ANSI/ASHRAE Standard 62.2-2007
(Supersedes ANSI/ASHRAE Standard 62.2-2004)
Includes ANSI/ASHRAE addenda listed in Appendix C

ASHRAE STANDARD

Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

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

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FOREWORD

Because of the effects it has on health, comfort, and serviceability, indoor air quality in our homes is becoming an increasing concern to many people. According to the American Lung Association, pollutants within our homes have been increasingly recognized as threats to our respiratory health. The Environmental Protection Agency lists poor indoor air quality as the fourth-largest environmental threat to our country. Asthma is the leading serious chronic illness of children in the United States. Moisture-related construction defects and damage are on the increase in new houses. Minimum residential ventilation can improve many of these indoor air quality problems.

ASHRAE has long been in the business of ventilation, but most of the focus of that effort has been in the area of commercial and institutional buildings. Residential ventilation was traditionally not a major concern because it was felt that between operable windows and envelope leakage, people were getting enough air. In the 30 years since the first oil shock, houses have become much more energy efficient. At the same time, the kinds of materials used and functions present in houses were changing in response to people's needs. People were also becoming more environmentally conscious, not only about the resources they were consuming but also about the environment in which they lived.

All of these factors contributed to an increasing level of public concern about residential indoor air quality and ventilation. Where once there was an easy feeling about the residential indoor environment, there is now a desire to define levels of acceptability and performance. Many institutions—both public and private—have interests in indoor air quality (IAQ), but ASHRAE, as the professional society that has had ventilation as part of its mission for over 100 years, was the logical place to develop a consensus standard.

In developing this standard the committee recognized that there were many different kinds of houses, many different climates, and many different styles of construction. To accommodate these differences, the major requirements were designed with several alternate paths to allow users flexibility. Some requirements are performance based, with specific prescriptive alternatives. The standard recognizes that there are several different ways to achieve a specified ventilation rate and allows both mechanical and natural methods.

There are three primary sets of requirements in the standard and a host of secondary ones. The three primary sets involve whole-house ventilation, local exhaust, and source control. Whole-house ventilation is intended to dilute the unavoidable contaminant emissions from people, from materials, and from background processes. Local exhaust is intended to remove contaminants from those specific rooms (e.g., kitchens and bathrooms) in which sources are expected because of their design function. Other source control measures are included to deal with those sources that can reasonably be anticipated to be found in a residence.

The standard's secondary requirements focus on properties of specific items that are needed to achieve the main objectives of the standard. Examples of this include sound and flow ratings for fans and labeling requirements. Some of the secondary requirements as well as the guidance in the appendices help keep the design of the building as a system from failing because ventilation systems were installed. For example, ventilation systems that depressurize the house can cause natural draft combustion appliances to backdraft or draw in pollutants (including moisture) through leaks.

The standard may seem to be principally about ventilation, but the purpose of ventilation is to provide acceptable IAQ. As indicated in ASHRAE's position document on indoor air quality, the most effective strategy for keeping exposure to undesirable pollutants low is usually to keep them from being released to the general indoor environment in the first place. Such "source control" measures actually make up the bulk of the pages in this standard, since local ventilation is intended to exhaust pollutants from specific rooms before they spread throughout the house. Whole-house ventilation is intended to bring fresh air into the general environment to dilute the pollutants that cannot be effectively controlled at the source.

The standard does not address specific pollutant concentration levels. It does not address certain potential pollutant sources such as unvented combustion space heaters and contaminant migration from polluted buffer zones (such as garages, etc.). It also does not address contamination from outdoor sources or from episodic occupant-controlled events such as painting, smoking, cleaning, or other high-polluting events. It does not include credit for air cleaning or for pollutant detection devices such as carbon monoxide alarms or volatile organic compound (VOC) controllers. While many of these considerations could be important factors in achieving acceptable IAQ, the committee believes that these issues are not yet ready for inclusion in a minimum standard. The committee continues to work on many of these issues for inclusion in either a companion guideline or as potential future addenda.

1. PURPOSE

This standard defines the roles of and minimum requirements for mechanical and natural ventilation systems and the building envelope intended to provide acceptable indoor air quality (IAQ) in low-rise residential buildings.

2. SCOPE

This standard applies to spaces intended for human occupancy within single-family houses and multifamily structures of three stories or fewer above grade, including manufactured and modular houses. This standard does not apply to transient housing such as hotels, motels, nursing homes, dormitories, or jails.

2.1 This standard considers chemical, physical, and biological contaminants that can affect air quality. Thermal comfort requirements are not included in this standard (see *ANSI/ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy*).

2.2 While acceptable indoor air quality is the goal of this standard, it will not necessarily be achieved even if all requirements are met

a. because of the diversity of sources and contaminants in indoor air and the range of susceptibility in the population;
b. because of the many other factors that may affect occupant perception and acceptance of IAQ, such as air temperature, humidity, noise, lighting, and psychological stress;
c. if the ambient air is unacceptable and this air is brought into the building without first being cleaned (cleaning of ambient outdoor air is not required by this standard);
d. if the systems are not operated and maintained as designed; or
e. when high-polluting events occur.

2.3 This standard does not address unvented combustion space heaters.

3. DEFINITIONS

acceptable indoor air quality: air toward which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at concentrations that are known to pose a health risk.

air cleaning: the use of equipment that removes particulate, microbial, or gaseous contaminants (including odors) from air.

air, exhaust: air discharged from any space to the outside by an exhaust system.

air, indoor: air in an occupiable space.

air, outdoor: air from outside the building taken into a ventilation system or air from outside the building that enters a space through infiltration or natural ventilation openings.

air, transfer: air moved from one occupiable space to another, usually through doorways or grilles.

air, ventilation: outdoor air delivered to a space that is intended to dilute airborne contaminants.

air change rate: airflow in volume units per hour divided by the volume of the space on which the air change rate is based in identical units (normally expressed in air changes per hour [ach]).

balanced system: one or more fans that supply outdoor air and exhaust building air at substantially equal rates.

bathroom: any room containing a bathtub, a shower, a spa, or a similar source of moisture.

climate, hot, humid: climate in which the wet-bulb temperature is 67°F (19°C) or higher for 3500 hours or more, or 73°F (23°C) or higher for 1750 hours or more, during the warmest six consecutive months of a year that is typical for that geographic area (see Section 8).

climate, very cold: climates that have more than 9000 annual heating degree-days base 65°F-day (5000 annual heating degree-days base 18°C-day) (see Section 8).

conditioned space: the part of a building that is capable of being thermally conditioned for the comfort of occupants.

contaminant: a constituent of air that may reduce acceptability of that air.

exhaust system: one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope.

exhaust flow, net: flow through an exhaust system minus the compensating outdoor airflow through any supply system that is interlocked to the exhaust system.

habitable space: building space intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.

heating degree-day: the difference in temperature between the outdoor mean temperature over a 24-hour period and a given base temperature of a building space; that is, for heating degree-day base 65°F (18°C), for any one day, when the mean temperature is less than 65°F (18°C), there are as many heating degree-days as degrees Fahrenheit (Celsius) temperature difference between the mean temperature for the day and 65°F (18°C). Annual heating degree-days are the sum of the heating degree-days over a calendar year.

high-polluting events: isolated and occupant-controllable events that release pollutants in excess quantities. Typical cooking, bathing, and laundry activities are not considered high-polluting events.

infiltration: uncontrolled inward leakage of air through cracks and interstices in any building element and around windows and doors of a building.

kitchen: any room containing cooking appliances.

mechanical cooling: reducing the temperature of a fluid by using vapor compression, absorption, desiccant dehumidification combined with evaporative cooling, or other energy-driven thermodynamic means. Indirect or direct evaporative cooling alone is not considered mechanical cooling.

