Ventilation for Acceptable Indoor Air Quality

Part 7 - Make Buildings Safer During and After COVID-19

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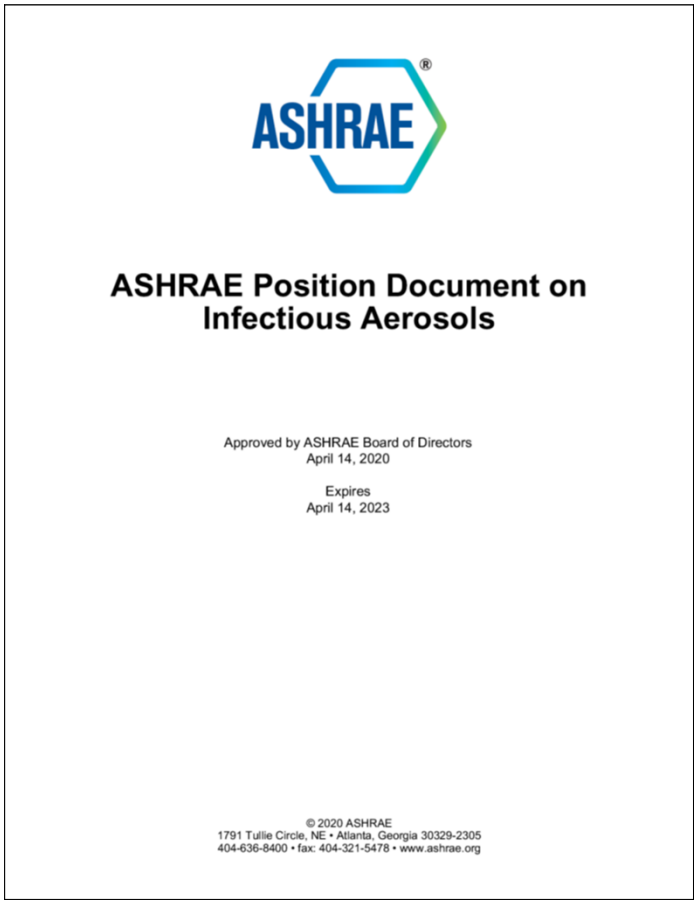

ASHRAE Position Document on Infectious Aerosols

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ASHRAE Position Document on Infectious Aerosols

from "Section 1. THE ISSUE"

Building science professionals must recognize the importance of facility operations and ventilation systems in interrupting disease transmission.

Dilution and extraction ventilation, pressurization, airflow distribution and optimization, mechanical filtration, ultraviolet germicidal irradiation (UVGI), and humidity control are effective strategies for reducing the risk of dissemination of infectious aerosols in buildings and transportation environments.

