.
- SHGC_{win} = Solar Heat Gain Coefficient of the window.
- H = horizontal projection of the overhang from the surface of the window in feet, but no greater than V.
- V = vertical distance from the window sill to the bottom of the overhang, in feet.
- a = -0.41 for north-facing windows, -1.22 for south-facing windows and -0.92 for east- and west-facing windows.
- b = 0.20 for north-facing windows, 0.66 for south-facing windows and 0.35 for east- and west-facing windows.

**EQUATION 140.3-B
VERTICAL FENESTRATION MINIMUM VT**

$$VT \geq 0.11/WWR$$

where:

- WWR = Window wall ratio, the ratio of (i) the total window area of the entire building to (ii) the total gross exterior wall area of the entire building. If the WWR is greater than 0.40, then 0.40 shall be used as the value for WWR in Equation 140.3-B.
- VT = Visible transmittance of framed window.

6. Skylights. Skylights shall:

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

Exception to Section 140.3(a)6A: Atria over 55 feet high shall have a skylight area no greater than 10 percent of the gross exterior roof area.

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

Exception 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 skylights; and

iii. area-weighted averaging with other skylights that is not chromogenic shall not be permitted.

C. Have an area-weighted performance rating solar heat gain coefficient no greater than the applicable value in Table 140.3-B, C or D.

Exception to Section 140.3(a)6C: For skylights containing chromogenic type glazing:

i. the lower-rated labeled SHGC shall be used to demonstrate compliance with this section; and

ii. chromogenic glazing shall be considered separately from other skylights; and

iii. area-weighted averaging with other skylights that is not chromogenic shall not be permitted.

D. Have an area-weighted performance rating VT no less than the applicable value in Table 140.3-B or C; and

Exception 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 skylights; and

iii. area-weighted averaging with other skylights that are not chromogenic shall not be permitted.

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 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.

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, C or D. Doors that are more than one-half glass in area are considered glazed doors.

8. **Relocatable public school buildings.** In complying with Sections 140.3(a)1 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-D 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 two labels on the plans submitted to the enforcing agency.

9. **Air barrier.** To meet the requirement of Table 140.3-B, all buildings shall have a continuous air barrier that is designed and constructed to control air leakage into, and out of, the building's conditioned space. The air barrier shall be sealed at all joints for its entire length and shall be composed of:

A. Materials that have an air permeance not exceeding 0.004 cfm/ft², under a pressure differential of 0.3 in. w.g. (1.57 psf) (0.02 L/m² at 75 pa), when tested in accordance with ASTM E2178; or

Exception to Section 140.3(a)9A: Materials in Table 140.3-A shall be deemed to comply with Section 140.3(a)9A, provided all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions.

B. Assemblies of materials and components that have an average air leakage not exceeding 0.04 cfm/ft², under a pressure differential of 0.3 in. w.g. (1.57 psf) (0.2 L/m² at 75 pa), when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680 or ASTM E283; or

Exception to Section 140.3(a)9B: The following materials shall be deemed to comply with Section 140.3(a)9B if all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions:

1. Concrete masonry walls that have at least two coatings of paint or at least two coatings of sealer coating.

2. Concrete masonry walls with integral rigid board insulation.

3. Structurally insulated panels.

4. Portland cement or Portland sand parge, or stucco, or a gypsum plaster, each with a minimum 1/2 inch thickness.

C. The entire building has an air leakage rate not exceeding 0.40 cfm/ft² at a pressure differential of 0.3 in w.g. (1.57 psf) (2.0 L/m² at 75 pa), when the entire building is tested, after completion of construction, in accordance with ASTM E779 or another test method approved by the Commission.

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

MATERIALS AND THICKNESS	
1	Plywood – min. 3/8 inch thickness
2	Oriented strand board – min. 3/8 inch thickness
3	Extruded polystyrene insulation board – min. 1/2 inch thickness
4	Foil-back polyisocyanurate insulation board – min. 1/2 inch thickness
5	Closed cell spray foam with a minimum density of 2.0 pcf and a min. 2.0 inch thickness
6	Open cell spray foam with a density no less than 0.4 pcf and no greater than 1.5 pcf, and a min. 5 1/2 inch thickness
7	Exterior or interior gypsum board min. 1/2 inch thickness
8	Cement board – min. 1/2 inch thickness
9	Built up roofing membrane
10	Modified bituminous roof membrane
11	Fully adhered single-ply roof membrane
12	A Portland cement or Portland sand parge, or a gypsum plaster, each with min. 5/8 inch thickness
13	Cast-in-place concrete, or precast concrete
14	Fully grouted concrete block masonry
15	Sheet steel or sheet aluminum

**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 GUESTROOMS OF HOTEL/MOTEL BUILDINGS)**

			CLIMATE ZONE																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
ENVELOPE	Maximum U-factor	Roofs/Ceilings	Metal building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	
			Wood-framed and other	0.034	0.034	0.034	0.034	0.034	0.049	0.049	0.049	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
		Walls	Metal building	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
			Metal-framed	0.069	0.062	0.082	0.062	0.062	0.069	0.069	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
			Mass light ¹	0.196	0.170	0.278	0.227	0.440	0.440	0.440	0.440	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass heavy ¹	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.184	0.160
			Wood-framed and other	0.095	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	0.045	0.059	0.059	0.059	0.059	0.042	0.059
		Floors/Soffits	Raised mass	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.058
	Other		0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039	0.039		
	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	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-sloped	Aged solar reflectance	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	0.20	0.20	0.20	
			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	
	Air Barrier			NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	Exterior Doors, Maximum U-factor	Nonswinging		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	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	0.70	

		ALL CLIMATE ZONES							
		Fixed Window	Operable Window	Curtainwall or Storefront	Glazed ² Doors				
ENVELOPE	FENESTRATION	Vertical	Area-Weighted performance rating		Max U-factor	0.36	0.46	0.41	0.45
			Area-Weighted performance rating		Max RSHGC	0.25	0.22	0.26	0.23
			Maximum WWR%		Min VT	0.42	0.32	0.46	0.17
				40%					
		Skylights			Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted		
			Area-Weighted performance rating		Max U-factor	0.58	0.46	0.88	
	Area-Weighted performance rating		Max SHGC	0.25	0.25	NR			
	Area-Weighted performance rating		Min VT	0.49	0.49	0.64			
			5%						

1. Light mass walls are walls with a heat capacity of at least 7.0 Btu/h-ft² and less than 15.0 Btu/h-ft². Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/h-ft².
 2. Glazed doors applies to both site-built and to factory-assembled glazed doors.

TABLE 140.3-C

PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUESTROOMS OF HOTEL/MOTEL BUILDINGS

			CLIMATE ZONE																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
ENVELOPE	Maximum U-factor	Roofs/ Ceilings	Metal building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	
			Wood-framed and other	0.028	0.028	0.034	0.028	0.034	0.034	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
		Walls	Metal building	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057
			Metal-framed	0.069	0.069	0.069	0.069	0.069	0.069	0.105	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.048	0.069
			Mass light ¹	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.196	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass heavy ¹	0.160	0.160	0.160	0.184	0.211	0.690	0.690	0.690	0.690	0.690	0.184	0.253	0.211	0.184	0.184	0.160
			Wood-framed and other	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.042	0.059	0.059	0.042	0.042	0.042
		Floors/ Soffits	Raised mass	0.045	0.045	0.058	0.058	0.058	0.069	0.092	0.092	0.092	0.669	0.058	0.058	0.058	0.045	0.058	0.037
	Other		0.034	0.034	0.039	0.039	0.039	0.039	0.071	0.039	0.039	0.039	0.039	0.039	0.039	0.034	0.039	0.034	
	Roofing Products	Low- sloped	Aged solar reflectance	NR	NR	NR	NR	NR	NR	NR	NR	0.55	0.55	0.55	NR	0.55	0.55	0.55	NR
			Thermal emittance	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR
		Steep- sloped	Aged solar reflectance	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	0.20	NR
			Thermal emittance	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	NR
	Exterior Doors, Maximum U-factor	Nonswinging	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	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	0.70	

ENVELOPE		FENESTRATION		ALL CLIMATE ZONES				
					Fixed Window	Operable Window	Curtainwall or Storefront	Glazed ² Doors
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	Area-Weighted performance rating		Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted			
		Max U-factor	0.58	0.46	0.88			
	Area-Weighted performance rating	Max SHGC	0.25	0.25	NR			
	Area-Weighted performance rating	Min VT	0.49	0.49	0.64			
Maximum SRR%	5%							

1. Light mass walls are walls with a heat capacity of at least 7.0 Btu/h-ft² and less than 15.0 Btu/h-ft². Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/h-ft².

2. Glazed doors applies to both site-built and to factory-assembled glazed doors.

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

Roofs/ Ceilings	Metal Buildings	Maximum <i>U</i> -factor	0.041			
	Non-Metal Buildings		0.034			
Walls	Wood frame buildings		0.042			
	Metal frame buildings		0.057			
	Metal Buildings		0.057			
	Mass/7.0 ≤ HC		0.170			
	All Other Walls		0.059			
Floors and Soffits	Floors and Soffits		0.048			
Roofing Products	Low-Sloped		Aged Solar Reflectance	0.63		
			Thermal Emittance	0.75		
	Steep-Sloped	Aged Solar Reflectance	0.20			
		Thermal Emittance	0.75			
Fenestration	Windows	Maximum <i>U</i> -factor	0.47			
		Maximum SHGC	0.26			
	Glazed Doors (Site-Built and Factory Assembled)	Maximum <i>U</i> -factor	0.45			
		Maximum SHGC	0.23			
	Skylights	Glass with Curb	Maximum <i>U</i> -factor	0.99		
				Glass without Curb	0.57	
					Plastic with Curb	0.87
		Glass Type	0-2% SRR	Maximum SHGC		0.46
			2.1-5% SRR			0.36
		Plastic Type	0-2% SRR	0.69		
2.1-5% SRR	0.57					
Exterior Doors	Non-Swinging doors	Maximum <i>U</i> -factor	0.50			
	Swinging doors		0.70			

Exception to Section 140.3(a)9: Relocatable public school buildings.

(b) **Reserved.**

(c) **Minimum daylighting requirement for large enclosed spaces.** In climate zones 2 through 15, conditioned enclosed spaces, and unconditioned enclosed spaces that are greater than 5,000 square feet and that are directly under a roof with ceiling heights greater than 15 feet, shall meet the following requirements:

1. A combined total of at least 75 percent of the floor area, as determined in building floor plan (drawings) view, shall be within one or more of the following:
 - A. Primary sidelit daylight zone in accordance with Section 130.1(d)1B, or
 - B. The total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.
2. All skylit daylight zones and primary sidelit daylight zones shall be shown on building plans.

3. General lighting in daylight zones shall be controlled in accordance with Section 130.1(d).
4. The total skylight area is at least 3 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights; or the product of the total skylight area and the average skylight visible transmittance is no less than 1.5 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.
5. All skylights shall have a glazing material or diffuser that has a measured haze value greater than 90 percent, tested according to ASTM D1003 (notwithstanding its scope) or other test method approved by the Commission.
6. Skylights for conditioned and unconditioned spaces shall have an area-weighted average visible transmittance (VT) no less than the applicable value required by Section 140.3(a)6D.

