Nonresidential Buildings: What's New in 2022?

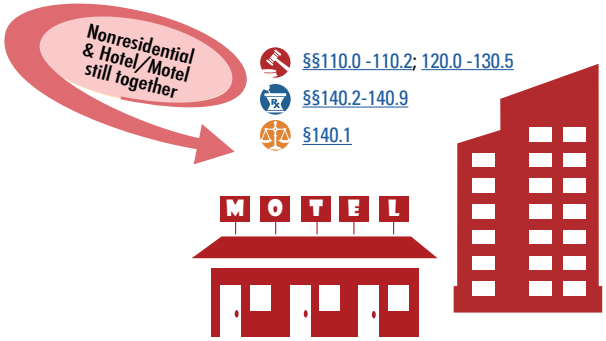
What's Included in this Fact Sheet?

The 2022 Title 24, Part 6 Building Energy Efficiency Standards (Energy Code or Title 24, Part 6) updates the 2019 Energy Code.

The 2022 Energy Code is effective as of January 1, 2023. Any projects that apply for a permit on or after this date will be subject to the 2022 Energy Code. Information and documents are available at: bit.ly/CEC-2022-Standards

This fact sheet highlights the key changes to the Energy Code that apply to nonresidential buildings such as hotels, motels, factories, office buildings, retail spaces and healthcare facilities.

In the 2019 Energy Code, high-rise multifamily buildings were grouped with nonresidential buildings. The 2022 Energy Code reorganizes low-rise and high-rise multifamily buildings into one building type and moves requirements for multifamily buildings to their own subchapters.



Hotel/Motel and Nonresidential Buildings
§§120.0-140.9

How to Use this Fact Sheet

Use this fact sheet for highlights on the ways in which the Energy Code has changed in 2022 for nonresidential buildings. For detail about the code changes, refer to the *Nonresidential Buildings: What's Changed in 2022 Fact Sheet*.

Highlights and details about the code changes for other building types are given in the following fact sheets:

- *Multifamily Buildings: What's New in 2022?*
- *Multifamily Buildings: What's Changed in 2022?*
- *Single-family Buildings: What's New in 2022?*
- *Single-family Buildings: What's Changed in 2022?*

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Why Did the Energy Code Change?

The 2022 Energy Code is an important part of California's work to reduce carbon emissions and fight climate change. The Energy Code is updated every three years with the mandate to increase building energy efficiency while staying cost-effective for building owners over the lifespan of a building.

Increases in energy efficiency and on-site generation:

- Reduce utility bills
- Improve indoor comfort and air quality
- Increase market value
- Reduce greenhouse gas emissions (GHG)

The California Energy Commission (CEC) estimates that over 30 years the 2022 Energy Code will provide $1.5 billion in consumer benefits and reduce 10 million metric tons of GHG – equivalent to taking nearly 2.2 million gas cars off the road for a year.

The CEC estimates that the 2022 Energy Code improvements in efficiency for new nonresidential buildings and covered processes, plus the move toward all-electric design, will reduce net CO_2 emissions by 142,858 metric tons per year compared to the 2019 Energy Code, the equivalent of taking 32,051 gas cars off the road each year.

BENEFITS OF THE 2022 ENERGY CODE ACROSS ALL BUILDING TYPES

- Increases on-site renewable energy generation from solar
- Increases electric load flexibility to support grid reliability
- Reduces emissions from newly constructed buildings
- Reduces air pollution for improved public health
- Encourages adoption of environmentally beneficial efficient electric technologies

Decarbonization Goals

California is aiming to reduce its greenhouse gas emissions (GHG) while creating an energy system that is resilient to climate risks, spurring innovation and a low-carbon transition nationally and internationally. Per the CEC Energy Assessment, California has some of the most ambitious climate and energy goals in the world.

GHG Emission Reduction Goals

Assembly Bill 32:

1990 levels by 2020

Senate Bill 32:

40% below 1990 levels by 2030

Executive Order S-3-05:

80% below 1990 levels by 2050

This can be achieved through a variety of measures, such as incremental steps toward "carbon neutral" buildings, and timely balancing of onsite energy production and consumption in support of a healthy, stable grid. The Energy Code supports reaching these goals.

Learn more from the CEC Building Decarbonization Assessment at bit.ly/CEC-building-decarbonization

Envelope Highlights

Envelope Prescriptive Requirements

Envelope Component Requirements
§140.3

Prescriptive Requirements

The 2022 Energy Code makes notable changes in Table 140.3-B, which outlines Prescriptive envelope requirements for nonresidential buildings by Climate Zone.

Metal-framed Walls: Maximum U-factor values are lowered.

Steep-sloped Cool Roofs: Higher minimum revised aged solar reflectance and thermal emittance are required for many Climate Zones.

Air Barrier: Per Table 140.3-B and Table 140.3-C, an air barrier is now Prescriptively required in all Climate Zones (except in Climate Zone 7 for hotels and motels).