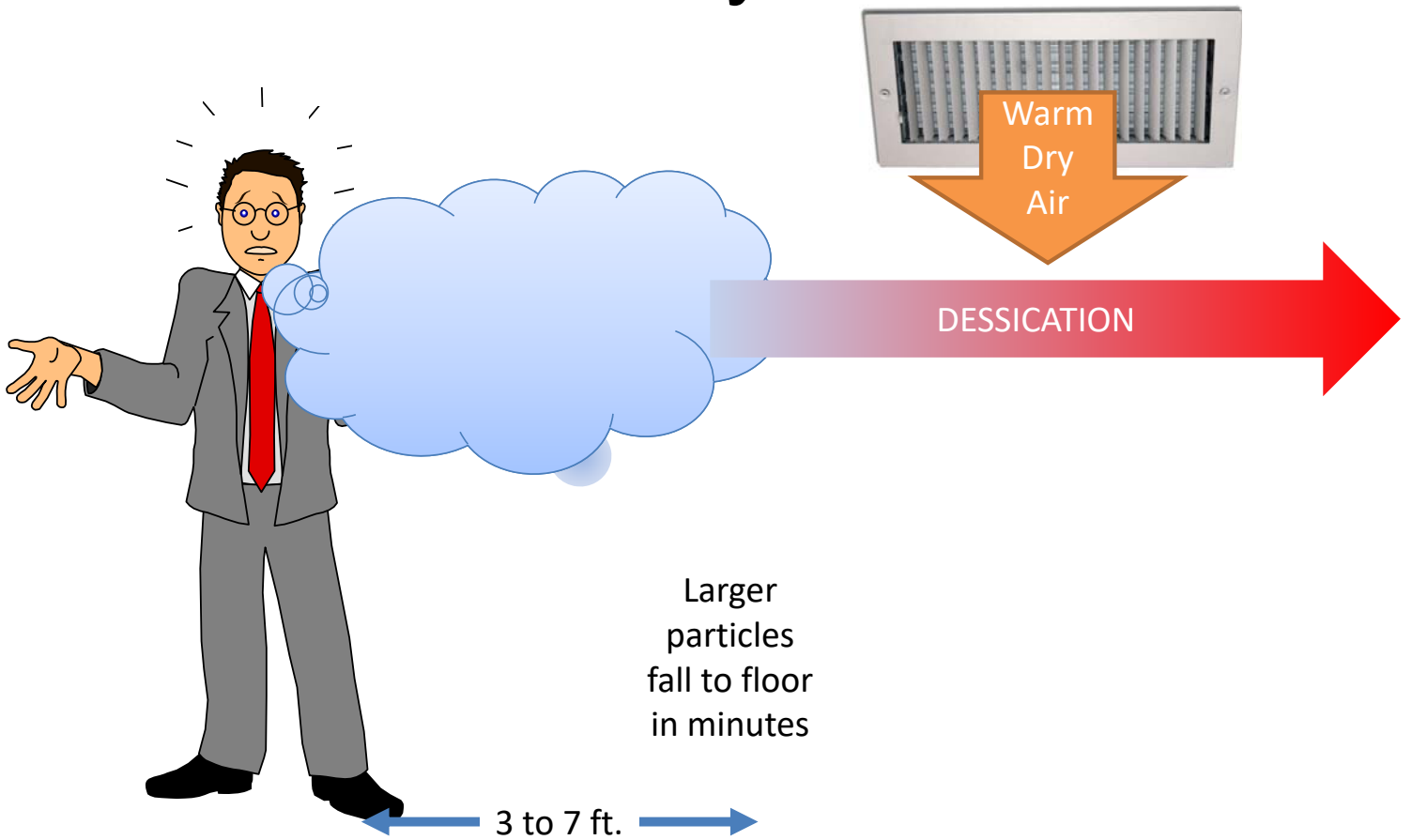
ASHRAE Position Document on Infectious Aerosols

from "Section 2.1 Airborne Dissemination"

Pathogen dissemination through the air occurs though droplets and aerosols typically generated by coughing, sneezing, shouting, breathing, toilet flushing, some medical procedures, singing and talking (Bischoff et al. 2013, Yan et al. 2018). The majority of larger emitted droplets are drawn by gravity to land on surfaces within about 3-7 ft *1-2 m) from the source. General dilution ventilation and pressure differentials do not significantly influence short range transmission. Conversely, dissemination of small infection aerosols, include droplet nuclei from desiccation, can be affected by airflow patterns in a space in general and airflow patterns surrounding the source in particular. Of special interest are small aerosols (<10 μm), which can stay airborne and infectious for extended periods (several minutes, hours, or days) and thus can travel longer distances and infect secondary hosts who had no contact with the primary host.

While ventilation systems cannot interrupt the rapid settling of large droplets, they can influence the transmission of droplet nuclei infectious aerosols.

