

**REVISION RECORD  
FOR THE STATE OF CALIFORNIA  
SUPPLEMENT**

**July 1, 2018**

**2016 Title 24, Part 4 California Mechanical Code**

**General Information:**

1. The date of this Supplement is for identification purposes only. See the History Note Appendix on the backside or accompanying page.
2. This supplement is issued by the California Building Standards Commission in order to provide new and/or replacement pages containing recently adopted provisions for California Code of Regulations, Title 24, Part 4, of the 2016 California Mechanical Code. Instructions are provided below.
3. Health and Safety Code Section 18938.5 establishes that only building standards in effect at the time of the application for a building permit may be applied to the project plans and construction. This rule applies to both adoptions of building standards for Title 24 by the California Building Standards Commission, and local adoptions and ordinances imposing building standards. The new building standards provided with the enclosed blue supplement pages must not be enforced before the effective date.
4. Not all code text on the enclosed blue supplement pages is a new building standard. New, amended, or repealed building standards are identified by margin symbols. An explanation of margin symbols is provided in the code before the Table of Contents.
5. You may wish to retain the superseded material with this revision record so that the prior wording of any section can be easily ascertained.

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**CALIFORNIA MECHANICAL CODE – MATRIX ADOPTION TABLE  
CHAPTER 1 – ADMINISTRATION**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the code user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt Entire Chapter																					
Adopt Entire Chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below	X		X	X	X			X	X	X	X	X	X								
Chapter/Section																					
<i>Division I – California Administration</i>																					
1.1.0	X		X	X	X			X	X	X	X	X	X								
1.1.1	X		X	X	X			X	X	X	X	X	X								
1.1.2	X		X	X	X			X	X	X	X	X	X								
1.1.3	X		X	X	X			X	X	X	X	X	X								
1.1.3.1	X		X	X	X			X	X	X	X	X	X								
1.1.3.2	X		X	X	X			X	X	X	X	X	X								
1.1.4	X		X	X	X			X	X	X	X	X	X								
1.1.5	X		X	X	X			X	X	X	X	X	X								
1.1.6	X		X	X	X			X	X	X	X	X	X								
1.1.7	X		X	X	X			X	X	X	X	X	X								
1.1.7.1	X		X	X	X			X	X												
1.1.7.2	X		X	X	X			X	X												
1.1.7.3	X		X	X	X			X	X												
1.1.8	X		X	X	X			X	X	X	X	X	X								
1.1.9	X		X	X	X			X	X	X	X	X	X								
1.1.10	X		X	X	X			X	X	X	X	X	X								
1.1.11	X		X	X	X			X	X	X	X	X	X								
1.1.12	X		X	X	X			X	X	X	X	X	X								
1.2.0 – 1.2.3	X																				
1.8.0 – 1.8.10				X	X																
1.9.0								X	X												
1.9.1							X														
1.9.2								X	X												
1.9.2.1								X													
1.9.2.2								X													
1.9.2.3									X												
1.9.2.4									X												
1.10.1										X											
1.10.2											X										
1.10.3												X									
1.10.4													X								
1.11.0			X																		
Division II – Administration																					
101.0 – 104.1										X	X	X	X								
104.2 (Items 1 – 5)				X	X																
104.3 – 107.0										X	X	X	X								

*This state agency does not adopt sections identified with the following symbol: †*

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*





**CALIFORNIA MECHANICAL CODE – MATRIX ADOPTION TABLE  
CHAPTER 2 – DEFINITIONS**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the code user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt Entire Chapter																					
Adopt Entire Chapter as amended (amended sections listed below)	X		X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below																					
Article/Section																					
203.0			X	X	X					X	X	X	X								
204.0			X	X	X					X	X	X	X								
206.0				X	X																
207.0			X	X	X					X	X	X	X								
208.0			X	X				X	X												
209.0	X		X				X	X	X	X	X	X	X								
210.0										X	X	X	X								
214.0			X	X	X																
215.0			X																		
216.0				X	X																
217.0			X	X	X					X	X	X	X								
218.0				X	X																
222.0				X	X																
223.0			X	X	X					X	X	X	X								

|| This state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.



**CALIFORNIA MECHANICAL CODE – MATRIX ADOPTION TABLE  
CHAPTER 3 – GENERAL REGULATIONS**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the code user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt Entire Chapter	X																				
Adopt Entire Chapter as amended (amended sections listed below)			X	X	X			X	X	X	X	X	X								
Adopt only those sections that are listed below																					
Chapter/Section																					
303.2, Exception										X	X	X	X								
303.7			X					X	X												
303.7.1				X	X																
318.0										X	X		X								
319.1								x		X			X								
319.2											X		X								
320.1										X			X								
320.2											X		X								
320.3												X									
320.4										X			X								
320.5										X	X		X								
321.0										X	X	X	X								
322.0										X	X	X	X								
322.1										X	X	X	X								

*This state agency does not adopt sections identified with the following symbol: †*

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



- » **316.7.2 Exterior Walls.** In exterior walls, annular space between sleeves and pipes or tubing shall be sealed and made watertight, as approved by the Authority Having Jurisdiction. A penetration through fire-resistive construction shall be in accordance with Section 316.5.
- » **316.8 Firewalls.** A pipe sleeve through a firewall shall have the space around the pipe or tubing completely sealed with an approved fire-resistive material in accordance with other codes.
- » **316.9 Structural Members.** A structural member weakened or impaired by cutting, notching, or otherwise shall be reinforced, repaired, or replaced so as to be left in a safe structural condition in accordance with the requirements of the building code.
- » **316.10 Rodentproofing.** Mechanical system shall be constructed in such a manner as to restrict rodents or vermin from entering a building by following the ductwork from the outside into the building.
- » **316.11 Metal Collars.** In or on buildings where openings have been made in walls, floors, or ceilings for the passage of ductwork or pipes, such openings shall be closed and protected by the installation of approved metal collars securely fastened to the adjoining structure.
- 317.0 Trenching, Excavation, and Backfill.**
- » **317.1 Trenches.** Trenches deeper than the footings of a building or structure, and paralleling the same, shall be located not less than 45 degrees (0.79 rad) from the bottom exterior edge of the footing, or as approved in accordance with Section 302.0.
- » **317.2 Tunneling and Driving.** Tunneling and driving shall be permitted to be done in yards, courts, or driveways of a building site. Where sufficient depth is available to permit, tunnels shall be permitted to be used between open-cut trenches. Tunnels shall have a clear height of 2 feet (610 mm) above the pipe and shall be limited in length to one-half the depth of the trench, with a maximum length of 8 feet (2438 mm). Where pipes are driven, the drive pipe shall be not less than one size larger than the pipe to be laid.
- 317.3 Open Trenches.** Excavations required to be made for the installation of a mechanical system or part thereof, within the walls of a building, shall be open trench work and shall be kept open until it has been inspected, tested, and accepted.
- » **317.4 Excavations.** Excavations shall be completely backfilled as soon after inspection as practicable. Precaution shall be taken to ensure compactness of backfill around piping without damage to such piping. Trenches shall be backfilled in thin layers to 12 inches (305 mm) above the top of the piping with clean earth, which shall not contain stones, boulders, cinderfill, frozen earth, construction debris, or other materials that will damage or break the piping or cause corrosive action. Mechanical devices such as bulldozers, graders, etc., shall be permitted to then be used to complete backfill to grade. Fill shall be properly compacted. Precautions shall be taken to ensure permanent stability for pipe laid in filled or made ground.

### 318.0 Scope.

**318.1 Applicability.** This part is applicable to health facilities regulated by OSHPD (See Adoption Tables for application for specific sections).

**Note:** This section has no corresponding provisions in the UMC. For the scope and authority of each state agency, refer to Chapter 1.

**318.2 Services/Systems and Utilities.** Refer to Section 1224.4.1 of the California Building Code.

### 319.0 Steam and Hot-Water Systems.

**319.1 Requirements for Hospitals and Optional Services Provided in Correctional Treatment Centers. [OSHPD 1 & 4]**

**319.1.1** Boilers shall have the capacity, based upon the rest ratings published by the Hydronics Institute or another acceptable national standard to supply the normal operating requirements of all connected systems and equipment.

**319.1.2** A minimum of two boilers shall be provided. The arrangement of boilers shall be based on the capacity and capability of a boiler or boilers to operate all systems during-periods of breakdown or maintenance of any one boiler.

**319.1.3** Boiler systems providing space heating shall be designed to maintain a minimum temperature of 60°F (15.6°C) in general patient areas and the temperatures specified in Table 4-A for sensitive areas during periods of breakdown or maintenance of any one boiler.

**319.1.4** Boiler feed pumps, condensate return pumps, fuel oil pumps, and heating circulating pumps shall be connected and installed to provide standby service in the event of pump failure. Installation of duplex pumps or provision of a spare pump will meet this requirement.

**319.1.5** At least two sources of heat (e.g. two pieces of equipment) shall be provided for supplying essential services such as sterilizers, hot water for dishwashing, and domestic hot water for minimum patient service, such as handwashing and baths. Booster heaters for dishwashing providing 125°F to 180°F (52°C to 82°C) water may be counted as the second source of heat for that service.

**319.2 Requirements for Skilled Nursing, Intermediate Care Facilities and Basic Services Provided in Correctional Treatment Centers. [For OSHPD 2 & 4]**

**319.2.1** Boilers, if provided, shall accommodate Section 319.1.

**319.2.2** Two or more interconnected water heaters are an acceptable means to provide two sources of heat for hot water (See Section 319.1.5).

### 320.0 Air Conditioning and Heating Systems.

**320.1 Requirements for Hospitals and Optional Services Provided in Correctional Treatment Centers. [OSHPD 1 & 4]**

**320.1.1** The systems shall be designed to provide the temperatures and relative humidity for sensitive areas or rooms shown in Table 4-A. When outdoor humidity and

internal moisture sources are not sufficient to meet the requirements of sensitive areas or rooms in Table 4-A, humidification shall be provided by means of the health-care facility air-handling systems. Temperature shall be individually controlled for each operating and delivery room. Burn unit patient rooms that require humidifiers to comply with the requirements of sensitive areas or rooms in Table 4-A shall be provided with individual humidity control. All humidifiers shall use dry steam. Humidifiers shall be located within air handling systems or ductwork to avoid moisture accumulation in downstream components, including filters and insulation.

**320.1.2** Heating systems shall be designed based on the "Heating DB 99.6%" column of the Climatic Design Data in ASHRAE Handbook-Fundamentals. The systems shall be thermostatically controlled with appropriate zoning to achieve the above conditions.

**320.1.3** Cooling systems shall be designed based on the 0.4% columns of the four Annual Design Conditions titled Cooling, Evaporation, Dehumidification, and Enthalpy shown by the Climate Design Data in ASHRAE Handbook-Fundamentals. The systems shall be thermostatically controlled with appropriate zoning to achieve the above conditions.

**320.2 Requirements for Skilled Nursing, Intermediate Care Facilities and Basic Services Provided in Correctional Treatment Centers. [For OSHPD 2 & 4]**

**320.2.1** Systems shall accommodate the provisions of Sections 320.1.2 through 320.1.3.

**320.2.2** Where air conditioning is provided, the system shall be thermostatically controlled in one or more zones.

**320.3 Requirements for Outpatient Facilities and Licensed Clinics. [For OSHPD 3]**

**320.3.1** The system shall be designed to provide the temperature and humidity's for sensitive areas for rooms shown in Table 4-A.

**320.4 Telephone and Data Equipment Rooms. [OSHPD 1 & 4]** Where telecommunications service entrance rooms, technology equipment centers, or technology distribution rooms are provided in accordance with Section 1224.5 of the California Building Code, the following requirements shall apply:

**320.4.1** Power for HVAC systems serving the room(s) shall be supplied by the Equipment Branch pursuant to the California Electrical Code. Where redundant systems are provided, only one shall be required to be supplied by the Equipment Branch.

**320.4.2** Mechanical equipment or fixtures that are not directly related to the support of the room shall not be installed in or pass through the room.

**Exception:** Unrelated ductwork may be installed and shall be not less than 10 feet (3048 mm) above the finished floor.

**320.4.3** HVAC systems shall be provided to maintain environmental conditions recommended in ASHRAE's Thermal Guidelines for Data Processing Environment and the requirements of the specific equipment installed.

**320.5 Psychiatric Services. [OSHPD 1, 2, & 4]** For projects associated with provision of psychiatric services in acute

psychiatric hospitals, general acute-care hospitals, and special treatment program service units in skilled nursing facilities, psychiatric, seclusion, and holding-patient rooms shall be designed with security diffusers, grilles, and registers.

**321.0 Essential Mechanical Provisions. [OSHPD 1, 2, 3 (Surgical Clinics only) & 4]** During periods of power outages essential electrical power shall be provided for the following equipment:

**321.1** (Does not apply to OSHPD 3 surgical clinic.) All heating equipment necessary to maintain a minimum temperature of 60°F (15.6°) in patient areas which are not specified in Section 322.0.

**321.2** All heating equipment necessary to maintain the minimum temperatures listed in Table 4-A for sensitive areas specified in Section 322.0.

**321.3** Equipment necessary for humidification of the areas listed in Section 322.0.

**321.4** All supply, return, and exhaust fans required to maintain the positive and negative air balances as required in Table 4-A.

**321.5** All control components and control systems necessary for the normal operation of equipment required to have essential electrical power.

**321.6** Alarms for airborne infection isolation rooms and protective environment rooms.

**322.0 Sensitive Areas or Rooms. [OSHPD 1, 2, 3 (Surgical Clinics) & 4]** The following are sensitive areas or rooms:

- (1) Operating room, hybrid operation room
- (2) Cystoscopy
- (3) Cardiac catheterization lab
- (4) Trauma/cardiac room
- (5) Delivery room, cesarean operating room
- (6) Gastrointestinal endoscopy procedure room
- (7) Post-anesthesia care unit
- (8) Newborn nursery
- (9) Newborn intensive-care nursery unit
- (10) Intensive care
- (11) Burn unit

**322.1** The following conditions shall be met for sensitive areas or rooms:

- (1) Thermostats and humidistats shall be either locally resettable and of the non-locking type or remotely resettable and of the locking type.
- (2) Systems shall be capable of maintaining the rooms within the temperature range in Table 4-A during normal operation. Lower or higher temperature shall be permitted when patients' comfort and/or medical conditions require those conditions.
- (3) The humidity ranges listed in Table 4-A are the minimum and maximum limits where control is specifically needed.
- (4) Types of intensive care service spaces are listed in the California Building Code.

