

ANSI/ASHRAE Standard 62.1 What's new in ventilation?

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ANSI/ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality



ANSI/ASHRAE Standard 62.1-2004
(Includes ANSI/ASHRAE Addenda listed in Appendix H)



ASHRAE STANDARD

Ventilation for Acceptable Indoor Air Quality

See Appendix H for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, <http://www.ashrae.org>, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2306. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in U.S. and Canada).

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Introduction to Standard 62.1

- Consensus standard
- First published in 1973
- Now on continuous maintenance
- Backed by years of research
- Initially prescribed ventilation rates only
- Introduced “IAQ” Procedure in 1981
- Specifies “Breathing Zone Ventilation Rates”

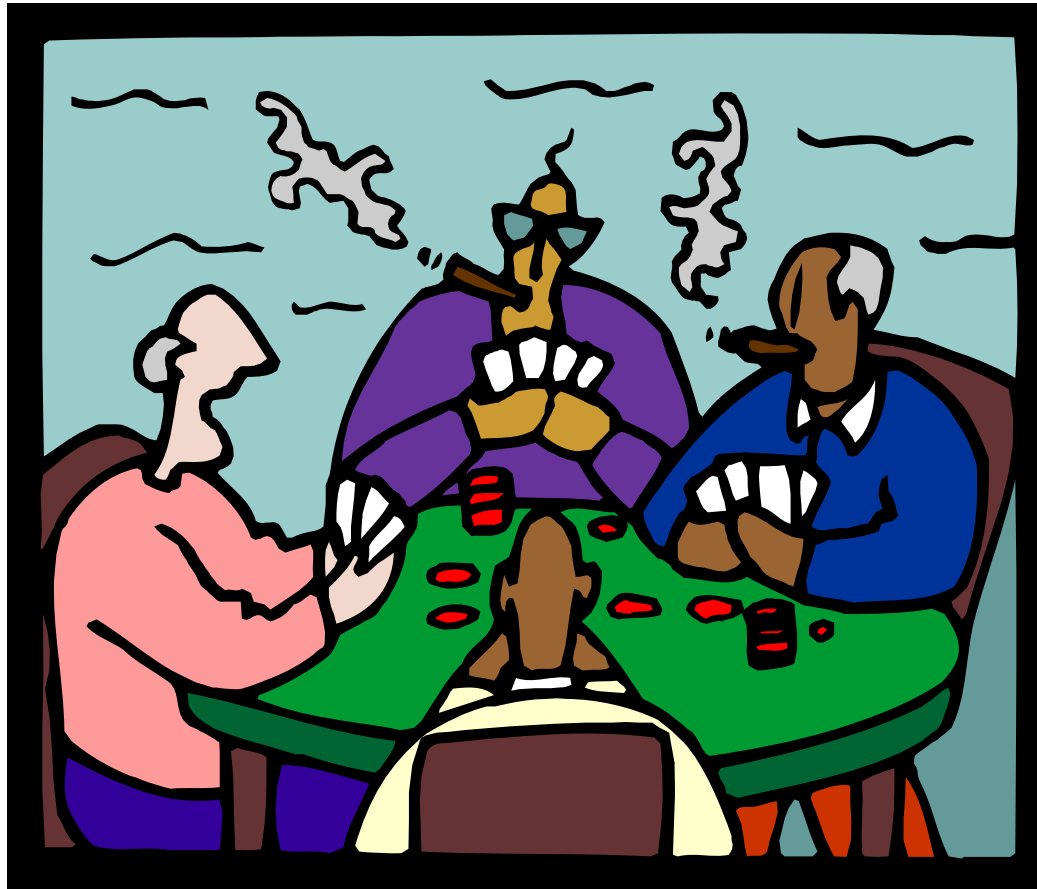


Introduction to Standard 62.1

- Applicable to new buildings and changes to existing buildings
- Applies to all indoor or enclosed spaces that people may occupy
- Also covers release of moisture in bathrooms, locker rooms, etc.