mechanical ventilation: the active process of supplying or removing air to or from an indoor space by powered equipment such as motor-driven fans and blowers but not by devices such as wind-driven turbine ventilators and mechanically operated windows.

natural ventilation: ventilation occurring as a result of only natural forces, such as wind pressure or differences in air density, through intentional openings such as open windows and doors.

occupiable space: any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas.

pressure boundary: primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to the outside than to the conditioned space would be considered outside the pressure boundary.

readily accessible: capable of being quickly and easily reached for operation, maintenance, and inspection.

source: an indoor object, person, or activity from which indoor air contaminants are released; or a route of entry of contaminants from outdoors or sub-building soil.

supply system: one or more fans that supply outdoor air to the building, causing indoor air to leave by normal leakage paths through the building envelope.

system: equipment and other components that collectively perform a specific function, such as mechanical cooling or ventilation.

toilet: space containing a toilet, water closet, urinal, or similar sanitary service.

utility: laundry, lavatory, or other utility room containing sinks or washing equipment.

ventilation: the process of supplying outdoor air to or removing indoor air from a dwelling by natural or mechanical means. Such air may or may not have been conditioned.

4. WHOLE-BUILDING VENTILATION

4.1 Ventilation Rate. A mechanical exhaust system, supply system, or combination thereof shall be installed for each dwelling unit to provide whole-building ventilation with outdoor air each hour at no less than the rate specified in Tables 4.1a and 4.1b or, equivalently, Equations 4.1a and 4.1b, based on the floor area of the conditioned space and number of bedrooms.

$$Q_{fan} = 0.01A_{floor} + 7.5(N_{br} + 1) \quad (4.1a)$$

where

Q_{fan} = fan flow rate, cfm
A_{floor} = floor area, ft^2
N_{br} = number of bedrooms; not to be less than one

$$Q_{fan} = 0.05A_{floor} + 3.5(N_{br} + 1) \quad (4.1b)$$

where

Q_{fan} = fan flow rate, L/s
A_{floor} = floor area, m^2
N_{br} = number of bedrooms; not to be less than one

TABLE 4.1a (I-P)
Ventilation Air Requirements, cfm

Floor Area (ft^2)	Bedrooms 0–1	2–3	4–5	6–7	>7
<1500	30	45	60	75	90
1501–3000	45	60	75	90	105
3001–4500	60	75	90	105	120
4501–6000	75	90	105	120	135
6001–7500	90	105	120	135	150
>7500	105	120	135	150	165

TABLE 4.1b (SI)
Ventilation Air Requirements, L/s

Floor Area (m^2)	Bedrooms 0–1	2–3	4–5	6–7	>7
<139	14	21	28	35	42
139.1–279	21	28	35	42	50
279.1–418	28	35	42	50	57
418.1–557	35	42	50	57	64
557.1–697	42	50	57	64	71
>697	50	57	64	71	78

Exceptions: Whole-building mechanical systems are not required provided that at least one of the following conditions is met:

a. the building is in zone 3B or 3C of the IECC 2004 Climate Zone Map (see Figure 8.2),
b. the building has no mechanical cooling and is in zone 1 or 2 of the IECC 2004 Climate Zone Map (see Figure 8.2), or
c. the building is thermally conditioned for human occupancy for less than 876 hours per year,

and if the authority having jurisdiction determines that window operation is a locally permissible method of providing ventilation.

4.1.1 Different Occupant Density. Tables 4.1a and 4.1b and Equations 4.1a and 4.1b assume two persons in a studio or one-bedroom dwelling unit and an additional person for each additional bedroom. Where higher occupant densities are known, the rate shall be increased by 7.5 cfm (3.5 L/s) for each additional person. When approved by the authority having jurisdiction, lower occupant densities may be used.

4.1.2 Alternative Ventilation. Other methods may be used to provide the required ventilation rates (of Tables 4.1a and 4.1b) when approved by a licensed design professional.

4.1.3 Infiltration Credit. Section 4.1 includes a default credit for ventilation provided by infiltration of 2 cfm/100 ft^2 (10 L/s per 100 m^2) of occupiable floor space. For buildings built prior to the application of this standard, when excess infiltration has been measured using *ANSI/ASHRAE Standard*

136, A Method of Determining Air Change Rates in Detached Dwellings,[1] the rates in Section 4.1 may be decreased by half of the excess of the rate calculated from Standard 136 that is above the default rate.

4.2 System Type. The whole-house ventilation system shall consist of one or more supply or exhaust fans and associated ducts and controls. Local exhaust fans shall be permitted to be part of a mechanical exhaust system. Outdoor air ducts connected to the return side of an air handler shall be permitted as supply ventilation if manufacturers' requirements for return air temperature are met. See Appendix B for guidance on selection of methods.

4.3 Control and Operation. The "fan on" switch on a heating or air-conditioning system shall be permitted as an operational control for systems introducing ventilation air through a duct to the return side of an HVAC system. Readily accessible override control must be provided to the occupant. Local exhaust fan switches and "fan on" switches shall be permitted as override controls. Controls, including the "fan-on" switch of a conditioning system, must be appropriately labeled.

Exception: An intermittently operating, whole-house mechanical ventilation system may be used if the ventilation rate is adjusted according to the exception to Section 4.4. The system must be designed so that it can operate automatically based on a timer. The intermittent mechanical ventilation system must operate at least one hour out of every twelve.

4.4 Delivered Ventilation. The delivered ventilation rate shall be calculated as the larger of the total supply or total exhaust and shall be no less than specified in Section 4.1 during each hour of operation.

Exception: The effective ventilation rate of an intermittent system is the combination of its delivered capacity, its daily fractional on-time, and the ventilation effectiveness from Table 4.2.

$$Q_f = Q_r / (\varepsilon f) \qquad (4.2)$$

where

Q_f = fan flow rate

Q_r = ventilation air requirement (from Table 4.1a or 4.1b)

ε = ventilation effectiveness (from Table 4.2)

f = fractional on time

If the system runs at least once every three hours, 1.0 can be used as the ventilation effectiveness. (See Appendix B for an example of this calculation.)

4.5 Restrictions on System Type. Use of certain ventilation strategies is restricted in specific climates as follows.

4.5.1 Hot, Humid Climates. In hot, humid climates, whole-house mechanical net exhaust flow shall not exceed 7.5 cfm per 100 ft^2 (35 L/s per 100 m^2). (See Section 8 for a listing of hot, humid US climates.)

TABLE 4.2
Ventilation Effectiveness for Intermittent Fans

Daily Fractional On-Time, f	Ventilation Effectiveness, ε
$f \le 35\%$	0.33
$35\% \le f < 60\%$	0.50
$60\% \le f < 80\%$	0.75
$80\% \le f$	1.0

4.5.2 Very Cold Climates. Mechanical supply systems exceeding 7.5 cfm per 100 ft^2 (35 L/s per 100 m^2) shall not be used in very cold climates. (See Section 8 for a listing of very cold US climates.)

Exception: These ventilation strategies are not restricted if the authority having jurisdiction approves the envelope design as being moisture resistant.

5. LOCAL EXHAUST

5.1 Local Mechanical Exhaust. A local mechanical exhaust system shall be installed in each kitchen and bathroom. Each local ventilation system shall be either one of the following two:

1. an intermittent mechanical exhaust system meeting the requirements of Section 5.2 or
2. a continuous mechanical exhaust system meeting the requirements of Section 5.3.

Exception: *Alternative Ventilation.* Other design methods may be used to provide the required exhaust rates when approved by a licensed design professional.

5.2 Intermittent Local Exhaust. An intermittently operating, local mechanical exhaust system shall be designed to be operated as needed by the occupant.