The air barrier requirements have been expanded to include:

- Construction documents must include air barrier boundaries, interconnections and penetration details, and associated square foot calculations for all sides of the air barrier.
- Acceptable materials and assemblies must be used for entire length of the air barrier and composed of one of the following. Exceptions and ASTM testing procedures may apply.
  - Materials with air permeance ≤0.004 CFM/ft² (under a pressure differential of 0.3 inches of water: Use Table 140.3-A Materials Deemed to Comply.
  - Assemblies of materials and components with an average air leakage ≤ 0.04 CFM/ft² (under a pressure differential of 0.3 inches of water)
- Verification, if chosen (not a requirement) may use one of the following two options for the entire building:
  - Testing per the new Nonresidential Appendix 5 is ≤ 0.40 CFM/ft²
  - Sampling, if the building has 50,000 ft² or more conditioned floor area (CFA)

  If air leakage does not meet testing or sampling requirements, perform a visual inspection and diagnostic evaluation per the Nonresidential Appendix 5.7.

Fenestration: Table 140.3-B also includes Climate Zone-specific changes to the U-factor, SHGC and VT requirements for fixed windows, curtain walls and storefronts. Requirements for operable windows and glazed doors remain the same.
See Table 2 on the next page.

Nonresidential		Measurement or Status	Climate Zone															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roofs/ Ceilings	Metal Building	Maximum U-factor	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	Maximum U-factor	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
Walls	Metal Building	Maximum U-factor	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	0.057	0.061
	Metal-framed	Maximum U-factor	0.060	0.055	0.071	0.055	0.055	0.060	0.060	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
Steep- Sloped Roofing Products		Aged Solar Reflectance	0.20	0.25	0.20	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
		Thermal Emittance	0.75	0.80	0.75	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Air Barrier		Installed	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
Table 1 is an excerpt only and does not represent Table 140.3-B in its entirety.																		

Table 1. *Prescriptive Envelope Criteria for Nonresidential Buildings - Excerpt from Table 140.3-B*

Nonresidential	Measurement	Climate Zone															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fixed Window	Maximum U-factor	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.34	0.36	0.34	0.34	0.34	0.34	0.34	0.36
	Maximum RSHGC	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.25	0.22	0.22	0.22	0.22	0.22	0.25
	Minimum VT	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Curtainwall or Storefront	Maximum U-factor	0.38	0.41	0.41	0.41	0.41	0.41	0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
	Maximum RSHGC	0.25	0.26	0.26	0.26	0.26	0.26	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
	Minimum VT	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
***RSHGC** = relative solar heat gain coefficient; **VT** = visible transmittance.*																	
Table 2 is an excerpt only and does not represent Table 140.3-B in its entirety.																	

***Table 2.** Prescriptive Envelope Criteria for Nonresidential Buildings - Excerpt from Table 140.3-B*

Roof Recover and Replacement Alterations

Roof and Ceiling Insulation for Low-sloped Roofs

§141.0(b)2

Prescriptive Requirements

Roof recover and replacement must be insulated per Table 3. Exceptions may apply.

Climate Zone	R-value	U-factor
1-5 and 9-16	R-23	0.037 utilizing ≥R-10 above roof deck
6-8	R-17	0.047 utilizing ≥R-10 above roof deck

***Table 3.** Insulation Requirements for Roof Alterations - Adapted from Table 141.0-C*

Fenestration Formulas

Certification of Fenestration Products and Exterior Doors Other than Field-fabricated

§110.6(a)

Mandatory Requirements

For U-factor, solar heat gain coefficient (SHGC) and visible transmittance (VT):

- Nonresidential Appendix Chapter 6 (NA6) center of glass formula can only be used for skylights < 200 ft².
- The NA6 formula is not allowed for any new vertical fenestration but is allowed for any amount of altered fenestration.

This basically means you will be using National Fenestration Rating Council (NFRC)-tested products in all applications. This Mandatory requirement applies to New Construction and Alterations.

Mechanical Systems Highlights

Equipment Efficiency

Equipment Efficiency
§110.2

Mandatory Requirements

There are higher efficiencies in the 2022 Energy Code with Mandatory increases in various cooling and heating system efficiencies, cooling tower efficiency, furnace efficiencies and boiler efficiencies. New minimum efficiency tables are added for dedicated outdoor air systems (DOAS), computer room units and heat pump and heat recovery chillers.

Where to Find Certified Products

The National Appliance Efficiency Conservation Act (NAECA) and/or the California Appliance Efficiency Regulations (Title 20) regulate many types of heating and cooling equipment installed in California businesses.

Installers should confirm and document that only certified products are installed. **Use the Modernized Appliance Efficiency Database System (MAEDbS) tool to find certified products.**

(MAEDbS)

bit.ly/MAEDbS

Ventilation Systems

Mechanical Ventilation
§120.1(c)3

Mandatory Requirements

Minimum Ventilation Requirements: The minimum outdoor air for each zone must be no less than that calculated using Equation 120.1-F, (A_z x R_t). This equation multiplies the net occupiable ventilation zone floor area in ft² (A_z) times the total minimum outdoor air CFM/ft² from Table 120.1-A (R_t).