Exception 1 to Section 140.3(c): Auditoriums, churches, movie theaters, museums and refrigerated warehouses.

Exception 2 to Section 140.3(c): In buildings with unfinished interiors, future enclosed spaces for which there are plans to have:

- A. A floor area of less than or equal to 5,000 square feet, or
- B. Ceiling heights of less than or equal to 15 feet.

This exception shall not be used for S-1 or S-2 (storage), or for F-1 or F-2 (factory) occupancies.

Exception 3 to Section 140.3(c): Enclosed spaces having a designed general lighting system with a lighting power density less than 0.5 watts per square foot.

Exception 4 to Section 140.3(c): Enclosed spaces where it is documented that permanent architectural features of the building, existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed space for more than 1500 daytime hours per year between 8 a.m. and 4 p.m.

**SECTION 140.4
PRESCRIPTIVE REQUIREMENTS
FOR SPACE-CONDITIONING SYSTEMS**

A building complies with this section by being designed with and having constructed and installed a space-conditioning system that meets the applicable requirements of Subsections (a) through (m).

(a) **Sizing and equipment selection.** Mechanical heating and mechanical cooling equipment shall be the smallest size, within the available options of the desired equipment line, necessary to meet the design heating and cooling loads of the building, as calculated according to Subsection (b).

Exception 1 to Section 140.4(a): Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building TDV energy use.

Exception 2 to Section 140.4(a): Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating.

Exception 3 to Section 140.4(a): Multiple units of the same equipment type, such as multiple chillers and boilers, having combined capacities exceeding the design load, if they have controls that sequence or otherwise optimally control the operation of each unit based on load.

(b) **Calculations.** In making equipment sizing calculations under Subsection (a), all of the following rules shall apply:

1. **Methodology.** The methodologies, computer programs, inputs and assumptions approved by the Commission shall be used.
2. **Heating and cooling loads.** Heating and cooling system design loads shall be determined in accordance with the procedures described in the ASHRAE Handbook, Fundamentals Volume or as specified in a method approved by the Commission.
3. **Indoor design conditions.** Indoor design temperature and humidity conditions for general comfort applications shall be determined in accordance with ASHRAE Standard 55 or the ASHRAE Handbook, Fundamentals Volume, Chapter 8 except that winter humidification and summer dehumidification shall not be required.
4. **Outdoor design conditions.** Outdoor design conditions shall be selected from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X. Heating design temperatures shall be no lower than the Heating Winter Median of Extremes values. Cooling design temperatures shall be no greater than the 0.5 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.

Exception to Section 140.4(b)4: Cooling design temperatures for cooling towers shall be no greater than the 0.5 percent cooling design wet bulb values.

5. **Ventilation.** Outdoor air ventilation loads shall be calculated using the ventilation rates required in Section 120.1.
6. **Envelope.** Envelope heating and cooling loads shall be calculated using envelope characteristics, including square footage, thermal conductance, Solar Heat Gain Coefficient or shading coefficient, and air leakage, consistent with the proposed design.
7. **Lighting.** Lighting loads shall be based on actual design lighting levels or power densities as specified in Section 140.6.
8. **People.** Occupant density shall be based on the expected occupancy of the building and shall be the same as determined under Section 120.1(b)2B, if used. Sensible and latent heat gains shall be as listed in the

2005 ASHRAE Handbook- Fundamentals, Chapter 30, Table 1.

9. **Process loads.** Loads caused by a process shall be based upon actual information on the intended use of the building.
10. **Miscellaneous equipment.** Equipment loads other than process loads shall be calculated using design data compiled from one or more of the following sources:
 - A. Actual information based on the intended use of the building; or
 - B. Published data from manufacturer's technical publications or from technical societies, such as the ASHRAE Handbook, Applications Volume; or
 - C. Other data based on the designer's experience of expected loads and occupancy patterns.
11. **Internal heat gains.** Internal heat gains may be ignored for heating load calculations.
12. **Safety factor.** Design loads may be increased by up to 10 percent to account for unexpected loads or changes in space usage.
13. **Other loads.** Loads such as warm-up or cool-down shall be calculated from principles based on the heat capacity of the building and its contents, the degree of setback, and desired recovery time; or may be assumed to be no more than 30 percent for heating and 10 percent for cooling of the steady-state design loads. In addition, the steady-state load may include a safety factor in accordance with Section 140.4(b)12.

(c) **Power consumption of fans.** Each fan system used for space conditioning shall meet the requirements of Items 1, 2, 3 and 4 below. Total fan system power demand equals the sum of the power demand of all fans in the system that are required to operate at design conditions in order to supply air from the heating or cooling source to the conditioned space, and to return it back to the source or to exhaust it to the outdoors; however, total fan system power demand need not include (i) the additional power demand caused solely by air treatment or filtering systems with final pressure drops more than 245 pascals or 1-inch water column (only the energy accounted for by the amount of pressure drop that is over 1 inch may be excluded) or (ii) fan system power caused solely by exempt process loads.

1. **Constant volume fan systems.** The total fan power index at design conditions of each fan system with total horsepower over 25 hp shall not exceed 0.8 watts per cubic feet per minute of supply air.
2. **Variable air volume (VAV) systems.**
 - A. The total fan power index at design conditions of each fan system with total horsepower over 25 hp shall not exceed 1.25 watts per cubic feet per minute of supply air; and
 - B. Static pressure sensor location. Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller set point

is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with Section 140.4(c)2C. If this results in the sensor being located downstream of any major duct split, multiple sensors shall be installed in each major branch with fan capacity controlled to satisfy the sensor furthest below its setpoint; and,

C. Setpoint reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure setpoints shall be reset based on the zone requiring the most pressure; i.e., the setpoint is reset lower until one zone damper is nearly wide open.

3. **Air-treatment or filtering systems.** For systems with air-treatment or filtering systems, calculate the total adjusted fan power index using Equation 140.4-A:

**EQUATION 140.4-A
ADJUSTED TOTAL-FAN POWER INDEX**

Adjusted total fan power index =
Fan power index × Fan adjustment

$$\text{Fan adjustment} = 1 - \left(\frac{SP_a - 1}{SP_f} \right)$$

where:

SP_a = Air pressure drop across the air-treatment or filtering system.

SP_f = Total pressure drop across the fan.

4. **Fractional HVAC motors for fans.** HVAC motors for fans that are less than 1 hp and $1/12$ hp or greater shall be electronically-commutated motors or shall have a minimum motor efficiency of 70 percent when rated in accordance with NEMA Standard MG 1-2006 at full load rating conditions. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of a varying motor speed.

Exception 1 to Section 140.4(c)4: Motors in fan-coils and terminal units that operate only when providing heating to the space served.

Exception 2 to Section 140.4(c)4: Motors in space conditioning equipment certified under Section 110.1 or 110.2.

(d) **Space-conditioning zone controls.** Each space-conditioning zone shall have controls that prevent:

1. Reheating; and
2. Recooling; and
3. Simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems.

Exception 1 to Section 140.4(d): Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, recooled

or mixed air are allowed only if the controls meet all of the following requirements:

A. For each zone with direct digital controls (DDC):

i. The volume of primary air that is reheated, recooled or mixed air supply shall not exceed the larger of:

- a. 50 percent of the peak primary airflow; or
- b. The design zone outdoor airflow rate as specified by Section 120.1.

ii. The volume of primary air in the deadband shall not exceed the larger of:

- a. 20 percent of the peak primary airflow; or
- b. The design zone outdoor airflow rate as specified by Section 120.1.

iii. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95°F while the airflow is maintained at the dead band flow rate.

iv. The second stage of heating consists of modulating the airflow rate from the dead band flow rate up to the heating maximum flow rate.

B. For each zone without DDC, the volume of primary air that is reheated, recooled, or mixed air supply shall not exceed the larger of the following:

- i. 30 percent of the peak primary airflow; or
- ii. The design zone outdoor airflow rate as specified by Section 120.1.

Exception 2 to Section 140.4(d): Zones with special pressurization relationships or cross-contamination control needs.

Exception 3 to Section 140.4(d): Zones served by space-conditioning systems in which at least 75 percent of the energy for reheating, or providing warm air in mixing systems, is provided from a site-recovered or site-solar energy source.

Exception 4 to Section 140.4(d): Zones in which specific humidity levels are required to satisfy exempt process loads. Computer rooms or other spaces where the only process load is from IT equipment may not use this exception.

Exception 5 to Section 140.4(d): Zones with a peak supply-air quantity of 300 cfm or less.

(e) **Economizers.**

1. Each cooling air handler that has a design total mechanical cooling capacity over 54,000 Btu/hr shall include either:

A. An air economizer capable of modulating outside-air and return-air dampers to supply 100 percent of the design supply air quantity as outside air; or

B. A water economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the

Commission, at outside air temperatures of 50°F dry-bulb and 45°F wet-bulb and below.

Exception 1 to Section 140.4(e)1: Where special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes compliance infeasible.

Exception 2 to Section 140.4(e)1: Where the use of outdoor air for cooling will affect other systems, such as humidification, dehumidification or super-market refrigeration systems, so as to increase overall building TDV energy use.

Exception 3 to Section 140.4(e)1: Systems serving high-rise residential living quarters and hotel/motel guestrooms.

Exception 4 to Section 140.4(e)1: Where comfort cooling systems have the cooling efficiency that meets or exceeds the cooling efficiency improvement requirements in Table 140.4-A.

**TABLE 140.4-A
ECONOMIZER TRADE-OFF TABLE FOR COOLING SYSTEMS**

CLIMATE ZONE	EFFICIENCY IMPROVEMENT ^a
1	70%
2	65%
3	65%
4	65%
5	70%
6	30%
7	30%
8	30%
9	30%
10	30%
11	30%
12	30%
13	30%
14	30%
15	30%
16	70%

a. If a unit is rated with an IPLV, IEER or SEER, then to eliminate the required air or water economizer, the applicable minimum cooling efficiency of the HVAC unit must be increased by the percentage shown. If the HVAC unit is only rated with a full load metric, such as EER or COP cooling, then that metric must be increased by the percentage shown.

Exception 5 to Section 140.4(e)1: Fan systems primarily serving computer rooms. See Section 140.9(a) for computer room economizer requirements.

2. If an economizer is required by Section 140.4(e)1, it shall be:
 - A. Designed and equipped with controls so that economizer operation does not increase the building heating energy use during normal operation; and

Exception to Section 140.4(e)2A: Systems that provide 75 percent of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source.

