

2022 Energy Code

Nonresidential Mechanical Overview



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Agenda

- Title 24, Part 6 Nonresidential HVAC Sections
- 2022 Energy Code basics and overview
- All occupancies - mandatory
- Nonresidential mechanical – mandatory
- Nonresidential mechanical – prescriptive
- Nonresidential mechanical – additions and alterations
- Demonstrating Compliance Documentation - Forms
- Resources



Title 24, Part 6 Nonresidential HVAC Sections

Subchapter	Subchapter Title	Section	Section Title
2	All Occupancies - Mandatory Requirements for the Manufacture, Construction and Installation of Systems, Equipment, and Building Components	§110.1 §110.2 §110.5 §110.12	Mandatory requirements for Appliances Mandatory requirements for Space-Conditioning Equipment Pilot Lights Prohibited Mandatory requirements for Demand Management
3	Nonresidential, Hotel/Motel Occupancies and Covered Processes- Mandatory Requirements	§120.1 §120.2 §120.3 §120.4 §120.5 §120.8 §120.9	Requirements for Ventilation Required Controls for Space-Conditioning Systems Requirements for Pipe Insulation Requirements for Air Distribution Systems, Ducts and Plenums Required Nonresidential Mechanical System Acceptance Nonresidential Building Commissioning Mandatory Requirements for Commercial Boilers
5	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - Performance and Prescriptive Compliance Approaches for Achieving Energy Efficiency	§140.0 §140.1 §140.2 §140.4	Performance and Prescriptive Compliance Approaches Performance Approach: Energy Budget Prescriptive Approach Prescriptive Requirements for Space Conditioning Systems
6	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - Additions, Alterations, and Repairs	§141.0	Additions, Alterations, and Repairs to Existing Nonresidential, High- Rise Residential, and Hotel/Motel Buildings



2022 Energy Code Basics



Energy Code History

Warren-Alquist Act established CEC in 1974

Authority to develop and maintain Building Energy Efficiency Standards (Energy Code)

Requires CEC to update periodically, usually every 3 years

Requires Energy Code to be cost-effective over economic life of building

WARREN-ALQUIST ACT

Warren-Alquist
State Energy Resources
Conservation and
Development Act

Public Resources Code
Section 25000 et seq.



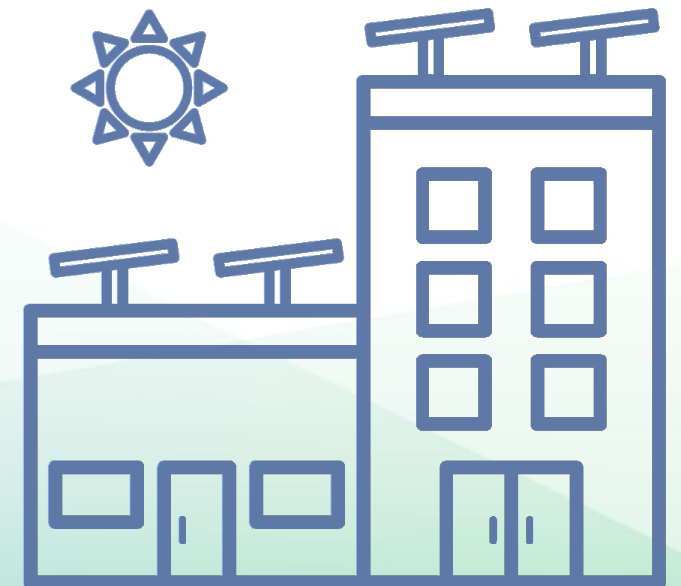
CALIFORNIA
ENERGY COMMISSION
Gavin Newsom, Governor

2020 EDITION
JANUARY 2020
CEC-140-2020-001



2022 Energy Code Goals

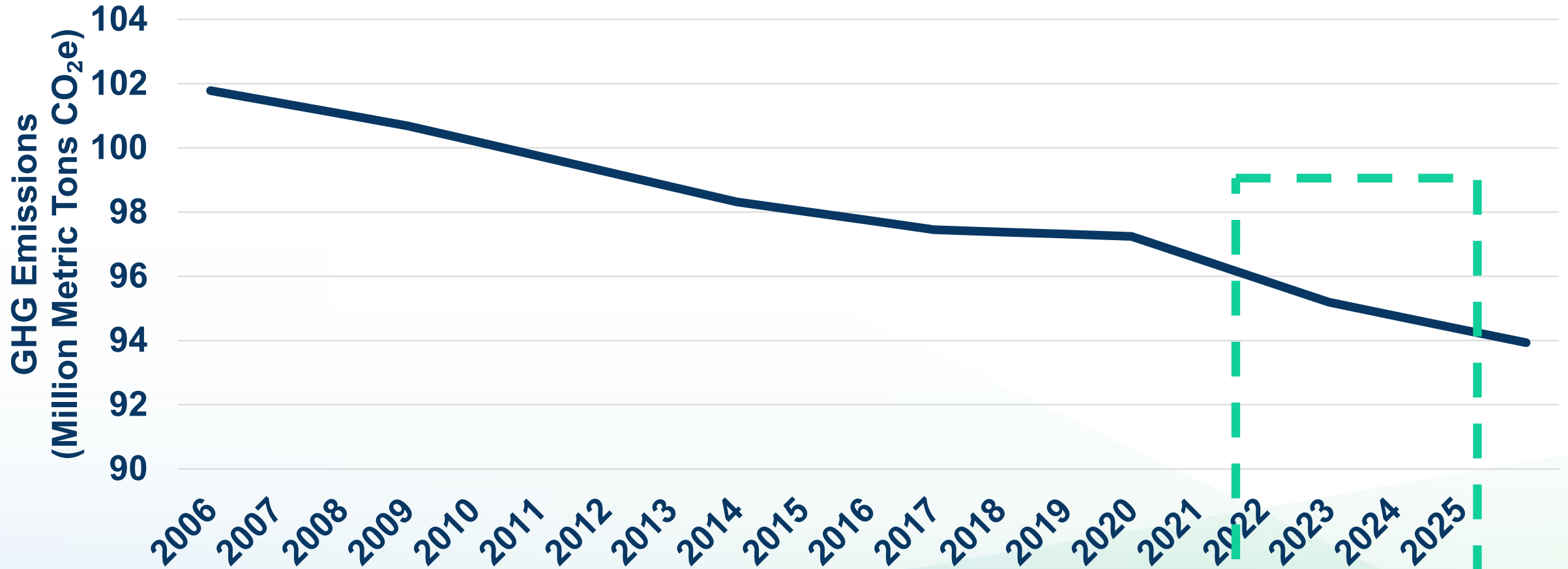
- Increase building energy efficiency cost-effectively
- Contribute to California's greenhouse gas (GHG) reduction goals
- Enable pathways for all-electric buildings
- Reduce residential building impacts on the electricity grid
- Promote demand flexibility and self-utilization of photovoltaic (PV)
- Provide tools for local government reach codes





Energy Code Environmental Benefit

Reduced Statewide Emissions



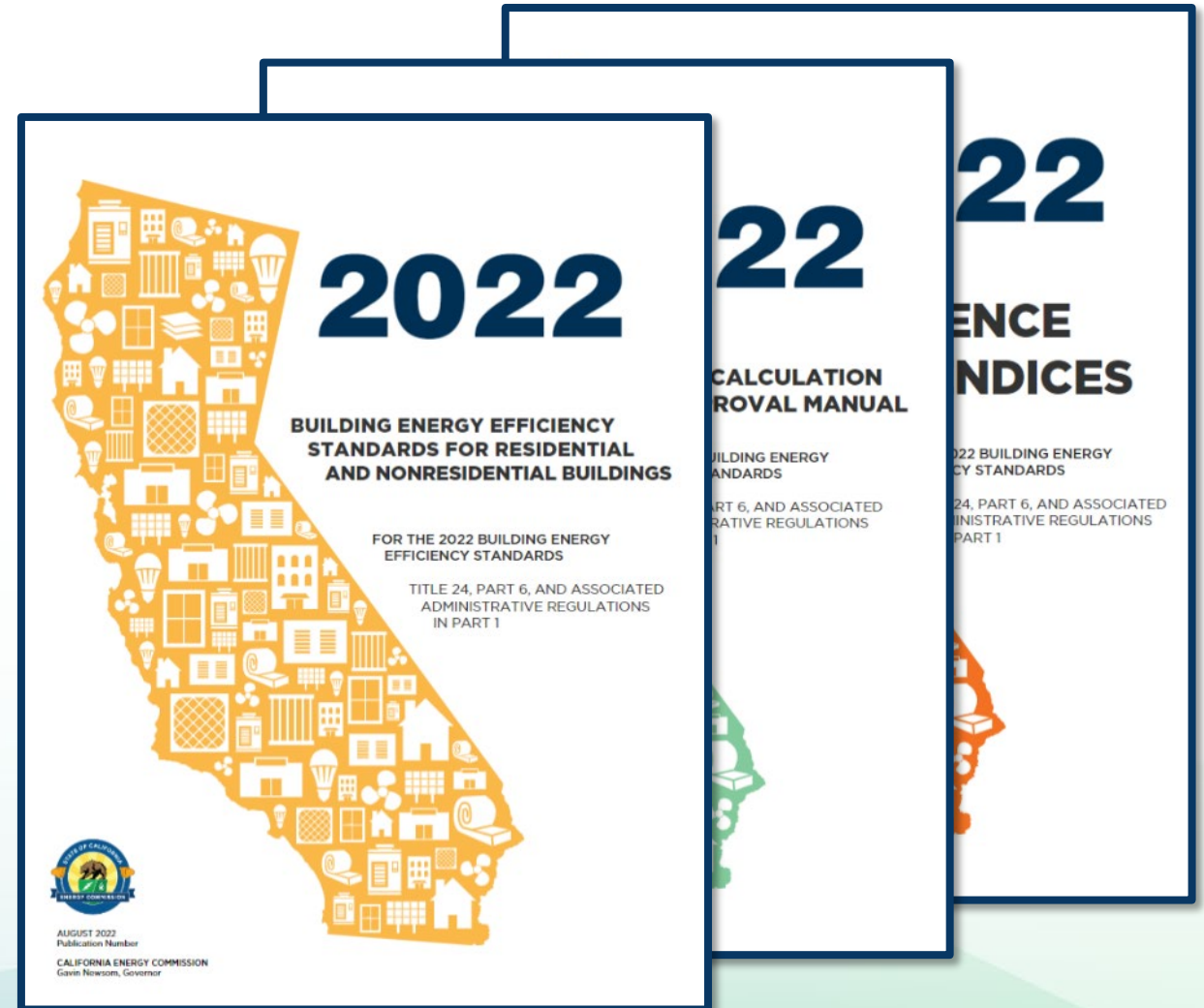
Source: CEC Impact Analysis 2005, 2008, 2013, 2016, 2019, 2022



2022 Energy Code

Effective January 1, 2023

- Building permit applications submitted on or after Jan 1, 2023
- Must use 2022 tools
 - Software
 - Forms





2022 Documents Online

2022 Building Energy Efficiency Standards

The Building Energy Efficiency Standards (Energy Code) apply to newly constructed buildings, additions, and alterations. They are a vital pillar of California's climate action plan. The 2022 Energy Code will produce benefits to support the state's public health, climate, and clean energy goals.

The California Energy Commission (CEC) updates the Energy Code every three years. On August 11, 2021, the CEC adopted the 2022 Energy Code. In December, it was approved by the California Building Standards Commission for inclusion into the California Building Standards Code. The 2022 Energy Code encourages efficient electric heat pumps, establishes electric-ready requirements for new homes, expands solar photovoltaic and battery storage standards, strengthens ventilation standards, and more. Buildings whose permit applications are applied for on or after January 1, 2023, must comply with the 2022 Energy Code.

2022 Energy Code for Residential and Nonresidential Buildings

2022 ENERGY CODE >



Expand All

Supporting Documents – Appendices, Compliance Manuals, and Forms +

Software – Compliance Software, Manuals, and Tools +

BUILDING ENERGY EFFICIENCY STANDARDS - TITLE 24

2025 Building Energy Efficiency Standards

2022 Building Energy Efficiency Standards ^

— Workshops, Notices, and Documents

2019 Building Energy Efficiency Standards

2016 Building Energy Efficiency Standards

Past Building Energy Efficiency Standards

Climate Zone tool, maps, and information supporting the California Energy Code

Online Resource Center

Solar Assessment Tools

RELATED LINKS

Workshops, Notices, and Documents

CONTACT

[Building Energy Efficiency Standards - Title 24](#)

Toll-free in California: 800-772-3300

Outside California: 916-654-5106

SUBSCRIBE

Building Energy Efficiency Standards

Email *

SUBSCRIBE

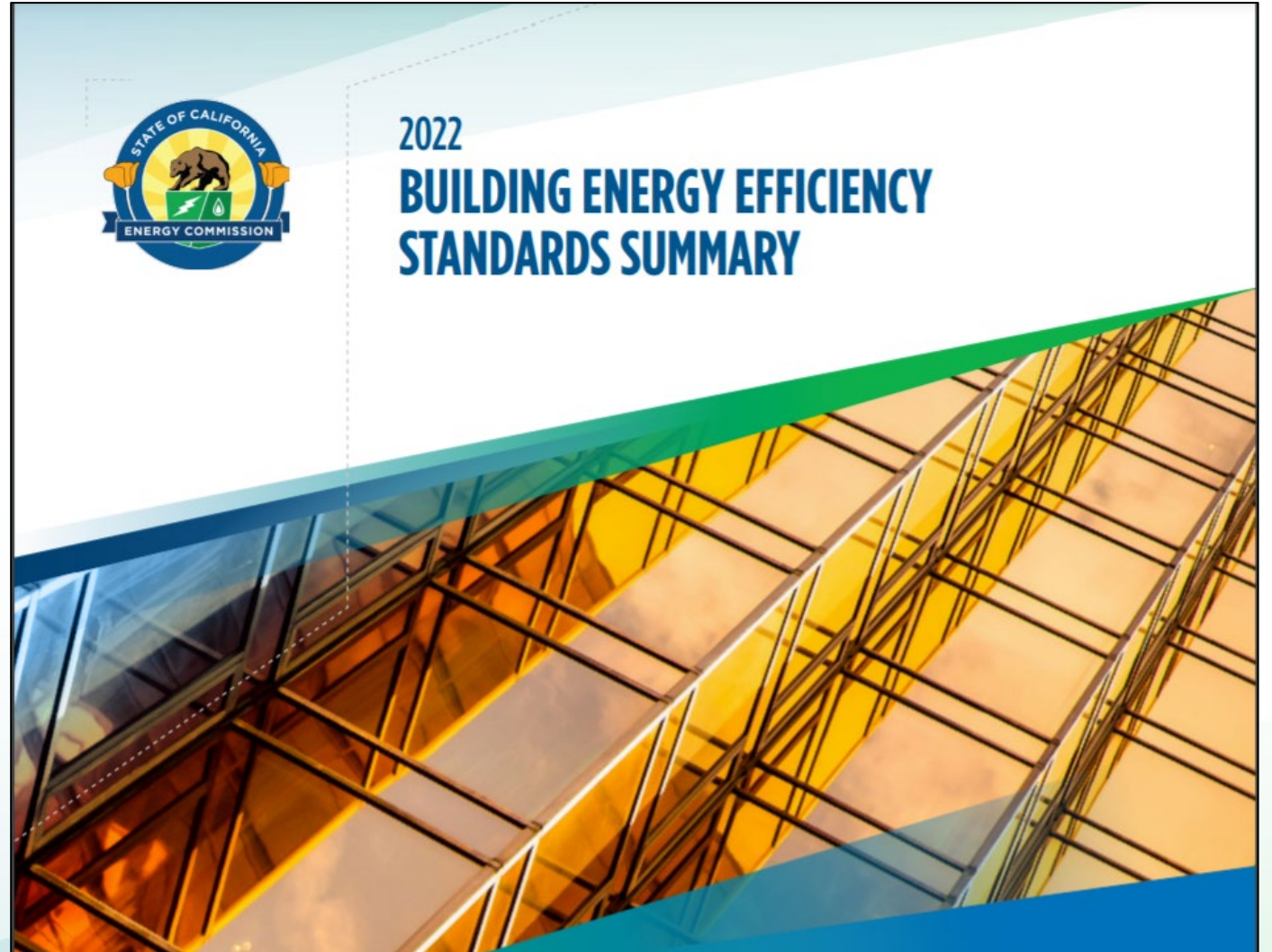
- Energy Code
- Reference Appendices
- Compliance Manuals
- Software
- Forms





