



AIR EQUIPMENT
COMPANY

1946
2016

EXPERTS HELPING EXPERTS

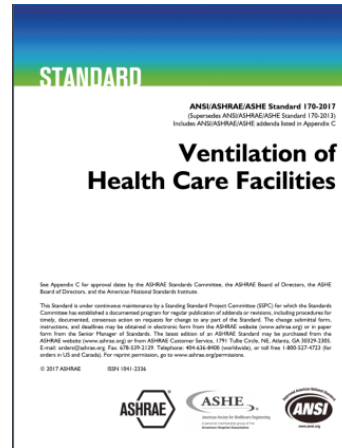
Providing Quality Equipment and Services
for Specialized Mechanical Air Systems

Serving Kentucky and Southern Indiana for over 70 years



ANSI/ASHRAE/ASHE Standard 170

- ANSI/ASHRAE/ASHE Standard 170-2017: Ventilation of Health Care Facilities
- Comprised of a set of minimum requirements intended for adoption by code-enforcing agencies.
- Defines ventilation system design guidelines for health care facilities.
- Provides environmental control for comfort and odor.



Why?

The health care sector is one of the largest segments of the U.S. economy (17% of U.S.GDP) and the average hospital uses 2.5 times the amount of energy as other commercial buildings, adding up to 836 trillion Btu or \$5 billion annually, based on Department of Energy (DOE) data.

Health care facilities serve a uniquely vulnerable population exposed to an elevated risk of health, fire, and safety hazard. These heavily regulated, high-stakes facilities undergo continuous maintenance, verification, inspection, and recertification, typically operate 24/7, and are owner occupied for long life. Systems in health care facilities must be carefully designed to be installed, operated and maintained in coordination with specialized buildings services, including emergency and normal power, plumbing and medical gas systems, automatic transport, fire protections and a myriad of IT systems, all within a limited building envelope.

In 2016, there were over 34 million admissions in all U.S. registered hospitals (1 out of every 9 Americans was admitted to a hospital)

In health care facilities, poor ventilation can be dire, as infectious agents can spread through airborne means.

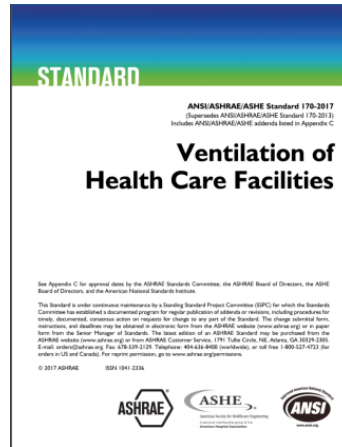
Unfavorable indoor environmental conditions can worsen a patient's symptoms or ailments. It is for these and other reasons that Standard 170-2017 also details guidelines for environmental control for disease-causing micro-organisms in health care facilities.

It is for use with new buildings, as well as additions to existing buildings.

Best practices are provided by other ASHRAE publications, such as ASHRAE Handbook—HVAC Applications and HVAC Design Manual for Hospitals and Clinics.

ANSI/ASHRAE/ASHE Standard 170

- Thermal comfort per ASHRAE Standard 55 includes dry bulb temperature, mean radiant temperature, relative humidity and draft
- Compliance with Standard 170-2017 doesn't automatically guarantee compliance with Standard 55-2017
- Design engineers must do Standard 55 calcs and adjust design within the constraints of Standard 170



The Design Manual complements the Standard

History of Standard 170

- **1947 - The Hill-Burton Act**– Only covered OR's and Delivery Rooms (addressed humidification and 100% OA Requirement)
- **1978 - ASHRAE Applications Handbook**– Addressed ventilation for healthcare facilities for the first time. FGI had their own set of tables.
- **1996** – It was determined by agreement between the Standard 62.1 project committee and the 9.8 technical committee that a new ANSI standard on health care ventilation was needed.
- **2003** - First edition of the *HVAC Design Manual* was published
- **2008** – First edition of Standard 170, Ventilation of Health Care Facilities, was released
- **2010** - The ventilation rate tables were removed from the FGI Guidelines and reference was made to Standard 170 for direction on ventilation design.