Low Humidity and COVID-19



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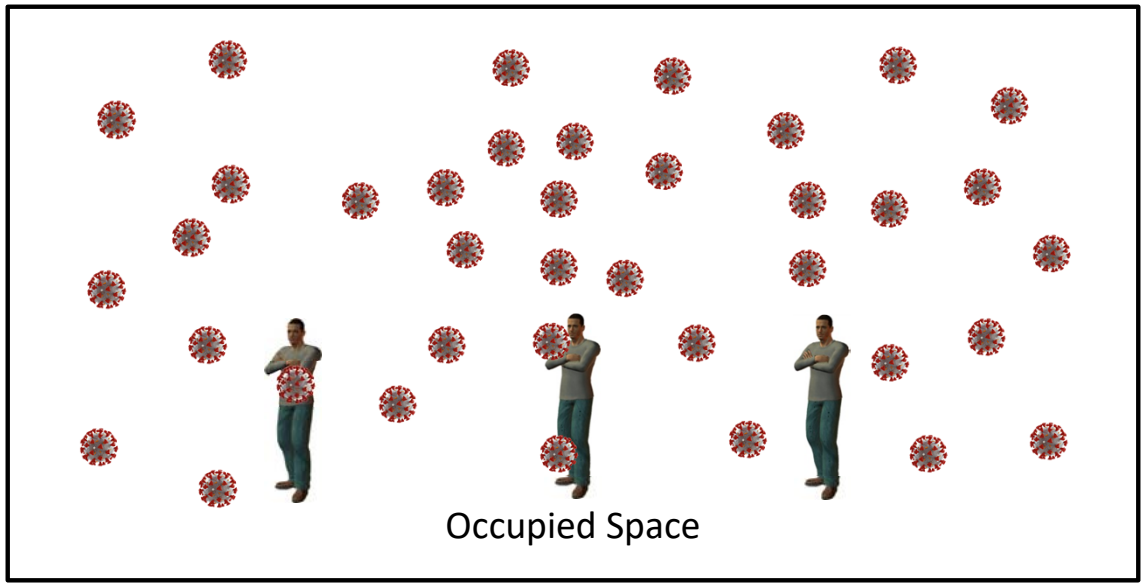
Airborne Infectious Aerosols and Ventilation

No Outdoor Air Dilution or High Level Mechanical Filtration



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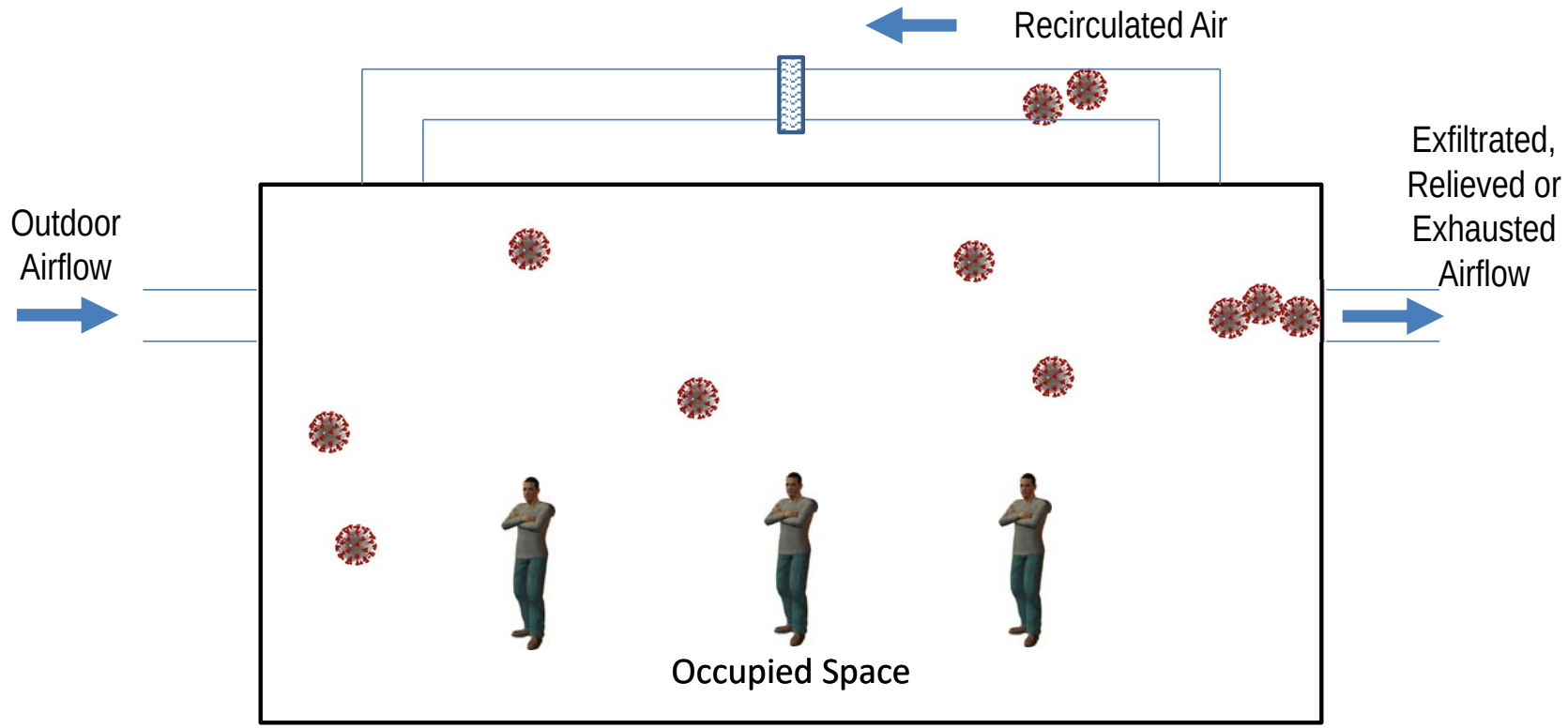
Airborne Infectious Aerosols and Ventilation

