(This foreword 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.)

FOREWORD

ANSI/ASHRAE Standard 62.1-2013 is the latest edition of Standard 62.1. The 2013 edition combines Standard 62.1-2010 and the ten approved and published addenda to the 2010 edition, thereby providing an easy-to-use, consolidated standard. Specific information on the contents of each addendum and approval dates for each addendum are included in Informative Appendix J.

First published in 1973 as Standard 62, Standard 62.1 is now updated on a regular basis using ASHRAE's continuous maintenance procedures. According to these procedures, Standard 62.1 is continuously revised by addenda that are publicly reviewed, approved by ASHRAE and ANSI, and published in a supplement approximately 18 months after each new edition of the standard, or in a new, complete edition of the standard, published every three years.

Standard 62.1 has undergone some key changes over the years, reflecting the ever-expanding body of knowledge, experience, and research related to ventilation and air quality. While the purpose of the standard has remained consistent—to specify minimum ventilation rates and other measures intended to provide indoor air quality that is acceptable to human occupants and that minimizes adverse health effects—the means of achieving this goal have evolved. In its first edition, the standard adopted a prescriptive approach to ventilation by specifying both minimum and recommended outdoor airflow rates to obtain acceptable indoor air quality for a variety of indoor spaces. In its 1981 edition, the standard reduced minimum outdoor airflow rates and introduced an alternative performance-based approach, the Indoor Air Quality Procedure (IAQP), which allowed for the calculation of the amount of outdoor air necessary to maintain the levels of indoor air contaminants below recommended limits. Today the standard includes three procedures for ventilation design, the IAQ Procedure, the Ventilation Rate Procedure (VRP), and the Natural Ventilation Procedure.

In its 1989 edition, and in response to a growing number of buildings with apparent indoor air quality problems, the standard increased minimum outdoor airflow rates significantly and introduced a requirement for finding outdoor air intake flow requirements for multiple-zone, recirculating systems.

The 1999 and 2001 editions made several minor changes and clarifications that did not impact the minimum required outdoor airflow rates. In its 2004 edition—the last time the standard was revised in its entirety—the standard modified the IAQ Procedure to improve enforceability, but more significantly, it modified the Ventilation Rate Procedure, changing both the minimum outdoor airflow rates and the procedures for calculating both zone-level and system-level outdoor airflow rates. The 2007 and 2010 editions of the standard provided some significant updates, but the changes primarily focused on usability and clarity.

The 2013 edition revises and improves the standard in several ways. A number of changes remove inconsistencies and improve clarity. Significant changes include the following:

- *Table 6.2.2.2, "Zone Air Distribution Effectiveness," is modified to increase the effectiveness of underfloor air distribution systems that meet certain conditions.*
- *The requirements for the quality of water used in humidification systems is modified and clarified.*
- *Building level pressurization requirements were clarified, and a definition of "exfiltration" was added.*
- *A performance alternative to the prescriptive exhaust rates is added. This approach differs from the IAQP in that monitoring of the concentrations of contaminants of concern is required and provides the basis for control of exhaust flow rates.*
- *Some changes are made to the ventilation rates and space types in Table 6.2.2.1. These add refrigerated warehouses and, for sports-related spaces, change the ventilation rate to include a per-occupant component that allows the use of demand-controlled ventilation in these spaces.*
- *The filter requirement on air entering wetted cooling coils has been modified to change the MERV rating from 6 to 8. This change reduces potential for particulate deposition on the coils that could lead to biological or other contamination.*
- *Toilet exhaust air that is cleaned to Class 1 may be recirculated.*

For more specific information on these changes and on other revisions made to the standard by other addenda, refer to Informative Appendix J. Users of the standard are encouraged to use the continuous maintenance procedure to suggest changes for further improvements.

A form for submitting change proposals is included in the back of the standard. The project committee for Standard 62.1 will take formal action on all change proposals received.

1. PURPOSE

1.1 The purpose of this standard is to specify minimum ventilation rates and other measures intended to provide indoor air quality that is acceptable to human occupants and that minimizes adverse health effects.

1.2 This standard is intended for regulatory application to new buildings, additions to existing buildings, and those changes to existing buildings that are identified in the body of the standard.

1.3 This standard is intended to be used to guide the improvement of indoor air quality in existing buildings.

2. SCOPE

2.1 This standard applies to all spaces intended for human occupancy except those within single-family houses, multi-

family structures of three stories or fewer above grade, vehicles, and aircraft.

2.2 This standard defines requirements for ventilation and air-cleaning-system design, installation, commissioning, and operation and maintenance.

