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ASHRAE® Recommendations for COVID-19

This *Engineers Newsletter* provides an overview of current guidance from ASHRAE for operating non-healthcare building HVAC systems during the COVID-19 pandemic.

For health care facilities, industry standards such as ASHRAE Standard 170, *Ventilation of Health Care Facilities*, define specific criteria for ventilation system design to mitigate airborne transmission of infectious diseases.

DISCLAIMER: The transmission of the SARS-CoV-2 virus, which causes the COVID-19 disease, may occur in a variety of ways and circumstances, many of the aspects of which are currently not known. HVAC systems, products, services and other offerings have not been tested for their effectiveness in reducing the spread of the SARS-CoV-2 virus, including through the air in closed environments.

The U.S. Centers for Disease Control (CDC) has published general guidance for occupying various types of workplaces and buildings during the COVID-19 pandemic, including the following building types:[1]

- Businesses and workplaces
- Schools and childcare
- Colleges and universities
- Shared and congregate housing
- Gatherings and community events
- Community and faith-based organizations
- Parks and recreational facilities
- Retirement communities
- Correctional and detention facilities
- Tribal communities

Most of their recommendations are outside the purview of the HVAC industry, focusing on policies, social distancing, shielding, and personal protective equipment, for example.

Therefore, ASHRAE has published recommendations specific to operating building HVAC systems during these circumstances. These HVAC-related recommendations, published in the *ASHRAE Position Document on Infectious Aerosols* and on the society's web site (www.ashrae.org), can be grouped into four categories: Dilute, Exhaust, Contain, and Clean.[2,3]

ASHRAE statement regarding transmission of SARS-CoV-2

"Transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures."[3]

Dilute

Recommendations under this category involve introducing more clean outdoor air to help dilute the buildup of indoor contaminants.

Disable DCV. Under this category, the first recommendation from ASHRAE is to disable demand-controlled ventilation (DCV).[2] DCV is a common energy-saving control strategy that reduces outdoor airflow during periods of partial occupancy, typically using a carbon dioxide (CO_2) sensor, an occupancy sensor, or some other means of counting people.

Disabling DCV will keep outdoor airflow high (at "design occupancy" levels) to improve dilution. And if building occupancy is going to be limited (to 25 or 50 percent of design occupancy, for example) then this will result in over-ventilation and more dilution. Of course, disabling DCV will increase energy use during most weather conditions.

Increase ventilation. ASHRAE recommends bringing in even more outdoor air to further improve dilution.[2] This might involve raising the outdoor-air (OA) damper, or flow, setpoints in the ventilation equipment, but again will also impact energy use.

When possible, ASHRAE recommends **operating the equipment with 100-percent outdoor air** to avoid recirculation.[2] Of course, this will require the ventilation system to have sufficient cooling, dehumidification, heating, and humidification capacity to properly condition this excess outdoor airflow during extreme weather conditions. During mild weather, the existing system might not have a problem maintaining desired indoor temperature and humidity conditions, but that might not be the case when it is very hot or very cold outside.

If additional capacity cannot be provided, the controls could be adjusted to maximize ventilation whenever possible, without sacrificing acceptable temperature or humidity control in the building.

One specific question that has been raised is related to exhaust-air energy recovery and cross leakage, which refers to air that leaks from the exhaust airstream into the incoming outdoor airstream. ASHRAE mentions that **bypassing the energy-recovery device**, to avoid cross-leakage, may be desirable.[2,3] But this depends on the type of ventilation system being used. If the system brings in 100-percent outdoor air, or is being modified to bring in 100-percent outdoor air with no recirculation, bypassing the energy-recovery device will reduce or avoid any cross-leakage of exhaust air back into the entering outdoor air stream. However, this results in forfeiting the added cooling, heating, or dehumidification capacity the energy-recovery device can provide to condition the outdoor air.