5.2.1 Control and Operation. Control devices such as, but not limited to, the following are permissible provided they do not impede occupant control: shut-off timers, occupancy sensors, multiple-speed fans, combined switching, IAQ sensors, etc.

5.2.2 Ventilation Rate. The minimum airflow rating shall be at least the amount indicated in Table 5.1.

5.3 Continuous Mechanical Exhaust. A continuously operating mechanical exhaust system shall be installed to operate without occupant intervention. The system may be part of a balanced mechanical system. See Appendix B for guidance on selection of methods.

5.3.1 Control and Operation. The system shall be designed to operate during all occupiable hours. Readily accessible override control must be provided to the occupant.

5.3.2 Ventilation Rate. The minimum delivered ventilation shall be at least the amount indicated in Table 5.2 during each hour of operation.

TABLE 5.1 Intermittent Local Ventilation Exhaust Airflow Rates

Application	Airflow	Notes
Kitchen	100 cfm (50 L/s)	Vented range hood (including appliance-range hood combinations) required if exhaust fan flow rate is less than 5 kitchen ach.
Bathroom	50 cfm (25 L/s)	

TABLE 5.2
Continuous Local Ventilation Exhaust Airflow Rates

Application	Airflow	Notes
Kitchen	5 ach	Based on kitchen volume.
Bathroom	20 cfm (10 L/s)	

6. OTHER REQUIREMENTS

6.1 Transfer Air. Dwelling units shall be designed and constructed to provide ventilation air directly from the outdoors and not as transfer air from adjacent dwelling units or other spaces, such as garages, unconditioned crawlspaces, or unconditioned attics. Measures shall be taken to prevent air movement across envelope components separating attached, adjacent dwelling units and between dwelling units and other spaces, both vertically and horizontally. Measures shall include sealing of common envelope components, pressure management, and use of airtight recessed lighting fixtures.

6.2 Instructions and Labeling. Information on the ventilation design and/or ventilation systems installed, instructions on their proper operation to meet the requirements of this standard, and instructions detailing any required maintenance (similar to that provided for HVAC systems) shall be provided to the owner and the occupant of the dwelling unit. Controls shall be labeled as to their function (unless that function is obvious, such as toilet exhaust fan switches). See Appendix A for information on instructions and labeling.

6.3 Clothes Dryers. Clothes dryers shall be exhausted directly to the outdoors.

Exception: Condensing dryers plumbed to a drain.

6.4 Combustion and Solid-Fuel Burning Appliances. Combustion and solid-fuel burning appliances must be provided with adequate combustion and ventilation air and vented in accordance with manufacturers' installation instructions, *NFPA 54/ANSI Z223.1, National Fuel Gas Code,*[2] *NFPA 31-2001, Standard for the Installation of Oil-Burning Equipment,* [3] or *NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid-Fuel Burning Appliances,*[4] or other equivalent code acceptable to the building official. Where atmospherically vented combustion appliances or solid-fuel burning appliances are located inside the pressure boundary, the total net exhaust flow of the two largest exhaust fans (not including a summer cooling fan intended to be operated only when windows or other air inlets are open) shall not exceed 15 cfm/100 ft^2 (75 Lps/100 m^2) of occupiable space when in operation at full capacity. If the designed total net flow exceeds this limit, the net exhaust flow must be reduced by reducing the exhaust flow or providing compensating outdoor airflow. Atmospherically vented combustion appliances do not include direct-vent appliances.

6.5 Garages. When an occupiable space adjoins a garage, the design must prevent migration of contaminants to the adjoining occupiable space. Doors between garages and occupiable spaces shall be gasketed or made substantially airtight with weather stripping. HVAC systems that include air handlers or return ducts located in garages shall have total air leakage of no more than 6% of total fan flow when measured at 0.1 in. w.c. (25 Pa) using California Title 24[5] or equivalent.

6.6 Ventilation Opening Area. Spaces shall have ventilation openings as listed below. Such openings shall meet the requirements of Section 6.8.

Exception: Spaces that meet the local ventilation requirements set for bathrooms in Section 5.

6.6.1 Habitable Spaces. Each habitable space shall be provided with ventilation openings with an openable area not less than 4% of the floor area nor less than 5 ft^2 (0.5 m^2).

6.6.2 Toilets and Utility Rooms. Toilets and utility rooms shall be provided with ventilation openings with an openable area not less than 4% of the room floor area nor less than 1.5 ft^2 (0.15 m^2).

Exceptions: (1) Utility rooms with a dryer exhaust duct; (2) toilet compartments in bathrooms.

6.7 Minimum Filtration. Mechanical systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length and through a thermal conditioning component, except evaporative coolers, shall be provided with a filter having a designated minimum efficiency of MERV 6 or better when tested in accordance with *ANSI/ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.*[6] The system shall be designed such that all recirculated and mechanically supplied outdoor air is filtered before passing through the thermal conditioning components. The filter shall be located and installed in such a manner as to facilitate access and regular service by the owner. The filter shall be selected and sized to operate at a clean pressure drop no greater than 0.1 in. w.c. (25 Pa) unless the equipment is designed or selected to accommodate any additional pressure drop imposed by the filter selection (i.e., greater than 0.1 in. w.c. [25 Pa]).

TABLE 7.1 Prescriptive Duct Sizing

Duct Type	Flex Duct				Smooth Duct			
Fan Rating cfm @ 0.25 in. w.g. (L/s @ 62.5 Pa)	50 (25)	80 (40)	100 (50)	125 (65)	50 (25)	80 (40)	100 (50)	125 (65)
Diameter, in. (mm)	**Maximum Length, ft (m)**							
3 (75)	X	X	X	X	5 (2)	X	X	X
4 (100)	70 (27)	3 (1)	X	X	105 (35)	35 (12)	5 (2)	X
5 (125)	NL	70 (27)	35 (12)	20 (7)	NL	135 (45)	85 (28)	55 (18)
6 (150)	NL	NL	125 (42)	95 (32)	NL	NL	NL	145 (48)
7 (175) and above	NL	NL	NL	NL	NL	NL	NL	NL

This table assumes no elbows. Deduct 15 ft (5 m) of allowable duct length for each elbow.
NL = no limit on duct length of this size.
X = not allowed, any length of duct of this size with assumed turns and fitting will exceed the rated pressure drop.

6.8 Air Inlets. Air inlets that are part of the ventilation design shall be located a minimum of 10 ft (3 m) from known sources of contamination such as a stack, vent, exhaust hood, or vehicle exhaust. The intake shall be placed so that entering air is not obstructed by snow, plantings, or other material. Forced air inlets shall be provided with rodent/insect screens (mesh not larger than 1/2 in. [13 mm]).

Exceptions:

a. Ventilation openings in the wall may be as close as a stretched-string distance of 3 ft (1 m) from sources of contamination exiting through the roof or dryer exhausts.

b. No minimum separation distance shall be required between windows and local exhaust outlets in kitchens and bathrooms.

c. Vent terminations covered by and meeting the requirements of the National Fuel Gas Code (*NFPA 54/ANSI Z223.1, National Fuel Gas Code*[2]) or equivalent.

6.8.1 Ventilation Openings. Operable windows, skylights, through-the-wall inlets, window air inlets, or similar devices shall be readily accessible to occupants. Where openings are covered with louvers or otherwise obstructed, openable area shall be based on the free unobstructed area through the opening.

7. AIR-MOVING EQUIPMENT

All air-moving equipment used to comply with this standard shall meet the following criteria.

7.1 Selection and Installation. Ventilation devices and equipment shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (*HVI 915, HVI Loudness Testing and Rating Procedure*,[7] *HVI 916, HVI Airflow Test Procedure*,[8] and *HVI 920, HVI Product Performance Certification Procedure*[9]). Installations of systems or equipment shall be carried out in accordance with manufacturers' design requirements and installation instructions.

