California Energy Code (Title 24, Part 6)

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California Energy Commission
May 24, 2023

Introduction

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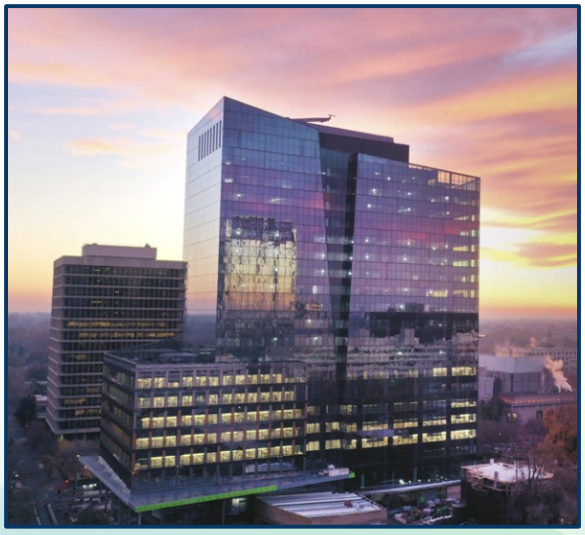
Been with the Energy Commission since 2014, and the 2025 Energy Code will be my 5th code cycle with the CEC

Previously functioned as the lead on the compliance documents (2013/2016), residential compliance software (2019/2022), and residential envelope measures (2019/2022).

CEC Building Standards Branch

1. Energy Code – CA's Building Energy Efficiency Standards for newly constructed buildings, additions and alterations (Title 24, Parts 6 & 11)
2. CBECCs – Public domain computer program, certification process, manuals, sample calculations, field testing, model designs
3. Education & Outreach – Technical assistance program, seminars, monthly newsletter, hotline



The Building Standards Branch, which I am here representing today, are charged with three primary tasks:

(1) Updating and maintaining the state's Energy Code – Title 24, Parts 6 & 11;
(2) Developing and maintaining the state's public domain computer compliance program known as CBECC; and
(3) Providing outreach, training, and technical assistance on the state's Energy Code.

References

https://www.energy.ca.gov/publications/2023/warren-alquist-act-2023-edition

Building Standards Branch

Our mission statement:

"On behalf of all Californians, uphold and advance the most impactful building energy efficiency standards in the nation."

2022 Energy Code
Mechanical Controls & Sensors

Mandatory Requirements for Space Conditioning Equipment

§110.2 – Mandatory Requirements for Space Conditioning Equipment

- 110.2(b) – Controls for heat pumps with supplementary electric resistance heaters.
- 110.2(c) – **Thermostats.** All heating or cooling systems not controlled by a central energy management control system (EMCS) shall have a setback thermostat. [setback thermostat]

110.2(b) Controls for Heat Pumps with Supplementary Electric Resistance Heaters. Heat pumps with supplementary electric resistance heaters shall have controls:

1) That prevent supplementary heater operation when the heating load can be met by the heat pump alone; and
2) In which the cut-on temperature for compression heating is higher than the cut-on temperature for supplementary heating, and the cut-off temperature for compression heating is higher than the cut-off temperature for supplementary heating.

Exception 1 to Section 110.2(b): The controls may allow supplementary heater operation during;

A. Defrost; and
B. Transient periods such as start-ups and following room thermostat setpoint advance, if the controls provide preferential rate control, intelligent recovery, staging, ramping or another control mechanism designed to preclude the unnecessary operation of supplementary heating.

Exception 2 to Section 110.2(b): Room air-conditioner heat pumps.

Setback Thermostats

Section 110.2(c) – Thermostats

1. **Setback capabilities.** All thermostats shall have a clock mechanism that allows the building occupant to program the temperature setpoints for at least four period within 24 hours. Thermostats for heat pumps shall meet the requirements of Section 110.2(b)

Exception to Section 110.2(c): Gravity gas wall heaters, gravity floor heaters, gravity room heaters, noncentral electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners and room air-conditioner heat pumps.

Mandatory Requirements for Demand Management

§110.12 – Mandatory Requirements for Demand Management

- 110.12(a) – Demand Responsive Controls [OCST]
- 110.12(b) – Demand Responsive Zonal HVAC Controls [EMCS]

110.12(a) Demand responsive controls.

1. All demand responsive controls shall be either:
    A. A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Claus 11, Conformance, in the applicable OpenADR 2.0 Specification; or
    B. Certified by the manufacturer as being capable of responding to a demand response signal from certified OpenADR 2.0b Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment controls.
2. All demand responsive controls shall be capable of communicating with the VEN using a wired or wireless bidirectional communication pathway.
3. RESERVED
4. When communications are disabled or unavailable, all demand responsive controls shall continue to perform all other control functions provided by the control.
5. Demand responsive control thermostats shall comply with Reference Appendices, Joint Appendix JA5, Technical Specifications for Occupant Controlled Smart Thermostats (OCST).