- B. Capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.
3. If an economizer is required by Section 140.4(e)1, and an air economizer is used to meet the requirement, then it shall be a type listed in, and shall have high limit shutoff controls complying with Table 140.4-B.
4. If an economizer is required by Section 140.4(e)1, and an air economizer is used to meet the requirement, then the air economizer, and all air dampers shall have the following features:
 - A. **Warranty.** 5-year manufacturer warranty of economizer assembly.
 - B. **Damper reliability testing.** Suppliers of economizers shall certify that the economizer assembly, including but not limited to outdoor air damper, return air damper, drive linkage and actuator, have been tested and are able to open and close against the rated airflow and pressure of the system for 60,000 damper opening and closing cycles.
 - C. **Damper leakage.** Economizer outdoor air and return air dampers shall have a maximum leakage rate of 10 cfm/sf at 250 Pascals (1.0 in. w.g.) when tested in accordance with AMCA Standard 500-D. The economizer outside air and return air damper leakage rates shall be certified to the Energy Commission in accordance with Section 110.0.
 - D. **Adjustable setpoint.** If the high-limit control is fixed dry bulb or fixed enthalpy ± fixed dry bulb, then the control shall have an adjustable setpoint.
 - E. **Sensor accuracy.** Outdoor air, return air, mixed air, and supply air sensors shall be calibrated within the following accuracies.
 - i. Drybulb and wetbulb temperatures accurate to ±2°F over the range of 40°F to 80°F.
 - ii. Enthalpy accurate to ±3 Btu/lb over the range of 20 Btu/lb to 36 Btu/lb.
 - iii. Relative humidity (RH) accurate to ±5 percent over the range of 20 percent to 80 percent RH.
 - F. **Sensor calibration data.** Data used for control of the economizer shall be plotted on a sensor performance curve.
 - G. **Sensor high limit control.** Sensors used for the high limit control shall be located to prevent false readings, including but not limited to being properly shielded from direct sunlight.
 - H. **Relief air system.** Relief air systems shall be capable of providing 100 percent outside air without over-pressurizing the building.

**TABLE 140.4-B
AIR ECONOMIZER HIGH LIMIT SHUT OFF CONTROL REQUIREMENTS**

DEVICE TYPE ^a	CLIMATE ZONES	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		Equation ^b	Description
Fixed dry bulb	1, 3, 5, 11–16	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
	2, 4, 10	$T_{OA} > 73^{\circ}\text{F}$	Outdoor air temperature exceeds 73°F
	6, 8, 9	$T_{OA} > 71^{\circ}\text{F}$	Outdoor air temperature exceeds 71°F
	7	$T_{OA} > 69^{\circ}\text{F}$	Outdoor air temperature exceeds 69°F
Differential dry bulb	1, 3, 5, 11–16	$T_{OA} > T_{RA}^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature
	2, 4, 10	$T_{OA} > T_{RA}-2^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 2°F
	6, 8, 9	$T_{OA} > T_{RA}-4^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 4°F
	7	$T_{OA} > T_{RA}-6^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 6°F
Fixed Enthalpy ^c + Fixed dry bulb	All	$h_{OA} > 28 \text{ Btu/lb}^{\circ}$ or $T_{OA} > 75^{\circ}\text{F}$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air ^c or Outdoor air temperature exceeds 75°F

- a. Only the high limit control devices listed are allowed to be used and at the setpoints listed. Others such as Dew Point, Fixed Enthalpy, Electronic Enthalpy, and Differential Enthalpy Controls may not be used in any climate zone for compliance with Section 140.4(e)1 unless approval for use is provided by the Energy Commission Executive Director.
- b. Devices with selectable (rather than adjustable) setpoints shall be capable of being set to within 2°F and 2 Btu/lb of the setpoint listed.
- c. At altitudes substantially different than sea level, the Fixed Enthalpy limit value shall be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at approximately 6,000 foot elevation, the fixed enthalpy limit is approximately 30.7 Btu/lb.

5. Systems that include an air economizer to meet Section 140.4(e)1 shall include the following:

A. Unit controls shall have mechanical capacity controls interlocked with economizer controls such that the economizer is at 100 percent open position when mechanical cooling is on and does not begin to close until the leaving air temperature is less than 45°F.

B. Direct Expansion (DX) units greater than 65,000 Btu/hr that control the capacity of the mechanical cooling directly based on occupied space temperature shall have a minimum of two stages of mechanical cooling capacity.

C. DX units not within the scope of Section 140.4(e)5.B shall (i) comply with the requirements in Table 140.4-C, and (ii) shall have controls that do not false load the mechanical cooling system by limiting or disabling the economizer or by any other means except at the lowest stage of mechanical cooling capacity.

supply air temperature. Supply air temperature reset controls shall be:

1. In response to representative building loads or to outdoor air temperature; and
2. At least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

Exception 1 to Section 140.4(f): Systems that meet the requirements of Section 140.4(d), without using Exception 1 or 2 to that section.

Exception 2 to Section 140.4(f): Where supply-air temperature reset would increase overall building energy use.

Exception 3 to Section 140.4(f): Systems supplying zones in which specific humidity levels are required to satisfy exempt process loads. Computer rooms or other spaces with only IT equipment may not use this exception.

(g) **Electric resistance heating.** Electric resistance heating systems shall not be used for space heating.

Exception 1 to Section 140.4(g): Where an electric resistance heating system supplements a heating system in which at least 60 percent of the annual energy requirement is supplied by site-solar or recovered energy.

Exception 2 to Section 140.4(g): Where an electric resistance heating system supplements a heat pump heating system, and the heating capacity of the heat pump is more than 75 percent of the design heating load calculated in accordance with Section 140.4(a) at the design outdoor temperature specified in Section 140.4(b)4.

Exception 3 to Section 140.4(g): Where the total capacity of all electric resistance heating systems serving the entire building is less than 10 percent of the total design output capacity of all heating equipment serving the entire building.

**TABLE 140.4-C
DIRECT EXPANSION (DX) UNIT REQUIREMENTS
FOR COOLING STAGES AND COMPRESSOR DISPLACEMENT**

COOLING CAPACITY	MINIMUM NUMBER OF MECHANICAL COOLING STAGES	MINIMUM COMPRESSOR DISPLACEMENT
≥ 65,000 Btu/h and < 240,000 Btu/h	3 stages	≤ 35% full load
≥ 240,000 Btu/h	4 stages	≤ 25% full load

(f) **Supply air temperature reset controls.** Space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply air temperatures. Air distribution systems serving zones that are likely to have constant loads, such as interior zones, shall be designed for the air flows resulting from the fully reset

Exception 4 to Section 140.4(g): Where the total capacity of all electric resistance heating systems serving the building, excluding those allowed under Exception 2, is no more than 3 kW.

Exception 5 to Section 140.4(g): Where an electric resistance heating system serves an entire building that is not a high-rise residential or hotel/motel building; and has a conditioned floor area no greater than 5,000 square feet; and has no mechanical cooling; and is in an area where natural gas is not currently available and an extension of a natural gas system is impractical, as determined by the natural gas utility.

(h) Heat rejection systems.

1. **Scope.** Section 140.4(h) applies to heat rejection equipment used in comfort cooling systems, such as air-cooled condensers, open cooling towers, closed-circuit cooling towers and evaporative condensers.
2. **Fan speed control.** Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature or pressure of the heat rejection device.

Exception 1 to Section 140.4(h)2: Heat rejection devices included as an integral part of the equipment listed in Tables 110.2-A through 110.2-I.

Exception 2 to Section 140.4(h)2: Condenser fans serving multiple refrigerant circuits.

Exception 3 to Section 140.4(h)2: Condenser fans serving flooded condensers.

Exception 4 to Section 140.4(h)2: Up to one third of the fans on a condenser or tower with multiple fans where the lead fans comply with the speed control requirement.

3. **Tower flow turndown.** Open cooling towers configured with multiple condenser water pumps shall be designed so that all cells can be run in parallel with the larger of:
 - A. The flow that is produced by the smallest pump, or
 - B. 50 percent of the design flow for the cell.
4. **Limitation on centrifugal fan cooling towers.** Open cooling towers with a combined rated capacity of 900 gpm and greater at 95°F condenser water return, 85°F condenser water supply and 75°F outdoor wet-bulb temperature shall use propeller fans and shall not use centrifugal fans.

Exception 1 to Section 140.4(h)4: Cooling towers that are ducted (inlet or discharge) or have an external sound trap that requires external static pressure capability.

Exception 2 to Section 140.4(h)4: Cooling towers that meet the energy efficiency requirement for propeller fan towers in Section 110.2, Table 110.2-G.

5. **Multiple cell heat rejection equipment.** Multiple cell heat rejection equipment with variable speed fan drives shall:
 - A. Operate the maximum number of fans allowed that comply with the manufacturer's requirements for all system components, and
 - B. Control all operating fans to the same speed. Minimum fan speed shall comply with the minimum allowable speed of the fan drive as specified by the manufacturer's recommendation. Staging of fans is allowed once the fans are at their minimum operating speed.

(i) Minimum chiller efficiency. Chillers shall meet or exceed Path B from Table 110.2-D.

Exception 1 to Section 140.4(i): Chillers with electrical service > 600V.

Exception 2 to Section 140.4(i): Chillers attached to a heat recovery system with a design heat recovery capacity > 40 percent of the design chiller cooling capacity.

Exception 3 to Section 140.4(i): Chillers used to charge thermal energy storage systems where the charging temperature is < 40°F.

Exception 4 to Section 140.4(i): In buildings with more than three chillers, only three chillers are required to meet the Path B efficiencies.

(j) Limitation of air-cooled chillers. Chilled water plants shall not have more than 300 tons provided by air-cooled chillers.

Exception 1 to Section 140.4(j): Where the water quality at the building site fails to meet manufacturer's specifications for the use of water-cooled chillers.

Exception 2 to Section 140.4(j): Chillers that are used to charge a thermal energy storage system with a design temperature of less than 40°F (4°C).

Exception 3 to Section 140.4(j): Air cooled chillers with minimum efficiencies approved by the Commission pursuant to Section 10-109(d).

(k) Hydronic system measures.

1. **Hydronic variable flow systems.** HVAC chilled and hot water pumping shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of: a) 50 percent or less of the design flow rate; or b) the minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system.

Exception 1 to Section 140.4(k)1: Systems that include no more than three control valves.

Exception 2 to Section 140.4(k)1: Systems having a total pump system power less than or equal to 1.5 hp.

2. **Chiller isolation.** When a chilled water system includes more than one chiller, provisions shall be made so that flow through any chiller is automatically shut off when that chiller is shut off while still maintaining flow through other operating chiller(s). Chillers that are piped

in series for the purpose of increased temperature differential shall be considered as one chiller.

3. **Boiler isolation.** When a hot water plant includes more than one boiler, provisions shall be made so that flow through any boiler is automatically shut off when that boiler is shut off while still maintaining flow through other operating boiler(s).
4. **Chilled and hot water temperature reset controls.** Systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water shall include controls that automatically reset supply water temperatures as a function of representative building loads or outside air temperature.

Exception to Section 140.4(k)4: Hydronic systems that use variable flow to reduce pumping energy in accordance with 140.4(k)1.

5. **Water-cooled air conditioner and hydronic heat pump systems.** Water circulation systems serving water-cooled air conditioners, hydronic heat pumps, or both that have total pump system power exceeding 5 hp shall have flow controls that meet the requirements of Section 140.4(k)6. Each such air conditioner or heat pump shall have a two-position automatic valve interlocked to shut off water flow when the compressor is off.

6. **Variable flow controls.**

A. Variable speed drives. Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp shall have controls or devices (such as variable speed control) that will result in pump motor demand of no more than 30 percent of design wattage at 50 percent of design water flow. The pumps shall be controlled as a function of required differential pressure.

B. Pressure sensor location and setpoint.

- i. For systems without direct digital control of individual coils reporting to the central control panel, differential pressure shall be measured at the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.
- ii. For systems with direct digital control of individual coils with a central control panel, the static pressure setpoint shall be reset based on the valve requiring the most pressure, and the setpoint shall be no less than 80 percent open. Pressure sensors may be mounted anywhere.