**CALIFORNIA MECHANICAL CODE – MATRIX ADOPTION TABLE  
CHAPTER 4 – VENTILATION AIR**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the code user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt Entire Chapter																					
Adopt Entire Chapter as amended (amended sections listed below)	X		X	X	X			X	X												
Adopt only those sections that are listed below											X	X	X	X							
Chapter/Section																					
401.0			X								X	X	X	X							
402.0											X	X	X	X							
402.1	X							X	X	X	X	X	X								
402.5				X	X																
403.0											X	X	X	X							
403.7.2.1 – 403.7.2.4			X	X	X																
405.0											X	X	X	X							
407.0											X	X	X	X							
408.0											X	X	X	X							
409.0											X	X	X	X							
410.0											X	X	X	X							
411.0											X	X	X	X							
412.0											X	X	X	X							
413.0											X	X	X	X							
414.0											X	X	X	X							
415.0											X	X	X	X							
416.0											X	X	X	X							
416.3														X							
417.0											X	X	X	X							
418.0											X	X	X	X							
Table 4-A											X	X	X	X							
Table 4-B											X		X								
Table 4-C												X		X							
Table 402.1	X							X	X												
Table 403.7 Note 10 & 11				X	X																

*This state agency does not adopt sections identified with the following symbol: †*

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*





# CHAPTER 4

## VENTILATION AIR

### 401.0 General.

**401.1 Applicability.** This chapter contains requirements for ventilation air supply, exhaust, and makeup air requirements for occupiable spaces within a building. *[OSHPD 1, 2, 3 & 4] See Sections 404.0 through 418.0. [SFM] Air filters shall comply with all requirements of Part 12, Title 24, Chapter 12-71, SFM Standard 12-71-1.*

**402.0 Ventilation Air.** *[Not permitted for OSHPD 1, 2, 3 & 4]*

**402.1 Occupiable Spaces.** Occupiable spaces listed in Table 402.1 shall be designed to have ventilation (outdoor) air for occupants in accordance with this chapter. *Ventilation air supply requirements for occupancies regulated by the California Energy Commission are found in the California Energy Code.*

**402.1.1 Construction Documents.** The outdoor air ventilation rate and air distribution assumptions made in the design of the ventilation system shall be clearly identified on the construction documents.

**402.1.2 Dwelling.** Requirements for ventilation air rate for single-family dwellings shall be in accordance with this chapter or ASHRAE 62.2.

**402.1.3 Ventilation in Health Care Facilities.** Mechanical ventilation for health care facilities shall be designed and installed in accordance with this code and ASHRAE 170-2013, through Addendum ae, as published with "Guidelines for Design and Construction of Hospitals and Outpatient Facilities," 2014 edition (published by The Facility Guidelines Institute). All supply-air, return air, and exhaust-air systems shall comply with ASHRAE 170. The text of ASHRAE 170 shall be modified as follows:

- (1) ASHRAE 170. Section 6.1.2.1 -- Not adopted.
- (2) ASHRAE 170. Section 6.3.2 -- Not adopted.
- (3) ASHRAE 170. Table 6.4 - Not adopted.
- (4) ASHRAE 170. Section 6.4-6.4.4 -- Not adopted.
- (5) ASHRAE 170. Section 6.9 -- Not adopted.
- (6) ASHRAE 170. Section 7.1a -- Modify as follows:  
Replace reference to Table 7.1 with reference to Table 4-A.
- (7) ASHRAE 170. Section 7.2.1a through e -- Not adopted.
- (8) ASHRAE 170. Section 7.2.2 a through c, and e -- Not adopted
- (9) ASHRAE 170. Section 7.2.3 -- Not adopted.
- (10) ASHRAE 170. Section 7.3.1 -- Modify as follows:  
Replace reference to Table 7.1 with reference to Table 4-A.
- (11) ASHRAE 170. Section 7.4.1 -- Modify as follows:  
Delete the Exception that allows for high return grilles.

**402.2 Natural Ventilation.** Natural ventilation systems shall be designed in accordance with this section and shall include mechanical ventilation systems designed in accordance with Section 403.0, Section 404.0, or both.

#### Exceptions:

- (1) An engineered natural ventilation system where approved by the Authority Having Jurisdiction need not comply with Section 402.2.
- (2) A mechanical ventilation system is not required where natural ventilation openings comply with the requirements of Section 402.2 and are permanently open or have controls that prevent the openings from being closed during occupancy.
- (3) A mechanical ventilation system is not required where the zone is not served by heating or cooling equipment. [ASHRAE 62.1:6.4]

**402.2.1 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, in accordance with Section 402.2.1.1, Section 402.2.1.2, or Section 402.2.1.3, from operable wall openings in accordance with Section 402.2.2. For spaces with ceilings which are not parallel to the floor, the ceiling height shall be determined in accordance with Section 402.2.1.4. [ASHRAE 62.1:6.4.1]

**402.2.1.1 Single Side Opening.** For spaces with operable openings on one side of the space, the distance from the operable openings shall be not more than  $2H$ , where  $H$  is the ceiling height. [ASHRAE 62.1:6.4.1.1]

**402.2.1.2 Double Side Opening.** For spaces with operable openings on two opposite sides of the space, the distance from the operable openings shall be not more than  $5H$ , where  $H$  is the ceiling height. [ASHRAE 62.1:6.4.1.2]

**402.2.1.3 Corner Openings.** For spaces with operable openings on two adjacent sides of a space, such as two sides of a corner, the distance from the operable openings shall be not more than  $5H$  along a line drawn between the two openings that are farthest apart. Floor area outside that line shall comply with Section 402.2.1.1. [ASHRAE 62.1:6.4.1.3]

**402.2.1.4 Ceiling Height.** The ceiling height,  $H$ , to be used in Section 402.2.1.1 through Section 402.2.1.3 shall be the minimum ceiling height in the space.

**Exception:** For ceilings that are increasing in height as distance from the openings is increased, the ceiling height shall be determined as the average height of the ceiling within 20 feet (6096 mm) from the operable openings. [ASHRAE 62.1:6.4.1.4]

» **402.2.2 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 of which is a minimum of 4 percent of the net occupiable floor area. Where openings are covered with louvers or otherwise obstructed, 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 shall have a free area of not less than 8 percent of the area of the interior room nor less than 25 square feet (2.3 m<sup>2</sup>). [ASHRAE 62.1:6.4.2]

» **402.2.3 Control and Accessibility.** The means to open required operable openings shall be readily accessible to building occupants where the space is occupied. Controls shall be designed to coordinate operation of the natural and mechanical ventilation systems. [ASHRAE 62.1:6.4.3]

**402.3 Mechanical Ventilation.** Where natural ventilation is not permitted by this section or the building code, mechanical ventilation systems shall be designed, constructed, and installed to provide a method of supply air and exhaust air. Mechanical ventilation systems shall include controls, manual or automatic, that enable the fan system to operate wherever the spaces served are occupied. The system shall be designed to maintain minimum outdoor airflow as required by Section 403.0 under any load conditions.

**402.4 Outdoor Air Intake Protection.** Required outdoor-air intakes shall be covered with a screen having not less than ¼ of an inch (6.4 mm) openings, and shall have not more than ½ of an inch (12.7 mm) openings.

**402.4.1 Weather Protections.** Outdoor air intakes that are part of the mechanical ventilation system shall be designed to manage rain entrainment, to prevent rain intrusion, and manage water from snow in accordance with ASHRAE 62.1.

**402.5 Bathroom Exhaust Fans.** [HCD 1 & HCD 2] Each bathroom shall be mechanically ventilated in accordance with Division 4.5 of the California Green Building Standards Code (CALGreen).

**403.0 Ventilation Rates.** [Not permitted for OSHPD 1, 2, 3 & 4]

**403.1 General.** The design outdoor air intake flow rate for a ventilation system shall be determined in accordance with Section 403.2 through Section 403.9.4.

**403.2 Zone Calculations.** Ventilation zone parameters shall be determined in accordance with Section 403.2.1 through Section 403.2.3 for each ventilation zone served by the ventilation system. [ASHRAE 62.1:6.2.2]

**403.2.1 Breathing Zone Outdoor Airflow.** The outdoor airflow required in the breathing zone of the occupiable space or spaces in a ventilation zone, i.e., the breathing

zone outdoor airflow ( $V_{bz}$ ), shall be not less than the value determined in accordance with Equation 403.2.1.

$$V_{bz} = R_p \cdot P_z + R_a \cdot A_z \quad \text{(Equation 403.2.1)}$$

Where:

$A_z$  = zone floor area: the net occupiable floor area of the ventilation zone, square feet (m<sup>2</sup>).

$P_z$  = zone population: The number of people in the ventilation zone during typical usage.

$R_p$  = outdoor airflow rate required per person as determined from Table 402.1.

$R_a$  = outdoor airflow rate required per unit area as determined from Table 402.1. [ASHRAE 62.1:6.2.2.1]

**403.2.2 Zone Air Distribution Effectiveness.** The zone air distribution effectiveness ( $E_z$ ) shall be not greater than the default value determined in accordance with Table 403.2.2. [ASHRAE 62.1:6.2.2.2]

**403.2.3 Zone Outdoor Airflow.** The zone outdoor airflow ( $V_{Oz}$ ), i.e., the outdoor airflow rate that shall be provided to the ventilation zone by the supply air distribution system, shall be determined in accordance with Equation 403.2.3. [ASHRAE 62.1:6.2.2.3]

$$V_{Oz} = V_{bz} / E_z \quad \text{(Equation 403.2.3)}$$

**403.3 Single-Zone Systems.** For ventilation systems where one or more air handlers supply a mixture of outdoor air and recirculated air to only one ventilation zone, the outdoor air intake flow ( $V_{Ot}$ ) shall be determined in accordance with Equation 403.3. [ASHRAE 62.1:6.2.3]

$$V_{Ot} = V_{Oz} \quad \text{(Equation 403.3)}$$

**403.4 One Hundred Percent Outdoor Air Systems.** For ventilation systems where one or more air handlers supply only outdoor air to one or more ventilation zones, the outdoor air intake flow ( $V_{Ot}$ ) shall be determined in accordance with Equation 403.4. [ASHRAE 62.1:6.2.4]

$$V_{Ot} = \sum \text{all zones } V_{Oz} \quad \text{(Equation 403.4)}$$

**403.5 Multiple-Zone Recirculating Systems.** For ventilation systems where one or more air handlers supply a mixture of outdoor air and recirculated air to more than one ventilation zone, the outdoor air intake flow ( $V_{Ot}$ ) shall be determined in accordance with Section 403.5.1 through Section 403.5.4. [ASHRAE 62.1:6.2.5]

**403.5.1 Primary Outdoor Air Fraction.** The primary outdoor air fraction ( $Z_{pz}$ ) shall be determined for ventilation zones in accordance with Equation 403.5.1. [ASHRAE 62.1:6.2.5.1]

$$Z_{pz} = V_{oz}/V_{pz} \quad \text{(Equation 403.5.1)}$$

Where:

$V_{pz}$  is the zone primary airflow, i.e., the primary airflow rate to the ventilation zone from the air handler, including outdoor air and recirculated air. [ASHRAE 62.1:6.2.5.1]

**403.5.2 System Ventilation Efficiency.** The system ventilation efficiency ( $E_v$ ) shall be determined in accordance with Table 403.5.2 or Section 404.0. [ASHRAE 62.1:6.2.5.2]

**403.5.3 Uncorrected Outdoor Air Intake.** The uncorrected outdoor air intake ( $V_{ou}$ ) flow shall be determined in accordance with Equation 403.5.3(1). [ASHRAE 62.1:6.2.5.3]

$$V_{ou} = D \sum \text{all zones } (R_p \cdot P_z) + \sum \text{all zones } (R_a \cdot A_z) \quad \text{[Equation 403.5.3(1)]}$$

The occupant diversity ratio ( $D$ ) shall be determined in accordance with Equation 403.5.3(2) to account for variations in population within the ventilation zones served by the system.

$$D = P_s / \sum \text{all zones } P_z \quad \text{[Equation 403.5.3(2)]}$$

Where the system population ( $P_s$ ) is the total population in the area served by the system.

**Exception:** Alternative methods to account for occupant diversity shall be permitted, provided that the resulting ( $V_{ou}$ ) value is not less than that determined in accordance with Equation 403.5.3(1). [ASHRAE 62.1:6.2.5.3.1]

**403.5.4 Outdoor Air Intake.** The design outdoor air intake flow ( $V_{ot}$ ) shall be determined in accordance with Equation 403.5.4. [ASHRAE 62.1:6.2.5.4]

$$V_{ot} = V_{ou}/E_v \quad \text{(Equation 403.5.4)}$$

**403.6 Design for Varying Operating Conditions.** Ventilation systems shall be designed to be capable of providing not less than the minimum ventilation rates required in the breathing zone where the zones served by the system are occupied, including all full and part-load conditions. The minimum outdoor air intake flow shall be permitted to be less than the design value at part-load conditions. [ASHRAE 62.1:6.2.6.1]

**403.6.1 Short-Term Conditions.** Where it is known that peak occupancy will be of short duration or the ventilation will be varied or interrupted for a short period of time, the design shall be permitted to be based on the average conditions over a time period ( $T$ ) determined in accordance with Equation 403.6.1.

$$T = 3v/V_{bz} \quad \text{(Equation 403.6.1)}$$

Where:

$T$  = averaging time period, minutes.

$v$  = the volume of the ventilation zone for which averaging is being applied, cubic foot ( $m^3$ ).

$V_{bz}$  = the breathing zone outdoor airflow determined in accordance with Equation 403.2.1 and design value of the zone population ( $P_z$ ), cubic foot per minute (cfm) ( $m^3/\text{min}$ ).

Acceptable design adjustments based on this optional provision shall be in accordance with the following:

- (1) Zones with fluctuating occupancy: The zone population ( $P_z$ ) shall be permitted to be averaged over time ( $T$ ).
- (2) Zones with intermittent interruption of supply air: The average outdoor airflow supplied to the breathing zone over time ( $T$ ) shall be not less than the breathing zone outdoor airflow ( $V_{bz}$ ) calculated using Equation 403.2.1.
- (3) Systems with intermittent closure of the outdoor air intake: The average outdoor air intake over time ( $T$ ) shall be not less than the minimum outdoor air intake ( $V_{ot}$ ) calculated using Equation 403.3, Equation 403.4, or Equation 403.5.4. [ASHRAE 62.1:6.2.6.2]

**403.7 Exhaust Ventilation.** Exhaust airflow shall be provided in accordance with the requirements in Table 403.7. Exhaust makeup air shall be permitted to be a combination of outdoor air, recirculated air, and transfer air.

**403.7.1 Parking Garages.** Exhaust rate for parking garages shall be in accordance with Table 403.7. Exhaust rate shall not be required for enclosed parking garages having a floor area of 1000 square feet ( $92.9 m^2$ ) or less and used for the storage of 5 or less vehicles.

**403.7.2 Enclosed Parking Garages.** Mechanical ventilation systems for enclosed parking garages shall operate continuously.

**Exceptions:**

- (1) Mechanical ventilation systems shall be permitted to operate intermittently where the system is designed to operate automatically upon detection of vehicle operation or the presence of occupants by approved automatic detection devices.
- (2) Approved automatic carbon monoxide sensing devices shall be permitted to be employed to modulate the ventilation system to not exceed a maximum average concentration of carbon monoxide of 50 parts per million during an eight-hour period, with a concentration of not more than 200 parts per million for a period not exceeding one hour. Automatic carbon monoxide sensing devices installed to modulated parking garage ventilation systems shall be approved in accordance with Section 301.2.

**403.7.2.1 Alternative Exhaust Ventilation for Enclosed Parking Garages.**

**403.7.2.2 Minimum Exhaust Rate.** [HCD 1 & 2] In lieu of the exhaust rates in Table 403.7, ventilation systems shall be capable of providing 14,000 cfm

(6608 L/s) of exhaust air for each operating vehicle. Number of operating vehicles shall be determined based on 2.5 percent of all parking spaces (and not less than one vehicle).

**403.7.2.3 Exhaust Inlet Distribution. [HCD 1 & 2]**  
 To ensure proper exhaust of contaminated air and fumes from parking garages, exhaust systems utilizing multiple exhaust inlets shall be designed so that exhaust inlets are distributed in such a manner that no portion of the parking garage is more than 50 feet (15 240 mm) from an exhaust inlet. Such exhaust inlets shall be installed so that the highest elevation of the exhaust inlet is no greater than 12 inches (305 mm) below the lowest ceiling level.