110.12(b) Demand responsive zonal HVAC controls. Nonresidential HVAC systems with DDC to the Zone level shall be programmed to allow centralized demand shed for noncritical zones as follows:

1. The controls shall have a capability to remotely increase the operating cooling temperature setpoints by 4° or more in all noncritical zones on signal from a centralized contact or software point within an Energy Management Control System (EMCS).
2. The controls shall have a capability to remotely increase the operating heating temperature setpoints by 4° or more in all noncritical zones on signal from a centralized contact or software point with an EMCS.
3. The controls shall have capabilities to remotely reset the temperatures in all noncritical zones to original operating levels on signal from a centralized contact or software point within an EMCS.
4. The controls shall be programmed to provide an adjustable rate of change for the temperature increase, decrease, reset.
5. The controls shall have the following features:
    A. Disabled. Disabled by authorized facility operators; and
    B. Manual control. Manual control by authorized facility operators to allow adjustment of heating and cooling setpoints globally from a single point in the EMCS; and
    C. Automatic demand shed control. Upon receipt of a demand response signal, the space conditioning systems shall conduct a centralized demand shed, as specified in Sections 110.12(b)1 and 110.12(b)2, for noncritical zones during the demand response period.

Occupant Controlled Smart Thermostats (OCST)

Intended to be compatible with National Electrical Manufacturers Association (NEMA) Standard DC 3-2013 Residential Controls – Electrical Wall Mounted Thermostats and NEMA DC 3 Annex A-2013 Energy-Efficiency Requirements for Programmable Thermostats

An OCST is compliant with Title 24, Part 6, only if it has been certified to the Energy Commission as meeting all of the requirements in this Appendix. Certification to the Energy Commission shall be as specified in Section 110.0.

- CEC certified OCST devices

Reference Appendices, Joint Appendix, JA5 – Technical Specifications for Occupant Controlled Smart Thermostats

JA5.1 – Introduction

JA5.1.1 – Manufacturer Self-Certification

JA5.2 – Required Functional Specification

JA5.2.1 – Setback Capabilities

JA5.2.2 – Restart Settings

JA5.2.3 – Automatic Rejoin

JA5.2.4 – Event Response

JA5.2.5 – User Display and Interface

JA5.2.6 – Required Functional Behavior

JA5.3 – HVAC System Interface

Energy Management Control System (EMCS)

Energy Management Control System (EMCS) is an automated control system that regulates the energy consumption of a building by controlling the operation of energy consuming systems and is capable of monitoring loads and adjusting operations in order to optimize energy usage and respond to demand response signals.

Definition from Section 100.1(b).

[NR] Requirements for Ventilation and Indoor Air Quality

§120.1 – Requirements for Ventilation and Indoor Air Quality

- 120.1(c)2 – Natural ventilation
  - 120.1(c)2C – Control and accessibility
- 120.1(d) – Operation and control requirements for minimum quantities of outdoor air
  - 120.1(d)4 – Demand control ventilation devices [CO2 sensors]
  - 120.1(d)5 – Occupant sensor ventilation control devices [occupant sensors]
- 120.1(f) – Design and control requirements for quantities of outdoor air

120.1(c)2 – Control and Accessibility. The means to open the required operable opening shall be readily accessible to building occupants whenever the space is occupied. Controls shall be designed to coordinate operation of the natural and mechanical ventilation systems. [ASHRAE 62.1:6.4.3]

120.1(f) – Design and Control Requirements for Quantities of Outdoor Air.

1. All mechanical ventilation and space conditioning systems shall be designed with and have installed ductwork, dampers, and controls that allow design minimum outside air rates to be operated at no less than the larger of (1) the minimum levels specified in Section 120.1(c)3 or (2) the rate required for makeup of exhaust systems that are required for an exempt or covered process, for control of odors, or for the removal of contaminants within the space.
2. All variable air volume mechanical ventilation and space conditioning systems shall include dynamic controls that are capable of maintaining measured outside air ventilation rates within 10 percent of the design minimum outside air ventilation rate at both full and reduced supply airflow conditions. Fixed minimum damper position is not considered to be dynamic and is not an allowed control strategy.
3. All mechanical ventilation and space conditioning systems shall be tested to

confirm their ability to operate within 10 percent of the design minimum outside air rate.

CO2 Sensors

Section 120.1(d)4 – Demand Control Ventilation Devices

A. Shall be installed in each room that meets the criteria of Section 120.1(d)3 with no less than one sensor per 10,000 square feet of floor space. When a zone or space is served by more than one sensor, a signal from any sensor indicating that CO2 is near or at the setpoint within the zone or space, shall trigger an increase in ventilation.

B. CO2 sensors shall be located in the room between 3 feet and 6 feet above the floor or at the anticipated height of occupant's heads.

C. CO2 sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1,000 ppm concentration when measured at sea level and 25°C, factory calibrated and certified by the manufacturer to require calibration no more frequently than every 5 years.

D. Sensor readings for each zone shall be displayed continuously and shall be recorded on systems with DDC to the zone level.

Occupant Sensors

Section 120.1(d)5 – Occupant Sensor Control Devices

Occupant sensor ventilation control devices used to reduce the rate of outdoor airflow when occupants are not present shall comply with the following:

A. Occupant sensors shall have suitable coverage and placement to detect occupants in the entire space ventilated. In 20 minutes or less after no occupancy is detected by any sensors covering the room, occupant sensing controls shall indicate room is vacant.