Does not address smoking



Includes Code Intended Language

- The standard has been incorporated in one form or another in the model codes

2003 International Mechanical Code

VENTILATION

402.3 Adjoining spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining rooms shall be unobstructed and shall have an area not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m²). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

402.4 Openings below grade. Where openings below grade provide required natural ventilation, the outside horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

SECTION 403 MECHANICAL VENTILATION

403.1 Ventilation system. Mechanical ventilation shall be provided by a method of supply air and return or exhaust air. The amount of supply air shall be approximately equal to the amount of return and exhaust air. The system shall not be prohibited from producing negative or positive pressure. The system to convey ventilation air shall be designed and installed in accordance with Chapter 6.

Ventilation supply systems shall be designed to deliver the required rate of supply air to the occupied zone within an occupied space. The occupied zone shall have boundaries measured at 3 inches (76 mm) and 72 inches (1829 mm) above the floor and 24 inches (610 mm) from the enclosing walls.

403.2 Outdoor air required. The minimum ventilation rate of required outdoor air shall be determined in accordance with Section 403.3.

403.2.1 Recirculation of air. The air required by Section 403.3 shall not be recirculated. Air in excess of that required by Section 403.3 shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

- Ventilation air shall not be recirculated from one dwelling unit to another or to dissimilar occupancies.
- Supply air to a swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces.
- Where mechanical exhaust is required by Table 403.3, recirculation of air from such spaces shall be prohibited. All air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 403.3.

403.2.2 Transfer air. Except where recirculation from such spaces is prohibited by Table 403.3, air transferred from occupied spaces is not prohibited from serving as makeup air for required exhaust systems in such spaces as kitchens, baths, toilet rooms, elevators and smoking lounges. The amount of transfer air and exhaust air shall be sufficient to

provide the flow rates as specified in Sections 403.3 and 403.3.1. The required outdoor air rates specified in Table 403.3 shall be introduced directly into such spaces or into the occupied spaces from which air is transferred or a combination of both.

403.3 Ventilation rate. Ventilation systems shall be designed to have the capacity to supply the minimum outdoor airflow rate determined in accordance with Table 403.3 based on the occupancy of the space and the occupant load or other parameter as stated therein. The occupant load utilized for design of the ventilation system shall not be less than the number determined from the estimated maximum occupant load rate indicated in Table 403.3. Ventilation rates for occupancies not represented in Table 403.3 shall be determined by an approved engineering analysis. The ventilation system shall be designed to supply the required rate of ventilation air continuously during the period the building is occupied, except as otherwise stated in other provisions of the code.

Exception: The occupant load is not required to be determined, based on the estimated maximum occupant load rate indicated in Table 403.3 where approved statistical data document the accuracy of an alternate anticipated occupant density.

403.3.1 System operation. The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 403.3 and the actual number of occupants present.

403.3.2 Common ventilation system. Where spaces having different ventilation rate requirements are served by a common ventilation system, the ratio of outdoor air to total supply air for the system shall be determined based on the space having the largest outdoor air requirement or shall be determined in accordance with the following formula:

$$Y = \frac{X}{(1 + X - Z)} \quad \text{(Equation 4-1)}$$

where

$Y = V_o/V_s$ = Corrected fraction of outdoor air in system supply.

$X = V_{o1}/V_{s1}$ = Uncorrected fraction of outdoor air in system supply

$Z = V_{o2}/V_{s2}$ = Fraction of outdoor air in critical space. The critical space is that space with the greatest required fraction of outdoor air in the supply to this space.

V_{o1} = Corrected total outdoor airflow rate.

V_{s1} = Total supply flow rate, i.e., the sum of all supply for all branches of the system.

V_{o2} = Sum of outdoor airflow rates for all branches on system.

V_{s2} = Outdoor airflow rate required in critical spaces.

V_{s1} = Supply flow rate in critical space.

