

Breath of fresh air

A look at new health facility ventilation standards

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Health care facilities require special design considerations. Like all other buildings, they require ventilation for comfort cooling and removing objectionable odors. But, because of their clinical nature, they also need to provide tighter control of temperature and humidity as well as the ability to handle infection control and cross-contamination issues.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recently published a standard developed over the past eight years to address these issues. Co-authored with the American Society for Healthcare Engineering (ASHE) and approved as a national standard by the American National Standards Institute (ANSI), "Standard 170, Ventilation of Health Care Facilities," defines ventilation system design requirements that provide environmental control for comfort, as well as infection and odor control.

It is the first ANSI standard in the nation to specifically address ventilation in health care facilities and is available for adoption by various authorities, including city, state and federal governments as well as private national organizations such as the Facility Guidelines Institute (FGI) and The Joint Commission.

The standard addresses systems and equipment; space ventilation for a variety of areas in health care facilities, including airborne infection isolation rooms, critical care units, burn units and surgery rooms; and planning, construction and system startup.

Health and safety

Air-transmitted pathogens can be found everywhere in poorly ventilated health care facilities. Because these organisms are found in higher concentrations in hospitals and some patients are susceptible to them, additional care should be taken when designing ventilation systems. Some patients within hospitals are more likely to be susceptible to normal environmental organisms such as fungal spores, bacteria and viruses

than are healthy individuals.

Today, ventilation is an important component of a successful infection control program and should be considered a part of health care delivery. Unfortunately, infection control is not normally a design parameter for the novice ventilation engineer, nor are the reasons for ventilation requirements to accomplish infection control often understood by many ventilation designers.

Adding to this difficulty are the number of published rules and guidelines for ventilation rates, filtration efficiencies and pressure control that have been adopted by both building codes and state departments of health as requirements for designers. Ventilation designers often use the required values and assume that they are absolute, using them not only as minimums but also maximums.

The experienced health care ventilation designer knows that the quality of the ventilation (temperature, humidity, velocity and filtration) required in any particular health care space is determined by the clinical care given in the space and the physical condition of the patients within the space. The experienced designer also knows that the quality of ventilation plays an important role in infection control of some diseases in the health care environment.

The proper ventilation quality will vary between spaces, climates and projects. When establishing the minimum requirements or guidelines for ventilation quality, design engineers and health care professionals must work together.

Hill-Burton beginnings

Requirements for the design of HVAC systems in hospitals were published in the Federal Register in 1946 as part of the Hill-Burton Act. This legislation, intended to encourage states to build hospitals to serve the growing populations, made states follow minimum requirements for construction to receive federal funds for building efforts. The science of ventilation in the hospital environment has developed slowly over the years since, in part because HVAC systems were not consid-

ered important for health care delivery.

In 1962, for instance, ventilation system design with respect to infection control in hospitals was not well understood. A telling example of the clinical community's mistrust of hospital ventilation of the time comes from a monograph published by the American Hospital Association titled *Control of Infections in Hospitals*: "If a child develops whooping cough while in the hospital, he should, if possible, be sent home, since secondary pneumonia, caused by various bacteria other than the causative organisms of whooping cough, is the chief cause of death or lasting debility. A child is more likely to acquire these secondary infections in the hospital than at home."

Without proper ventilation, hospitals would be places of poor indoor air quality. But this leads to the obvious question: What is proper ventilation for infection control? Standard 170 offers an answer.

Need for a standard

Standard 170 actually started because of another publication developed by one of ASHRAE's technical committees. The *HVAC Design Manual for Health Care Facilities* was written by a relatively large group of contributors who worked nearly 10 years to produce what turned out to be a best-selling book for ASHRAE. As work continued with this document, it became apparent that a full-fledged standard was necessary.

The group discovered that there were two reasons to create a new ASHRAE standard on health care ventilation. The first was a fear that when the design manual was finished it could be inappropriately considered a de facto ASHRAE standard by authorities having jurisdiction over the construction of hospitals around the country, as has happened with the ASHRAE *Applications Handbook* chapter on health care facilities.