B. When Occupant sensors controlling lighting are also used for ventilation, the ventilation signal shall be independent of daylighting, manual lighting overrides or manual control of lighting.

C. When a single zone damper or a single zone system serves multiple rooms, there shall be an occupant sensor in each room and the zone shall not be considered vacant until all rooms in the zone are vacant.

Occupant Sensors

D. One hour prior to normal scheduled occupancy, the occupant sensor ventilation control shall allow pre-occupancy purge as described in Section 120.1(d)2.

E. When the zone is scheduled to be occupied and occupant sensing controls in all rooms and areas served by the zone indicate the spaces are unoccupied, the zone shall be placed in occupied-standby mode.

F. In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall be shut off until the space becomes occupied or until ventilation is needed to provide space heating or conditioning. When mechanical ventilation is shut off to the zone, the ventilation system serving the zone shall reduce the system outside air rate by the amount of outside air required for the zone.

Occupant Sensors

G. Where the system providing space conditioning also provides ventilation the zone, in 5 minutes or less after entering occupied-standby mode, space conditioning zone setpoints shall be reset in accordance with Section 120.2(e)3.

[NR] Requirements for Space Conditioning Systems

§120.2 – Requirements for Space Conditioning Systems

- 120.2(a) – Thermostatic controls for each zone
- 120.2(b) – Criteria for zonal thermostatic controls
- 120.2(c) – Hotel/motel guest room thermostats
- 120.2(d) – Heat pump controls
- 120.2(e) – Shut-off controls and reset controls for space conditioning systems
  - 120.2(e)3 – Occupant sensing zone controls
- 120.2(h) – Automatic demand shed controls
- 120.2(i) – Economizer fault detection and diagnostics [FDD]
- 120.2(j) – Direct digital controls [DDC]

120.2(a) – Thermostatic Controls for Each Zone. The supply of heating and cooling energy to each space conditioning zone or dwelling unit shall be controlled by an individual thermostatic control that responds to temperature within the zone and that meets the applicable requirements of Section 120.2(b). An EMCS may be installed to comply with the requirements of one or more thermostatic controls if it complies with all applicable requirements for each thermostatic control.

Exception to Section 120.2(a): An independent perimeter heating or cooling system may serve more than one zone without individual thermostatic controls if:

1. All zones are also served by an interior cooling system; and
2. The perimeter system is designed solely to offset envelope heat losses or gains; and
3. The perimeter system has at least one thermostatic control for each building orientation of 50 feet or more; and
4. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.

120.2(b) – Criteria for Zonal Thermostatic Controls. The individual thermostatic controls required by Section 120.2(a) shall meet the following requirements as

applicable:

1. Where used to control comfort heating, the thermostatic controls shall be capable of being set, locally or remotely, down to 55°F or lower.
2. Where used to control comfort cooling, the thermostatic controls shall be capable of being set, locally or remotely, up to 85°F or higher.
3. Where used to control both comfort heating and comfort cooling, the thermostatic controls shall meet Items 1 and 2 and shall be capable of providing a temperature range or deadband of at least 5F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exception 1 to Section 120.2(b)3: Systems with thermostats that require manual changeover between heating and cooling modes.

Exception 2 to Section 120.2(b)3: Systems serving healthcare facilities.

4. Thermostatic controls for all single zone air conditioners and heat pumps, shall comply with the requirements of Section 110.2(c) and 110.12(a) and, if equipped with DDC to the Zone level, with the Automatic Demand Shed Controls of Section 110.12(b).

Exception 1 to Section 12.2(b)4: Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plans or animals.

Exception 2 to Section 120.2(b)4: Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air-conditioner heat pumps.

Exception 3 to Section 120.2(b)4: Systems serving healthcare facilities.

120.2(c) – Hotel/Motel Guest Room Thermostats.

1. Hotel/motel guest room thermostats shall:
    A. Have numeric temperature setpoints in °F and °C; and
    B. Have setpoint stops, which are accessible only to authorized personnel, such that guest room occupants cannot adjust the setpoint more than ±5°F (±3°C); and
    C. Meet the requirements of Section 110.2(c).

    Exception to Section 120.2(c)1: Thermostats that are integrated into the room heating and cooling equipment.

120.2(d) – Heat Pump Controls. All heat pumps with supplementary electric resistance heaters shall be installed with controls that comply with Section 110.2(b).

120.2(e) – Shut-off Controls and Reset Controls for Space Conditioning Systems. Each space conditioning system shall be installed with controls that comply with the following:

1. The control shall be capable of automatically shutting off the system during periods of nonuse and shall have:

A. An automatic time switch control device complying with Section 110.9, with an accessible manual override that allows operation of the system for up to 4 hours; or
B. An occupancy sensor; or
C. A 4-hour timer that can be manually operated.

Exception to Section 120.2(e)1: Mechanical systems serving retail stores and associated malls, restaurants, grocery stores, churches, and theaters equipped with 7-day programmable timers.

1. The control shall automatically restart and temporarily operate the system as required to maintain:
    A. A setback heating thermostat setpoint if the system provides mechanical heating; and

    Exception to Section 120.2(e)2A: Thermostat setback controls are not required in nonresidential buildings in areas where the Winter Median of Extremes outdoor air temperature determined in accordance with Section 140.4(b)3 is greater than 32°F.