VENTILATION

TABLE 403.3
REQUIRED OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION	ESTIMATED MAXIMUM OCCUPANT LOAD, PERSONS PER 1,000 SQUARE FEET ^a	OUTDOOR AIR (Cubic feet per Minute (cfm) Per person) UNLESS NOTED ^b
Correctional facilities		
Cells	20	20
without plumbing fixtures with plumbing fixtures	20	20
Dining halls	100	15
Guard stations	40	15
Dry Cleaners, laundries		
Coin-operated dry cleaner	20	15
Coin-operated laundries	20	15
Commercial dry cleaner	30	30
Commercial laundry	10	25
Storage rack up	30	35
Education		
Auditoriums	150	15
Classrooms	50	15
Corridors	—	0.10 cfm/ft ²
Laboratories	30	20
Libraries	20	15
Locker rooms ^c	—	0.50 cfm/ft ²
Music rooms	30	15
Smoking lounges ^d	70	60
Training shops	30	20
Food and beverage service		
Bar, cocktail lounge	100	30
Cafeteria, hot food	100	20
Dining rooms	70	20
Kitchens (cooking) ^{e,f}	20	15
Hospitals, nursing and convalescent homes		
Autopsy rooms ^g	—	0.50 cfm/ft ²
Medical procedure rooms	20	15
Operating rooms	20	30
Patient rooms	10	25
Physical therapy	20	15
Recovery and ICU ^h	20	15
Hotels, motels, resorts and dormitories		
Assembly rooms	120	15
Bedrooms ^{i,j}	—	35 cfm per person
Bedrooms	—	30 cfm per person
Conference rooms	50	20
Dormitory sleeping areas	20	15
Gaming casinos	120	30
Living rooms	—	30 cfm per person
Lobbies	30	15
Offices		
Conference rooms	50	20
Office spaces	7	20
Reception areas	60	15
Telecommunication centers and data entry	60	20

(continued)

TABLE 403.3—continued
REQUIRED OUTDOOR VENTILATION AIR

OCCUPANCY CLASSIFICATION	ESTIMATED MAXIMUM OCCUPANT LOAD, PERSONS PER 1,000 SQUARE FEET ^a	OUTDOOR AIR (Cubic feet per Minute (cfm) Per person) UNLESS NOTED ^b
Private dwellings, single and Multiple		
Living areas ^c	Based upon number of bedrooms. For bedrooms: 2; each additional bedroom: 1	0.25 air changes per hour ^d or 15 cfm per person, whichever is greater
Kitchens^e		100 cfm (recirculate or 25 cfm outdoors)
Toilet rooms and bathrooms^f		mechanical exhaust capacity of 50 cfm (recirculate or 20 cfm outdoors)
Garages, separate for each dwelling		300 cfm per car
Garages, common for multiple units^g		1.5 cfm/ft ²
Public spaces		
Corridors and utilities		0.05 cfm/ft ²
Elevators ^h		1.00 cfm/ft ²
Locker rooms ⁱ		0.50 cfm/ft ²
Toilet rooms ^{j,k}		75 cfm per water closet or urinal
Shower rooms (per shower head) ^l		50 cfm (recirculate or 20 cfm outdoors)
Smoking lounges ^m	70	60
Retail stores, sales floors and Showroom floors		
Basement and street		0.20 cfm/ft ²
Display rooms		0.20 cfm/ft ²
Malls and arcades		0.20 cfm/ft ²
Shopping and receiving		0.15 cfm/ft ²
Smoking lounges ⁿ	70	60
Storage rooms		0.15 cfm/ft ²
Upper floors		0.20 cfm/ft ²
Warehouses		0.05 cfm/ft ²
Specialty shops		
Automotive service stations		1.5 cfm/ft ²
Barber	25	12
Beauty	25	25
Clothing, furniture		0.20 cfm/ft ²
Florists	4	15
Hardware, drapery, fabrics	4	15
Nail salons ^o		25
Pet shops		1.00 cfm/ft ²
Restroom salons	20	15
Supermarkets	8	15

(continued)

IMC, UMC, OR ASHRAE 62.1-2004???



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ASHRAE, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, will advance the arts and sciences of heating, ventilating, air conditioning and refrigerating to serve humanity and promote a sustainable world.

Membership in ASHRAE is open to any person associated with heating, ventilation, air conditioning or refrigeration through such disciplines as indoor air quality and energy conservation, for example.