**Exception:** Garage exhaust systems designed without distributed exhaust inlets may have their exhaust inlets designed based on the principles of engineering and mechanics and shall provide the minimum required exhaust rate in Table 403.7.

**403.7.2.4 Exhaust System Operation. [HCD 1 & 2]**  
 Exhaust systems shall operate continuously unless one of the exceptions to continuous operation of Section 403.7 is utilized.

**403.8 Dynamic Reset.** The system shall be permitted to be designed to reset the outdoor air intake flow ( $V_{ot}$ ), the space or ventilation zone airflow ( $V_{oz}$ ) as operating conditions change. [ASHRAE 62.1:6.2.7]

**403.9 Air Classification and Recirculation.** Air shall be classified, and the recirculation or transfer shall be limited in accordance with Section 403.9.1 through Section 403.9.4. [ASHRAE 62.1:5.16] Recirculated air shall not be taken from prohibited locations in accordance with Section 311.3.

**403.9.1 Class 1 Air.** Recirculation or transfer of Class 1 air to other spaces shall be permitted. [ASHRAE 62.1:5.16.3.1]

**403.9.2 Class 2 Air.** Recirculation of Class 2 air within the space of origin shall be permitted. Recirculation or transfer of Class 2 air to other Class 2 or Class 3 spaces shall be permitted, provided 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. Transfer of Class 2 air to toilet rooms shall be permitted. Recirculation or transfer of Class 2 air to Class 4 spaces shall be permitted. Class 2 air shall not be recirculated or transferred to Class 1 spaces. Where using an energy recover device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device shall be permitted and the recirculated Class 2 air shall not exceed 10 percent of the outdoor air intake flow. [ASHRAE 62.1:5.16.3.2]

**403.9.3 Class 3 Air.** Recirculation of Class 3 air within the space of origin shall be permitted. Class 3 air shall not be recirculated or transferred to other spaces. Where using an energy recover device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device shall be permitted and the recirculated Class 3 air shall not exceed 5 percent of the outdoor air intake flow. [ASHRAE 62.1:5.16.3.3]

**403.9.4 Class 4 Air.** Class 4 air shall not be recirculated or transferred to other spaces or be recirculated within the space of origin. [ASHRAE 62.1:5.16.3.4]

**404.0 Multiple-Zone Systems.**

**404.1 General.** This section presents an alternative procedure for calculating the system ventilation efficiency ( $E_v$ ) where values in Table 403.5.2 are not used. The system ventilation efficiency shall equal the lowest zone ventilation efficiency among the ventilation zones served by the air handler in accordance with Equation 404.1. [ASHRAE 62.1:A1.3]

$$E_v = \text{minimum } (E_{vz}) \quad (\text{Equation 404.1})$$

**404.2 Average Outdoor Air Fraction.** The average outdoor air fraction ( $X_s$ ) for the ventilation system shall be determined in accordance with Equation 404.2.

$$X_s = V_{out}/V_{ps} \quad (\text{Equation 404.2})$$

The uncorrected outdoor air intake ( $V_{ou}$ ) shall be determined in accordance with Section 403.5.3, and the system primary airflow ( $V_{ps}$ ) shall be determined at the condition analyzed. [ASHRAE 62.1:A1.1]

**404.3 Zone Ventilation Efficiency.** The zone ventilation efficiency ( $E_{vz}$ ) shall be the efficiency with which a system distributes outdoor air from the intake to an individual breathing zone, and shall be determined in accordance with Section 404.3.1 or Section 404.3.2. [ASHRAE 62.1:A1.2]

**404.3.1 Single Supply Systems.** For single supply systems, where the air supplied to a ventilation zone is a mixture of outdoor air and system-level recirculated air, zone ventilation efficiency ( $E_{vz}$ ) shall be determined in accordance with Equation 404.3.1. Examples of single supply systems include constant-volume reheat, single-duct VAV, single-fan dual-duct, and multizone systems.

$$E_{vz} = 1 + X_s - Z_{pz} \quad (\text{Equation 404.3.1})$$

The average outdoor air fraction for the system ( $X_s$ ) shall be determined in accordance with Equation 404.2 and the primary outdoor air fraction for the zone ( $Z_{pz}$ ) shall be determined in accordance with Section 403.5.1. [ASHRAE 62.1:A1.2.1]

**404.3.2 Secondary-Recirculation Systems.** For secondary-recirculation systems where the supply air or a portion thereof to a ventilation zone is recirculated air from other zones, without being directly mixed with outdoor air, the zone ventilation efficiency ( $E_{vz}$ ) shall be determined in accordance with Equation 404.3.2(1). Examples of secondary-recirculation systems include dual-fan dual-duct and fan-powered mixing box systems, and systems that include transfer fans for conference rooms.

[Equation 404.3.2(1)]

$$E_{vz} = (F_a + X_s \cdot F_b - Z_{pz} \cdot E_p \cdot F_c) / F_a$$

The system air fractions  $F_a$ ,  $F_b$ , and  $F_c$  shall be determined in accordance with Equation 404.3.2(2), Equation 404.3.2(3), and Equation 404.3.2(4). The zone primary air fraction ( $E_p$ ) shall be determined in accordance with Equation 404.3.2(5). For single-zone and single-supply systems  $E_p$  shall equal to 1.0. The zone secondary recirculation fraction ( $E_r$ ) shall be determined by the designer based on system configuration. The zone air distribution effectiveness ( $E_z$ ) shall be determined in accordance with Section 403.2.2. [ASHRAE 62.1:A1.2.2]

$$F_a = E_p + (1 - E_p) \cdot E_r \quad \text{[Equation 404.3.2(2)]}$$

$$F_b = E_p \quad \text{[Equation 404.3.2(3)]}$$

$$F_c = 1 - (1 - E_z) \cdot (1 - E_r) \cdot (1 - E_p) \quad \text{[Equation 404.3.2(4)]}$$

$$E_p = V_{pz} / V_{dz} \quad \text{[Equation 404.3.2(5)]}$$

Where:

$E_p$  - Primary air fraction: The fraction of primary air in the discharge air to the ventilation zone.

$E_r$  - Secondary recirculation fraction: In systems with secondary recirculation of return air, the fraction of secondary recirculated air to the zone that is representative of average system return air rather than air directly recirculated from the zone.

$F_a$  - Supply air fraction: The fraction of supply air to the ventilation zone from sources or air outside the zone.

$F_b$  - Mixed air fraction: The fraction of supply air to the ventilation zone from fully mixed primary air.

$F_c$  - Outdoor air fraction: The fraction of outdoor air to the ventilation zone from sources of air outside the zone.

$V_{dz}$  - Zone discharge airflow: The expected discharge (supply) airflow to the zone that includes primary airflow and secondary recirculated airflow, cfm (m<sup>3</sup>/min).

$V_{pz}$  - Zone primary airflow: Determine in accordance with Section 403.5.1.

$X_s$  - Average outdoor air fraction: At the primary air handler, the fraction of outdoor air intake flow in the system primary airflow.

$Z_{pz}$  - Primary outdoor air fraction: The outdoor air fraction required in the primary air supplied to the ventilation zone prior to the introduction of secondary recirculation air. [ASHRAE 62.1: A4]

**405.0 Evaporative Cooling System for Health Care Facilities.** [For OSHPD 1, 2, 3 & 4] Direct evaporative cooling systems where the air directly contacts the wetted surface or spray shall be limited in health facilities to nonpatient areas such as laundry rooms, food preparation areas, and boiler or machinery rooms. Similar rooms with high heating-producing

equipment will be considered when specifically approved by the enforcing agency. The evaporative pads shall be a synthetic type. Filters shall be required in accordance with Tables 4-B and 4-C except utility rooms, i.e.: boiler or machinery rooms.

**406.0 Reserved.**

**407.0 Ventilation System Details. [OSHPD 1, 2, 3 & 4]**

**407.1 General.**

**407.1.1** All supply-air, return air, and exhaust-air systems shall be mechanically operated and such systems for areas listed in Table 4-A shall be operated continuously. Natural ventilation through windows or other openings such as louvers will be considered as supplemental to the required mechanical ventilation systems.

**Exceptions:**

- (1) Natural ventilation shall not be used in airborne infection isolation rooms and protective environment rooms.
- (2) The number of air changes may be reduced to 25 percent of the indicated value in Table 4-A, when the room is unoccupied, if provisions are made to ensure the following:

- (1) The number of air changes per hour indicated is reestablished whenever the space is occupied.
- (2) The pressure relationship with the surrounding rooms is maintained when the air changes per hour are reduced. In areas requiring no continuous directional control as identified in accordance with Table 4-A, ventilation systems may be shut down when the space is unoccupied and ventilation is not otherwise required. Ventilation shall not be reduced in rooms specifically used for airborne infection control, such as waiting rooms, triage rooms, corridors, reception areas, areas adjacent to waiting areas, airborne infection isolation rooms, negative pressure exam room, negative pressure x-ray treatment rooms, and protective environment rooms. All operating and delivery rooms shall maintain a minimum of six air changes per hour of total air when not in use.

**407.1.2** Fans serving exhaust systems shall be located at the discharge end of the system. The ventilation rates shown in Table 4-A shall be considered as minimum acceptable rates and shall not be construed as precluding the use of higher ventilation rates if they are required to meet design conditions.

**407.1.3 Services/Systems and Utilities.** (Refer to Section 1224.4.1 of the California Building Code).

**407.2 Outdoor Air Intakes and Exhaust Outlets.**

**407.2.1 Outdoor Air Intakes.** Outdoor air intakes shall be located at least 25 feet (7.62 m) from exhaust outlets of ventilating systems, combustion equipment stacks, medical-surgical vacuum systems, cooling towers, and areas that may collect vehicular exhaust or other noxious

fumes. Plumbing vents shall be located in relation to outdoor air intakes per California Plumbing Code. The bottom of outdoor air intakes shall be located as high as practicable, but not less than 10 feet (3048 mm) above ground level. If installed above the roof, they shall be located 18 inches (457 mm) above roof level or 3 feet (914 mm) above a flat roof where heavy snowfall is anticipated.

**Exceptions:**

- (1) These dimensions may be reduced if it is demonstrated by the submission of details and calculations that location of intakes with respect to exhausts and their orientation, or the use of special filters, provides equal performance.
- (2) The requirements regarding the bottom of outdoor air intakes and installation through the roof do not apply to skilled nursing facilities, intermediate-care facilities or nonsensitive areas in correctional treatment centers.

**407.2.2 Exhaust Outlets.** Exhaust outlets shall be located a minimum of 10 feet (3048 mm) above adjoining grade and 10 feet (3048 mm) from doors, occupied areas, and operable windows.

**Exception:** Airborne infection isolation rooms shall comply with Section 414.1.



**407.3 Air Balance.**

**407.3.1** The ventilation systems shall be designed and balanced to provide the general air balance relationship to adjacent areas, shown in Table 4-A. The ventilation systems shall be balanced in accordance with the latest edition of standards published by the Associated Air Balance Council (AABC), the National Environmental Balancing Bureau (NEBB), or the Testing, Adjusting and Balancing Bureau (TABB).



**407.4 Air Circulation.**

**407.4.1** Design of the ventilation system shall provide air movement that is generally from clean to less clean areas.

**407.4.1.1** Air supplied to operating rooms, cesarean operating rooms, cardiac catheterization labs, cystoscopy rooms, delivery rooms, and nurseries shall be delivered at or near the ceiling of the area served. In these areas and in morgues and autopsy rooms all air removed from the area shall be removed near floor level. Exhaust or recirculation inlets shall be located not less than 3 inches (76 mm) nor more than 8 inches (203 mm) above the finished floor; except in morgues and autopsy rooms where all of the exhaust air is removed through an autopsy table designed for this purpose. At least two exhaust or recirculation air inlets of equal capacity shall be used in all cardiac catheterization labs, cystoscopy rooms, operating rooms, and delivery rooms and shall be located not less than 3 inches (76 mm) nor more than 8 inches (203 mm) above the finished floor.

**Exception:** For airborne infection isolation rooms and protective environment rooms, see Sections 414.0 and 415.0.

**407.4.1.2** Room supply air outlets and room recirculation and exhaust air inlets installed in nonsensitive areas shall be located not less than 3 inches (76 mm) above the floor.

**Exception:** For airborne infection isolation rooms and protective environment rooms, see Sections 414.0 and 415.0.

**407.4.1.3** Corridors shall not be used to convey supply, return, or exhaust air to or from any room if the corridor is required to be of fire resistive construction per the California Building Code.

**Exceptions:**

- (1) Mechanically exhausted toilet rooms of 50 square feet (4.7 m<sup>2</sup>) or less and small rooms of 30 square feet (2.79 m<sup>2</sup>) or less such as janitor closets, housekeeping rooms, and electrical or telephone closets opening directly onto corridor.
- (2) Air transfer caused by pressure differentials in rooms required to have a positive or negative air balance by Table 4-A.

**407.4.1.4** No space above a ceiling may be utilized as an outside-air, relief-air, supply-air, exhaust-air, or return-air plenum.

**Exception:** Designs specifically approved by the enforcing agency.

**407.4.1.5** Air from a patient room, exam room, treatment room shall not be transferred to another similar room without first having passed through air filters as required by Table 4-B or Table 4-C.

**407.4.1.6** Supply outlets and return and exhaust air inlets shall be located to prevent short-circuiting.

**407.5 Variable Air Volume.**

**407.5.1 Variable Air Volume Systems (VAV).** Variable air volume systems subjecting the patient to a fluctuating air movement are not acceptable for airborne infection isolation rooms, protective environment rooms or those critically sensitive areas listed in Table 320.0. For nonsensitive areas, variable air volume systems meeting the following criteria can be considered:

**407.5.1.1** The VAV system shall comply with code requirements for outside air, total air, and pressure relationship through the full range of operation from minimum to maximum.

**407.5.1.2** The central return or exhaust fan shall be controlled to accomplish the variable air volume requirements of the individual rooms served by the fan as described in Section 407.5.1.3.

**407.5.1.3** Variable air volume for return or exhaust air shall be accomplished by utilizing an automatic

modulating damper in the return or exhaust air for each zone. The damper will modulate from full open to minimum position in conjunction with the supply air VAV terminal box.

#### **408.0 Filters. [OSHPD 1, 2, 3 & 4]**

**408.1 General.** Filter efficiencies shall be certified by the manufacturer and shall be based on ASHRAE 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size when specifically set forth in these standards.

**408.1.1** A filter gauge shall be installed across each filter bank serving central air systems. The gauge shall be red lined or a filter alarm light installed to signal when the recommended maximum static pressure drop has been reached.

**408.1.2** Central air-handling systems are defined as any unit requiring duct work on the supply or inlet side that serve more than one room.

**408.1.3** Filter banks shall be visually inspected for torn media and bypass in filter frames by means of a flashlight or equivalent, both with fans in operation and stopped. Tears in media and bypass in filter frames shall be eliminated in accordance with the manufacturer's directions and the requirements of the enforcing agency prior to commencing operation of the system.

**408.1.4** Central air-handling systems shall be maintained in a reasonably clean condition during construction and shall be cleaned as necessary prior to replacement of temporary filter used during construction to ensure that clean air will be delivered to the occupied spaces.

**408.1.5** Filter bank No. 1 shall be located upstream of the air-conditioning equipment. Filter bank No. 2 and filter bank No. 3 shall be located downstream of the supply fan and all cooling and humidification equipment with efficiencies as indicated in Table 4-B or Table 4-C.