    B. A setback cooling thermostat setpoint if the system provides mechanical cooling.

    Exception to Section 120.2(e)2B: Thermostat setup controls are not required in nonresidential buildings in areas where the Summer Design Dry Bulb 0.5% temperature determined in accordance with Section 140.4(b)3 is less than 100°F.
2. Occupant Sensing Zone Controls. Where the system providing space conditioning also provides the ventilation required by Section 120.1 and includes occupant sensor ventilation control as specified in Section 120.1(d)5, the occupant sensing zone controls shall additionally comply with the following:
    A. In 5 minutes or less after entering occupied-standby mode as described in Section 120.1(d).
        i. Automatically set p the operating cooling temperature setpoint by 2°F or more and set back the operating heating temperature setpoint by 2°F or more; or
        ii. For multiple zone systems with Direct Digital Controls (DDC) to the zone level, set up the operating cooling temperature setpoint by 0.5°F or more and set back the operating heating temperature setpoint by 0.5°F or more.
    B. In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall remain off whenever the space temperature is between the active heating and cooling setpoints.

    Exception 1 to Section 120.1(e)1, 2, and 3: Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

    Exception 2 to Section 120.1(e)1, 2, and 3: Systems with full load demands of

2 kW or less, if they have a readily accessible manual shut-off switch.

Exception 3 to Section 120.1(e)1 and 2: Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off control switch.

1. Hotel and motel guest rooms shall have captive card key controls, occupancy sensing controls, or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, setpoints are set up at least ±5°F (±3°C) in cooling mode and set down -5°F (-3°C) in heating mode.

Exception to Section 120.2(e): Systems serving healthcare facilities.

120.2(h) – Automatic Demand Shed Controls. See Section 110.12 for requirements for Automatic Demand Shed Controls.

Economizer FDD

Section 120.2(i) – Economizer Fault Detection and Diagnostics

All newly installed air handlers with a mechanical cooling capacity greater than 33,000 Btu/hr and an installed air economizer are to include stand-alone or integrated Fault Detection and Diagnostics (FDD) meeting the criteria of Section 120.2(i)1 through 120.2(i)8.

Relies on manufacturer self-certification to the Energy Commission.

- CEC Fault Detection and Diagnostics System Certification List

1. The following temperature sensors shall be permanently installed to monitor system operation: outside air, supply air, and when required for differential economizer operation, a return air sensor; and
2. Temperature sensors shall have an accuracy of ±2°F over the range of 40°F to 80°F; and
3. The controller shall have the capability of displaying the value of each sensor; and
4. The controller shall provide system status by indicating the following conditions:
    1. Free cooling available;
    2. Economizer enabled;
    3. Compressor enabled;
    4. Heating enabled, if the system is capable of heating; and
    5. Mixed air flow limit cycle active.
5. The unit controller shall allow manual initiation of each operating mode so that the operating of cooling systems, economizers, fans, and heating systems can be independently tested and verified; and
6. Faults shall be reported in one of the following ways:
    A. Reported to an EMCS regularly monitored by facility personnel.
    B. Annunciated locally on one more zone thermostats, or a device within five (5) feet of zone thermostat(s), clearly visible, at eye level, and meeting the

following requirements:

i. On the thermostat, device, or an adjacent written sign, display instructions to contact appropriate building personnel or an HVAC technician; and

ii. In buildings with multiple tenants, the annunciation shall either be within property management offices or in a common space accessible by the property or building manager.

A. Reported to a fault management application which automatically provides notification of the fault to remote HVAC service provider.

1. The FDD system shall detect the following faults:
    1. Air temperature sensor failure/fault;
    2. Not economizing when it should;
    3. Economizing when it should not;
    4. Damper not modulating; and
    5. Excess outdoor air.
2. The FDD system shall be certified by the Energy Commission as meeting requirements of Sections 120.2(i)1 through 120.2(i)7 in accordance with Section 110.0 and JA6.3.

Exception to Section 120.2(i)8: FDD algorithms based in Direct Digital Control systems are not required to be certified to the Energy Commission.

Direct digital controls (DDC)

Section 120.2(j) – Direct Digital Controls (DDC)

Direct digital controls to the zone shall be provided as specified by Table 120.2-A.

The provided DDC system shall meet the control logic requirements of Sections 120.1(d), 110.12(a) and 110.12(b), and be capable of the following:

1. Monitoring zone and system demand for fan pressure, pump pressure, heating and cooling;
2. Transferring zone and system demand information from zones to air distribution system controllers and from air distribution system to heating and cooling plant controllers;
3. 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;

Direct digital controls (DDC)

4. Readily allow operator removal of zone(s) from the reset algorithm;
5. For new buildings, trending and graphically displaying input and output points; and
6. Resetting heating and cooling setpoints in all noncritical zones upon receipt of a signal from a centralized contact or software point as described in Section 110.12(b).