In contrast, if the system mixes outdoor air with recirculated air (a conventional multiple-zone VAV system, for example), and is being modified to bring in more outdoor air (from 25-percent OA to 50 percent, for example), then it may be more beneficial to leave the energy-recovery device operating, not bypass it. Even with the increased outdoor airflow, 50 percent of the air is being recirculated on purpose, so the small amount of cross leakage that occurs through the energy-recovery device pales in comparison. With the energy-recovery device operating, it is available to help condition the excess outdoor airflow.

Keep ventilation systems operating for a longer period of time. ASHRAE recommends to keep ventilation systems operating for longer hours, twenty-four hours per day if possible.[2] Even if it is at some reduced airflow, this continues dilution during unoccupied periods.

If continuous operation is not feasible, consider implementing a **pre- and post-occupancy purge sequence** to flush the building with outdoor air. This involves bringing in 100-percent outdoor air for a period of time each day prior to scheduled occupancy, and then again after people leave at the end of each day. ASHRAE suggests that three air changes (when combining both pre-occupancy and post-occupancy periods) should be sufficient for most systems.[3]

Exhaust

Recommendations under this category involve removing contaminants at their source.

Keep restroom exhaust operating continuously. ASHRAE recommends keeping restroom exhaust fans operating constantly under these circumstances.[3]

To prevent negative building pressure, especially during humid weather, ensure that the ventilation system is simultaneously bringing in a sufficient quantity of conditioned, outdoor air to replace the air exhausted from the restrooms.

Contain

For non-healthcare spaces, recommendations under this category involve keeping indoor humidity levels within the optimal range. The *ASHRAE Position Document on Infectious Aerosols* states:

> "scientific literature generally reflects the most unfavorable survival for microorganisms [is] when the relative humidity is between 40 and 60 percent."[2]

Maintain indoor relative humidity between 40 percent and 60 percent. For existing buildings, wireless sensing technology makes it more feasible to add humidity sensors needed to control humidity in this desired range. Depending on the equipment installed in the building, this might involve re-programming or re-configuring controllers, or might require installing new equipment or new components in existing equipment. For cold and dry climates, this might involve adding humidification equipment.

For conventional VAV systems, **disabling discharge-air temperature (DAT) reset** during humid weather will keep indoor humidity levels lower, but may increase overall system energy use. Also, ensure that the **hot-water heating system is enabled**, not turned off, so it can provide reheat for humidity control, if necessary.

Clean

Recommendations under this category involve reducing the presence of particles and microorganisms using some type of air cleaning technology.

Upgrade filters to MERV-13 (or higher) and ensure effective air seals. ASHRAE recommends upgrading air filters to MERV-13, or higher if possible.[2] And while doing so, ensure effective air sealing around the filter media.

Highly-efficient filtration can help reduce the airborne load of infectious particles. While a filter with a higher MERV rating can remove more particles from the air, it will typically also have a higher static pressure loss, which will usually increase fan energy use. Therefore, ensure that the fan has sufficient capacity to overcome any increase in filter pressure loss.

Add portable room air cleaners with HEPA or high-MERV filters. If upgrading existing filters is not feasible, ASHRAE recommends adding portable room air cleaners with high-efficiency particulate air (HEPA) filters, or filters with a high MERV rating (see previous recommendation).[2]

Note that a HEPA filter is better at removing particles from the air than a filter with the highest MERV rating (MERV-16).

Install ultraviolet (UV) lamps in ductwork, air-handling equipment, or upper region of the room. ASHRAE recommends installing ultraviolet lamps in either the ductwork, air-handling equipment, or the upper region of the room.[2]

The effectiveness of ultraviolet germicidal irradiation (UVGI) at reducing the presence of microorganisms depends on the intensity of the UV-C wavelength and the duration of exposure.[4] Therefore, consult the UV lamp manufacturer to determine the number and type of lamps needed.

Note that this will require a higher intensity than is used to clean cooling coils and drain pans (often called surface treatment). This is because surface treatment applications benefit from continuous exposure to the UV-C. When trying to reduce the presence of microorganisms in a passing airstream, the duration of exposure is shorter, so a higher intensity of UV-C is needed.

