

HVAC Strategies for Re-Opening K-12 Schools

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The diversity of space types and systems found within a K-12 school require different strategies to improve the environment. To maintain a productive learning environment, schools should implement some short and long-term strategies for existing and new HVAC systems to minimize further spread of the virus within the schools.

Many of the following recommendations are in conformance with the ASHRAE EPIDEMIC TASK FORCE document published May 5, 2020 for Schools & Universities. These strategies require evaluation by a qualified professional to determine if the specific configuration of your system is compatible with the strategy.

SHORT TERM MEASURES:

- **Enhanced Filtration** – Replace filters with higher efficiency filters wherever possible. Minimum MERV 13 efficiency. MERV 16 if possible. Ratings higher than MERV 13 require 6-12 inch cartridge type or bag filters. Higher efficiency filters will reduce fan air flow.
- **Increase Mechanical Ventilation** – Where feasible, introduce outside air to help flush out particles and virus. Monitor system capacity since available capacity for space conditioning will be diminished.
- **Natural Ventilation** – If it is not possible to introduce more outside air through the mechanical system, when weather permits open windows for natural ventilation. This generally reduces the concentration of indoor contaminants but will introduce outdoor contaminants. Because of the unpredictable flow of natural ventilation, the virus could be transported to other areas of the building.
- **Extended System Operation** – Extend air handling system hours of operation beyond occupied hours for systems that provide outside air. This will help reduce the concentration of viruses in the space prior to the start of the next day.
- **Flush Out Cycle** – Set mechanical systems to flush the air out of the building at night. This is an enhanced version of extended system operation. Generally applies to systems with economizer capability. Apply only when outside air conditions allow. Requires adjustment of system controls.
- **Controls Override** – Disable demand control reduction of outside air or minimum supply air settings. Provides increased outside air and supply air to rooms.
- **Toilet Exhaust Fans** – Operate toilet room exhaust fans 24 hours per day. Toilet rooms can have a high potential for transmission of viruses.
- **Alter Space Pressurization** – If possible, rebalance HVAC system to make lobbies and common corridors negatively pressurized relative to classrooms. If rebalance is not possible, this may require adding exhaust systems as part of a long-term solution.
- **Portable Air Purifiers** – Deploy in spaces where other strategies are not feasible. Units including HEPA filters, UV lamps, and bipolar ionization are available.

LONG TERM MEASURES:

- **Enhanced Filtration** – Add or replace filters with higher efficiency levels. MERV 13 minimum. Retrofit systems if possible. Deeper filters provide higher efficiency. Retrofit for HEPA filters is generally not practical due to size. Practice safe protocols when changing filters since they may hold active viruses. Anti-microbial coated filters are available to help reduce presence of active viruses.
- **Bipolar Ionization (BPI)** – BPI devices are available for all types of air handling systems, large and small. Lamp types and needlepoint types are available. Needlepoint types have little to no maintenance. Lamp types need lamp replacement every two to three years depending on use. Installed in the supply side of air handling systems since the ionization works in the occupied space to deactivate viruses.
- **UV-C Lamps in HVAC Systems** – Requires types specifically developed to provide high intensity irradiation located at coils and filters in the AHU/RTUs. In-duct systems and types for mounting in air handling units to disinfect the moving air are available but require further validation from manufacturers.
- **Upper Room UV-C Systems** – Irradiates the upper part of the room above the occupied zone. Normal air circulation moves room air through the irradiated zone to deactivate viruses. These systems are designed to avoid occupant exposure. Can be utilized in the classrooms, nurses areas, faculty offices, during occupancy.
- **UV-C or far UV-C Lamps in Spaces** – Applied when the spaces are not occupied for sanitizing surfaces (classrooms and restrooms). They can be portable or permanently installed with proper protection and controls. Requires careful evaluation and design for each space to prevent exposure to eyes and skin.
- **Humidification** – Add humidification systems to air handling systems to maintain relative humidity of 40%-60%. Installation, operation and maintenance of these systems require careful consideration. May not be appropriate for older buildings due the potential for condensation and mold growth.
- **Hands-Free Toilet Room Fixtures** – Replace hand-operated fixtures with hands-free fixtures for toilets and lavatories.
- **Toilet Lids** – Replace toilet seats with lids to contain viruses when flushing.

SYSTEM STRATEGIES:

Below are potential strategies for each HVAC system type. Each strategy requires evaluation by a qualified professional to determine if the specific configuration of your system is compatible with the strategy. A combination of strategies utilized on a system can yield greater benefits.

Central Air Handling System – Variable air volume or constant volume mixed air systems with outside air and recirculated return air. Includes rooftop units.

- Enhanced filtration
- Increase outside air

- Bipolar Ionization
- Controls Override
- Extended Hours
- Flush-out
- Humidification
- UV-C Lamps in Duct or Air Handling Units

Dedicated Outside Air Systems – Systems that provide 100% outside air and exhaust air with and energy recovery component (DOAS, ERV)

- Increase outside air (limited by fan capacity, heating and cooling capacity, and ductwork configuration)
- Bipolar Ionization
- Controls Override
- Extended Hours
- Flush-out
- Humidification

Classroom Unit Ventilators – Systems with outside air intake typically with economizer capability. Supplies air directly to the space.

- Enhanced Filtration (evaluate impact on unit capacity)
- Increase Outside Air (evaluate impact on unit capacity)
- Bipolar Ionization
- UV-C Lamps

Terminal Fan Units – Includes heating and/ or cooling fan coil units for chilled water, hot water, DX split, variable refrigerant flow, and heat pumps systems

- Enhanced Filtration (evaluate impact on unit capacity)
- Increase Outside Air (evaluate impact on unit capacity)
- Bi-Polar Ionization
- UV-C Lamps (recirculation air)

Ductless Split Indoor Units – Single or multiple mini-split or variable refrigerant flow

- Bipolar Ionization
- Extended Hours (with BPI)

K-12 schools face many challenges from the COVID-19 pandemic. The strategies outlined above were derived from Bala Consulting Engineers' white paper [COVID-19 and the Impacts to K-12 Schools](#).