[NR] Mandatory Requirements for Covered Processes

§120.6 – Mandatory Requirements for Covered Processes

- 120.6(c) – Mandatory requirements for enclosed parking garages [CO sensors]

120.6(c) – Mandatory Requirements for Enclosed Parking Garages. Mechanical ventilation systems for enclosed parking garages where the total design exhaust rate for the garage is greater than or equal to 10,000 cfm shall conform to all of the following:

1. Automatically detect contaminant levels and stage fans or modulate fan airflow rates to 50 percent or less of design capacity provided acceptable contaminant levels are maintained.
2. Have controls and/or devices that will result in fan motor demand of no more than 30 percent of design wattage at 50 percent of design airflow.
3. CO shall be monitored with at least one sensor per 5,000 square feet, with the sensor located in the highest expected concentration locations, with at least two sensors per proximity zone. A proximity zone is defined as an area that is isolated from other areas either by floor or other impenetrable construction.
4. CO concentration at all sensors is maintained at 25 ppm or less at all times.
5. The ventilation rate shall be at least 0.15 cfm/ft2 when the garage is scheduled to be occupied.
6. The system shall maintain the garage at negative or neutral pressure relative to other occupiable spaces when the garage is scheduled to be occupied.
7. CO sensors shall be:

A. Certified by the manufacturer to be accurate within plus or minus 5 percent of measurement.
B. Factory calibrated.
C. Certified by the manufacturer to drift no more than 5 percent per year.
D. Certified by the manufacturer to require calibration no more frequently than once a year.
E. Monitored by a control system. The system shall have logic that automatically checks for sensor failure by the following means. Upon detection of a failure, the system shall reset to design ventilation rates and transmit an alarm to the facility operators.
    i. If any sensor has not been calibrated according to the manufacturer's recommendations within the specified calibration period, the sensor has failed.
    ii. During occupied periods, the system compares the readings of all sensors, e.g., if any sensor is more than 15 ppm above or below the average of all sensors for longer than four hours, the sensor has failed.
    iii. During occupied periods, the system compares the readings of sensors in the same proximity zone, e.g., if the 30 minute rolling average for any sensor in a proximity zone is more than 15 ppm above or below the 30 minute rolling average for other sensor(s) in that proximity zone, the sensor has failed.

CO Sensors

Section 120.6(c) – Mandatory Requirements for Enclosed Parking Garages

7. CO sensors shall be:
   A. Certified by the manufacturer to be accurate within plus or minus 5 percent of measurement.
   B. Factory calibrated.
   C. Certified by the manufacturer to drift no more than 5 percent per year.
   D. Certified by the manufacturer to require calibration no more frequently than once a year.

CO Sensors

E. Monitored by a control system. The system shall have logic that automatically checks for sensor failure by the following means. Upon detection of a failure, the system shall reset to design ventilation rates and transmit an alarm to the facility operators.
   i. If any sensor has not been calibrated according to the manufacturer's recommendations within the specified calibration period, the sensor has failed.
   ii. During occupied periods, the system compares the readings of all sensors, e.g., if any sensor is more than 15 ppm above or below the average of all sensors for longer than four hours, the sensor has failed.
   iii. During occupied periods, the system compares the readings of sensors in the same proximity zone, e.g., if the 30-minute rolling average for any sensor in a proximity zone is more than 15 ppm above or below the 30-minute rolling average for other sensor(s) in that proximity zone, the sensor has failed.

[NR] Prescriptive Requirements for Space Conditioning Systems

§140.4 – Prescriptive Requirements for Space Conditioning Systems

- 140.4(c)2 – Variable air volume (VAV) systems [static pressure sensor]
- 140.4(d)2A – Space conditioning zone controls – variable air volume (VAV) systems [DDC]
- 140.4(f) – Supply air temperature reset controls
- 140.4(k) – Hydronic system measures
  - 140.4(k)4 – Chilled and hot water temperature reset controls
  - 140.4(k)5 – Water-cooled air conditioned and hydronic heat pump systems
  - 140.4(k)6 – Variable flow controls [static pressure sensor]
  - 140.4(k)7 – Hydronic heat pump (WLHP) controls

Static Pressure Sensors

Section 140.4(c)2 – Variable air volume (VAV) systems

A. Static pressure sensor location. Static pressure sensors used to control variable air volume fans shall be place in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for system with zone reset control complying with Section 140.4(c)2B. If this results in the sensor being located downstream of any major duct split, multiple sensors shall be installed in each major branch with fan capacity controlled to satisfy the sensor furthest below its setpoint; and

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

Static Pressure Sensors

Section 140.4(k)6 – Variable Flow Controls

B. Pressure sensor location and setpoint.

i. For systems without direct digital control of individual coils reporting to the central control panel, differential pressure shall be measured at the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.

ii. For systems with direct digital control of individual coils with a central control panel, the static pressure setpoint shall be reset based on the valve requiring the most pressure, and the setpoint shall be no less than 80 percent open. Pressure sensors may be mounted anywhere.

[SF] Mandatory Features and Devices

§150.0 – Mandatory Features and Devices

- 150.0(i) – Thermostats
- 150.0(o)1Biv – Central fan integrated (CFI) ventilation systems – Variable Ventilation
- 150.0(o)1Giiia – Local mechanical exhaust – Demand-controlled mechanical exhaust – control and operation
- 150.0(o)1Giva – Continuous mechanical exhaust – control and operation

150.0(i) – Thermostats. All heating and cooling systems, including heat pumps, not controlled by an EMCS shall have a setback thermostat, as specified in Section 110.2(c).