ANSI/ASHRAE/ASHE Standard 170

6.0 Systems and Equipment

- 6.1 Utilities
- 6.2 Air Handling Unit Design
- 6.3 Outdoor Air Intakes and Exhaust Air Outlets
- 6.4 Filtration
- 6.5 Heating and Cooling Systems
- 6.6 Humidifiers
- 6.7 Air Distribution Systems
- 6.8 Energy Recovery Systems
- 6.9 Insulation and Duct Lining



ANSI/ASHRAE/ASHE Standard 170

- General Requirements
- [Additional Room-Specific Requirements](#)
- AII Rooms
- PE Rooms
- Critical Care Units
- Surgery Rooms
- ORs, Operating/Surgical Cystoscopic Rooms, and Caesarean Delivery Rooms
- Sterilization Rooms
- Imaging Procedure Rooms
- Morgue and Autopsy Rooms
- Bronchoscopy
- Psychiatric Patient Areas

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 |

Airborne Infection Isolation (AII) Rooms.

Protective Environment (PE) Rooms.

Do you need visual indicators of room pressurization?

Filtration Requirements

Room Envelope requirements

Location and types of diffusers & grilles

Duct Insulation & Cleaning

Maintenance for HVAC units

N+1 Redundancy

Emergency Power

Table 7.1 - Air movement should always be from clean to less clean

Changes to Standard 170-2017

- Previous version was 2013
- Reformatted into three sections:
 - Hospital spaces
 - Outpatient spaces
 - Nursing Home spaces



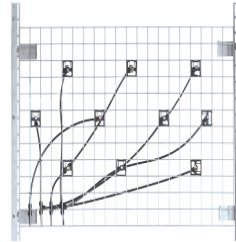
This is also the drive behind a major change to ANSI/ASHRAE/ASHE Standard 170-2017.

Since the 2018 of the FGI documents will consist of three separate books, this 2017 edition of the standard for ventilation of health care facilities has been reformatted into three sections: hospital spaces, outpatient spaces, and nursing home spaces.

In 170-2017 all three are identical

Changes to Standard 170-2017

- **The addition of adiabatic humidifiers as an acceptable type of humidifier.**
 - Previously, only steam systems were allowed.
 - 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.
 - 6.6.3a... (Adiabatic) Humidifier water shall be treated with a reverse osmosis process, a UV-C sterilization light source, and a submicron filter.
 - 6.6.3b .. Treated humidifier water shall be continuously circulated
 - 6.6.3c ...Water quality testing ports required
 - 6.6.3d ...Moisture eliminators required to prevent moisture accumulation in duct



Changes to Standard 170-2017

- **A new type of exam room with lower guidelines for less acute applications.**
 - Design Parameters Table now includes “Special Examination Room”
 - Defined as examination rooms programmed for use by patients with undiagnosed gastrointestinal symptoms, undiagnosed respiratory symptoms, or undiagnosed skin symptoms.
 - Minimum 2 ACH OA / 6 ACH total, Max. 60% RH, Design Temp 70-75F
- **Clarification that controls to change pressure relationships between spaces are prohibited for all spaces.**
 - For spaces with pressure relationship requirements in Table 7.1 (Design Parameters), controls shall not be allowed that change the pressure relationship between positive and negative. This requirement was previously only applicable to AII Rooms.



AII – Airborne Infection Isolation room

Changes to Standard 170-2017

- **Reduction in guidelines for electroconvulsive therapy (ECT) procedure rooms.**
 - These rooms are often referred to as “procedure” rooms, but they are not used to perform the procedures typically performed in procedure rooms.
 - Minimum 2 ACH OA / 4 ACH total, Max. 60% RH, Design Temp 72-78F
- **Reduction in guidelines for laboratories when allowed by certain calculations.**
 - Updates the terminology used for Laboratories to align with the 2014 FGI Guidelines and includes provisions to reduce air total change rates in these spaces in certain circumstances. Media Transfer was added and requires only 4 ACH total.



Electroconvulsive therapy (ECT), formerly known as electroshock therapy, and often referred to as shock treatment, is a psychiatric treatment in which seizures are electrically induced in patients to provide relief from mental disorders.

