

2019

BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS

FOR THE 2019 BUILDING
ENERGY EFFICIENCY
STANDARDS

TITLE 24, PART 6, AND ASSOCIATED
ADMINISTRATIVE REGULATIONS
IN PART 1.



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CALIFORNIA ENERGY COMMISSION
Edmund G. Brown Jr., Governor

SUBCHAPTER 3

NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES—MANDATORY REQUIREMENTS

SECTION 120.0— GENERAL

Sections 120.1 through 120.9 establish requirements for the design and installation of building envelopes, ventilation, space-conditioning and service water-heating systems and equipment in nonresidential, high-rise residential, and hotel/motel buildings as well as covered processes that are within the scope of Section 100.0(a).

NOTE: The requirements of Sections 120.1 through 120.9 apply to newly constructed buildings. Section 141.0 specifies which requirements of Sections 120.1 through 120.9 also apply to additions or alterations to existing buildings.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, Public Resources Code.

SECTION 120.1 – REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

(a) General Requirements.

1. All occupiable spaces in high-rise residential buildings, hotel/motel buildings, and nonresidential buildings other than healthcare facilities shall comply with the applicable requirements of Section 120.1(a) through 120.1(g). Healthcare facilities shall be ventilated in accordance with Chapter 4 of the California Mechanical Code.
2. The required outdoor air-ventilation rate and the air-distribution system design shall be clearly identified on the plans in accordance with Section 10-103 of Title 24, Part 1.

(b) High-rise Residential Buildings.

Attached dwellings units shall comply with the requirements of subsections 1 and 2 below. Occupiable spaces other than attached dwelling units shall comply with the requirements of section 120.1(c).

1. Air Filtration.

A. System types specified in subsections i, ii, and iii shall be provided with air filters in accordance with Sections 120.1(b)1B through 1D. System types specified in subsection i shall also comply with Section 120.1(b)1E.

- i. Mechanical space conditioning systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length.
- ii. Mechanical supply-only ventilation systems that provide outside air to an occupiable space.
- iii. The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems and energy recovery ventilation systems that provide outside air to an occupiable space.

B. System Design and Installation.

- i. The system shall be designed to ensure that all recirculated air or outdoor air supplied to the occupiable space is filtered before passing through any system thermal conditioning components.

EXCEPTION to Section 120.1(b)1Bi: For heat recovery ventilators and energy recovery ventilators the location of the filters required by Section 120.1(b) may be downstream of a system thermal conditioning component, provided the system is equipped with ancillary filtration upstream of the system's thermal conditioning component.

- ii. All systems shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter(s). The design airflow rate, and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter shall be determined and reported on labels according to subsection iv below.

Systems specified in Section 120.1(b)1Ai shall be equipped with air filters that meet either subsection a or b below:

- a. Nominal two-inch minimum depth filter(s) shall be sized by the system designer; or
- b. Nominal one-inch minimum depth filters(s) shall be allowed if the filter(s) are sized according to Equation 120.1-A, based on a maximum face velocity of 150 ft per minute and according to the maximum allowable clean filter pressure drop specified in Section 120.1(b)1Dii

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

Where,

A_{face} = air filter face area, the product of air filter nominal length x nominal width, ft²

Q_{filter} = design airflow rate for the air filter, ft³/min

V_{face} = air filter face velocity ≤ 150 , ft/min

- iii. All system air filters shall be located and installed in such a manner as to be accessible for regular service by the system owner.
 - iv. All system air filter installation locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels shall be permanently affixed to the air filter installation location, readily legible, and visible to a person replacing the air filter.
- C. Air Filter Efficiency. The system shall be provided with air filter(s) having a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30-1.0 μm range and equal to or greater than 85 percent in the 1.0-3.0 μm range, when tested in accordance with AHRI Standard 680.
- D. Air Filter Pressure Drop. All systems shall be provided with air filter(s) that conform to the applicable maximum allowable clean-filter pressure drop specified by i, ii or iii below, when tested using ASHRAE Standard 52.2, or as rated using AHRI Standard 680, for the applicable design airflow rate(s) for the system air filter(s).
- i. The maximum allowable clean-filter pressure drop determined by the system design for the nominal two inch minimum depth air filter required by Section 120.1(b)1Biia; or
 - ii. A maximum of 25 PA (0.1 in. of water) clean-filter pressure drop shall be allowed for a nominal one-inch depth air filter sized according to Section 120.1(b)1Biib; or
 - iii. For system specified in 120.1(b)1Aii, and 120.1(b)1Aiii, the maximum allowable clean filter pressure drop determined by the system design.
- E. Air Filter Product Labeling. Systems described in 120.1(b)1Ai shall be equipped with air filters that have been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that demonstrate conformance with Sections 120.1(b)1.