150.0(o)1Biv – Variable Ventilation. CFI ventilation systems shall incorporate controls that track outdoor air ventilation run time, and either open or close the required motorized damper(s) depending on whether or not outdoor air ventilation is required for compliance with Section 150.0(o)1C. During periods when comfort conditioning is not called for by the space conditioning thermostat, the CFI ventilation system controls shall operate the space conditioning system central fan and outdoor air damper(s) when necessary to ensure compliance with the minimum outdoor air ventilation required by Sections 150.0(o) in accordance with applicable variable mechanical ventilation methods specified in ASHRAE 62.2 section 4.5.

150.0(o)1Giii – Demand-Controlled Mechanical Exhaust. A local mechanical exhaust system shall be designed to be operated as needed.

a. Control and operation. Demand-controlled mechanical exhaust systems shall be provided with at least one of the following controls:

1. A readily accessible occupant-controlled ON-OFF control

2. An automatic control that does not impede occupant ON control

a. Ventilation Rate and Capture Efficiency. The system shall meet or exceed the minimum airflow in accordance with Table 150.0-E or the minimum capture efficiency in accordance with Table 150.0-E, and Table 150.0-G. Capture efficiency ratings shall be determined in accordance with ASTM E3087 and listed in a product directory approved by the Energy Commission.

150.0(o)1Giv – Continuous Mechanical Exhaust. A mechanical exhaust system shall be installed to operate continuously. The system may be part of a balanced mechanical ventilation system.

a. Control and Operation. A manual ON-OFF control shall be provided for each continuous mechanical exhaust system. The system shall be designed to operate during all occupiable hours. The ON-OFF control shall be accessible to the dwelling unit occupant.

b. Ventilation Rate. The minimum delivered ventilation shall be at least the amount indicated in Table 150.0-F during each hour of operation.

Fault Indicator Display (FID) – Indoor Air Quality

Alternative Calculation Method (ACM) Reference Manuals

The nonresidential and residential ACM Reference Manuals provide compliance credit for indoor air quality FID systems which meet the requirements listed in the Residential ACM Reference Manual.

Relies on manufacturer self-certification to the Energy Commission.

- CEC Residential Fault Indicator Display Certification List

Residential ACM Reference Manual – IAQ FID System Requirements

[SF] Prescriptive Compliance

§150.1 – Performance and Prescriptive Compliance Approaches for Single-Family Residential Buildings

- 150.1(c)7AicII – Refrigerant charge [FID]

§150.2 – Energy Efficiency Standards for Additions and Alterations to Existing Single-Family Residential Buildings

- 150.2(b)1Fi – Thermostats [setback thermostat]
- 150.2(b)1Fiib – Refrigerant charge [FID]

As an alternative to the standard charge procedure specified in RA3.2.2, and weigh-in charging procedure of RA3.2.3.1:
150.1(c)AicII – The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2.

150.2(b)1Fi – All thermostats associated with the system shall be replaced with setback thermostats meeting the requirements of Section 110.2(c),

150.2(b)1FiibII – The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2.

Fault Indicator Display (FID) – Refrigerant Charge Verification

Reference Appendices, Joint Appendix, JA6.1 – Fault Indicator Display (FID)

- The Energy Code, Section 150.1(c)7A and 150.2(b)1E provide exceptions to refrigerant charge verification based on use of a fault indicator display (FID) that meets requirements specific in Joint Appendix JA6.1.

Relies on manufacturer self-certification to the Energy Commission.

- CEC Residential Fault Indicator Display Certification List

[MF] Mandatory Requirements for Ventilation and Indoor Air Quality

This section is copied from NR – 120.1

§160.2 – Mandatory Requirements for Ventilation and Indoor Air Quality

- 160.2(c)2 – Natural ventilation
  - 160.2(c)2C – Control and accessibility
- 160.2(c)5 – Operation and control requirements for minimum quantities of outdoor air
  - 160.2(c)5D – Demand control ventilation devices (CO_2 sensors)
  - 160.2(c)5E – Occupant sensing ventilation control devices
- 160.2(c)7 – Design and control requirements for quantities of outdoor air

[MF] Mandatory Requirements for Space Conditioning Systems

This section is copied from NR – 120.2

§160.3 – Mandatory Requirements for Space Conditioning Systems

- **160.3(a)1 – Dwelling unit thermostats**
- **160.3(a)2 – Common use area controls**
- 160.3(a)A – Thermostatic controls for each zone
- 160.3(a)B – Criteria for zonal thermostatic controls
- 160.3(a)C – Heat pump controls
- 160.3(a)D – Shut-off controls and reset controls for space conditioning systems
  - 160.3(a)Diii – Occupant sensing zone controls (CO2 sensors)
- 160.3(a)G – Automatic demand she controls
- 160.3(a)H – Economizer fault detection and diagnostics (FDD)
- 160.3(a)I – Direct digital controls (DDC)