**Exception:** Dry steam-type humidifiers for local room humidity control may be installed in the supply air duct downstream of the final filter bank where designs are specifically approved by the enforcing agency. Dry steam is that which is defined in the ASHRAE HVAC Systems and Equipment Handbook.

**408.1.6** Filter bank No. 2 and filter bank No. 3 media shall be rigid or supported (noncollapsing type) and shall operate on the principles of impingement, straining, and diffusion.

#### **408.2 Filters for Hospitals.**

**408.2.1** All air-ventilation systems shall comply with code requirements of this section and shall have filter bank efficiencies as listed in Table 4-B.

**408.2.2** Noncentral recirculating air systems providing cooling to high heat producing equipment located in nonsensitive areas shall have a filter with 30 percent average efficiency based on ASHRAE 52.2 or a minimum efficiency reporting value (MERV) of 8 based on ASHRAE 52.2.

**408.2.3** Noncentral air systems serving any areas not listed in Table 4-B shall be provided with filter arrangement and efficiency specifically approved by the enforcing agency.

**408.2.4** Noncentral recirculating air handling systems, for example, through-the-wall units, fan coil units, and heat pumps may be utilized for single patient rooms of one or more beds. Filtration for these units shall have a minimum weight arrestance value of 50 percent, based on ASHRAE 52.2 or a minimum efficiency reporting value (MERV) of 1, based on ASHRAE 52.2. The air ventilation system providing the minimum air changes of outdoor air shall comply with Table 4-B. These units may be used as recirculating units only. All outdoor air requirements shall be met by a separate central air handling systems.

#### **408.3 Filters for Skilled Nursing Facilities, Intermediate Care Facilities, and Correctional Treatment Centers.**

**408.3.1** The air ventilation systems shall comply with code requirements of this section for skilled nursing facilities, intermediate care facilities and correctional treatment centers and shall have filter bank efficiencies as listed in Table 4-C.

**408.3.2** Noncentral air systems serving single patient rooms of one or more beds shall comply with Table 4-C.

**408.3.3** Noncentral recirculating air-handling systems, i.e. through the wall units, may be utilized for each patient room with one or more beds. Filtration for these units shall have a minimum weight arrestance value of 50 percent, based on ASHRAE 52.2 or a minimum efficiency reporting value (MERV) of 1, based on ASHRAE 52.2. The air ventilation system providing the minimum air changes of outdoor air shall comply with Table 4-C. These units may be used as recirculating units only. All outdoor air requirements shall be met by a separate central air handling system.

**408.3.4** Airborne infection isolation rooms, protective environment rooms, and sensitive areas in correctional treatment centers shall comply with Section 408.2.

#### **408.4 Filters for Outpatient Facilities.**

**408.4.1** The air ventilation systems shall comply with code requirements of this section for outpatient facilities and shall have filter bank efficiencies as listed in Table 4-B.

**408.4.2** Noncentral air systems serving individual rooms shall comply with Table 4-B.

#### **409.0 Ducts. [OSHPD 1, 2, 3 & 4]**

**409.1** Ducts which penetrate construction, intended for X-ray or other radiation protection, shall not impair the effectiveness of the protection.

**409.2** Duct linings and their use shall meet the requirements of Chapter 6, California Mechanical Code.

**409.3 Insulation of Ducts.** Cold air ducts shall be insulated wherever necessary or to prevent condensation.

**409.4** The anchorage and supporting structural elements for airducts shall be designed to withstand the lateral forces as required by the California Building Code, Title 24, Part 2.

**410.0 Laboratory Ventilating Systems and Hoods. [OSHPD 1, 2, 3 & 4]**

**410.1 Laboratory Ventilating Systems.** Laboratory ventilating systems shall comply with NFPA 99, as required by Section 1224.4.6.4 of the California Building Code.

**410.2 Exhaust Hoods and Safety Cabinets.** Hoods and safety cabinets may be used for normal exhaust of a space provided minimum air change rates are maintained. If air change standards in Table 4-A do not provide sufficient air for proper operation of exhaust hoods and safety cabinets (when in use), supplementary makeup air (filtered and preheated) shall be provided around these units to maintain the required airflow direction and exhaust velocity. Makeup systems for hoods shall be arranged to minimize "short circuiting" of air and to avoid reduction in air velocity at the point of contaminant capture.

**410.3 Laboratory Fume Hoods.** Laboratory fume hoods shall meet the following standards:

**410.3.1 General Standard.** Average face velocity shall be at least 75 feet per minute (0.38 meters per second). Exhaust system shall be separate from the building exhaust system. Exhaust fan shall be located at the discharge end of the system. Exhaust duct system shall be of noncombustible corrosion-resistant material as required to meet the planned usage of the hood.

**410.3.2 Special Standards for Use with Strong Oxidants.** Fume hoods and their associated equipment in the air stream intended for use with perchloric acid and other strong oxidants shall be constructed of stainless steel or other material consistent with special exposures. Hoods and equipment shall be provided with a water wash and drain system to permit periodic flushing of duct and hood. When perchloric acid or other strong oxidants are only transferred from one container to another, standard laboratory fume hoods and the associated equipment may be used in lieu of stainless steel construction.

**410.3.3 Special Standards for Use with Infectious or Radioactive Materials.** Each hood shall have a minimum face velocity of 90 to 110 feet per minute (0.45 to 0.56 meters per second) with suitable pressure-independent air-modulating devices and alarms to alert staff of fan shutdown or loss of airflow. Each hood shall have filters with a 99.97 percent efficiency (based on the DOP test method) in the exhaust stream and be designed and equipped to permit the safe removal, disposal, and replacement of contaminated filters. Filters shall be as close to the hood as practical to minimize duct contamination. Fume hoods intended for use with radioactive isotopes shall be constructed of stainless steel or other material suitable for the particular exposure.

**411.0 Kitchen and Dining Areas. [OSHPD 1, 2, 3 & 4]**

**411.1** The air from dining areas may be used to ventilate the food preparation areas only after it has passed through a

filter with at least an 80 percent average efficiency based on ASHRAE 52.2 or a minimum efficiency reporting value (MERV) of 13, based on ASHRAE 52.2.

**Exception:** For skilled nursing facilities, intermediate care facilities and correctional treatment centers, the air from dining area may be used to ventilate food preparation areas only after it has passed through a filter with a 50 percent average efficiency based on ASHRAE 52.2 or a minimum efficiency reporting value (MERV) of 10, based on ASHRAE 52.2.

**412.0 Boiler, Mechanical, and Electrical Rooms. [OSHPD 1, 2, 3 & 4]**

**412.1** Boiler, heater and electrical equipment rooms shall be provided with outdoor air so as to maintain combustion rates of equipment and temperatures in the rooms and in adjoining areas as rated in this chapter.

**412.2** Floor surfaces in occupied spaces above such rooms should not exceed a temperature of 85°F (29.4°C), and suitable insulation may be required.

**413.0 Odorous Rooms. [OSHPD 1, 2, 3 & 4]**

**413.1** Rooms in areas where excessive heat or moisture is generated, where objectional odors or dust are present, or where flammable or toxic gases may accumulate, which are used by health facility personnel or patients, shall be provided with exhaust ventilation to change the air a minimum of ten times per hour.

**413.2** Kitchen, morgues and laundries located inside a hospital building or skilled nursing facility in which patients are accommodated, or treated, shall be ventilated with exhaust systems which will provide a minimum of ten air changes per hour and prevent odors from entering patient areas.

**414.0 Airborne Infection Isolations Rooms. [OSHPD 1, 2, 3 & 4]**

**414.1 Exhaust Systems.** A separate, dedicated exhaust system shall be provided for airborne infection isolation rooms. The dedicated system may serve more than one airborne infection isolation room, adjoining toilet room and anteroom. The exhaust ducts shall be identified by appropriate labeling with the words "Caution Airborne Infection Isolation Rooms Exhaust" or similar terminology. Such labeling shall be in a manner which is not readily removable and shall appear on the exhaust duct at intervals of not more than 20 feet (6096 mm) and at least once near each room and each story traversed by the exhaust system. Exhaust fans shall comply with Section 407.1.2. The discharge from exhaust fans shall be located above the roof and shall be located a minimum of 25 feet (7620 mm) from areas that may be occupied, doors, operable windows, outdoor air intakes, or other openings into the building. The exhaust fan discharge shall be labeled in a manner which readily identifies the precautions which should be observed. To ensure that the airborne contaminants do not reenter the building, one of the following shall be provided:



**414.1.1** Exhaust discharge from fan shall extend at least 7 feet (2134 mm) above the roof and discharge vertically upward. Self-draining stacks or equivalent shall be used for rain protection. Rain caps which divert the exhaust toward the roof shall be prohibited.

**414.1.2** Exhaust shall discharge above roof level and through an accessible HEPA filter. The HEPA filter shall be located upstream of the exhaust fan and have a minimum efficiency of 99.97 percent based on the DOP method in accordance with Mil-Std. 282 or a minimum efficiency reporting value (MERV) of 17, based on ASHRAE 52.2. Filter gage shall be installed across the filter. For maintenance of air balance relationship, see Section 407.3.2. The 25-foot (7620 mm) dimension required by Section 414.1 may be reduced when a 99.97 percent HEPA filter or a minimum efficiency reporting value (MERV) of 17, based on ASHRAE 52.2 is used and the reduced dimension is specifically approved by the enforcing agency.

**414.2 Air Distribution.** The supply outlets and exhaust inlets shall be located to provide airflow patterns that prevent stagnation of the air and eliminate short circuiting of the supply to the exhaust, and minimize exposure of health care workers to airborne infectious particles. Supply-air outlets shall be located at or near the ceiling and at the end of the airborne infection isolation room which is opposite the head of the bed. Exhaust registers shall be located on the wall behind the patient's head, or as close to that wall as practical and shall be located not less than 3 inches (76 mm) nor more than 24 inches (610 mm) above the finished floor.

**Exception:** For correctional treatment centers, the location and design of the supply outlets an exhaust or return inlets shall not compromise the safety, security and protection of staff, inmates and property.

**415.0 Protective Environment Rooms. [OSHPD 1, 2, 3 & 4]**

**415.1 Air Distribution.** The supply outlets and exhaust and return inlets shall be located to provide airflow patterns that prevent stagnation of the air and eliminate short circuiting of the supply to the exhaust or return. Supply air shall be delivered at or near the ceiling and near the patient's bed. All exhaust or return registers shall be located near the entrance to the protective environment room and not less than 3 inches (76 mm) nor more than 8 inches (203 mm) above the finished floor.

**Exception:** For correctional treatment centers, the location and design of the supply outlets and exhaust or return inlets shall not compromise the safety, security, and protection of staff, inmates and property.

**416.0 Alarms – Airborne Infection Isolation Rooms and Protective Environment Rooms. [OSHPD 1, 2, 3 & 4]**

**416.1** An alarm system which is based on static pressure control, volumetric control, or directional flow measurement shall be provided for each isolation room. The alarm system shall consist of a display monitor located on the corridor wall

near the door to the room and a visual and audible alarm which annunciates at the room and at a nurses' station or other suitable location that will provide responsible surveillance. A time delay shall be provided to allow for routine openings of doors. The alarm shall annunciate when the supply, return, or exhaust fans are interrupted and when one of the following conditions is not being met during closed door conditions:

- (1) When the minimum air quantity difference of 75 cfm (35.4 L/s) required by Table 4-A is not being maintained; or
- (2) When a minimum pressure differential of 0.01 inch (0.003 kPa) of water and a minimum inward (outward for protective environment rooms) air velocity of 100 feet per minute (0.508 m/s) is not being maintained at the air transfer opening required by Table 4-A.

**416.2** Other acceptable alarm systems will be allowed when designs are specifically approved by the enforcing agency.

**416.3 [For OSHPD 4]** For correctional treatment centers, the alarm system shall not create false alarms or security hazards.

**416.4** Prior to acceptance of the rooms, the alarm system shall be tested and operated to demonstrate to the owner or designated representative that the installation and performance of the system conforms to design intent.

**417.0 Testing and Balancing Airborne Infection Isolation Rooms and Protective Environment Rooms. [OSHPD 1, 2, 3 & 4]** Prior to acceptance of the rooms, all mechanical systems shall be tested, balanced, and operated to demonstrate to the owner or designated representative that the installation and performance of the systems conform to design intent. All testing and balancing shall be performed by a qualified independent agency certified by the Associated Air Balance Council (AABC): the National Environmental Balancing Bureau (NEBB); or the Testing, Adjusting and Balancing Bureau (TABB).

**418.0 Design Requirements for Ethylene Oxide (ETO) Sterilization Areas. [OSHPD 1, 2, 3 & 4]**

**418.1 Air Changes.** The ETO sterilization equipment room shall be provided with minimum air changes per hour per Table 4-A and be maintained at a negative air balance.

**418.2 Exhaust Requirements.**

**418.2.1** All air from the ETO sterilizer equipment room shall be exhausted to the outside by a dedicated system or other approved method.

**418.2.2** The exhaust fan for the dedicated system shall be located at the discharge point of the system and identified as ETO Equipment Room Exhaust.

**418.2.3 Discharge Point.** The discharge point shall be a minimum of 25 feet (7620 mm) away from any outside intake, operable window or personnel passage.

**418.3 Ventilation Requirements.**

**418.3.1 Aeration Units.** The aeration units shall be ventilated through a nonrecirculating dedicated ventilation exhaust system.