EXCEPTION to Section 120.1(b)1: Evaporative coolers are not subject to the air filtration requirements of Section 120.1(b)1.

2. **Attached dwelling units.** All dwelling units shall meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings, subject to the amendments specified in subsection A below. All dwelling units shall comply with the Acceptance requirements specified in subsection B below.

A. Amendments to ASHRAE 62.2 requirements.

- i. Window operation is not a permissible method of providing the dwelling unit ventilation airflow specified in subsections iv or v below.
- ii. Continuous operation of central forced air system air handlers used in central fan integrated ventilation systems is not a permissible method of providing the dwelling unit ventilation airflow required in Section 4 of ASHRAE Standard 62.2.

EXCEPTION to Section 120.1(b)2Aii: The Energy Commission may approve continuous operation of central fan integrated ventilation systems pursuant to Section 10-109(h).

- iii. Air filtration shall conform to the specifications in Section 120.1(b)1. Compliance with ASHRAE 62.2 Sections 6.7 (Minimum Filtration) and 6.7.1 (Filter Pressure Drop) shall not be required.
- iv. Multifamily attached dwelling units shall comply with subsections a and b.
 - a. Mechanical ventilation airflow shall be provided at rates determined in accordance with Equation 120.1-B.

Total Required Ventilation Rate [ASHRAE 62.2.4.1.1]

$$Q_{\text{tot}} = 0.03A_{\text{floor}} + 7.5(N_{\text{br}} + 1) \quad (\text{Equation 120.1-B})$$

Where,

Q_{tot} = total required ventilation rate, cfm

A_{floor} = dwelling-unit floor area, ft²

N_{br} = number of bedrooms (not to be less than 1)

- b. The mechanical ventilation system shall comply with one of the following subsections 1 or 2 below. When subsection 2 is utilized for compliance, all dwelling units in the multifamily building shall use the same ventilation system type.
 1. A balanced mechanical ventilation system shall provide the required dwelling-unit ventilation airflow.
 2. Continuously operating supply ventilation systems or continuous operating exhaust ventilation systems shall be allowed to be used to provide the required dwelling unit ventilation airflow if the dwelling-unit envelope leakage is less than or equal to 0.3 cubic feet per minute at 50 Pa (0.2 in. of water) per ft² of dwelling unit envelope surface area as confirmed by field verification and diagnostic testing in accordance with Reference Nonresidential Appendix NA7.18.2.
- v. Multifamily building central ventilation systems that serve multiple dwelling-units shall be balanced to provide ventilation airflow to each dwelling-unit served at a rate equal to or greater than the rate specified by Equation 120.1-B, but not more than twenty percent greater than the specified rate. These systems shall utilize balancing means to ensure the dwelling unit airflows can be adjusted to meet this balancing requirement. These system balancing means may include but not be limited to constant air regulation devices, orifice plates, and variable speed central fans.
- vi. Kitchen range hoods shall be rated for sound in accordance with Section 7.2 of ASHRAE 62.2.
EXCEPTION to Section 120.1(b)2Avii: Kitchen range hoods may be rated for sound at a static pressure determined at working speed as specified in HVI 916 Section 7.2.
- vii. Compliance with ASHRAE 62.2 Section 6.5.2 (Space Conditioning System Ducts) shall not be required.
- viii. Compliance with ASHRAE 62.2 Section 4.4 (Control and Operation) shall require manual switches associated with dwelling unit ventilation systems to have a label clearly displaying the following text, or equivalent text: "This switch controls the indoor air quality ventilation for the home. Leave it on unless the outdoor air quality is very poor."