OA Dilution and High Level Mechanical Filtration



Traditional Thinking Does not Work During a Pandemic!

ASHRAE Position Document on Infectious Aerosols

from "Section 3.1 Varying Approaches by Facility Type"

Healthcare facilities have criteria for ventilation design to mitigate airborne transmission of infectious diseases … ASHRAE does not provide specific requirements for infectious disease control in homes, schools, prisons, shelters, transportation or other public facilities.

What makes sense during COVID-19?

STANDARD

ASHRAE

ANSI/ASHRAE Standard 62.1-2019
(Supersedes ANSI/ASHRAE Standard 62.1-2016)
Includes ANSI/ASHRAE addenda listed in Appendix O

Ventilation for Acceptable Indoor Air Quality

See Appendix O for approval dates by ASHRAE and the American National Standards Institute.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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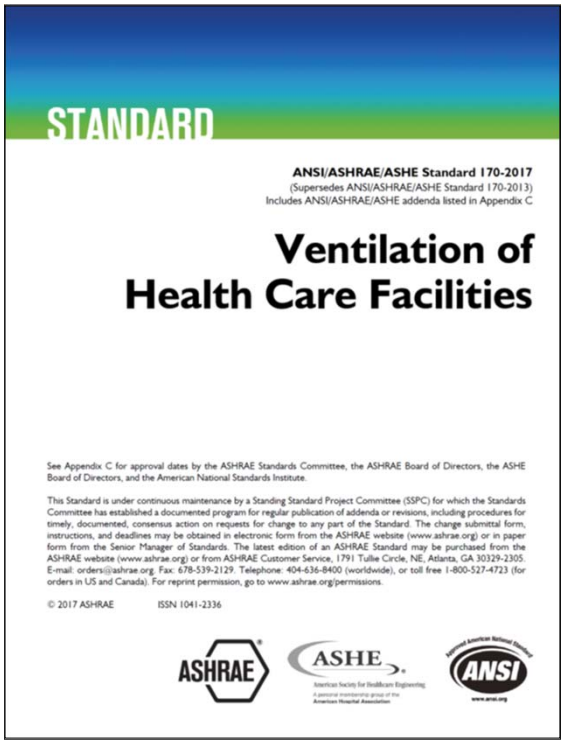
ANSI



STANDARD

ANSI/ASHRAE/ASHE Standard 170-2017
(Supersedes ANSI/ASHRAE/ASHE Standard 170-2013)
Includes ANSI/ASHRAE/ASHE addenda listed in Appendix C

Ventilation of Health Care Facilities

See Appendix C for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the ASHE Board of Directors, and the American National Standards Institute.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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ASHRAE ASHE ANSI

What makes sense during COVID-19?

