Application Note LC-126

Health Care Guidelines and Standards

Introduction

This publication provides excerpts from some of the many guidelines and standards that pertain to the construction and operation of hospital and medical facilities, primarily concerning ventilation systems that maintain and control room pressurization. The intent of the publication is to provide owners, engineers, architects and hospital personnel an overview of the standards and guidelines that pertain to the design and operation of today's medical facilities. Excerpts have been taken that apply to planning, safety, operation and system design.

This document is arranged by standard or guideline. Effort has been made to present the statements that best summarize the document as it pertains to safety and containment of the ventilation system.

The excerpts in most cases are worded as they appear in the standard or guideline, though in some instances may be out of context. Please review the actual guideline or standard for more detailed information and to make the best interpretation of each statement.

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Airborne Infection Isolation Room

Topic	Standard
Usage	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 5. Construction** **5.1 Planning and Design** ...During the programming phase of a construction project, the owner shall provide an Infection Control Risk Assessment (ICRA). An ICRA is a determination of the potential risk of transmission of various agents in the facility. This continuous process is an essential component of a facility functional or master program to provide a safe environment of care. The ICRA shall be conducted by a panel with expertise in infection control, risk management, facility design, construction, ventilation, safety and epidemiology... ...the ICRA shall address but not be limited to the following key elements: ...(c) Placement of effective barriers to protect susceptible patients from airborne contaminants such as Aspergillus sp. (d) Air handling and ventilation needs in surgical services, airborne infection isolation and protective environment rooms... (e) Determination of additional numbers of airborne infection isolation or protective environment room requirements... **Chapter 7. General Hospital** **7.2.C Airborne Infection Isolation Room(s)** **Note:** The airborne infection isolation room requirements contained in these Guidelines for particular service areas throughout a facility should be predicated on an Infection Control Risk Assessment (ICRA) and based on the needs of specific community and patient populations served by an individual organization. The number of airborne infection isolation rooms for individual patient units shall be increased based upon an ICRA or by a multidisciplinary group designated for that purpose. This process ensures a more accurate determination of environmentally safe and appropriate room types and spatial needs...It is suggested that reference be made to the Centers for Disease Control and Prevention (CDC) "Guidelines for Preventing the Transmission of *Mycobacterium Tuberculosis* in Health-Care Facilities"... **7.2.C1.** At least one airborne infection room shall be provided... **7.3 Critical Care Units** **7.3.A14.** At least one airborne infection isolation room shall be provided. The number of airborne infection isolation rooms shall be determined based on an Infection Control Risk Assessment...

Topic	Standard
Usage *(cont.)*	**7.3.E. Newborn Intensive Care Units** Each Newborn Intensive Care Unit (NICU) shall include or comply with the following: **7.3.E12.** An airborne infection isolation room is required in at least one level of nursery care...All airborne infection isolation rooms shall comply with the requirements of Section 7.2.C... **7.4 Nurseries** **7.4.A6.** An airborne infection isolation room is required in or near at least one level of nursery care... **7.5 Pediatric and Adolescent Unit** **7.5.C6** At least one airborne infection isolation room shall be provided in each pediatric unit. The total number of infection isolation rooms shall be determined by an Infection Control Risk Assessment... **7.9 Emergency Service** **7.9.C7.** Airborne infection control. At least one airborne infection isolation room shall be provided...The need for additional airborne infection isolation rooms or for protective environment rooms...shall be determined by the Infection Control Risk Assessment. **7.14 Renal Dialysis Unit (Acute and Chronic)** **7.14.B6.** The number of and need for required airborne infection isolation rooms shall be determined by an Infection Control Risk Assessment (ICRA)... **7.15 Respiratory Therapy Service** **7.15.E Cough-Inducing and Aerosol-Generating Procedures** All cough-inducing procedures performed on patients who may have *Mycobacterium tuberculosis* shall be performed in rooms using local exhaust ventilation devices...These procedures may also be performed in a room that meets the ventilation requirements for airborne infection control. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **Chapter 7 Health Care Facilities** **Infection Sources and Control Measures** **Viral Infection** … isolation rooms and isolation anterooms with appropriate ventilation-pressure relationships are the primary means used to prevent the spread of airborne viruses in the he hospital environment. **Nursing** **Infectious Isolation Unit**. The infectious isolation room is used to protect the remainder of the hospital from the patients' infectious diseases. Recent multidrug-resistant strains of tuberculosis have increased the importance of pressurization, air change rates, filtration , and air distribution design…