2022 Energy Code Highlights

- Heat pump baselines
- Solar and battery storage
- Ventilation requirements
- Lighting
- Multifamily restructuring





Energy Code Requirements

Mandatory requirements

- Minimum efficiency requirements must always be met
- Can never trade off

Prescriptive requirements

- Predefined efficiency requirements
- May supersede mandatory requirements
- Different requirements for newly constructed buildings, additions, and alterations



Compliance Approaches

Prescriptive approach

- Simple approach, no trade-offs
- Defines the standard building design
- 2022 heat pump baselines

Performance approach

- Most flexible approach, allows for trade-offs
- Must meet all mandatory requirements
- Requires the use of CEC-approved software
- Proposed building design meets or exceed standard building design





2022 Performance Metrics

Source energy performance calculations

- Nonresidential and multifamily
 - Hourly source energy
 - TDV Efficiency
 - TDV Total
 - Efficiency, PV + battery



Demonstrating Compliance

Compliance forms confirm Energy Code is met

- Completed by responsible party
 - Designers, consultants, builders, contractors, technicians, HERS raters, etc.
- Submitted to enforcement agencies for verification

Type of form	Single-family	Multifamily 3 or less habitable stories	Nonresidential Multifamily 4 or more habitable stories
Certificate of compliance	CF1R	LMCC	NRCC
Certificate of installation	CF2R	LMCI	NRCI
Certificate of verification	CF3R	LMCV	NRCV
Certificate of acceptance	-	-	NRCA



2022 Compliance Software

Performance approach must use approved compliance software versions

- Nonresidential and multifamily
 - CBECC 2022.3.0
 - EnergyPro 9.2
 - IES VE 1.1



Nonresidential Defined

All Buildings § 100.1

Nonresidential building

- All buildings in California Building Code (CBC) occupancies of group A, B, E, F, H, I, M, S, U
 - Not occupancy group I-3 or I-4
- No longer includes high-rise residential multifamily

- Assembly and conference areas
- Commercial or industrial storage
- Financial institutions
- Hotels and motels
- Healthcare facilities
- Industrial and manufacturing
- Museums
- Offices
- Retail and wholesale stores
- Restaurants
- Schools and churches
- Theaters



Subchapter 2 - All Occupancies

Mandatory §§ 110.0, 110.2, 110.5, 110.12



All Occupancies - Mandatory HVAC Requirements

§110.1 - §110.12

- §110.1 - Mandatory Requirements for Appliances
- §110.2 - Mandatory Requirements for Space Conditioning Equipment
- §110.5 - Natural Gas Central Furnaces, Cooking Equipment, Pool and Spa Heaters, and Fireplaces: Pilot Lights Prohibited
- §110.12 - Mandatory Requirements for Demand Management



Mandatory Requirements for Appliances

§110.1

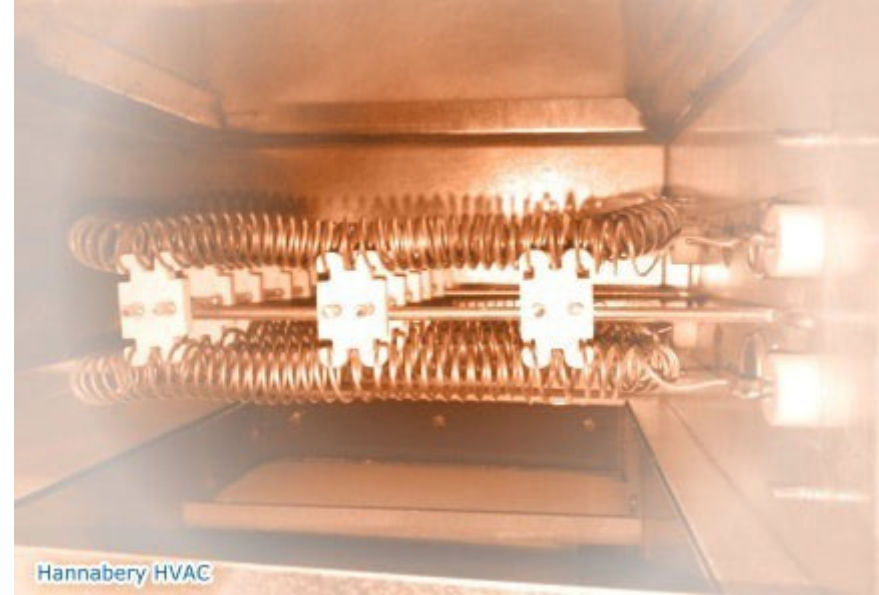
- **Systems, equipment and appliances may be installed only if they are certified and listed as follows:**
 - Item covered by Title 20 must meet the Title 20 efficiency requirements and be listed in the Title 20 database (MAEDBS)
 - Items having efficiency requirements in Title 24, Part 6 must be listed in one of the following:
 - [Title 20 database](#)
 - [Federal database](#)
 - Approved trade association database
 - [AHRI](#) (Air Conditioning, Heating and Refrigeration Institute) or [CTI](#) (Cooling Technology Institute)
 - If the equipment cannot be listed, it must demonstrate efficiency conformance per Section 10-109 of Part 1



Mandatory Requirements for Space Conditioning Equipment

§110.2(b)

- **Heat pumps with supplementary electric resistance heaters must have controls:**
 - Prevent supplementary heater operation when the heating load can be met by the heat pump alone
 - The cut-on and cut-off temperatures for the electric resistance heating must be lower than the heat pump cut-on and cut-off temperatures
- **EXCEPTION:**
 - There are exceptions for defrost, transient periods, and room air conditioners.



Source: <https://www.hannabery.com/faq4.shtml>



Mandatory Requirements for Space Conditioning Equipment

§110.2(a)

- All equipment covered in this section must be certified by the manufacturer
- All equipment listed in [TABLE 110.2-A through TABLE 110.2-N](#) must meet the applicable efficiencies when tested per the listed test procedure

EXCEPTIONS:

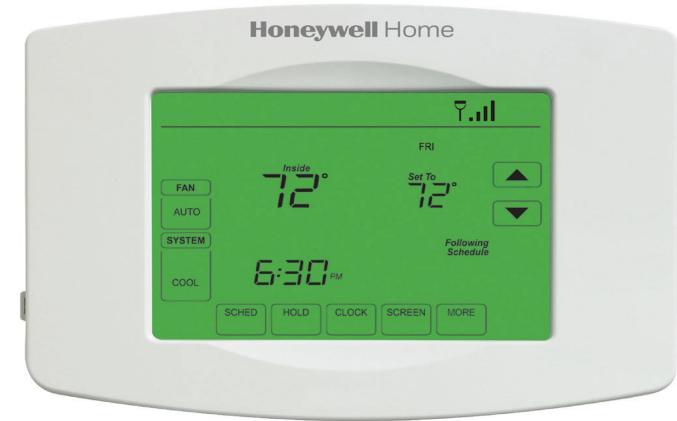
- Some water chilling packages
- Some positive displacement chillers
- Equipment serving refrigerated warehouses or commercial refrigeration.
- See §110.2(a) for details.



Mandatory Requirements for Space Conditioning Equipment

§110.2(c)

- **Thermostat Requirements**
 - All unitary systems without an EMCS must have a setback thermostat programmed with at least four temperature setpoints within 24 hours.
 - Thermostats for heat pumps must also control supplementary electric resistance heaters
- **EXCEPTION:**
 - Gravity gas wall heaters, gravity floor heaters, gravity room heaters, non-central electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners, and room air-conditioner heat pumps.



Source: www.honeywellhome.com/us/en/products/air/thermostats/



Mandatory Requirements for Space Conditioning Equipment

§110.2(d)

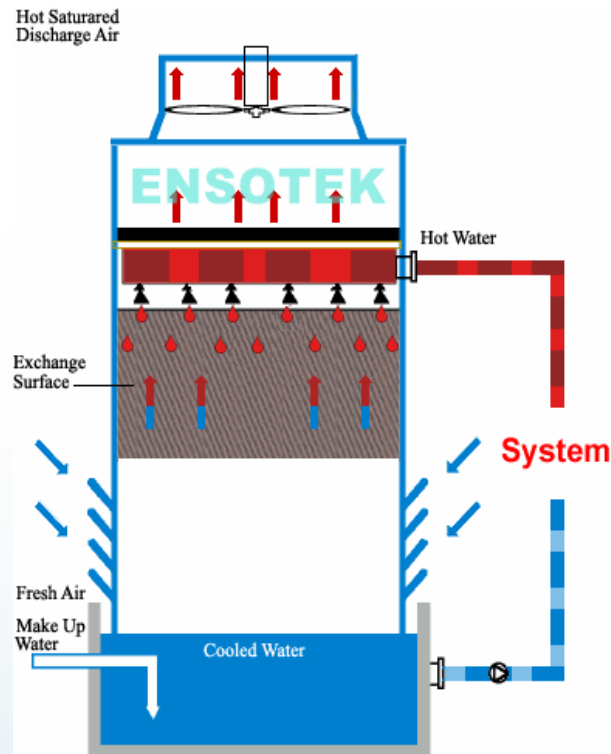
- **Gas- and Oil-Fired Furnaces \geq 225,000 Btu/h must have controls to limit Standby Loss:**
 - **Intermittent ignition or interrupt device (IID)**
 - **Either power venting or a flue damper**
 - **A vent damper** is permissible with furnaces using combustion air from the conditioned space
 - All furnaces in unconditioned space must have **jacket heat losses** not exceeding 0.75 percent of the input rating



Mandatory Requirements for Space Conditioning Equipment

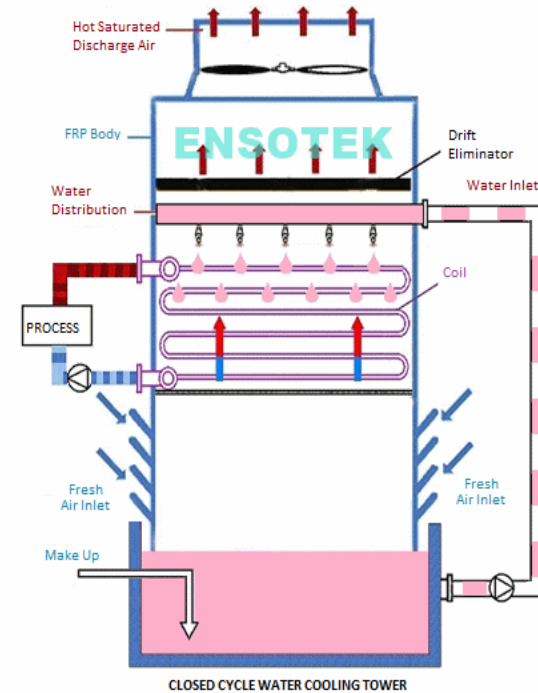
Two types of cooling towers

Open Cycle



Source: www.Ensotek.com

Closed Cycle



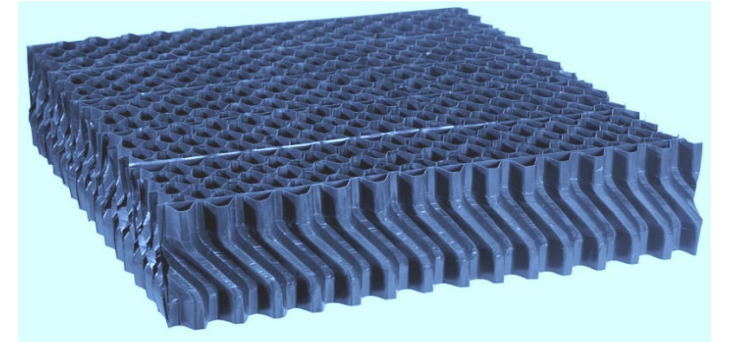
Source: www.Ensotek.com



Mandatory Requirements for Space Conditioning Equipment

§110.2(e)

- Cooling towers > 150 tons must have the following:
 - Conductivity or Flow-based controls
 - The NRCC-MCH-E, Table M is used to document this and must be signed by a Professional Engineer (PE)
 - A **flow meter** with an analog output for flow
 - Equipped with **Drift Eliminators**
- Multifamily and Nonresidential Compliance Manual chapter 4.2.7 is a good resource for cooling tower water conservation information



Source: <https://www.innovek.co.th>



Mandatory Requirements for Space Conditioning Equipment

§110.2(f)

- **Low leakage air handler compliance credit:**
 - Must be listed on the [Energy Commission's list of certified products](#).
 - After installation, the system and attached ducts must be leak tested by a **HERS rater** and the documentation uploaded to the **HERS Registry**.
 - Credit is only available if the performance method is used



Source: <http://microcleanroom.com/air-handling-units.html>



Natural Gas Central Furnaces, Cooking Equipment, Pool and Spa Heaters, and Fireplaces: Pilot Lights Prohibited

§110.5

- **Any natural gas system or equipment listed below may be installed only if it does not have a continuously burning pilot light:**
 - Fan-type central furnaces
 - Household cooking appliances
 - **EXCEPTION:** Household cooking appliances without an electrical supply voltage connection and each pilot consumes less than 150 Btu/hr
 - Pool heaters
 - Spa heaters
 - Indoor and outdoor fireplaces



Mandatory Requirements for Demand Management

§110.12(a)

- **Demand Responsive Controls**

- When meeting demand management requirements, thermostats must meet JA5 requirements, if no EMCS
- Must be capable of communicating using one or more of the following: Wi-Fi, ZigBee, BACnet, Ethernet, or hard-wiring
- Spelled out communication protocols
 - Must be certified as Open ADR 2.0a or b Virtual End Node (VEN), certified and listed at <https://products.openadr.org/>, or
 - Must be capable of responding to open ADR 2.0b VEN, certified to CEC and listed at www.energy.ca.gov/title24/equipment_cert/



