STANDARD

ANSI/ASHRAE/ASHE Standard 170-2017
(Supersedes ANSI/ASHRAE/ASHE Standard 170-2013)
Includes ANSI/ASHRAE/ASHE addenda listed in Appendix C

Ventilation of Health Care Facilities

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

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SPECIAL NOTE

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

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The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

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ANSI/ASHRAE/ASHE Standard 170-2017
Ventilation of Health Care Facilities

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

(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

Standard 170 originated with an agreement between ASHRAE and the Facility Guidelines Institute (publishers of the Guidelines for Design and Construction of Health Care Facilities*) that an ASHRAE standard would provide the best location for ventilation requirements for the health care industry. The American Society of Health Care Engineering (ASHE) was also included in this process, which resulted in the initial (2008) edition of this standard—the first standard jointly sponsored by ASHRAE and ASHE.*

This 2017 edition to the standard includes a number of significant improvements to the 2013 edition. As a continuous maintenance document, Standard 170 is updated on a four-year cycle in concert with documents published by FGI.

This standard does not constitute a design guide. Rather it comprises a set of minimum requirements intended for adoption by code-enforcing agencies. Best practices are provided by other ASHRAE publications, such as ASHRAE Handbook—HVAC Applications *and* HVAC Design Manual for Hospitals and Clinics*.*

The 2017 edition includes several significant improvements:

- *The addition of adiabatic humidifiers as an acceptable type of humidifier*
- *A new type of exam room with lower requirements for less acute applications*
- *Clarification that controls to change pressure relationships between spaces are prohibited for all spaces, not only airborne infection isolation and protective environment rooms*
- *Reduction in requirements for electroconvulsive therapy procedure rooms*
- *Reduction in requirements for laboratories when allowed by certain calculations*
- *Higher requirements for higher hazard exhaust airstreams*
- *Coordination of space temperature requirements in the Sterile Processing Department with other industry groups*
- *Clarification of the definition of the primary diffuser array in operating rooms*

The 2017 edition was also editorially reformatted into three sections: hospital spaces, outpatient spaces, and nursing home spaces. This change allows for easier coordination between the standard and FGI documents, which, as of the 2018 edition, will consist of three separate books:

- Guidelines for the Design and Construction of Hospitals
- Guidelines for the Design and Construction of Residential Health, Care, and Support Facilities
- Guidelines for the Design and Construction of Outpatient Facilities

Standard 170 will be included in the Hospitals and Outpatient Facilities books.

Due to timing constraints, these three sections in the standard are identical. Changes to help differentiate outpatient and residential health, care, and support requirements from hospital requirements are currently undergoing final publication approval and will be published as Addendum n. The reformat was included in this edition to simplify the incorporation of these upcoming changes. As always, the standard does not dictate which types of spaces are required in which types of facilities. The requirements for spaces that do not exist in any given facility type may be ignored.

The committee appreciates the hard work invested in this edition by everyone who participated. The committee also appreciates the feedback received from the addendum public review and continuous maintenance proposal processes. Additional future input from the public is welcome.

1. PURPOSE

The purpose of this standard is to define ventilation system design requirements that provide environmental control for comfort, asepsis, and odor in health care facilities.

2. SCOPE

2.1 The requirements in this standard apply to patient care areas and related support areas within health care facilities, including hospitals, nursing facilities, and outpatient facilities.

2.2 This standard applies to new buildings, additions to existing buildings, and those alterations to existing buildings that are identified within this standard.

2.3 This standard considers chemical, physical, and biological contaminants that can affect the delivery of medical care to patients; the convalescence of patients; and the safety of patients, health care workers, and visitors.

3. DEFINITIONS

absorption distance: the distance downstream of a humidifier required for all moisture to be absorbed into the airstream.

addition: an extension or increase in floor area or height of a building, building system, or equipment.

airborne infection isolation (AII): the isolation of patients infected with organisms spread by airborne droplet nuclei less than 5 μm in diameter. For the purposes of this standard, the abbreviation "AII" refers to the room that provides isolation. ***Informative Note:*** See FGI (2014), CDC (2003), and CDC (2005) in Appendix B.

airborne infection isolation room: a room that is designed according to the requirements of this standard and that is intended to provide airborne infection isolation.

alteration: a significant change in the function or size of a space, in the use of its systems, or in the use of its equipment, either through rearrangement, replacement, or addition. Routine maintenance and service shall not constitute an alteration.