Topic	Standard
Usage *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **I. Air-Handling Systems in Health-Care Facilities** A. Use AIA guidelines as minimum standards where state or local regulations are not in place for design and construction of ventilation systems in new or renovated health-care facilities. Ensure that existing structures continue to meet the specifications in effect at the time of construction... E. Conduct an infection-control risk assessment (ICRA) and provide an adequate number of AII and PE rooms (if required) or other areas to meet the needs of the patient population. **IV. Infection-Control and Ventilation Requirements for AII Rooms** …C. Implement environmental infection-control measures for persons with diagnosed or suspected airborne infectious diseases. 1. Use AII rooms for patients with or suspected of having an airborne infection who also require cough-inducing procedures, or use an enclosed booth that is engineered to provide 1) ≥12 ACH; 2) air supply and exhaust rate sufficient to maintain a 2.5 Pa (0.01-inch water gauge) negative pressure difference with respect to all surrounding spaces with an exhaust rate of ≥50 ft^3/min; and 3) air exhausted directly outside away from air intakes and traffic or exhausted after HEPA filtration before recirculation. 2. Although airborne spread of viral hemorrhagic fever (VHF) has not been documented in a health-care setting, prudence dictates placing a VHF patient in an AII room, preferably with an anteroom, to reduce the risk of occupational exposure to aerosolized infectious material in blood, vomitus, liquid stool, and respiratory secretions present in large amounts during the end stage of a patient's illness. 3. Place smallpox patients in negative pressure rooms at the onset of their illness, preferably using a room with an anteroom, if available. **OSHA Instructions CPL 2.106** **Subject: Enforcement Procedures and scheduling for Occupational Exposure to Tuberculosis** **5. Engineering Controls** **b.** Isolation and treatment rooms in use by individuals with suspected or confirmed infectious TB disease shall be kept under negative pressure to induce airflow into the room from all surrounding areas…

Topic	Standard
Construction	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General hospital** **7.2.C. Airborne Infection Isolation Room(s)** **7.2.C2.** Each airborne infection isolation room shall have an area for hand washing, gowning, and storage of clean and soiled materials located directly outside or immediately inside the entry door to the room. **7.2.C3.** Airborne infection isolation room perimeter walls, ceiling, and floors, including penetrations, shall be sealed tightly so that air does not infiltrate the environment from the outside or other spaces… **7.2.C4.** Airborne infection isolation room(s) shall have self-closing devices on all room exit doors. **7.2.C5.** Separate toilet, bathtub (or shower), and hand washing stations shall be required for each airborne infection isolation room. **Table 7.2 Ventilation Requirements for Areas Affecting Patient Care in Hospitals and Outpatient Facilities** from note [18]…Rooms with reversible provisions for the purpose of switching between protective environment and AII functions are not acceptable. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **Chapter 7 Health Care Facilities** **Hospital Facilities** The basic difference between air conditioning for hospital and that of other building types stem from (1) the need to restrict air movement in and between the various departments; (2) the specific requirements for ventilation and filtration to dilute and remove contamination in the form of odor, airborne microorganisms and viruses, and hazardous chemical and radioactive substance; (3) the different temperature and humidity requirements for various areas; and (4) the design sophistication needed to permit accurate control of environmental conditions. **Air Quality** **Air Movement** **…** In general, outlets supplying air to sensitive ultra-clean areas and highly contaminated areas should be located on the ceiling, with perimeter or several exhaust inlets near the floor. This arrangement provides a downward movement of clean air through the breathing and working zones to the contaminated floor area for exhaust…