B. High-Rise Residential Dwelling Unit Acceptance.

- i. **Airflow Performance.** The dwelling-unit ventilation airflow required by Section 120.1(b)2Aiv or 120.1(b)2Av shall be confirmed through field verification and diagnostic testing in accordance with Reference Nonresidential Appendix NA7.18.1.
- ii. **Kitchen Range Hoods.** The installed kitchen range hood shall be field verified in accordance with Reference Nonresidential Appendix NA7.18.1 to confirm the model is rated by HVI to comply with the following requirements:
 - a. The minimum ventilation airflow rate as specified in Section 5 of ASHRAE 62.2.
 - b. The maximum sound rating as specified in Section 120.1(b)2Avi.

(c) **Nonresidential and Hotel/Motel Buildings.** All occupiable spaces shall meet the requirements of subsection 1 and either 2 or 3:

1. Air Filtration.

- A. Mechanical system types described in Section 120.1(b)1A shall be provided with air filters to clean the outside and return air prior to its introduction into occupied spaces.
- B. **Air Filter Efficiency.** The filters shall have a designated efficiency **equal to or greater than MERV 13** when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30-1.0 μm range, and equal to or greater than 85 percent in the 1.0-3.0 μm range when tested in accordance with AHRI Standard 680; and
- C. Systems shall be equipped with air filters that meet either subsection i or ii below.

- i. Nominal two inch minimum depth filter(s); or
 - ii. Nominal one inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 120.1-A, based on a maximum face velocity of 150 ft per minute.
2. **Natural Ventilation.** Naturally ventilated spaces shall be designed in accordance with 120.1(c)2A through 120.1(c)2C and include a mechanical ventilation system designed in accordance with 120.2(c)3:
- A. Floor area to be ventilated. Spaces or portions of spaces to be naturally ventilated shall be located within a distance based on the ceiling height, as specified in i, ii and iii. The ceiling height (H) to be used in i, ii or iii shall be the minimum ceiling height in the space, or for ceilings that are increasing in height as distance from the operable openings is increased, the ceiling height shall be determined as the average height of the ceiling within 20 ft from the operable opening. [ASHRAE 62.1:6.4.1]
 - i. Single Side Opening. For spaces with operable opening on one side of the space, the maximum distance from the operable opening shall be not more than 2H. [ASHRAE 62.1:6.4.1.1]
 - ii. Double Side Opening. For spaces with operable openings on two opposite sides of the space, the maximum distance from the operable opening shall be not more than 5H. [ASHRAE 62.1:6.4.1.2]
 - iii. Corner Opening. For spaces with operable openings on two adjacent sides of a space, the maximum distance from the operable openings shall be not more than 5H along a line drawn between the two openings that are the farthest apart. Floor area outside that line shall comply with i or ii. [ASHRAE 62.1:6.4.1.3]
 - iv. Ceiling Height. The ceiling height (h) to be used in Section 120.1(c)2Ai through 120.1(c)2Aiii shall be the minimum ceiling height in the space.

EXCEPTION to Section 120.1(c)2Aiv: For ceilings that are increasing in height as distance from the opening is increased, the ceiling height shall be determined as the average height of the ceiling within 20 feet from the operable openings. [ASHRAE 62.1:6.4.1.4]
 - B. Location and Size of Openings. Spaces or portions of spaces to be naturally ventilated shall be permanently open to operable wall openings directly to the outdoors. The openable area shall be not less than 4 percent of the net occupiable floor area. Where openings are covered with louvers or otherwise obstructed, the openable area shall be based on the net free unobstructed area through the opening. Where interior rooms, or portions of rooms, without direct openings to the outdoors are ventilated through adjoining rooms, the opening between rooms shall be permanently unobstructed and have a free area of not less than 8 percent of the area of the interior room or less than 25 square feet. [ASHRAE 62.1:6.4.2]
 - C. 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]

EXCEPTION 1 to Section 120.1(c)2: The mechanical ventilation system shall not be required where natural ventilation openings complying with 120.1(c)2 are either permanently open or have controls that prevent the openings from being closed during periods of expected occupancy.

EXCEPTION 2 to Section 120.1(c)2: The mechanical ventilation system shall not be required where the zone is not served by a space conditioning system.

3. **Mechanical Ventilation.** Occupiable spaces shall be ventilated with a mechanical ventilation system capable of providing an outdoor airflow rate (V_z) to the zone no less than the larger of A or B as described below:

- A. The outdoor airflow rate to the zone (V_z) shall be determined in accordance with Equation 120.1-F; or

$$V_z = R_a \times A_z \quad \text{(Equation 120.1-F)}$$

Where:

R_a = Outdoor airflow rate required per unit area as determined from Table 120.1-A.