A new exception to §120.1(c)3 applies to spaces designed with an expected number of occupants or with fixed seating. (See the exception to California Building Code §1004.5 or §1004.6.) The minimum outdoor air rate for these zones is calculated using Equation 120.1-G to be the larger of:

(R_p x P_z) = 15 CFM per person (R_p) times the expected number of occupants (P_z)

or

(A_z x R_a) = the net occupiable ventilation zone floor area in ft² (A_z) times the minimum CFM/ft² for DCV (demand-controlled ventilation) from Table-120.1-A (R_a)

Design and Testing Requirements for Quantities of Outdoor Air
§120.1(f)

Mandatory Requirements

In the 2019 code cycle, only constant volume HVAC systems required testing to confirm their ability to operate within 10% of the design minimum outdoor air rate. In the 2022 code cycle, all mechanical, ventilation and space-conditioning systems must be tested to confirm that they operate within 10% of the designed minimum outside air rate.

Fan Power
§120.10

Mandatory Requirements

Each fan, or fan array, must meet a fan energy index (FEI) of ≥ 1 at fan design conditions, when the combined motor nameplate horsepower is > 1.00 hp, or fan nameplate electrical input power is > 0.89 kW.

Each VAV fan, or fan array, that meets §140.4(c)2 (Fan Systems) must have an FEI of ≥ 0.95 at fan system design conditions.

Additional requirements and exceptions may apply.

Fan Power
§140.4(c)

Prescriptive Requirements

New fan power requirements regulate fan systems with fan electrical input power ≥ 1 kW. A fan system includes all of the fans that contribute to the movement of air through a point of a common duct, plenum or cabinet. This requirement applies to fan systems that move air into, out of, or between conditioned or circulating air for the purpose of conditioning air within a space.

The fan system electrical input power must not exceed kW budgets for the fan system design airflow using new tables and equations. Table values are shown in W/CFM, with many more entries than the excerpted rows shown on page 6 in Table 4. Each fan component gets an allowance and allowances vary by system type, CFM and floors served. For elevations 3,000 feet or over, multiply fan budget by Correction Factor listed in Table 140.4-C.

Exceptions may apply.

Ventilation Systems *(continued)*

Dedicated Outdoor Air Systems
§140.4(p)

Prescriptive Requirements

Prescriptive requirements have been added for dedicated outdoor air systems (DOAS) design such as DX-DOAS, HRV or ERV units.

DOAS Unit Fan Systems:

- If input power < 1 kW, the system must not exceed a total combined fan power of 1.0 W/CFM.
- If input power ≥ 1 kW, the system must meet the requirements of §140.4(c).

Supply and Exhaust Fans:

- The system must have a minimum of three speeds to facilitate system balancing.

Supply Air:

- Supply air must be delivered directly to the occupied space or at the downstream of any terminal heating or cooling coils.
- The system must cycle off any zone heating and cooling equipment fans, circulation pumps and terminal unit fans when there is no call for heating or cooling in the zone.
- Exceptions:
  - Active chilled beam systems
  - Sensible-only cooling terminal units with pressure-independent variable-airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements
  - Any configuration where a DOAS unit provides ventilation air to a downstream fan (a terminal box, air handling unit or other space-conditioning equipment) where the total system airflow can be reduced to ventilation minimum or the downstream fan power is no greater than 0.12 W/CFM when space temperatures are within the thermostat dead band (at low speed per manufacturer literature)

Reheat:

- Dedicated outdoor air systems with active cooling must have a maximum reheat limit of 60°F when the majority of zones require cooling.

Airflow	Multi-Zone VAV Systems ≤ 5,000 CFM	Multi-Zone VAV Systems > 5,000 and ≤ 10,000 CFM	Multi-Zone VAV Systems > 10,000 CFM	All Other Fan Systems ≤ 5,000 CFM	All Other Fan Systems > 5,000 and ≤ 10,000 CFM	All Other Fan Systems > 10,000 CFM
Supply System Base Allowance: AHU Serving Spaces **≤ 6 floors** away).	0.395	0.453	0.413	0.232	0.256	0.236
Supply System Base Allowance: AHU Serving Spaces **> 6 Floors** Away	0.508	0.548	0.501	0.349	0.356	0.325
MERV 13 to MERV 16 Filter Upstream of Thermal Conditioning Equipment (two times the clean filter pressure drop)	0.136	0.114	0.105	0.139	0.120	0.107
MERV 13 to MERV 16 Final Filter Downstream of Thermal Conditioning Equipment (two times the clean filter pressure drop)	0.225	0.188	0.176	0.231	0.197	0.177
VAV = *variable air volume.*						
Table 4 is an excerpt only and does not represent Table 140.4-A in its entirety.						

Table 4. *Supply Fan Power Allowances in Watts/CFM - Excerpt from Table 140.4-A*

Ace Tips

Dedicated Outdoor Air System (DOAS)

A DOAS is a ventilation system which delivers 100% outdoor air and delivers ventilation supply air to each space, either directly or in conjunction with local or central space-conditioning systems serving those same spaces such as a DX-DOAS, HRV, ERV, or custom ventilation only unit.