Exception 1 to Section 140.4(k)6: Heating hot water systems.

Exception 2 to Section 140.4(k)6: Condenser water systems serving only water-cooled chillers.

7. **Hydronic heat pump (WLHP) controls.** Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of

at least 20°F between initiation of heat rejection and heat addition by the central devices.

Exception to Section 140.4(k)7: Where a system loop temperature optimization controller is used to determine the most efficient operating temperature based on real-time conditions of demand and capacity, dead bands of less than 20°F shall be allowed.

(l) **Air distribution system duct leakage sealing.** Duct systems shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler airflow rate as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures in Reference Nonresidential Appendices NA1 and NA2 if the criteria in Subsections 1, 2 and 3 below are met:

1. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space-conditioning system; and
2. The space conditioning system serves less than 5,000 square feet of conditioned floor area; and
3. The combined surface area of the ducts located in the following spaces is more than 25 percent of the total surface area of the entire duct system:
 - A. Outdoors, or
 - B. In a space directly under a roof that
 - i. Has a *U*-factor greater than the *U*-factor of the ceiling, or if the roof does not meet the requirements of Section 140.3(a)1B, or
 - ii. Has fixed vents or openings to the outside or unconditioned spaces, or
 - C. In an unconditioned crawlspace, or
 - D. In other unconditioned spaces.

(m) **Fan control.** Each cooling system listed in Table 140.4-D shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements: | | <

1. DX and chilled water cooling systems that control the capacity of the mechanical cooling directly based on occupied space temperature shall (i) have a minimum of two stages of fan control with no more than 66 percent speed when operating on stage 1; and (ii) draw no more than 40 percent of the fan power at full fan speed, when operating at 66 percent speed.
2. All other systems, including but not limited to DX cooling systems and chilled water systems that control the space temperature by modulating the airflow to the space, shall have proportional fan control such that at 50 percent air flow the power draw is no more than 30 percent of the fan power at full fan speed.
3. Systems that include an air side economizer to meet 140.4(e)1 shall have a minimum of two speeds of fan control during economizer operation.

Exception to Section 140.4(m): Modulating fan control is not required for chilled water systems with all fan motors < 1 HP, or for evaporative systems with all fan motors < 1

HP, if the systems are not used to provide ventilation air and all indoor fans cycle with the load.

**TABLE 140.4-D
FAN CONTROL SYSTEMS**

COOLING SYSTEM TYPE	FAN MOTOR SIZE	COOLING CAPACITY
DX cooling	Any	≥ 65,000 Btu/hr
Chilled water and evaporative	≥ 1/4 HP	Any

(n) **Mechanical system shut-off.** Any directly conditioned space with operable wall or roof openings to the outdoors shall be provided with interlock controls that disable or reset the temperature setpoint to 55°F for mechanical heating and disable or reset the temperature setpoint to 90°F for mechanical cooling to that space when any such opening is open for more than 5 minutes.

Exception 1 to Section 140.4(n): Interlocks are not required on doors with automatic closing devices.

Exception 2 to Section 140.4(n): Any space without a thermostatic control (thermostat or a space temperature sensor used to control heating or cooling to the space).

**SECTION 140.5
PRESCRIPTIVE REQUIREMENTS
FOR SERVICE WATER-HEATING SYSTEMS**

(a) **Nonresidential occupancies.** A service water-heating system installed in a nonresidential building complies with this section if it complies with the applicable requirements of Sections 110.1, 110.3 and 120.3.

(b) **High-rise residential and hotel/motel occupancies.** A service water-heating system installed in high-rise residential or hotel/motel buildings complies with this section if it meets the requirements of Section 150.1(c)8.

**SECTION 140.6
PRESCRIPTIVE REQUIREMENTS
FOR INDOOR LIGHTING**

A building complies with this section if:

- > i. The calculation of actual indoor lighting power of all proposed building areas combined, calculated under Subsection (a) is no greater than the calculation of allowed indoor lighting power, specific methodologies calculated under Subsection (c); and
- > ii. The calculation of allowed indoor lighting power, general rules comply with Subsection (b); and
- > iii. General lighting complies with the automatic daylighting controls in secondary daylight zone requirements in Subsection (d).
- > (a) **Calculation of actual indoor lighting power.** The actual indoor lighting power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through 3 of this subsection and the requirements of Subdivision 4 of this subsection.

Exception to Section 140.6(a): Up to 0.3 watts per square foot of portable lighting for office areas shall not be required to be included in the calculation of actual indoor lighting power.

1. **Two interlocked lighting systems.** No more than two lighting systems may be used for an area, and if there are two they must be interlocked. Where there are two interlocked lighting systems, the watts of the lower wattage system may be excluded from the actual indoor lighting power density if:
 - A. An installation certificate detailing compliance with Section 140.6(a)1 is submitted in accordance with Sections 10-103 and 130.4; and
 - B. The area or areas served by the interlocking systems is an auditorium, a convention center, a conference room, a multipurpose room or a theater; and
 - C. The two lighting systems are interlocked with a nonprogrammable double-throw switch to prevent simultaneous operation of both systems.

For compliance with Part 6 a nonprogrammable double-throw switch is an electrical switch commonly called a “single pole double throw” or “three-way” switch that is wired as a selector switch allowing one of two loads to be enabled. It can be a line voltage switch or a low voltage switch selecting between two relays. It cannot be overridden or changed in any manner that would permit both loads to operate simultaneously.

2. Reduction of wattage through controls. In calculating actual indoor lighting power, the installed watts of a luminaire providing general lighting in an area listed in Table 140.6-A may be reduced by the product of (i) the number of watts controlled as described in Table 140.6-A, times (ii) the applicable power adjustment factor (PAF), if all of the following conditions are met:

- A. An installation certificate is submitted in accordance with Section 130.4(b), and
- B. Luminaires and controls meet the applicable requirements of Section 110.9, and Sections 130.0 through 130.5; and
- C. The controlled lighting is permanently installed general lighting systems and the controls are permanently installed nonresidential-rated lighting controls.

When used for determining PAFs for general lighting in offices, furniture mounted luminaires that comply with all of the following conditions shall qualify as permanently installed general lighting systems:

- i. The furniture mounted luminaires shall be permanently installed no later than the time of building permit inspection; and
- ii. The furniture mounted luminaires shall be permanently hardwired; and

- iii. The furniture mounted lighting system shall be designed to provide indirect general lighting; and
 - iv. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.3 watts per square foot of the area illuminated by the furniture mounted luminaires shall be subtracted from installed watts of the furniture mounted luminaires; and
 - v. The lighting control for the furniture mounted luminaire complies with all other applicable requirements in Section 140.6(a)2.
- D. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in Table 140.6-A. Luminaires on lighting tracks shall be within the applicable area in order to qualify for a PAF.
- E. Only one PAF from Table 140.6-A may be used for each qualifying luminaire. PAFs shall not be added together unless allowed in Table 140.6-A.
- F. Only lighting wattage directly controlled in accordance with Section 140.6(a)2 shall be used to reduce the calculated actual indoor lighting power as allowed by Section 140.6(a)2. If only a portion of the wattage in a luminaire is controlled in accordance with Section 140.6(a)2, then only that portion of controlled wattage may be reduced in calculating actual indoor lighting power.
- G. Lighting controls used to qualify for a PAF shall be designed and installed in addition to manual, multilevel, and automatic lighting controls required in Section 130.1, and in addition to any other lighting controls required by any provision of Part 6. PAFs shall not be available for lighting controls required by Part 6.
- H. To qualify for the PAF for daylight dimming plus OFF control, the daylight control and controlled luminaires shall comply with Section 130.1(d), 130.4(a)3 and 130.4(a)7, and shall additionally turn lights completely OFF when the daylight available in the daylit zone is greater than 150 percent of the illuminance received from the general lighting system at full power. The PAF shall apply only to the luminaires in the primary sidelit daylit zone and the skylit daylit zone.
- I. To qualify for the PAF for an occupant sensing control controlling the general lighting in large open plan office areas above workstations, in accordance with Table 140.6-A, the following requirements shall be met:
- i. The open plan office area shall be greater than 250 square feet; and
 - ii. This PAF shall be available only in office areas which contain workstations; and
- iii. Controlled luminaires shall only be those that provide general lighting directly above the controlled area, or furniture mounted luminaires that comply with Section 140.6(a)2 and provide general lighting directly above the controlled area; and
 - iv. Qualifying luminaires shall be controlled by occupant sensing controls that meet all of the following requirements, as applicable:
 - a. Infrared sensors shall be equipped by the manufacturer, or fitted in the field by the installer, with lenses or shrouds to prevent them from being triggered by movement outside of the controlled area.
 - b. Ultrasonic sensors shall be tuned to reduce their sensitivity to prevent them from being triggered by movements outside of the controlled area.
 - c. All other sensors shall be installed and adjusted as necessary to prevent them from being triggered by movements outside of the controlled area.
- J. To qualify for the PAF for an Institutional Tuning in Table 140.6-A, the tuned lighting system shall comply with all of the following requirements:
- i. The lighting controls shall limit the maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw; and
 - ii. The means of setting the limit is accessible only to authorized personnel; and
 - iii. The setting of the limit is verified by the acceptance test required by Section 130.4(a)7; and
 - iv. The construction documents specify which lighting systems shall have their maximum light output or maximum power draw set to no greater than 85 percent of full light output or full power draw.
- K. To qualify for the PAF for a demand responsive control in Table 140.6-A, a demand responsive control shall meet all of the following requirements:
- i. The building shall be 10,000 square feet or smaller; and
 - ii. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal; and
 - iii. Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in Table 130.1-A; and
 - iv. Spaces that are nonhabitable shall not be used to comply with this requirement, and

spaces with a lighting power density of less than 0.5 watts per square foot shall not be counted toward the building’s total lighting power.