## VENTILATION AIR

**418.3.2 Capture Box.** *When the drain is not located in the ETO sterilizer equipment room, ventilation is required by a capture box.*

**418.3.3 Cylinder Change.** *When not located in the ETO sterilizer equipment room, exhaust during cylinder change is required by installing a hood that is part of a dedicated ventilation exhaust system, positioned no more than 1 foot (305 mm) above or behind the point where the change of cylinders takes place.*

**418.3.4 Sterilizer Relief Valve.** *The ventilation of sterilizer relief valve is required through a pipe connected to the outlet of the relief valve exhausted directly to the outdoors at a point high enough to be away from passers by, and not near any windows that open, nor near any air-conditioning or ventilation air intakes.*

**418.3.5 Ventilation of Sterilizer Door Area.** *The system shall be designed to capture the ETO when the door is opened following the completion of the sterilization process. A hood or canopy closed on each end should be installed over the sterilization door. A hood or canopy shall be connected to a dedicated exhaust ventilation system.*

**418.4 Gas Valves.** *Installation of gas line hand valves at the connection to the supply cylinders are required to minimize leakage during cylinder change.*

**418.5 Alarm Systems.** *An Audible and visual alarm system shall be installed to alert sterilizer operating personnel if the air flow falls below design cubic feet per minute (L/s).*

**TABLE 4-A  
PRESSURE RELATIONSHIP AND VENTILATION REQUIREMENTS FOR GENERAL ACUTE CARE  
HOSPITALS, SKILLED NURSING FACILITIES, INTERMEDIATE CARE FACILITIES, CORRECTIONAL  
TREATMENT CENTERS, OUTPATIENT FACILITIES, AND LICENSED CLINICS**

<b>FUNCTION OR SPACE</b>	<b>PRESSURE RELATIONSHIP TO ADJACENT AREAS (f) (n)</b>	<b>MINIMUM OUTDOOR ACH</b>	<b>MINIMUM TOTAL ACH</b>	<b>MINIMUM TOTAL ACH IF 100% O.A.</b>	<b>ALL ROOM AIR EXHAUSTED DIRECTLY TO OUTDOORS (j)</b>	<b>AIR RECIRCULATED BY MEANS OF ROOM UNITS (a)</b>	<b>DESIGN RELATIVE HUMIDITY(k), %</b>	<b>DESIGN TEMPERATURE (l), °F/°C</b>
<i>Administrative</i>	<i>NR</i>	<i>2</i>	<i>4</i>	<i>2</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Airborne infection isolation anteroom (u)</i>	<i>(e)</i>	<i>NR</i>	<i>10</i>	<i>10</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>
<i>Airborne infection isolation room (u)</i>	<i>Negative</i>	<i>2</i>	<i>12</i>	<i>12</i>	<i>Yes</i>	<i>No</i>	<i>max 60</i>	<i>70-75/21-24</i>
<i>Airborne infection isolation treatment/exam room</i>	<i>Negative</i>	<i>2</i>	<i>12</i>	<i>12</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>
<i>Angiography room</i>	<i>Positive</i>	<i>5</i>	<i>15</i>	<i>12</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Bathing room</i>	<i>Negative</i>	<i>NR</i>	<i>10</i>	<i>NR</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>70-75/21-24</i>
<i>Bathroom</i>	<i>Negative</i>	<i>NR</i>	<i>10</i>	<i>10</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>72-78/22-26</i>
<i>Bedpan room</i>	<i>Negative</i>	<i>NR</i>	<i>10</i>	<i>10</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>
<i>Blood bank/tissue storage</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Blood draw/phlebotomy</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Bronchoscopy, sputum collection, and pentamidine administration (n)</i>	<i>Negative</i>	<i>2</i>	<i>12</i>	<i>12</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>68-73/20-23</i>
<i>Cardiac catheterization lab</i>	<i>Positive</i>	<i>5</i>	<i>20</i>	<i>12</i>	<i>NR</i>	<i>No</i>	<i>max 60</i>	<i>70-75/21-24</i>
<i>Clean linen storage</i>	<i>Positive</i>	<i>NR</i>	<i>2</i>	<i>2</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>72-78/22-26</i>
<i>Clean workroom (central medical and surgical supply space)</i>	<i>Positive</i>	<i>2</i>	<i>4</i>	<i>4</i>	<i>NR</i>	<i>No</i>	<i>max 60</i>	<i>72-78/22-26</i>
<i>Clean workroom or clean holding (support)</i>	<i>Positive</i>	<i>2</i>	<i>4</i>	<i>4</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Critical and intensive care</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>NR</i>	<i>No</i>	<i>30-60</i>	<i>70-75/21-24</i>
<i>CT Scan</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>NR</i>	<i>NR</i>	<i>max 60</i>	<i>NR</i>
<i>Darkroom (g)</i>	<i>Negative</i>	<i>2</i>	<i>10</i>	<i>12</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>
<i>Delivery room (caesarean) (m), (n), (o)</i>	<i>Positive</i>	<i>4</i>	<i>20</i>	<i>12</i>	<i>NR</i>	<i>No</i>	<i>20-60</i>	<i>68-75/20-24</i>
<i>Dialysis treatment area</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>72-78/22-26</i>
<i>Dialyzer reprocessing room</i>	<i>Negative</i>	<i>NR</i>	<i>10</i>	<i>NR</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>
<i>Dietary storage</i>	<i>NR</i>	<i>NR</i>	<i>2</i>	<i>2</i>	<i>NR</i>	<i>No</i>	<i>NR</i>	<i>72-78/22-26</i>
<i>Dining room</i>	<i>NR</i>	<i>2</i>	<i>10</i>	<i>10</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Dishwashing room</i>	<i>N</i>	<i>NR</i>	<i>10</i>	<i>NR</i>	<i>Yes</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Electroconvulsive therapy procedure room</i>	<i>P</i>	<i>3</i>	<i>15</i>	<i>10</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Emergency department exam/treatment room (p)</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>NR</i>	<i>NR</i>	<i>max 60</i>	<i>70-75/21-24</i>
<i>Endoscope cleaning</i>	<i>Negative</i>	<i>2</i>	<i>10</i>	<i>10</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>
<i>ER decontamination</i>	<i>Negative</i>	<i>2</i>	<i>12</i>	<i>4</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>
<i>ER waiting rooms</i>	<i>Negative</i>	<i>2</i>	<i>12</i>	<i>12</i>	<i>Yes (q)</i>	<i>NR</i>	<i>max 65</i>	<i>70-75/21-24</i>
<i>Examination room</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>NR</i>	<i>NR</i>	<i>max 60</i>	<i>70-75/21-24</i>
<i>Fast track room</i>	<i>NR</i>	<i>2</i>	<i>6</i>	<i>2</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Fluoroscopy room</i>	<i>Negative</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>Yes</i>	<i>No</i>	<i>NR</i>	<i>NR</i>

**TABLE 4-A (continued)**  
**PRESSURE RELATIONSHIP AND VENTILATION REQUIREMENTS FOR GENERAL ACUTE CARE HOSPITALS, SKILLED NURSING FACILITIES, INTERMEDIATE CARE FACILITIES, CORRECTIONAL TREATMENT CENTERS, OUTPATIENT FACILITIES, AND LICENSED CLINICS**

FUNCTION OR SPACE	PRESSURE RELATIONSHIP TO ADJACENT AREAS (f) (n)	MINIMUM OUTDOOR ACH	MINIMUM TOTAL ACH	MINIMUM TOTAL ACH IF 100% O.A.	ALL ROOM AIR EXHAUSTED DIRECTLY TO OUTDOORS (j)	AIR RECIRCULATED BY MEANS OF ROOM UNITS (a)	DESIGN RELATIVE HUMIDITY(k), %	DESIGN TEMPERATURE (l), °F/°C
Food preparation center (i)	NR	2	10	10	NR	No	NR	72-78/22-26
Gamma camera	NR	2	6	6	NR	No	NR	NR
Gastrointestinal endoscopy procedure room (x)	NR	2	6	12	NR	No	20-60	68-73/20-23
Hazardous material storage	Negative	2	10	10	Yes	No	NR	NR
Hydrotherapy	Negative	2	6	6	NR	NR	NR	72-80/22-27
Infusion room	Positive	2	6	6	NR	NR	NR	NR
Intermediate care (s)	NR	2	6	6	NR	NR	max 60	70-75/21-24
Interventional imaging procedure room	Positive	5	15	12	NR	NR	NR	NR
IV Prep. room	Positive	2	6	6	NR	NR	NR	NR
Janitor's closet, housekeeping	Negative	NR	10	10	Yes	No	NR	NR
Labor/delivery/recovery (LDR) (s)	NR	2	6	2	NR	NR	max 60	70-75/21-24
Labor/delivery/recovery/postpartum (LDRP) (s)	NR	2	6	2	NR	NR	max 60	70-75/21-24
Laboratory, bacteriology (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, biochemistry (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, cytology (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, general (v)	Negative	2	6	6	NR	NR	NR	70-75/21-24
Laboratory, glasswashing	Negative	2	10	10	Yes	NR	NR	NR
Laboratory, histology (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, infectious disease and virus	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, media transfer (v)	Positive	2	4	4	NR	NR	NR	70-75/21-24
Laboratory, microbiology (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, nuclear medicine (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, pathology (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, serology (v)	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Laboratory, sterilizing	Negative	2	10	10	Yes	NR	NR	70-75/21-24
Lactation	NR	2	6	2	NR	NR	NR	NR
Laser eye room	Positive	3	15	15	NR	No	20-60	70-75/21-24
Laundry, general	Negative	2	10	10	Yes	No	NR	NR
Linen and trash chute room	Negative	NR	10	10	Yes	No	NR	NR
Medical/anesthesia gas storage (r)	Negative	NR	8	8	Yes	NR	NR	NR
Medication room	NR	2	4	2	NR	NR	max 60	70-75/21-24
Morgues and autopsy room (n)	Negative	2	12	12	Yes	No	NR	68-75/20-24
MRI room	NR	2	6	6	NR	NR	NR	NR
Multipurpose room	NR	2	6	6	NR	NR	NR	NR

**TABLE 4-A (continued)**  
**PRESSURE RELATIONSHIP AND VENTILATION REQUIREMENTS FOR GENERAL ACUTE CARE HOSPITALS, SKILLED NURSING FACILITIES, INTERMEDIATE CARE FACILITIES, CORRECTIONAL TREATMENT CENTERS, OUTPATIENT FACILITIES, AND LICENSED CLINICS**

FUNCTION OR SPACE	PRESSURE RELATIONSHIP TO ADJACENT AREAS (f) (n)	MINIMUM OUTDOOR ACH	MINIMUM TOTAL ACH	MINIMUM TOTAL ACH IF 100% O.A.	ALL ROOM AIR EXHAUSTED DIRECTLY TO OUTDOORS (j)	AIR RECIRCULATED BY MEANS OF ROOM UNITS (a)	DESIGN RELATIVE HUMIDITY(k), %	DESIGN TEMPERATURE (l), °F/°C
Negative-pressure x-ray room	Negative	2	12	12	Yes	No	max 60	72-78/22-26
Newborn intensive care	Positive	2	6	6	NR	No	30-60	72-78/22-26
Newborn/well baby nursery suite	NR	2	6	6	NR	No	30-60	72-78/22-26
Nonrefrigerated body-holding room (h)	Negative	NR	10	10	Yes	No	NR	70-75/21-24
Nourishment area or room	NR	NR	2	2	NR	NR	NR	NR
Nuclear medicine (Gamma, PET, SPECT)	Negative	2	6	6	Yes	No	NR	NR
Nuclear medicine hot lab	Negative	NR	6	6	Yes	No	NR	70-75/21-24
Nuclear medicine treatment room	Negative	2	6	6	Yes	NR	NR	70-75/21-24
Observation/seclusion room	NR	2	6	2	NR	NR	NR	NR
Occupational therapy	NR	2	6	6	NR	NR	NR	70-75/21-24
Operating room, hybrid operating room (m), (n), (o)	Positive	4	20	12	NR	No	20-60	68-75/20-24
Operating/surgical cystoscopic room (m), (n), (o)	Positive	4	20	12	NR	No	20-60	68-75/20-24
Patient corridor	NR	NR	2	2	NR	NR	NR	NR
Patient holding preparation	NR	2	6	6	NR	No	NR	NR
Patient room	NR	2	4 (y)	2	NR	NR	max 60	70-75/21-24
Pediatric play area	NR	2	6	6	NR	NR	NR	NR
Pharmacy (b)	Positive	2	4	2	NR	NR	NR	NR
Physical therapy (nursing facility)	Negative	2	6	6	NR	NR	NR	70-75/21-24
Physical therapy (diagnostic and treatment)	Negative	2	6	6	NR	NR	max 65	72-80/22-27
Post-anesthesia care unit	NR	2	6	6	Yes	No	20-60	70-75/21-24
Pre-screening area	Negative	2	12	12	Yes (q)	NR	NR	NR
Procedure room (o), (d)	Positive	3	15	12	NR	No	20-60	70-75/21-24
Protective environment anteroom (t)	(e)	NR	10	15	NR	No	NR	NR
Protective environment room (t)	Positive	2	12	15	NR	No	max 60	70-75/21-24
Radiology waiting rooms	Negative	2	12	12	Yes (q), (w)	NR	max 60	70-75/21-24
Recovery room	NR	2	6	2	NR	No	20-60	70-75/21-24
Recreation/activity room	NR	2	6	6	NR	NR	NR	NR
Resident gathering/activity/dining (nursing facility)	NR	4	4	4	NR	NR	NR	70-75/21-24
Resident room (nursing facility)	NR	2	2	2	NR	NR	NR	70-75/21-24
Resident unit corridor (nursing facility)	NR	NR	4	2	NR	NR	NR	NR

**TABLE 4-A (continued)**  
**PRESSURE RELATIONSHIP AND VENTILATION REQUIREMENTS FOR GENERAL ACUTE CARE HOSPITALS, SKILLED NURSING FACILITIES, INTERMEDIATE CARE FACILITIES, CORRECTIONAL TREATMENT CENTERS, OUTPATIENT FACILITIES, AND LICENSED CLINICS**

FUNCTION OR SPACE	PRESSURE RELATIONSHIP TO ADJACENT AREAS (f) (n)	MINIMUM OUTDOOR ACH	MINIMUM TOTAL ACH	MINIMUM TOTAL ACH IF 100% O.A.	ALL ROOM AIR EXHAUSTED DIRECTLY TO OUTDOORS (j)	AIR RECIRCULATED BY MEANS OF ROOM UNITS (a)	DESIGN RELATIVE HUMIDITY(k), %	DESIGN TEMPERATURE (l), °F/°C
Semi-restricted corridor	NR	2	4	2	NR	NR	NR	NR
Shower room	Negative	NR	10	NR	Yes	No	NR	NR
Soiled linen sorting and storage	Negative	NR	10	10	Yes	No	NR	NR
Soiled or decontamination room	Negative	2	6	4	Yes	No	NR	72-78/22-26
Soiled workroom or soiled holding, utility room	Negative	2	10	4	Yes	No	NR	NR
Special purpose room (SNF & ICF only)	NR	2	6	6	Yes	NR	NR	NR
Speech therapy/audiology room	NR	2	6	2	NR	NR	NR	NR
Staff sleep rooms	NR	2	4	2	NR	NR	NR	NR
Sterile storage	Positive	2	4	4	NR	NR	max 60	72-78/22-26
Sterilizer equipment room	Negative	NR	10	10	Yes	No	NR	NR
Substerile service area	NR	2	6	10	NR	No	NR	NR
Toilet room	Negative	NR	10	10	Yes	No	NR	NR
Trauma/cardiac room (crisis or shock) (c)	Positive	3	15	12	NR	No	20-60	70-75/21-24
Treatment room (surgery and critical care) (p)	NR	2	6	6	NR	NR	20-60	70-75/21-24
Treatment room (diagnostic and treatment) (x)	NR	2	6	6	NR	NR	max 60	70-75/21-24
Triage	Negative	2	12	12	Yes (q)	NR	max 60	70-75/21-24
Ultrasound room	NR	2	6	6	NR	NR	NR	NR
Unsterile supply	NR	2	2	2	NR	NR	NR	NR
Waiting area (nuclear medicine)	Negative	2	12	12	Yes	No	NR	NR
Waiting area primary care clinic	Negative	2	10	10	Yes(q)	NR	NR	NR
Warewashing	Negative	NR	10	10	Yes	No	NR	NR
Wound intensive care (burn unit)	NR	2	6	6	NR	No	40-60	70-75/21-24
X-ray (diagnostic and treatment)	NR	2	6	6	NR	NR	max 60	72-78/22-26
X-ray (surgery/critical care and catheterization)	Positive	3	15	12	NR	No	max 60	70-75/21-24

Note: NR = No requirement

**Notes:**

- Except where indicated by a "No" in this column, recirculating room HVAC units (with heating or cooling coils) are acceptable for providing that portion of the minimum total air changes per hour that is permitted by Section 7.1 (subparagraph [a][5]). Because of the cleaning difficulty and potential for buildup of contamination, recirculating room units shall not be used in areas marked "No." Recirculating devices with HEPA filters shall be permitted in existing facilities as interim, supplemental environmental controls to meet requirements for the control of airborne infectious agents. The design of either portable or fixed systems should prevent stagnation and short circuiting of airflow. The design of such systems shall also allow for easy access for scheduled preventative maintenance and cleaning.
- Pharmacy compounding areas may have additional air change, differential pressure, and filtering requirements beyond the minimum of this table depending on the type of pharmacy, the regulatory requirements which may include adoption of USP 797, the associated level of risk of the work (see USP [2013] in Informative Appendix B), and the equipment utilized in the spaces.
- The term trauma room as used herein is a first-aid room and/or emergency room used for general initial treatment of accident victims. The operating room within the trauma center that is routinely used for emergency surgery is considered to be an operating room by this standard.