Heating and Cooling Systems

Duct Leakage Testing
§120.4(g)

Mandatory Requirements

The Prescriptive duct leakage testing requirement for single zone constant volume systems serving less than 5,000 ft² of conditioned space has moved from a Prescriptive requirement in the 2019 code cycle to a Mandatory requirement in 2022. When a project is subject to §120.4(g)1, verification testing is done by either a Home Energy Rating System (HERS) Rater or a certified mechanical Acceptance Test Technician (ATT).

New duct systems that are not subject to testing under §120.4(g)1 must meet instead the duct leakage testing requirements of California Mechanical Code §603.9.2.

Sizing, Equipment Selection and Type
§140.4(a)2

Prescriptive Requirements

New Prescriptive heat pump equipment requirements apply to certain building space types and may differ based on Climate Zone and equipment sizing. When single zone space-conditioning with direct expansion (DX) cooling with rated cooling capacity ≤ 240,000 Btuh is used, the following building spaces shown in Table 5 below are Prescriptively required to use heat pump equipment, or they must meet the Performance compliance requirements of §140.1.

Other equipment does not have this Prescriptive requirement but must meet all other Energy Code requirements.

This requirement does not apply to systems using heat recovery for space heating.

Building Space Type	Climate Zone	Space-conditioning Requirements
Retail and Grocery	2-15	Cooling capacity ≤ 240,000 Btuh: Heat pump
	1 and 16	Cooling capacity < 65,000 Btuh: Air conditioner with furnace
		Cooling capacity ≥ 65,000 Btuh: Dual-fuel heat pump
School	2-15	Cooling capacity ≤ 240,000 Btuh: Heat pump
	1 and 16	Cooling capacity ≤ 240,000 Btuh: Dual-fuel heat pump
Office, Financial Institution, and Library	1-15	Cooling capacity ≤ 240,000 Btuh: Heat pump
	16	Cooling capacity < 65,000 Btuh: Air conditioner with furnace
		Cooling capacity ≥ 65,000 Btuh: Dual-fuel heat pump
Office Spaces in Warehouses	1-16	Cooling capacity ≤ 240,000 Btuh: Heat pump

Table 5. *Space-conditioning Requirements by Building Space and Climate Zone*

Economizers
§140.4(e)

Prescriptive Requirements

Each cooling air handler with a cooling capacity over 33,000 Btuh is required Prescriptively to provide an air or water economizer. (In the 2019 Energy Code, 54,000 Btuh cooling capacity triggered this requirement.)

With the new smaller cooling output trigger, a variety of equipment previously not subject to economizers will have to be considered:

- Smaller rooftop units
- Smaller split direct expansion (DX) air handlers
- Variable refrigerant flow (VRF) and mini-split systems

Exception:

In all Climate Zones air handlers that have a design cooling capacity < 54,000 Btuh and ventilation provided by a dedicated outdoor air system (DOAS) with exhaust air heat recovery:

- The DOAS unit must meet the exhaust air heat recovery ratio as specified in §140.4(q)1 and includes bypass or control to disable energy recovery as specified in §140.4(q)2.
- The DOAS unit must provide at least the minimum ventilation air flow rate as specified in §120.1(c)3 and provide no less than 0.3 CFM/ft² during economizer conditions.

Heating and Cooling Systems *(continued)*

High-capacity Boiler Systems

§140.4(k)8

Prescriptive Requirements

In Climate Zones 1-6, 9-14 and 16, new Prescriptive requirements apply to space-heating gas boiler systems with total input 1,000,000 – 10,000,000 Btuh.

Boiler systems must have 90% minimum efficiency and their hot water distribution must be designed so that either:

- Coils and other heat exchangers are designed for hot water return temperature of 120°F or less.
- The flow rate is reduced to 20% or less of the design flow of the operating boilers.

Individual boilers under 300,000 Btuh are not included in the calculations of the total system input.

High-capacity boilers that are served by on-site renewable energy, site-recovered energy or heat recovery chillers which provide at least 25% of the annual space heating requirement are exempt.

Exceptions may apply.

Ace Tips

Boiler System

One or more boilers and their piping and controls that work together to supply steam or hot water to heat output devices remote from the boiler.

Exhaust Air Heat Recovery

§140.4(q)

Prescriptive Requirements

New Prescriptive exhaust air heat recovery requirements are triggered by Climate Zone, design airflow rate, percent of outdoor air and hours of operation. Fan systems that operate more hours at higher outdoor air rates such as hospitals and hotels/motels are more likely to require exhaust air heat recovery, depending on Climate Zone. Refer to Table 6 and Table 7.