3. **Lighting wattage excluded.** The watts of the following indoor lighting applications may be excluded from actual indoor lighting power density. (Indoor lighting not listed below shall comply with all applicable nonresidential indoor lighting requirements in Part 6.):

- A. In theme parks: lighting for themes and special effects;
- B. Studio lighting for film or photography, provided that these lighting systems are in addition to and separately switched from a general lighting system;
- C. Lighting for dance floors, lighting for theatrical and other live performances, and theatrical lighting used for religious worship, provided that these lighting systems are additions to a general lighting system and are separately controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators;

Lighting intended for makeup, hair, and costume preparation in performing arts facility dressing rooms, provided that the lighting is separately switched from the general lighting system, switched independently at each dressing station, and is controlled with a vacancy sensor.
- D. In civic facilities, transportation facilities, convention centers and hotel function areas: lighting for temporary exhibits, if the lighting is in addition to a general lighting system, and is separately controlled from a panel accessible only to authorized operators;
- E. Lighting installed by the manufacturer in walk-in freezers, vending machines, food preparation equipment, and scientific and industrial equipment;
- F. In medical and clinical buildings, examination and surgical lights, low ambient night lights and lighting integral to medical equipment, provided that these lighting systems are additions to and separately switched from a general lighting system;
- G. Lighting for plant growth or maintenance if it is controlled by a multilevel astronomical time-switch control that complies with the applicable provisions of Section 110.9;
- H. Lighting equipment that is for sale;
- I. Lighting demonstration equipment in lighting education facilities;
- J. Lighting that is required for exit signs subject to the CBC. Exit signs shall meet the requirements of the Appliance Efficiency Regulations;

- K. Exitway or egress illumination that is normally off and that is subject to the CBC;
- L. In hotel/motel buildings, lighting in guest rooms (lighting in hotel/motel guestrooms shall comply with Section 130.0(b). (Indoor lighting not in guestrooms shall comply with all applicable nonresidential lighting requirements in Part 6.)
- M. In high-rise residential buildings, lighting in dwelling units (lighting in high-rise residential dwelling units shall comply with Section 130.0(b). (Indoor lighting not in dwelling units shall comply with all applicable nonresidential lighting requirements in Part 6.)
- N. Temporary lighting systems. (As defined in Section 100.1.)
- O. Lighting in occupancy group U buildings less than 1,000 square feet;
- P. Lighting in unconditioned agricultural buildings less than 2,500 square feet;
- Q. Lighting systems in qualified historic buildings, as defined in the *California Historical Building Code* (Title 24, Part 8), are exempt from the lighting power density allowances, if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems in qualified buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other lighting systems in qualified historic buildings shall comply with the lighting power density allowances;
- R. Lighting in nonresidential parking garages for seven or less vehicles: Lighting in nonresidential parking garages for seven or less vehicles shall comply with the applicable residential parking garage provisions of Section 150.0(k).
- S. Lighting for signs: Lighting for signs shall comply with Section 140.8.
- T. Lighting in refrigerated cases less than 3,000 square feet. (Lighting in refrigerated cases less than 3,000 square feet shall comply with the Title 20 Appliance Efficiency Regulations).
- U. Lighting in elevators where the lighting meets the requirements in Section 120.6(f).

4. **Luminaire classification and power.** Luminaire classification and power shall be determined in accordance with Section 130.0(c).

(b) **Calculation of allowed indoor lighting power: general rules**

- 1. The allowed indoor lighting power allotment for conditioned areas shall be calculated separately from the allowed lighting power allotment for unconditioned areas. Each allotment is applicable solely to the area to which it applies, and there shall be no trade-offs

between conditioned and unconditioned area allotments.

- > 2. Allowed indoor lighting power allotment shall be calculated separately from the allowed outdoor lighting power allotment. Each allotment is applicable solely to the area to which it applies, and there shall be no trade-offs between the separate indoor and outdoor allotments.
- > 3. The allowed indoor lighting power density allotment for general lighting shall be calculated as follows:
 - > A. The complete building method, as described in Section 140.6(c)1, shall be used only for an entire building, except as permitted by Section 140.6(c)1. As described more fully in Section 140.6(c)1, and subject to the adjustments listed there, the allowed indoor lighting power allotment for general lighting for the entire building shall be calculated as follows:
 - i. For a conditioned building, the product of the square feet of conditioned space of the building times the applicable allotment of watts per square foot described in Table 140.6-B.
 - ii. For an unconditioned building, the product of the square foot of unconditioned space of the building times the applicable allotment of watts per square feet described in Table 140.6-B.
 - > B. The area category method, as described in Section 140.6(c)2, shall be used either by itself for all areas in the building, or when some areas in the building use the tailored method described in Section 140.6(c)3. Under the area category method (either by itself or in conjunction with the tailored method), as described more fully in Section 140.6(c)2, and subject to the adjustments listed there, the allowed indoor lighting power allotment for general lighting shall be calculated for each area in the building as follows:
 - i. For conditioned areas, by multiplying the conditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-C (or Table 140.6-D if the tailored method is used for that area).
 - ii. For unconditioned areas, by multiplying the unconditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-C (or Table 140.6-D if the tailored method is used for that area).
 - > The allowed indoor lighting power allotment for general lighting for one area for which the area category method was used may be increased up to the amount that the allowed indoor lighting power allotment for general lighting for another area using the area category method or tailored method is decreased, except that such increases and decreases shall not be made between conditioned and unconditioned space.
 - > C. The tailored method, as described in Section 140.6(c)3, shall be used either by itself for all areas in the building, or when some areas in the building use the area category method described in Section

140.6(c)2. Under the tailored method (either by itself or in conjunction with the area category method) as described more fully in Section 140.6(c)3, and subject to the adjustments listed there, allowed indoor lighting power allotment for general lighting shall be calculated for each area in the building as follows:

- i. For conditioned areas, by multiplying the conditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-D (or Table 140.6-C if the area category method is used for that area);
- ii. For unconditioned areas, by multiplying the unconditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-D (or Table 140.6-C if the area category method is used for that area);

The allowed indoor lighting power allotment for general lighting for one area for which the tailored method was used may be increased up to the amount that the allowed indoor power lighting for general lighting for another area is decreased, but only if the tailored method or area category method was used for the other area, except that such increases and decreases shall not be made between conditioned and unconditioned space.

D. If the area category method is used for an area, the tailored method may not be used for that area. If the tailored method is used for an area, the area category method may not be used for that area.

- > 4. Allowed indoor lighting power allotments for all lighting power allotments other than general lighting shall be restricted as follows:
 - A. When using the area category method, allowed indoor lighting power allotments for specialized task work; ornamental; precision commercial and industrial work; white board or chalk board; accent, display and feature; decorative; or videoconferencing studio; may not be increased as a result of, or otherwise traded off against, decreasing any other allotment; and
 - B. When using the tailored method, allowed indoor lighting power allotments for wall display; floor display and task; ornamental/special effect; or very valuable display case; may not be increased, or otherwise traded between any of the separate allotments.

(c) **Calculation of allowed indoor lighting power: specific methodologies.** The allowed indoor lighting power for each building type, or each primary function area shall be calculated using only one of the methods in Subsection 1, 2 or 3 below as applicable.

- 1. **Complete building method.** Requirements for using the complete building method include all of the following:
 - A. The complete building method shall be used only for building types, as defined in Section 100.1, that are specifically listed in Table 140.6-B. (For example,

retail and wholesale stores, hotel/motel, and high-rise residential buildings shall not use this method.)

B. The complete building method shall be used only on projects involving:

i. Entire buildings with one type of use occupancy; or

Exception to Section 140.6(c)1Bi: If a parking garage plus another type of use listed in Table 140.6-B are part of a single building, the parking garage portion of the building and other type of use portion of the building shall each separately use the complete building method.

ii. Mixed occupancy buildings where one type of use makes up at least 90 percent of the entire building (in which case, when applying the complete building method, it shall be assumed that the primary use is 100 percent of the building); or

iii. A tenant space where one type of use makes up at least 90 percent of the entire tenant space (in which case, when applying the complete building method, it shall be assumed that the primary use is 100 percent of the tenant space).

C. The complete building method shall be used only when the applicant is applying for a lighting permit and submits plans and specifications for the entire building or the entire tenant space.

D. Under the complete building method, the allowed indoor lighting power allotment is the lighting power density value times the floor area of the entire building.

2. **Area category method.** Requirements for using the area category method include all of the following:

A. The area category method shall be used only for primary function areas, as defined in Section 100.1, that are listed in Table 140.6-C.

B. Primary function areas in Table 140.6-C shall not apply to a complete building. Each primary function area shall be determined as a separate area.

C. For purposes of compliance with Section 140.6(c)2, an “area” shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Table 146.0-C.

D. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in primary function area.

E. If at the time of permitting for a newly constructed building, a tenant is not identified for a multitenant area, a maximum of 0.6 watts per square foot shall be allowed for the lighting in each area in which a tenant has not been identified. The area shall be classified as unleased tenant area.

F. Under the area category method, the allowed indoor lighting power for each primary area is the lighting power density value in Table 140.6-C times the square feet of the primary function. The total

allowed indoor lighting power density for the building is the sum of all allowed indoor lighting powers densities for all areas in the building.

G. In addition to the allowed indoor lighting power calculated according to Sections 140.6(c)2.A through F, the building may add additional lighting power allowances for specialized task work, ornamental, precision, accent, display, decorative, and white boards and chalk boards, in accordance with the footnotes in Table 140.6-C under the following conditions:

i. Only primary function areas having a footnote next to the allowed lighting power density allotments in Table 140.6-C shall qualify for the added lighting power allowances in accordance with the correlated footnote listed at the bottom of the table; and

ii. The additional lighting power allowances shall be used only if the plans clearly identify all applicable task areas and the lighting equipment designed to illuminate these tasks; and

iii. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for the additional lighting power allowances; and

iv. The additional lighting power allowances shall not utilize any type of luminaires that are used for general lighting in the building; and

v. The additional lighting power allowances shall not be used when using the complete building method, or when the tailored method used for any area in the building; and

vi. The additional lighting power allowed is the smaller of lighting power listed in the applicable footnote in Table 140.6-C, or the actual design wattage may be added to the allowed lighting power; and

vii. In addition to all other additional lighting power allowed under Sections 140.6(c)2Gi through vi, up to 1.5 watts per square foot of additional lighting power shall be allowed in a videoconferencing studio, as defined in Section 100.1, provided the following conditions are met:

a. A completed and signed installation certificate is prepared and submitted in accordance with Section 130.4(b), specifically detailing compliance with the applicable requirements of Section 140.6(c)2Gvii; and

b. The videoconferencing studio is a room with permanently installed videoconferencing cameras, audio equipment, and playback equipment for both audio-based and video-based two-way communication between local and remote sites; and

>
>

- c. General lighting is switched in accordance with Table 130.1-A; and
 - d. Wall wash lighting is separately switched from the general lighting system; and
 - e. All of the lighting in the studio, including general lighting and additional lighting power allowed by Section 140.6(c)2Gvii is controlled by a multiscene programmable control system (also known as a scene preset control system).
3. **Tailored method.** Requirements for using the tailored method include all of the following:
- A. The tailored method shall be used only for primary function areas listed in Table 140.6-D, as defined in Section 100.1, and for IES allowances listed in Section 140.6(c)3H.
 - > B. Allowed indoor lighting power allotments for general lighting shall be determined according to Section 140.6(c)3G or H, as applicable. General lighting shall not qualify for a mounting height multiplier.
 - C. For compliance with this item, an “area” shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Table 140.6-D.
 - D. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in a primary function area.
 - > E. In addition to the allowed indoor lighting power allotments for general lighting calculated according to Sections 140.6(c)3G or H, as applicable, the building may add additional lighting power allowances for wall display, floor display and task lighting, ornamental/special effects, and very valuable display cases according to Sections 140.6(c)3I through L.
 - F. The general lighting system shall not use narrow beam direction lamps, wall-washer, valance, direct cove or perimeter linear slot types of lighting systems.
 - > G. Determine allowed indoor lighting power allotments for general lighting for primary function areas listed in Table 140.6-D as follows:
 - i. Use the IES Illuminance values (Lux) listed in Column 2 to determine the allowed general lighting power density allotments for the area.
 - ii. Determine the room cavity ratio (RCR) for the area. The RCR shall be calculated according to the applicable equation in Table 140.6-F.
 - iii. Find the allowed lighting power density allotments in Table 140.6-G that is applicable to the IES illuminance value (Lux) from Column 2 of Table 140.6-D (as described in Item i) and the RCR determined in accordance with Table 140.6-F (as described in Item ii).
 - H. Determine allowed indoor lighting power allotments for general lighting for only specific primary function areas NOT listed in Table 140.6-D as follows:
 - i. Use this section only to calculate allowed indoor lighting power for general lighting in the following primary function areas. Do not use Section 140.6(c)3H for any primary function areas NOT listed below:
 - a. Exercise center, gymnasium
 - b. Medical and clinical care
 - c. Police stations and fire stations
 - d. Public rest areas along state and federal roadways
 - e. Other primary function areas that are listed in neither Table 140.6-C Table 140.6-D
 - ii. When calculating allowed indoor lighting power allotments for general lighting using Section 140.6(c)3H, the building shall not add additional lighting power allowances for any other use, including but not limited to wall display, floor display and task, ornamental/special effects, and very valuable display case lighting.
 - iii. Calculate the allowed indoor lighting power for each primary function area in the building as follows:
 - a. Determine the illuminance values (Lux) according to the Tenth Edition IES *Lighting Handbook* (IES HB), using the recommended horizontal maintained illuminance targets for observers 25–65 years old for illuminance.
 - b. Determine the room cavity ratio (RCR) for area. The RCR shall be calculated according to the applicable equation in Table 140.6-F.
 - c. Find the allowed lighting power density in Table 140.6-G that is applicable to the illuminance value (Lux) determined in accordance with Item (a) and the RCR determined in accordance with Item (b).
 - d. Determine the square feet of the area. For compliance with this item, an “area”

shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Item (i). Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in a primary function area.