A_z = Zone floor area is the net occupiable floor area of the ventilation zone in square feet. B.

For spaces designed for an expected number of occupants or spaces with fixed seating, the outdoor airflow rate to the zone (V_z) shall be determined in accordance with Equation 120.1-G;

$$V_z = R_p \times P_z \quad (\text{Equation 120.1-G})$$

Where:

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

P_z = The expected number of occupants. The expected number of occupants shall be the expected number specified by the building designer. For spaces with fixed seating, the expected number of occupants shall be determined in accordance with the California Building Code.

EXCEPTION to Section 120.1(c)3: Transfer air. The rate of outdoor air required by Section 120.1(c)3 may be provided with air transferred from other ventilated space if:

- A. Use of transfer air is in accordance with Section 120.1(g); and
 - B. The outdoor air that is supplied to all spaces combined, is sufficient to meet the requirements of Section 120.1(c)3 for each space individually.
4. Exhaust Ventilation. The design exhaust airflow shall be determined in accordance with the requirements in Table 120.1-B. Exhaust makeup air shall be permitted to be any combination of outdoor air, recirculated air, or transfer air. [ASHRAE 62.1:6.5.1]

(d) **Operation and Control Requirements for Minimum Quantities of Outdoor Air.**

1. **Times of occupancy.** The minimum rate of outdoor air required by Section 120.1(c) shall be supplied to each space at all times when the space is usually occupied.

EXCEPTION 1 to Section 120.1(d)1: Demand control ventilation. In intermittently occupied spaces that do not have processes or operations that generate dusts, fumes, mists, vapors or gasses and are not provided with local exhaust ventilation (such as indoor operation of internal combustion engines or areas designated for unvented food service preparation), the rate of outdoor air may be reduced if the ventilation system serving the space is controlled by a demand control ventilation device complying with Section 120.1(d)4 or by an occupant sensor ventilation control device complying with Section 120.1(d)5.

EXCEPTION 2 to Section 120.1(d)1: Temporary reduction. The rate of outdoor air provided to a space may be reduced below the level required by Section 120.1(c) for up to 30 minutes at a time if the average rate for each hour is equal to or greater than the required ventilation rate.

2. **Pre-occupancy.** The lesser of the minimum rate of outdoor air required by Section 120.1(c) or three complete air changes shall be supplied to the entire building during the 1-hour period immediately before the building is normally occupied.
3. **Required Demand Control Ventilation.** Demand ventilation controls complying with 120.1(d)4 are required for a space with a design occupant density, or a maximum occupant load factor for egress purposes in the CBC, greater than or equal to 25 people per 1000 square feet (40 square feet or less per person) if the system serving the space has one or more of the following:
 - A. an air economizer; or
 - B. modulating outside air control; or
 - C. design outdoor airflow rate > 3,000 cfm.

EXCEPTION 1 to Section 120.1(d)3: Where space exhaust is greater than the design ventilation rate specified in Section 120.1(c)3 minus 0.2 cfm per ft² of conditioned area.

EXCEPTION 2 to Section 120.1(d)3: Spaces that have processes or operations that generate dusts, fumes, mists, vapors, or gasses and are not provided with local exhaust ventilation, such as indoor operation of internal combustion engines or areas designated for unvented food service preparation, daycare sickrooms, science labs, barber shops or beauty and nail salons shall not install demand control ventilation.

EXCEPTION 3 to Section 120.1(d)3: Spaces with an area of less than 150 square feet, or a design occupancy of less than 10 people as specified by Section 120.1(c)3.