The UV-C wavelength can be damaging to some materials, particularly plastics and gaskets used in air-handling equipment, so proper shielding is needed to prevent direct exposure. Also, UV-C can be damaging to eyes and skin, so the application requires careful attention to protect service personnel.

Retrofit air-handling equipment with a suitable air cleaning device. ASHRAE's current recommendations focus primarily on high-efficiency particulate filters and UV-C lamps, due to the existence of peer-reviewed research studies.[2] However, there are other air cleaning technologies in the marketplace (including photocatalytic oxidation and bipolar ionization) that claim to reduce the presence of microorganisms in the airstream. When applying these other technologies, consider the manufacturer's test data carefully and follow their instructions for installation.

For more information, see the *ASHRAE Position Document on Filtration and Air Cleaning*.[5]

Table 1. Summary of ASHRAE recommendations for operating non-healthcare building HVAC systems during the COVID-19 pandemic

DILUTE: Increase ventilation with outdoor air
• Disable demand-controlled ventilation (DCV)
• Raise minimum outdoor-air damper (or airflow) setpoints
• Operate air-handling units with 100 percent outdoor air (no recirculation), when conditions allow
• Keep ventilation systems operating for a longer period of time, even if at lower airflows
• Implement pre- and post-occupancy purge sequences to flush building with outdoor air
EXHAUST: Keep local exhausts running
• Keep restroom exhaust operating continuously
CONTAIN: Control indoor humidity
• Install humidity sensors, update control sequences, and add equipment or components to maintain indoor RH between 40 and 60 percent
• Disable discharge-air temperature reset for multiple-zone VAV systems during humid weather
• Ensure hot-water heating system is enabled to provide reheat for humidity control, if necessary
CLEAN: Safely use air cleaning technology, as appropriate
• Upgrade filters to MERV-13 (or higher, if possible) and ensure effective air seals
• Add portable room air cleaners with HEPA or high-MERV filters
• Install ultraviolet (UV) lamps in ductwork, air-handling equipment, or upper region of the room
• Retrofit air-handling equipment with a suitable air cleaning device

Summary

Table 1 summarizes current recommendations from ASHRAE for operating non-healthcare building HVAC systems during the COVID-19 pandemic.[2,3]

Not every one of these recommendations may be feasible or pertinent to a specific building or system. Therefore, a building-specific assessment is warranted to identify and prioritize which recommendations to implement.

By John Murphy, Trane. To subscribe or view previous issues of the *Engineers Newsletter* visit trane.com/EN. Send comments to ENL@trane.com.

References

[1] "Coronavirus Disease 2019 (COVID-19): Communities, Schools, Workplaces, and Events," U.S. Centers for Disease Control and Prevention, www.cdc.gov/coronavirus/2019-ncov/community

[2] *ASHRAE Position Document on Infectious Aerosols*, updated 14 April 2020, www.ashrae.org/covid19

[3] "COVID-19 Preparedness Resources," ASHRAE, www.ashrae.org/covid19

[4] *Germicidal Ultraviolet – Frequently Asked Questions*, Illumination Engineering Society, IEC CR-2-20-V1, updated 15 April 2020, www.ies.org/standards/committee-reports

[5] *ASHRAE Position Document on Filtration and Air Cleaning*, reaffirmed 13 January 2018, www.ashrae.org/about/position-documents.

Indoor Air Quality Assesment

In light of the recent COVID-19 pandemic events, focus on indoor air quality has become more important than ever. As business spaces start to welcome back employees, tenants and customers, high quality indoor air will help restore people's confidence that they can safely return to facilities with more comfortable and cleaner air.

Trane is ready to help you create confidence in your building plans with fact-based information on the quality of your air. For more information on the Trane Indoor Air Quality Assesment, please visit: **www.Trane.com/IAQ**

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Decarbonize HVAC Systems. Many municipalities are taking action to reduce their carbon emissions which includes the reduction, or removal, of natural gas for heating. The HVAC industry will face the challenge of heating buildings with electric heat. This ENL will cover the motivation to electrify, areas currently effected by this trend, and potential systems to meet electrification needs.

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