2.3 Additional requirements for laboratory, industrial, health care, and other spaces may be dictated by workplace and other standards, as well as by the processes occurring within the space.

2.4 Although the standard may be applied to both new and existing buildings, the provisions of this standard are not intended to be applied retroactively when the standard is used as a mandatory regulation or code.

2.5 This standard does not prescribe specific ventilation rate requirements for spaces that contain smoking or that do not meet the requirements in the standard for separation from spaces that contain smoking.

2.6 Ventilation requirements of this standard are based on chemical, physical, and biological contaminants that can affect air quality.

2.7 Consideration or control of thermal comfort is not included.

2.8 This standard contains requirements, in addition to ventilation, related to certain sources, including outdoor air, construction processes, moisture, and biological growth.

2.9 Acceptable indoor air quality may not be achieved in all buildings meeting the requirements of this standard for one or more of the following reasons:

a. Because of the diversity of sources and contaminants in indoor air
b. Because of the many other factors that may affect occupant perception and acceptance of indoor air quality, such as air temperature, humidity, noise, lighting, and psychological stress
c. Because of the range of susceptibility in the population
d. Because outdoor air brought into the building may be unacceptable or may not be adequately cleaned

3. DEFINITIONS (SEE FIGURE 3.1)

acceptable indoor air quality: air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction.

air-cleaning system: a device or combination of devices applied to reduce the concentration of airborne contaminants such as microorganisms, dusts, fumes, respirable particles, other particulate matter, gases, and/or vapors in air.

air conditioning: the process of treating air to meet the requirements of a conditioned space by controlling its temperature, humidity, cleanliness, and distribution.

air, ambient: the air surrounding a building; the source of outdoor air brought into a building.

air, exhaust: air removed from a space and discharged to outside the building by means of mechanical or natural ventilation systems.

air, indoor: the air in an enclosed occupiable space.

air, makeup: any combination of outdoor and transfer air intended to replace exhaust air and exfiltration.

air, outdoor: ambient air that enters a building through a ventilation system, through intentional openings for natural ventilation, or by infiltration.

air, primary: air supplied to the ventilation zone prior to mixing with any locally recirculated air.

air, recirculated: air removed from a space and reused as supply air.

air, return: air removed from a space to be recirculated or exhausted.

air, supply: air delivered by mechanical or natural ventilation to a space and composed of any combination of outdoor air, recirculated air, or transfer air.

air, transfer: air moved from one indoor space to another.

air, ventilation: that portion of supply air that is outdoor air plus any recirculated air that has been treated for the purpose of maintaining acceptable indoor air quality.

breathing zone: the region within an occupied space between planes 3 and 72 in. (75 and 1800 mm) above the floor and more than 2 ft (600 mm) from the walls or fixed air-conditioning equipment.

cognizant authority: an agency or organization that has the expertise and jurisdiction to establish and regulate concentration limits for airborne contaminants, or an agency or organization that is recognized as authoritative and has the scope and expertise to establish guidelines, limit values, or concentrations levels for airborne contaminants.

concentration: the quantity of one constituent dispersed in a defined amount of another.

conditioned space: that part of a building that is heated or cooled, or both, for the comfort of occupants.

contaminant: an unwanted airborne constituent that may reduce acceptability of the air.

demand-controlled ventilation (DCV): any means by which the breathing zone outdoor airflow (V_{bz}) can be varied to the occupied space or spaces based on the actual or estimated number of occupants and/or ventilation requirements of the occupied zone.

energy recovery ventilation system: a device or combination of devices applied to provide the outdoor air for ventilation in which energy is transferred between the intake and exhaust airstreams.

environmental tobacco smoke (ETS): the "aged" and diluted combination of both side-stream smoke (smoke from the lit end of a cigarette or other tobacco product) and exhaled mainstream smoke (smoke that is exhaled by a smoker). ETS is commonly referred to as *secondhand smoke*.