Changes to Standard 170-2017

- **Higher guidelines for higher hazard exhaust airstreams.**
 - Terminology for the emergency department public waiting area is made consistent within the standard and with the FGI Guidelines.
 - Terminology for nuclear medicine hot lab is made consistent within the standard and with the FGI Guidelines. All room air must be exhausted directly to outdoors
- **Coordination of space temperature guidelines in the Sterile Processing Department with other industry groups.**
 - Currently there is a discrepancy between ASHRAE standards and AAMI standards with regard to several requirements for environmental conditions in areas of the sterile processing department. ASHRAE standards guide the design of these areas, while AAMI standards guide the operation of these areas.
 - Representatives of ASHRAE, AAMI, FGI, AORN, ASHE, and APIC met to discuss these issues. This addendum represents the recommendations for space temperature in several spaces from this group.



(AAMI) Association for the Advancement of Medical Instrumentation

(AORN) Association of periOperative Registered Nurses

(APIC) Association for Professionals in Infection Control and Epidemiology

Changes to Standard 170-2017

- **Clarification of the definition of the primary diffuser array in operating rooms.**

- 7.4.1 Operating Rooms (ORs), Operating/Surgical Cystoscopic Rooms, and Caesarean Delivery Rooms.



- ...These rooms shall be provided with a primary supply diffuser array that is designed as follows:
 - The airflow shall be unidirectional, downwards, and the average velocity of the diffusers shall be 25 to 35 cfm/ft²
 - The diffusers shall be concentrated to provide an airflow pattern over the patient and surgical team.
 - The coverage area of the primary supply diffuser array shall extend a minimum of 12 in. (305 mm) beyond the footprint of the surgical table on each side.
 - No more than 30% of this portion of the primary supply diffuser array area shall be used for nondiffuser uses such as lights, gas columns, equipment booms, access panels, sprinklers, etc.



Changes to Standard 170-2017

- **Potential reduction in the separation distance between the outdoor air intake and the flue for gas-fired packaged rooftop units.**
 - 6.3.1.1 Outdoor air intakes for AHUs shall be located a minimum of 25 ft (8 m) from cooling towers and all exhaust and vent discharges.
 - 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".



Kentucky Code

CHAPTER 28 MECHANICAL SYSTEMS

SECTION 2801 GENERAL

2801.1 Scope. Mechanical appliances, equipment and systems shall be constructed, installed and maintained in
84

accordance with the *International Mechanical Code* and the NFPA 54 National Fuel Gas Code. *Masonry chimneys, fireplaces and barbecues* shall comply with the *International Mechanical Code* and Chapter 21 of this code.

Exception: Mechanical ventilating systems may be designed in accordance with the provisions of ASHRAE 62, as incorporated by reference herein.

2801.2 Boilers. All boilers, pressure vessels and associated pressure piping shall meet the standards for construction, installation, and inspection in accordance with the requirements of KRS Chapter 236 and 815 KAR Chapter 15.

2801.3 Unfired pressure vessels. All unfired pressure vessels shall meet the standards set forth in Section VIII of the ASME Boiler and Pressure Vessel Code as incorporated by reference herein.

2801.4 Design of mechanical systems. The code official shall allow the use of the actual *occupant load* in lieu of Table 1004.1.2 in the design of mechanical ventilating systems. This applies to the mechanical code and ASHRAE 62 Standard as incorporated by reference herein.

2013 Kentucky Building Code

Fourth Edition
April 2017



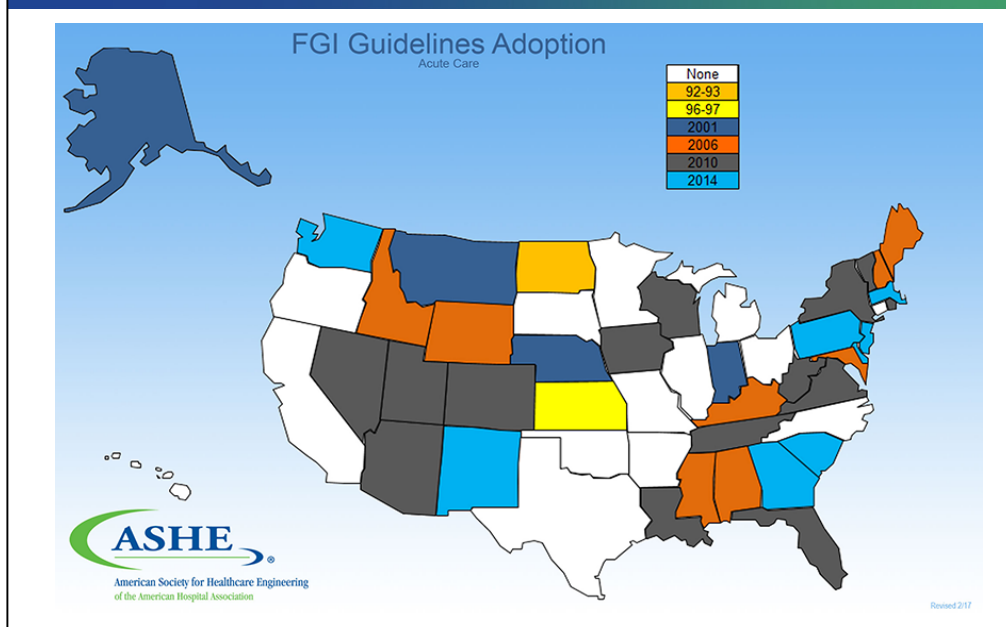
As Adopted by:
Department of Housing, Building and Construction
101 New Hope Road, Suite 100
Frankfort, Kentucky 40601-5412
Telephone: (502) 873-4065
FAX: (502) 873-1097