7.2 Sound Ratings for Fans. Ventilation fans shall be rated for sound at no less than the minimum airflow rate required by this standard, as noted below.

7.2.1 Continuous Ventilation Fans. These fans shall be rated for sound at a maximum of 1.0 sone.

7.2.2 Intermittent Fans. These fans shall be rated for sound at a maximum of 3 sone, unless their maximum rated airflow exceeds 400 cfm (200 L/s).

Exception: HVAC air handlers and remote-mounted fans need not meet sound requirements. To be considered for this exception, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways, and there must be at least 4 ft (1 m) of ductwork between the fan and the intake grille.

7.3 Airflow Rating. The airflows required by this standard refer to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measuring device. Alternatively, the airflow rating at a pressure of 0.25 in. w.c. (62.5 Pa) may be used, provided the duct sizing meets the prescriptive requirements of Table 7.1 or manufacturers' design criteria.

7.4 Multi-Branch Exhaust Ducting. If more than one of the exhaust fans in a dwelling unit shares a common exhaust duct, each fan shall be equipped with a back-draft damper to prevent the recirculation of exhaust air from one room to another through the exhaust ducting system. Exhaust fans in separate dwelling units shall not share a common exhaust duct. Exhaust outlets from more than one dwelling unit may be served by a single exhaust fan downstream of all the exhaust inlets if the fan is designed and intended to run continuously or if each outlet is equipped with a back-draft damper to prevent cross-contamination when the fan is not running.

8. CLIMATIC DATA

Very cold and hot, humid climates are shown graphically in Figure 8.1 for North America. Table 8.1 lists US cities that have hot, humid climates. Zones 3B and 3C of the IECC 2004 climate map are shown in Figure 8.2. Table 8.2 lists cities that have very cold climates.

Figure 8.1 Map for identifying very cold and hot, humid climatic zones for continental North America.

TABLE 8.1 Hot, Humid US Climates

City, State	
Mobile, AL	Baton Rouge, LA
Selma, AL	Lake Charles, LA
Montgomery, AL	New Orleans, LA
Texarkana, AR	Shreveport, LA
Apalachicola, FL	Biloxi, MS
Daytona, FL	Gulfport, MS
Jacksonville, FL	Jackson, MS
Miami, FL	Wilmington, NC
Orlando, FL	Charleston, SC
Pensacola, FL	Myrtle Beach, SC
Tallahassee, FL	Austin, TX
Tampa, FL	Beaumont, TX
Savannah, GA	Brownsville, TX
Valdosta, GA	Corpus Christi, TX
Hilo, HI	Dallas, TX
Honolulu, HI	Houston, TX
Lihue, HI	Galveston, TX
Kahului, HI	San Antonio, TX
	Waco, TX

TABLE 8.2 Very Cold US Climates

City, State
Anchorage, AK
Fairbanks, AK
Caribou, ME
Marquette, MI
Sault Ste. Marie, MI
Duluth, MN
International Falls, MN
Fargo, ND
Grand Forks, ND
Williston, ND

9. REFERENCES

1. *ANSI/ASHRAE Standard 136-1993 (RA 2006), A Method of Determining Air Change Rates in Detached Dwellings.* American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
2. *NFPA 54-2002/ANSI Z223.1-2002, National Fuel Gas Code.* National Fire Protection Association and American Gas Association, Quincy, MA, and Washington, DC.
3. *NFPA 31-2001, Standard for the Installation of Oil-Burning Equipment.* National Fire Protection Association, Quincy, MA.
4. *NFPA 211-2000, Standard for Chimneys, Fireplaces, Vents, and Solid-Fuel Burning Appliances.* National Fire Protection Association, Quincy, MA.
5. California Energy Commission (2001). California Title 24 Standards, *ACM Manual*, Appendix F, Sections 4.3.8.2.1 and 4.3.7.2.
6. *ANSI/ASHRAE Standard 52.2-1999, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.* American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
7. *HVI 915-06, Loudness Testing and Rating Procedure.* Home Ventilating Institute, Arlington Heights, IL.
8. *HVI 916-05, Airflow Test Procedure.* Home Ventilating Institute, Arlington Heights, IL.
9. *HVI 920-05, Product Performance Certification Procedure.* Home Ventilating Institute. Arlington Heights, IL.

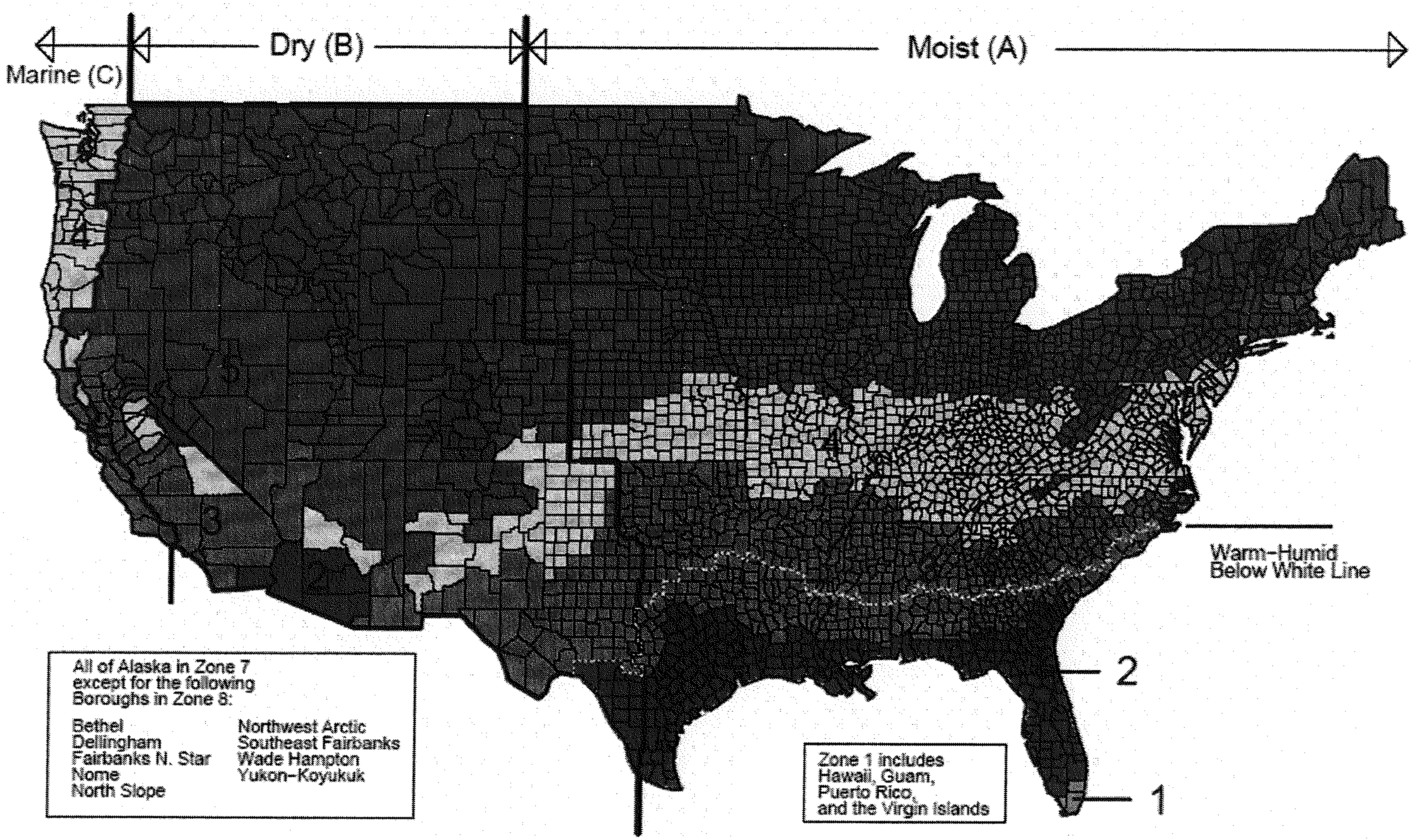

Figure 8.2 Climate zones for US locations.

