March 2020

White Paper

# Infectious Disease Response

## Commercial Ducted HVAC Systems

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) developed the *Airborne Infectious Diseases* Position Document that describes the use of HVAC systems to prevent the spread of viral disease.[1] The document was last updated in February 2020. This white paper is meant as a summary of ASHRAE's document and other affiliated industry standards. For more detailed information, readers should reference the technical resource documents at www.ashrae.org/technical-resources/resources.

The common cold (rhinoviruses) and influenza (e.g. H1N1) can be transmitted by airborne aerosol, droplets, or direct contact. HVAC systems can have a positive effect on limiting airborne transmission and a minor effect on droplet transmissions. Coronavirus (e.g. COVID-19) is similarly transmitted via droplets and direct contact, and therefore best practice is to ensure HVAC systems are installed, maintained and serviced to mitigate the transmission of infectious disease.

### Infectious Disease Transmission Types

**Airborne:** The virus or bacteria can turn into an aerosol, allowing suspension in the air. The suspension time may allow infectious particles to move through the HVAC system.[1]

**Droplets:** The virus or bacteria move via small droplets that fall to surfaces within 3 feet (1 meter) from transmission source (e.g. coughing, sneezing).[1]

**Contact:** The virus or bacteria is transmitted through either person-to-person or person-to-surface contact.[1]

### Disease Mitigation Responses

- Dilution Ventilation
- Air Filtration
- Isolation - Space Pressurization
- Disease Deactivation
  - UV Lights
  - Humidity Control [1]

## Dilution Ventilation

The primary method to reduce spread of infectious disease in buildings is to increase the delivered amount of clean fresh air to the space while exhausting the existing air. Studies indicate that people in properly ventilated spaces are six times less likely to catch an infectious disease than people in non- or poorly ventilated spaces.[1] This method simply means replacing the entire volume of air in the space more than twice per hour (2 air changes/hour (ACH)) with outdoor air and/or properly filtered return air. For many higher-risk spaces, such as surgical suites, the ACH may need to be extended to 20 ACH. See ASHRAE Standards 55,[2] 62.1,[3] 62.2,[4] and 170 [5] for recommended ventilation and airflow rates.

### Action Items

- Consider increasing the ventilation quantities. Do not exceed more than 30% of the recommended minimum values per ASHRAE-62.1,[3] -62.2,[4] and -170.[5]
- Avoid actions that decrease ventilation quantities. Adjust the demand control ventilation to temporarily disallow zero ventilation during occupied periods.
- Install and/or increase use of an airside economizer to control space temperature during mild weather operation, which increases fresh air.[1]
- Protect fresh air intake systems from pollutants.[3]

*Notes*

1. *Airborne Infectious Diseases* (ASHRAE, 2020), pp. 3, 7, 9, 16
2. *Thermal Environmental Conditions* (ASHRAE, 2017), p. 13
3. *Ventilation for Acceptable IAQ* (ASHRAE, 2019), pp. 8–9, 21
4. *Ventilation and Acceptable IAQ* (ASHRAE, 2019), p. 6
5. *Ventilation of Health Care Facilities* (ASHRAE, 2017), pp. 9–12, 17–20

## Air Filtration

When viruses and bacteria become airborne, the HVAC system has the potential to transmit them to other spaces around the building. Therefore, effective HVAC designs incorporate filters to remove and trap the particles in the filter media where they naturally deactivate over time. Filters that are capable of arresting virus-sized particles tend to require frequent changes. Because the necessity to filter at this level can be infrequent, many HVAC systems use lower arresting filters.

### Action Items

- Inspect and change HVAC system filters in critical application.
- Consider temporarily converting MERV 8[1] or lower filters to MERV 12[2] or higher. Please note the fan system may need to be adjusted to maintain airflow.
- Use a HEPA filter bank that can pass Poly Alpha Olefin (PAO) testing in accordance with IEST-RP-CC034.4 HEPA/ULPA filter leak testing.[3]
- Consider the increased use of a HEPA filters for high-impact spaces such as nursing and assisted living homes.