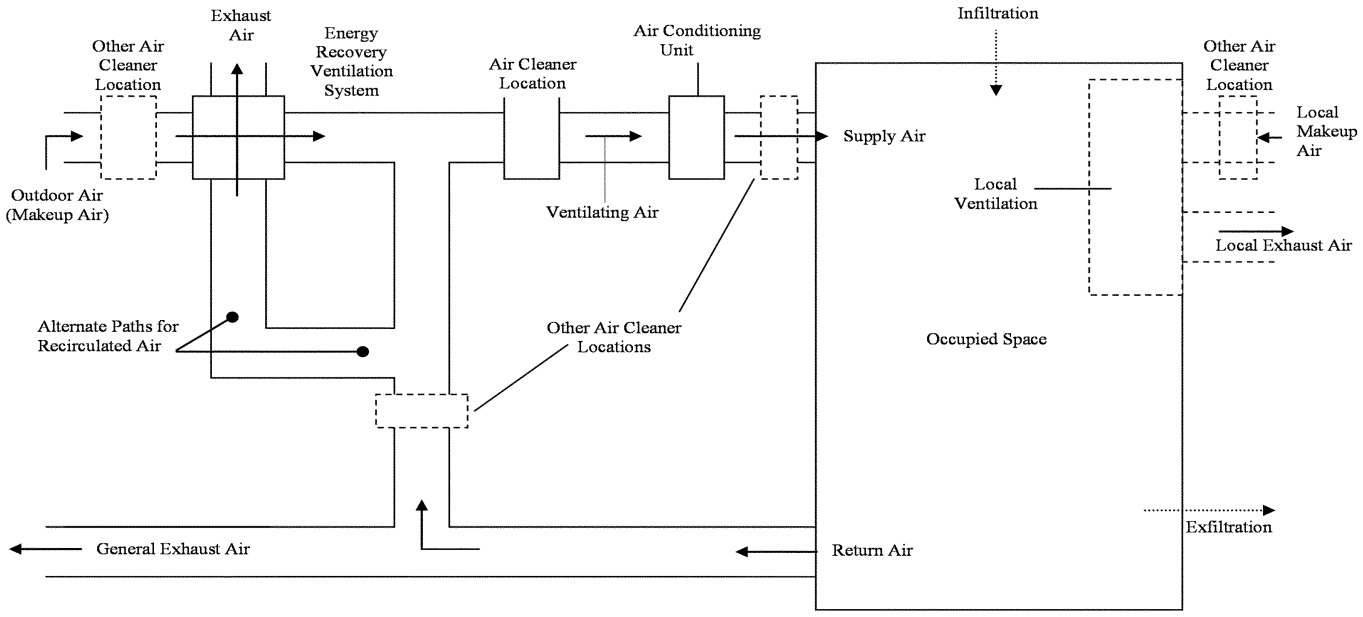

Figure 3.1 Ventilation system.

ETS-free area: an area where no smoking occurs and that is separated from ETS areas according to the requirements of this standard.

Note: A no-smoking area is not necessarily an ETS-free area.

ETS area: spaces where smoking is permitted, as well as those not separated from spaces where smoking is permitted in accord with the requirements of Section 5 in this standard.

exfiltration: uncontrolled outward air leakage from conditioned spaces through unintentional openings in ceilings, floors, and walls to unconditioned spaces or the outdoors caused by pressure differences across these openings due to wind, inside-outside temperature differences (stack effect), and imbalances between outdoor and exhaust airflow rates.

industrial space: an indoor environment where the primary activity is production or manufacturing processes. The processes in these spaces may generate contaminants with characteristics and in quantities dictating that principles of worker safety and industrial hygiene be used to define contaminant control strategies, including ventilation. Also, the primary occupants of these spaces consist of the individuals involved in these processes.

infiltration: uncontrolled inward air leakage to conditioned spaces through unintentional openings in ceilings, floors, and walls from unconditioned spaces or the outdoors caused by the same pressure differences that induce exfiltration.

mechanical ventilation: ventilation provided by mechanically powered equipment, such as motor-driven fans and blowers, but not by devices such as wind-driven turbine ventilators and mechanically operated windows.

microorganism: a microscopic organism, especially a bacterium, fungus, or protozoan.

natural ventilation: ventilation provided by thermal, wind, or diffusion effects through doors, windows, or other intentional openings in the building.

net occupiable area: the floor area of an occupiable space defined by the inside surfaces of its walls but excluding shafts, column enclosures, and other permanently enclosed, inaccessible, and unoccupiable areas. Obstructions in the space, such as furnishings, display or storage racks, and other obstructions, whether temporary or permanent, are considered to be part of the net occupiable area.

occupiable space: an enclosed space intended for human activities, excluding those spaces that are intended primarily for other purposes, such as storage rooms and equipment rooms, and that are only occupied occasionally and for short periods of time.

odor: a quality of gases, liquids, or particles that stimulates the olfactory organ.

readily accessible: capable of being reached quickly for operation without requiring those for whom ready access is required to climb over or remove obstacles or to resort to portable ladders, chairs, or other climbing aids.

ventilation: the process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space.

volume, space: the total volume of an occupiable space enclosed by the building envelope, plus that of any spaces permanently open to the occupiable space, such as a ceiling attic used as a ceiling return plenum.

ventilation zone: any indoor area that requires ventilation and consists of one or more occupiable spaces with similar occupancy category (see Table 6.2.2.1), occupant density, zone air distribution effectiveness (see Section 6.2.2.2), and zone primary airflow (see Section 6.2.5.1) per unit area.