e. Multiply the square feet determined in accordance with item (d), by the allowed lighting power density determined in accordance with Item (c). The product is the allowed indoor lighting power allotment for general lighting for the area.

I. Determine additional allowed power for wall display lighting according to column 3 of Table 140.6-D for each primary function area as follows:

- i. Additional wall display lighting power shall not be available when using Section 140.6(c)3H for determining the allowed indoor lighting power allotment for general lighting for the area.
- ii. Floor displays shall not qualify for wall display allowances.

iii. Qualifying wall lighting shall:

- a. Be mounted within 10 feet of the wall having the wall display. When track lighting is used for wall display, and where portions of that lighting track are more than 10 feet from the wall and other portions are within 10 feet of the wall, portions of track more than 10 feet from the wall shall not be used for the wall display allowance.
- b. Be a lighting system type appropriate for wall lighting. Lighting systems appropriate for wall lighting are lighting track adjacent to the wall, wall-washer luminaires, luminaires behind a wall valance or wall cove, or accent light. (Accent luminaires are adjustable or fixed luminaires with PAR, R, MR, AR or other directional lamp types.)

iv. Additional allowed power for wall display lighting is available only for lighting that illuminates walls having wall displays. The length of display walls shall include the length of the perimeter walls, including but not limited to closable openings and permanent full height interior partitions. Permanent full height interior partitions are those that (I) extend from the floor to no more than 2 feet of the ceiling or are taller than 10 feet, and (II) are permanently anchored to the floor, provided, however, that neither commercial industrial stacks nor industrial storage stacks are permanent full height interior partitions.

v. The wall display mounting height multiplier is the applicable factor from Table 140.6-E. Mount-

ing height is the distance from the finished floor to the bottom of the luminaire. The wall display mounting height multipliers shall be used to reduce the design watts of the space.

vi. The additional allowed power for wall display lighting shall be the smaller of:

- a. The product of wall display power determined in accordance with Table 140.6-D, times the wall display lengths determined in accordance with Item iv; or
- b. The actual power used for the wall display lighting systems.

J. Determine additional allowed power for floor display lighting and task lighting as follows:

- i. Neither additional allowed power for floor display lighting nor additional allowed power for task lighting shall be available when using Section 140.6(c)3H for determining allowed indoor lighting power allotment for general lighting.
- ii. Displays that are installed against a wall shall not qualify for the floor display lighting power allowances.
- iii. Lighting internal to display cases shall be counted as floor display lighting in accordance with Section 140.6(c)3J; or very valuable display case lighting in accordance with Section 140.6(c)3Liii and iv.
- iv. Additional allowed power for floor display lighting, and additional allowed power for task lighting, may be used by qualifying floor display lighting systems, qualifying task lighting systems, or a combination of both. For floor areas qualifying for both floor display and task lighting power allowances, the additional allowed power shall be used only once for the same floor area, so that the allowance shall not be additive.
- v. Qualifying floor display lighting shall:
 - a. Be mounted no closer than 2 feet to a wall.
 - b. Consist of only (I) directional lighting types, such as PAR, R, MR, AR; or (II) lighting employing optics providing directional display light from nondirectional lamps.
 - c. If track lighting is used, shall be only track heads that are classified as direction lighting types.
- vi. Qualifying task lighting shall:
 - a. Be located immediately adjacent to and capable of illuminating the task for which it is installed.
 - b. Be of a type different from the general lighting system.
 - c. Be separately switched from the general lighting system.

- vii. If there are illuminated floor displays, floor display lighting power shall be used only if allowed by Column 4 of Table 140.6-D.
- viii. Additional allowed power for a combination of floor display lighting and task lighting shall be available only for (I) floors having floor displays; or (II) floors not having floor displays but having tasks having illuminance recommendations that appear in the Tenth Edition of the IES *Lighting Handbook*, and that are higher than the general lighting level in Column 2 of Table 140.6-D. The square footage of floor display or the square footage of task areas shall be determined in accordance with Section 140.6(c)3C and D, except that any floor area designed to not have floor displays or tasks, such as floor areas designated as a path of egress, shall not be included for the floor display allowance.
- ix. For floor display lighting where the bottom of the luminaire is 12 feet or higher above the finished floor, the wattage allowed in Column 4 of Table 140.6-D may be increased by multiplying the floor display lighting power allowance by the appropriate factor from Table 140.6-E

Luminaire mounting height is the distance from the finished floor to the bottom of the luminaire. The floor display mounting height multipliers shall be used to reduce the design watts of the space.

- x. The additional allowed power for floor display lighting for each applicable area shall be the smaller of:
 - a. The product of allowed floor display and task lighting power determined in accordance with Section 140.6(c)3Jvii times the floor square footage determined in accordance with Section 140.6(c)3Jviii; or
 - b. The actual power used for the floor display lighting systems.
- K. Determine additional allowed power for ornamental/special effects lighting as follows:
 - i. Additional allowed power for ornamental/special effects lighting shall not be available when using Section 140.6(c)3H for determining general lighting power allowances.
 - ii. Qualifying ornamental lighting includes luminaires such as chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights and light color panels, when any of those lights are used in a decorative manner that does not serve as display lighting or general lighting.
 - iii. Additional lighting power for ornamental/special effects lighting shall be used only if allowed by Column 5 of Table 140.6-D.

- iv. Additional lighting power for ornamental/special effects lighting shall be used only in areas having ornamental/special effects lighting. The square footage of the floor area shall be determined in accordance with Section 140.6(c)3C and D, and it shall not include floor areas not having ornamental/special effects lighting.
- v. The additional allowed power for ornamental/special effects lighting for each applicable area shall be the smaller of:
 - a. The product of the allowed ornamental/special effects lighting power determined in accordance with Section 140.6(c)3Kiii, times floor square footage determined in accordance with Section 140.6(c)3Kiv; or
 - b. The actual power of allowed ornamental/special effects lighting.
- L. Determine additional allowed power for very valuable display case lighting as follows:
 - i. Additional allowed power for very valuable display case lighting shall not be available when using Section 140.6(c)3H for determining general lighting power allowances.
 - ii. Additional allowed power for very valuable display case lighting shall be available only for display cases in appropriate function areas in retail merchandise sales, museum and religious worship.
 - iii. To qualify for additional allowed power for very valuable display case lighting, a case shall contain jewelry, coins, fine china, fine crystal, precious stones, silver, small art objects and artifacts, and/or valuable collections the display of which involves customer inspection of very fine detail from outside of a locked case.
 - iv. Qualifying lighting includes internal display case lighting or external lighting employing highly directional luminaires specifically designed to illuminate the case or inspection area without spill light, and shall not be fluorescent lighting unless installed inside of a display case.
 - v. If there is qualifying very valuable display case lighting in accordance with Section 140.6(c)3Liii, the smallest of the following separate lighting power for display cases presenting very valuable display items is permitted:
 - a. The product of the area of the primary function and 0.8 watt per square foot; or
 - b. The product of the area of the display case and 12 watts per square foot; or
 - c. The actual power of lighting for very valuable displays.

(d) **Automatic daylighting controls in secondary daylight zones.** All luminaires providing general lighting that is in, or partially in a secondary sidelit daylight zones as defined in Sec-

tion 130.1(d)1C, and that is not in a primary sidelit daylit zone shall:

1. Be controlled independently from all other luminaires by automatic daylighting controls that meets the applicable requirements of Section 110.9; and
2. Be controlled in accordance with the applicable requirements in Section 130.1(d)2; and

3. All secondary sidelit daylit zones shall be shown on the plans submitted to the enforcing agency.

Exception 1 to Section 140.6(d): Luminaires in secondary sidelit daylit zone(s) in areas where the total wattage of general lighting is less than 120 Watts.

Exception 2 to Section 140.6(d): Luminaires in parking garages complying with Section 130.1(d)3.

**TABLE 140.6-A
LIGHTING POWER ADJUSTMENT FACTORS (PAF)**

TYPE OF CONTROL	TYPE OF AREA	FACTOR	
a. To qualify for any of the power adjustment factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2. b. Only one PAF may be used for each qualifying luminaire unless combined below. c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF.			
1. Daylight Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone	0.10	
2. Occupant sensing controls in large open plan offices	In open plan offices > 250 square feet: One sensor controlling an area that is:	No larger than 125 square feet	0.40
		From 126 to 250 square feet	0.30
		From 251 to 500 square feet	0.20
3. Institutional Tuning	Luminaires in non-daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.10	
	Luminaires in daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05	
4. Demand responsive control	All building types less than 10,000 square feet. Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF.	0.05	

**TABLE 140.6-B
COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES**

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Auditorium building	1.4
Classroom building	1.1
Commercial and industrial storage building	0.60
Convention center building	1.0
Financial institution building	1.0
General commercial building/industrial work building	1.00
Grocery store building	1.50
Library building	1.2
Medical building/clinic building	1.0
Office building	0.80
Parking garage building	0.20
Religious facility building	1.5
Restaurant building	1.1
School building	0.95
Theater building	1.3
All others buildings	0.50