Mandatory Requirements for Demand Management

§110.12(b)

- **Demand Responsive Zonal HVAC Controls**

Systems with DDC to the Zone shall be programmed to allow centralized demand shed for noncritical zones as follows:

- A centralized contact or software point within an Energy Management Control System (EMCS) must have the following remote capabilities:
 - Increase the operating cooling temperature set points by 4° or more
 - Decrease the operating heating temperature set points by 4° or more
 - Must reset the temperatures in all to the original operating levels
- The controls must provide an adjustable rate of change for the temperature increase, decrease, and reset.
- The controls shall have the following features:
 - Can be disabled by authorized facility operators; and
 - Allow manual control by authorized facility operators to allow adjustment of heating and cooling set points globally from a single point in the EMCS



Subchapter – 3

Nonresidential, Hotel/Motel Occupancies

Mandatory §§ 120.1, 120.2, 120.3, 120.4, 120.5, 120.8, 120.9



Ventilation and Indoor Air Quality

§120.1(c)1

- **Air Filtration**

Required for the following:

- Mechanical space-conditioning systems with ductwork exceeding 10 ft (3 m) in length.
- Mechanical supply-only ventilation systems and makeup air systems that provide outside air to an occupiable space.
- The supply side of mechanical balanced ventilation systems, including
 - Heat recovery ventilation (HRV) systems
 - Energy recovery ventilation (ERV) systems



Ventilation and Indoor Air Quality

§120.1(c)1

- **Air Filtration – cont.**

Filters required for both **space conditioning and ventilation systems**:

- Filter efficiency \geq MERV 13
- Use of gaskets, sealing or other means to close gaps around filters
- Filter depth:
 - 2-inch depth filter: allowable pressure drop determined by the system designer
OR
 - 1-inch depth filter allowed if: Sized per equation 120.1-A at \leq 150 ft/min face velocity:

$$A_{\text{face}} = Q_{\text{filter}} / V_{\text{face}} \quad \text{Equation 120.1-A}$$

Where:

A_{face} = filter face area (sf)

Q_{filter} = filter air flow (cfm)

V_{face} = face velocity (150 ft/min or less)



Ventilation and Indoor Air Quality

§120.1(c)2

- **Natural Ventilation**

- Requirements aligned with ASHRAE 62.1.
- Maximum distance from operable openings is based on location, number of openings, and ceiling height.
- Size of openings must be $\geq 4\%$ of ventilated floor area.
- Adjoining rooms without outside air openings must have a permanently opened area $\geq 8\%$ of the unventilated area but not less than 25 sf.





Ventilation and Indoor Air Quality

§120.1(c)2

- **Natural Ventilation – cont.**

- If a natural ventilation system is used, there must also be a mechanical system per 120.1(c)3.
 - Exceptions where mechanical ventilation is not required:
 - Permanent openings for natural ventilation; or
 - If there are controls preventing ventilation openings from closing during times of expected occupancy; or
 - In zones not served by a space conditioning system



Ventilation and Indoor Air Quality

§120.1(c)3

- **Mechanical Ventilation**

- Outdoor ventilation rate determined by [Equation 120.1-F](#):

$$V_z = R_t \times A_z$$

Where:

V_z = Required outdoor airflow rate (cfm)

R_t = Outdoor airflow rate per unit area from Table [120.1-A](#) (cfm/sf)

A_z = The net floor area of the ventilation zone (sf)



Ventilation and Indoor Air Quality

§120.1(c)3

- **Mechanical Ventilation – cont.**

Exception – Designed Occupancy

- Spaces with an expected number of occupants or fixed seating use [Equation 120.1-G](#):

$$V_z = \text{the larger of } R_p \times P_z \text{ or } R_a \times A_z$$

Where:

V_z = Required outdoor airflow rate (cfm)

R_p = 15 cubic feet per minute of outdoor airflow per person

P_z = The expected number of occupants as specified by the building designer, or for spaces with fixed seating, as determined by the California Building Code

R_a = The minimum ventilation airflow rate allowed for DCV in Table [120.1-A](#); $R_a = 0$ if not defined for an occupancy category.

A_z = Zone floor area, meaning the net occupiable floor area of the ventilation zone in square feet.



Ventilation and Indoor Air Quality

Table 120.1-A

TABLE 120.1-A– Minimum Ventilation Rates

Occupancy Category	Total Outdoor Air Rate ¹ R _t (cfm/ft ²)	Min Ventilation Air Rate for DCV R _a (cfm/ft ²)	Air Class	Notes
Educational Facilities				
Daycare (through age 4)	0.21	0.15	2	
Daycare sickroom	0.15		3	
Classrooms (ages 5-8)	0.38	0.15	1	
Classrooms (age 9 -18)	0.38	0.15	1	
Lecture/postsecondary classroom	0.38	0.15	1	F
Lecture hall (fixed seats)	-	0.15	1	F
Art classroom	0.15		2	
Science laboratories	0.15		2	
University/college laboratories	0.15		2	
Wood/metal shop	0.15		2	



Ventilation and Indoor Air Quality

§120.1(c)4

- **Exhaust Ventilation**

- New exhaust ventilation rate requirements are listed in [Table 120.1-B](#) (Aligns with ASHRAE 62.1)

Table 120.1-B – Minimum Exhaust Rates
[ASHRAE 62.1: TABLE 6.5]

Occupancy Category	Exhaust Rate, cfm/unit	Exhaust Rate, cfm/ft ²	Air Class	Notes
Arenas	-	0.50	1	B
Art classrooms	-	0.70	2	
Auto repair rooms	-	1.5	2	A
Barber shops	-	0.50	2	
Beauty and nail salons	-	0.60	2	
Cells with toilet	-	1.00	2	
Copy, printing rooms	-	0.50	2	



Ventilation and Indoor Air Quality

§120.1(d)1

Operation and control requirements for minimum quantities of outdoor air

- **Times of Occupancy**

- The minimum outdoor air always supplied **unless**:
 - The space is intermittently occupied and controlled with an **Occupancy Sensor (OS)** or **Demand Control Ventilation (DCV)**
 - A temporary reduction is allowed for up to 30 minutes at a time if the average rate for each hour is \geq the required rate



Ventilation and Indoor Air Quality

§120.1(d)2

Operation and control requirements for minimum quantities of outdoor air

- **Pre-Occupancy**

- A preoccupancy purge is required in the hour prior to occupancy. The **lesser** of the following must be provided to the entire building:
 - The minimum required rate of outdoor air, or
 - Three complete air changes



Ventilation and Indoor Air Quality

§120.1(d)3

Operation and control requirements for minimum quantities of outdoor air

- **Required demand control ventilation**

- DCV is required if the system serving the space has one of the following:
 - An air economizer; or
 - Modulating outside air control; or
 - A design outdoor airflow rate is > 3,000 cfm
- EXCEPTIONS:
 - There are several exceptions related to
 - Airborne contaminants,
 - Space type,
 - Occupant density,
 - Exhaust rate, and
 - Space size.



Ventilation and Indoor Air Quality

§120.1(d)4

Operation and control requirements for minimum quantities of outdoor air

- **Demand control ventilation devices**

- Requirements for DCV systems with **CO₂ Sensors**

- CO₂ sensors in **each room** with no less than **one per 10,000 ft² of floor space**.
- When a zone or space is served by more than one sensor, **a high CO₂ signal from any sensor** in the zone or space must increase ventilation
- CO₂ sensors must be located within 3 ft and 6 ft above the floor or at the anticipated height of the occupants' heads
- CO₂ must be maintained to **600 ppm or less plus the outdoor air CO₂ concentration**
- Outdoor air CO₂ can be assumed to be 400 ppm, or measured with a CO₂ sensor located within 4 feet of the outdoor air intake



Ventilation and Indoor Air Quality

§120.1(d)5

Operation and control requirements for minimum quantities of outdoor air

- **Occupant sensor ventilation control devices**
 - Occupant sensor ventilation controls required when
 - HVAC zones where ventilation air reduced to zero while in occupied-standby mode and
 - Installed occupant sensors to meet §130.1(c)5-7
 - Occupant sensors comply with:
 - Indicate room vacant after 20 minutes max
 - Independent sensor in each space
 - Allow pre-occupancy purge per §120.1(d)2
 - Sensor overridden when zone scheduled for Occupied standby mode
 - Ventilation shut off after 5 minutes
 - Occupied standby mode in 5 min or less and zone setpoints reset per §120.2(e)3

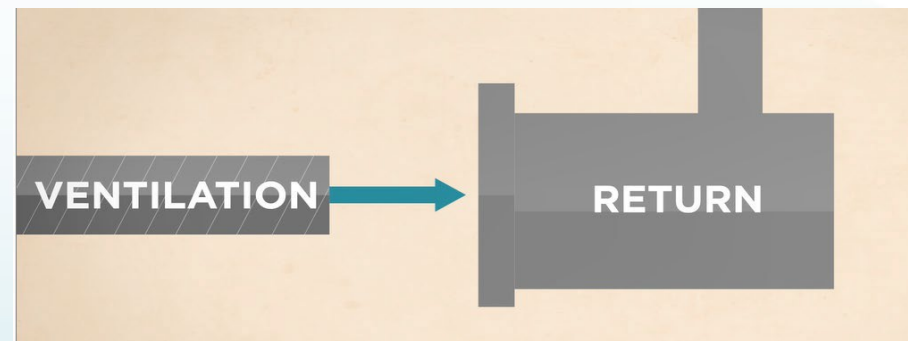


Ventilation and Indoor Air Quality

§120.1(e)

Ducting for zonal heating and cooling units

- Where a return plenum is used to supply outdoor air, the outdoor air should be ducted to discharge either:
 - Within 5 feet of the intake; or
 - If the velocity is ≥ 500 feet per minute, it can be up to 15 feet away if it is directed substantially toward the intake





Ventilation and Indoor Air Quality

§120.1(f)

Design and control requirements for quantities of outdoor air

- Systems must have ductwork, dampers, and controls
- Supply the larger of:
 - the required outside air rates; **or**
 - the rate required for make-up of all exhaust systems that are required for processes, control of odors, or the removal of contaminants
- Dynamic controls for VAV systems to maintain measured outside air ventilation rates within 10% of the required rate
- All mechanical ventilation and space-conditioning systems must be within 10 percent of the required outside air rate



Ventilation and Indoor Air Quality

§120.1(g)

Air classification and recirculation limitations

- Limits on recirculation or transfer of air based on occupancy air class
 - Table 120.1-A or -C designates the air class for each occupancy as: 1, 2, 3, or 4
 - The lower the number, the higher the air quality. For example:
 - Class 1 air can be recirculated or transferred to any space
 - Class 4 air cannot be recirculated or transferred to any other space
 - Air class definitions aligns with ASHRAE 62.1



Ventilation and Indoor Air Quality

§120.1(h)

Ventilation only mechanical systems

- HVAC systems without mechanical cooling or mechanical heating must meet the requirements of [Section 120.2\(f\)](#).



Required Controls for Space-Conditioning Systems

§120.2(a)

Thermostatic controls for each zone

- Each zone or dwelling unit must have an individual thermostatic control or be controlled by an Energy Management Control System (EMCS)
- **EXCEPTION:**
 - An independent perimeter heating or cooling system to serve more than one zone without individual thermostatic controls. See Exception to 120.2(a) for details.



Required Controls for Space-Conditioning Systems

§§120.2(b)1-3

Criteria for zonal thermostatic controls

- Thermostats must be able to set temperatures to the following:
 - Down to 55°F or lower for heating
 - Up to 85°F or higher for cooling
- If used for both heating and cooling it must also have a **dead band** of at least 5°F where space conditioning is shut off or reduced to a minimum
 - EXCEPTIONS:
 - Systems with thermostats that require manual changeover between heating and cooling modes do not need a dead band.
 - Systems serving Healthcare facilities.





Required Controls for Space-Conditioning Systems

§120.2(b)4

Criteria for zonal thermostatic controls

- **Single zone** systems must have one of the following:
 - An **Occupant Controlled Smart Thermostat (OCST)** that meets setback requirements of §110.2(c) and demand response signal requirements in §110.12(a) and certified to the Commission per requirements in JA5
 - And if system has DDC to the zone, the OCST must also meet the demand response control requirements in §110.12(b)
- **EXCEPTIONS:**
 - Healthcare facilities and systems serving exempt process loads that must have constant temperatures.
 - Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air-conditioner heat pumps.



Required Controls for Space-Conditioning Systems

§120.2(c)

Hotel/motel guest room thermostats

- Thermostats must have all the following:
 - Must be an EMCS or setback thermostat.
 - Numeric temperature setpoints in °F and °C
 - Setpoint stops that prevent guest room occupants from adjusting the setpoint more than $\pm 5^{\circ}\text{F}$ ($\pm 3^{\circ}\text{C}$)
- EXCEPTIONS:
 - Thermostats that are integrated into the room heating and cooling equipment.



Required Controls for Space-Conditioning Systems

§120.2(d)

Heat Pump Controls

- All heat pumps with supplementary electric resistance heaters must have controls that comply with [Section 110.2\(b\)](#)



Required Controls for Space-Conditioning Systems

§120.2(e)1

Shut-off and reset controls for space-conditioning systems

- The controls must automatically shut off the system during periods of nonuse and must have **one** of the following:
 - An **occupancy sensor**; or
 - A **4-hour timer** that can be manually operated; or
 - An **automatic time switch control** listed in the [Title 20 database \(MAEDBS\)](#), with an accessible manual override for up to 4 hours
- EXCEPTIONS:
 - Mechanical systems serving retail stores and associated malls, restaurants, grocery stores, churches, and theaters equipped with 7-day programmable timers.



Required Controls for Space-Conditioning Systems

§120.2(e)2

Shut-off and reset controls for space-conditioning systems

- Controls must automatically restart the system to maintain:
 - A setback heating thermostat setpoint; and
 - A setup cooling thermostat setpoint
- EXCEPTIONS:
 - Not required for cooling where the Summer Design Dry Bulb 0.5 percent temperature per JA2 is less than 100°F.
 - Not required for heating where the Winter Median of Extremes outdoor air temperature per JA2 is greater than 32°F.



Required Controls for Space-Conditioning Systems

§120.2(e)3

Shut-off and reset controls for space-conditioning systems

- For HVAC system which also provides ventilation, occupancy sensors are mandatory per section 120.1(d)5
 - In 5 minutes or less in occupied standby mode, and must comply with the following:
 - The temperature must automatically set up the operating cooling or heating temperature set point by 2°F or more
 - For multiple zone systems with (DDC) to the zone, setup and setback temperatures by 0.5°F or more
 - During occupied-standby mode, all air must be turned off if zone temperature is between setpoints



Required Controls for Space-Conditioning Systems

§120.2(e)4

Shut-off and reset controls for space-conditioning systems

- **Hotel and motel guest rooms** must have captive card key, occupancy sensing, or automatic controls that adjust setpoints by 5°F, within 30 minutes after vacancy





Required Controls for Space-Conditioning Systems

§120.2(f)

Dampers for air supply and exhaust equipment

- Outdoor air supply and exhaust equipment must have **dampers that automatically close** upon fan shutdown
- EXCEPTIONS:
 - Equipment serving an area that must operate continuously.
 - Gravity type or other nonelectrical equipment with readily accessible manual damper controls.
 - At combustion air intake and shaft vents.
 - Prohibited by other provisions of law.