(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX A
OPERATIONS AND MAINTENANCE

A1. INTRODUCTION

A1.1 This appendix provides general guidance regarding the minimum operations and maintenance information to be provided by the ventilation system designer or installer. It is intended to offer guidance on what should be provided; however, it does not set a requirement. It is recommended that this material be placed in a binder along with equipment installation information, warranties, and homeowners' manuals and be given to the owner/occupant of the unit. A form is provided to summarize the essential information for the homeowner or occupant.

A1.2 Many of the systems described in this standard require occupant interaction to work as intended. It is important that the building occupants be informed as to the function of the individual components and what they are expected to do or not do. This is especially important when systems are logically but not physically coupled, when safety issues are involved, or when the components are multifunctional and may not be easily recognized as part of a designed ventilation system. Labels can assist in this endeavor.

A2. OPERATIONS

Written information on the proper and expected operation of the ventilation system chosen to comply with Sections 4, 5, 6, and 7 of this standard should be provided, including the design parameters assumed by the ventilation system designer. This system operation information should include all mechanical ventilation equipment, ventilation controls, and any passive or natural ventilation devices used to comply with this standard.

A2.1 Design Parameters

- Installing contractor's contact name and numbers
- Heating/cooling load calculations
- Ventilation calculations
- As-built drawings
- Any required energy calculations
- Any combustion safety calculations or requirements
- Permit documentation
- Clear statement of type of ventilation approach being used (natural, continuous mechanical, intermittent mechanical, or demonstrated)
- Operating schedule

A2.2 Mechanical Ventilation Equipment

- Operation, maintenance, and installation/owner's manuals from manufacturer
- Make, model, size, and supplier for all equipment
- Operating range
- Electrical requirements
- Emergency contact names and numbers

A2.3 Natural and Passive Ventilation Devices

- Operation, maintenance, and installation/owner's manuals from manufacturer
- Make, model, size, and supplier for all devices
- Operational requirements/schedule of operation by the occupant to ensure acceptable IAQ
- Limitations on the acceptability of IAQ if natural ventilation devices are not operated as intended

A2.4 Ventilation Controls

- Operation, maintenance, and installation/owner's manuals from manufacturer
- Make, model, size, and supplier for all equipment
- Control strategy and description

A3. MAINTENANCE

Written information on the required maintenance of the ventilation system components chosen to comply with Sections 4, 5, 6, and 7 of this standard should be provided, including any mechanical or passive components and controls. Maintenance information should include any information provided by the ventilation equipment manufacturers.

A3.1 Mechanical Ventilation Equipment

- Maintenance contractor's contact name and numbers
- Filter cleaning/replacement schedule

A3.2 Natural Ventilation Devices

- Inspection requirements to ensure that inlets and outlets will operate (e.g., they are not painted shut)
- Any required maintenance for the devices

A3.3 Ventilation Controls

- Any required maintenance for the controls
- Troubleshooting and reset methods for the controls

A3.4 Building Envelope. Whether intended or otherwise, the building envelope is part of the ventilation system. The building envelope should be maintained to operate as intended.

A3.4.1 If the building is of unusually tight construction, air inlets may have been added for ventilation makeup air. In addition, combustion air from outside the structure must be provided in accordance with *NFPA 31, Standard for the Installation of Oil-Burning Equipment,*[A-1] *NFPA 54/ANSI Z223.1, National Fuel Gas Code,*[A-2] and *NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid-Fuel Burning.*[A-3] If credit for infiltration is taken, the building envelope air leakage is part of the ventilation. In such cases, the requirements of the standard should be reviewed whenever envelope tightening is considered.

A3.4.2 Without proper maintenance, the building envelope tightness may degrade over time. Excessive building leakage can cause increased energy use and can unbalance some mechanical ventilation systems. Excessive leakage can also allow moisture into the envelope, which may lead to damage and loss of serviceability. (See *ASTM E241, Standard Guide for Limiting Water-Induced Damage to Buildings*[A-4] for more details.)

A4. REFERENCES

A-1. *NFPA 31-2001, Standard for the Installation of Oil-Burning Equipment.* National Fire Protection Association, Quincy, MA.

A-2. *NFPA 54-2002/ANSI Z223.1-2002, National Fuel Gas Code.* National Fire Protection Association and American Gas Association, Quincy, MA, and Washington, DC.

A-3. *NFPA 211-2000, Standard for Chimneys, Fireplaces, Vents, and Solid-Fuel Burning Appliances.* National Fire Protection Association, Quincy, MA.

A-4. *ASTM E241-00e1, Standard Guide for Limiting Water-Induced Damage to Buildings.* ASTM International, West Conshohocken, PA.

HOMEOWNERS OPERATIONS AND MAINTENANCE DOCUMENTATION FORM

Installer Information:

Company Name ______________________________ Date Installed: ______________

Address ______________________________ Date Serviced: ______________

______________________________ Date Serviced: ______________

______________________________ Date Serviced: ______________

Phone: ______________________________ Date Serviced: ______________

Whole-Building Ventilation System Type: ______________________________

____

____

Whole-Building Ventilation Operating Instructions and Schedule: ______________

____

____

____

Required Maintenance (annual or seasonal recommended as a minimum):

____

____

____

Ventilation Equipment and/or Devices:

Equipment	**Model**	**Manufacturer**
______________	______________	______________
______________	______________	Phone: ______________
______________	______________	______________
______________	______________	Phone: ______________
______________	______________	______________
______________	______________	Phone: ______________
______________	______________	______________
______________	______________	Phone: ______________
______________	______________	______________
______________	______________	Phone: ______________
______________	______________	______________
______________	______________	Phone: ______________

(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX B
HVAC SYSTEMS

B1. INTRODUCTION

The professional may use different strategies and systems to meet the requirements of this standard. The professional should consider occupant comfort, energy efficiency, ease of use, service life, first and life-cycle cost, value-added features, and indoor environmental quality when selecting a strategy and system. Ventilation systems and strategies that result in discomfort (e.g., due to drafts) or excessive energy usage may not be utilized by occupants as intended, possibly resulting in poor IAQ.

This appendix addresses the HVAC (and related) systems as potential causes of poor IAQ and as a control mechanism. Careful design, operations, and maintenance are necessary to provide optimal effectiveness.

B2. DESIGN, INSTALLATION, AND BUILD OUT

This section focuses on design issues related to the HVAC system. System design cannot be separated from envelope design or consideration of other sources.

B2.1 Pressure in the Living Space. All exhaust, supply, or air-handling fans have the potential to change the pressure of the living space relative to outside. High-volume fans such as the air handler and some cooking exhaust fans can cause high levels of depressurization, particularly in homes of tight construction. Consideration of these effects is essential in the design process.

Depressurization of the living space relative to outdoors may cause back-drafting of combustion appliances and the migration of contaminants (such as radon or other soil gases, car exhaust, insulation particles, etc.) into the living space. Depressurization can also result in moisture intrusion into building cavities in hot, humid climates, potentially causing structural damage and fungal growth.

Pressurization of the living space can cause condensation in building cavities in very cold climates, resulting in damage to the structural integrity of the home.