- d. Pressure relationships need not be maintained when the room is unoccupied.
- e. See Section 7.2 and its subsections for pressure-relationship requirements.
- f. For operating rooms, cardiac catheterization labs, angiography rooms, cystoscopy rooms, delivery rooms, cesarean operating rooms, newborn intensive care, intensive care units, and nurseries provide approximately 15% excess supply air to the room or a sufficient quantity of excess supply air to maintain an appropriate positive air balance based on the room tightness and number of doors. For all rooms not listed in this footnote or not listed in Section 322.0 requiring either a positive or negative air balance, provide approximately 10% differential cfm between supply and return/exhaust airflow but not less than 25 cfm differential shall be provided regardless of room size. Room function, size, and tightness may be considered when determining the differential airflow required. Where continuous directional control is not required, variations between supply cfm and return or exhaust cfm shall be minimized.
- g. All air need not be exhausted if darkroom equipment has a scavenging exhaust duct attached and meets ventilation standards regarding NIOSH, OSHA, and local employee exposure limits.<sup>2,3</sup>
- h. A nonrefrigerated body-holding room is applicable only to facilities that do not perform autopsies on-site and use the space for short periods while waiting for the body to be transferred.
- i. Minimum total<sup>4</sup> air changes per hour (ach) shall be that required to provide proper makeup air to kitchen exhaust systems as specified in ANSI/ASHRAE Standard 154. In some cases, excess exfiltration or infiltration to or from exit corridors compromises the exit corridor restrictions of NFPA 90A, the pressure requirements of NFPA 96, or the maximum defined in the table. During operation, a reduction to the number of air changes to any extent required for odor control shall be permitted when the space is not in use. (See FGI [2010] in Informative Appendix B.)
- j. In some areas with potential contamination and/or odor problems, exhaust air shall be discharged directly to the outdoors and not recirculated to other areas. Individual circumstances may require special consideration for air exhausted to the outdoors. To satisfy exhaust needs, constant replacement air from the outdoors is necessary when the system is in operation.
- k. The RH ranges listed are the minimum and/or maximum allowable at any point within the design temperature range required for that space.
- l. Systems shall be capable of maintaining the rooms within the range during normal operation. Lower or higher temperature shall be permitted when patients' comfort and/or medical conditions require those conditions.
- m. National Institute for Occupational Safety and Health (NIOSH) criteria documents regarding occupational exposure to waste anesthetic gases and vapors, and control of occupational exposure to nitrous oxide<sup>7</sup> indicate a need for both local exhaust (scavenging) systems and general ventilation of the areas in which the respective gases are utilized. Refer to NFPA 99 for other requirements.
- n. If pressure-monitoring device alarms are installed, allowances shall be made to prevent nuisance alarms. Short-term excursions from required pressure relationships shall be allowed while doors are moving or temporarily open. Simple visual methods such as smoke trail, ball-in-tube, or flutterstrip shall be permitted for verification of airflow direction.
- o. Surgeons or surgical procedures may require room temperatures, ventilation rates, humidity ranges, and/or air distribution methods that exceed the minimum indicated ranges.
- p. Treatment rooms used for bronchoscopy shall be treated as bronchoscopy rooms. Treatment rooms used for procedures with nitrous oxide shall contain provisions for exhausting anesthetic waste gases.
- q. In a recirculating ventilation system, HEPA filters shall be permitted instead of exhausting the air from these spaces to the outdoors provided that the return air passes through the HEPA filters before it is introduced into any other spaces. The entire minimum total air changes per hour of recirculating airflow shall pass through HEPA filters. When these areas are open to larger, nonwaiting spaces, the exhaust air volume shall be calculated based on the seating area of the waiting area. (Note: The intent here is to not require the volume calculation to include a very large space [e.g., an atrium] just because a waiting area opens onto it.)
- r. See NFPA 99 for further requirements.<sup>8</sup>
- s. For intermediate care, labor/delivery/recovery rooms, and labor/delivery/recovery/postpartum rooms, four total ach shall be permitted when supplemental heating and/or cooling systems (radiant heating and cooling, baseboard heating, etc.) are used.
- t. The protective environment airflow design specifications protect the patient from common environmental airborne infectious microbes (i.e., *Aspergillus* spores). The anteroom shall have negative air pressure in relation to the protective environment room. A door louver, transfer grille, or other acceptable means shall be provided to allow for airflow from the protective environment room to the anteroom. The protective environment room shall have positive-pressure in relation to the anteroom and adjoining toilet room. Recirculation HEPA filters shall be permitted to increase the equivalent room air exchanges; however, the outdoor air changes are still required. Constant-volume airflow is required for consistent ventilation for the protected environment. The pressure relationship to adjacent areas shall remain unchanged if the PE room is utilized as a normal patient room. Rooms with reversible airflow provisions for the purpose of switching between protective environment and AII functions shall not be permitted. Positive pressure in each anteroom shall be achieved by balancing the supply cfm to not less than 75 cfm (35.4 L/s) greater than the exhaust and return cfm. Positive-pressure for each protective environment room the anteroom serves shall be achieved by balancing the supply cfm to not less than 75 cfm (35.4 L/s) greater than the exhaust and return cfm.
- u. The AII room described in this standard shall be used for isolating the airborne spread of infectious diseases, such as measles, varicella, or tuberculosis. The airborne infection isolation room shall have negative pressure in relation to the anteroom, and the adjoining toilet room shall have negative pressure in relation to the airborne infection isolation room. Supplemental recirculating devices using HEPA filters shall be permitted in the AII room to increase the equivalent room air exchanges; however, the minimum outdoor air changes of Table 4-A are still required. AII rooms that are retrofitted from standard patient rooms from which it is impractical to exhaust directly outdoors may be recirculated with air from the AII room, provided that air first passes through a HEPA filter. When the AII room is not utilized for airborne infection isolation, the pressure relationship to adjacent areas, when measured with the door closed, shall remain unchanged and the minimum total air change rate shall be 6 ach. Switching controls for reversible airflow provisions shall not be permitted. Negative pressure shall be achieved by balancing the exhaust cfm to not less than 75 cfm (35.4 L/s) greater than the supply cfm for each airborne infection isolation room the anteroom serves. The anteroom shall have positive air pressure in relation to the airborne infection isolation room. A door louver, transfer grille, or other acceptable means shall be provided to allow for airflow from the anteroom to the airborne infection isolation room.
- v. When required, appropriate hoods and exhaust devices for the removal of noxious gases or chemical vapors shall be provided in accordance with NFPA 99.<sup>8</sup>
- w. The requirement that all room air is exhausted directly to outdoors applies only to radiology waiting rooms programmed to hold patients who are waiting for chest x-rays for diagnosis of respiratory disease.
- x. If the planned space is designated in the organization's operational plan to be utilized for both bronchoscopy and gastrointestinal endoscopy, the design parameters for "bronchoscopy, sputum collection, and pentamidine administration" shall be used.
- y. For single-bed patient rooms using Group D diffusers, a minimum of six total ach shall be provided and calculated based on the volume from finished floor to 6 ft (1.83 m) above the floor.
- z. This table is based on Table 7.1 in ASHRAE 170, "Ventilation of Healthcare Facilities", and is used with expressed written permission from ASHRAE.

**TABLE 4-B  
FILTER EFFICIENCIES FOR CENTRAL VENTILATION AND AIR-CONDITIONING SYSTEMS IN GENERAL ACUTE CARE HOSPITALS, ACUTE PSYCHIATRIC HOSPITALS, OUTPATIENT FACILITIES, AND LICENSED CLINICS<sup>1</sup>**

AREA DESIGNATION	MINIMUM NUMBER OF FILTER BANKS	FILTER EFFICIENCY % FILTER BANK (MINIMUM EFFICIENCY REPORTING VALUE MERV) <sup>5</sup>		
		NO. 1 <sup>1</sup>	NO. 2 <sup>1</sup>	NO. 3 <sup>1</sup>
		<i>Orthopedic operating room, bone marrow transplant operating room, organ transplant operating room</i>	3	30% (8)
<i>Protective environment rooms</i>	3	30% (8)	90% (14)	99.97% <sup>4</sup> (17)
<i>Angiography; cardiac catheterization labs; operating rooms; interventional imaging procedure rooms; delivery rooms nurseries; patient care, treatment, cystoscopy, cesarean operating room, diagnostic, and related areas; airborne infection isolation rooms; areas providing direct patient service or clean supplies such as sterile and clean processes, and patient area corridors</i>	2	30% (8)	90% (14)	— —
	2	30% (8)	80% (13)	— —
<i>Laboratories</i>	1	30% (8)	— —	— —
	1	30% (8)	— —	— —
<i>Psychiatric hospitals intended for the care and treatment of inpatients who do not require acute medical services</i>	1	30% (8)	— —	— —

<sup>1</sup> Based on ASHRAE 52.2.

<sup>2</sup> Based on DOP test in accordance with MIL-STD-282 or based on ASHRAE 52.2.

<sup>3</sup> HEPA filters at air outlet or other locations when approved by the Authority Having Jurisdiction.

<sup>4</sup> HEPA filter located in the supply duct which serves the positive-pressure isolation room or rooms may serve more than one supply outlet and more than one positive-pressure isolation room. HEPA filter or a filter with minimum efficiency reporting value (MERV) of 17 installation shall be designed and equipped to permit safe removal, disposal and replacement of filters.

<sup>5</sup> The numbers in parentheses represent MERV rating based on ASHRAE 52.2.

**TABLE 4-C  
FILTER EFFICIENCIES FOR CENTRAL VENTILATION AND AIR-CONDITIONING SYSTEMS IN SKILLED NURSING FACILITIES AND INTERMEDIATE CARE FACILITIES AND CORRECTIONAL TREATMENT CENTERS<sup>1</sup>**

AREA DESIGNATION	MINIMUM NUMBER OF FILTER BANKS	FILTER EFFICIENCY % FILTER BANK (MINIMUM EFFICIENCY REPORTING VALUE MERV) <sup>3</sup>	
		NO. 1 <sup>1</sup>	NO. 2 <sup>1</sup>
		<i>All areas for inpatient care, treatment and/or diagnosis, and those areas providing direct service or cleaning supplies</i>	2
<i>Administrative, bulk storage, soiled holding, laundries and food prep areas</i>	1	30% <sup>2</sup> (8)	— —

<sup>1</sup> Based on ASHRAE 52.2.

<sup>2</sup> Filters are not required for evaporative coolers serving laundries and food preparation areas.

<sup>3</sup> The numbers in parentheses represent MERV rating based on ASHRAE 52.2.



**TABLE 402.1**  
**MINIMUM VENTILATION RATES IN BREATHING ZONE<sup>1, 2, 4</sup>**  
**[ASHRAE 62.1: TABLE 6.2.2.1]**

**Note:** Ventilation air supply requirements for occupancies regulated by the California Energy Commission are found in the California Energy Code.

OCCUPANCY CATEGORY <sup>4</sup>	PEOPLE OUTDOOR Air Rate R <sub>P</sub> (cfm/person)	AREA OUTDOOR Air Rate R <sub>A</sub> (cfm/ft <sup>2</sup> )	DEFAULT OCCUPANT Density <sup>3</sup> (people/1000 ft <sup>2</sup> )	AIR CLASS
<b>CORRECTIONAL FACILITIES</b>				
Booking/waiting	7.5	0.06	50	2
Cell	5	0.12	25	2
Day room	5	0.06	30	1
Guard stations	5	0.06	15	1
<b>EDUCATIONAL FACILITIES</b>				
Art classroom	10	0.18	20	2
Classrooms (ages 5-8)	10	0.12	25	1
Classrooms (age 9 plus)	10	0.12	35	1
Computer lab	10	0.12	25	1
Daycare (through age 4)	10	0.18	25	2
Daycare sickroom	10	0.18	25	3
Lecture classroom	7.5	0.06	65	1
Lecture hall (fixed seats)	7.5	0.06	150	1
Media center <sup>a</sup>	10	0.12	25	1
Multi-use assembly	7.5	0.06	100	1
Music/theater/dance	10	0.06	35	1
Science laboratories	10	0.18	25	2
University/college laboratories	10	0.18	25	2
Wood/metal shop	10	0.18	20	2
<b>FOOD AND BEVERAGE SERVICE</b>				
Bars, cocktail lounges	7.5	0.18	100	2
Cafeteria/fast food dining	7.5	0.18	100	2
Kitchen (cooking)	7.5	0.12	20	2
Restaurant dining rooms	7.5	0.18	70	2
<b>GENERAL</b>				
Break rooms	5	0.06	25	1
Coffee stations	5	0.06	20	1
Conference/meeting	5	0.06	50	1
Corridors	–	0.06	–	1
Occupiable storage rooms for liquids or gels <sup>b</sup>	5	0.12	2	2
<b>HOTELS, MOTELS, RESORTS, DORMITORIES</b>				
Barracks sleeping areas	5	0.06	20	1
Bedroom/living room	5	0.06	10	1
Laundry rooms, central	5	0.12	10	2
Laundry rooms within dwelling units	5	0.12	10	1
Lobbies/pre-function	7.5	0.06	30	1
Multipurpose assembly	5	0.06	120	1
<b>OFFICE BUILDINGS</b>				
Breakrooms	5	0.12	50	1
Main entry lobbies	5	0.06	10	1
Occupiable storage rooms for dry materials	5	0.06	2	1
Office space	5	0.06	5	1
Reception areas	5	0.06	30	1
Telephone/data entry	5	0.06	60	1
<b>MISCELLANEOUS SPACES</b>				
Bank or bank lobbies	7.5	0.06	15	1
Bank vaults/safe deposit	5	0.06	5	2
Computer (not printing)	5	0.06	4	1
Freezer and refrigerated spaces (<50°F) <sup>e</sup>	10	–	–	2
General manufacturing (excludes heavy industrial and processes using chemicals)	10	0.18	7	3

**TABLE 402.1 (continued)**  
**MINIMUM VENTILATION RATES IN BREATHING ZONE<sup>1,2</sup>**  
**[ASHRAE 62.1: TABLE 6.2.2.1]**

