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Updated ASHRAE® Recommendations for COVID-19

This *Engineers Newsletter, originally published in June 2020, has been updated to* provide an overview of the guidance from ASHRAE for operating non-healthcare building HVAC systems during the COVID-19 pandemic. Refer to www.ashrae.org/covid19 for the most up-to-date guidance.

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: There is evidence from ASHRAE® and other sources that HVAC technologies can mitigate the risk of exposure to infectious aerosols in built environments; however, the transmission of SARS-CoV-2 and mitigation of COVID-19 in buildings has yet to be broadly tested and confirmed.

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
- 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, personal protective equipment, and sanitation, for example.

Therefore, ASHRAE assembled an Epidemic Task Force made up of experts from across the industry. This task force has been developing recommendations specific to operating building HVAC systems during these circumstances (referred to as "Epidemic Conditions in Place" or ECiP). The initial recommendations were based on the *ASHRAE Position Document on Infectious Aerosols,* published in April 2020.[2] Since then, the task force has updated its guidance.[3,4] This EN is intended to summarize the HVAC-related recommendations, which can be grouped into four categories: Dilute, Exhaust, Contain, and Clean.

ASHRAE statement regarding transmission of SARS-CoV-2

"Airborne transmission of SARS-CoV-2 is significant and should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures."[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.

Dilute

Early in the pandemic, both the CDC and ASHRAE recommended introducing more clean outdoor air (up to 100 percent) to help dilute the buildup of indoor contaminants, if the HVAC system had sufficient capacity to do so and still maintain desired space conditions. But more recently, the ASHRAE Task Force has acknowledged the impact of this on both energy use and indoor conditions, particularly humidity.

Ensure at least code-required design outdoor airflow whenever occupied. For this reason, the first recommendation from ASHRAE is now to ensure ventilation systems are operating properly and bringing in at least code-required design outdoor airflow is being delivered whenever the building occupied. This involves an assessment of the ventilation systems to ensure they are indeed bringing in the proper amount of outdoor air.

This also involves **disabling demand-controlled ventilation** (DCV). 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.

Consider increasing outdoor airflow, if possible, when outdoor conditions allow. ASHRAE guidance still suggests bringing in more outdoor airflow (above design airflow rates), if possible. Bringing in even more outdoor air will further improve dilution, but again will impact energy use. This might involve raising the outdoor-air (OA) damper, or flow, setpoints in the ventilation equipment.

Of course, this will require the ventilation system to have sufficient cooling, dehumidification, heating, and possibly 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.

Because of these challenges, the ASHRAE Task Force mentions the possibility of using a combination of outdoor air and cleaned recirculated air to achieve the equivalent result.

Implement purge sequences to flush the building with outdoor air, or cleaned recirculated air, between periods of occupancy. ASHRAE recommends implementing a pre- and/or post-occupancy purge sequence to flush the building with outdoor air. This involves bringing in 100-percent outdoor air (or a combination of outdoor air and cleaned recirculated air, to achieve the equivalent result) for a period of time between periods of occupancy. ASHRAE suggests that three air changes should be sufficient for most systems.

Early in the pandemic, ASHRAE recommended operating the ventilation system 24 hours a day. But the ASHRAE Task Force has modified this to just recommend a purge sequence between occupancy.

Exhaust

Recommendations under this category involve removing contaminants at their source.

Ensure exhaust systems are operating properly and removing code-required exhaust airflow.

ASHRAE recommends that exhaust systems should be inspected and tested to verify exhaust airflow rates meet the requirements of the current building code.

This is a change from early guidance, when some in the industry recommended operating restroom exhaust systems 24 hours a day.

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

Inspect ventilation systems to minimize re-entry of contaminated exhaust air. ASHRAE also recommends inspecting ventilation and exhaust systems, including exhaust-air energy recovery devices, to minimize re-entry of contaminated exhaust air.

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. Some in the industry have suggested that **bypassing the energy-recovery device**, to avoid cross-leakage, may be desirable. 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.

Contain

For non-healthcare spaces, recommendations under this category involve keeping indoor humidity levels within the optimal range. While the *ASHRAE Position Document on Infectious Aerosols* does not make a definitive recommendation on indoor humidity levels for the purpose of controlling infectious aerosol transmission, it also shares that:

> "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 in the desired range. For existing buildings, wireless sensing technology makes it more feasible to add humidity sensors needed to control humidity. 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.

Caution: Raising the indoor humidity level during cold weather can result in condensation forming on inside surfaces of windows or walls. Therefore, an assessment of the building envelope is necessary before modifying the system to add humidity to a building.