Topic	Standard
Construction *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **IV. Infection-Control and Ventilation Requirements for AII Rooms** A. Incorporate certain specifications into the planning and construction of AII units …2. Ensure that rooms are well-sealed by properly constructing windows, doors, and air-intake and exhaust ports; when monitoring indicates air leakage, locate the leak and make necessary repairs. 3. Install self-closing devices on all AII room exit doors. …5. Direct exhaust air to the outside, away from air-intake and populated areas. If this is not practical, air from the room can be recirculated after passing through a HEPA filter.
Ventilation	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General Hospital** **Table 7.2 Ventilation Requirements for Areas Affecting Patient Care in Hospitals and Outpatient Facilities** Airborne Infection Isolation Room[11,18]: Minimum air changes of outdoor air per hour: 2 Minimum total air changes per hour: 12 All air exhausted directly to outdoors: yes Recirculated by room units[7]: No [7] Recirculating room HVAC units refers to those local units that are used primarily for heating and cooling of air, and not disinfection of air…for airborne infection control, air may be recirculated within individual isolation rooms if HEPA filters are used… [18] …The design of airborne infection isolation (AII) rooms should include the provision for normal patient care during periods not requiring isolation precautions. Supplemental recirculating devices may be used in the patient room, to increase the equivalent room air changes; however, such recirculating devices do not provide the outside air requirements. Air may be recirculated within individual isolation rooms if HEPA filters are used…

Topic	Standard
Ventilation *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994 Introduction** **II. Recommendations** **E. Management of Hospitalized Patients Who Have Confirmed or Suspected TB** **3. The TB isolation Room** .For the purposes of reducing concentrations of droplet nuclei, TB isolation and treatment rooms in existing health-care facilities should have an airflow of ≥6 ACH. Where feasible, the airflow rate shall be increased to ≥12 ACH…New construction or renovation of existing health-care facilities should be designed so that TB isolation rooms achieve an airflow of ≥12 ACH. **Supplement 3: Engineering Controls** **II. Ventilation** **B. General Ventilation** **3. Airflow direction in the facility** **a. Directional airflow** The general ventilation system should be designed and balanced so that air flows from less contaminated (i.e., more clean) to more contaminated (less clean) areas. For example, air should flow from corridors (cleaner areas) into TB isolation rooms (less clean areas) to prevent spread of contaminants to other areas… **Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **IV. Infection-Control and Ventilation Requirements for AII Rooms** A.4. Provide ventilation to ensure ≥12 ACH for renovated rooms and new rooms, and ≥6 ACH for existing AII rooms. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **CHAPTER 7HEALTH CARE FACILITIES** **Hospital Facilities** **Air Quality** **Air Movement** Systems serving highly contaminated areas, such as autopsy rooms and isolation rooms for contagious … patients, should maintain a … negative air pressure with these rooms relative to adjoining rooms or the corridor. The pressure is obtained by supplying less air to the area than is exhausted from it. This induces a flow of air into the area around the perimeters of doors and prevents an outward airflow...