[MF] Prescriptive Approach

This section is copied from NR – 140.4

§170.2 – Prescriptive Approach

- 170.2(c)3BiaIIIB – Refrigerant charge [FID]
- 170.2(c)3Bii – Variable air volume (VAV) systems [static pressure sensors]
- 170.2(c)4B – Space conditioning zone controls [DDC]
- 170.2(c)4D – Supply air temperature reset controls
- 170.2(c)4I – Hydronic system measures
  - 170.2(c)4Iiv – Chilled and hot water temperature reset controls
  - 170.2(c)Iv – Water-cooled air conditioned and hydronic heat pump systems
  - 170.2(c)4Ivi – Variable flow controls [pressure sensors]
  - 170.2(c)4Ivii – Hydronic heat pump (WLHP) controls

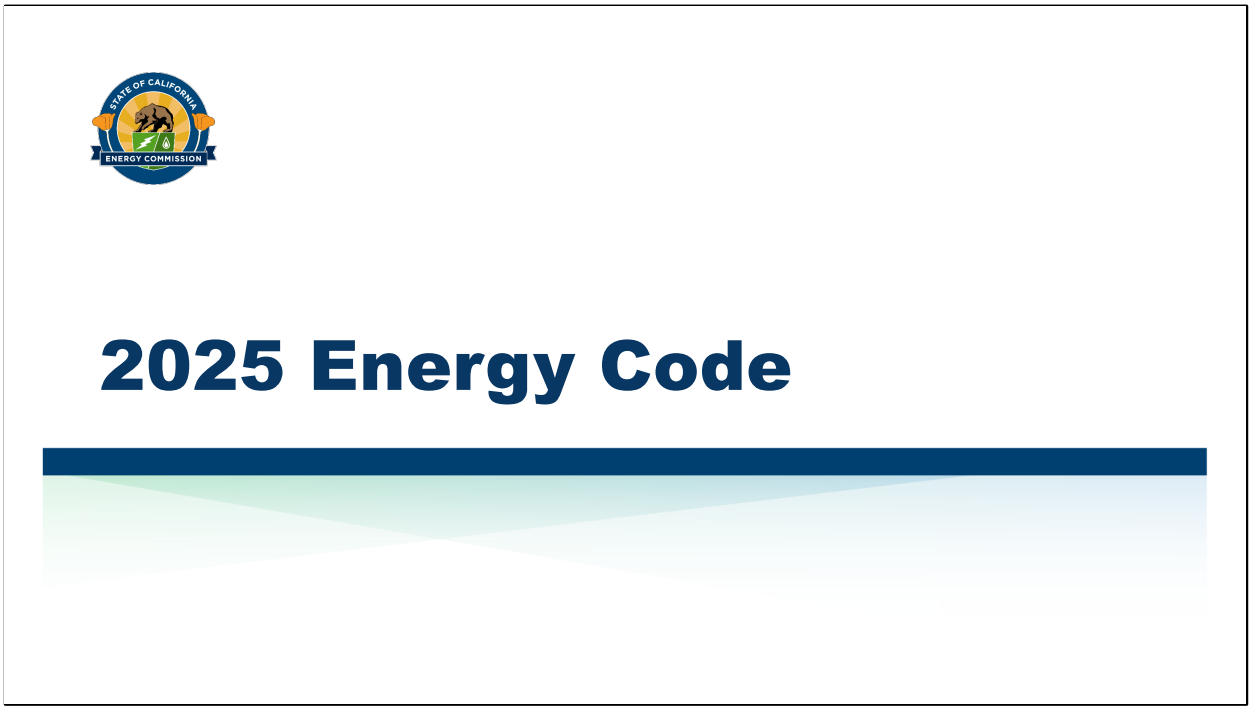
[MF] Alterations

§180.2 - Alterations

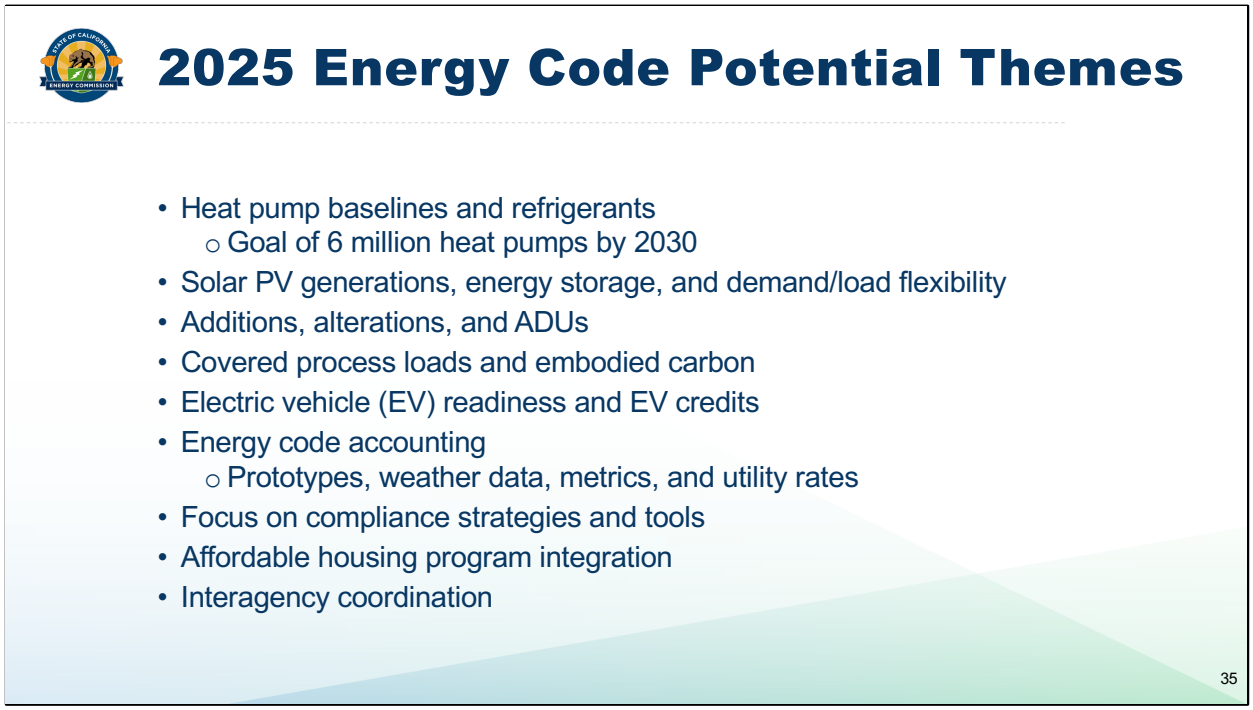
- 180.2(b)2Aiva – Thermostats [setback thermostat]
- 180.2(b)2AivbIIB – Refrigerant charge [FID]