Exhaust air heat recovery systems must meet the following design criteria:

1. Have either:
   - A sensible energy recovery ratio of at least 60%
   - An enthalpy recovery ratio of at least 50% for both heating and cooling design conditions, and be rated in accordance with AHRI 1060
2. Provide energy recovery bypass or control to both:
   - Disable energy recovery
   - Directly economize with ventilation air based on outdoor air temperature limits specified in Table 140.4-G
3. For energy recovery systems where the transfer of energy cannot be stopped, bypass must prevent the total airflow rate of either outdoor air or exhaust air through the energy recovery exchanger from exceeding 10% of the full design airflow rate.

Exceptions may apply.

Heating and Cooling Systems *(continued)*

%Outdoor Air at Full Design Flow	Climate Zone															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
≥ 10% and < 20%	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
≥ 20% and < 30%	≥ 15,000	≥ 20,000	NR	NR	NR	NR	NR	NR	NR	NR	≥ 18,500	≥ 18,500	≥ 18,500	≥ 18,500	≥ 18,500	≥ 18,500
Table 6 is an excerpt only and does not represent Table 140.4-J in its entirety.																

Table 6. Energy Recovery Requirements by Climate Zone and Percent of Outdoor Air at Full Design Airflow (< 8,000 Hours/Year) - Excerpt from Table 140.4-J

% Outdoor Air at Full Design Flow	Climate Zone															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
≥ 10% and < 20%	≥ 10,000	≥ 10,000	NR	NR	NR	NR	NR	NR	NR	≥ 40,000	≥ 40,000	≥ 20,000	≥ 10,000	≥ 10,000	≥ 10,000	≥ 10,000
≥ 20% and < 30%	≥ 2,000	≥ 5,000	≥ 13,000	≥ 9,000	≥ 9,000	NR	NR	NR	NR	≥ 15,000	≥ 15,000	≥ 5,000	≥ 5,000	≥ 5,000	≥ 5,000	≥ 5,000
≥ 30% and < 40%	≥ 2,000	≥ 3,000	≥ 10,000	≥ 6,500	≥ 6,500	NR	NR	NR	≥ 15,000	≥ 7,500	≥ 7,500	≥ 3,000	≥ 3,000	≥ 3,000	≥ 3,000	≥ 3,000
Table 7 is an excerpt only and does not represent Table 140.4-K in its entirety.																

Table 7. Energy Recovery Requirements by Climate Zone and Percent of Outdoor Air at Full Design Airflow (≥ 8,000 Hours/Year) - Excerpt from Table 140.4-K

New and Replacement HVAC System Alterations

§§140.4, 141.0

Prescriptive Requirements

The 2022 Energy Code has additional fan power allowances available as specified in Table 141.0-D. These values can be added to the Fan Power Allowance values in Table 140.4-A and Table 140.4-B.

Exceptions:

- §140.4(a)2 Prescriptive Single Zone Space Conditioning System Type does not apply to new or replacement space-conditioning systems or components.
- §140.4(e) Prescriptive Economizers does not apply to single package air-cooled commercial unitary air conditioners or heat pumps, with cooling capacity of < 54,000 Btuh.
- §140.4(k)8 Prescriptive Boilers: A new or replacement gas hot water boiler system 1,000,000–10,000,000 Btuh need not comply with the 90% efficiency requirement.

Service Water-heating Systems

Service Water-heating – Nonresidential
§140.5(a)

Prescriptive Requirements

Note that hotel/motel occupancies must meet the multifamily requirements of §170.2. See *Multifamily Buildings: What's New in 2022*

The 2022 Energy Code updates requirements for service water-heating systems for the following:

- School buildings under 25,000 ft² and less than 4 stories in Climate Zones 2-15 must use a heat pump water heater that meets the requirements of §§110.1, 110.3 and 120.3.

  Exception: Water heaters serving an individual bathroom space may be an instantaneous electric resistance water heater.
- For all other nonresidential occupancies, see §140.4(k)8 for boiler requirements. Otherwise, there are no new Prescriptive service water-heating requirements.
- High-capacity service water-heating systems (≥ 1 MMBtuh) must install gas service water-heating equipment with minimum thermal efficiency of 90%.
  - Water-heating systems may contain one or more water heaters that work together to supply hot water for sanitary purposes for human occupancy. The designed system efficiency is the average of the individual water heaters capacity-weighted average efficiencies.

Exceptions:

- High-capacity service water-heating systems that are served by on-site renewable energy or site-recovered energy which provide at least 25% of the annual space heating requirement are exempt.
- Water heaters installed in individual dwelling units are exempt.
- Individual gas water heaters with an input capacity ≤ 100kbtu must not be included in the calculations of the total system input or total system efficiency.

Lighting and Electrical Distribution Highlights

Indoor Lighting

Controlled Receptacles
§110.12(e)

Mandatory Requirements

Receptacles must be connected to the demand-response system if the building is required to have both demand-responsive lighting controls and controlled receptacles.

There is an exception for spaces where a health or life safety statute, ordinance or regulation does not permit the receptacles to be automatically controlled.