**TABLE 140.6-C
AREA CATEGORY METHOD – LIGHTING POWER DENSITY VALUES (WATTS/FT²)**

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER DENSITY (W/ft ²)	PRIMARY FUNCTION AREA	ALLOWED LIGHTING POWER DENSITY (W/ft ²)	
Auditorium area		1.40 ³	Library area	Reading areas	1.1 ³
Auto repair area		0.90 ²		Stack areas	1.5 ³
Beauty salon area		1.7	Lobby area	Hotel lobby	0.95 ³
Civic meeting place area		1.3 ³		Main entry lobby	0.95 ³
Classroom, lecture, training, vocational areas		1.2 ⁵	Locker/dressing room		0.70
Commercial and industrial storage areas (conditioned and unconditioned)		0.60	Lounge area		0.90 ³
Commercial and industrial storage areas (refrigerated)		0.7	Malls and atria		0.95 ³
Convention, conference, multipurpose and meeting center areas		1.2 ³	Medical and clinical care area		1.2
Corridor, restroom, stair, and support areas		0.60	Office area	> 250 square feet	0.75
Dining area		1.0 ³		≤ 250 square feet	1.0
Electrical, mechanical, telephone rooms		0.55 ²	Parking garage area	Parking area ¹⁰	0.14
Exercise center, gymnasium areas		1.0		Dedicated ramps	0.30
Exhibit, museum areas		1.8		Daylight adaptation zones ⁹	0.60
Financial transaction area		1.0 ³	Religious worship area		1.5 ³
General commercial and industrial work areas	Low bay	0.9 ²	Retail merchandise sales, wholesale showroom areas		1.2 ^{6,7}
	High bay	1.0 ²			
	Precision	1.2 ⁴			
Grocery sales area		1.2 ^{6,7}	Theater area	Motion picture	0.90 ³
Hotel function area		1.4 ³		Performance	1.4 ³
Kitchen, food preparation areas		1.2	Transportation function area	Concourse and baggage	0.50
				Ticketing	1.0
Laboratory area, scientific		1.4 ¹	Videoconferencing studio		1.2 ⁸
Laundry area		0.70	Waiting area		0.80 ³
			All other areas		0.50

Notes:

See Section 140.6(c)2 for an explanation of additional lighting power available for specialized task work, ornamental, precision, accent, display, decorative and white boards and chalk boards, in accordance with the footnotes in this table. The smallest of the added lighting power listed in each footnote below, or the actual design wattage, may be added to the allowed lighting power only when using the area category method of compliance.

Footnote number	Type of lighting system allowed	Allowed lighting power density. (W/ft ² of task area unless otherwise noted)
1	Specialized task work.	0.20 W/ft ²
2	Specialized task work.	0.50 W/ft ²
3	Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6.(c)2.	0.50 W/ft ²
4	Precision commercial and industrial work.	1.0 W/ft ²
5	Per linear foot of white board or chalk board.	5.5 W per linear foot
6	Accent, display and feature lighting - luminaires shall be adjustable or directional.	0.30 W/ft ²
7	Decorative lighting - primary function shall be decorative and shall be in addition to general illumination.	0.20 W/ft ²
8	Additional videoconferencing studio lighting complying with all of the requirements in Section 140.6(c)2Gvii.	1.5 W/ft ²
9	Daylight adaptation zones shall be no longer than 66 feet from the entrance to the parking garage.	
10	Additional allowance for ATM locations in parking garages. Allowance per ATM.	200 watts for first ATM location. 50 watt for each additional ATM location in a group.

**TABLE 140.6-D
TAILORED METHOD LIGHTING POWER ALLOWANCES**

1	2	3	4	5
Primary Function Area	General Illumination Level (Lux)	Wall Display Lighting Power Density (W/ft)	Allowed Combined Floor Display Power and Task Lighting Power Density (W/ft ²)	Allowed Ornamental/Special Effect Lighting Power Density (W/ft ²)
Auditorium area	300	2.25	0.3	0.5
Civic meeting place	300	3.15	0.2	0.5
Convention, conference, multipurpose, and meeting center areas	300	2.50	0.4	0.5
Dining areas	200	1.50	0.6	0.5
Exhibit, museum areas	150	15.0	1.2	0.5
Financial transaction area	300	3.15	0.2	0.5
Grocery store area	500	8.00	0.9	0.5
Hotel function area	400	2.25	0.2	0.5
Lobby area:				0.5
Hotel lobby	200	3.15	0.2	0.5
Main entry lobby	200	0	0.2	0
Lounge area	200	7.00	0	0.5
Malls and atria	300	3.50	0.5	0.5
Religious worship area	300	1.50	0.5	0.5
Retail merchandise sales, and showroom areas	400	14.00	1.0	0.5
Theater area:				0.5
Motion picture	200	3.00	0	0.5
Performance	200	6.00	0	0.5
Transportation function area	300	3.15	0.3	0.5
Waiting area	300	3.15	0.2	0.5

**TABLE 140.6-E
ADJUSTMENTS FOR MOUNTING HEIGHT ABOVE FLOOR**

HEIGHT IN FEET ABOVE FINISHED FLOOR AND BOTTOM OF LUMINAIRE(S)	FLOOR DISPLAY OR WALL DISPLAY – MULTIPLY BY
< 12'	1.00
12' to 16'	0.87
> 16'	0.77

**TABLE 140.6-F
ROOM CAVITY RATIO (RCR) EQUATIONS**

Determine the room cavity ratio for Table 140.6-G using one of the following equations.
Room cavity ratio for rectangular rooms
$RCR = \frac{5 \times H \times (L + W)}{L \times W}$
Room cavity ratio for irregular-shaped rooms
$RCR = \frac{2.5 \times H \times P}{A}$
Where: <i>L</i> = Length of room; <i>W</i> = Width of room; <i>H</i> = Vertical distance from the work plane to the centerline of the lighting fixture; <i>P</i> = Perimeter of room; and <i>A</i> = Area of room

**TABLE 140.6-G
ILLUMINANCE LEVEL (LUX) POWER DENSITY VALUES (WATTS/FT²)**

ILLUMINANCE LEVEL (LUX)	RCR ≤ 2.0	RCR > 2.0 AND ≤ 3.5	RCR > 3.5 AND ≤ 7.0	RCR > 7.0
50	0.18	0.22	0.32	0.46
100	0.30	0.38	0.56	0.84
200	0.48	0.64	0.88	1.34
300	0.64	0.82	1.12	1.76
400	0.78	0.98	1.34	2.08
500	0.90	1.10	1.52	2.32
600	1.06	1.26	1.74	2.60
700	1.24	1.46	1.82	2.96
800	1.44	1.70	2.28	3.30
900	1.66	2.00	2.64	3.74
1000	1.84	2.20	2.90	4.06

**SECTION 140.7
REQUIREMENTS FOR OUTDOOR LIGHTING**

(a) An outdoor lighting installation complies with this section if it meets the requirements in Subsections (b) and (c), and the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection (d). The allowed outdoor lighting shall be calculated according to outdoor lighting zone in Title 24, Part 1, Section 10-114.

Exceptions to Section 140.7(a): When more than 50 percent of the light from a luminaire falls within one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 140.7:

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
3. Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields, and children’s playgrounds.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
6. Lighting of public monuments.
7. Lighting of signs complying with the requirements of Sections 130.3 and 140.8.
8. Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.
9. Landscape lighting.
10. In theme parks: outdoor lighting only for themes and special effects.

11. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems are additions to area lighting systems and are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.

12. Outdoor lighting systems for qualified historic buildings, as defined in the *California Historic Building Code* (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 140.7.

(b) **Outdoor lighting power trade-offs.** Outdoor lighting power trade-offs shall be determined as follows:

1. Allowed lighting power determined according to Section 140.7(d)1 for general hardscape lighting allowance may be traded to specific applications in Section 140.7(d)2, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section 140.7(d)1A.
2. Allowed lighting power determined according to Section 140.7(d)2 for additional lighting power allowances for specific applications shall not be traded between specific applications, or to hardscape lighting in Section 140.7(d)1.
3. Trading of lighting power allowances between outdoor and indoor areas shall not be permitted.

(c) **Calculation of actual lighting power.** The wattage of outdoor luminaires shall be determined in accordance with Section 130.0(c).

(d) **Calculation of allowed lighting power.** The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accor-

dance with Section 140.7(d)1, and the sum of the additional lighting power allowance for specific applications determined in accordance with Section 140.7(d)2.

1. General hardscape lighting allowance. Determine the general hardscape lighting power allowances as follows:

A. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is ten times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the area wattage allowance (AWA) from Table 140.7-A for the appropriate lighting zone.

B. Determine the perimeter length of the general hardscape area. The total perimeter shall not include portions of hardscape that are not illuminated according to Section 140.7(d)1A. Multiply the hardscape perimeter by the linear wattage allowance (LWA) for hardscape from Table 140.7-A for the appropriate lighting zone. The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:

- i. Landscaped areas completely enclosed within the hardscape area, and which have a width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
- ii. Landscaped areas completely enclosed within the hardscape area, and which width or length is a minimum of 10 feet wide, the perimeter of the

landscaped areas or permanent planter shall be added to the hardscape perimeter length.

iii. Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.

C. Determine the initial wattage allowance (IWA) for general hardscape lighting from Table 140.7-A for the appropriate lighting zone. The hardscape area shall be permitted one IWA per site.

D. The general hardscape lighting allowance shall be the sum of the allowed watts determined from (A), (B) and (C) above.

2. Additional lighting power allowance for specific applications. Additional lighting power for specific applications shall be the smaller of the additional lighting allowances for specific applications determined in accordance with Table 140.7-B for the appropriate lighting zone, or the actual installed lighting power meeting the requirements for the allowance.

**SECTION 140.8
REQUIREMENTS FOR SIGNS**

This section applies to all internally illuminated and externally illuminated signs, unfiltered light emitting diodes (LEDs) and unfiltered neon, both indoor and outdoor. Each sign shall comply with either subsection (a) or (b), as applicable.

(a) Maximum allowed lighting power.

- 1. For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.
- 2. For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.
- 3. Lighting for unfiltered light emitting diodes (LEDs) and unfiltered neon shall comply with Section 140.8(b).

**TABLE 140.7-A
GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE**

TYPE OF POWER ALLOWANCE	LIGHTING ZONE 0	LIGHTING ZONE 1	LIGHTING ZONE 2 ²	LIGHTING ZONE 3 ²	LIGHTING ZONE 4
Area wattage allowance (AWA)	No allowance ¹	0.020 W/ft ²	0.030 W/ft ²	0.040 W/ft ²	0.050 W/ft ²
Linear wattage allowance (LWA)		0.15 W/lf	0.25 W/lf	0.35 W/lf	0.45 W/lf
Initial wattage allowance (IWA)		340 W	450 W	520 W	640 W

1. Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 Watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse, or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed in Lighting Zone 0 shall meet the maximum zonal lumen limits for Uplight and Glare specified in Table 130.2-A and 130.2-B.

2. For Lighting Zone 2 and 3, where greater than 50% of the paved surface of a parking lot is finished with concrete, the AWA for that area shall be 0.035 W/ft² for Lighting Zone 2 and 0.040 W/ft² for Lighting Zone 3, and the LWA for both lighting zones shall be 0.70 W/lf. This does not extend beyond the parking lot, and does not include any other general hardscape areas.