4. Demand Control Ventilation Devices.

- A. For each system with demand control ventilation (DCV), CO₂ sensors 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 ft² of floor space. When a zone or a 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 ft and 6 ft above the floor or at the anticipated height of the occupants' heads.
- C. Demand ventilation controls shall maintain CO₂ concentrations less than or equal to 600 ppm plus the outdoor air CO₂ concentration in all rooms with CO₂ sensors.
EXCEPTION to Section 120.1(d)4C: The outdoor air ventilation rate is not required to be larger than the design outdoor air ventilation rate required by Section 120.1(c)3 regardless of CO₂ concentration.
- D. Outdoor air CO₂ concentration shall be determined by one of the following:
 - i. CO₂ concentration shall be assumed to be 400 ppm without any direct measurement; or
 - ii. CO₂ concentration shall be dynamically measured using a CO₂ sensor located within 4 ft of the outdoor air intake.
- E. When the system is operating during hours of expected occupancy, the controls shall maintain system outdoor air ventilation rates no less than the rate listed in Table 120.1-A for DCV, times the conditioned floor area for spaces with CO₂ sensors, plus the rate required by Section 120.1(c)3 for other spaces served by the system, or the exhaust air rate whichever is greater.
- F. CO₂ sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1000 ppm concentration when measured at sea level and 25°C, factory calibrated, and certified by the manufacturer to require calibration no more frequently than once every 5 years. Upon detection of sensor failure, the system shall provide a signal which resets to supply the minimum quantity of outside air to levels required by Section 120.1(c)3 to the zone serviced by the sensor at all times that the zone is occupied.
- G. The CO₂ sensor(s) reading for each zone shall be displayed continuously, and shall be recorded on systems with DDC to the zone level.

5. Occupant Sensor Ventilation Control Devices. When occupancy sensor ventilation devices are required by Section 120.2(e)3, occupant sensors shall be used to reduce the rate of outdoor air flow when occupants are not present in accordance with the following:

- A. Occupant sensors shall meet the requirements in Section 110.9(b)4 and shall have suitable coverage and placement to detect occupants in the entire space ventilated. If occupant sensors controlling lighting are used for ventilation, the ventilation signal shall be independent of daylighting, manual lighting overrides or manual control of lighting. When a single zone damper or a single zone system serves multiple rooms, there shall be an occupancy sensor in each room and the zone is not considered vacant until all rooms in the zone are vacant.
- B. One hour prior to normal scheduled occupancy, the occupancy sensor ventilation control shall allow pre-occupancy purge as described in Section 120.1(d)2.

(e) Ducting for Zonal Heating and Cooling Units. Where a return plenum is used to distribute outdoor air to a zonal heating or cooling unit which then supplies the air to a space in order to meet the requirements of Section 120.1(c)3, the outdoor air shall be ducted to discharge either:

- 1. Within 5 feet of the unit; or
- 2. Within 15 feet of the unit, substantially toward the unit, and at a velocity not less than 500 feet per minute.

(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 to allow outside air rates to be operated at the larger of (1) the minimum levels specified in Section 120.1(c)3 or (2) the rate required for make-up 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 maintain measured outside air ventilation rates within 10 percent of the required 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. Measured outdoor air rates of constant volume mechanical ventilation and space-conditioning systems shall be within 10 percent of the required outside air rate.

(g) **Air Classification and Recirculation Limitations.** Air classification and recirculation limitations of air shall be based on the air classification as listed in Table 120.1-A or Table 120.1-C, and in accordance with the requirements of 120.1(g)1 through 4.

1. Class 1 Air. Recirculation or transfer of Class 1 air to any space shall be permitted; [ASHRAE 62.1:5.16.3.1]
2. Class 2 Air. Recirculation or transfer of Class 2 air shall be permitted in accordance with 120.1(g)A through 120.1(g)E:
 - A. Recirculation of Class 2 air within the space of origin shall be permitted [ASHRAE 62.1:5.16.3.2.1];
 - B. Recirculation or transfer of Class 2 to other Class 2 or Class 3 spaces shall be permitted, provided that the other spaces are used for the same or similar purpose or task and involve the same or similar pollutant sources as the Class 2 space [ASHRAE 62.1:5.16.3.2.2]; or
 - C. Transfer of Class 2 air to toilet rooms [ASHRAE 62.1:5.16.3.2.3]; or
 - D. Recirculation or transfer of Class 2 air to Class 4 spaces [ASHRAE 62.1:5.16.3.2.4]; or
 - E. Class 2 air shall not be recirculated or transferred to Class 1 spaces. [ASHRAE 62.1:5.16.3.2.5]

EXCEPTION to Section 120.1(g)2E: When using any energy recovery device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 2 air shall not exceed 10% of the outdoor air intake flow.

3. Class 3 Air. Recirculation or transfer of Class 3 air shall be permitted in accordance with 120.1(g)A and 120.1(g)B:
 - A. Recirculation of Class 3 air within the space of origin shall be permitted. [ASHRAE 62.1:5.16.3.3.1]
 - B. Class 3 air shall not be recirculated or transferred to any other space. [ASHRAE 62.1:5.16.3.3.2].