Lighting Controls
§130.1

Mandatory Requirements

Demand-responsive Lighting Controls: The trigger for demand-responsive lighting controls is now based on lighting wattage rather than floor area. When general and all other lighting is subject to the multilevel requirements of §130.1(b) for a project 4,000 watts or more, demand-responsive controls are required. A demand-response signal must be capable of automatically reducing general lighting as specified in the Table 130.1-A requirements. All other lighting can also be included, but this is not required.

Manual Area Controls: There are new exceptions to the manual area control accessibility and location requirements.

Shut-OFF Controls: Offices over 250 ft² have new shut-OFF control requirements.

Daylighting Controls: Secondary daylighting controls are now Mandatory along with primary and skylit daylighting controls.

Power Adjustment Factors and Lighting Power Allowances
§140.6(a)

Prescriptive Requirements

Because offices over 250 ft² now have Mandatory occupancy sensor control requirements, the large office power adjustment factors (PAFs) have been revised in Table 140.6-A.

The allowed indoor lighting power density has been reduced for many types of buildings and spaces:

- Table 140.6-B: Complete Building Method
- Table 140.6-C: Area Category Method
- Tables 140.6-D, E, F and G Tailored Methods

Indoor Lighting Alterations
§141.0(b)2I

Prescriptive Requirements

Changes are made to Table 141.0-F Control Requirements for Indoor Lighting Systems Alterations.

Alterations do not need to meet new occupancy sensor requirements for offices 250 ft² or larger that either:

- Use 80% or less of allowed wattage allowance of §140.6
- Reduce wattage one-for-one at least 40%

Outdoor Lighting

Outdoor Lighting Zones

Title 24, Part 1 §10-114

Mandatory Requirements

The 2022 Energy Code changes how lighting zones LZ1, LZ2 and LZ3 apply. In Table 8, excerpted from Table 10-114-A, there are two urban zones, and new examples are given. See the excerpt below.

Zone	Ambient Illumination	Statewide Default Location
LZ0	Very Low	**Undeveloped areas** of government designated parks, recreation areas and wildlife preserves
LZ1	Low	**Rural areas,** as defined by the 2010 U.S. Census **These areas include** single- or dual-family residential areas, parks and agricultural zone districts; the developed portion of government designated parks, recreation areas and wildlife preserves. Those that are wholly contained within a higher lighting zone may be considered by the local government as part of that lighting zone.
LZ2	Moderate	**Urban clusters,** as defined by the 2010 U.S. Census **The urban clusters include** multifamily housing, mixed-use residential neighborhoods, religious facilities, schools and light commercial business districts or industrial zoning districts.
LZ3	Moderately High	**Urban areas,** as defined by the 2010 U.S. Census **These areas include** high-intensity commercial corridors, entertainment centers and heavy industrial or manufacturing zone districts.
LZ4	High	None

Table 8. *Outdoor Lighting Zones - Excerpt from Table 10-114-A*

Outdoor Lighting Power Allowances

§140.7

Prescriptive Requirements

Table 140.7-A General Hardscape Lighting Power Allowance has revised wattage allowances.

Asphalt and concrete are no longer differentiated on the table.

An additional allowance for security cameras is added to Table 140.7-B Additional Lighting Power Allowance for Specific Applications. This allowance applies when a security camera is installed within 2 mounting heights of the general hardscape area and mounted over 10 ft away from a building.

Photovoltaic and Battery Storage System Highlights

Community-shared Systems

Community-shared Solar and Battery Systems

Title 24, Part 1 §10-115

Mandatory Requirements

A common shared system may offset solar and/or battery requirements if it meets these requirements:

- Is operational before the final permit is signed off on the building
- Provides equivalent or better performance than what is specified for the building
- Provides benefit to the building for a minimum of 20 years and cannot transfer that benefit to another building
- Is located on a distribution system of the participating buildings
- Is no larger than 20 MW

Photovoltaic Systems

Photovoltaic Requirements

§140.10(a)

Mandatory Requirements

The solar access roof area (SARA) includes the area of a building's roof space capable of structurally supporting a photovoltaic (PV) system and includes the area of all roof spaces on covered parking areas, carports and all other newly constructed structures on the site that are compatible with supporting a PV system per California Building Code §1511.2.

Exceptions:

- Any roof area that has less than 70% annual solar access
- Occupied roof areas as specified by California Building Code §503.1.4
- Roof area that is otherwise not available due to compliance with other building code requirements if confirmed by the CEC Executive Director

Ace Tips

How To Determine Solar Access

Annual solar access is determined by dividing the total annual solar insolation (accounting for shading obstructions) by the total annual solar insolation if the same areas were unshaded by those obstructions.

For all roofs, all obstructions may be considered for the annual solar access calculations. Obstructions that may be considered include those that are external to the building and obstructions that are part of the building design and elevation features.

Photovoltaic Systems *(continued)*

Photovoltaic Requirements
§140.10(a)

Prescriptive Requirements

The photovoltaic (PV) system capacity requirements below apply to New Construction only.