OCCUPANCY CATEGORY <sup>4</sup>	PEOPLE OUTDOOR Air Rate R <sub>p</sub> (cfm/person)	AREA OUTDOOR Air Rate R <sub>A</sub> (cfm/ft <sup>2</sup> )	DEFAULT OCCUPANT Density <sup>3</sup> (people/1000 ft <sup>2</sup> )	AIR CLASS
Pharmacy (prep. area)	5	0.18	10	2
Photo studios	5	0.12	10	1
Shipping/receiving <sup>b</sup>	10	0.12	2	2
Sorting, packing, light assembly	7.5	0.12	7	2
Telephone closets	–	–	–	1
Transportation waiting	7.5	0.06	100	1
Warehouses <sup>b</sup>	10	0.06	–	2
<b>PUBLIC ASSEMBLY SPACES</b>				
Auditorium seating area	5	0.06	150	1
Courtrooms	5	0.06	70	1
Legislative chambers	5	0.06	50	1
Libraries	5	0.12	10	1
Lobbies	5	0.06	150	1
Museums (children's)	7.5	0.12	40	1
Museums/galleries	7.5	0.06	40	1
Places of religious worship	5	0.06	120	1
<b>RESIDENTIAL</b>				
Common corridors	–	0.06	–	1
Dwelling unit <sup>f, g</sup>	5	0.06	See footnote <sup>f</sup>	1
<b>RETAIL</b>				
Sales (except as below)	7.5	0.12	15	2
Barber shop	7.5	0.06	25	2
Beauty and nail salons	20	0.12	25	2
Coin-operated laundries	7.5	0.12	20	2
Mall common areas	7.5	0.06	40	1
Pet shops (animal areas)	7.5	0.18	10	2
Supermarket	7.5	0.06	8	1
<b>SPORTS AND ENTERTAINMENT</b>				
Bowling alley (seating)	10	0.12	40	1
Disco/dance floors	20	0.06	100	2
Gambling casinos	7.5	0.18	120	1
Game arcades	7.5	0.18	20	1
Gym, sports arena (play area) <sup>c</sup>	20	0.18	7	2
Health club/aerobics room	20	0.06	40	2
Health club/weight rooms	20	0.06	10	2
Spectator areas	7.5	0.06	150	1
Stages, studios <sup>d</sup>	10	0.06	70	1
Swimming (pool & deck) <sup>c</sup>	–	0.48	–	2

For SI units: 1 cubic foot per minute = 0.0283 m<sup>3</sup>/min, 1 square foot = 0.0929 m<sup>2</sup>

**Notes:**

- <sup>1</sup> This table applies to no-smoking areas. Rates for smoking-permitted spaces shall be determined using other methods.
- <sup>2</sup> Volumetric airflow rates are based on an air density of 0.075 pounds of dry air per cubic foot (lb<sub>da</sub>/ft<sup>3</sup>) (1.201 kg<sub>da</sub>/m<sup>3</sup>), which corresponds to dry air at a barometric pressure of 1 atm (101 kPa) and an air temperature of 70°F (21°C). Rates shall be permitted to be adjusted for actual density but such adjustment is not required for compliance with this chapter.
- <sup>3</sup> The default occupant density shall be used where actual occupant density is not known.
- <sup>4</sup> Where the occupancy category for a proposed space or zone is not listed, the requirements for the listed occupancy category that is most similar in terms of occupant density, activities, and building construction shall be used.

ITEM-SPECIFIC NOTES FOR TABLE 402.1

- <sup>a</sup> For high school and college libraries, use values shown for Public Assembly Spaces – Libraries.
- <sup>b</sup> Rate is capable of not being sufficient where stored materials include those having potentially harmful emissions.

- <sup>c</sup> Rate does not allow for humidity control. Additional ventilation or dehumidification shall be permitted to remove moisture. “Deck area” refers to the area surrounding the pool that would be expected to be wetted during normal pool use, i.e., where the pool is occupied. Deck area that is not expected to be wetted shall be designated as a space type (for example, “spectator area”).
- <sup>d</sup> Rate does not include special exhaust for stage effects, e.g., dry ice vapors, smoke.
- <sup>e</sup> 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.
- <sup>f</sup> Default occupancy for dwelling units shall be two persons for studio and one-bedroom units, with one additional person for each additional bedroom.
- <sup>g</sup> Air from one residential dwelling shall not be recirculated or transferred to other spaces outside of that dwelling.

**TABLE 403.2.2**  
**ZONE AIR DISTRIBUTION EFFECTIVENESS<sup>1, 2, 3, 4, 5</sup>**  
**[ASHRAE 62.1: TABLE 6.2.2.2]**

AIR DISTRIBUTION CONFIGURATION	$E_z$
Ceiling supply of cool air.	1.0
Ceiling supply of warm air and floor return.	1.0
Ceiling supply of warm air 15°F or more above space temperature and ceiling return.	0.8
Ceiling supply of warm air less than 15°F above space temperature and ceiling return provided that the 150 feet per minute (fpm) supply air jet reaches to within 4.5 feet of floor level.	1.0 <sup>6</sup>
Floor supply of cool air and ceiling return, provided that the vertical throw is more than 50 fpm at a height of 4.5 feet or more above the floor.	1.0
Floor supply of cool air and ceiling return, provided low velocity displacement ventilation achieves unidirectional flow and thermal stratification, or underfloor air distribution systems where the vertical throw is 50 fpm or less at a height of 4.5 feet above the floor.	1.2
Floor supply of warm air and floor return.	1.0
Floor supply of warm air and ceiling return.	0.7
Makeup supply drawn in on the opposite side of the room from the exhaust, return, or both.	0.8
Makeup supply drawn in near to the exhaust, return, or both locations.	0.5

For SI units: °C = (°F-32)/1.8, 1 foot per minute = 0.005 m/s, 1 foot = 304.8 mm

**Notes:**

- <sup>1</sup> “Cool air” is air cooler than space temperature.
- <sup>2</sup> “Warm air” is air warmer than space temperature.
- <sup>3</sup> “Ceiling supply” includes any point above the breathing zone.
- <sup>4</sup> “Floor supply” includes any point below the breathing zone.
- <sup>5</sup> As an alternative to using the above values,  $E_z$  shall be permitted to be regarded as equal to air change effectiveness determined in accordance with ASHRAE 129 for air distribution configurations except unidirectional flow.
- <sup>6</sup> For lower velocity supply air,  $E_z=0.8$

**TABLE 403.5.2**  
**SYSTEM VENTILATION EFFICIENCY<sup>1, 2, 3</sup>**  
**[ASHRAE 62.1: TABLE 6.2.5.2]**

MAX ( $Z_{pz}$ )	$E_v$
≤ 0.15	1.0
≤ 0.25	0.9
≤ 0.35	0.8
≤ 0.45	0.7
≤ 0.55	0.6
> 0.55	Use Section 404.0

**Notes:**

- <sup>1</sup> “Max  $Z_{pz}$ ” refers to the largest value of  $Z_{pz}$ , calculated in accordance with Equation 403.5.1, among the ventilation zones served by the system.
- <sup>2</sup> For values of Max ( $Z_{pz}$ ) between 0.15 and 0.55, the corresponding value of  $E_v$  shall be permitted to be determined by interpolating the values in the table.
- <sup>3</sup> The values of  $E_v$  in this table are based on a 0.15 average outdoor air fraction for the system (i.e., the ratio of the uncorrected outdoor air intake ( $V_{out}$ ) to the total zone primary airflow for the zones served by the air handler). For systems with higher values of the average outdoor air fraction, this table is capable of resulting in unrealistically low values of  $E_v$ , and the use of Section 404.0 is capable of yielding more practical results.

VENTILATION AIR

**TABLE 403.7  
MINIMUM EXHAUST RATES  
[ASHRAE 62.1: TABLE 6.5]**

OCCUPANCY CATEGORY <sup>8</sup>	EXHAUST RATE (cfm/unit)	EXHAUST RATE (cfm/ft <sup>2</sup> )	AIR CLASS
Arenas <sup>2</sup>	–	0.50	1
Art classrooms	–	0.70	2
Auto repair rooms <sup>1</sup>	–	1.50	2
Barber shops	–	0.50	2
Bathroom <sup>10,11</sup>	20/50	–	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
Kitchens – commercial	–	0.70	2
Kitchenettes	–	0.30	2
Locker rooms	–	0.50	2
Locker/dressing rooms	–	0.25	2
Paint spray booths	–	–	4
Parking garages <sup>3</sup>	–	0.75	2
Pet shops (animal areas)	–	0.90	2
Refrigerating machinery rooms <sup>6</sup>	–	–	3
Residential – kitchens <sup>7</sup>	50/100	–	2
Soiled laundry storage rooms	–	1.00	3
Storage rooms, chemical	–	1.50	4
Toilets – private <sup>5,9</sup>	25/50	–	2
Toilets – public <sup>4,9</sup>	50/70	–	2
Woodwork shop/classrooms	–	0.50	2

For SI units: 1 cubic foot per minute = 0.0283 m<sup>3</sup>/min, 1 square foot = 0.0929 m<sup>2</sup>

**Notes:**

- <sup>1</sup> Stands where engines are run shall have exhaust systems that directly connect to the engine exhaust and prevent escape of fumes.
- <sup>2</sup> Where combustion equipment is intended to be used on the playing surface, additional dilution ventilation, source control, or both shall be provided.
- <sup>3</sup> Exhaust rate is not required for open parking garages as defined in accordance with the building code.
- <sup>4</sup> Rate is per water closet, urinal, or both. Provide the higher rate where periods of heavy use are expected to occur, e.g., toilets in theatres, schools, and sports facilities. Otherwise the lower rate shall be permitted to be used.
- <sup>5</sup> Rate is for a toilet room intended to be occupied by one person at a time. For continuous system operation during normal hours of use, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used.
- <sup>6</sup> For refrigeration machinery rooms, the exhaust rate shall comply with Chapter 11.
- <sup>7</sup> For continuous system operation, the lower rates shall be permitted. Otherwise the higher rate shall be used.
- <sup>8</sup> For unlisted occupancies for a proposed space not listed in the table, the requirements for the listed occupancy that is most similar in terms of occupant density and occupancy type shall be used.
- <sup>9</sup> Exhaust air that has been cleaned in accordance with the criteria of Class 1 shall be permitted to be recirculated.
- <sup>10</sup> [HCD 1 & HCD 2] A bathroom is any room containing a bathtub, a shower, a spa, or a similar source of moisture.
- <sup>11</sup> [HCD 1 & HCD 2] ANSI/ASHRAE 62.2: Tables 5.1 and 5.2.

**CALIFORNIA MECHANICAL CODE – MATRIX ADOPTION TABLE  
CHAPTER 5 – EXHAUST SYSTEMS**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the code user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt Entire Chapter				X	X							X									
Adopt Entire Chapter as amended (amended sections listed below)	X		X					X	X	X	X		X								
Adopt only those sections that are listed below		X																	X		
Chapter/Section																					
503.3		X						X	X												
503.3 Exception 1 & 2		X						X	X												
503.3.1		X						X	X												
504.1.1										X	X		X								
505.7																				X	
505.7.1																				X	
508.5										X	X		X								
509.2.3			X																		
509.2.3.4															X						
511.1.6		X						X	X												
513.2.2			X					X	X												
513.2.2 Exception 2								X	X												
513.3.2			X																		
513.11			X																		
513.11.1			X																		
516.2.7 Exception			X																		
516.2.9			X																		

*This state agency does not adopt sections identified with the following symbol: †*

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



# CHAPTER 5

## EXHAUST SYSTEMS

### 501.0 General.

**501.1 Applicability.** This chapter includes requirements for environmental air ducts, product-conveying systems, and commercial hoods and kitchen ventilation. Part I addresses environmental air ducts and product conveying systems. Part II addresses commercial hoods and kitchen ventilation.

### 502.0 Termination.

**502.1 Exhaust Opening Protection.** Exhaust openings terminating to the outdoors shall be covered with a corrosion-resistant screen having not less than 1/4 of an inch (6.4 mm) openings, and shall have not more than 1/2 of an inch (12.7 mm) openings.

**Exception:** Clothes dryers.

**502.2 Termination of Exhaust Ducts.** Exhaust ducts shall terminate in accordance with Section 502.2.1 through Section 502.2.3.

» **502.2.1 Environmental Air Ducts.** Environmental air duct exhaust shall terminate not less than 3 feet (914 mm) from a property line, 10 feet (3048 mm) from a forced air inlet, and 3 feet (914 mm) from openings into the building. Environmental exhaust ducts shall not discharge onto a public walkway.

» **502.2.2 Product Conveying Ducts.** Ducts conveying explosive or flammable vapors, fumes, or dusts shall terminate not less than 30 feet (9144 mm) from a property line, 10 feet (3048 mm) from openings into the building, 6 feet (1829 mm) from exterior walls or roofs, 30 feet (9144 mm) from combustible walls or openings into the building that are in the direction of the exhaust discharge, and 10 feet (3048 mm) above adjoining grade.

Other product-conveying outlets shall terminate not less than 10 feet (3048 mm) from a property line, 3 feet (914 mm) from exterior walls or roofs, 10 feet (3048 mm) from openings into the building, and 10 feet (3048 mm) above adjoining grade.

**502.2.3 Commercial Kitchen Ducts.** Commercial kitchens exhaust ducts shall terminate in accordance with Section 510.9 or Section 510.10.

### Part I – Environmental Air Ducts and Product-Conveying Systems.

### 503.0 Motors, Fans, and Filters.

**503.1 General.** Motors and fans shall be sized to provide the required air movement. Motors in areas that contain flammable vapors or dusts shall be of a type approved for such environments. A manually operated remote control installed at an approved location shall be provided to shut off fans or blowers in flammable vapor or dust systems. Equipment used

in operations that generate explosive or flammable vapors, fumes, or dusts shall be interlocked with the ventilation system so that the equipment cannot be operated unless the ventilation fans are in operation. Motors for fans used to convey flammable vapors or dusts shall be located outside the duct or shall be protected with approved shields and dust-proofing. Where belts are used, they shall not enter the duct unless the belt and pulley within the duct are enclosed. Motors and fans shall be accessible for servicing and maintenance.

**503.2 Fans.** Parts of fans in contact with explosive or flammable vapors, fumes, or dusts shall be of nonferrous or nonsparking materials or their casing shall be lined or constructed of such material. Where the size and hardness of materials passing through a fan are capable of producing a spark, both the fan and the casing shall be of nonsparking materials. Where fans are required to be spark-resistant, their bearings shall not be within the airstream, and parts of the fan shall be grounded. Fans in systems handling materials that are likely to clog the blades, and fans in buffing or wood-working exhaust systems, shall be of the radial-blade or tube-axial type.

Equipment used to exhaust explosive or flammable vapors, fumes, or dusts shall bear an identification plate stating the ventilation rate for which the system was designed.

Fans located in systems conveying corrosives shall be of materials that are resistant to the corrosive or shall be coated with corrosion-resistant materials.

**503.3 Filters.** [BSC-CG], [DSA-SS & DSA-SS/CC] In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media for outside and return air that provides at least a Minimum Efficiency Reporting Value (MERV) of 8. MERV 8 filters shall be installed prior to occupancy, and recommendations for maintenance with filters of the same value shall be included in the operation and maintenance manual in compliance with Chapter 5, Division 5.5. of the California Green Building Standards Code (CALGreen).

#### Exceptions:

1. An ASHRAE 10-percent to 15-percent efficiency filter shall be permitted for an HVAC unit meeting the 2013 California Energy Code having 60,000 Btu/h (17.6 kW) or less capacity per fan coil, if the energy use of the air delivery system is 0.4 W/cfm [848 W/(m<sup>3</sup>/s)] or less at design air flow.
2. Existing mechanical equipment.

**503.3.1 Labeling.** Installed filters shall be clearly labeled by the manufacturer indicating the MERV rating.

### 504.0 Environmental Air Ducts.

**504.1 General.** Where not specified in this chapter, exhaust ducts shall be constructed and installed in accordance with

Chapter 6 and shall be airtight as approved by the Authority Having Jurisdiction. Environmental air ducts that have an alternate function as a part of an approved smoke-control system do not require design as Class 1 product-conveying ducts.

**Exceptions:**

- (1) Ductless range hoods where installed in accordance with the manufacturer's installation instructions.
- (2) Condensing clothes dryers where installed in accordance with the manufacturer's installation instructions.