authority having jurisdiction (AHJ): the agent or agency responsible for enforcing this standard.

average velocity: the volumetric flow rate obtained by dividing the air quantity issuing from an air distribution device by the nominal face area of the device.

building: a structure that is wholly or partially enclosed within exterior walls and a roof, or within exterior and party walls and a roof, and that affords shelter to persons, animals, or property. In this standard, a building is a structure intended for use as a hospital or health care facility.

equipment: devices for heating, ventilating, and/or air conditioning, including but not limited to furnaces, boilers, air conditioners, heat pumps, chillers, and heat exchangers.

essential accessories: those components of a system, required to allow proper operation of that system, that are reasonably subject to mechanical failure (e.g., pumps, fans, control air compressors). Humidifiers, controls, and tanks are not included in this definition.

high-risk immunocompromised patients: patients who have the greatest risk of infection caused by airborne or waterborne microorganisms. These patients include but are not limited to allogeneic stem-cell transplant patients and intensive chemotherapy patients.

immunocompromised patients: patients whose immune mechanisms are deficient because of immunologic disorders, chronic diseases, or immunosuppressive therapy.

Informative Notes:

1. Examples of immunologic disorders include human immunodeficiency virus (HIV) infection or congenital immune deficiency syndrome.
2. Examples of chronic diseases include diabetes, cancer, emphysema, or cardiac failure.
3. Examples of immunosuppressive therapy include radiation, cytotoxic chemotherapy, antirejection medication, or steroids.
4. For more information, see CDC (2003) in Appendix B.

infection control risk assessment (ICRA): a determination of the potential risk of transmission of various infectious agents in the facility, a classification of those risks, and a list of required practices for mitigating those risks during construction or renovation.

inpatient: a patient whose stay at the health care facility is anticipated to require twenty-four hours or more of patient care.

invasive procedure*: a procedure that

a. penetrates the protective surfaces of a patient's body (e.g., skin, mucous membranes, cornea);
b. is performed in an aseptic surgical field (i.e., a procedure site);
c. generally requires entry into a body cavity; and
d. may involve insertion of an indwelling foreign body.

Informative Note: Invasive procedures are performed in locations suitable to the technical requirements of the procedure with consideration of infection control and anesthetic risks and goals. Accepted standards of patient care are used to determine where an invasive procedure is performed. "Invasive procedure" is a broad term commonly used to describe procedures ranging from a simple injection to a major surgical procedure. For the purposes of this document, the term is limited to the above description. The intent is to differentiate those procedures that carry a high risk of infection, either by exposure of a usually sterile body cavity to the external environment or by implantation of a foreign object into a normally sterile site. Procedures performed through orifices normally colonized with bacteria, and percutaneous procedures that do not involve an incision deeper than skin, would not be included in this definition.

invasive imaging procedure room: a room in which radiographic imaging is used and in which instruments or devices are inserted into patients through the skin or body orifice under sterile conditions for diagnosis and/or treatment.

nonaspirating diffuser: a diffuser that has unidirectional downward airflow from the ceiling with minimum entrainment of room air. Classified as ASHRAE Group E, these diffusers generally have very low average velocity. For the purposes of this standard, the performance of these diffusers is to be measured in terms of average velocity.

nursing facility: a facility that provides resident care, treatment, and services areas (including skilled nursing, subacute care, and Alzheimer's and other dementia facilities).

operating room (OR)*: a room in the surgical suite that meets the requirements of a restricted area and is designated and equipped for performing surgical or other invasive procedures. An aseptic field is required for all procedures performed in an OR. Any form of anesthesia may be administered in an OR if proper anesthesia gas administration devices are present and waste anesthesia gas disposal systems are provided.

patient care area: an area used primarily for the provision of clinical care to patients. Such care includes monitoring, evaluation, and treatment services.

procedure room*: a room designated for the performance of procedures that do not meet the definition of "invasive procedure" and may be performed outside the restricted area of a surgical suite and may require the use of sterile instruments or supplies. Local anesthesia and minimal and moderate sedation may be administered in a procedure room as long as special ventilation or waste-anesthesia gas-disposal systems are not required for anesthetic agents used in these rooms.

protective environment (PE) room: a patient room that is designed according to this standard and intended to protect a high-risk immunocompromised patient from human and environmental airborne pathogens.

restricted area*: a designated space in the semirestricted area of the surgical suite that can only be accessed through a semirestricted area. The restricted access is primarily intended to support a high level of asepsis control, not necessarily for security purposes. Traffic in the restricted area is limited to authorized personnel and patients. Personnel in restricted areas are required to wear surgical attire and cover head and facial hair.