Required Controls for Space-Conditioning Systems

§120.2(g)

Isolation area devices

Each space-conditioning system serving multiple zones with a combined conditioned floor area of more than 25,000 square feet shall be designed, installed, and controlled to serve isolation areas.

- Each zone, or any combination of zones $\leq 25,000$ ft², is considered a separate isolation area
- Each isolation area must have isolation devices, such as valves or dampers that control heating or cooling independently
- Each isolation area must have shut-off and reset controls such as an automatic time switch, occupancy sensor, or a 4-hour manual timer
- EXCEPTION:
 - Zones designed to be conditioned continuously.



Required Controls for Space-Conditioning Systems

§120.2(h)

Automatic demand shed controls

- Buildings, other than healthcare facilities, that install or are required to install demand responsive controls must comply with the applicable demand responsive control requirements of Section 110.12
 - Certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN); or
 - Certified as capable of responding to a demand response signal from a certified OpenADR 2.0b Virtual End Node
- Does not have to be implemented but the controls must have these capabilities



Required Controls for Space-Conditioning Systems

§120.2(i)

Economizer fault detection and diagnostics (FDD)

- Economizer FDD is required for all newly installed air handlers with the following:
 - Cooling capacity greater than 33,000 Btu/hr; and
 - An air economizer
- Temperature sensors must be permanently installed to monitor:
 - Outside air
 - Supply air
 - Return air
- Temperature sensors must have an accuracy of $\pm 2^{\circ}\text{F}$ in the range of 40°F to 80°F .
- The controller must be capable of displaying the value of **each** sensor



Required Controls for Space-Conditioning Systems

§120.2(i)

Economizer fault detection and diagnostics (FDD) – cont.

- The controller must provide system status by indicating the following conditions:
 - Free cooling available;
 - Economizer enabled;
 - Compressor enabled;
 - Heating enabled, if the system is capable of heating; **and**
 - Mixed air low limit cycle active
- The **unit** controller must allow **manual initiation** of each operating mode so that the **operation** of cooling system, economizers, fans, and heating systems can be **independently** tested and verified



Required Controls for Space-Conditioning Systems

§120.2(i)

Economizer fault detection and diagnostics (FDD) – cont.

- Faults must be reported in **one** of the following ways:
 - Reported to an EMCS that is monitored by facility personnel
 - Reported to a fault management application which automatically provides notification of the fault to a remote HVAC service provider
 - Display the fault on one or more zone thermostats, or a device or sign within five (5) feet of zone thermostat(s), clearly visible, and meeting the following requirements:
 - Display instructions to contact appropriate building personnel or an HVAC technician; and
 - In buildings with multiple tenants, the display must either be within the property management offices or in a common space accessible to the facilities manager



Required Controls for Space-Conditioning Systems

§120.2(i)

Economizer fault detection and diagnostics (FDD) – cont.

- The FDD system must detect the following faults:
 - Air temperature sensor failure/fault;
 - Not economizing when it should be;
 - Economizing when it should not be;
 - Damper not modulating; and
 - Excess outdoor air
- The FDD systems must be **certified** to the Energy Commission as meeting all of these requirements
- EXCEPTION to FDD:
 - FDD algorithms based in Direct Digital Control systems are not required to be certified to the Energy Commission.



Required Controls for Space-Conditioning Systems

§120.2(j)

Direct Digital Controls (DDC)

- DDC must be provided as specified in [Table 120.2-A](#)
- The DDC system must meet control logic requirements for ventilation in 120.1(d), 110.12(a) and 110.12(b) and the following:
 - **Monitoring zone and system demand** for fan pressure, pump pressure, heating and cooling;
 - **Transferring demand information** from zones to air distribution system controllers and from air distribution systems to heating and cooling plant controllers;
 - Automatically **detecting** the zones and systems that may be excessively driving the reset logic and generate an alarm or other indication to the system operator;
 - Allow for **operator removal** of zones(s) from the reset algorithm;
 - For new buildings, **trending and graphical displaying** of input and output points



Required Controls for Space-Conditioning Systems

§120.2(j)

Table 120.2-A DDC Applications and Qualifications

Table 120.2-A DDC Applications and Qualifications

Building Status	Applications	Qualifications
Newly Constructed Buildings	Air-handling system and all zones served by the system	Individual systems supplying more than three zones and with design heating or cooling capacity of 300 kBtu/h and larger
Newly Constructed Buildings	Chilled water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design cooling capacity of 300 kBtu/h (87.9 kW) and larger
Newly Constructed Buildings	Hot water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design heating capacity of 300 kBtu/h (87.9 kW) and larger
Additions or Alterations	Zone terminal unit such as VAV box	Where existing zones served by the same air-handling, chilled water, or hot water systems that have DDC
Additions or Alterations	Air-handling system or fan coil	Where existing air-handling system(s) and fan coil(s) served by the same chilled or hot water plant have DDC
Additions or Alterations	New air-handling system and all new zones served by the system	Individual systems with design heating or cooling capacity of 300 kBtu/h and larger and supplying more than three zones and more than 75 percent of zones are new
Additions or Alterations	New or upgraded chilled water plant	Where all chillers are new and plant design cooling capacity is 300 kBtu/h (87.9 kW) and larger
Additions or Alterations	New or upgraded hot water plant	Where all boilers are new and plant design heating capacity is 300 kBtu/h (87.9 kW) and larger



Required Controls for Space-Conditioning Systems

§120.2(k)

Optimum start/stop controls

- Space conditioning systems with **DDC to the zone** level must have optimum start/stop controls
- The control algorithm must, **as a minimum**, be a function of the difference between occupied space temperature setpoint, the outdoor air temperature, and the amount of time prior to scheduled occupancy
- Mass radiant floor slab systems must also incorporate **floor temperature** into the optimum start algorithm
- EXCEPTIONS:
 - Systems that must operate continuously.



Requirements for Pipe Insulation

§120.3(a)

General requirements

- Insulation is required on the following:
 - Space cooling refrigerant suction, chilled water and brine lines.
 - Space heating systems steam, steam condensate and hot water lines
- EXCEPTION
 - No insulation is required on the refrigerant liquid line per exception to §120.3(a)2

Cooling System Pipe Insulation is Required For:



Refrigerant Suction



Chilled Water



Brine Lines

Heating System Pipe Insulation is Required For:



Conveying Steam



Steam Condensate



Hot Water



Requirements for Pipe Insulation

§120.3(b)

Insulation Protection

- Insulation must be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind
- Insulation exposed to weather must be water retardant and provide shielding from solar radiation that can cause degradation of the material
- Insulation for chilled water piping and refrigerant suction piping located outside the conditioned space must have a Class I or Class II vapor retarder
- All penetrations and joints must be sealed
- Pipe insulation buried below grade must be installed in a waterproof and non-crushable casing or sleeve



Requirements for Pipe Insulation

§120.3(c)

Insulation Thickness

- Insulation thickness levels are specified in [Table 120.3-A](#)
- If the conductivity is outside the range listed in Table 120.3-A, the calculation method shown below from §120.3(c)2 must be used

$$T = PR \left[\left(1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

T = insulation thickness

PR = actual outside radius

t = insulation thickness from Table 120.3-A

K = conductivity of alternate material from Table 120.3-A

k = lower value of the conductivity range from Table 120.3-A



Requirements for Pipe Insulation

§120.3(c)

Insulation Thickness – cont.

Table 120.3-A Pipe insulation thickness

Table 120.3-A PIPE INSULATION THICKNESS

Fluid Operating Temperature Range (°F)	Insulation Conductivity			Nominal Pipe Diameter (in inches)				
	Conductivity (in Btu-in/h-ft ² -°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				Minimum Pipe Insulation Required (Thickness in inches or R-value)				
Above 350	0.32-0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R 37	R 41	R 37	R 27	R 23
251-350	0.29-0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R 24	R 34	R 35	R 26	R 22
201-250	0.27-0.30	150	Inches	2.5	2.5	2.5	3.0	3.0
			R-value	R 21	R 20	R 17.5	R 17	R 14.5
141-200	0.25-0.29	125	Inches	1.5	1.5	2.0	2.0	2.0
			R-value	R 11.5	R 11	R 14	R 11	R 10
105-140	0.22-0.28	100	Inches	1.0	1.5	1.5	1.5	1.5
			R-value	R 7.7	R 12.5	R 11	R 9	R 8



Requirements for Pipe Insulation

§120.3

EXCEPTIONS

- Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2
- Piping with a design operating temperature range between 60°F and 105°F
- Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use
- Piping that penetrates framing members is not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing must have grommets, plugs, wrapping or other insulation to prevent contact with the metal framing



Requirements for Ducts and Plenums

§120.4(a)

CMC compliance

- All air distribution systems must be installed, sealed and insulated to meet the requirements of the California Mechanical Code (CMC) and ANSI/SMACNA-006-2006 HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition
- This includes the following but not limited to:
 - Ducts
 - Plenums
 - Building cavities
 - Mechanical closets
 - Air-handler boxes
 - Support platforms used as ducts or plenums



Requirements for Ducts and Plenums

§120.4(a)

CMC Compliance - cont.

- Connections of metal ducts and the inner core of flexible ducts must be mechanically fastened
- Openings must be sealed with mastic, tape, aerosol sealant, or other duct-closure system that meets the requirements of UL 181, 181A, or 181B
- If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape must be used



Requirements for Ducts and Plenums

§120.4(a)

CMC Compliance - cont.

- Supply and return ducts located in the following spaces must be insulated to a minimum of R-8:
 - Outdoors
 - In a space between the roof and an insulated ceiling
 - Directly under a roof with fixed vents or openings to the outside or unconditioned spaces
 - In an unconditioned crawlspace
 - In other unconditioned spaces
- Parts of the supply ducts not located in one of these spaces, including buried in concrete slab, must be insulated to a minimum of R-4.2
- Parts of the supply ducts enclosed inside directly conditioned spaces do not need to be insulated



Requirements for Ducts and Plenums

§§120.4(b) - (e)

Ducts and plenum materials

- The energy code requires UL and/or ASTM material performance testing for the following:
 - Factory fabricated ducts
 - Field fabricated ducts
 - Tapes
 - Mastics and Mesh
 - Aerosol sealants
 - Draw bands
 - Insulation R-values
- Duct and plenum materials with pressure class rating: all ductwork and plenums construction to Seal A
 - Seal A not required for exposed ductwork in occupied space and exposed to view.



Requirements for Ducts and Plenums

§120.4(f)

Protection of Insulation

- Protection is must from sunlight, moisture, equipment maintenance, and wind
- If exposed to weather must be protected by aluminum, sheet metal, painted canvas, or plastic cover
- Cellular foam insulation must be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation



Requirements for Ducts and Plenums

§120.4(g)

Duct Sealing

Duct systems must comply with the following:

- Leakage rate $\leq 6\%$ of nominal air handler airflow rate for new ducts systems tested by HERS Rater and
 - Does not serve healthcare facility
 - Provides conditioned air to an occupiable space for constant volume, single zone and space conditioning system
 - Serves single zone $< 5,000$ square ft of conditioned floor area
 - Ducts outdoors or unconditioned space combined surface area $> 25\%$ of entire duct system
- OR, meet testing requirements CMC §603.9.2



Required Mechanical System Acceptance

§120.5(a) – (b)

Nonresidential Mechanical System Acceptance

- Acceptance testing is required for HVAC, indoor/outdoor lighting, site-built fenestration, and covered processes
- Applicable mechanical acceptance tests must be specified on the NRCC-MCH form at permit
- Certified mechanical acceptance test technician (CMATT) must report results of acceptance testing on respective NRCA-MCH form at final inspection
- Test procedures located in Reference Nonresidential Appendix NA7
- For a list of required Acceptance Tests, see [§120.5](#)
- Healthcare facilities are exempted from §120.5



Required Mechanical System Acceptance

§120.5(a) – (b)

Nonresidential Mechanical System Acceptance Test

Equipment/System	Nonresidential Appendix Reference
Outdoor air ventilation	NA7.5.1
Constant volume, single zone air conditioning and heat pump unit controls	NA7.5.2
Duct systems	NA7.5.3
Air economizers	NA7.5.4
Demand control ventilation	NA7.5.5
Supply fan variable flow control	NA7.5.6
Hydronic system variable flow controls	NA7.5.7 & NA7.5.9
Boiler or Chiller with isolation controls	NA7.5.7



Required Mechanical System Acceptance

§120.5(a) – (b)

Nonresidential Mechanical System Acceptance Test

Equipment/System	Nonresidential Appendix Reference
Hydronic systems with supply water temperature reset controls	NA7.5.8
Automatic demand shed controls	NA7.5.10
FDD for packaged DX units	NA7.5.11
Automatic FDD for air handling units	NA7.5.12
Distributed energy storage DX ac systems	NA7.5.13
Thermal Energy storage (TES)	NA7.5.14
Supply air temperature reset controls	NA7.5.15
Water-cooled chillers served by cooling towers with condenser water reset controls	NA7.5.16
Occupant sensing zone controls	NA7.5.17



Requirements for Commercial Boilers

§120.9

Definition per §100.1

- **Commercial Boiler:** A type of boiler with a capacity (rated maximum input) of 300,000 Btus per hour (Btu/h) or more and serving a space heating or water heating load in a commercial building.