The second reason was that, during the course of creating the design manual, new research occurred that would alter the generally accepted health care ventilation design practice, creating a need for

a broader public review to be accepted. So, at the 1999 winter meeting in Chicago, discussions took place between the design manual committee leadership and the chairman of ASHRAE's committee for "Standard 62.1, Ventilation for Acceptable Indoor Air Quality" about the development of a new standard for health care.

By March that year, a draft title, purpose and scope (TPS) was created, with an overall goal of providing a new level of guidance for health care ventilation designers and a useful addition to the arts and sciences of health care facility engineering. The TPS was released for public review and miraculously received no comments. So the committee was formed, the chair selected and members approved. Then work began on turning an informative design manual into a standard.

Drafting the standard

The committee began with way too much content and little idea how to pare it down. Much of the current language in the standard comes from the design manual, but just as much comes from the FGI's *Guidelines for Design and Construction of Health Care Facilities*. It contains the familiar ventilation rate table but with additional information from recent research on operating room ventilation.

The document went out for a 45-day review in the fall of 2005 and received hundreds of comments, accounting for

more than half of all comments received from all of the ASHRAE standards sent out during that public review period.

The committee received many comments from practicing hospital facilities managers, some of whom had learned about the standard in seminars at several ASHE meetings. The high volume of comments from the first public review and the subsequent comments that came from three other public reviews improved the quality of the content and showed that there was not only considerable interest in the document but also that many people thought highly enough of the work to spend their own time in review and comment.

For the most part, the comments were constructive, well thought out and extremely useful to the committee in completing its work. The Standard 170 committee responded to comments about pressure control and other topics with evidence-based research whenever possible. Obviously, more applied research is still needed to verify or disprove some of the design requirements that have been passed down from the days of the Hill-Burton Act.

Next steps

Because the Standard 170 project committee followed the strict review and revision requirements of ANSI—and because it is also based on good research—it is

appropriate for use in the development of objective criteria for health care construction.

The standing project committee, which has now been established under new leadership by ASHRAE for the continuous maintenance of the standard, will seek more input from the health care facilities design, construction, operations, management and regulatory community to improve the document and perform new research on the applied science of heating, ventilating and air conditioning.

By paying attention to details such as room pressure relationships, ASHRAE not only fulfills its mission of advancing the arts and sciences of HVAC and refrigeration for the benefit of the public, but it also maintains a long-standing tradition of careful study of these sciences in an unbiased and objective manner.

Though it was a long time in coming, the new Standard 170 will be beneficial to the health care industry for many years to come. **HFM**

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Specific requirements found in ASHRAE/ASHE Standard 170

Following are some of the specific requirements found in the American Society of Heating, Refrigerating and Air-Conditioning Engineers/American Society for Healthcare Engineering (ASHRAE/ASHE) "Standard 170, Ventilation of Health Care Facilities":

- Maintain pressure relationships even upon the loss of normal electrical power in certain clinical spaces.
- Maintain heating to specific uses even upon the loss of any one heat source. (Exceptions are warm climates.)
- Maintain cooling to support the owner's facility operation plan upon the loss of any one cooling source. (Exceptions are cold climates.)
- Air handling units must comply with ASHRAE Standard 62.1.
- Locations of outdoor air intakes and exhaust discharges are restricted.
- Filtration of specific spaces is regulated, with two filter banks required: The first bank is minimum efficiency reporting value (MERV) 7 and the second bank varies with the use of the space.
- Radiant heating and cooling panels have specific restrictions.
- Humidifiers have design restrictions.
- The familiar ventilation rate table is revised and includes clarification of the places where no requirement exists, a reduction of air change rates in operating rooms, elimination of a low-humidity requirement in some spaces, pressurizing cystoscopic rooms like operating rooms, and reducing requirements for Class A operating rooms.
- There are restrictions on the type of diffusers in operating rooms and isolation.
- Existing air handling units need updated test and balance reports before a load is added to them.
- An infection control risk assessment must be performed prior to construction.
- Acceptance testing is required following construction.
- New ductwork must be cleaned.

The standard is written in enforceable language and has clear compliance requirements, including flexibility for authorities having jurisdiction to interpret the standard. ■

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