* ***Informative Note:*** Definition is adapted from the FGI Guidelines; see FGI (2014) in Appendix B.

Masks are required where open sterile supplies or scrubbed persons may be located.

triage: the process of determining the severity of the illness of or injury to patients so that those who have the most emergent illnesses/injuries can be treated immediately and those less severely injured can be treated later or in another area.

4. COMPLIANCE

4.1 Compliance Requirements

4.1.1 New Buildings. New buildings shall comply with the provisions of this standard.

4.1.2 Existing Buildings

4.1.2.1 Additions to Existing Buildings. Additions shall comply with the provisions of this standard.

4.1.2.2 Alterations to Existing Buildings. Portions of a heating, ventilating, and air-conditioning system and other systems and equipment that are being altered shall comply with the applicable requirements of this standard.

4.1.2.2.1 Heating, Ventilation, and Air-Conditioning System Alterations. Alterations to mechanical systems serving the building heating, cooling, or ventilating needs shall comply with the requirements of Section 6, "Systems and Equipment," applicable to those specific portions of the building and its systems that are being altered. Any new mechanical equipment installed in conjunction with the alteration as a direct replacement of existing mechanical equipment shall comply with the provisions of Sections 6.2, 6.4, 6.5, and 6.6.

4.1.2.2.2 Space Alterations. Alterations to spaces listed in Table 6.4 shall comply with the requirements of Sections 6.7, 7, 8, and 9, applicable to those specific portions of the building and its systems that are being altered. Any alteration to existing health care space in a building that will continue to treat patients during construction shall comply with Sections 10.1, 10.3, 10.4, and 10.5.

4.2 Administrative Requirements. Administrative requirements relating to permit requirements, enforcement by the authority having jurisdiction (AHJ), interpretations, claims of exemption, approved calculation methods, rights of approved calculation methods, and rights of appeal are specified by the AHJ.

4.3 Compliance Documents

4.3.1 General. Compliance documents are those plans, specifications, engineering calculations, diagrams, reports, and other data that are approved as part of the permit by the AHJ. The compliance documents shall include all specific construction-related requirements of the owner's infection control risk assessment.

4.3.2 Construction Details. Compliance documents shall contain all pertinent data and features of the building, equipment, and systems in sufficient detail to allow a determination of compliance by the AHJ and to indicate compliance with the requirements of this standard.

4.3.3 Supplemental Information. Supplemental information necessary to verify compliance with this standard, such as calculations, worksheets, compliance forms, vendor literature, or other data, shall be made available when required by the AHJ.

4.4 Alternate Materials, Methods of Construction, or Design. The provisions of this standard are not intended to prevent the use of any material, method of construction, design, or building system not specifically prescribed herein, provided that such construction, design, or building system has been approved by the AHJ as meeting the intent of this standard.

4.5 Informative Appendices. The informative appendices to this standard and informative notes located within this standard contain recommendations, explanations, and other nonmandatory information and are not part of this standard.

4.6 Criteria Ranges. This standard often specifies a range of values that will comply with a specific requirement of the standard. If it is permitted by the AHJ, compliance with this requirement may be achieved by the presentation of compliance documents that demonstrate a system's ability to perform within the specified range.

5. PLANNING

Owners/managers of health care facilities shall prepare a detailed program that shall include the clinical service expected in each space, the specific user equipment expected to be used in each space, and any special clinical needs for temperature, humidity, and pressure control. This program shall be prepared in the planning phase of design.

6. SYSTEMS AND EQUIPMENT

Air-handling and distribution systems are required to provide health care facilities not only with a comfortable environment but also with ventilation to dilute and remove contaminants, provide conditioned air, and assist in controlling the transmission of airborne infection. In order to meet these requirements, air-handling and distribution systems shall be designed according to the requirements of this standard.

6.1 Utilities

6.1.1 Ventilation Upon Loss of Electrical Power. The space ventilation and pressure relationship requirements of Tables 7.1, 8.1, and 9.1 shall be maintained for the following spaces, even in the event of loss of normal electrical power:

a. AII rooms
b. PE rooms
c. Operating rooms (ORs), including delivery rooms (Caesarean)

Informative Note: For further information, see NFPA (2015) in Appendix B.