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. 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.

The ASHRAE Task Force clarifies that a combination of filters and air cleaners could be used to achieve an equivalent result.

If not possible to upgrade existing filters, consider portable room air cleaners. If upgrading existing filters in the HVAC equipment is not feasible, ASHRAE recommends adding portable room air cleaners.[5]

Retrofit air-handling equipment (or occupied space) with a suitable air cleaning device. ASHRAE's current recommendations focus primarily on MERV-13 filtration (see previous recommendation) and ultraviolet (UV-C) lamps, due to the existence of peer-reviewed research studies.[6] However, there are other air cleaning technologies in the marketplace (including dry hydrogen peroxide, photocatalytic oxidation, and bipolar ionization) that claim to reduce the presence of microorganisms in the airstream.[7,8,9] When applying these other technologies, analyze the manufacturer's test data to ensure it is pertinent for the desired application, and follow their instructions for safe installation.

Summary

Table 1 summarizes the most recent recommendations from the ASHRAE Epidemic Task Force for operating non-healthcare building HVAC systems during the COVID-19 pandemic.

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

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

DILUTE: Increase ventilation with outdoor air, or cleaned recirculated air
• Ensure ventilation systems are operating properly and bringing in at least code-required design outdoor airflow whenever occupied (i.e., system commissioning)
• Consider increasing outdoor airflow, if possible, when outdoor conditions allow
• Can use a combination of outdoor air and cleaned recirculated air to achieve equivalent result
• Implement purge sequences to flush occupied spaces with outdoor air, or cleaned recirculated air, between periods of occupancy
EXHAUST: Ensure local exhaust systems are operating properly
• Ensure exhaust systems are operating properly and removing code-required exhaust airflow(i.e., system commissioning)
• Inspect ventilation systems to minimize re-entry of contaminated exhaust air
CONTAIN: Control indoor humidity
• Install humidity sensors, update control sequences, and possibly add equipment or components to maintain indoor humidity in the desired range
CLEAN: Safely use air cleaning technology
• Upgrade filters to MERV-13 (or higher, if possible) and ensure effective air seals
• If not possible to upgrade existing filters, consider portable room air cleaners
• Retrofit air-handling equipment (or occupied space) with a suitable air cleaning device

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): Community, Work, and School, " U.S. Centers for Disease Control and Prevention, www.cdc.gov/coronavirus/2019-ncov/community

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

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

[4] *Core Recommendations for Reducing Airborne Infectious Aerosol Exposure,* ASHRAE, published 6 January 2021, www.ashrae.org/covid19

[5] "*In-Room Air Cleaner Guidance for Reducing COVID-19 in Your Space/Room*," ASHRAE, 21 January 2021, www.ashrae.org/covid19

[6] *Germicidal Ultraviolet – Frequently Asked Questions*, Illumination Engineering Society, IEC CR-2-20-V1, published 5 May 2020, www.ies.org/standards/committee-reports

[7] Trane. *A Taxonomy of Air-Cleaning Technologies Featuring Synexis* (dry hydrogen peroxide) white paper. SYS-SLB025*-EN. 2020.

[8] Trane. *A Taxonomy of Air-Cleaning Technologies Featuring Bipolar Ionization* white paper. SYS-PRB003*-EN. 2021.

[9] Trane. *Trane Catalytic Air Cleaning System* (photocatalytic oxidation) engineering bulletin. CLCH-PRB023*-EN. 2020.

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Indoor Air Quality Assessment

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.

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ASHRAE Standard 62.1-2019. The 2019 version of ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality, was published in late 2019. This ENL will overview the standard, discuss several key changes implemented in the 2019 version, explain the three allowed procedures for determining ventilation airflows (Ventilation Rate Procedure, IAQ Procedure, and Natural Ventilation Procedure), and walk through calculation steps using an example office building.

SEPTEMBER

Air Cleaning Devices for IEQ. A building's indoor environmental quality is key to the safety, health, and comfort of its occupants as we move forward in a post-pandemic future. This ENL will cover what Indoor Environmental Quality is, how to create resilient systems, and discuss air cleaning device testing in order to construct healthy and efficient spaces.

NOVEMBER

ASHRAE Standard 15. ASHRAE Standard 15, Safety Standard for Refrigeration Systems, focuses on the safe design, construction, installation, and operating of refrigerating systems. This ENL will overview the 2019 version of this standard and explain how its requirements apply to various types of refrigerating systems, including new requirements for systems with Class A2L (lower flammability) refrigerants.

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