Excessive pressures may best be prevented by balanced ventilation systems combined with tight ducting systems accompanied by adequate return pathways for all supply air on air-handling devices. When pressure-relief openings are used instead of balanced systems, their effect on comfort and energy consumption should be considered. It should also be considered that occupants may block pressure-relief openings.

B3. HVAC SYSTEM DESIGN, INSTALLATION, MAINTENANCE, AND OPERATION

It is important that HVAC systems be designed, built, operated, and maintained in a way that discourages the growth of biological contaminants. This means that condensate drain pans need to be sloped to the drain, condensate drains be maintained free of obstructions, cooling coils be maintained free of dirt and other obstructions, and that any cause of moisture inside ducts be investigated and eliminated. It is particularly useful for any inside cooling coils to be installed in a manner that makes cleaning practical.

It is also important that HVAC systems be designed, built, operated, and maintained in a way that reduces or eliminates the migration of contaminants into occupiable spaces. This means that the pressurization of spaces with contaminants and the depressurization of adjacent spaces are to be avoided. Return systems are linked to powerful fans, and the flows are often poorly controlled. Return systems that use building cavities often draw air from multiple unknown sources.

When contaminants are present in the home, air-moving equipment associated with heating or cooling rapidly disperses the contaminants through the home. This effect both lowers peak concentrations and distributes the contaminants to other spaces. This effect must be taken into account when considering source control.

B3.1 Mechanical Ventilation System Design, Installation, Maintenance, and Operation. The concentration of indoor contaminants can increase if ventilation systems are inadequately designed, installed, maintained, or operated or if strong local contaminant sources are not isolated, spot-ventilated, or controlled. Manual switches associated with a continuous ventilation system should have a clear label such as, "This controls the ventilation system of the home. Leave on except for severe outdoor contamination." Appendix A contains guidelines on operations and maintenance procedures and documentation.

B3.2 Effect of Outdoor Conditions on Moisture Removal. During periods when the outdoor air has a higher absolute humidity than the air to be exhausted, neither natural ventilation nor mechanical exhaust provide good moisture control. The best and most cost-effective moisture control may be the mechanical cooling system or a mechanical dehumidification system. High outdoor air moisture content suggests the elimination of mechanical exhaust; however, typical mechanical cooling systems do not provide for removal of contaminants other than moisture. When these conditions happen only occasionally, special provisions may not be necessary.

B3.3 Considerations in Hot, Humid Climates. Providing controlled ventilation in hot, humid climates can lead to or exacerbate moisture-related problems in air- conditioned homes if adequate dehumidification is not provided by the air-conditioning system or other process (such as a supplemental dehumidifier). Failure to control humidity levels in hot, humid climates can lead to poor IAQ—as well as decreased durability and maintainability—by allowing the growth of microbiologicals.

Outdoor air will add to the moisture load of the enclosure but is nevertheless required for adequate IAQ. Reducing outdoor air below the minimums of this standard is not an acceptable moisture-control strategy. Correct sizing of the air-conditioning systems, reducing airflow across coils, and the use of a dehumidifier are all acceptable strategies to remove moisture generated by occupants as well as moisture brought into the enclosure by ventilation.

It has been proven difficult to control indoor humidity within comfort limits in enclosures with leaky ductwork or leaky air handlers, especially when they are located outside the conditioned space. This additional outdoor air exacerbates moisture-control problems. Many dwellings in hot, humid climates currently have excess quantities of outside air inadvertently brought into building enclosures. Leaky ductwork and equipment located in ventilated attics, ventilated crawlspaces, and garages can lead to air change rates several times greater than that required by this standard. It is recommended that ductwork and equipment be placed inside the conditioned space or be well sealed to reduce the induced infiltration. These steps should be taken in conjunction with providing outside air in a controlled manner in sufficient quantities to meet this standard. Provisions for moisture control and ventilation should be considered together in the design of the dwelling.

Residences with high-performance glazing systems and thermally efficient roof and wall assemblies can have sensible loads sufficiently low so that traditional air-conditioning systems can have trouble providing humidity control. Under partial load conditions, the required outdoor air and occupant activities will often produce a larger latent load than can be handled by the air-conditioning systems. Under such circumstances, independent dehumidification control should be used.

B4. SELECTING THE WHOLE-HOUSE VENTILATION SYSTEM

Whole-house ventilation is provided through mechanical means. It is important to consider where the outdoor air comes from, how it enters the house, how it is distributed, and how it leaves the house. Systems that are uncomfortable, expensive to operate, unsafe, noisy, or in other ways unacceptable to the occupants are not likely to be used.

There is no air distribution requirement in this standard. However, the distribution of exhaust and outdoor air supply is an important consideration. Air distribution can be provided by either a distribution system provided for that purpose, a ducted thermal distribution system, or the connections between spaces when the spaces are sufficiently linked to the air inlets and outlets.

Whole-house ventilation may be provided by single or multiple fans. These fans may also be the fans supplying the local exhaust ventilation.

B4.1 Sizing. The mechanical whole-house systems may run continuously or intermittently. This standard requires that intermittent systems supply more ventilation air; thus, they may cost more to temper the outside air that is introduced and to run the fans. The system can consist of supply, exhaust, or a balanced combination of the two. In all cases, fans consume electricity and are potentially noisy. Fans that are noisy are likely to be unacceptable to many occupants and will be disabled; noise should be reduced by using quiet fans or by remote mounting of the system.

Intermittent systems require a larger flow rate than continuous systems. The flow rate is related to the fractional on-time as noted in the equation below:

$$Q_f = Q_r / (\varepsilon f) \qquad \text{(B1)}$$

where

Q_f = fan flow rate

Q_r = ventilation air requirement (from Table 4.1a or 4.1b)

ε = ventilation effectiveness (from Table 4.2)

f = fractional on-time

Example: A fan operated 30% of the time with cycle times of four hours (six cycles per day) with a ventilation air requirement of 40 cfm will have a ventilation effectiveness of 33% (from Table 4.2), and the fan flow will have to equal or exceed 404 cfm.

$$40 \text{ cfm} / (0.33 \times 0.30) = 404 \text{ cfm}$$

B4.2 Energy Consumption. The professional should consider the energy consumption of the mechanical ventilation system and the factors that influence that consumption. These factors include:

- Duct flow resistance (this is captured in the total pressure, p_t)
- Fan flow, Q_f, which is dependent on the fractional on-time (see Section B4.1)
- Fractional on time, f
- Combined fan/motor/cabinet efficiency, e_{fm}

These factors are related to the energy consumption through the following relationships (I-P) (note that the energy consumption to temper outside air is not included in these equations):

$$FHP = Q_f p_t / (6370\, e_{fm}) \qquad \text{(B2)}$$

where

FHP = fan horsepower

Q_f = fan flow, cfm

p_t = total pressure (in. w.c.)

e_{fm} = combined fan/motor/cabinet efficiency

$$E_f = FHP\ 8760\ NDS\ 0.7457 \qquad \text{(B3)}$$

where

E_f = fan energy consumption, kWh

8760 = annual hours

NDS = net duty cycle (fractional on-time for single-duty fans)

0.7457 = kilowatts per horsepower

B4.2.1 Examples

- **Example 1**—low-flow resistance duct, continuous "high"-efficiency single-purpose fan
- **Example 2**—higher flow resistance duct, continuous "normal"-efficiency single-purpose fan
- **Example 3**—higher flow resistance duct, intermittent operation (more than three hours between the beginning of on-cycles), fractional on-time 40%, "normal"-efficiency single-purpose fan
- **Example 4**—higher flow resistance duct, intermittent operation (less than three hours between the beginning of on-cycles), fractional on-time 35%, "normal"-efficiency dual-purpose fan (e.g., furnace fan), net duty cycle 15%
- **Example 5**—higher flow resistance duct, intermittent operation (less than three hours between the beginning of on-cycles), fractional on time 35%, "higher"-efficiency dual-purpose fan (e.g., electronically commutated motor [ECM] on furnace fan), net duty cycle 15%
- **Example 6**—higher flow resistance duct, continuous operation (high speed on heating or cooling and low speed for ventilation only), "higher"-efficiency dual-purpose fan (e.g., ECM on furnace fan), net duty cycle 80%