6.1.2 Heating and Cooling Sources

6.1.2.1 Provide heat sources and essential accessories in number and arrangement sufficient to accommodate the facility needs (reserve capacity), even when any one of the heat sources or essential accessories is not operating due to a breakdown or routine maintenance. The capacity of the remaining source or sources shall be sufficient to provide for domestic hot water, sterilization, and dietary purposes and to provide heating for operating, delivery, birthing, labor, recov-

ery, emergency, intensive care, nursery, and inpatient rooms. Fuel sufficient to support the owner's facility operation plan upon loss of fuel service shall be provided on site.

Exception to 6.1.2.1: Reserve capacity is not required if the ASHRAE 99% heating dry-bulb temperature for the facility is greater than or equal to 25°F (–4°C).

6.1.2.2 For central cooling systems greater than 400 tons (1407 kW) peak cooling load, the number and arrangement of cooling sources and essential accessories shall be sufficient to support the owner's facility operation plan upon a breakdown or routine maintenance of any one of the cooling sources.

6.2 Air-Handling Unit (AHU) Design

6.2.1 AHU Casing. The casing of the AHU shall be designed to prevent water intrusion, resist corrosion, and permit access for inspection and maintenance. All airstream surfaces of AHUs shall comply with ANSI/ASHRAE Standard 62.1, Section 5.4 [1].

6.3 Outdoor Air Intakes and Exhaust Discharges

6.3.1 Outdoor Air Intakes

6.3.1.1 General. Outdoor air intakes for AHUs shall be located a minimum of 25 ft (8 m) from cooling towers and all exhaust and vent discharges. Outdoor air intakes shall be located such that the bottom of the air intake is at least 6 ft (2 m) above grade. New facilities with moderate-to-high risk of natural or man-made extraordinary incidents shall locate air intakes away from public access. All intakes shall be designed to prevent the entrainment of wind-driven rain, shall contain features for draining away precipitation, and shall be equipped with a birdscreen of mesh no smaller than 0.5 in. (13 mm).

Exception to 6.3.1.1: For gas-fired, packaged rooftop units, the separation distance of the unit's outdoor air intake from its flue may be less than 25 ft (8 m). The separation distance shall be greater than or equal to the distance prescribed in ANSI/ASHRAE Standard 62.1, Table 5-1, "Air Intake Minimum Separation Distance [1].

6.3.1.2 Relief Air. Relief air is exempt from the 25 ft (8 m) separation requirement. Relief air is defined as the Class 1 air that could be returned to the air-handling unit from the occupied spaces but is being discharged to the outdoors to maintain building pressurization (such as during air-side economizer operation).

Informative Note: For more information, see ASHRAE Standard 62.1 (ASHRAE 2016a) in Appendix B.

6.3.1.3 Roof Locations. Intakes on top of buildings shall be located with the bottom of the air intake a minimum of 3 ft (1 m) above roof level.

6.3.1.4 Areaways. In the case of an areaway, the bottom of the air intake opening shall be at least 6 ft (2 m) above grade. The bottom of the air intake opening from the areaway into the building shall be at least 3 ft (1 m) above the bottom of the areaway.

Informative Note: See Appendix A, Figure A3.

6.3.2 Exhaust Discharges

6.3.2.1 General. Exhaust discharge outlets that discharge air from AII rooms, bronchoscopy and sputum collection and pentamidine administration rooms, emergency department public waiting areas, nuclear medicine hot labs, radiology waiting rooms programmed to hold patients who are waiting for chest x-rays for diagnosis of respiratory disease, pharmacy hazardous-drug exhausted enclosures, and laboratory work area chemical fume hoods shall

a. be designed so that all ductwork within the building is under negative pressure;

Exception to 6.3.2.1(a): Ductwork located within mechanical equipment rooms. Positive-pressure exhaust ductwork located within mechanical equipment rooms shall be sealed in accordance with SMACNA duct leakage Seal Class A [2].

b. be located such that they reduce the potential for the recirculation of exhausted air back into the building.