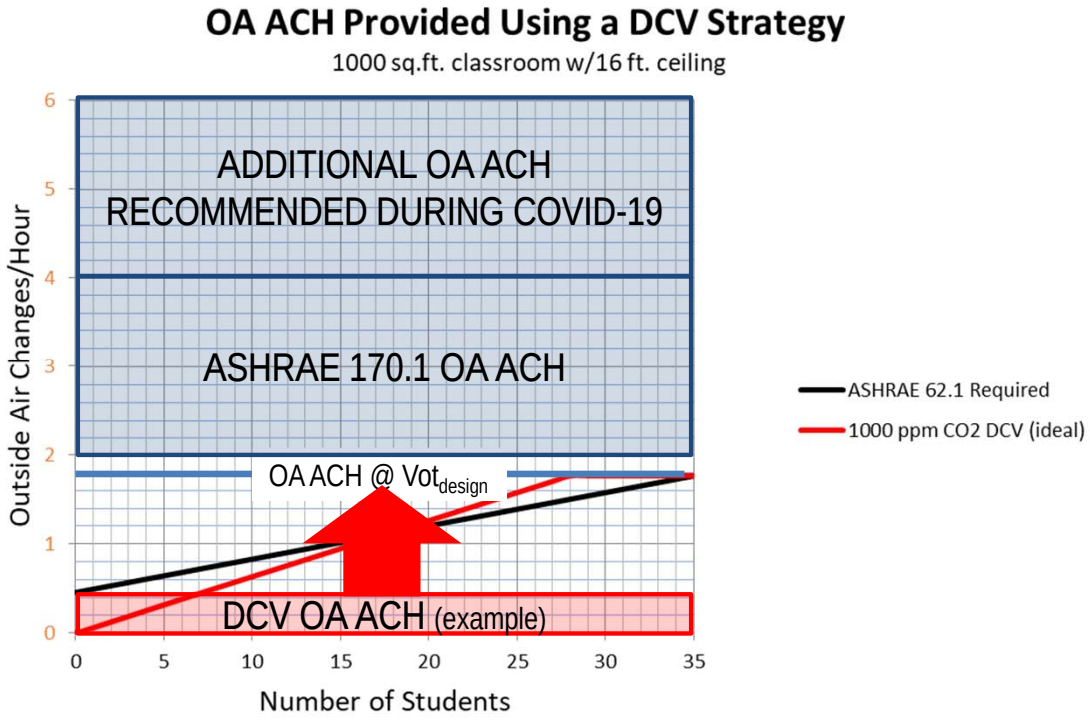
ASHRAE 62.1-2019

- Complicated, compliance is subject to interpretation – not very enforceable.
- VRP
  - Ventilation rates are based on per person/floor area rather than outdoor air changes.
  - Allows for significant reduction in outdoor air with changes in occupancy when DCV is implemented.
- IAQP
  - Lacks substance and requires no proof of performance.
  - Promotes reduction of the VRP ventilation rates (which may already be too low).

ASHRAE 170.1-2017

- Not subject to interpretation – very enforceable.
- Ventilation is based on room and outdoor air changes to maximize filter effectiveness and displace infectious disease with outdoor air.
- Has specific requirements for airborne infectious disease.
- Specifies acceptable filtration/contaminant removal systems and performance requirements.
- Requires that pressurization is maintained and designed to flow from clean to contaminated environments, generally requiring differential airflow control to accomplish.