180.2(b)2Aiva – All thermostats associated with the system shall be replaced with setback thermostats meeting the requirements of Section 110.2(c).

180.2(b)2AivbIIB – The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2.



And then just quickly looking towards the future and where we are looking to go with the 2025 Energy Code…

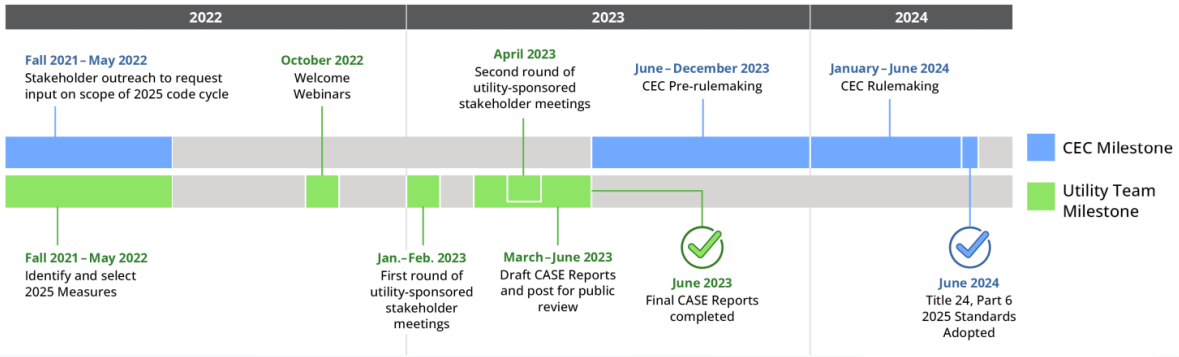


References

[1] 6 million heat pumps by 2020: https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2021-integrated-energy-policy-report

Here is a list of potential themes for the 2025 Energy Code.

2025 Timeline



Estimated 2025 Schedule

Milestone	Tentative Dates
Measure identification and selection	June 2021 – May 2022
CEC Updates Weather Files and Develops 2025 TDV	November 2021 – October 2022
Research version of CBECC with 2025 TDV and weather files available	October 2022
Welcome Webinars	October 2022
First Round of Utility-Sponsored Stakeholder Meetings	January – February 2023
Utilities Submit Draft CASE Reports to CEC and Post for Public Review	March – April 2023
Second Round of Utility-Sponsored Stakeholder Meetings	April 2023
CEC Pre-rulemaking Workshops	June 2023 – December 2023
Utilities Submit Final CASE Reports to CEC and Post for Public Review	No Later than July 31, 2023
Express Term Review	October 2023
45-Day Express Terms Review	January – February 2024
15-Day Express Term Review	Beginning of April 2024
2025 Title 24, Part 6 Adopted	End of June 2024
2025 Title 24, Part 11 (CALGreen) Adopted	July 2024
2025 Compliance Manuals and ACM Reference Manuals Approved	November 2024
CASE Study Results Reports and CCSRs Complete	December 31, 2024
2025 Compliance Software Available to Public	January 1, 2025
2025 Standards Effective	January 1, 2026

How you can participate

You can follow along with the CASE team's work on their website:
Title24Stakeholders.com

The CASE team is currently accepting comments on their Draft CASE Reports, and those comments can be sent to:
info@title24stakeholders.com

Sign up to receive updates and information on news, programs, and events from the CEC: https://www.energy.ca.gov/subscriptions

- Topic: Building Energy Efficiency Standards

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- Ronald Balneg – NR space heating/space cooling, ventilation
- Simon Lee – lighting, EV chargers
- Thao Chao – controlled environment horticulture

Senior Engineers

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- Muhammad Saeed – PV, battery
- Payam Bozorgchami – technical lead, envelope, existing buildings

Thank you