Topic	Standard
Room Pressure Differential	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General Hospital** **Table 7.2 Ventilation Requirements for Areas Affecting Patient Care in Hospitals and Outpatient Facilities** Airborne Infection Isolation Room[11,18]: Air Movement relationship to adjacent area[2]: In [2] Design of the ventilation system shall provide air movement which 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 must not compromise the corridor-to-room pressure balancing relationships or the minimum air changes required by the table. [11] Differential pressure shall be a minimum of 0.01" water gauge (2.5 Pa). If alarms are installed, allowances shall be made to prevent nuisance alarms of monitoring devices. **Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994 Introduction** **Supplement 3: Engineering Controls** **II. Ventilation** **B. General Ventilation** **3. Airflow direction in the facility** **b. Negative pressure for achieving directional airflow** The direction of airflow is controlled by creating a lower (negative) pressure in the area into which the flow of air is desired. For air to flow from one area to another, the air pressure in the two areas must be different. ... Negative pressure is attained by exhausting air from an area at a higher rate than air is being supplied. **Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994 Introduction** **Supplement 3: Engineering Controls** **II. Ventilation** **B. General Ventilation** **4. Achieving negative pressure in a room** **a. Pressure differential** The minimum pressure difference necessary to achieve and maintain negative pressure that will result in airflow into the room is very small (0.001 inch of water)…To establish negative pressure in a room that has a normally functioning ventilation system, the room supply and exhaust air flows are first balanced to achieve an exhaust flow of either 10% or 50 cubic feet per minute (cfm) greater than the supply (whichever is the greater). In most situations, this specification should achieve a negative pressure of at least 0.001 inch of water.

Topic	Standard
Room Pressure Differential *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **IV. Infection Control and Ventilation Requirements for AII Rooms** A.1. Maintain continuous negative air pressure (2.5 Pa [0.01 inch water gauge]) in relation to the air pressure in the corridor;
Room Pressure Differential Monitors	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General Hospital** **7.2C. Airborne Infection Isolation Room(s)** **7.2.C7.** Room shall have a permanently installed visual mechanism to constantly monitor the pressure status of the room when occupied by patients with an airborne infectious disease. The mechanism shall continuously monitor the direction of the airflow. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **Chapter 7 Health Care Facilities** **Hospital Facilities** **Specific Design Criteria** **Surgery and Critical Care** The following conditions are recommended for operation, catheterization, cystoscopic, and fracture rooms: …4. Differential pressure indication device should be installed to permit air pressure readings in the rooms.

Topic	Standard
Room Pressure Differential Monitors *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994 Introduction** **Supplement 3: Engineering Controls** **II. Ventilation** **B. General Ventilation** **4. Achieving negative pressure in a room** **c. Monitoring negative pressure** The negative pressure in a room can be monitored by visually observing the direction of airflow (e.g., using smoke tubes) or by measuring the differential pressure between the room and its surrounding area… Differential pressure-sensing devices also can be used to monitor negative pressure. They can provide either periodic (noncontinuous) pressure measurements or continuous pressure monitoring. The continuous monitoring component may simply be a visible and/or audible warning signal that air pressure is low. In addition, it may also provide a pressure readout signal, which can be recorded for later verification or used to automatically adjust the facility's ventilation control system… Pressure-measuring devices should sense the room pressure just inside the airflow path into the room (e.g., at the bottom of the door). Unusual airflow patterns within the room can cause pressure variations; for example, the air can be at negative pressure at the middle of a door and at positive pressure at the bottom of the same door. If the pressure-sensing ports of the device cannot be located directly across the airflow path, it will be necessary to validate that the negative pressure at the sensing point is and remains the same as the negative pressure across the flow path… Pressure-sensing devices should incorporate an audible warning with a time delay to indicate that a door is open. When the door to the room is opened, the negative pressure will decrease. The time-delayed signal should allow sufficient time for persons to enter or leave the room without activating the audible warning… Periodic checks are required to ensure that the desired negative pressure is present and that the continuous monitor devices, if used, are operating properly. ... If pressure-sensing devices are used, negative pressure should be verified at least once a month by using smoke tubes or taking pressure measurements.

Topic	Standard
Room Pressure Differential Monitors *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **IV. Infection Control and Ventilation Requirements for AII Rooms** A.1. … monitor air pressure periodically; preferably daily, with audible manometers or smoke tubes at the door (for existing AII rooms), or with a permanently installed visual monitoring mechanism. Document the results of monitoring. **OSHA Instructions CPL 2.106** **Subject: Enforcement Procedures and scheduling for Occupational Exposure to Tuberculosis** **5. Engineering Controls** …Note: The employer must assure that AFB isolation rooms are maintained under negative pressure. At a minimum, the employer must use nonirritating smoke trails or some other indicator to demonstrate that direction of air flow is from the corridor into the isolation/treatment room with the door closed.