	Q_r	ε	f	Q_f	p_t	e_{fm}	*FHP*	*NDS*	E_f
Example 1	40	1	1	40	0.25	0.2	0.0078	1	51
Example 2	40	1	1	40	0.35	0.15	0.0147	1	96
Example 3	40	0.5	0.4	200	0.35	0.15	0.0733	0.4	191
Example 4	40	1	0.35	1200	0.5	0.15	0.6279	0.15	615
Example 5	40	1	0.35	1200	0.5	0.22	0.4281	0.15	420
Example 6	40	1	1	500	0.33	0.22	0.1152	0.8	602

B4.2.2 Discussion of Examples. Each example uses a common ventilation air requirement of 40 cfm.

Example 1—A "higher"-efficiency bath fan has about a 20% efficiency against a duct resistance of 0.25 in. w.c. This is a relatively low-restriction duct system for the field.

The ventilation air requirement of the standard requires very little power delivered to the air and very little energy consumption if the system is designed with low resistance ducting and a higher efficiency fan/motor assembly.

Example 2—When a lower efficiency fan is used and the ducts are somewhat more restricted, the energy consumption increases.

Example 3—If the system is changed to intermittent and the time between on cycles is over three hours, the fan size and flow must increase significantly.

Example 4—An air-handler fan designed for air conditioning can be used to provide ventilation by adding a duct with a calibration damper from the return plenum to an outside air source. When this type of system is used, the amount of air moved by the ventilation system is much greater than a single-purpose ventilation system. In this example, a flow rate of 1200 cfm is used as the nominal flow of a 3 ton air-conditioner indoor fan. The pressures regularly exceed 0.5 in. w.c., and the efficiency (measured as energy provided divided by work external to the air-handler cabinet and coil) is regularly below 15%. With this system, the fan is controlled to operate more than needed for heating or cooling during moderate weather conditions. This is estimated to produce a duty cycle of 35% overall and an increase of 15% above normal use over the whole year.

This system would need to be designed for a flow of 114 cfm (40 cfm/0.35 duty cycle) through the duct providing the outside air. Caution must be exercised in this type of design to ensure that the temperature in the return plenum does not go below the manufacturer's specification (usually 60°F). Systems that use the air-handler fan for ventilation should pay particular attention to minimizing duct leakage.

Example 5—When the system in Example 4 is installed on a unit with a higher fan/motor combined efficiency, as with an ECM, the fan power draw and the annual energy consumption drop proportionally.

Example 6—When the system in Example 5 (ECM) is used in multi-speed operation (normal speed for heating and cooling, low speed for ventilation only), duty cycle can be extended to 100%. This means that the flow through the air duct from outdoors can be reduced to 40 cfm. Low-speed operation will reduce the duct pressures and the fan power draw but increase the annual fan energy consumption. In this example, the fan flow is cut to 42% of normal. This design will need an automatic flow-control device to maintain the correct outside airflow when the fan speeds change. Without a control, the flow from outside would increase by 240% when the fan operates at high speed.

The professional should calculate the electrical energy required to operate the system and the energy required to temper the outside air introduced through ventilation.

B4.3 Supply Ventilation. In a supply ventilation system, there is usually a single air intake for the ventilation air, which is then dispersed through the house either by a dedicated duct system or using the thermal distribution system. A supply ventilation system allows the filtration of outdoor air, which can remove pollen and dust.

Exhaust pathways are normally provided by envelope leakage, exhaust stacks, and flues. Supply ventilation can result in indoor pressurization, which may be unacceptable in cold climates. Supply ventilation can mitigate radon entry or back-drafting problems and may reduce interstitial moisture problems in hot, humid climates.

In temperate or severe climates, the supply air, if delivered directly to rooms without tempering, can cause thermal discomfort or draft. Energy recovery from the exiting air is not possible. When a dedicated duct system is used, the cost of a supply ventilation system is increased.

B4.4 Exhaust Ventilation. In an exhaust ventilation system, there is usually a mechanical exhaust, centrally located. Air enters the house through envelope leakage, open windows, or designed inlets. Because the air intake is dispersed, there is usually not any thermal discomfort associated with the system. Energy recovery can be provided with the addition of an exhaust air heat pump but may not be economical in many climates.

The exhaust fan depressurizes the house, which can aggravate radon or back-drafting problems. Because of potential interstitial space moisture problems, exhaust ventilation may be unacceptable in hot, humid climates when the indoor air is mechanically cooled.

Although air intake through building leaks reduces the particulate concentration somewhat, filtration of outdoor air is not generally possible with exhaust ventilation. In unusually tight houses, envelope leakage may be insufficient to provide air supply and designed intakes may be needed.

B4.5 Balanced Ventilation. In a balanced ventilation system, there is usually a mechanical exhaust either centrally located or ducted from locations likely to have high contaminant levels. There is a single outside air intake for the ventilation air, which is then dispersed through the house. The systems are designed to produce equal supply and exhaust flows. With equal flows, the system creates neither pressurization nor depressurization, thus problems associated with house pressures are reduced. Filtration and tempering of the incoming air can be accomplished at the central unit.

Most balanced systems feature either heat recovery or energy recovery. Heat-recovery systems provide thermal tempering of the incoming air using the exiting air as a source for heat (or cooling). Energy-recovery systems provide both thermal and moisture tempering of the incoming air. Energy-recovery systems use the exiting air as the source of the tempering.

Because of its energy-recovery properties, a balanced system becomes more attractive as total space-conditioning costs increase, such as in severe climates. The balanced system is initially the most costly of the three systems, but total operating costs may be less, particularly if high-efficiency fan/motor assemblies are used.

In severe climates, the amount of tempering in the recovery device is generally limited. The designer needs to carefully evaluate the locations for outside air delivery registers to avoid discomfort.

B4.6 Demonstrated Ventilation Alternatives. There are other ventilation strategies in use apart from natural ventilation and continuous or intermittent mechanical ventilation. These can be used in the standard if they follow good engineering practice and can be demonstrated to work appropriately for the situation.

The most common alternatives involve the use of stack- and wind-driven infiltration alone or combined with intermittent fan operation to provide equivalent ventilation. For example, a house with a leaky envelope might meet the standard based on its infiltration rate under some weather conditions (generally higher indoor-outdoor temperature differentials) and meet the standard under other conditions from a combination of infiltration and mechanical ventilation.

ANSI/ASHRAE Standard 136, Method of Determining Air Change Rates in Detached Dwellings[B-1] can be used to combine ventilation, continuous fans, supply/exhaust fans, and intermittent fans of an equivalent ventilation rate. It is necessary to make blower door measurements if stack- and wind-driven infiltration are included.

Other demonstration techniques, such as tracer gas, can be acceptable. Other ventilation approaches such as passive stacks or heat-recovery natural ventilation can also be considered.

Designed passive ventilation systems, such as passive stacks, are used in some parts of the world, such as Europe, but are not common in North America. Such systems can provide acceptable ventilation at low cost, but there are not yet any accepted prescriptive design mechanisms for use in North America. The standard allows the use of such systems within the context of a demonstrated ventilation system.