6.3.2.2 Additional Requirements

a. Exhaust discharge outlets from AII rooms, bronchoscopy and sputum collection exhaust, pharmacy hazardous-drug exhausted enclosures, and laboratory work area chemical fume hoods shall additionally be arranged to discharge to the atmosphere in a vertical direction (with no rain cap or other device to impede the vertical momentum) and at least 10 ft (3 m) above the adjoining roof level.

b. Exhaust discharge outlets from laboratory work area chemical fume hoods shall discharge with a stack velocity of at least 2500 fpm (1180 L/s).

c. Exhaust discharge outlets from AII rooms, bronchoscopy and sputum collection exhaust, and laboratory work area chemical fume hoods shall be located not less than 25 ft (8 m) horizontally from outdoor air intakes, openable windows/doors, and areas that are normally accessible to the public.

Exception to 6.3.2.2(c): If permitted by the AHJ, an alternate location (***Informative Note:*** e.g., located adjacent to an air intake but with the exhaust discharge point above the top of the air intake) may be used. The submitted reentrainment analysis shall demonstrate that an exhaust discharge outlet located at a distance less than 25 ft (8 m) horizontally provides a lower concentration of reentrainment than all the areas located at a distance greater than 25 ft (8 m) horizontally on the roof level where the exhaust discharge is located.

6.4 Filtration. Filter banks shall be provided in accordance with Table 6.4. Each filter bank with an efficiency of greater than MERV 12 shall be provided with an installed manometer or differential pressure measuring device that is readily accessible and provides a reading of differential static pressure across the filter to indicate when the filter needs to be changed. All of the air provided to a space shall be filtered in accordance with Table 6.4, except as otherwise indicated in Sections 7.1, 8.1, and 9.1 for spaces that allow recirculating HVAC room units.

Informative Note: For more information, see CDC (2003) in Appendix B.

Table 6.4 Minimum Filter Efficiencies

Space Designation (According to Function)	Filter Bank No. 1 (MERV)[a]	Filter Bank No. 2 (MERV)[a]
Operating rooms (ORs); inpatient and ambulatory diagnostic and therapeutic radiology; inpatient delivery and recovery spaces	7	14
Inpatient care, treatment, and diagnosis, and those spaces providing direct service or clean supplies and clean processing (except as noted below); AII (rooms)	7	14
Protective environment (PE) rooms	7	HEPA[c,d]
Laboratory work areas, procedure rooms, and associated semirestricted spaces	13[b]	NR
Administrative; bulk storage; soiled holding spaces; food preparation spaces; and laundries	7	NR
All other outpatient spaces	7	NR
Nursing facilities	13	NR
Psychiatric hospitals	7	NR
Resident care, treatment, and support areas in inpatient hospice facilities	13	NR
Resident care, treatment, and support areas in assisted living facilities	7	NR

NR = not required

a. ***Informative Note:*** The minimum efficiency reporting value (MERV) is based on the method of testing described in ANSI/ASHRAE Standard 52.2 (ASHRAE [2017a]).

b. Additional prefilters may be used to reduce maintenance for filters with efficiencies higher than MERV 7.

c. As an alternative, MERV-14 rated filters may be used in Filter Bank No. 2 if a tertiary terminal HEPA filter is provided for these spaces.

d. ***Informative Note:*** High-efficiency particulate air (HEPA) filters are those filters that remove at least 99.97% of 0.3 micron-sized particles at the rated flow in accordance with the testing methods of IEST RP-CC001.6 (IEST [2016]).

6.4.1 First Filtration Bank. Filter Bank No. 1 shall be placed upstream of the heating and cooling coils such that all mixed air is filtered.

6.4.2 Second Filtration Bank. Filter Bank No. 2 shall be installed downstream of all wet-air cooling coils and the supply fan. All second filter banks shall have sealing interface surfaces.

6.4.3 Filter-Bank Blank-Off Panels. Filter-bank blank-off panels shall be permanently attached to the filter-bank frame, constructed of rigid materials, and have sealing surfaces equal to or greater than the filter media installed within the filter-bank frame.

6.4.4 Filter Frames. Filter frames shall be durable and proportioned to provide an airtight fit with the enclosing ductwork. All joints between filter segments and enclosing ductwork shall have gaskets or seals to provide a positive seal against air leakage.

6.5 Heating and Cooling Systems

6.5.1 Cooling Coils and Drain Pans. Cooling coils and drain pans shall comply with the requirements of ANSI/ASHRAE Standard 62.1 [1].