The PV system size must be the smaller of either of the following:

- Total SARAs x 14 W/ft^2
- System size determined by Equation 140.10-A:

$$\mathbf{kW_{PVdc} = (CFA \times A) / 1000}$$

kW_{PVdc} = Size of the PV system in kW
CFA = Conditioned floor area in square feet
A = PV capacity factor specified in Table 140.10-A for the building type and Climate Zone

Exceptions may apply, such as:

- The total of all available SARA is < 3% of CFA.
- The required PV system size is < 4 kW_{dc}.
- The SARA contains < 80 contiguous ft^2.
- An enforcement authority approved a building's roof design and then determined that it is not possible for the PV system (including panels, modules, components, supports and attachments to the roof structure) to meet ASCE 7-16, Chapter 7, Snow Loads.

Building Type	Factor A – Minimum PV Capacity (W/ft² of conditioned floor area)		
	CZ 1, 3, 5, 16	CZ 2, 4, 6-14	CZ 15
Grocery	2.62	2.91	3.53
High-rise Multifamily	1.82	2.21	2.77
Office, Financial Institutions, Unleased Tenant Space	2.59	3.13	3.80
Retail	2.62	2.91	3.53
School	1.27	1.63	2.46
Warehouse	0.39	0.44	0.58
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.39	0.44	0.58
***CZ** = Climate Zone; **PV** = photovoltaic.*			

Table 9. *Photovoltaic Capacity Factors - Adapted from Table 140.10-A*

Ace Tips

For mixed-use buildings, the PV capacity factors are applied proportionally to the floor area dedicated to each use.

For example, a mixed-use grocery (10,000 ft^2) and a multifamily building (50,000 ft^2) in Climate Zone 3 would be Grocery (10,000 x 2.62)/1,000 + Multifamily (50,000 x 1.82)/1,000 = 117.2 total PV kW.

Battery Storage Systems

Battery Storage Requirements
§140.10(b)

Prescriptive Requirements

All buildings that are required by §140.10(a) to have a PV system also must have a battery storage system meeting the minimum qualification requirements of Reference Joint Appendix JA12. Where the building includes more than one of the space types listed in Table 140.10-B Battery Storage Capacity Factors, the total battery system capacity for the building must be determined by applying Equations 140.10-B and 140.10-C to each of the listed space types and summing the capacities determined for each space type and equation.

The minimum rated **energy capacity** for battery storage is set by Equation 140.10-B:

$$kWh_{batt} = kW_{PVdc} \times B / D^{0.5}$$

- kWh_{batt} = Rated Usable Energy Capacity of the battery storage system in kWh
- kW_{PVdc} = PV system capacity required by §140.10(a) in kW_{dc}
- B = Battery energy capacity factor specified in Table 140.10-B for the building type
- D = Rated single charge-discharge cycle AC to AC (round-trip) efficiency of the battery storage system

The minimum rated **power capacity** for battery storage is set by Equation 140.10-C:

$$kW_{batt} = kW_{PVdc} \times C$$

- kW_{batt} = Power capacity of the battery storage system in kW_{dc}
- kW_{PVdc} = PV system capacity required by §140.10(a) in kW_{dc}
- C = Battery power capacity factor specified in Table 140.10-B for the building type

The same weighting applies as that shown in the PV requirements example.

The following exceptions may apply:

- Buildings where the installed PV system size is < 15% of the size determined by Equation 140.10-A
- Buildings with battery storage system requirements with < 10 kWh rated capacity
- Offices, schools and warehouses located Climate Zone 1
- Single-tenant buildings with < 5,000 ft^2 of conditioned floor area
- Multi-tenant buildings, basing the energy capacity and power capacity of the battery storage system on the tenant spaces with more than 5,000 ft^2 of conditioned floor area

Building Type	Factor B – Energy Capacity	Factor C – Power Capacity
	Wh/W	W/W
Grocery	1.03	0.26
High-rise Multifamily	1.03	0.26
Office, Financial Institutions, Unleased Tenant Space	1.68	0.42
Retail	1.03	0.26
School	1.87	0.46
Warehouse	0.93	0.23
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.93	0.23

Table 10. *Battery Storage Capacity Factors - Adapted from Table 140.10-B*

Covered Process Highlights

Commercial Refrigeration

Refrigerated Warehouses

§120.6(a-b)

Mandatory Requirements

Refrigerated warehouse have new compressor design requirements. Transcritical CO_2 fan powered air-cooled gas cooler(s) are not allowed in Climate Zones 9-15 for refrigerated warehouses or in Climate Zones 10-15 for commercial refrigeration. Automatic door closers are required for refrigerated warehouses. There are many other new design criteria requirements in §120.6(a).

Boilers, Steam Traps and Compressed Air Systems

Process Boiler

§120.6(d)

Mandatory Requirements

Boilers with an input capacity > 5 MMBtuh must maintain (stack-gas) oxygen concentrations at ≤ 3.0% by volume on a dry basis over firing rates of 20 to 100%. (The 2019 Energy Code trigger was 10 MMBtuh.)

Combustion air volume must be controlled with respect to measured flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.

There is a new exception for boilers with steady state full-load combustion efficiency ≥ 90%.