B5. SELECTING THE LOCAL VENTILATION SYSTEM

Local ventilation is used to remove pollutants typically generated in the "wet rooms" of kitchens, baths, toilets, etc. Moisture and odor are major drivers, but potentially toxic volatile compounds are also often present.

The local exhaust fans may be all or part of the whole-house ventilation system. Where local fans are used there is always a potential for significant depressurization if spaces can be closed off from the remainder of the house.

B5.1 Mechanical Exhaust. Exhaust fans can be single or multiple speed and should be ducted outside (not into buffer spaces). In kitchens, especially those open to other rooms in the house, hoods should be considered to improve capture efficiency over cooking surfaces. Extra exhaust ventilation capacity may be desirable, especially with combustion-based cooking.

Mechanical exhaust normally is balanced by transfer air from other parts of the house. For the sizes specified in this standard, they do not usually induce much extra ventilation of the whole house and thus have little impact on space-conditioning costs. However, in tight houses or in houses with large exhaust flows, local exhaust can induce extra infiltration or cause unacceptable depressurization. Local exhaust fans usually do not affect thermal comfort adversely.

Exhaust fans directly consume electricity and represent an added cost of construction. Fan noise can be an inhibiting factor in their use, but quiet systems are available. Mechanical exhaust systems also require some maintenance.

B5.2 Other Local Ventilation Systems. If demonstrable, other systems can be used to provide the local ventilation. Although not used much in North America, passive stacks and other forms of designed natural ventilation are used in some parts of the world to provide local ventilation.

B6. REFERENCE

B-1. *ANSI/ASHRAE Standard 136-1993 (RA 2006), A Method of Determining Air Change Rates in Detached Dwellings.* American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.

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INFORMATIVE APPENDIX C
ADDENDA DESCRIPTION INFORMATION

ANSI/ASHRAE Standard 62.2-2007 incorporates ANSI/ASHRAE Standard 62.2-2004 and Addenda *e*, *g*, *h*, and *i* to ANSI/ ASHRAE Standard 62.2-2004. Table C-1 lists each addendum and describes the way in which the standard is affected by the change. It also lists the ASHRAE and ANSI approval dates for each addendum.

TABLE C-1
Addenda to ANSI/ASHRAE Standard 62.2-2004

Addendum	Section(s) Affected	Description of Changes*	ASHRAE Standards Committee Approval	ASHRAE Board of Directors Approval	ANSI Approval
62.2e	Exception (a) to Section 4.1 and Table 8.2	This addendum substitutes the IECC climate zone map for infiltration degree days as the basis for the criteria of Section 4.1 Exception (a).	June 24, 2006	June 29, 2006	July 27, 2006
62.2g	Section 6.3	Condensing clothes dryers have entered the market. This addendum adds an exception to Section 6.3 for condensing dryers plumbed to a drain.	January 21, 2006	January 26, 2006	April 10, 2006
62.2h	Sections 7.1 and 8	This addendum adds requirements for HVI testing and rating of ventilation devices and equipment.	January 27, 2007	March 2, 2007	March 27, 2007
62.2i	Exception (b) to Section 4.1 and Table 8.2	This addendum substitutes the IECC climate zone map for degree days in Section 4.1 Exception (b).	June 24, 2006	June 29, 2006	March 3, 2007

*These descriptions may not be complete and are provided for information only.

NOTE

When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at http://www.ashrae.org.

NOTICE

INSTRUCTIONS FOR SUBMITTING A PROPOSED CHANGE TO THIS STANDARD UNDER CONTINUOUS MAINTENANCE

This standard is maintained under continuous maintenance procedures 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. SSPC consideration will be given to proposed changes at the Annual Meeting (normally June) if proposed changes are received by the Manager of Standards (MOS) no later than December 31. Proposals received after December 31 shall be considered by the SSPC no later than at the Annual Meeting of the following year.

Proposed changes must be submitted to the MOS in the latest published format available from the MOS. However, the MOS may accept proposed changes in an earlier published format if the MOS concludes that the differences are immaterial to the proposed change submittal. If the MOS concludes that a current form must be utilized, the proposer may be given up to 20 additional days to resubmit the proposed changes in the current format.

ELECTRONIC PREPARATION/SUBMISSION OF FORM FOR PROPOSING CHANGES

An electronic version of each change, which must comply with the instructions in the Notice and the Form, is the preferred form of submittal to ASHRAE Headquarters at the address shown below. The electronic format facilitates both paper-based and computer-based processing. Submittal in paper form is acceptable. The following instructions apply to change proposals submitted in electronic form.

Use the appropriate file format for your word processor and save the file in either a recent version of Microsoft Word (preferred) or another commonly used word-processing program. Please save each change proposal file with a different name (for example, "prop01.doc," "prop02.doc," etc.). If supplemental background documents to support changes submitted are included, it is preferred that they also be in electronic form as word-processed or scanned documents.

ASHRAE will accept the following as equivalent to the signature required on the change submittal form to convey non-exclusive copyright:

Files attached to an e-mail:	Electronic signature on change submittal form (as a picture; *.tif, or *.wpg).
Files on a CD:	Electronic signature on change submittal form (as a picture; *.tif, or *.wpg) or a letter with submitter's signature accompanying the CD or sent by facsimile (single letter may cover all of proponent's proposed changes).

Submit an e-mail or a CD containing the change proposal files to:
Manager of Standards
ASHRAE
1791 Tullie Circle, NE
Atlanta, GA 30329-2305
E-mail: change.proposal@ashrae.org
(Alternatively, mail paper versions to ASHRAE address or fax to 404-321-5478.)

The form and instructions for electronic submittal may be obtained from the Standards section of ASHRAE's Home Page, www.ashrae.org, or by contacting a Standards Secretary, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.
Phone: 404-636-8400. Fax: 404-321-5478. E-mail: standards.section@ashrae.org.

FORM FOR SUBMITTAL OF PROPOSED CHANGE TO AN ASHRAE STANDARD UNDER CONTINUOUS MAINTENANCE

NOTE: Use a separate form for each comment. Submittals (Microsoft Word preferred) may be attached to e-mail (preferred), submitted on a CD, or submitted in paper by mail or fax to ASHRAE, Manager of Standards, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: change.proposal@ashrae.org. Fax: +1-404/321-5478.

1. Submitter:

Affiliation:

Address: City: State: Zip: Country:

Telephone: Fax: E-Mail:

I hereby grant the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) the non-exclusive royalty rights, including non-exclusive rights in copyright, in my proposals. I understand that I acquire no rights in publication of the standard in which my proposals in this or other analogous form is used. I hereby attest that I have the authority and am empowered to grant this copyright release.

Submitter's signature: ______________________________ Date: ____________________

All electronic submittals must have the following statement completed:

I *(insert name)* ______________________________, through this electronic signature, hereby grant the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) the non-exclusive royalty rights, including non-exclusive rights in copyright, in my proposals. I understand that I acquire no rights in publication of the standard in which my proposals in this or other analogous form is used. I hereby attest that I have the authority and am empowered to grant this copyright release.

2. Number and year of standard:

3. Page number and clause (section), subclause, or paragraph number:

4. I propose to: [ ] Change to read as follows [ ] Delete and substitute as follows
(check one) [ ] Add new text as follows [ ] Delete without substitution

Use underscores to show material to be added (added) and strike through material to be deleted (~~deleted~~). Use additional pages if needed.

5. Proposed change:

6. Reason and substantiation:

7. Will the proposed change increase the cost of engineering or construction? If yes, provide a brief explanation as to why the increase is justified.

[ ] Check if additional pages are attached. Number of additional pages: _______

[ ] Check if attachments or referenced materials cited in this proposal accompany this proposed change. Please verify that all attachments and references are relevant, current, and clearly labeled to avoid processing and review delays. *Please list your attachments here:*

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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