Requirements for Commercial Boilers

§120.9(a)

Mandatory requirements

- Combustion air positive shut-off is required on all newly installed boilers as follows:
 - Boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is designed to operate with a nonpositive vent static pressure
 - Two or more boilers served by one stack with a total combined input of 2.5 MMBtu/h (2,500,000 Btu/h)



Requirements for Commercial Boilers

§120.9(b)

Mandatory requirements

- Combustion air fans with motors 10 horsepower or larger must have one of the following for newly installed boilers:
 - Variable speed drive motor; or
 - Controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume



Requirements for Commercial Boilers

§120.9(c)

Mandatory requirements

- Newly installed boilers with 5 MMBtu/h (5,000,000 Btu/h) input and greater must control stack-gas oxygen concentrations
 - Must be less than or equal to 5.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent
 - Combustion air volume must be controlled with respect to firing rate or flue gas oxygen concentration
 - Use of a common gas and combustion air control linkage or jack shaft is prohibited

EXCEPTION

- Boilers with steady state full-load combustion efficiency 90 percent or higher



Requirements for Fans

§120.10

Fans

- Fan Energy Index (FEI) of 1 or greater required for:
 - Each fan or fan array with a combined motor nameplate > 1.0 hp, or
 - Each fan or fan array with combined fan nameplate electrical input power > 0.89 kW
- Variable Air Volume shall have $FEI \geq 0.95$
- Fan arrays calculation accordance with ANSI/AMCA 208-18 Annex C
- All FEI values shall be provided by the manufacturer and third party verified
 - Embedded fans exempted from third party verification



Subchapter – 5

Nonresidential, Hotel/Motel Occupancies

Performance and Prescriptive §§ 140.1, 140.2, 140.4



Performance Approach: Energy Budgets

§§140.1(a),(b),(c)

Energy Budget

Energy budget = sum of TDV for HVAC, indoor lighting, water heating, and covered process

- Standard Design = Mandatory and prescriptive requirements
- Proposed Design = Calculated TDV for proposed design by CEC-certified compliance software
 - Required solar PV/battery can be offset by CEC-approved (§10-115) community shared solar and/or battery system providing dedicated benefits to permitted building
- Source energy, efficiency TDV, and total TDV must be met separately



Prescriptive Approach for Space Conditioning Systems

§140.4(a)1

Sizing, Equipment Selection, and Type

- **Sizing and equipment selection:** Heating and cooling equipment must 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

EXCEPTIONS:

- Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building TDV energy use
- Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating
- 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



Prescriptive Approach for Space Conditioning Systems

§140.4(a)2

Sizing, Equipment Selection, and Type

- **Single zone space-conditioning system type**
 - **Single-zone space, DX, conditioning systems 240,000 Btu/hr or less:** Heat pump baseline for certain spaces
 - **Retail, grocery**
 - Climate zones 2-15: heat pump
 - Climate zones 1, 16 cooling capacity less than 65,000 Btu/hr: air conditioner with furnace
 - Climate zones 1, 16 cooling capacity 65,000 Btu/hr or greater: dual-fuel heat pump
 - **Schools**
 - Climate zones 2-15: heat pump
 - Climate zones 1, 16: dual-fuel heat pump
 - **Office, financial institution, library**
 - Climate zones 1-15: heat pump
 - Climate zones 16 cooling capacity less than 65,000 Btu/hr: air conditioner with furnace
 - Climate zones 16 cooling capacity 65,000 Btu/hr or greater: dual-fuel heat pump
 - **Office spaces in warehouses**
 - All climate zones: heat pump



Prescriptive Approach for Space Conditioning Systems

§140.4(b)

Calculations

- Heating and cooling **design loads** must be determined in accordance with the ASHRAE Handbook, Fundamentals Volume, or as specified in a method approved by the Commission
- Other calculation methods such as ACCA, SMACNA, etc., are acceptable because they are based on ASHRAE
- **Indoor** design conditions must be determined in accordance with ASHRAE Standard 55 or ASHRAE Handbook, Fundamentals Volume
- **Outdoor** design conditions must be selected from Reference Joint Appendix JA2, which is based on climate data from ASHRAE
- Healthcare facility loads must be determined by the method and conditions described in the California Mechanical Code



Prescriptive Approach for Space Conditioning Systems

§140.4(b)

Calculations – cont.

- Load calculations should include the following:
 - Outdoor air ventilation
 - Envelope thermal conductance and air leakage
 - Solar heat gain
 - Shading such as overhangs
 - People loads based on occupant density
 - Process loads
 - Lighting loads
 - Any anticipated miscellaneous loads
- Internal heat gains can be ignored for heating calcs



Prescriptive Approach for Space Conditioning Systems

§140.4(b)

Calculations– cont.

- **Safety factor:** Design loads may be increased by up to 10 percent to account for unexpected loads or changes in space usage.
- **Other loads:**
 - Loads such as warm-up or cool-down should be based on the heat capacity of the building and contents, the degree of setback, and desired recovery time
 - They may be assumed to be up to 30 percent for heating and 10 percent for cooling on top of the 10 percent safety factor.

Total Safety Factor

Cooling: $1.1 \times 1.1 = 1.21$	21%
Heating: $1.1 \times 1.3 = 1.43$	43%



Prescriptive Approach for Space Conditioning Systems

§140.4(c)1

Fan Systems

- Fan Power budget
 - For each fan system that includes at least one fan or fan array with fan electrical input power ≥ 1 kW; fan system electrical input power (Fan $\text{kW}_{\text{design,system}}$ determined per 140.4(c)1B must not exceed Fan $\text{kW}_{\text{budget}}$ calculated per 140.4(c)1A



Prescriptive Approach for Space Conditioning Systems

§140.4(c)1A

Fan Systems

- Calculation of fan power budget (Fan kW_{budget})
 - Fan power allowance dependent on system type

Fan System Type	Fan System Power Allowance Tables
Single Cabinet	140.4-A and 140.4-B
Supply Only	140.4-A
Relief	140.4-B
Exhaust, Return, Transfer	140.4-B
Complex Supply, Return/Exhaust	Airflow- - Supply – 140.4-A - Return/Exhaust – 140.4 B

- To determine fan power allowance for the components of fan system, use [Equation 140.4-A](#)



Prescriptive Approach for Space Conditioning Systems

§140.4(c)1A

Equation 140.4-A Fan Power Allowance

$$FPA_{adj} = \frac{Q_{comp}}{Q_{sys}} \times FPA_{comp}$$

Where:

FPA_{adj} = The corrected fan power allowance for the component in w/cfm

Q_{comp} = The airflow through component in cfm

Q_{sys} = The fan system airflow in cfm

FPA_{comp} = The fan power allowance of the component from Table 140.4A or Table 140.4B



Prescriptive Approach for Space Conditioning Systems

§140.4(c)1A

Fan Systems

- Multiply the fan system airflow by the sum of the fan power allowances for the fan system.
- Divide by 1,000 to convert to Fan kW_{budget}
- Building at elevations > 3,000 ft, use correction factor in [Table 140.4-C](#)

Table 140.4-C: AIR DENSITY CORRECTION FACTORS

Altitude (ft)	Correction Factor
<3,000	1.000
≥3,000 and <4,000	0.896
≥4,000 and <5,000	0.864
≥5,000 and <6,000	0.832
≥6,000	0.801



Prescriptive Approach for Space Conditioning Systems

§140.4(c)1B

Fan Systems

- Determination of fan system electrical input power ($\text{Fan kW}_{\text{design,system}}$) and depends on:
 - Designed fan power for each fan or fan array in the system
 - Efficiency losses of variable speed drives
 - Clean filter and final filter pressure drop
- Designed fan power must be determined by using of the following:
 - Using Table [140.4-D](#)
 - Not for complex fan systems
 - Provided by manufacturer
 - Using maximum electrical input power on motor nameplate



Prescriptive Approach for Space Conditioning Systems

§140.4

Fan Systems

- Table 140.4-D: Default Values for Fan kW_{design} based on motor nameplate HP

Motor Nameplate HP	Default Fan kW _{design} with variable speed drive (Fan kW _{design})	Default Fan kW _{design} without variable speed drive(Fan kW _{design})
<1	0.96	0.89
≥1 and <1.5	1.38	1.29
≥1.5 and <2	1.84	1.72
≥2 and <3	2.73	2.57
≥3 and <5	4.38	4.17
≥5 and <7.5	6.43	6.15
≥7.5 and <10	8.46	8.13
≥10 and <15	12.47	12.03
≥15 and <20	16.55	16.04
≥20 and <25	20.58	19.92
≥25 and <30	24.59	23.77
≥30 and <40	32.74	31.70
≥40 and <50	40.71	39.46
≥50 and <60	48.50	47.10
≥60 and <75	60.45	58.87
≥75 and ≤100	80.40	78.17



Prescriptive Approach for Space Conditioning Systems

§140.4(c)2

Fan Systems

Variable air volume (VAV) systems

- Static pressure sensors location requirements for optimal operation
- Static pressure setpoint reset based on the zone requiring the most pressure for DDC systems



Prescriptive Approach for Space Conditioning Systems

§140.4(c)3

Fan Systems

Fractional HVAC motors for fans

- HVAC motors for fans that are < 1 hp and $\geq 1/12$ hp must be electronically commutated motors (ECM) or have a minimum motor efficiency of 70 percent
- These motors must also be capable of speed adjustment
- EXCEPTIONS:
 - Motors in fan-coils and terminal units that operate only when providing heating to the space served
 - Motors in space conditioning equipment certified under Section 110.1 or 110.2



Prescriptive Approach for Space Conditioning Systems

§140.4(d)

Space-conditioning zone controls

Each space-conditioning zone must have controls to prevent

- Reheating, recooling and mixed air supply, or
- For variable air volume (VAV) systems with and without DDC, there are some allowances for how much volume of primary air that can be reheated, re-cooled, or mixed air supply.

EXCEPTIONS:

- Zones with special pressurization relationships or cross-contamination control needs
- Zones with systems in which at least 75 percent of the energy for reheating, or warm air in mixing systems, is from a site-recovered or site solar energy source
- Zones where specific humidity levels are required
- Zones with a peak supply-air quantity of 300 cfm or less
- Healthcare facilities



Prescriptive Approach for Space Conditioning Systems

§140.4(e)1

Economizers

Cooling air handlers over 33,000 Btu/hr or chilled water systems without a fan and with capacities listed in [Table 140.4-E](#) must have either:

- A modulating air economizer capable of supplying 100 percent of the design supply cooling air as outside-air; or
- A water economizer providing 100 percent of the cooling load at outside air temperatures of 50°F dry-bulb and 45°F wet-bulb and below



Prescriptive Approach for Space Conditioning Systems

§140.4(e)

Economizers

- [Table 140.4-E](#): Chilled water system cooling capacity

TABLE 140.4-E CHILLED WATER SYSTEM COOLING CAPACITY

Climate Zones	Total Building Chilled Water System Capacity, Minus Capacity of the Cooling units with Air Economizers	
	Building Water-Cooled Chilled Water System	Air-Cooled Chilled Water Systems or District Chilled Water Systems
15	≥ 960,000 Btu/h (280 kW)	≥ 1,250,000 Btu/h (365 kW)
1-14	≥ 720,000 Btu/h (210 kW)	≥ 940,000 Btu/h (275 kW)
16	≥ 1,320,000 Btu/h (385 kW)	≥ 1,720,000 Bu/h (505 kW)



Prescriptive Approach for Space Conditioning Systems

§140.4(e)1

Economizers

Exemptions:

- Systems serving hotel/motel guestrooms
- Fans systems primarily serving computer rooms
- Air handler with design total mechanical capacity less than 54,000 Btu/hr and ventilation provided by DOAS with exhaust air heat recovery per section 140.4(p) and
 - DOAS unit meet exhaust air heat recovery ratio per section 140.4(q)1 and includes bypass or control per 140.4(q)2
 - DOAS unit provide at least the minimum ventilation air flow rate per section 120.1(c)3 and no less 0.3 cfm/ft² during economizer conditions
- Where the use of air economizer in controlled horticulture spaces will affect CO₂ enrichment systems



Prescriptive Approach for Space Conditioning Systems

§§140.4(e)2A-C

Economizers

If an air economizer is installed to meet the prescriptive requirement, it must have controls that:

- Prevent an increase in the building heating energy use during normal operation
 - EXCEPTION: Systems that provide 75 percent of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source may increase building energy use.
- Must provide partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load
- Air economizers must be a type listed in [TABLE 140.4-G](#) with high limit shut off shown



Prescriptive Approach for Space Conditioning Systems

§140.4(e)

TABLE 140.4-G

TABLE 140.4-G 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	$T_{DA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
	2, 4, 10	$T_{DA} > 73^{\circ}\text{F}$	Outdoor air temperature exceeds 73°F
	6, 8, 9	$T_{DA} > 71^{\circ}\text{F}$	Outdoor air temperature exceeds 71°F
	7	$T_{DA} > 69^{\circ}\text{F}$	Outdoor air temperature exceeds 69°F
Differential Dry Bulb	1, 3, 5, 11-16	$T_{DA} > T_{RA}^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature
	2, 4, 10	$T_{DA} > T_{RA}-2^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 2°F
	6, 8, 9	$T_{DA} > T_{RA}-4^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 4°F
	7	$T_{DA} > T_{RA}-6^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 6°F
Fixed Enthalpy ^c + Fixed Drybulb	All	$h_{DA} > 28 \text{ Btu/lb}^{\circ}$ or $T_{DA} > 75^{\circ}\text{F}$	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.



Prescriptive Approach for Space Conditioning Systems

§140.4(e)2D

Economizers

Air economizer and all air dampers requirements:

- **Warranty:** 5-year Manufacturer warranty of economizer assembly
- **Damper reliability testing:** Suppliers must certify that dampers and actuators operate at rated system airflow and pressure for 60,000 cycles
- **Damper leakage:** Outdoor and return dampers must be tested to leak ≤ 10 cfm/sf at 250 Pascals (1.0 in. of water) when tested per AMCA Standard 500-D, and leakage rates **certified to the Commission** per Section 110.0
- **Adjustable setpoint:** If the high-limit control is fixed dry-bulb or fixed enthalpy + fixed dry-bulb then the control must have an adjustable setpoint
- **Relief air system.** Relief air systems must allow 100 percent outside air without over-pressurizing the building
- **Sensors must be calibrated**



Prescriptive Approach for Space Conditioning Systems

§140.4(e)2E

Economizers

Space-conditioning systems requirements:

- **Capacity controls** interlocked with economizer allowing 100 percent open and does not start closing until the leaving air is less than 45°F
- Direct Expansion (**DX**) units > 65,000 Btu/hr controlling cooling **based on the occupied space temperature** must have a **minimum of 2 stages** of mechanical cooling
- All other DX units must comply with the following:
 - 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
 - Comply with the requirements in TABLE 140.4-H



Prescriptive Approach for Space Conditioning Systems

§140.4(e)3

Economizers

Water Economizers requirements:

- Precooling coils and water-to-water heat exchangers must have a waterside pressure drop of < 15 feet of water; or secondary loop that prevents the coil or heat exchanger from contributing to pressure drop when the system is in non-economizer cooling mode.
- Must be integrated to allow partial cooling



Prescriptive Approach for Space Conditioning Systems

§140.4(f)

Supply air temperature (SAT) reset controls

- Space-conditioning systems supplying multiple zones must include controls that automatically reset supply-air temperatures
- SAT must be reset by the following:
 - In response to representative building loads or to outdoor air temperature.
 - At least 25 percent of the difference between the design supply-air temperature and the design room air temperature
- EXCEPTIONS:
 - There are some exceptions for certain zonal controls and process humidification requirements
 - Healthcare facilities



Prescriptive Approach for Space Conditioning Systems

§140.4(g)

Electric resistance heating

- Electric resistance heating systems cannot be used for space heating
- EXCEPTIONS:
 - There are exceptions related to solar power, heat pumps, percentage of total building design output, maximum wattage, and building features.



Prescriptive Approach for Space Conditioning Systems

§140.4(h)1

Heat rejection systems

Cooling system heat rejection equipment such as condensers, and cooling towers

Fan Control:

- Fan motor 7.5 hp (5.6 kW) or larger must be able to operate at 2/3 of full speed or less
- Fans must be able to change speed in order to control condenser temperature or pressure

EXCEPTIONS:

- Heat rejection devices included as an integral part of the equipment listed in Table 110.2-A through 110.2-N
- Condenser fans serving multiple refrigerant circuits
- Condenser fans serving flooded condensers.
- 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.



