

Protocols for Building Reopening Ventilation Verification - Classrooms

The pandemic has put a lens on decades of neglect of the indoor air quality (IAQ) in schools. Students, parents, and teachers should enter a classroom and know that they are safe, which includes the air they breathe. Even classrooms tested a few years after a new air system installation can provide ventilation levels below the minimum required ratesⁱ.

With incoming federal grants, there is a once-in-a-generation opportunity to improve our schools' heating, ventilation, and air conditioning (HVAC) systems. However, the intended outcomes will only be achieved if the systems are repaired, installed, adjusted and maintained by technicians who are trained and certified.

It is well known that HVAC systems serving educational facilities are in need of repair. A 2020 report by the United States Government Accountability Office (GAO) estimated 41% of school districts need to update or replace the existing HVAC systems in at least half of their schools, representing approximately 36,000 schools. Per the report, *“If not addressed, HVAC issues can result in health and safety problems.”*ⁱⁱ

Improving the performance of school HVAC systems not only saves energy and provides a safer and healthier building environment, but it also has a significant correlation to student performance. In a 2017 literature review, W. J. Fisk, a senior scientist with the Indoor Environment Group, summarized that eight studies reported statistically significant improvements in some measures of student performance associated with increased ventilation rates or lower CO₂ concentrations, with performance increases as high as 15%.ⁱⁱⁱ

To address this gap, we propose a physical assessment of the existing HVAC infrastructure. The assessment is to be performed by a skilled, trained and certified technician. Systems will be verified to meet or exceed the recommendations of the World Health Organization (WHO)^{iv}, Centers for Disease Control and Prevention (CDC)^v, and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)^{vi} as well as any applicable local and state agency school-reopening guidance. The resulting assessment report allows design professionals to make recommendations for adjustments, repairs, upgrades or replacements with reduced assumptions. School districts and building owners can then make educated decisions on proposed improvements.

1. Ventilation Verification Assessment^{vii}

- **Filtration** - Review system capacity and airflow to determine the highest Minimum Efficiency Reporting Value (MERV) filtration for reducing contagions, replace or upgrade filters where needed, and verify that such filters are installed correctly.



- **MERV 13 or better filtration** shall be installed in the facility's HVAC system where feasible.
 - **Ventilation Rate** - Calculate the required ventilation rates for each occupied area based on the actual occupancy. Physically verify that the ventilation rate meets or exceeds the minimum outside air (OSA) rates set forth by the local jurisdiction.
 - **Ventilation System Operation** - Physically test all ventilation components for proper operation.
 - **Air Distribution** - Survey all inlets and outlets. Verify all ventilation is reaching the served zone and there is adequate distribution.
 - **Building Pressure** - Verify the building pressure is per design and a negative pressure is maintained for contaminant rooms temporarily occupied by sick occupants.
 - **Operational Controls** - Review control sequences to verify systems will maintain intended ventilation, temperature and humidity conditions during school operation. During unoccupied hours, verify a daily flush is scheduled for three changes of building volume using outdoor air.
 - **CO₂ Monitoring** - As an indicator of proper ventilation throughout the school year, all classrooms shall be equipped with a CO₂ monitor within each zone of the building.
 - **Limited or No Existing Mechanical Ventilation.** In cases where there is limited or no existing mechanical ventilation, the assessment would then focus on available options and provide the design professional with documentation to provide ventilation options.
2. **Design Professional Review** – Submit the Ventilation Verification assessment report to qualified design professionals (licensed mechanical engineer, certified industrial hygienist (CIH), or mechanical design professional as defined by state or provincial guidelines).
 3. **Repairs, Adjustments, Replacements and Upgrades** – Work with the design professional to determine cost effective options to improve ventilation, filtration energy efficiency for the students, parents and staff that depend on a healthy learning environment.

Completing any replacements or adjustments to the system — such as increasing ventilation and filtration or installing new equipment — without a physical assessment by a skilled, trained and certified professional may result in wasted funding, additional energy increases and premature equipment failure with no assurance the recommended strategies to reduce pathogen transmission and increase the indoor air quality were achieved.

Physical verification — and thereby adjustment and/or replacement — of an HVAC system by a skilled, trained, and certified technician will ensure accurate ventilation rates, functioning filtration and achievement of the desired outcome with money well spent to protect the health and safety of students, teachers and parents.

ⁱ Chan, et al, Ventilation rates in California classrooms: Why many recent HVAC retrofits are not delivering sufficient ventilation, Building and Environment Journal 167 (2020)
(<https://www.sciencedirect.com/science/article/pii/S0360132319306365>).

ⁱⁱ *K-12 Education School Districts Frequently Identified Multiple Building Systems Needing Updates or Replacement* (Rep. No. GAO-20-494). (June 4th, 2020). United States Government Accountability Office. <https://www.gao.gov/assets/710/707374.pdf>

ⁱⁱⁱ Fisk, W. J., The ventilation problem in schools: literature review, *Indoor Air*. 2017;27:1039–1051 (<https://onlinelibrary.wiley.com/doi/epdf/10.1111/ina.12403>)

^{iv} World Health Organization, Considerations for school-related public health measures in the context of COVID-19 (September 14, 2020) (<https://www.who.int/publications-detail/considerations-for-school-related-public-health-measures-in-the-context-of-covid-19>); World Health Organization, Considerations for public health and social measures in the workplace in the context of COVID-19 (May 10, 2020) (<https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19>); World Health Organization, Q&A: Ventilation and air conditioning in public spaces and buildings and COVID-19 (July 29, 2020) <https://www.who.int/news-room/q-a-detail/q-a-ventilation-and-air-conditioning-in-public-spaces-and-buildings-and-covid-19>

^v Centers for Disease Control and Prevention, Operating schools during COVID-19: CDC's Considerations (February 3, 2021) <https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/schools.html>; Centers For Disease Control and Prevention, Interim Guidance For Businesses and Employers Responding To Coronavirus Disease 2019 (COVID-19) (January 4, 2021) (<https://www.cdc.gov/coronavirus/2019-ncov/community/guidance-business-response.html>)

^{vi} ASHRAE, ASHRAE Epidemic Task Force: Building Readiness (February 1, 2021) (<https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-building-readiness.pdf>); ASHRAE, ASHRAE Epidemic Task Force: Core Recommendations for Reducing Airborne Infectious Aerosol Exposure (January 6, 2021) (<https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf>); ASHRAE, ASHRAE Epidemic Task Force: Schools & Universities (October 7, 2021) (<https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-reopening-schools-and-universities-c19-guidance.pdf>);

^{vii} Ventilation Verification. Retrieved from <https://www.nemionline.org/ventilation-verification/>
Training, Sample Assessment Test Sheets, Sample Method of Procedure