Protective Environment Room

Topic	Standard
Usage	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 5 Construction** **5.1 Planning and Design** ...During the programming phase of a construction project, the owner shall provide an Infection Control Risk Assessment (ICRA). An ICRA is a determination of the potential risk of transmission of various agents in the facility. This continuous process is an essential component of a facility functional or master program to provide a safe environment of care. The ICRA shall be conducted by a panel with expertise in infection control, risk management, facility design, construction, ventilation, safety and epidemiology... ...the ICRA shall address but not be limited to the following key elements: …(d) Air handling and ventilation needs in surgical services, airborne infection isolation and protective environment rooms... **Chapter 7 General Hospital** **7.2.D. Protective Environment Room(s)** **7.2.D1.** As designated by the functional program, both airborne infection isolation and protective environment rooms may be required. Many facilities care for patients with an extreme susceptibility to infection, e.g., immunosuppressed patients with prolonged granulocytopenia, most notably bone marrow recipients; or solid-organ transplant recipients and patients with hematological malignancies who are receiving chemotherapy and are severely granulocytopenic. These rooms are not intended for use with patients diagnosed with HIV infection or AIDS, unless they are also severely granulocytopenic. Generally, protective environments are not needed in community hospitals, unless these facilities take care of these types of patients. The appropriate clinical staff should be consulted regarding room type and spatial needs to meet facility infection control requirements should be incorporated in design programming. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **Chapter 7 Health Care Facilities** **Air Quality** **Air Movement** The operation room … which requires air that is free of contamination, must be positively pressurized relative to adjoining rooms or corridors to prevent any airflow from theses relative highly contaminated areas.

Topic	Standard
Usage *(cont.)*	**Specific Design Criteria** Surgery and Critical Care **Operating rooms** …The following conditions are recommended for operation, catheterization, cystoscopic, and fracture rooms: 3. Air pressure should be maintained positive with respect to any adjoining rooms by supplying 15% excess air… **Obstetrical**. …The pressure in the obstetrical department should be positive or equal to that in other areas. **Delivery Rooms**. …The design for the deliver room should conform to the requirement of operating rooms. Nursing **Intensive Care Unit**... positive air pressure are recommended. **Protective Isolation Units**. ...In the case where the patient is immunosuppressed but not contagious, a positive pressure should be maintained…A positive pressure should also be maintained between the entire unit and the adjacent areas to preserve sterile conditions. **Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **I. Air-Handling Systems in Health-Care Facilities** A. Use AIA guidelines as minimum standards where state or local regulations are not in place for design and construction of ventilation systems in new or renovated health-care facilities. Ensure that existing structures continue to meet the specifications in effect at the time of construction... E. Conduct an infection-control risk assessment (ICRA) and provide an adequate number of AII and PE rooms (if required) or other areas to meet the needs of the patient population. **OSHA Instructions CPL 2.106** **Subject: Enforcement Procedures and scheduling for Occupational Exposure to Tuberculosis** **5. Engineering Controls** **a.** …Individuals with suspected or confirmed infectious TB disease must be placed in a respiratory acid-fast bacilli (AFB) isolation room…AFB isolation refers to a negative pressure room or an area that exhausts room air directly outside or through HEPA filters if recirculation is unavoidable.

