



HVAC Design for Hospitals and Healthcare Facilities

An Online Continuing Education Course for Engineers

Course Number: HV-6001

Credit: 6 Hours / 6 PDH / 6 CPD

Course: HVAC DESIGN FOR HOSPITALS & HEALTHCARE FACILITIES

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Course Description

Hospitals and other healthcare facilities are complex environments that require special attention to HVAC design. Hospital air conditioning assumes a more important role than just the promotion of comfort. In many cases, proper air conditioning is a factor in patient therapy; in some instance, it is the major treatment. Studies show that patient in controlled environments generally has more rapid physical improvement than do those in uncontrolled environments.

Poor IAQ can adversely impact the patients' and staffs' health, comfort and productivity. To build an effective HVAC system, maintaining the quality of air as well as designing for the efficient removal of foreign particles is a challenge. The filtration and building pressure control is the most important component of HVAC design.

This 6 hr course briefly outlines the best practices for design, construction and maintenance of healthcare HVAC systems. This course contains some, but not all, of the criteria pertinent to the design of HVAC systems for hospitals and is not substitute for industry standards such as AIA, OSHA, ASHRAE, ARI, JCAHO etc.

This course is applicable to architects, mechanical engineers, HVAC designers and others in the design and renovation of health care facilities.

The reader must take a multiple-choice quiz consisting of thirty (30) questions at the end of this course to obtain PDH credits.

Learning Objectives

The course includes the following topics:

1. Infection control practices to minimize airborne contaminants
2. Air distribution effectiveness within spaces served by the ventilation/HVAC systems
3. Air quality requirements in the healthcare facilities

4. Room pressure relationships of isolation rooms
5. Temperature and humidity design criteria
6. Filtration practices
7. Selection of HVAC equipment including chillers, air-handling systems and distribution systems
8. System reliability and redundancy recommendations
9. Energy-conservative design practices for the healthcare environment

SECTION #1

HVAC FOR HEALTHCARE FACILITIES – AN OVERVIEW

HVAC design for health care facilities is all about providing a safer environment for patients and staff. The basic difference between air conditioning for healthcare facility and that of other building types stem from:

1. The need to restrict air movement in and between the various departments (no cross movement).
2. The specific requirements for ventilation and filtration to dilute and reduce contamination in the form of odor, airborne micro organisms and viruses, and hazardous chemical and radioactive substances. Ventilation effectiveness is very important to maintain appropriate indoor air quality.
3. The different temperature and humidity requirements for various areas and the accurate control of environmental conditions.
4. The design sophistication to minimize the risk of transmission of airborne pathogens and preserve a sterile and healing environment for patients and staff.

These requirements demand very high quantities of outside air along with significant treatment of this ventilation air, including cooling, dehumidifying, reheating, humidifying and filtration.

Infection Control

In a hospital environment, there tend to be high concentrations of harmful micro-organisms. From an infection control perspective, the primary objective of hospital design is to place the patient at no risk for infection while hospitalized. The special technical demands include hygiene, reliability, safety and energy-related issues.

Infections, which may result from activities and procedures taking place within the facility, are a cause for great concern. Three main routes responsible for infections are contact, droplet, and airborne transmission, which are quite affected by room design and construction factors.

Contact Transmission

Contact transmission is the most important and frequent mode of transmission of infections (nosocomial). It can be subdivided into direct-contact transmission and indirect-contact transmission.

- a) Direct-contact transmission involves direct body to body contact for the transfer of micro-organisms from an infected person to a susceptible host.
- b) Indirect-contact transmission involves the contamination of an inanimate object (such as instruments or dressings) by an infected person.

Droplet Transmission

Droplet transmission occurs when an infected person generates droplets containing microorganisms which are propelled at a short distance through the air and deposited on the conjunctivae, nasal mucosa or mouth of a host. Droplets do not remain suspended in the air, so special air handling and ventilation are not required to prevent droplet transmission. (Do not confuse droplet transmission with airborne transmission.) A person's coughing, sneezing and talking generate droplets. Other procedures such as suctioning and bronchoscopy are also a source of droplets.

Airborne Transmission

Airborne transmission occurs when either airborne droplet nuclei or dust particles disseminate infectious agents.

- a) Droplet nuclei - The high velocity with which coughing and sneezing expel droplets from the respiratory tract results in large numbers of bacteria or viruses entering the air in smaller droplets. These droplets rapidly evaporate in the air leaving a residue of typically 5 μm or smaller in size. These droplet nuclei settle so slowly that they remain airborne in occupied spaces and circulate on air currents until mechanically removed by the ventilation system. Control of environmental factors (such as special air handling and ventilation) is necessary to prevent nosocomial airborne transmission of microorganisms.
- b) **Dust** - Dust contaminated by viable infectious agents may build up as a reservoir

capable of causing an outbreak of infection, even after the departure of the infectious patient from whom the pathogens originated. Dust may become contaminated when dried sputum and other infectious secretions suspended in the air as dust particles mix with environmental dust.

ISOLATION ROOMS

The infected patient can contaminate the environment with appropriate air handling and ventilation. Indirect contact

transmission of microorganisms. This is often

rooms and 2)

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To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course.

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How does above classification affect HVAC designer?

The differentiating factor between "All" and "PE" rooms is the pressure relationships.

- The protective environments (PE) are set at POSITIVE air pressure relative to adjoining spaces. These areas require frequent air exchanges (≥ 12 per hour) and