The 2013 Kentucky Building Code (KBC) went into effect Jan. 1, 2014 for commercial buildings.

ASHRAE 62.1-2010 and more current editions (2016) now simply refer the designer to ASHRAE Standard 170 for outdoor air flow rates

What Other States Are Doing



FGI/AIA Guidelines for Design and Construction of Health Care Facilities

FGI 2006 has table 2.1-2 for Ventilation Requirements

Comparison:

Delivery Room (FGI 2006): Negative Pressure, Min. Air Changes OA = 3, Min. Total Air Change = 15, Recirc by means of room units – no, RH – 30-60%, Temp – 68-73F

Delivery Room (170-2017): Positive Pressure, Min. Air Changes OA = 4, Min. Total Air Change = 20, Recirc by means of room units – no, RH – 20-60%, Temp – 68-75F

Other Design Guidelines

- **LEED BD+C: Healthcare | v4 - LEED v4**

- Ventilation - Mechanically Ventilated Spaces

- Use the ventilation rates in ASHRAE Standard 170–2008, Section 7
- The requirements of the 2010 FGI Guidelines for Design and Construction of Health Care Facilities (Table 2.1–2)
- Or a local equivalent - whichever is most stringent



- **WELL Building Standard v1**

- Air - Feature 3 – Ventilation effectiveness - Part 1

- Ventilation Design

- One of the following requirements is met for all spaces:
 - a. Ventilation rates comply with all requirements set in ASHRAE 62.1-2013
 - b. Comply with (a) and demonstrate that ambient air quality within 1.6 km [1 mi] of the building is compliant with EPA Air Quality Standards



LEED BD+C: Healthcare | v4 - LEED v4

For mechanically ventilated spaces (and for mixed-mode systems when the mechanical ventilation is activated), determine the minimum outdoor air intake flow for mechanical ventilations systems using the ventilation rates in ASHRAE Standard 170–2008, Section 7; the requirements of the 2010 FGI Guidelines for Design and Construction of Health Care Facilities (Table 2.1–2); or a local equivalent, whichever is most stringent [[Canada ACP](#)]. For any area not covered in 170 or the FGI guidelines, follow ASHRAE 62.1 or a local equivalent, whichever is more stringent and meet the minimum requirements of ASHRAE Standard 170–2008, Sections 6–8, Ventilation of Health Care Facilities (with errata) or a USGBC-approved equivalent standard for projects outside the U.S.

WELL

b. Comply with (a) and demonstrate that ambient air quality within 1.6 km [1 mi] of the building is compliant with either the U.S. EPA's NAAQS or passes the Air Quality Standards feature in the WELL Building Standard for at least 95% of all hours in the previous year.

Final Thoughts

- **Why is ventilation critical in Healthcare applications?**
- **What special requirements must be considered when designing HVAC systems for Healthcare applications?**
- **Why not just do the minimum required by Kentucky Building Code?**

<https://www.youtube.com/watch?v=ChQK8j6so8>



In health care facilities, poor ventilation can be dire, as infectious agents can spread through airborne means.

Unfavorable indoor environmental conditions can worsen a patient's symptoms or ailments. It is for these and other reasons that Standard 170-2017 also details guidelines for environmental control for disease-causing micro-organisms in health care facilities.