Topic	Standard
Construction	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General Hospital** **7.2.D. Protective Environment Room(s)** **7.2.D2.** Each protective environment room shall have an area for hand washing, gowning, and storage of clean and soiled materials located directly outside or immediately inside the entry door to the room. **7.2.D3.** Protective environment room perimeter walls, ceiling, and floors, including penetrations, shall be sealed tightly so that air does not infiltrate the environment from outside or from other spaces. **7.2.D4.** Protective environment room(s) shall have self-closing devices on all room exit doors. **7.2.D5.** Separate toilet, bathtub (or shower), and hand washing stations shall be provided for each protective environment room. **Table 7.2 Ventilation Requirements for Areas Affecting Patient Care in Hospitals and Outpatient Facilities** from note [17]…Rooms with reversible provisions for the purpose of switching between protective environment and airborne infection isolation functions are not acceptable. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **Chapter 7 Health Care Facilities** **Hospital Facilities** The basic difference between air conditioning for hospital and that of other building types stem from (1) the need to restrict air movement in and between the various departments; (2) the specific requirements for ventilation and filtration to dilute and remove contamination in the form of odor, airborne microorganisms and viruses, and hazardous chemical and radioactive substance; (3) the different temperature and humidity requirements for various areas; and (4) the design sophistication needed to permit accurate control of environmental conditions. **Air Quality** **Air Movement** **…** In general, outlets supplying air to sensitive ultra-clean areas and highly contaminated areas should be located on the ceiling, with perimeter or several exhaust inlets near the floor. This arrangement provides a downward movement of clean air through the breathing and working zones to the contaminated floor area for exhaust….

Topic	Standard
Construction *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **III. Infection Control and Ventilation Requirements for PE rooms** D. Incorporate ventilation engineering specifications and dust-controlling processes into the planning and construction of new PE units. 1. Install central or point-of-use HEPA filters for supply (incoming) air. 2. Ensure that rooms are well-sealed by 1) properly construction windows, doors, and intake and exhaust ports; 2) maintaining ceilings that are smooth and free of fissures, open joints, and crevices; 3) sealing walls above and below the ceiling; and 4) monitoring for leakage and making any necessary repairs… 7. Install self-closing devices on all room exit doors in PE rooms.
Ventilation	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General Hospital** **Table 7.2 Ventilation Requirements for Areas Affecting Patient Care in Hospitals and Outpatient Facilities** Protective Environment Room[11,1\7]: Minimum air changes of outdoor air per hour: 2 Minimum total air changes per hour: 12 All air exhausted directly to outdoors: yes Recirculated by room units[7]: No [7]Recirculating room HVAC units refers to those local units that are used primarily for heating and cooling of air, and not disinfection of air…for airborne infection control, air may be recirculated within individual isolation rooms if HEPA filters are used… [17] …These special ventilation areas shall be designed to provide directed airflow from the cleanest patient areas to less clean areas. These rooms shall be protected with HEPA filters at 99.97 percent efficiency for a 0.3µm sized particle in the supply air stream. these interrupting filters protect patient rooms from maintenance-derived release of environmental microbes from the ventilation system components. Recirculation HEPA filters can be used to increase the equivalent room air exchanges. Constant volume airflow is required for consistent ventilation for the protected environment. If the facility determines that airborne infection isolation is necessary for protective environment patients, an anteroom should be provided.

Topic	Standard
Ventilation *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **III. Infection Control and Ventilation Requirements for PE Rooms** D.3. Ventilate the room to maintain ≥12 ACH.
Room Pressure Differential	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General Hospital** **Table 7.2 Ventilation Requirements for Areas Affecting Patient Care in Hospitals and Outpatient Facilities** Protective Environment Room[11,17]: Air Movement relationship to adjacent area[2]: Out [2] Design of the ventilation system shall provide air movement which 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 must not compromise the corridor-to-room pressure balancing relationships or the minimum air changes required by the table. [11] Differential pressure shall be a minimum of 0.01" water gauge (2.5 Pa). If alarms are installed, allowances shall be made to prevent nuisance alarms of monitoring devices. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **Chapter 7 Health Care Facilities** **Hospital Facilities** **Specific Design Criteria** **Surgery and Critical Care** The following conditions are recommended for operation, catheterization, cystoscopic, and fracture rooms: …4. Differential pressure indication device should be installed to permit air pressure readings in the rooms. **Nursing** **Intensive Care Unit**. ... positive air pressure are recommended. **Protective Isolation Units**. In the case where the patient is immunosuppressed but not contagious, a positive pressure should be maintained…A positive pressure should also be maintained between the entire unit and the adjacent areas to preserve sterile conditions.