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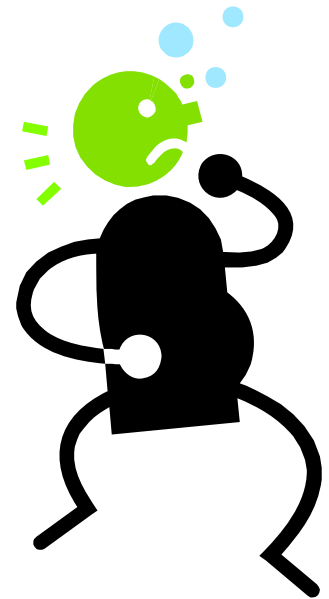
Why do we need a ventilation standard?

- Help insure indoor air quality acceptable to human occupants
- Minimize potential for adverse health effects



How do we define “Acceptable Indoor Air Quality”?

- “Air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and which a substantial majority (80% or more) of the people exposed do not express dissatisfaction.”



Ventilation Rate Procedure



- Verify outside air quality meets EPA ambient air quality standards
- Treat outside air if required
- Carefully locate outside air intakes

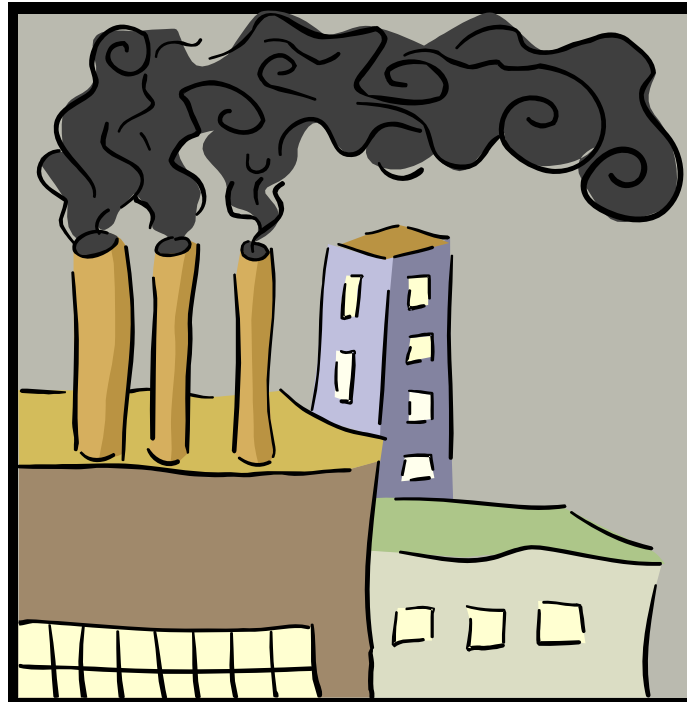


TABLE 5-1 Air Intake Minimum Separation Distance

Object	Minimum Distance, ft (m)
Significantly contaminated exhaust (Note 1)	15 (5)
Noxious or dangerous exhaust (Notes 2 and 3)	30 (10)
Vents, chimneys, and flues from combustion appliances and equipment (Note 4)	15 (5)
Garage entry, automobile loading area, or drive-in queue (Note 5)	15 (5)
Truck loading area or dock, bus parking idling area (Note 5)	25 (7.5)
Driveway, street, or parking place (Note 5)	5 (1.5)
Thoroughfare with high traffic volume	25 (7.5)
Roof, landscaped grade, or other surface directly below intake (Notes 6 and 7)	1 (0.30)
Garbage storage pick-up area, dumpsters	15 (5)
Cooling tower intake or basin	15 (5)
Cooling tower exhaust	25 (7.5)

Note 1: Significantly contaminated exhaust is exhaust air with significant contaminant concentration, significant sensory-irritation intensity, or offensive odor.

Note 2: Laboratory fume hood exhaust air outlets shall be in compliance with NFPA 45-1991³ and ANSI/AIHA Z9.5-1992.⁴

Note 3: Noxious or dangerous exhaust is exhaust air with highly objectionable fumes or gases and/or exhaust air with potentially dangerous particles, bioaerosols, or gases at concentrations high enough to be considered harmful. Information on separation criteria for industrial environments can be found in the ACGIH Industrial Ventilation Manual⁵ and in the *ASHRAE Handbook—HVAC Applications*.⁶

Note 4: Shorter separation distances are permitted when determined in accordance with (a) Chapter 7 of ANSI Z223.1/NFPA 54-2002⁷ for fuel gas burning appliances and equipment; (b) Chapter 6 of NFPA 31-2001⁸ for oil burning appliances and equipment, or (c) Chapter 7 of NFPA 211-2003⁹ for other combustion appliances and equipment.