Steam Traps

§120.6(i)

Mandatory Requirements

There are new requirements when steam trap operating pressure is > 15 psig and the total combined connected boiler input rating is > 5,000,000 Btuh.

Compressed Air Systems

§120.6(e)

Mandatory Requirements

There are new monitoring, leak testing and pipe sizing requirements.

Controlled Environment Horticulture Spaces

Controlled Environment Horticulture Spaces

§120.6(h)

Mandatory Requirements

Controlled environment horticulture (CEH) indoor growing spaces have new dehumidification, lighting and electrical power distribution measures. Conditioned greenhouses have new envelope, space-conditioning and lighting measures.

What Is a Controlled Environment Horticulture Space (CEH)?

A controlled environment horticulture (CEH) space is a building space dedicated to plant production by manipulating indoor environmental conditions, such as through electric lighting, mechanical heating, mechanical cooling or dehumidification. CEH space does not include building space where plants are grown solely to decorate that same space.

The ***Code Breaker: Controlled Environment Horticulture (CEH)*** live webinar brings critical Energy Code information to industry organization chapters. This 90-minute webinar reviews the electrical, envelope and mechanical requirements for indoor grow facilities and conditioned greenhouses. For more information on learning objectives, credits and how to schedule a webinar, see the Code Breaker landing page at bit.ly/CEH-Code-Breaker.

Computer Rooms

Computer Rooms
§120.6(j)

Mandatory Requirements

Space-conditioning systems serving a computer room must have:

- ◊ Reheat controls to prevent reheating, recooling and simultaneous heating and cooling
- ◊ Adiabatic humidification
- ◊ Variable fan controls when mechanical cooling capacity is over 60,000 Btuh

Computer Rooms
§140.9(a)

Prescriptive Requirements

Economizers: New language is added for economizer operation.

Air Containment: Air containment for computer rooms with air-cooled computers in racks and with a ITE design load >10 kW (2.8 tons) per room must 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.

Exceptions:

- Expansions of existing computer rooms
- Computer racks with a design load <1 kW (0.28 tons) per rack
- Equivalent energy performance based on computational fluid dynamics or other analysis

Alternating Current-output Uninterruptible Power Supply (UPS): UPSs must meet or exceed minimum average efficiencies for alternating current-output uninterruptible power supplies in Table 140.9-B. The minimum average efficiency for alternating current-output UPS must meet or exceed calculation and testing requirements identified in ENERGY STAR Program Requirements for Uninterruptible Power Supplies (UPSs) – Eligibility Criteria Version 2.0.

There is an exception for an alternating current-output UPS that utilizes standardized NEMA 1-15P or NEMA 5-15P input plug, as specified in ANSI/NEMA WD-6-2016).

For More Information

CALIFORNIA ENERGY COMMISSION

www.energy.ca.gov

Learn more about the California Energy Commission (CEC) and its programs on its website.

2022 Building Energy Efficiency Standards

bit.ly/CEC-2022-Standards

Explore the main CEC web portal for the 2022 Energy Code, including information, documents and historical information.

2022 Building Energy Efficiency Standards Summary

bit.ly/CEC-2022-Summary

View or download this visual summary of the Energy Code's purpose, current changes and impact.

Energy Code Hotline

Call: 1-800-772-3300 (Free)

Email: Title24@energy.ca.gov

Online Resource Center

bit.ly/CEC-ORC

Use these online resources developed for building and enforcement communities to learn more about the Energy Code.

EnergyCodeAce™

www.energycodeace.com

Stop by this online "one-stop-shop" for no-cost tools, training and resources designed to help you comply with California's Title 24, Part 6 and Title 20.

Tools

www.energycodeace.com/tools

Explore this suite of interactive tools to understand the compliance process, required forms, installation techniques and energy efficiency regulations in California.

Reference Ace

www.energycodeace.com/content/reference-ace-2022-tool

Navigate the Title 24, Part 6 Energy Code using an index, keyword search and hyperlinked text.

Q&Ace

www.energycodeace.com/QAndAce

Search our online knowledge base or submit your question to Energy Code Ace experts.

Virtual Compliance Assistant

www.energycodeace.com/content/project-tool

Coming Soon for 2022: Use our virtual assistant to complete your forms and verify compliance.

Training

www.energycodeace.com/training

On-demand, live in-person and online training alternatives are tailored to a variety of industry professionals and address key measures.

Of Special Interest:

◊ 2022 Title 24, Part 6 Essentials – Nonresidential Standards: What's New
bit.ly/ECA-training-2022-nonres-whats-new

Resources

www.energycodeace.com/resources

Downloadable materials provide practical and concise guidance on how and when to comply with California's building and appliance energy efficiency standards.

Of Special Interest:

Fact Sheets

◊ Nonresidential Buildings: What's Changed in 2022?

Create an account on the Energy Code Ace site and select an industry role for your profile in order to receive messages about all our offerings!

Coming Soon!
Check EnergyCodeAce.com for our latest 2022 tools, training and resources!

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