Prescriptive Approach for Space Conditioning Systems

§140.4(h)2

Tower flow turndown

- Open cooling towers with multiple condenser water pumps must be designed so that all cells can be run in parallel with the larger of:
 - The flow that is produced by the smallest pump; or
 - 50 percent of the design flow for the cell



Prescriptive Approach for Space Conditioning Systems

§140.4(h)3

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 wetbulb temperature, must use propeller fans and cannot use centrifugal fans
- EXCEPTIONS:
 - Cooling towers that are ducted (inlet or discharge) or have an external sound trap that requires external static pressure capability
 - Cooling towers that meet the energy efficiency requirement for propeller fan towers in Section 110.2, Table 110.2-F



Prescriptive Approach for Space Conditioning Systems

§140.4(h)4

Multiple cell heat rejection equipment

- Multiple cell heat rejection equipment with variable speed fan drives must:
 - Operate the maximum number of fans allowed by the manufacturer
 - Control all operating fans to the same speed
 - Minimum fan speed is based on the manufacture's specifications
 - Staging of fans is allowed once the fans are at their minimum operating speed



Prescriptive Approach for Space Conditioning Systems

§140.4(h)5

Cooling tower efficiency

- Axial fan, open-circuit cooling towers with capacity of 900 gpm or greater, must have an efficiency ≥ 60 gpm/hp
- EXCEPTIONS:
 - Replacement of existing cooling towers inside an existing building or on an existing roof
 - Cooling towers serving buildings in Climate Zone 1 or 16



Prescriptive Approach for Space Conditioning Systems

§§140.4(i),(j)

Minimum chiller efficiency

- Chillers must meet or exceed Path B from [Table 110.2-D](#)
- EXCEPTIONS:
 - There are exceptions related to electrical service size, chillers with heat recovery systems, thermal energy storage and the number of chillers.

Limitation of air-cooled chillers

- Chilled water plants cannot have more than 300 tons of capacity provided by air-cooled chillers.
- EXCEPTIONS:
 - There are exceptions related to poor water quality and thermal energy storage.
 - Healthcare facilities



Prescriptive Approach for Space Conditioning Systems

§140.4(k)1

Hydronic system measures

Hydronic variable flow systems

- HVAC chilled and hot water must have variable fluid flow and be capable of reducing pump flow rates to no more than the larger of:
 - 50 percent or less of the design flow rate; or
 - The minimum flow required by the equipment manufacturer.
- **EXCEPTIONS:**
 - Systems that include no more than three control valves or have total pump power less than 1.5 hp.



Prescriptive Approach for Space Conditioning Systems

§§140.4(k)2,3

Hydronic system measures

Chiller isolation

- System with parallel chillers must have provisions to automatically shut off flow to chillers not in use while still maintaining flow through operating chiller(s).

Boiler isolation

- Hot water plants with more than one boiler must automatically shut off flow through boilers not in use while maintaining flow through other operating boiler(s).



Prescriptive Approach for Space Conditioning Systems

§§140.4(k)4,5

Hydronic system measures

Chilled and hot water temperature reset controls

- Systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water must have controls that automatically reset supply water temperatures as a function of building loads or outside air temperature

Water-cooled air conditioner and hydronic heat pump systems

- Systems with total pump system power exceeding 5 hp must have variable flow controls
- Air conditioners and heat pumps must automatically shut off water flow when the compressor is off

Exceptions may apply



Prescriptive Approach for Space Conditioning Systems

§140.4(k)6

Hydronic system measures

Variable flow controls

- Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp must have controls or devices resulting in demand of no more than 30% power at 50% flow.
- Pressure Sensor Location and Setpoint depends on DDC to the coil or not.
- **EXCEPTIONS:**
 - Heating hot water systems
 - Condenser water systems serving only water-chilled chillers



Prescriptive Approach for Space Conditioning Systems

§140.4(k)7

Hydronic system measures

Hydronic heat pump (WLHP) controls

- WLHPs with central heat rejection and heat addition must allow for a water supply temperature dead band of at least 20°F between initiation of heat rejection and heat addition
- EXCEPTIONS:
 - Systems with a temperature optimization controller.



Prescriptive Approach for Space Conditioning Systems

§140.4(k)8

Hydronic system measures

High capacity space heating gas boiler systems

Gas hot water boiler system for space heating in CZ 1-6, 9-14 and 16 with total system input range from 1 – 10 MMBtu/h must have:

- Minimum thermal efficiency of 90%
- Water temp entering boiler not more than 120°F or flow rate of supply hot water not more than 20% of design flow

EXCEPTIONS:

- When 25% of the annual space heating provided by on-site renewable, site-recovered energy or heat recovery chillers
- Space heating boilers in individual dwelling units
- When 50% or more of design heating load uses perimeter convective heating, radiant ceiling panels or both
- Individual gas boilers with input capacity less than 300,000 btu/h



Prescriptive Approach for Space Conditioning Systems

§140.4(m)

Fan control

- Each cooling system listed in [TABLE 140.4-I](#) must vary the indoor fan airflow as a function of load
- These systems must have least 2 speed fan control

TABLE 140.4-I 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



Prescriptive Approach for Space Conditioning Systems

§140.4(n)

Mechanical system shut-off

- Any directly conditioned space with operable openings to outdoors must have interlock controls
- When open for more than 5 minutes:
 - Disable or reset the setpoint to 55°F for mechanical heating, and
 - Disable or reset the setpoint to 90°F for mechanical cooling

EXCEPTIONS:

- They are not required on openings with automatic closing devices or in spaces without thermostatic control.
- Healthcare facilities.



Prescriptive Approach for Space Conditioning Systems

§140.4(o)

Exhaust system transfer air

- Conditioned supply air delivered to a space with mechanical exhaust cannot exceed the greater of:
 - The supply flow required to meet the space heating or cooling load; or
 - The required ventilation rate; or
 - The mechanical exhaust flow minus the available transfer air



Prescriptive Approach for Space Conditioning Systems

§140.4(p)

Dedicate outdoor air systems (DOAS)

- DOAS unit fan system power less than 1kW not exceed total combined fan power 1.0 W/cfm.
- DOAS fan power greater than 1kW meets follow requirements in section 140.4(c).
- DOAS supply air delivered directly to occupied space or at outlet of any terminal heating or cooling coils and equipment fans cycle off when there is no call for heat or cooling.
 - Active chilled beam systems exempted.
- Supply and exhaust fans have minimum 3 speeds.
- System must not use heat recovery or heating to warm the supply air above 60°F when majority of zones require cooling.



Prescriptive Approach for Space Conditioning Systems

§140.4(q)

Exhaust air heat recovery

Fan systems designed to criteria in either Table 140.4-J or Table 140.4-K must include exhaust air heat recovery system and must have the following requirements.

- Sensible energy ratio no less than 60% or enthalpy recovery ratio no less than 50%.
- Energy recovery bypass or control

EXCEPTIONS:

- Please refer to section 140.4(q) for exceptions



Prescriptive Approach for Space Conditioning Systems

§140.4

Table 140.4-K: Energy Recovery Requirements By Climate Zone And Percent Outdoor Air at Full Design Airflow ($\geq 8,000$ Hours / Year)

% Outdoor Air at Full Design Airflow	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
$\geq 10\%$ and $< 20\%$	$\geq 10,000$	$\geq 10,000$	NR	NR	NR	NR	NR	NR	NR	$\geq 40,000$	$\geq 40,000$	$\geq 20,000$	$\geq 10,000$	$\geq 10,000$	$\geq 10,000$	$\geq 10,000$
$\geq 20\%$ and $< 30\%$	$\geq 2,000$	$\geq 5,000$	$\geq 13,000$	$\geq 9,000$	$\geq 9,000$	NR	NR	NR	NR	$\geq 15,000$	$\geq 15,000$	$\geq 5,000$	$\geq 5,000$	$\geq 5,000$	$\geq 5,000$	$\geq 5,000$
$\geq 30\%$ and $< 40\%$	$\geq 2,000$	$\geq 3,000$	$\geq 10,000$	$\geq 6,500$	$\geq 6,500$	NR	NR	NR	$\geq 15,000$	$\geq 7,500$	$\geq 7,500$	$\geq 3,000$	$\geq 3,000$	$\geq 3,000$	$\geq 3,000$	$\geq 3,000$
$\geq 40\%$ and $< 50\%$	$\geq 2,000$	$\geq 2,000$	$\geq 8,000$	$\geq 6,000$	$\geq 6,000$	NR	NR	NR	$\geq 12,000$	$\geq 6,000$	$\geq 6,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$
$\geq 50\%$ and $< 60\%$	$\geq 2,000$	$\geq 2,000$	$\geq 7,000$	$\geq 6,000$	$\geq 6,000$	NR	NR	$\geq 20,000$	$\geq 10,000$	$\geq 5,000$	$\geq 5,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$
$\geq 60\%$ and $< 70\%$	$\geq 2,000$	$\geq 2,000$	$\geq 6,000$	$\geq 6,000$	$\geq 6,000$	NR	NR	$\geq 18,000$	$\geq 9,000$	$\geq 4,000$	$\geq 4,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$
$\geq 70\%$ and $< 80\%$	$\geq 2,000$	$\geq 2,000$	$\geq 6,000$	$\geq 5,000$	$\geq 5,000$	NR	NR	$\geq 15,000$	$\geq 8,000$	$\geq 3,000$	$\geq 3,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$
$\geq 80\%$	$\geq 2,000$	$\geq 2,000$	$\geq 6,000$	$\geq 5,000$	$\geq 5,000$	NR	NR	$\geq 12,000$	$\geq 7,000$	$\geq 3,000$	$\geq 3,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$	$\geq 2,000$



Subchapter – 6

Nonresidential, Hotel/Motel Occupancies

Additions, Alterations, and Repairs §§ 141.0, 141.1



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(a)

Additions

- **Definition:** Addition is any change to a building that increases conditioned floor area and conditioned volume. Addition is also any change that increases the floor area and volume of an unconditioned building of an occupancy group or type regulated by Part 6. Addition is also any change that increases the illuminated area of an outdoor lighting application regulated by Part 6.
- **Prescriptive Approach:** Newly installed space-conditioning systems installed in an addition must meet the applicable prescriptive requirements of §140.4 and all applicable mandatory requirements as discussed in previous sections.
- **Performance Approach:** All applicable mandatory measures must be achieved or exceeded; Either the addition alone can comply or the existing plus addition or the existing plus addition plus alteration approach can be taken.



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(a)

Exceptions

- When expanding existing systems, existing systems and equipment need not comply with current requirements except for duct sealing.
- Duct Sealing. When ducts are extended from an existing duct system, the existing and extended ducts must have $\leq 15\%$ leakage or pass a smoke test.
- There are exceptions allowing expansion of existing systems with electric heat when adding VAV boxes to the addition. See Exception 2 to Section 141.0(a).
- Section 140.4(a)2 shall not apply to new space conditioning systems or components.



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(b)1D

Alterations

Mandatory Requirements

- Per section 141.0(b)1D new fan systems serving an existing building must meet requirements per [section 120.10](#).



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(b)2C

Alterations - Prescriptive Requirements

New or replacement space-conditioning systems or components

- New Systems or Components except ducts must meet the requirements of section §140.4 applicable to the systems or components being altered
- Additional fan power allowances available per Table 141.0-D

EXCEPTIONS:

- Section 140.4(a)2 does not apply to new or replacement space conditioning systems or components
- Replacements of electric resistance heaters with equivalent or smaller heaters for high rise residential units or when natural gas is not available.
- Mechanical System Shutoff Devices in §140.4(n) (interlock devices) are not required for new or replacement space conditioning systems.
- Systems other than single package air-cooled unitary AC and heat pumps with cooling capacity < 54,000 Btu/h are exempt from requirements of section 140.4(e)
- New or replaced gas hot water boiler system with total system input between 1 – 10 MMBtu/h exempted from 140.4(k)8



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(b)

Table 141.0-D

TABLE 141.0-D: ADDITIONAL FAN POWER ALLOWANCES

Airflow	Multi-Zone VAV Systems ¹ ≤5,000 cfm	Multi-Zone VAV Systems ¹ >5,000 and ≤10,000 cfm	Multi-Zone VAV Systems ¹ >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 Fan System Additional Allowance	0.135	0.114	0.105	0.139	0.12	0.107
Supply Fan System Additional Allowance In Unit with Adapter Curb	0.033	0.033	0.043	0.000	0.000	0.000
Exhaust/ Relief/ Return/ Transfer Fan System Additional Allowance	0.07	0.061	0.054	0.07	0.062	0.055
Exhaust/ Relief/ Return/ Transfer Fan System Additional Allowance In Unit with Adapter Curb	0.016	0.017	0.022	0.000	0.000	0.000



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(b)2D

Alterations - Prescriptive Requirements

Altered Duct Systems requirements

- Entirely new or complete replacement duct system with at least 75% new duct material
 - Up to 25% may be reused parts from existing system
 - Leak tested per section 120.4(g)

OR

- Extended ducts to existing duct system must be sealed and a leakage rate not more than 15% of nominal air handler airflow tested per NA7.5.3. The combined new system also meets the criteria:
 - Does not serve Healthcare facility
 - Provides conditioned air to occupiable space for constant volume, single zone, space-conditioning system
 - Serves less than 5,000 sq ft of conditioned floor area
 - Combined surface area of ducts in following areas is not less than 25% of the total surface area of entire duct system.

OR

- If new ducts are installed as part of alteration are exempt from leakage testing according to section 141.0(b)2Di or 141.0(b)2Dii, it must meet duct leakage testing requirements per CMC section 603.9.2



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(b)2E

Alterations - Prescriptive Requirements

Altered Space-Conditioning Systems

- When replacing the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:
 - An Occupant Controlled Smart Thermostat (OCST) that complies with Reference Joint Appendix JA5 must be installed; and
 - The connected duct system to new or replaced space-conditioning system shall be sealed per 141.0(b)2Dii.

EXCEPTIONS:

- Buildings altered so that the duct system no longer meets the criteria of Section 141.0(b)2Dii.
- Ducts documented to have been previously tested by a HERS Rater.
- Existing duct systems constructed, insulated or sealed with asbestos.



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(b)3

Alterations - Performance Approach

- All applicable mandatory measures for the new equipment must be met.
- For altered components, the standard design is based on either the existing conditions or the prescriptive requirements, whichever has higher efficiency.
- For components not being altered, the standard design is based on the existing conditions.
- The proposed design must be based on the actual values of the altered components.



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(b)3

Alterations - Performance Approach

EXCEPTIONS

- When HVAC for an alteration are provided by expanding existing systems, the existing systems and equipment need not comply with the current requirements.
- When existing systems or components are moved in a building, the existing systems or components need not comply with the current requirements.
- There are exceptions allowing expansion of existing systems with electric heat when adding VAV boxes to the addition. See Exception 3 to §141.0(b).
- Economizer fault detection diagnostics (FDD) per §120.2(i) is not required for alterations.