**504.1.1 Backdraft Protection.** Exhaust ducts shall terminate outside the building and shall be equipped with backdraft dampers or with motorized dampers that automatically shut where the systems or spaces served are not in use. *[OSHPD 1, 2 & 4] Exception: Backdraft dampers are not required when the exhaust fan must operate continuously.*

**Exception:** Where the exhaust duct does not discharge into a common exhaust plenum and one of the following:

- (1) The exhaust fan runs continuously.
- (2) The exhaust duct serves space(s) that are not mechanically heated or cooled.
- (3) The space served is maintained at positive pressure.

**504.2 Independent Exhaust Systems.** Single or combined mechanical exhaust systems shall be independent of other exhaust systems.

» **504.3 Domestic Range.** Ducts used for domestic kitchen range ventilation shall be of metal and shall have smooth interior surfaces.

**Exception:** Ducts for domestic kitchen downdraft grill-range ventilation installed under a concrete slab floor shall be permitted to be of approved Schedule 40 PVC provided:

- (1) The under-floor trench in which the duct is installed shall be completely backfilled with sand or gravel.
- (2) Not more than 1 inch (25.4 mm) of 6 inch diameter (152 mm) PVC coupling shall be permitted to protrude above the concrete floor surface.
- (3) PVC pipe joints shall be solvent cemented to provide an air and gasketight duct.
- (4) The duct shall terminate above grade outside the building and shall be equipped with a back-draft damper.

» **504.4 Clothes Dryers.** A clothes dryer exhaust duct shall not be connected to a vent connector, gas vent, chimney, and shall not terminate into a crawl space, attic, or other concealed space. Exhaust ducts shall not be assembled with screws or other fastening means that extend into the duct and that are capable of catching lint, and that reduce the efficiency of the exhaust system. Exhaust ducts shall be constructed of rigid metallic material. Transition ducts used to connect the dryer to the exhaust duct shall be listed for that application or installed in accordance with the clothes dryer manufacturer's installation instructions. Clothes dryer exhaust ducts shall terminate to the outside of the building in accordance with Section 502.2.1 and shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination.

Devices, such as fire or smoke dampers, that will obstruct the flow of the exhaust shall not be used. Where joining of ducts, the male end shall be inserted in the direction of airflow.

**504.4.1 Provisions for Makeup Air.** Makeup air shall be provided in accordance with the following: «

- (1) Makeup air shall be provided for Type 1 clothes dryers in accordance with the manufacturer's instructions. [NFPA 54:10.4.3.1]. Where a closet is designed for the installation of a clothes dryer, an opening of not less than 100 square inches (0.065 m<sup>2</sup>) for makeup air shall be provided in the door or by other approved means.
- (2) Provision for makeup air shall be provided for Type 2 clothes dryers, with a free area of not less than 1 square inch (0.0006 m<sup>2</sup>) for each 1000 British thermal units per hour (Btu/h) (0.293 kW) total input rating of the dryer(s) installed. [NFPA 54:10.4.3.2]

**504.4.2 Domestic Clothes Dryers.** Where a compartment or space for a Type 1 clothes dryer is provided, not less than a 4 inch diameter (102 mm) exhaust duct of approved material shall be installed in accordance with Section 504.0. «

Type 1 clothes dryer exhaust ducts shall be of rigid metal and shall have smooth interior surfaces. The diameter shall be not less than 4 inches nominal (100 mm) and the thickness shall be not less than 0.016 of an inch (0.406 mm).

**504.4.2.1 Length Limitation.** Unless otherwise permitted or required by the dryer manufacturer's instructions and approved by the Authority Having Jurisdiction, domestic dryer moisture exhaust ducts shall not exceed a total combined horizontal and vertical length of 14 feet (4267 mm), including two 90 degree (1.57 rad) elbows. A length of 2 feet (610 mm) shall be deducted for each 90 degree (1.57 rad) elbow in excess of two. «

**504.4.2.2 Transition Ducts.** Listed clothes dryer transition ducts not more than 6 feet (1829 mm) in length shall be permitted to be used to connect the Type 1 dryer to the exhaust ducts. Transition ducts and flexible clothes dryer transition ducts shall not be concealed within construction, and shall be installed in accordance with the manufacturer's installation instructions.

**504.4.3 Commercial Clothes Dryers.** Commercial dryer exhaust ducts shall be installed in accordance with their listings. The installation of commercial clothes dryer exhaust ducts shall comply with the appliance manufacturer's installation instructions. «

**504.4.3.1 Exhaust Ducts for Type 2 Clothes Dryers.** Exhaust ducts for Type 2 clothes dryers shall comply with the following: «

- (1) Exhaust ducts for Type 2 clothes dryers shall comply with Section 504.4. [NFPA 54:10.4.5.1]
- (2) Exhaust ducts for Type 2 clothes dryers shall be constructed of sheet metal or other noncom-



### 513.0 Fire-Extinguishing Equipment.

**513.1 General.** Fire-extinguishing equipment for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems shall be provided. [NFPA 96:10.1.1]

**513.1.1 Protection.** Cooking equipment that produces grease-laden vapors and is capable of being a source of ignition of grease in the hood, grease removal device, or duct shall be protected by fire-extinguishing equipment. [NFPA 96:10.1.2]

**513.2 Types of Equipment.** Fire-extinguishing equipment shall include both automatic fire-extinguishing systems as primary protection and portable fire extinguishers as secondary backup. [NFPA 96:10.2.1]

**513.2.1 Identification.** A placard shall be conspicuously placed near the fire extinguisher that states that the fire protection system shall be activated prior to using the fire-extinguisher. [NFPA 96:10.2.2]

**513.2.2 Standard.** *Commercial cooking equipment that produce grease laden vapors shall be provided with a Type I Hood, in accordance with this Code, and an automatic fire extinguishing system that is listed and labeled for its intended use as follows:*

- (1) *Wet chemical extinguishing system (NFPA 17A, Standard for Wet Chemical Extinguishing Systems), complying with UL 300, Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Equipment. All existing dry chemical and wet chemical extinguishing systems shall comply with UL 300, Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Equipment.*
- (2) *Carbon dioxide extinguishing systems (NFPA 12, Standard on Carbon Dioxide Extinguishing Systems).*
- (3) *Automatic fire sprinkler systems (NFPA 13, Standard for the Installation of Sprinkler Systems).*

*All existing dry chemical and wet chemical extinguishing systems shall comply with UL 300, no later than the second required servicing of the system following the effective date of this section.*

#### Exceptions:

- (1) Automatic fire-extinguishing equipment provided as part of listed recirculating systems in accordance with UL 710B. [NFPA 96:10.2.5]
- (2) **[DSA-SS and DSA-SS/CC]** *Public schools kitchens, without deep-fat fryers, shall be upgraded to a UL 300, Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Equipment, compliant system during state-funded modernization projects that are under the jurisdiction of the Division of the State Architect.*

**513.2.4 Modification of Existing Hood Systems.** An abandoned pipe or conduit from a previous installation shall be removed from within the hood, plenum, and exhaust duct. [NFPA 96:10.2.7.1]

**513.2.4.1 Sealing.** Penetrations and holes resulting from the removal of conduit or piping shall be sealed with listed or equivalent liquid-tight sealing devices. [NFPA 96:10.2.7.2]

**513.2.4.2 Obstructions.** The addition of obstructions to spray patterns from the cooking appliance nozzle(s) such as baffle plates, shelves, or a modification shall not be permitted. [NFPA 96:10.2.7.3]

**513.2.4.3 System Re-evaluation.** Changes or modifications to the hazard after installation of the fire-extinguishing systems shall result in re-evaluation of the system design by a properly trained, qualified, and certified person(s). [NFPA 96:10.2.7.4]

**513.2.5 Fixed Baffle Hoods with Water Wash.** Grease removal devices, hood exhaust plenums, and exhaust ducts requiring protection in accordance with Section 513.1 shall be permitted to be protected by a listed fixed baffle hood containing a constant or fire-actuated water wash system that is listed and in accordance with UL 300 or other equivalent standards and shall be installed in accordance with the requirements of their listing. [NFPA 96:10.2.8.1]

**513.2.5.1 Domestic Water Supply.** The water for listed, fixed baffle hood assemblies shall be permitted to be supplied from the domestic water supply where the minimum water pressure and flow are provided in accordance with the terms of the listing. [NFPA 96:10.2.8.3]

**513.2.5.2 Control Valve.** The water supply shall be controlled by a supervised water supply control valve. [NFPA 96:10.2.8.4]

**513.2.5.3 Activation.** The water wash in the fixed baffle hood specifically listed to extinguish a fire shall be activated by the cooking equipment extinguishing system. [NFPA 96:10.2.8.5]

**513.2.5.4 Water-Wash System.** A water-wash system approved to be used for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall include instruction and electrical interface for simultaneous activation of the water-wash system from an automatic fire-extinguishing system, where the automatic fire-extinguishing system is used for cooking equipment protection. [NFPA 96:10.2.8.6]

**513.2.5.5 Exception.** Where the fire-extinguishing system provides protection for the cooking equipment, hood, and duct, activation of the water-wash shall not be required. [NFPA 96:10.2.8.7]

**513.2.5.6 Water Supply.** The water required for listed automatic fire-extinguishing systems shall be permitted to be supplied from the domestic water supply where the minimum water pressure and flow are provided in accordance with the terms of the listing. The water supply shall be controlled by a supervised water supply control valve. Where the water supply is from a dedicated fire protection water supply in a building with one or more fire sprinkler systems, separate indicating control valves and drains shall be provided and arranged so that the hood system and sprinkler system are capable of being controlled individually. [NFPA 96:10.2.9]

**513.2.6 Water Valve Supervision.** Valves controlling the water supply to listed fixed baffle hood assemblies, automatic fire-extinguishing systems, or both shall be listed indicating type of valve and shall be supervised open by one of the following methods:

- (1) Central station, proprietary, or remote station alarm service.
- (2) Local alarm service that will cause the sounding of an audible signal at a constantly attended point.
- (3) Locking valves open.
- (4) Sealing of valves and approved weekly recorded inspection. [NFPA 96:10.2.10]

**513.3 Simultaneous Operation.** Fixed pipe extinguishing systems in a single hazard area shall be arranged for simultaneous automatic operation upon actuation of any one of the systems. [NFPA 96:10.3.1]

**513.3.1 Automatic Sprinkler System.** Simultaneous operation shall not be required where the one fixed pipe extinguishing system is an automatic sprinkler system. Where an automatic sprinkler system is used in conjunction with a water-based fire-extinguishing system served by the same water supply, hydraulic calculations shall consider both systems operating simultaneously. [NFPA 96:10.3.2, 10.3.2.1]

**513.3.2 Dry or Wet Chemical Systems.** Simultaneous operation shall be required where a dry or wet chemical system is used to protect common exhaust ductwork by NFPA 17A, *Wet Chemical Extinguishing Systems*.

**513.4 Fuel and Electric Power Shutoff.** Upon activation of a fire-extinguishing system for a cooking operation, sources of fuel and electric power that produce heat to equipment requiring protection by that system shall automatically shut off. [NFPA 96:10.4.1]

**Exception:** Solid-fuel cooking operations.

**513.4.1 Steam.** Steam supplied from an external source shall not be required to automatically shut off. [NFPA 96:10.4.2]

**513.4.2 Protection Not Required.** A gas appliance not requiring protection, but located under ventilating equipment where protected appliances are located, shall be automatically shut off upon activation of the extinguishing system. [NFPA 96:10.4.3]

**513.4.3 Manual Reset.** Shutoff devices shall require manual reset. [NFPA 96:10.4.4]

**513.5 Manual Activation.** A readily accessible means for manual activation shall be located between 42 inches and 48 inches (1067 mm and 1219 mm) above the floor, be accessible in the event of a fire, be located in a path of egress, and clearly identify the hazard protected. Not less than one manual actuation device shall be located not less than 10 feet (3048 mm) and not more than 20 feet (6096 mm) from the protected exhaust system(s) within the path of egress or at an alternative location acceptable to the Authority Having Jurisdiction. Manual actuation using a cable-operated pull station

shall not require more than 40 pounds-force (lbf) (178 N) of force, with a pull movement not to exceed 14 inches (356 mm) to activate the automatic fire extinguishing system. The automatic and manual means of system activation external to the control head or releasing device shall be separate and independent of each other so that failure of one will not impair the operation of the other except as permitted in Section 513.5.1. [NFPA 96:10.5.1 – 10.5.2]

**513.5.1 Location of Manual Activation Device.** The manual means of system activation shall be permitted to be common with the automatic means where the manual activation device is located between the control head or releasing device and the first fusible link. [NFPA 96:10.5.3]

**513.5.2 Automatic Sprinkler System.** An automatic sprinkler system shall not require a manual means of system activation. [NFPA 96:10.5.4]

**513.5.3 Manual Actuator(s).** The means for manual activation shall be mechanical or rely on electrical power for activation in accordance with Section 513.5.4. [NFPA 96:10.5.5]

**513.5.4 Standby Power Supply.** Electrical power shall be permitted to be used for manual activation where a standby power supply is provided or where supervision is provided in accordance with Section 513.7. [NFPA 96:10.5.6]

**513.6 System Annunciation.** Upon activation of an automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has activated. [NFPA 96:10.6.1]

**513.6.1 Signaling.** Where a fire alarm signaling system is serving the occupancy where the extinguishing system is located, the activation of the automatic fire-extinguishing system shall activate the fire alarm signaling system. [NFPA 96:10.6.2]

**513.7 System Supervision.** Where electrical power is required to operate the fixed automatic fire-extinguishing system, the system shall be provided with a reserve power supply and be monitored by a supervisory alarm except as permitted in accordance with Section 513.7.1. [NFPA 96:10.7.1]

**513.7.1 Automatic Fire-Extinguishing System.** Where a fixed automatic fire-extinguishing system includes automatic mechanical detection and actuation as a backup detection system, electrical power monitoring and reserve power supply shall not be required. [NFPA 96:10.7.2]

**513.7.2 Supervision.** System supervision shall not be required where a fire-extinguishing system(s) is interconnected or interlocked with the cooking equipment power source(s) so that where the fire-extinguishing system becomes inoperable due to power failure, sources of fuel or electric power that produce heat to cooking equipment serviced by that hood shall automatically shut off. [NFPA 96:10.7.3]

**513.7.3 Listed Water Wash System.** System supervision shall not be required where an automatic fire-extinguishing system, including automatic mechanical

# HISTORY NOTE APPENDIX

## CALIFORNIA MECHANICAL CODE

### (TITLE 24, PART 4, CALIFORNIA CODE OF REGULATIONS)

*For prior history, see the History Note Appendix to the California Mechanical Code, 2013 Triennial Edition effective January 1, 2014.*

1. *(BSC 02/15, HCD 05/15, DSA-SS 06/15, OSHPD 06/15, SFM 03/15) Adoption by reference of the 2015 Uniform Mechanical Code (UMC) with necessary state amendments and repeal of the 2012 edition of the UMC; Effective on January 1, 2017.*
2. *Errata to correct editorial errors within the preface as well as throughout various chapters in this code. Effective January 1, 2017.*
3. *2016 Intervening Update (DSA-SS/CC 03/16) Adopted by the California Building Standards Commission on June 20, 2017, published on January 1, 2018, effective on July 1, 2018.*
4. *2016 Intervening Update (OSHPD 04/16) Adopted by the California Building Standards Commission on August 14, 2017, published on January 1, 2018, effective on July 1, 2018.*