EXCEPTION to Section 120.1(g)3B: When using any energy recovery device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 3 air shall not exceed 5% of the outdoor air intake flow.

4. Class 4 Air. Class 4 air shall not be recirculated or transferred to any space or recirculated within the space of origin. [ASHRAE 62.1:5.16.3.4]
5. Ancillary spaces. Redesignation of Class 1 air to Class 2 air shall be permitted for Class 1 spaces that are ancillary to Class 2 spaces. [ASHRAE 62.1:5.16.2.3]
6. Transfer. A mixture of air that has been transferred through or returned from spaces or locations with different air classes shall be redesignated with the highest classification among the air classes mixed. [ASHRAE 62.1:5.16.2.2]
7. Classification. Air leaving each space or location shall be designated at an expected air-quality classification not less than that shown in Tables 120.1-A, 120.1-B or 120.1-C. Air leaving spaces or locations that are not listed in Tables 120.1-A, 120.1-B or 120.1-C shall be designated with the same classification as air from the most similar space or location listed in terms of occupant activities and building construction.

Table 120.1-A – Minimum Ventilation Rates

Occupancy Category	Area Outdoor Air Rate ¹ R _a	Min Air Rate for DCV ²	Air Class	Notes
	cfm/ft ²	cfm/ft ²		
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	
Computer lab	0.15		1	
Media center	0.15		1	A
Music/theater/dance	1.07	0.15	1	F
Multiuse assembly	0.50	0.15	1	F
Food and Beverage Service				
Restaurant dining rooms	0.50	0.15	2	
Cafeteria/fast-food dining	0.50	0.15	2	
Bars, cocktail lounges	0.50	0.20	2	
Kitchen (cooking)	0.15		2	
General				
Break rooms	0.50	0.15	1	F
Coffee Stations	0.50	0.15	1	F
Conference/meeting	0.50	0.15	1	F
Corridors	0.15		1	F
Occupiable storage rooms for liquids or gels	0.15		2	B
Hotels, Motels, Resorts, Dormitories				
Bedroom/living room	0.15		1	F
Barracks sleeping areas	0.15		1	F
Laundry rooms, central	0.15		2	
Laundry rooms within dwelling units	0.15		1	
Lobbies/pre-function	0.50	0.15	1	F
Multipurpose assembly	0.50		1	F

Table 120.1-A – Minimum Ventilation Rates [Continued]

Occupancy Category	Area Outdoor Air Rate R _a	Min Air Rate for DCV ^b	Air Class	Notes
	cfm/ft ²	cfm/ft ²		
Office Buildings				
Breakrooms	0.50	0.15	1	
Main entry lobbies	0.50	0.15	1	F
Occupiable storage rooms for dry materials	0.15		1	
Office space	0.15		1	F
Reception areas	0.15		1	F
Telephone/data entry	0.15		1	F
Miscellaneous Spaces				
Bank vaults/safe deposit	0.15		2	F
Banks or bank lobbies	0.15		1	F
Computer (not printing)	0.15		1	F
Freezer and refrigerated spaces (<50°F)	-		2	E
General manufacturing (excludes heavy industrial and process using chemicals)	0.15		3	
Pharmacy (prep. Area)	0.15		2	
Photo studios	0.15		1	
Shipping/receiving	0.15		2	B
Sorting, packing, light assembly	0.15		2	
Telephone closets	0.15		1	
Transportation waiting	0.50	0.15	1	F
Warehouses	0.15		2	B
All others	0.15		2	
Public Assembly Spaces				
Auditorium seating area	1.07	0.15	1	F
Places of religious worship	1.07	0.15	1	F
Courtrooms	0.19	0.15	1	F
Legislative chambers	0.19	0.15	1	F
Libraries (reading rooms and stack areas)	0.15		1	
Lobbies	0.50	0.15	1	F
Museums (children's)	0.25	0.15	1	
Museums/galleries	0.25	0.15	1	F

Table 120.1-A – Minimum Ventilation Rates [Continued]