6.5.2 Radiant Cooling Systems. If radiant cooling panels are used, the chilled-water temperature shall always remain above the dew-point temperature of the space.

6.5.3 Radiant Heating Systems. If radiant heating is provided for an AII room, a protective environment room, a wound intensive care unit (burn unit), an OR, or a procedure room, either flat and smooth radiant ceiling or wall panels with exposed cleanable surfaces or radiant floor heating shall be used. Gravity-type heating or cooling units, such as radiators or convectors, shall not be used in ORs and other special care areas.

6.5.4 Cooling Towers. Cooling towers shall be located so that drift is directed away from AHU intakes. They shall meet the requirements of Section 6.3.2.

6.6 Humidifiers. When outdoor humidity and internal moisture sources are not sufficient to meet the requirements of Tables 7.1, 8.1, or 9.1, humidification shall be provided by means of the facility air-handling systems. Steam or adiabatic high-pressure water-atomizing humidifiers shall be used.

6.6.1 General Requirements

a. Locate humidifiers within AHUs or ductwork to avoid moisture accumulation in downstream components, including filters and insulation.
b. A humidity sensor shall be provided, located at a suitable distance downstream from the injection source.
c. Controls shall be provided to limit duct humidity to a maximum value of 90% rh when the humidifier is operating.
d. Duct takeoffs shall not be located within the humidifier's absorption distance.
e. Humidifier control valves shall be designed so that they remain off whenever the AHU unit is not in operation.

6.6.2 Steam Humidifier Requirements. Chemical additives used in the steam systems that serve humidifiers shall comply with FDA requirements [3].

Table 6.7.2 Supply Air Outlets

Space Designation (According to Function)	Supply Air Outlet Classification[a]
Operating rooms (ORs) [b], procedure rooms	Supply diffusers within the primary supply diffuser array: Group E, nonaspirating Additional supply diffusers within the room: Group E
Protective environment (PE) rooms	Group E, nonaspirating
Wound intensive care units (burn units)	Group E, nonaspirating
Trauma rooms (crisis or shock)	Group E, nonaspirating
AII rooms	Group A or Group E
Single-bed patient or resident rooms [c]	Group A, Group D, or Group E
All other patient care or resident care spaces	Group A or Group E
All other spaces	No requirement

a. ***Informative Note:*** Refer to the 2017 *ASHRAE Handbook—Fundamentals*, Chapter 20 (ASHRAE [2017c]), for definitions related to outlet classification and performance.
b. Surgeons may require alternate air distribution systems for some specialized surgeries. Such systems shall be considered acceptable if they meet or exceed the requirements of this standard.
c. Air distribution systems using Group D diffusers shall meet the following requirements:
   1. The system shall be designed according to "Design Guidelines" in *System Performance Evaluation and Design Guidelines for Displacement Ventilation*, Chapter 7 [4].
   2. The supply diffuser shall be located where it cannot be permanently blocked (***Informative Note:*** e.g., opposite the foot of the bed).
   3. The room return/exhaust grille shall be located in the ceiling, approximately above the head of the patient bed.
   4. The transfer grille to the toilet room shall be located above the occupied zone.

6.6.3 Adiabatic Atomizing Humidifier Requirements

a. Humidifier water shall be treated with a reverse osmosis process, a UV-C sterilization light source, and a submicron filter. ***Informative Note:*** For more information, see ASTM (2011) in Appendix B.
b. Treated humidifier water shall be continuously circulated from the source to the humidifier valves. All valves, headers, and piping not part of the recirculation loop shall drain completely when not in use.
c. Ports suitable for testing water quality shall be provided in the treated humidifier water piping system.
d. Moisture eliminators shall be provided as required to prevent moisture accumulation in ductwork.

6.7 Air Distribution Systems

6.7.1 General. Maintain the pressure relationships required in Tables 7.1, 8.1, and 9.1 in all modes of HVAC system operation, except as noted in the tables. Spaces that have required pressure relationships shall be served by fully ducted return systems or fully ducted exhaust systems. The following additional surgery and critical-care patient care areas that do not require a pressure relationship to adjacent areas shall also be served by fully ducted return or exhaust systems: recovery rooms, critical and intensive care areas, intermediate care areas, and wound intensive care units (burn units). In inpatient facilities, patient care areas shall use ducted systems for return and exhaust air. Where space pressure relationships are required, the air distribution system design shall maintain them, taking into account recommended maximum filter loading, heating-season lower airflow operation, and cooling-season higher airflow operation. Airstream surfaces of the air distribution system downstream of Filter Bank No. 2, shall comply with ANSI/ASHRAE Standard 62.1, Section 5.4 [1]. The air distribution system shall be provided with access doors, panels, or other means to allow convenient access for inspection and cleaning.