Compare 62.1 ACH to 170.1



ASHRAE Position Document on Infectious Aerosols (Section 4.1 Positions)

4.1 ASHRAE's Positions

- Non-healthcare buildings should have a plan for an emergency response. The following modifications to building HVAC system operation should be considered:
  - Increase outdoor air ventilation (disable demand-controlled ventilation and open outdoor air dampers to 100% as indoor and outdoor conditions permit).
  - Keep systems running longer hours (24/7 if possible).
  - Maintain temperature and humidity as applicable to the infectious aerosol of concern.
  - Bypass energy recovery ventilation systems that leak potentially contaminated exhaust air back into the outdoor air supply.

Non-Healthcare Facilities

- Design for two operating modes – “Normal” and “Pandemic”.
  - Normal mode operation:
    - Low Occupancy Density Spaces: Maintain the required ventilation required by ASHRAE 62.1 for the maximum expected population.
    - High Density Spaces: Improve DCV performance by maintaining upper and lower airflow limits. Estimate the population using CO_2 levels and the outdoor airflow rate rather than single setpoint CO_2-DCV. Use population counting devices rather than CO_2 to avoid CO_2 assumption errors and lag.
  - Pandemic mode operation (all occupant densities):
    - Control outdoor airflow rates to the system’s capacity based on actual load conditions, disable DCV
    - Properly switchover to economizer when a system has an airside economizer.

Non-Healthcare Facilities

- Maintain pressurization to minimize the migration of non-treated outdoor air into the building (i.e. dirt/dust, moisture, hot/cold air, etc.).
  - Maintain minimum outdoor airflow rates above exhaust/relief airflow rates .
  - Maintain airflow differentials
    - Between supply/return air paths (recirculating fan systems)
    - Between supply/exhaust or supply/relief airflow paths (decoupled fan systems).
  - Compartmentalize pressure zones when possible by isolating the control of airflow differentials at each pressure zone.
  - Reset airflow differentials of pressure compartments (internal or external) to static pressure when positive verification of static pressure is desired (or required) rather than rely on basic static pressure control.
- Maintain supply air humidity to avoid desiccation of infectious aerosols.

ASHRAE Position Document on Infectious Aerosols (Section 4.1 Positions)

4.1 ASHRAE's Positions

- Healthcare buildings should consider design and operation to do the following:
  - Exhaust toilets and bed pans (a must).
  - **Maintain temperature and humidity as applicable to the infectious aerosol of concern.**
  - Maintain negatively pressurized intensive care units (ICUs) where infectious aerosols may be present.
  - Maintain rooms with infectious aerosol concerns at negative pressure.
  - Provide 100% exhaust of patient rooms.
  - **Increase the outdoor air change rate (e.g., increase patient rooms from 2 to 6 ach).**

Healthcare Facilities

- Air Changes
  - Maintain room air changes at specified levels to ensure maximum contaminant extraction.
  - Maintain outdoor air changes at specified levels to ensure maximum contaminant dilution.
    - Maximize ventilation and properly switchover to economizer when a system has an airside economizer.
- Humidity and Temperature
  - Maintain supply air humidity to avoid desiccation of infectious aerosols.
  - Ensure proper makeup of exhaust air to avoid negative temperature and humidity control problems.

Healthcare Facilities

- Maintain pressurization to minimize exposure to contaminants and infectious disease.
  - Maintain minimum outdoor airflow rates above exhaust/relief airflow rates .
  - Maintain airflow differentials to maintain pressure …
    - between supply/return air paths (recirculating fan systems)
    - between supply/exhaust or supply/relief airflow paths (decoupled fan systems).
  - Compartmentalize pressure zones, when possible, by isolating the control of airflow differentials at each pressure zone.
  - Reset airflow differentials of pressure compartments (internal or external) to static pressure when positive verification of static pressure is desired (or required) rather than rely on simple static pressure control.

Thank You!

Questions? More information?

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