Note 5: Distance measured to closest place that vehicle exhaust is likely to be located.

Note 6: No minimum separation distance applies to surfaces that are sloped more than 45 degrees from horizontal or that are less than 1 in. (3 cm) wide.

Note 7: Where snow accumulation is expected, distance listed shall be increased by the expected average snow depth.

- Determine “breathing zone outdoor air flow”

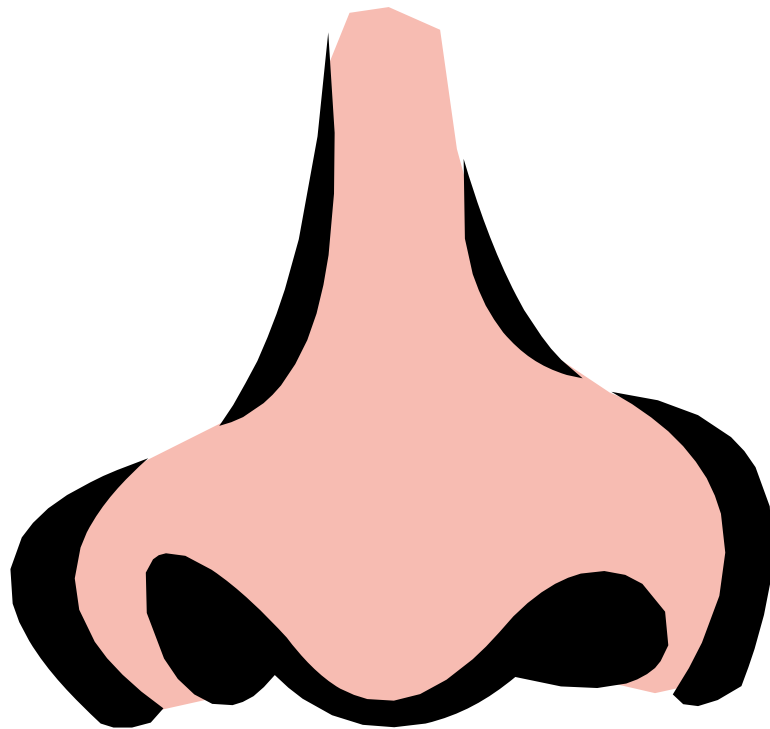


TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE
 (This table is not valid in isolation; it must be used in conjunction with the accompanying notes.)

Occupancy Category	People Outdoor Air Rate R_p		Area Outdoor Air Rate R_a		Notes	Default Values			Air Class
	cfm/person	L/person	cfm/ft ²	L/m ²		Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
						8/1000 ft ³ or 8/100 m ³	cfm/person	L/person	
Correctional Facilities									
Cell	5	2.5	0.12	0.6		25	10	4.9	2
Day room	5	2.5	0.06	0.3		30	7	3.5	1
Guard stations	5	2.5	0.06	0.3		15	9	4.5	1
Booking/waiting	7.5	3.8	0.06	0.3		50	9	4.4	2
Educational Facilities									
Daycare (through age 4)	10	5	0.18	0.9		25	17	8.6	2
Classrooms (ages 5-8)	10	5	0.12	0.6		25	15	7.4	1
Classrooms (age 9 plus)	10	5	0.12	0.6		35	13	6.7	1
Lecture classrooms	7.5	3.8	0.06	0.3		65	8	4.3	1
Lecture hall (fixed seats)	7.5	3.8	0.06	0.3		150	8	4.0	1
Art classroom	10	5	0.18	0.9		20	19	9.5	2
Science laboratories	10	5	0.18	0.9	E	25	17	8.6	-
Wood metal shop	10	5	0.18	0.9		20	19	9.5	2
Computer lab	10	5	0.12	0.6		25	15	7.4	1
Media center	10	5	0.12	0.6	A	25	15	7.4	1
Music/theater/dance	10	5	0.06	0.3		35	12	5.9	1
Multi-use assembly	7.5	3.8	0.06	0.3		100	8	4.1	1
Food and Beverage Service									
Restaurant dining rooms	7.5	3.8	0.18	0.9		70	10	5.1	2
Cafeteria/fast food dining	7.5	3.8	0.18	0.9		100	9	4.7	2
Bars, cocktail lounges	7.5	3.8	0.18	0.9		100	9	4.7	2
General									
Conference/meeting	5	2.5	0.06	0.3		50	6	3.1	1
Corridors	-	-	0.06	0.3		-	-	-	1
Storage rooms	-	-	0.12	0.6	B	-	-	-	1
Hotels, Motels, Resorts, Dormitories									
Bedroom/living Room	5	2.5	0.06	0.3		10	11	5.5	1
Baracks sleeping areas	5	2.5	0.06	0.3		20	8	4.0	1
Lobbies/prefunction	7.5	3.8	0.06	0.3		30	10	4.8	1
Multi-purpose assembly	5	2.5	0.06	0.3		120	6	2.8	1