Topic	Standard
Room Pressure Differential *(cont.)*	**Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **III. Infection Control and Ventilation Requirements for PE Rooms** D.5. Maintain positive room air pressure (≥2.5 Pa [0.01 inch water gauge]) in relation to the corridor.
Room Pressure Differential Monitors	**American Institute of Architects** **Guidelines for the Design and Construction of Hospital and Health-Care Facilities, 2001** **Chapter 7 General Hospital** **7.2D. Protective Environment Room(s)** **7.2.D6.** Room shall have a permanently installed visual mechanism to constantly monitor the pressure status of the room when occupied by patients requiring a protective environment. The mechanism shall continuously monitor the direction of the airflow. **ASHRAE HANDBOOK, HVAC APPLICATIONS, 1995** **Chapter 7 Health Care Facilities** **Hospital Facilities** **Specific Design Criteria** **Surgery and Critical Care** The following conditions are recommended for operation, catheterization, cystoscopic, and fracture rooms: …4. Differential pressure indication device should be installed to permit air pressure readings in the rooms. **Centers for Disease Control and Prevention (CDC)** **Morbidity and Mortality Weekly Report (MMWR)** **Guidelines for Environmental Infection Control in Health-Care Facilities, 2003** **Recommendations — Air** **III. Infection Control and Ventilation Requirements for PE Rooms** D.6. Maintain airflow patterns and monitor these on a daily basis by using permanently installed visual means of detecting airflow in new or renovated construction, or by using other visual methods (e.g., flutter strips or smoke tubes) in existing PE units. Document the monitoring results.

Pharmacies

Topic	Standard
Use of Isolators	**United States Pharmacopeia** **Chapter <797>** **Pharmaceutical Compounding – Sterile Preparations, 2004** **Responsibility of Compounding Personnel** …Compounding personnel are adequately skilled, educated, instructed and trained to correctly perform and document the following activities in their sterile compounding duties: c. Use laminar flow clean-air hoods, barrier isolates and other contamination control devices that are appropriate for the risk level; **Clean rooms and Barrier Isolators** In general, sterile product preparation facilities utilize laminar airflow workbenches (LAFWs) to provide an adequate critical site environment…
Required Air Quality	**United States Pharmacopeia** **Chapter <797>** **Pharmaceutical Compounding – Sterile Preparations, 2004** **Environmental controls** Engineering controls reduce the potential for airborne contamination in workspaces by limiting the amount and size of contaminants in the CSP processing environment. Primary engineering controls are used and generally include horizontal flow clean benches, vertical flow clean benches, biological safety cabinets, and barrier isolators. Primary environmental control must provide at least ISO Class 5 quality of air to which sterile ingredients and components of CSPs are directly exposed. Secondary engineering controls generally provide a buffer zone or buffer room as a core for the location of the workbenches or isolators… Buffer or clean-room areas in which LAFWs are located are to provide at least ISO Class 8 air quality…

References

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American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). HVAC Applications. Atlanta: ASHRAE. 1995.

Centers for Disease Control and Prevention. Guidelines for environmental infection control in health-care facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC), 2001. MMWR 2003;52 (No. rr-10):p 6-14.

Centers for Disease Control and Prevention. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 1994. MMWR 1994;43 (No. rr-13):p 29, 69-81.

OSHA Instruction CPL 2.106. Enforcement procedures and scheduling for occupational exposure to tuberculosis. 1996.

United States Pharmacopeia. USP General Chapter <797> Pharmaceutical Compounding – Sterile Preparations. 2004

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