Note: A ventilation zone is not necessarily an independent thermal control zone; however, spaces that can be combined for load calculation purposes can often be combined into a single zone for ventilation calculations purposes.

4. OUTDOOR AIR QUALITY

Outdoor air quality shall be investigated in accordance with Sections 4.1 and 4.2 prior to completion of ventilation system design. The results of this investigation shall be documented in accordance with Section 4.3.

4.1 Regional Air Quality. The status of compliance with national ambient air quality standards shall be determined for the geographic area of the building site.

4.1.1 In the United States, compliance status shall be either in "attainment" or "nonattainment" with the *National Ambient Air Quality Standards* (NAAQS).[1] In the United States, areas with no EPA compliance status designation shall be considered "attainment" areas.

Note: The NAAQS are shown in Table I-1 of Informative Appendix I.

4.2 Local Air Quality. An observational survey of the building site and its immediate surroundings shall be conducted during hours the building is expected to be normally occupied to identify local contaminants from surrounding facilities that may be of concern if allowed to enter the building.

4.3 Documentation. Documentation of the outdoor air quality investigation shall be reviewed with building owners or their representative and shall include the following as a minimum:

a. Regional air quality compliance status

Note: Regional outdoor air quality compliance status for the United States is available from the U.S. Environmental Protection Agency located at www.epa.gov.

b. Local survey information
   1. Date of observations
   2. Time of observations
   3. Site description
   4. Description of facilities on site and on adjoining properties
   5. Observation of odors or irritants
   6. Observation of visible plumes or visible air contaminants
   7. Description of sources of vehicle exhaust on site and on adjoining properties
   8. Identification of potential contaminant sources on the site and from adjoining properties
c. Conclusions regarding the acceptability of outdoor air quality based on consideration of information from investigation

5. SYSTEMS AND EQUIPMENT

5.1 Ventilation Air Distribution. Ventilating systems shall be designed in accordance with the requirements of the following subsections.

5.1.1 Designing for Air Balancing. The ventilation air distribution system shall be provided with means to adjust the system to achieve at least the minimum ventilation airflow as required by Section 6 under any load condition.

5.1.2 Plenum Systems. When the ceiling or floor plenum is used both to recirculate return air and to distribute ventilation air to ceiling-mounted or floor-mounted terminal units, the system shall be engineered such that each space is provided with its required minimum ventilation airflow.

Note: Systems with direct connection of ventilation air ducts to terminal units, for example, comply with this requirement.

5.1.3 Documentation. The design documents shall specify minimum requirements for air balance testing or reference applicable national standards for measuring and balancing airflow. The design documentation shall state assumptions that were made in the design with respect to ventilation rates and air distribution.

5.2 Exhaust Duct Location. Exhaust ducts that convey potentially harmful contaminants shall be negatively pressurized relative to spaces through which they pass, so that exhaust air cannot leak into occupied spaces; supply, return, or outdoor air ducts; or plenums.

Exception: Exhaust ducts that are sealed in accordance with SMACNA Seal Class A.[2]

5.3 Ventilation System Controls. Mechanical ventilation systems shall include controls in accordance with the following subsections.

5.3.1 All systems shall be provided with manual or automatic controls to maintain no less than the outdoor air intake flow (V_{ot}) required by Section 6 under all load conditions or dynamic reset conditions.

5.3.2 Systems with fans supplying variable primary air (V_{ps}), including single-zone VAV and multiple-zone recirculating VAV systems, shall be provided with one or more of the following:

a. Outdoor air intake, return air dampers, or a combination of the two that modulate(s) to maintain no less than the outdoor air intake flow (V_{ot})
b. Outdoor air injection fans that modulate to maintain no less than the outdoor air intake flow (V_{ot})
c. Other means of ensuring compliance with Section 5.3.1

5.4 Airstream Surfaces. All airstream surfaces in equipment and ducts in the heating, ventilating, and air-conditioning system shall be designed and constructed in accordance with the requirements of the following subsections.

5.4.1 Resistance to Mold Growth. Material surfaces shall be determined to be resistant to mold growth in accordance with a standardized test method, such as the "Mold Growth and Humidity Test" in UL 181,[3] ASTM C 1338,[4] or comparable test methods.

Exception: Sheet metal surfaces and metal fasteners

Note: Even with this resistance, any airstream surface that is continuously wetted is still subject to microbial growth.