- Correct for Zone air distribution effectiveness
- Correct for multiple zones (system ventilation efficiency)

TABLE 6-2
Zone Air Distribution Effectiveness

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 (8°C) or more above space temperature and ceiling return	0.8
Ceiling supply of warm air less than 15°F (8°C) above space temperature and ceiling return provided that the 150 fpm (0.8 m/s) supply air jet reaches to within 4.5 ft (1.4 m) of floor level. Note: For lower velocity supply air, $E_z = 0.8$.	1.0
Floor supply of cool air and ceiling return provided that the 150 fpm (0.8 m/s) supply jet reaches 4.5 ft (1.4 m) or more above the floor. Note: Most underfloor air distribution systems comply with this provision.	1.0
Floor supply of cool air and ceiling return, provided low-velocity displacement ventilation achieves unidirectional flow and thermal stratification	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 and/or return	0.8
Makeup supply drawn in near to the exhaust and/or return location	0.5

1. "Cool air" is air cooler than space temperature.
 2. "Warm air" is air warmer than space temperature.
 3. "Ceiling" includes any point above the breathing zone.
 4. "Floor" includes any point below the breathing zone.
 5. As an alternative to using the above values, E_z may be regarded as equal to air change effectiveness determined in accordance with ASHRAE Standard 129¹³ for all air distribution configurations except unidirectional flow.

TABLE 6-3
System Ventilation Efficiency

Max (Z_p)	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 Appendix A

1. "Max Z_p " refers to the largest value of Z_p calculated using Equation 6-3, among all the zones served by the system.
 2. For values of Z_p between 0.15 and 0.55, one may determine the corresponding value of E_v by interpolating the values in the table.
 3. 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 unrecycled outdoor air intake F_{out} to the total zone primary airflow for all the zones served by the air handler). For systems with higher values of the average outdoor air fraction, this table may result in unrealistically low values of E_v , and the use of Appendix A may yield more practical results.

6.2.9 Ventilation in Smoking Areas. Smoking areas shall have more ventilation and/or air cleaning than comparable non-smoking areas. Specific ventilation rate requirements cannot be determined until cognizant authorities determine the concentration of smoke that achieves an acceptable level of risk. Air from smoking areas shall not be recirculated or transferred to non-smoking areas.

6.3 Indoor Air Quality Procedure

The Indoor Air Quality (IAQ) Procedure is a performance-based design approach in which the building and its ventilation system are designed to maintain the concentrations of specific contaminants at or below certain limits identified during the building design and to achieve the design target (AWQ) of normalized indoor air quality acceptability by building

Other Requirements

- Ventilation air flow must be maintained during any load condition and at all times the space is occupied



Other Requirements

- Drain pans must drain
- Maintenance access to equipment required
- Building envelope designed for moisture control
- Insulate to prevent condensation
- Airstream surfaces must resist mold growth and erosion



Outdoor Air Intakes

- Must prevent rain intrusion
- Must manage snow entrainment
- Must have bird screens



Filters

- Minimum MERV 6 filters required ahead of wet coils



Relative Humidity

- Limited to 65% or less at design dew point condition



Smoking Areas

- Separate “ETS Free Areas” from “ETS Areas”