6.7.2 Air Distribution Devices. All air distribution devices shall meet the following requirements:

a. Surfaces of air distribution devices shall be suitable for cleaning. Supply air outlets in accordance with Table 6.7.2 shall be used.
b. The supply diffusers in ORs shall be designed and installed to allow for internal cleaning.
c. Psychiatric, seclusion, and holding patient rooms shall be designed with security diffusers, grilles, and registers.

6.7.3 Smoke Barriers. Where smoke barriers are required, heating, ventilating, and air-conditioning zones shall be coordinated with compartmentation to minimize ductwork penetrations of fire and smoke barriers.

6.7.4 Smoke and Fire Dampers

a. Maintenance access shall be provided at all dampers.
b. All damper locations shall be shown on design drawings.
c. Air-handling systems shall be arranged such that damper activation will not damage ducts.

6.7.5 Duct Penetrations. Ducts that penetrate construction intended to protect against x-ray, magnetic, radio frequency interference (RFI), or other radiation shall not impair the effectiveness of the protection, nor shall the treatment of these penetrations impair the ventilation of the space served.

6.8 Energy Recovery Systems

6.8.1 General. Energy recovery systems shall be located upstream of Filter Bank No. 2. If energy recovery systems are used, the systems shall not allow for any amount of cross-contamination of exhaust air back to the supply airstream via purge, leakage, carryover, or transfer except as allowed in Section 6.8.3.

6.8.2 Airborne Infectious Isolation Room Exhaust Systems. Airborne infectious isolation room exhaust systems serving AII rooms or combination AII/PE rooms shall not be used for energy recovery.

Exception to 6.8.2: Airborne infectious isolation room exhaust systems serving AII rooms or combination AII/PE rooms may be served by an energy recovery system where the supply airstream components and the exhaust airstream components are fully separated by an air gap of adequate distance to prevent cross-contamination that is open to the atmosphere (e.g., run-around pumped coils).

6.8.3 Energy Recovery Systems with Leakage Potential. If energy recovery systems with leakage potential are used, they shall be arranged to minimize the potential to transfer exhaust air directly back into the supply airstream. Energy recovery systems with leakage potential shall be designed to have no more than 5% of the total supply airstream consisting of exhaust air. Energy recovery systems with leakage potential shall not be used from these exhaust airstream sources: emergency department waiting rooms, triage, emergency department decontamination, radiology waiting rooms, darkroom, bronchoscopy sputum collection and pentamidine administration, laboratory fume hood and other directly ducted laboratory equipment exhaust, waste anesthesia gas disposal, autopsy, nonrefrigerated body holding, endoscope cleaning, central medical and surgical supply soiled or decontamination room, laundry general, hazardous material storage, dialyzer reprocessing room, nuclear medicine hot lab, nuclear medicine treatment room, and any other space identified by the AHJ or the infection control risk assessment (ICRA) team.

6.9 Insulation and Duct Lining

a. An exterior vapor barrier shall be provided for insulation on cold surfaces. A vapor barrier is not required for insulation materials that do not absorb or transmit moisture.
b. Existing insulation and duct lining accessible during a renovation project shall be inspected, repaired, and/or replaced as appropriate.
c. Duct lining shall not be used in ductwork located downstream of Filter Bank No. 2. Duct lining with an impervious cover may be allowed in terminal units, sound attenuators, and air distribution devices downstream of Filter Bank No. 2. This lining and cover shall be factory installed.
d. Duct lining shall not be installed within 15 ft (4.57 m) downstream of humidifiers.

7. SPACE VENTILATION—HOSPITAL SPACES

The ventilation requirements of this standard are minimums that provide control of environmental comfort, asepsis, and odor in hospital health care facilities. However, because they are minimum requirements and because of the diversity of the population and variations in susceptibility and sensitivity, these requirements do not provide assured protection from discomfort, airborne transmission of contagions, and odors.