**TABLE 140.7-B
ADDITIONAL LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS
All area and distance measurements in plan view unless otherwise noted.**

LIGHTING APPLICATION	LIGHTING ZONE 0	LIGHTING ZONE 1	LIGHTING ZONE 2	LIGHTING ZONE 3	LIGHTING ZONE 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.					
Building entrances or exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	Not applicable	15 watts	25 watts	35 watts	45 watts
Primary entrances to senior care facilities, police stations, hospitals, fire stations and emergency vehicle facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	Not applicable	45 watts	80 watts	120 watts	130 watts
Drive up windows. Allowance per customer service location. Luminaires qualifying for this allowance shall be within two mounting heights of the sill of the window.	Not applicable	40 watts	75 watts	125 watts	200 watts
Vehicle service station uncovered fuel dispenser. Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within two mounting heights of the dispenser.	Not applicable	120 watts	175 watts	185 watts	330 watts
ATM machine lighting. Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not applicable	250 watts for first ATM machine, 70 watts for each additional ATM machine.			
WATTAGE ALLOWANCE PER UNIT LENGTH (W/linear ft). May be used for one or two frontage side(s) per site.					
Outdoor sales frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides, provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	Not applicable	No Allowance	22.5 W/linear ft	36 W/linear ft	45 W/linear ft
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.					
Hardscape ornamental lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 100 watts or less as determined in accordance with Section 130.0(d), and shall be post-top luminaires, lanterns, pendant luminaires or chandeliers.	Not applicable	No Allowance	0.02 W/ft ²	0.04 W/ft ²	0.06 W/ft ²
WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate, provided that none of the following specific applications shall be used for the same area.					
Building facades. Only areas of building facade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the facade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.	Not applicable	No Allowance	0.18 W/ft ²	0.35 W/ft ²	0.50 W/ft ²
Outdoor sales lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other nonsales areas shall be considered hardscape areas even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within five mounting heights of the sales lot area.	Not applicable	0.164 W/ft ²	0.555 W/ft ²	0.758 W/ft ²	1.285 W/ft ²
Vehicle service station hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines or obstructed by a sign or other structure.	Not applicable	0.014 W/ft ²	0.155 W/ft ²	0.308 W/ft ²	0.485 W/ft ²
Vehicle service station canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	0.514 W/ft ²	1.005 W/ft ²	1.300 W/ft ²	2.200 W/ft ²
Sales canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	No Allowance	0.655 W/ft ²	0.908 W/ft ²	1.135 W/ft ²
Nonsales canopies and tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel.	Not applicable	0.084 W/ft ²	0.205 W/ft ²	0.408 W/ft ²	0.585 W/ft ²
Guard stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates and vehicle contents. Qualifying luminaires shall be within two mounting heights of a vehicle lane or the guardhouse.	Not applicable	0.154 W/ft ²	0.355 W/ft ²	0.708 W/ft ²	0.985 W/ft ²
Student pick-up/drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within two mounting heights of the student pick-up/drop-off zone.	Not applicable	No Allowance	0.12 W/ft ²	0.45 W/ft ²	No Allowance
Outdoor dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within two mounting heights of the hardscape area of outdoor dining.	Not applicable	0.014 W/ft ²	0.135 W/ft ²	0.240 W/ft ²	0.400 W/ft ²
Special security lighting for retail parking and pedestrian hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	Not applicable	0.007 W/ft ²	0.009 W/ft ²	0.019 W/ft ²	No Allowance

(b) **Alternate lighting sources.** The sign shall comply if it is equipped only with one or more of the following light sources:

1. High pressure sodium lamps; or
2. Metal halide lamps that are:
 - A. Pulse start or ceramic served by a ballast that has a minimum efficiency of 88 percent or greater, or
 - B. Pulse start that are 320 watts or smaller, are not 250 watt or 175 watt lamps, and are served by a ballast that has a minimum efficiency of 80 percent.

Ballast efficiency is the measured output wattage to the lamp divided by the measured operating input wattage when tested according to ANSI C82.6-2005.

3. Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to the following:
 - A. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or
 - B. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

The ratio of the output wattage to the input wattage is at 100 percent tubing load.
4. Fluorescent lighting systems meeting one of the following requirements:
 - A. Use only lamps with a minimum color rendering index (CRI) of 80; or
 - B. Use only electronic ballasts with a fundamental output frequency not less than 20 kHz.
5. Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

Exception to Section 140.8(b)5: Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the appliance efficiency regulations (Title 20).

6. Compact fluorescent lamps that do not contain a medium screw base socket (E24/E26).

Exception 1 to Section 140.8: Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign or an externally illuminated sign.

Exception 2 to Section 140.8: Exit signs. Exit signs shall meet the requirements of the appliance efficiency regulations.

Exception 3 to Section 140.8: Traffic Signs. Traffic signs shall meet the requirements of the appliance efficiency regulations.

SECTION 140.9 PRESCRIPTIVE REQUIREMENTS FOR COVERED PROCESSES

(a) **Prescriptive requirements for computer rooms.** Space conditioning systems serving a computer room with a power density greater than 20 W/ft² shall comply with this section by being designed with and having constructed and installed a cooling system that meets the requirements of Subsections 1 through 6.

1. **Economizers.** Each individual cooling system primarily serving computer room shall include either:
 - A. An integrated air economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 55°F dry-bulb/50°F wet-bulb and below; or
 - B. An integrated water economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 40°F dry-bulb/35°F wet-bulb and below.

Exception 1 to Section 140.9(a)1: Individual computer rooms under 5 tons in a building that does not have any economizers.

Exception 2 to Section 140.9(a)1: New cooling systems serving an existing computer room in an existing building up to a total of 50 tons of new cooling equipment per building.

Exception 3 to Section 140.9(a)1: New cooling systems serving a new computer room in an existing building up to a total of 20 tons of new cooling equipment per building.

Exception 4 to Section 140.9(a)1: A computer room may be served by a fan system without an economizer if it is also served by a fan system with an economizer that also serves other spaces within the building, provided that all of the following are met:

- i. The economizer system is sized to meet the design cooling load of the computer room when the other spaces within the building are at 50 percent of their design load; and
- ii. The economizer system has the ability to serve only the computer room, e.g., shut off flow to other spaces within the building when unoccupied; and
- iii. The noneconomizer system does not operate when the outside air drybulb temperatures is below 60°F and, the cooling load of other spaces within the building served by the economizer system is less than 50 percent of design load.

2. **Reheat.** Each computer room zone shall have controls that prevent reheating, recooling and simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been pre-

viously cooled, either by cooling equipment or by economizer systems.

3. **Humidification.** Nonadiabatic humidification (e.g., steam, infrared) is prohibited. Only adiabatic humidification (e.g., direct evaporative, ultrasonic) is permitted.
4. **Power consumption of fans.** The total fan power at design conditions of each fan system shall not exceed 27 W/kBtu-h of net sensible cooling capacity.
5. **Fan control.** Each unitary air conditioner with mechanical cooling capacity exceeding 60,000 Btu/hr and each chilled water fan system shall be designed to vary the airflow rate as a function of actual load and shall have controls and/or devices (such as two-speed or variable speed control) that will result in fan motor demand of no more than 50 percent of design wattage at 66 percent of design fan speed.
6. **Containment.** Computer rooms with air-cooled computers in racks and with a design load exceeding 175 kW/room shall include air barriers such that there is no significant air path for computer discharge air to recirculate back to computer inlets without passing through a cooling system.

Exception 1 to Section 140.9(a)6: Expansions of existing computer rooms.

Exception 2 to Section 140.9(a)6: Computer racks with a design load less than 1 kW/rack.

Exception 3 to Section 140.9(a)6: Equivalent energy performance based on computational fluid dynamics or other analysis.

(b) **Prescriptive requirements for commercial kitchens.**

1. **Kitchen exhaust systems.**

- A. Replacement air introduced directly into the hood cavity of kitchen exhaust hoods shall not exceed 10 percent of the hood exhaust airflow rate.
- B. For kitchen/dining facilities having total Type I and Type II kitchen hood exhaust airflow rates greater than 5,000 cfm, each Type I hood shall have an exhaust rate that complies with Table 140.9-A. If a single hood or hood section is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall not exceed the Table 140.9-A values for the highest appliance duty rating under the hood or hood section. Refer to ASHRAE Standard 154-2011 for definitions of hood type, appliance duty and next exhaust flow rate.

Exception 1 to Section 140.9(b)1.B: 75 percent of the total Type I and Type II exhaust replacement air is transfer air that would otherwise be exhausted.

Exception 2 to Section 140.9(b)1.B: Existing hoods not being replaced as part of an addition or alteration.

**TABLE 140.9-A
MAXIMUM NET EXHAUST FLOW RATE,
CFM PER LINEAR FOOT OF HOOD LENGTH**

TYPE OF HOOD	LIGHT DUTY EQUIPMENT	MEDIUM DUTY EQUIPMENT	HEAVY DUTY EQUIPMENT	EXTRA HEAVY DUTY EQUIPMENT
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/passover	210	210	280	Not allowed

2. **Kitchen ventilation.**

A. Mechanically cooled or heated makeup air delivered to any space with a kitchen hood shall not exceed the greater of:

- i. The supply flow required to meet the space heating and cooling load; or
- ii. The hood exhaust flow minus the available transfer air from adjacent spaces. Available transfer air is that portion of outdoor ventilation air serving adjacent spaces not required to satisfy other exhaust needs, such as restrooms, not required to maintain pressurization of adjacent spaces, and that would otherwise be relieved from the building.

Exception to Section 140.9(b)2.A: Existing kitchen makeup air units not being replaced as part of an addition or alteration.

B. A kitchen/dining facility having a total Type I and Type II kitchen hood exhaust airflow rate greater than 5,000 cfm shall have one of the following:

- i. At least 50 percent of all replacement air is transfer air that would otherwise be exhausted; or
- ii. Demand ventilation system(s) on at least 75 percent of the exhaust air. Such systems shall:
 - a. Include controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle; and
 - b. Include failsafe controls that result in full flow upon cooking sensor failure; and
 - c. Include an adjustable timed override to allow occupants the ability to temporarily override the system to full flow; and
 - d. Be capable of reducing exhaust and replacement air system airflow rates to the larger of:
 - (i) 50 percent of the total design exhaust and replacement air system airflow rates; or
 - (ii) The ventilation rate required as specified by Section 120.1.

- iii. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40 percent on at least 50 percent of the total exhaust airflow; or
- iv. A minimum of 75 percent of makeup air volume that is:
 - a. Unheated or heated to no more than 60°F; and
 - b. Uncooled or cooled without the use of mechanical cooling.

Exception to Section 140.9(b)2B: Existing hoods not being replaced as part of an addition or alteration.

3. **Kitchen exhaust system acceptance.** Before an occupancy permit is granted for a commercial kitchen subject to Section 140.9(b), the following equipment and systems shall be certified as meeting the acceptance requirements for code compliance, as specified by the Reference Nonresidential Appendix NA7. A certificate of acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.11.

(c) **Prescriptive requirements for laboratory exhaust systems.** For buildings with laboratory exhaust systems where the minimum circulation rate to comply with code or accreditation standards is 10 ACH or less, the design exhaust airflow shall be capable of reducing zone exhaust and makeup airflow rates to the regulated minimum circulation rate, or the minimum required to maintain pressurization requirements, whichever is larger. Variable exhaust and makeup airflow shall be coordinated to achieve the required space pressurization at varied levels of demand and fan system capacity.

Exception 1 to Section 140.9(c): Laboratory exhaust systems serving zones where constant volume is required by the authority having jurisdiction, facility environmental health & safety department or other applicable code.

Exception 2 to Section 140.9(c): New zones on an existing constant volume exhaust system.