- Air movement within building must observe air classification requirements

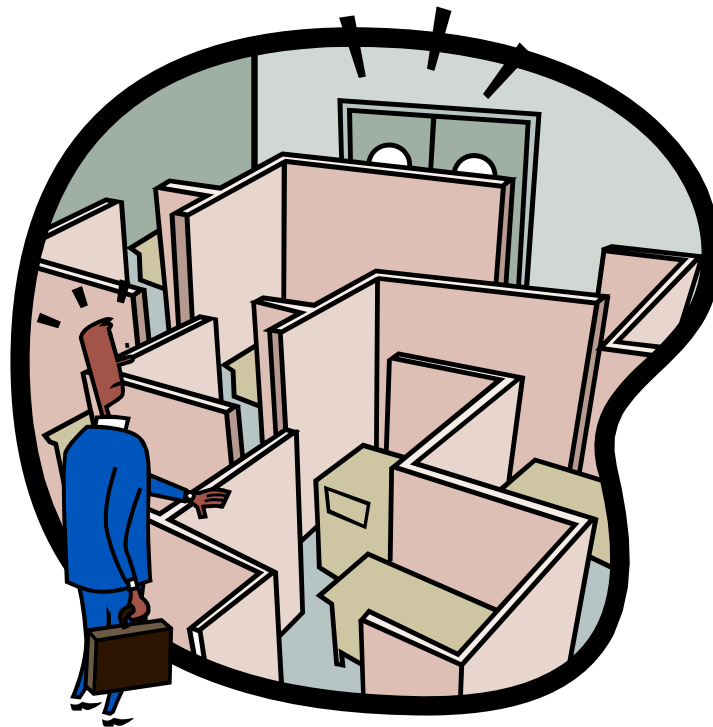


TABLE 5-2 Other Space Types

Description	Air Class
Spaces ancillary to Class 2 spaces	2
Kitchens	2
Break rooms	1
Coffee stations	1
Prayer toilet/bath	2
Employee locker rooms	2
Storage rooms, chemical	4
Equipment rooms	1
Electrical/telephone closets	1
Closet/machine rooms	1
Refrigerating machinery rooms	3
Laundry rooms, central	2
Laundry rooms within dwelling units	1
Sealed laundry storage	3
Janitors closet, trash room	3
General chemical/biological laboratories	3
University/college laboratories	3
Paint spray booths	4
Daycare sickroom	3

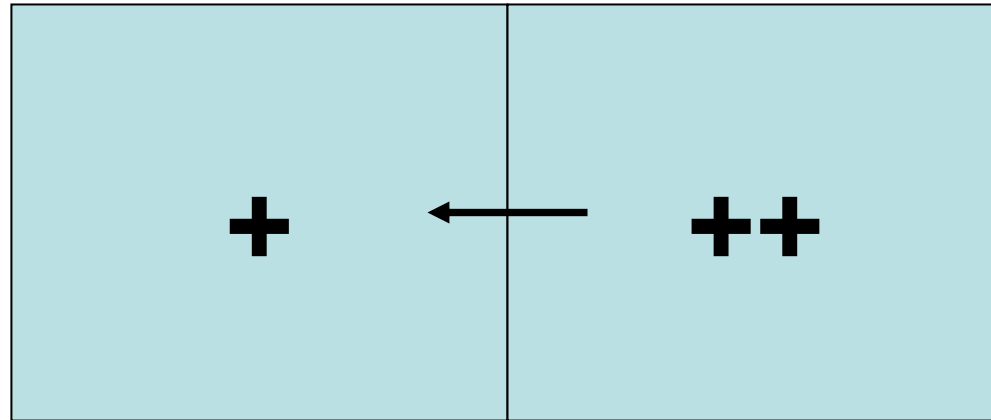
TABLE 5-3 Airstreams

Description	Air Class
Dyeing printing equipment discharge	4
Commercial kitchen grease hoods	4
Commercial kitchen hoods other than grease	3
Laboratory hoods	4
Residential kitchen vented hoods	3

- Short term conditions
- CO₂ measurement and control



Space Pressurization



Building Must be Positive

A Word About Clarifications

Sometimes there are unstated motives



What's Next??

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Pick up addenda

Clarifications