## Isolation – Space Pressurization

To assist in the prevention of receiving or transmitting airborne viruses, the HVAC system can be used to pressurize a space so that the delivered air can prevent movement of infectious particles into a given space. For example, when a tuberculous room is kept at a negative pressure, a person entering or leaving the space feels the rush of air from the adjoining hallway or room moving into the tuberculous room. The net effect is trapping the disease and other bacteria in the isolated room. The isolated room then safely exhausts air from the building using a separate HVAC system. Likewise, a room can be isolated so that contaminated air cannot enter the space.[2]

### Action Item

- Contact a consulting engineer to implement space pressurization for localized space isolation in critical care areas.

### Specify for New Jobs

**Premier, Pro, Choice, and Series 100 rooftop units**

- Single Zone VAV Control
- Unit Mounted Humidifiers*
- Dehumidification Control†
- HEPA† and MERV 13/14 Filters
- Economizer
- Demand Control Ventilation
- Factory Installed UV Lights†
- Energy Recovery Wheel**†

**JR Series DOAS equipment**

- MERV 14 Filters
- Dehumidification Control
- Variable Fan Control
- Pressurization Control

**Notes:** * Contact Application Engineering to request this option.
** Required per ASHRAE-90.1 for specific outdoor airflow rates.[6]
† Option only available for Premier units.

## Disease Deactivation

Airborne and droplet viruses naturally "die" or deactivate in a given amount of time after leaving the source. Studies show that HVAC systems with ultraviolet (UV) lights located in the upper room or in the mechanical system can deactivate infectious particles. In-room or upper room UV lights can have a direct impact in sanitizing droplets that linger on surfaces. However, because extended UV light contact may be harmful, it must be strategically placed in your HVAC system to avoid unnecessary exposure. Additionally, increased room airflow rates may decrease local UV light's effectiveness due to the lower particle time in the air.[4]

Viruses tend to maintain their infectious state longer in dry or very humid environments. Spaces with less than 23% relative humidity (RH) or greater than 80% RH are considered ideal conditions for infectious diseases.[4] ASHRAE standards recommend maintaining between 20–60% RH in spaces, thereby creating an environment that naturally deactivates viruses/bacteria.[2, 5] In addition, studies show higher space temperatures also reduce virus longevity.[2]

### Action Items

- Consider the use of equipment level humidifiers to maintain space RH in dry winter seasons.
- Consider the use of equipment level dehumidification, like hot gas reheat (HGRH), to maintain spaces below 60% RH in the humid summer season.
- Consider using single zone variable air volume (SZVAV) control, which naturally dehumidifies in lieu of other space temperature control strategies.
- Consider the use of equipment level or upper room UV light for direct disease deactivation potential.

*Notes*

1. *Ventilation for Acceptable IAQ* (ASHRAE, 2019), p. 10
2. *Ventilation of Health Care Facilities* (ASHRAE, 2017), pp. 5–6, 9–12, 14–22
3. *HEPA and ULPA Filters* (IEST, 2016), pp. 21–22
4. *Airborne Infectious Diseases* (ASHRAE, 2020), pp. 6, 11–12
5. *Ventilation and Acceptable IAQ* (ASHRAE, 2019), p. 10
6. *Energy Standard for Buildings* (ASHRAE, 2019), pp. 115–17

### References


American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). ***Airborne Infectious Diseases***, Position Document. Atlanta: ASHRAE, approved January 19, 2014; reaffirmed February 5, 2020.

———. *Energy Standard for Buildings Except Low-Rise Residential Buildings,* ANSI/ASHRAE/IES Standard 90.1-2019. Atlanta: ASHRAE, 2019.

———. *Thermal Environmental Conditions for Human Occupancy*, ANSI/ASHRAE Standard 55-2017. Atlanta: ASHRAE, 2017.

———. *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*, ANSI/ASHRAE Standard 62.2-2019. Atlanta: ASHRAE, 2019.

———. *Ventilation for Acceptable Indoor Air Quality*, ANSI/ASHRA Standard 62.1-2019. Atlanta: ASHRAE, 2019.

———. *Ventilation of Health Care Facilities*, ANSI/ASHRAE/ASHE Standard 170-2017. Atlanta: ASHRAE, 2017.

Institute of Environmental Sciences and Technology (IEST). ***HEPA and ULPA Filters***, IEST PR-CC001.6. Arlington Heights, IL: IEST, 2016.




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