5.4.2 Resistance to Erosion. Airstream surface materials shall be evaluated in accordance with the "Erosion Test" in UL 181[3] and shall not break away, crack, peel, flake off, or show evidence of delamination or continued erosion under test conditions.

Exception: Sheet metal surfaces and metal fasteners

TABLE 5.5.1 Air Intake Minimum Separation Distance

Object	Minimum Distance, ft (m)
Class 2 air exhaust/relief outlet (Note 1)	10 (3)
Class 3 air exhaust/relief outlet (Note 1)	15 (5)
Class 4 air exhaust/relief outlet (Note 2)	30 (10)
Plumbing vents terminating less than 3 ft (1 m) above the level of the outdoor air intake	10 (3)
Plumbing vents terminating at least 3 ft (1 m) above the level of the outdoor air intake	3 (1)
Vents, chimneys, and flues from combustion appliances and equipment (Note 3)	15 (5)
Garage entry, automobile loading area, or drive-in queue (Note 4)	15 (5)
Truck loading area or dock, bus parking/idling area (Note 4)	25 (7.5)
Driveway, street, or parking place (Note 4)	5 (1.5)
Thoroughfare with high traffic volume	25 (7.5)
Roof, landscaped grade, or other surface directly below intake (Notes 5 and 6)	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: This requirement applies to the distance from the outdoor air intakes for one ventilation system to the exhaust/relief outlets for any other ventilation system.

Note 2: Minimum distance listed does not apply to laboratory fume hood exhaust air outlets. Separation criteria for fume hood exhaust shall be in compliance with NFPA 45[5] and ANSI/AIHA Z9.5.[6] Information on separation criteria for industrial environments can be found in the *ACGIH Industrial Ventilation Manual*[7] and in *ASHRAE Handbook—HVAC Applications*.[8]

Note 3: Shorter separation distances shall be permitted when determined in accordance with (a) ANSI Z223.1/NFPA 54[9] for fuel gas burning appliances and equipment, (b) NFPA 31[10] for oil burning appliances and equipment, or (c) NFPA 211[11] for other combustion appliances and equipment.

Note 4: Distance measured to closest place that vehicle exhaust is likely to be located

Note 5: Shorter separation distance shall be permitted where outdoor surfaces are sloped more than 45 degrees from horizontal or that are less than 1 in. (30 mm) wide.

Note 6: Where snow accumulation is expected, the surface of the snow at the expected average snow depth constitutes the "other surface directly below intake."

5.5 Outdoor Air Intakes. Ventilation system outdoor intakes shall be designed in accordance with the following subsections.

5.5.1 Location. Outdoor air intakes (including openings that are required as part of a natural ventilation system) shall be located such that the shortest distance from the intake to any specific potential outdoor contaminant source shall be equal to or greater than the separation distance listed in Table 5.5.1.

Exception: Other minimum separation distances shall be permitted, provided it can be shown analytically that an equivalent or lesser rate of introduction of contaminants from outdoor sources will be attained.

Note: Informative Appendix F presents an analytical method for determining the minimum separation distances based on dilution of outdoor contaminants.

5.5.2 Rain Entrainment. Outdoor air intakes that are part of the mechanical ventilation system shall be designed to manage rain entrainment in accordance with any one of the following:

a. Limit water penetration through the intake to 0.07 oz/ft^2· h (21.5 g/m^2· h) of inlet area when tested using the rain test apparatus described in Section 58 of UL 1995.[12]
b. Select louvers that limit water penetration to a maximum of 0.01 oz/ft^2 (3 g/m^2) of louver free area at the maximum intake velocity. This water penetration rate shall be determined for a minimum 15-minute test duration when subjected to a water flow rate of 0.25 gal/min (16 mL/s) as described under the Water Penetration Test in AMCA 500-L[13] or equivalent. Manage the water that penetrates the louver by providing a drainage area and/or moisture removal devices.
c. Select louvers that restrict wind-driven rain penetration to less than 2.36 oz/ft^2· h (721 g/m^2· h) when subjected to a simulated rainfall of 3 in. (75 mm) per hour and a 29 mph (13 m/s) wind velocity at the design outdoor air intake rate with the air velocity calculated based on the louver face area.

Note: This performance corresponds to Class A (99% effectiveness) when rated according to AMCA 511[14] and tested per AMCA 500-L.[13]

d. Use rain hoods sized for no more than 500 fpm (2.5 m/s) face velocity with a downward-facing intake such that all intake air passes upward through a horizontal plane that intersects the solid surfaces of the hood before entering the system.
e. Manage the water that penetrates the intake opening by providing a drainage area and/or moisture removal devices.

5.5.3 Rain Intrusion. Air-handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and