Additions, Alterations, and Repairs for Space Conditioning Systems

§141.0(c)

Repairs

- A repair is the reconstruction or renewal for the purpose of maintenance of a component, system, or equipment of an existing building.
- Replacement of any component, system, or equipment for which there are requirements in the Standards is considered an alteration and not a repair.
- Repairs do not have requirements under Part 6 except they shall not increase the preexisting energy consumption of the repaired component, system, or equipment.



Nonresidential, Hotel/Motel Occupancies

Enforcement: Compliance Forms



Enforcement – Prescriptive Compliance

Permit and Plans Review

- NRCC-MCH-E Certificate of Compliance:
 - Verify Table A. **GENERAL INFORMATION** is correct



CALIFORNIA ENERGY COMMISSION

MECHANICAL SYSTEMS

CEC-NRCC-MCH-E

CERTIFICATE OF COMPLIANCE

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. GENERAL INFORMATION

01	Project Location (city)		04	Total Conditioned Floor Area		
02	Climate Zone		05	Total Unconditioned Floor Area		
03	Occupancy Types Within Project:		06	# of Stories (Habitable Above Grade)		
	• Office	• Retail	• Warehouse	• Hotel/Motel	• School	• Support Areas
	• High-Rise Residential	• Commercial	• Healthcare Facility	• Parking Garage	• Theater	• Sports Arena
	• Auditorium	• Library	• Relocatable School Building	• Medical Clinic	• Data Center	• Convention Center
	• Classroom	• Gymnasium	• Grocery Store	• Religious Facility	• Financial Institution	• All Others
	• Restaurant/Commercial Kitchen					



Enforcement – Prescriptive Compliance

Permit and Plans Review

- NRCC-MCH-E Certificate of Compliance:
 - Verify Table **B. PROJECT SCOPE** on form matches scope of work on plans



CALIFORNIA ENERGY COMMISSION

MECHANICAL SYSTEMS

CEC-NRCC-MCH-E

B. PROJECT SCOPE

This table includes mechanical systems or components that are within the scope of the permit application and are demonstrating compliance using the prescriptive path outlined in §140.4, 170.2(b) or §141.0(b)2 and 180.2(b)2 for alterations.

My project consists of (check all that apply)					
01		02		03	
Air System(s)		Wet System Components		Dry System Components	
<input type="checkbox"/>	Heating Air System	<input type="checkbox"/>	Water Economizer	<input type="checkbox"/>	Air Economizer
<input type="checkbox"/>	Cooling Air System	<input type="checkbox"/>	Pumps	<input type="checkbox"/>	Electric Resistance Heat
Mechanical Controls		<input type="checkbox"/>	System Piping	<input type="checkbox"/>	Fan Systems
		<input type="checkbox"/>	Cooling Towers	<input type="checkbox"/>	Ductwork (existing to remain, altered or new)
<input type="checkbox"/>	Mechanical Controls (existing to remain, altered or new)	<input type="checkbox"/>	Chillers	<input type="checkbox"/>	Ventilation
		<input type="checkbox"/>	Boilers	<input type="checkbox"/>	Zonal Systems/ Terminal Boxes



Enforcement – Prescriptive Compliance

Permit and Plans Review

- **NRCC-MCH-E** Certificate of Compliance:
 - Verify Table **C. COMPLIANCE RESULTS** shows **COMPLIES** when forms filled using **VCA**.

MECHANICAL SYSTEMS

CALIFORNIA ENERGY COMMISSION CEC-NRCC-MCH-E

C. COMPLIANCE RESULTS

Table C will indicate if the project data input into the compliance document is compliant with mechanical requirements. This table is not editable by the user. If this table says "DOES NOT COMPLY" or "COMPLIES with Exceptional Conditions" refer to Table D., or the table indicated as not compliance for guidance.

01	AND	02	AND	03	AND	04	AND	05	AND	06	AND	07	AND	08	09
System Summary §110.1, §110.2, §140.4, §170.2(c)		Pumps §140.4(k), §170.2(c)4I		Fans/ Economizers §140.4(c), §140.4€, §170.2(c)		System Controls §110.2, §120.2, §140.4(f), §170.2(c)		Ventilation §120.1, §160.2		Terminal Box Controls §140.4(d), §170.2(c)4B		Distributio n §120.3, §120.4, §160.2, §160.3		Cooling Towers §110.2(e)2	Compliance Results
(See Table F)		(See Table G)		(See Table H)		(See Table I)		(See Table J)		(See Table K)		(See Table L)		(See Table M)	
Yes/No	AND	Yes/No	AND	Yes/No	AND	Yes/No	AND	Yes/No	AND	Yes/No	AND	Yes/No	AND	Yes/No	COMPLIES or "COMPLIES WITH EXCEPTIONAL CONDITIONS" or DOES NOT COMPLY
Mandatory Measures Compliance (See Table Q for Details)															COMPLIES or DOES NOT COMPLY



Enforcement – Prescriptive Compliance

Permit and Plans Review

- **NRCC-MCH-E** Certificate of Compliance:
 - Table **D. EXCEPTIONAL CONDITIONS** and Table **E. ADDITIONAL REMARKS** are information tables to assist the AHJ at permit and plan check

D. EXCEPTIONAL CONDITIONS

This table is auto-filled with uneditable comments because of selections made or data entered in tables throughout the form.

--

E. ADDITIONAL REMARKS

This table includes remarks made by the installer to the Authority Having Jurisdiction.

--



Enforcement – Prescriptive Compliance

Permit and Plans Review

- **NRCC-MCH-E** Certificate of Compliance:
 - Verify mechanical plans match the equipment Tables F- M

F. HVAC SYSTEM SUMMARY (DRY & WET SYSTEMS)

This table is used to demonstrate compliance for mechanical equipment with mandatory requirements found in §110.1 and §110.2(a) and prescriptive requirements found in §140.4 (a), §140.4(b), §170.2(c)1, §170.2(c)3, §140.4(k) or §141.0(b)2 and §180.2(b)2 for alterations.

Space Conditioning System Information

01	02	03	04	05	06
Name or Item Tag	Quantity	System Serving	System Status	Space Type	Utilizing Recovered Heat
					<input type="checkbox"/>

Dry System Equipment Sizing (includes air conditioners, condensers, heat pumps, VRF, furnaces, unit heaters and DOAS systems)

01	02	03	04	05	06	07	08	09	10	11		
Name or Item Tag	Equipment Category per Tables 110.2, §140.4(a)2 and 170.2(c)3a	Equipment Type per Tables 110.2 & Title 20	Smallest Size Available ¹ §140.4(a) & 170.2(c)3a	Equipment Sizing per Mechanical Schedule (kBtu/h) §140.4 (a&b), §170.2(c)1 & §170.2(c)2								
				Heating Output ^{2,3}		Cooling Output ^{2,3}			Load Calculations ^{3,4}			
				Per Design (kBtu/h)	Rated (kBtu/h)	Supp. Heating Output (kBtu/h)	Sensible Per Design (kBtu/h)	Rated (kBtu/h)	Total Heating Load (kBtu/h)	Total Sensible Cooling Load (kBtu/h)		

¹ FOOTNOTES: 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 per §140.4(a) and §170.2(c)1. Healthcare facilities are exempted.

² It is common practice to show rated output capacity on the equipment schedule. Sensible cooling output comes from specification sheet tables.

³ If equipment is heating only, leave cooling output and load blank. If equipment is cooling only, leave heating output and load blank.

⁴ Authority Having Jurisdiction may ask for load calculations used for compliance per §140.4(b) and §170.2(c)2.



Enforcement – Prescriptive Compliance

Field Inspection

- **NRCI-MCH-E** Certificate of Installation:
 - Verify NRCI table **A. GENERAL INFORMATION** matches plans and NRCC-MCH-E information



CALIFORNIA ENERGY COMMISSION

MECHANICAL SYSTEMS

CEC-NRCI-MCH-E

CERTIFICATE OF INSTALLATION

This Certificate of Installation documents the installation of mechanical features, materials, components, and manufactured devices required to demonstrate compliance with Title 24, Part 6 per §10-103(a)3 for nonresidential, hotel/motel and high-rise residential occupancies.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. GENERAL INFORMATION

01	Project Location (city):	02	Zip Code:
03	Date of Permit Set used for construction:	04	Name of Permit Set used for construction:
05	Authority Having Jurisdiction:	06	Building Permit #:
07	Date of As-built Set:	08	Name of As-built Set:



Enforcement – Prescriptive Compliance

Field Inspection

- **NRCI-MCH-E** Certificate of Installation:
 - Verify information provided in **Table B. INSTALLER SCOPE** and if the installed features match exactly with NRCC-MCH

B. INSTALLER SCOPE

This table indicates construction systems and materials documented on this Certificate of Installation

01							
<input type="checkbox"/>	Dry System (Airside) Equipment	<input type="checkbox"/>	Ventilation	<input type="checkbox"/>	System Controls	<input type="checkbox"/>	Ductwork
<input type="checkbox"/>	Boiler	<input type="checkbox"/>	Pumps	<input type="checkbox"/>	Terminal Box Controls	<input type="checkbox"/>	Piping
<input type="checkbox"/>	Chiller	<input type="checkbox"/>	Fans and Air Economizers	<input type="checkbox"/>	Heat Rejection Equipment (cooling towers, condensers, waterside economizers)	<input type="checkbox"/>	Electric Resistance Heating

C. COMPLIANCE RESULTS

This table indicates whether the as-built conditions documented in this form are equal or better than what was documented on the permitted Certificate of Compliance. If the installation is not equal or better, Section 10-103(a)2B requires the Certificate of Compliance to be revised accordingly to demonstrate compliance.

01	INSTALLED FEATURES EXACTLY MATCH DESIGN ON PERMITTED CERTIFICATE OF COMPLIANCE
----	--

Documented as-built conditions should be verified by inspector from Authority Having Jurisdiction to comply.

The Certificate of Compliance should be revised to confirm as-built conditions comply and this Certificate of Installation updated accordingly.



Enforcement – Prescriptive Compliance

Field Inspection

- NRCI-MCH-E Certificate of Installation:
 - Verify installation details match with Table B and the as-built conditions documented by the installer/document author.

F. INSTALLATION DETAILS

The following tables indicate performance requirements as documented on the permitted Certificate of Compliance for all systems and components included in Table B. Installer Scope. Also indicated are the as-built conditions documented by the installer/ documentation author.



Enforcement – Prescriptive Compliance

Field Inspection

- **NRCC-MCH-E** Certificate of Compliance:
 - Check pass or fail in **Table N Declaration of Required Certificates of Installation** to verify NRCI-MCH-01 completion. Use of this table is optional.



CALIFORNIA ENERGY COMMISSION

MECHANICAL SYSTEMS

CEC-NRCC-MCH-E

N. DECLARATION OF REQUIRED CERTIFICATES OF INSTALLATION

Selections have been made based on information provided in previous tables of this document. If any selection needs to be changed, please explain why in Table E. Additional Remarks. These documents must be provided to the building inspector during construction and can be found online at https://www.energy.ca.gov/title24/2022standards/2022_compliance_documents/Nonresidential_Documents/NRCI/

YES	NO	Form/Title	Field Inspector	
			Pass	Fail
<input checked="" type="radio"/>	<input type="radio"/>	NRCI-MCH-01-E - Must be submitted for all buildings.	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="radio"/>	<input type="radio"/>	2022 NRCI-MCH-20-F Duct Leakage Diagnostic Test	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="radio"/>	<input type="radio"/>	2022 NRCI-MCH-22-F Fan Efficacy	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="radio"/>	<input type="radio"/>	2022-NRCI-MCH-23-F Airflow Rate	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="radio"/>	<input type="radio"/>	2022-NRCI-MCH-25-F Refrigerant Charge Verification	<input type="checkbox"/>	<input type="checkbox"/>



Enforcement – Prescriptive Compliance

Field Inspection

- **NRCC-MCH-E** Certificate of Compliance:
 - Review Table O and Table P to verify all acceptance and verification testing is complete. There should be an NRCA and NRCV form for each required test.

O. DECLARATION OF REQUIRED CERTIFICATES OF ACCEPTANCE

Selections have been made based on information provided in previous tables of this document. If any selection needs to be changed, please explain why in Table E. Additional Remarks. These documents must be provided to the building inspector during construction and any with "-A" in the form name must be completed through an Acceptance Test Technician Certification Provider (ATTCP). For more information visit: <http://www.energy.ca.gov/title24/attcp/providers.html>

YES	NO	Form/Title	Systems To Be Field Verified	Field Inspector	
				Pass	Fail
<input checked="" type="radio"/>	<input type="radio"/>	NRCA-MCH-02-A Outdoor Air must be submitted for all newly installed HVAC units. <i>Note: MCH-02-A can be performed in conjunction with MCH-07-A Supply Fan VFD Acceptance (if applicable) since testing activities overlap.</i>		<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="radio"/>	<input type="radio"/>	NRCA-MCH-03-A Constant Volume Single Zone HVAC <i>NOTE: This form does not automatically move to "Yes". If Constant Volume Single Zone HVAC Systems are included in the scope, permit applicant should move this form to "Yes".</i>		<input type="checkbox"/>	<input type="checkbox"/>

P. DECLARATION OF REQUIRED CERTIFICATES OF VERIFICATION

Selections have been made based on information provided in this document. If any selections have been changed by the permit applicant, an explanation should be included in Table E. Additional Remarks. These documents must be completed by a HERS Rater and provided to the building inspector during construction. The final documents must be created by a HERS Providers registry, but drafts can be found online at https://www.energy.ca.gov/title24/2022standards/2022_compliance_documents/Nonresidential_Documents/NRCV/

YES	NO	Form/Title	Systems To Be Field Verified	Field Inspector	
				Pass	Fail
<input checked="" type="radio"/>	<input type="radio"/>	NRCV-MCH-04-H Duct Leakage Test <i>NOTE: Must be completed by a HERS Rater</i>		<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="radio"/>	<input type="radio"/>	NRCV-MCH-24 Enclosure Air Leakage Worksheet <i>NOTE: Must be completed by a HERS Rater</i>		<input type="checkbox"/>	<input type="checkbox"/>



Enforcement – Prescriptive Compliance

NRCI-MCH-E Certificates of Installation:

- NRCI-MCH-20 Duct Leakage Diagnostic Test
- NRCI-MCH-22 Space Conditioning System Fan Efficacy
- NRCI-MCH-23 Space Conditioning System Airflow Rate
- NRCI-MCH-25 Refrigerant Charge Verification



Enforcement – Prescriptive Compliance

NRCA-MCH-E Certificates of Acceptance:

- NRCA-MCH-02-A Outdoor Air
- NRCA-MCH-03-A HVAC and Heat Pumps – Cont Volume Single Zone HVAC
- NRCA-MCH-04-A Duct Leakage
- NRCA-MCH-05-A Economizer DOAS HRV ERV
- NRCA-MCH-06-A Demand Control Ventilation
- NRCA-MCH-07-A Supply Fan Variable Flow Controls
- NRCA-MCH-08-A Valve Leakage Test
- NRCA-MCH-09-A Water Temp Reset
- NRCA-MCH-10-A Hydronic System Variable Flow Control Acceptance
- NRCA-MCH-11 Automatic Demand Shed Controls



Enforcement – Prescriptive Compliance

NRCA-MCH-E Certificates of Acceptance: Cont.

