Briefings on Hospital Safety

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ASHRAE updates guidelines for healthcare HVAC systems

New design manual replaces the 2003 guidelines and emphasizes new minimum standards for HVAC systems, infection control strategies

The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) has literally rewritten the book when it comes to recommendations for incorporating HVAC systems into hospital designs.

ASHRAE recently published the second edition of its go-to tome for hospital engineers, the HVAC Design Manual for Hospitals and Clinics, which is expected to be a much more user-friendly guideline for hospital design. The manual includes a special chapter devoted entirely to infection control strategies.

"HVAC in a school or office building is not the same as in healthcare, where the No. 1 priority is infection control," says Dan Koenigshofer, PE, MSPH, HFDP, SASHE, vice president for healthcare at Dewberry, a Fairfax, Va.-based professional services firm, who served as editor-in-chief for the new manual.

The second edition is a rewrite of the 2003 edition, which was generally considered the definitive design manual for hospital engineers, and the first of its kind devoted entirely to HVAC hospital design. About 20 of the nation's top consultants and hospital engineers collaborated on the new manual, which is available through ASHRAE for $115 for non-members and $99 for ASHRAE members.

"In our little part of the world, it's a landmark publication," Koenigshofer says. "The manual goes beyond the minimum. It's written in suggestions."

In the new edition, an entire chapter is devoted to the principles of infection control, the growing influence such principles have on HVAC systems, and the role they play in designing energy-efficient ventilation, cooling, and heating systems for the specialized hospital environment.

"Hospitals being designed today would do well to set to these standards," says contributing writer John M. Kramer, PE, hospital engineer and consultant at Duke University Medical Center in Chapel Hill, N.C.

"The intent is to give parameters and principles that you then apply to your design," he says. "It's very challenging, and there are a lot of things that wouldn't be so obvious, such as lint control in an operating room, as you have rags, towels, and blankets flying around. Now we understand these things better."
ASHRAE's hospital design manual contains specific information relating to the design of systems that control room ventilation, pressure control, airflow rates, temperature, humidity, and life safety factors such as smoke mitigation. A hospital contains several types of rooms, from operating suites to waiting rooms, and each requires a different type of atmosphere and environment. The manual specifies design information for each room type as recommended by teams of engineers.

The new manual also is considered the first to address Standard 170, a 2008 publication ASHRAE developed with the American National Standards Institute and the American Society for Healthcare Engineering.

Standard 170 was specifically developed to provide a universal engineering code for the ventilation of healthcare facilities, with an eye on infection control.

Although there are no real "laws" in place governing the design of hospitals and HVAC systems, ASHRAE's engineering specifications are generally considered the gold standard of the industry; most new hospital and clinic construction in the United States is done with at least a nod toward ASHRAE.

"[Regulators] may have their own rules, but they didn't just make them up out of thin air," says Kramer. "They are studying the current state-of-the-art standards, and they make reference to them when they were developed."

In addition, Kramer notes that standard-setting organizations such as OSHA and The Joint Commission weigh ASHRAE's suggestions heavily when conducting their inspections, and the standards are often applied in litigation or lawsuits involving negligence.

All this makes a good case for acquiring the new manual. "Why should you buy it? Because you know darn well the inspectors are going to buy it," Kramer says. "It's a defensive move."

**Changes in the manual**

Followers of the ASHRAE HVAC manual are not likely to notice huge differences in the new edition; in fact, most of the changes to design suggestions are incremental, experts say.

For instance, one of the biggest alterations in the new edition is the suggested air change rate in operating rooms.

Obviously, an operating room is required to be a sterile environment, and HVAC systems are designed to recycle the room air many times per hour to keep it clear of infectious bacteria and viruses. In the past, ASHRAE has recommended that operating room air be turned over as much as 25 times per hour or as little as 15 times per hour; the new edition recommends 20 times per hour.
"Research indicates that airborne infection is less than people thought," says Koenigshofer. "The vast majority of hospital-acquired infections occur because of poor hand washing or clothes washing and poor clinical practices by staff. That has driven some codes to loosen up."

Other small changes in the recommendations involve maintaining negative and positive pressure in certain types of rooms, as well as slight edits to humidity and air filtration percentages.

"Twenty years ago, 80% filtration was adequate; now we have understanding that it's more cost-efficient to have 90% to 95% filtration," says Koenigshofer. "These are modest changes, an update in technology and current codes, and [the manual] brings some changes up to date."

Perhaps the most prominent change in the manual is the chapter devoted entirely to infection control. The chapter deals not only with the technical design aspects of HVAC systems, but also gives a detailed explanation of how the human body is affected by airborne contaminants and a lesson on mitigating risks through proper infection control.

Although HVAC systems in hospitals have always sought to clean the air and reduce infection, this is the first time the manual has provided specific instructions on how HVAC systems should be designed to maximize infection control.

This is an indication of how the industry has changed—not only in what doctors are looking for in their working environment, but also regarding a hospital's ability to handle epidemics or possible bioterrorist attacks.

**Adapting to change**

The new changes to the ASHRAE manual reflect the growing influence of infection control on HVAC design, but don't expect sweeping changes in hospitals to occur right away.

On the one hand, for new hospitals, designers and engineers are likely to rely heavily on ASHRAE's suggestions regarding blueprints for those buildings. But when dealing with aging buildings, change can be costly, and experts say there won't be much money in the budget to conform to the new ASHRAE standards. As the adage goes, you can't teach an old dog new tricks.

"People trying to retrofit old rooms are not going to be able to," says Marge McFarlane, PhD, CHSP, CHFM, HEM, MEP, CHEP, principal of Superior Performance, LLC, in Eau Claire, Wis. "Infrastructure would have to completely change and be costly for hospitals to change. It would be a significant remodel at a significant cost. It would be burdensome for some smaller hospitals."

For example, McFarlane says upgrading a hospital's HVAC system from an air exchange rate of 15 times per hour (the 2003 specification) to 20 times per hour would require a significant amount of replacement ductwork, and perhaps new blower motors as well.
"When they do the budgets, they will understand that this needs to be in the budget [for new construction]," she says.

"I don't think there's much [the new standards] will do to help existing budgets. It will give a road map for future building."

**Start with the basics**

It's important to remember that the ASHRAE standards are guidelines, not laws. At the end of the day, many experts still say the best way to handle infection control is to start with the basics, such as proper hand washing and laundering, as well as identifying infectious hazards before they ever make it into patient areas.

"The biggest difficulty is recognizing when someone walking in is infectious," says Kramer. "How do you know when someone walking in has something? They aren't wearing a sign. Or how about a staff member who is sick? Those are the front lines of infection control."

Many hospital engineers will want to work with their existing systems and figure out what they can do to make improvements while keeping an eye on the bottom line. Knowing this, the writers of the new manual have included many helpful tips to reduce maintenance costs and help HVAC systems run more efficiently.

"Economics change and people are designing things tighter and tighter," says Koenigshofer. "The book talks about minimum codes, but suggests what [hospitals] might want to be done for less maintenance and energy efficiency, as well as being reliable, because you don't want it to break down in the middle of your grandma's surgery."