7.1 General Requirements. The following general requirements shall apply for space ventilation:

a. Spaces shall be ventilated according to Table 7.1.
   1. Design of the ventilation system shall provide air movement that is generally from clean to less-clean areas. If any form of variable-air-volume or load-shedding system is used for energy conservation, it shall not compromise the pressure balancing relationships or the minimum air changes required by the table.
   2. The ventilation rates in this table are intended to provide for comfort as well as for asepsis and odor control in spaces of a health care facility that directly affect patient care. Ventilation rates for spaces not specified here shall be obtained from ANSI/ASHRAE Standard 62.1 [1]. Where spaces with prescribed rates in both Standard 62.1 and Table 7.1 of this standard exist, the higher of the two air change rates shall be used.
   3. For design purposes, the minimum number of total air changes indicated shall be either supplied for positive pressure rooms or exhausted for negative pressure rooms. Spaces that are required in Table 7.1 to be at a negative pressure relationship and that are not required to be exhausted shall use the supply airflow rate to compute the minimum total air changes per hour required. For spaces that require a positive or negative pressure relationship, the number of air changes can be reduced when the space is unoccupied, provided that the required pressure relationship to adjoining spaces is maintained while the space is unoccupied and that the minimum number of air changes indicated is reestablished anytime the space becomes occupied. Controls intended to switch the required pressure relationships between spaces from positive to negative, and vice versa, shall not be permitted. Air change rates in excess of the minimum values are expected in some cases in order to maintain room temperature and humidity conditions based on the space cooling or heating load.
   4. The entire minimum outdoor air changes per hour required by Table 7.1 for the space shall meet the filtration requirements of Section 6.4.
   5. For spaces where Table 7.1 permits air to be recirculated by room units, the portion of the minimum total air changes per hour required for a space that is greater than the minimum outdoor air changes per hour required component may be provided by recirculating room HVAC units. Such recirculating room HVAC units shall
      i. not receive nonfiltered, nonconditioned outdoor air;
      ii. serve only a single space; and
      iii. provide a minimum MERV 6 filter for airflow passing over any surface that is designed to condense water. This filter shall be located upstream of any such cold surface, so that all of the air passing over the cold surface is filtered.
   6. For air-handling systems serving multiple spaces, system minimum outdoor air quantity shall be calculated using one of the following methods:
      i. System minimum outdoor air quantity for an air-handling system shall be calculated as the sum of

Table 7.1 Design Parameters—Hospital Spaces

Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (l), °F/°C
SURGERY AND CRITICAL CARE							
Critical and intensive care	NR	2	6	NR	No	30–60	70–75/21–24
Delivery room (Caesarean) (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24
Emergency department decontamination	Negative	2	12	Yes	No	NR	NR
Emergency department exam/treatment room (p)	NR	2	6	NR	NR	Max 60	70–75/21–24
Emergency department public waiting area	Negative	2	12	Yes (q)	NR	Max 65	70–75/21–24
Intermediate care (s)	NR	2	6	NR	NR	Max 60	70–75/21–24
Laser eye room	Positive	3	15	NR	No	20–60	70–75/21–24
Medical/anesthesia gas storage (r)	Negative	NR	8	Yes	NR	NR	NR
Newborn intensive care	Positive	2	6	NR	No	30–60	72–78/22–26
Operating room (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24
Operating/surgical cystoscopic rooms (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24
Procedure room (o), (d)	Positive	3	15	NR	No	20–60	70–75/21–24
Radiology waiting rooms	Negative	2	12	Yes (q), (w)	NR	Max 60	70–75/21–24
Recovery room	NR	2	6	NR	No	20–60	70–75/21–24
Substerile service area	NR	2	6	NR	No	NR	NR
Trauma room (crisis or shock) (c)	Positive	3	15	NR	No	20–60	70–75/21–24
Treatment room (p)	NR	2	6	NR	NR	20–60	70–75/21–24
Triage	Negative	2	12	Yes (q)	NR	Max 60	70–75/21–24
Wound intensive care (burn unit)	NR	2	6	NR	No	40–60	70–75/21–24
INPATIENT NURSING							
AII anteroom (u)	(e)	NR	10	Yes	No	NR	NR
AII room (u)	Negative	2	12	Yes	No	Max 60	70–75/21–24
Combination AII/PE anteroom	(e)	NR	10	Yes	No	NR	NR
Combination AII/PE room	Positive	2	12	Yes	No	Max 60	70-75/21-24

Note: NR = no requirement