- NRCA-MCH-12 FDD - Packaged Units
- NRCA-MCH-13-A AHU and Zone Terminal FDD
- NRCA-MCH-14-A Energy Storage for A/C – Distributed Energy Storage DX AX Systems
- NRCA-MCH-15-A Thermal Energy Storage
- NRCA-MCH-16-A Supply Air Temperature Reset Controls
- NRCA-MCH-17-A Condenser Water Temperature Reset Controls
- NRCA-MCH-18 EMS System Acceptance
- NRCA-MCH-19-A Occupied Standby



Enforcement – Prescriptive Compliance

NRCV-MCH-E Certificates of Verification:

- NRCV-MCH-04-H Duct Leakage Diagnostic Test
- NRCV-MCH-24 Building Air Leakage Diagnostic Test - HRMF
- NRCV-MCH-27 Indoor Air Quality and Mechanical Ventilation - HRMF
- NRCV-MCH-32 Local Mechanical Exhaust - HRMF



Resources





Online Resource Center

www.energy.ca.gov/orc



Handouts

- Fact sheets
- Guides

Tools

- Checklists
- Blueprint newsletter

Training

- Presentations
- Videos

Links

- Internal resources
- External resources



2022 Energy Code Handouts

- Solar PV and battery fact sheets coming soon
- Covered processes fact sheets
- Envelope fact sheets
- Summary of significant changes
- Summary of mandatory requirements
- Download from the [Online Resource Center](#)





New Resource Hub

Homeowners and renters

- Information about water and space heating, cooking, EV charging, incentives

Contractors

- Information about training, tools, incentives

Local government representatives

- Information about model policies, permitting, training, incentives

Links on the [Building and Home Energy Resource Hub](#)





HERS Program

HERS Program information



Newly constructed buildings
Additions
Alterations of residential and nonresidential buildings
California whole-house home energy ratings
HERS building performance contractors



Newly constructed buildings
Additions
Alterations of residential and nonresidential buildings

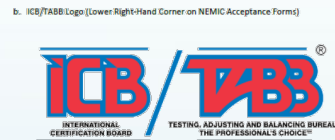


ATTCP Program

ATTCP Program information

Mechanical Systems

- California State Pipe Trades Council (CSPTC)
- National Energy Management Institute Committee (NEMIC)
- National Environmental Balancing Bureau (NEBB)
- Refrigeration Service Engineers Society (RSES)





Blueprint Newsletter

Energy Code quarterly newsletter

- Updates
- Clarifications
- Frequently asked questions



Issue 138
April - June 2022

BLUEPRINT

CALIFORNIA ENERGY COMMISSION
EFFICIENCY DIVISION

IN THIS ISSUE

- 2022 Energy Code: Multifamily Summary
- 2022 Energy Code: Compliance Software
- 2019 Energy Code: HERS Verifications
- Q&A
 - Solar PV for Multifamily Buildings
 - Multifamily Water Heating
 - Multifamily Common Use Areas

For additional help with the Energy Code see Energy Code Ace's **online offerings** of trainings, tools, and resources.

2022 Energy Code: Multifamily Summary

The 2022 Building Energy Efficiency Standards (Energy Code) reorganizes low-rise (three or fewer habitable stories) and high-rise (four or more habitable stories) multifamily buildings into one building type, updates the multifamily buildings definition in § 100.1, and moves all requirements for multifamily buildings to §§ 160.0-180.4. This and other significant changes include:

Mandatory Requirements

- Updates minimum efficiencies for HVAC equipment; adds minimum efficiency requirements for dedicated outdoor air systems (DOAS), heat pump, and heat recovery chiller packages. § 110.2
- Changes demand responsive lighting controls trigger to 4,000 watts or more; adds requirements for controlled receptacles. §§ 110.12, 160.5(b)4E

- Unifies envelope insulation, vapor retarder, and fenestration requirements. § 160.1
- For dwelling units
 - Adds requirements for central fan integrated ventilation systems requiring a motorized controlled damper, damper controls, and variable ventilation. § 160.2(b)2Aii
 - Requires vented kitchen range hoods ventilation rates or capture efficiencies based on conditioned floor area and fuel type per Tables 160.2-E, F, G. § 160.2(b)2Avic2
 - Requires a HERS-verified maximum fan efficacy of 1.0 Watts per cfm for heat recovery ventilation (HRV) and energy recovery ventilation (ERV) systems. § 160.2(b)2Biii
 - Adds mechanical acceptance testing requirements. § 160.3(d)2
 - Adds electric-ready requirements when gas equipment is installed for space heating, cooking, and clothes dryers. § 160.9(a-c)

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Receive Energy Code updates

- [Subscribe to Efficiency Division emails](#)
 - Appliances
 - Blueprint
 - Building Standards
- Respond to confirmation email

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Energy Code Hotline



Monday through Friday

- 8:00 a.m. to 12:00 p.m.
- 1:00 p.m. to 4:30 p.m.

Call

- 800-772-3300 in CA
- 916-654-5106 outside CA

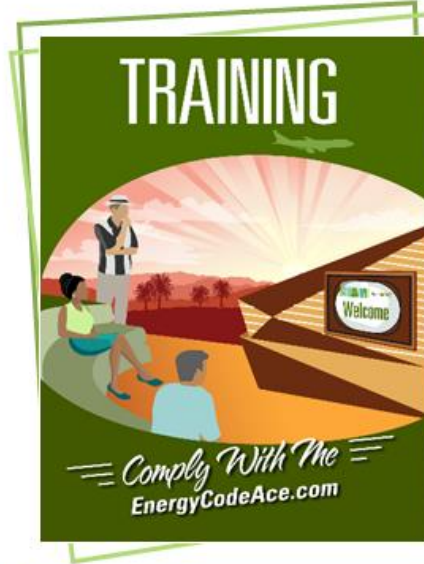
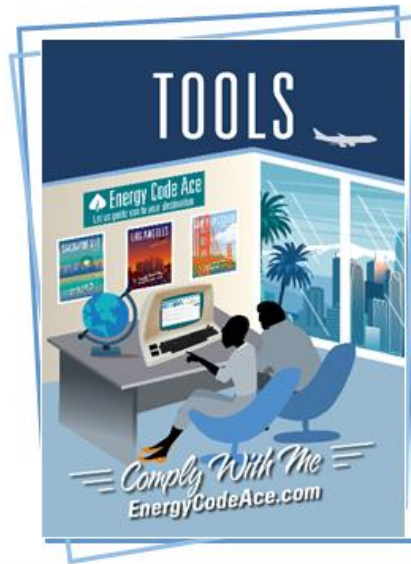


Email

- Title24@energy.ca.gov



Other Available Resources – Energy Code Ace



- Tools help automate tasks:**
- ✦ Energy Code Product Finder
 - ✦ Forms Ace
 - ✦ Image Ace
 - ✦ Navigator Ace
 - ✦ Nonres. Indoor Lighting Wheel
 - ✦ Q&Ace
 - ✦ Reference Ace
 - ✦ Timeline Ace
 - ✦ Virtual Compliance Assistant

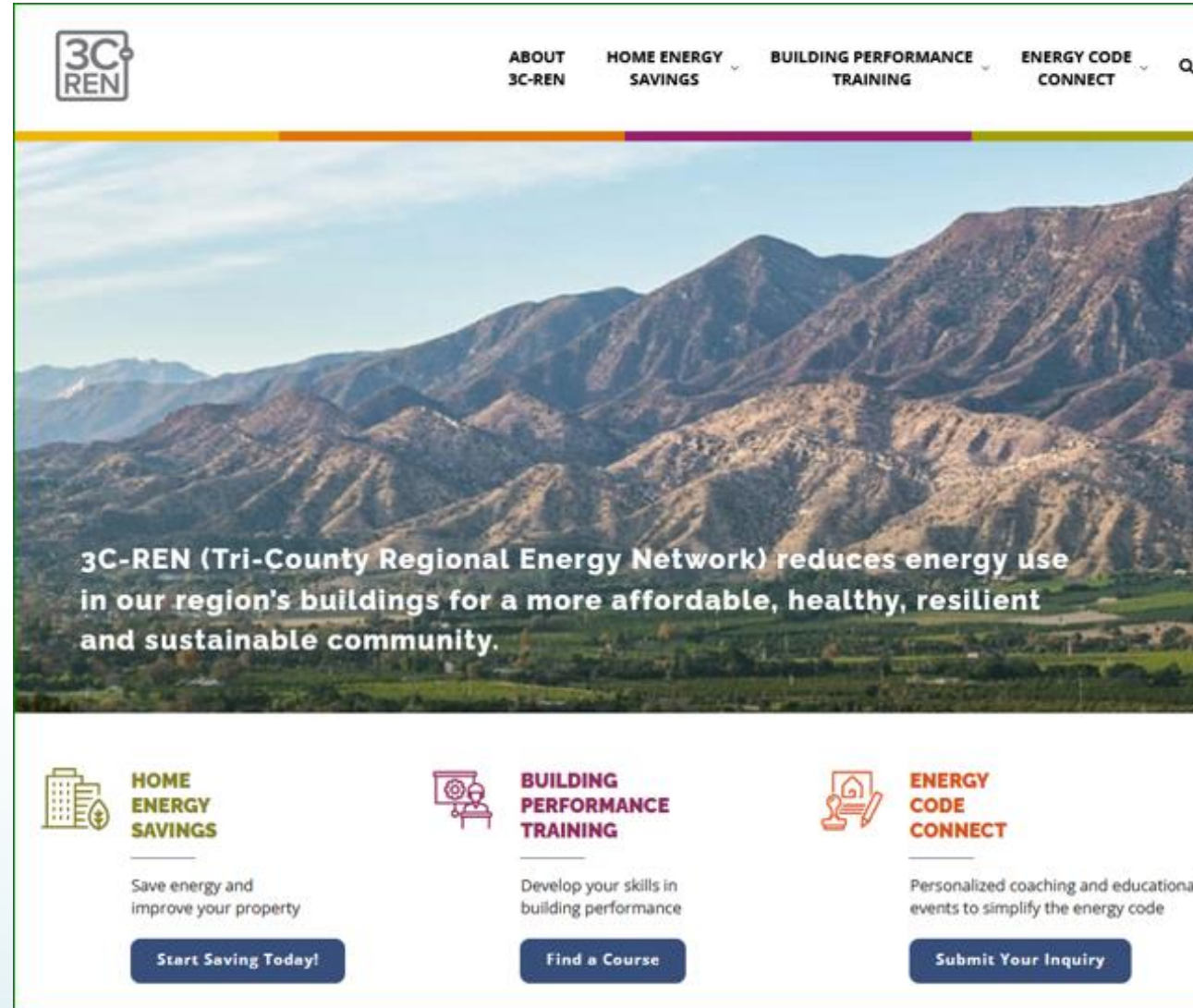
- Training is activity based and delivered in a variety of formats:**
- ✦ Live Online instructor-led
 - ✦ Online self-study
 - ✦ Recorded webinars
 - ✦ YouTube — live streaming & videos

- Resources provide quick, useful guidance:**
- ✦ Fact Sheets
 - ✦ Checklists
 - ✦ Application Guides
 - ✦ Submit a Question
 - ✦ Trigger Sheets
 - ✦ Useful Links

Join us at EnergyCodeAce.com



Other Available Resources – 3C-REN



The screenshot shows the homepage of the 3C-REN website. At the top left is the 3C-REN logo. To its right is a navigation menu with four items: "ABOUT 3C-REN", "HOME ENERGY SAVINGS", "BUILDING PERFORMANCE TRAINING", and "ENERGY CODE CONNECT", each with a dropdown arrow. A search icon is located to the right of the menu. Below the navigation is a large banner image of a mountain range. Overlaid on the bottom of the banner is the text: "3C-REN (Tri-County Regional Energy Network) reduces energy use in our region's buildings for a more affordable, healthy, resilient and sustainable community." Below the banner are three columns of content. The first column is for "HOME ENERGY SAVINGS", featuring a house icon with a plus sign and a leaf, the text "Save energy and improve your property", and a "Start Saving Today!" button. The second column is for "BUILDING PERFORMANCE TRAINING", featuring a person at a computer icon, the text "Develop your skills in building performance", and a "Find a Course" button. The third column is for "ENERGY CODE CONNECT", featuring a house icon with a checkmark, the text "Personalized coaching and educational events to simplify the energy code", and a "Submit Your Inquiry" button.

3C-REN

[ABOUT 3C-REN](#) [HOME ENERGY SAVINGS](#) [BUILDING PERFORMANCE TRAINING](#) [ENERGY CODE CONNECT](#)

3C-REN (Tri-County Regional Energy Network) reduces energy use in our region's buildings for a more affordable, healthy, resilient and sustainable community.

HOME ENERGY SAVINGS
Save energy and improve your property
[Start Saving Today!](#)

BUILDING PERFORMANCE TRAINING
Develop your skills in building performance
[Find a Course](#)

ENERGY CODE CONNECT
Personalized coaching and educational events to simplify the energy code
[Submit Your Inquiry](#)



Other Available Resources – BayREN

The screenshot shows the BayREN website homepage. At the top left is the BayREN logo with the tagline "Local Governments Empowering Our Communities". To the right of the logo is a navigation bar with links: "HOW TO GET STARTED", "FIND A CONTRACTOR", "FIND AN ASSESSOR", and "PARTNER WITH US". A search bar is located in the top right corner. On the left side, there is a vertical menu with categories: "REBATES & FINANCING", "HOME LEARNING CENTER", "EVENTS & TRAINING", "LOCAL GOVERNMENT RESOURCES", and "ABOUT". Below the menu are social media icons for Facebook, LinkedIn, Twitter, Instagram, and YouTube. The main content area features a large image of a park with a playground and people sitting at tables. Overlaid on the right side of this image is a dark purple circular callout box. Inside the box, there is an icon of a stack of coins with a dollar sign. The text reads: "Score big with smart energy upgrades." Below this, it says: "Upgrade your multifamily building and earn cash back — starting at \$750/unit." At the bottom of the callout box is a yellow button that says "Learn More".



Other Available Resources – Inland Regional Energy Network (I-REN)



iren.gov

info@iren.gov

Codes and Standards

Training and Education Program

- Free ICC-approved training sessions for 2022 Energy Code (Title 24, Part 6) requirements → www.iren.gov/161/CS-Trainings
- Requested training courses can also be scheduled

C&S Technical Support Program

Request Free Technical Assistance from Local Code Experts—Reach Code Development, Permit Guides, Etc. → www.iren.gov/162/CS-Technical-Support

Ask a Code Mentor an Energy Code Question

Submit queries online and receive a personalized response addressed by energy code experts within two business days! → www.iren.gov/162/CS-Technical-Support



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Coachella Valley Association of Governments (CVAG)
San Bernardino Council of Governments (SBCOG)
Western Riverside Council of Governments (WRCOG)

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Thank you