Occupancy Category	Area Outdoor Air Rate R _a	Min Air Rate for DCV ^b	Air Class	Notes
	cfm/ft ²	cfm/ft ²		
Residential				
Common corridors	0.15		1	F
Retail				
Sales (except as below)	0.25	0.20	2	
Mall common areas	0.25	0.15	1	F
Barbershop	0.40		2	
Beauty and nail salons	0.40		2	
Pet shops (animal areas)	0.25	0.15	2	
Supermarket	0.25	0.20	1	F
Coin-operated laundries	0.30		2	
Sports and Entertainment				
Gym, sports arena (play area)	0.50	0.15	2	E
Spectator areas	0.50	0.15	1	F
Swimming (pool)	0.15		2	C
Swimming (deck)	0.50	0.15	2	C
Disco/dance floors	1.50	0.15	2	F
Health club/aerobics room	0.15		2	
Health club/weight rooms	0.15		2	
Bowling alley (seating)	1.07	0.15	1	
Gambling casinos	0.68	0.15	1	
Game arcades	0.68	0.15	1	
Stages, studios	0.50	0.15	1	D, F
General:				
¹ R _a was determined as being the larger of the area method and the default per person method. The occupant density used in the per person method was assumed to be one half of the maximum occupant load assumed for egress purposes in the CBC.				
² If this column specifies a minimum cfm/ft ² then it shall be used to comply with Section 120.1(d)4E.				
Specific Notes:				
A – For high-school and college libraries, the values shown for “Public Assembly Spaces – Libraries” shall be used.				
B – Rate may not be sufficient where stored materials include those having potentially harmful emissions.				
C – Rate does not allow for humidity control. “Deck area” refers to the area surrounding the pool that is capable of being wetted during pool use or when the pool is occupied. Deck area that is not expected to be wetted shall be designated as an occupancy category.				
D – Rate does not include special exhaust for stage effects such as dry ice vapors and smoke.				
E – Where combustion equipment is intended to be used on the playing surface or in the space, additional dilution ventilation, source control, or both shall be provided.				
F – Ventilation air for this occupancy category shall be permitted to be reduced to zero when the space is in occupied-standby mode				

Table 120.1-B – Minimum Exhaust Rates

[ASHRAE 62.1: TABLE 6.5]

Occupancy Category	Exhaust Rete, 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	
Darkrooms	-	1.00	2	
Educational science laboratories	-	1.00	2	
Janitor closets, trash rooms, recycling	-	1.00	3	
Kitchenettes	-	0.30	2	
Kitchens – commercial	-	0.70	2	
Locker rooms for athletic or industrial facilities	-	0.50	2	
All other locker rooms	-	0.25	2	
Shower rooms	20/50	-	2	G,H
Paint spray booths	-	-	4	F
Parking garages	-	0.75	2	C
Pet shops (animal areas)	-	0.90	2	
Refrigerating machinery rooms	-	-	3	F
Soiled laundry storage rooms	-	1.00	3	F
Storage rooms, chemical	-	1.50	4	F
Toilets – private	25/50	-	2	E
Toilets – public	50/70	-	2	D
Woodwork shop/classrooms	-	0.50	2	
Notes: A – Stands where engines are run shall have exhaust systems that directly connect to the engine exhaust and prevent escape of fumes. B – Where combustion equipment is intended to be used on the playing surface, additional dilution ventilation, source control, or both shall be provided. C – Exhaust shall not be required where two or more sides comprise walls that are at least 50% open to the outside. D – Rate is per water closet, urinal, or both. Provide the higher rate where periods of heavy use are expected to occur. The lower rate shall be permitted to be used otherwise. E – Rate is for a toilet room intended to be occupied by one person at a time. For continuous systems operation during hours of use, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used. F – See other applicable standards for exhaust rate. G – For continuous system operation, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used. H – Rate is per showerhead				

Table 120.1-C – Airstreams or Sources

[ASHRAE 62.1:Table 5.16.1]

Description	Air Class
Diazo printing equipment discharge	4
Commercial kitchen grease hoods	4
Commercial kitchen hoods other than grease	3
Laboratory hoods	4 ^a
Hydraulic elevator machine room	2
a. Air Class 4 unless determined otherwise by the Environmental Health and Safety professional responsible to the owner or to the owner's designee.	

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, Public Resources Code.

SECTION 120.2 – REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.2(a) through 120.2(k).

- (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 Energy Management Control System (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.

- (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 dead band of at least 5°F 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 120.2(b)4: Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants 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.

- (c) **Hotel/Motel Guest Room and High-rise Residential Dwelling Unit 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.

2. High-rise residential dwelling unit thermostats shall meet the requirements of Section 110.2(c).
- (d) **Heat Pump Controls.** All heat pumps with supplementary electric resistance heaters shall be installed with controls that comply with Section 110.2(b).
- (e) **Shut-off 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.

2. 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 setup 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 percent temperature determined in accordance with Section 140.4(b)3 is less than 100°F.

3. Occupancy Sensing Zone Controls. Space conditioning systems serving room(s) that are required to have occupant sensing controls in accordance with Section 130.1(c), and where the Table 120.1-A occupancy category permits ventilation air to be reduced to zero when the space is in occupied-standby mode, shall meet the following:
 - A. The zone shall be placed in occupied standby mode when all room(s) served by the zone are unoccupied for more than 5 minutes; and
 - B. During occupied standby mode.
 - i. Automatically setup the operating cooling temperature set point by 2°F or more and setback the operating heating temperature set point by 2°F or more; or
 - ii. For multiple zone systems with Direct Digital Controls (DDC) to the zone level, setup the operating cooling temperature setpoint by 0.5°F or more and setback the operating heating temperature setpoint by 0.5°F or more.
 - C. During occupied-standby mode, all airflow to the zone shall be shut off whenever the space temperature is between the active heating and cooling setpoints.

EXCEPTION 1 to Sections 120.2(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 Sections 120.2(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 Sections 120.2(e)1 and 2: Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

4. 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 setup at least +5°F (+3°C) in cooling mode and set-down at least -5°F (-3°C) in heating mode.

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

- (f) **Dampers for Air Supply and Exhaust Equipment.** Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close upon fan shutdown.

EXCEPTION 1 to Section 120.2(f): Equipment that serves an area that must operate continuously.

EXCEPTION 2 to Section 120.2(f): Gravity and other nonelectrical equipment that has readily accessible manual damper controls.

EXCEPTION 3 to Section 120.2(f): At combustion air intakes and shaft vents.

EXCEPTION 4 to Section 120.2(f): Where prohibited by other provisions of law.

- (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.
1. Each zone, or any combination of zones not exceeding 25,000 square feet, shall be a separate isolation area.
 2. Each isolation area shall be provided with isolation devices, such as valves or dampers that allow the supply of heating or cooling to be reduced or shut-off independently of other isolation areas.
 3. Each isolation area shall be controlled by a device meeting the requirements of Section 120.2(e)1.

EXCEPTION to Section 120.2(g): Zones designed to be conditioned continuously.

- (h) **Automatic Demand Shed Controls.** See Section 110.12 for requirements for Automatic Demand Shed Controls.

- (i) **Economizer Fault Detection and Diagnostics (FDD).** All newly installed air handlers with a mechanical cooling capacity greater than 54,000 Btu/hr and an installed air economizer shall include a stand-alone or integrated Fault Detection and Diagnostics (FDD) system in accordance with Subsections 120.2(i)1 through 120.2(i)8.

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 $\pm 2^\circ\text{F}$ 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:
 - A. Free cooling available;
 - B. Economizer enabled;
 - C. Compressor enabled;
 - D. Heating enabled, if the system is capable of heating; and
 - E. Mixed air low limit cycle active.
5. The unit controller shall allow manual initiation of each operating mode so that the operation 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 Energy Management Control System regularly monitored by facility personnel.
 - B. Annunciated locally on one or 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.
 - C. Reported to a fault management application which automatically provides notification of the fault to remote HVAC service provider.
7. The FDD system shall detect the following faults:
- A. Air temperature sensor failure/fault;
 - B. Not economizing when it should;
 - C. Economizing when it should not;
 - D. Damper not modulating; and
 - E. Excess outdoor air.
8. 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 120.2(i)8: FDD algorithms based in Direct Digital Control systems are not required to be certified to the Energy Commission.

- (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) and 120.2(h), 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 systems 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;
4. Readily allow operator removal of zones(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 non-critical zones upon receipt of a signal from a centralized contact or software point as described in Section 120.2(h).

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

- (k) **Optimum Start/Stop Controls.** Space conditioning systems with DDC to the zone level shall have optimum start/stop controls. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint, the outdoor air temperature, and the amount of time prior to scheduled occupancy. Mass radiant floor slab systems shall incorporate floor temperature onto the optimum start algorithm.

EXCEPTION to Section 120.2(k): Systems that must operate continuously.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, Public Resources Code