



MONOMOY
REGIONAL SCHOOL DISTRICT

VENTILATION SYSTEM READINESS

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HOW THE VIRUS SPREADS

- Person to Person
- Contact surfaces
- Shortrange airborne transmission*

* CDC and WHO have not yet accepted that short range airborne transmission is possible. However in order to reduce the risk, we should do everything possible to mitigate it.

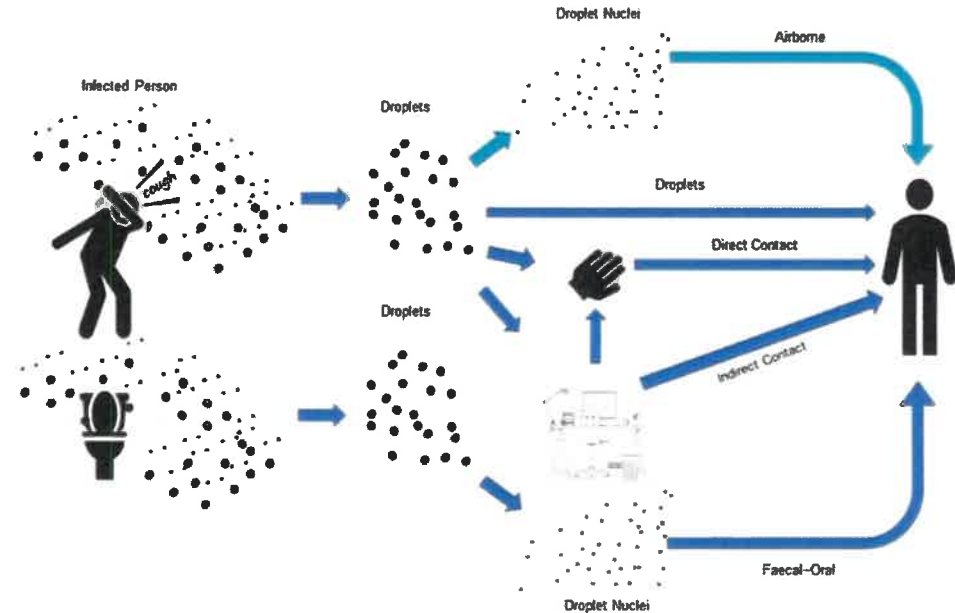


Figure 1. WHO reported exposure mechanisms of COVID-19 SARS-CoV-2 droplets (dark blue colour). Light blue colour: airborne mechanism that is known from SARS-CoV-1 and other flu, currently there is no reported evidence specifically for SARS-CoV-2 (figure: courtesy Francesco Franchimon).

Indoor crowded spaces with poor ventilation (<5 cfm per person) can cause short range airborne transmission

CDC GUIDELINES ON VENTILATION

- **Ventilation**
 - Ensure ventilation systems operate properly and increase circulation of outdoor air as much as possible, for example by opening windows and doors. Do not open windows and doors if doing so poses a safety or health risk (e.g., risk of falling, triggering asthma symptoms) to children using the facility.

OTHER MITIGATION STRATEGIES REVIEWED - UVGI

For non-healthcare buildings, ASHRAE's Position Document on Infectious Aerosols recommends consideration of all three UV-C applications for **"in high-density spaces such as waiting rooms, prisons, and shelters,"**

Upper Room UV-C applications have the best impact in reducing the risk. Based on ASHRAE's position document - installing upper room UV-C in classrooms was not feasible and cost effective and I did not think it was a right mitigation strategy as compared to ensuring enhanced ventilation and filtration.

RISK OF TRANSMISSION – TYPE OF OCCUPANCY AND VENTILATION

Type and level of group activity	Low occupancy			High occupancy		
	Outdoors and well ventilated	Indoors and well ventilated	Poorly ventilated	Outdoors and well ventilated	Indoors and well ventilated	Poorly ventilated
Wearing face coverings, contact for short time						
Silent	Low	Low	Low	Low	Low	Medium
Speaking	Low	Low	Low	Low	Low	Medium
Shouting, singing	Low	Low	Medium	Medium	Medium	High
Wearing face coverings, contact for prolonged time						
Silent	Low	Low	Medium	Low	Medium	High
Speaking	Low	Low	Medium	Medium	Medium	High
Shouting, singing	Low	Medium	High	Medium	High	High
No face coverings, contact for short time						
Silent	Low	Low	Medium	Medium	Medium	High
Speaking	Low	Medium	Medium	Medium	High	High
Shouting, singing	Medium	Medium	High	High	High	High
No face coverings, contact for prolonged time						
Silent	Low	Medium	High	Medium	High	High
Speaking	Medium	Medium	High	High	High	High
Shouting, singing	Medium	High	High	High	High	High
Risk of transmission Low ■ Medium ■ High ■						

* Borderline case that is highly dependent on quantitative definitions of distancing, number of individuals, and time of exposure

Source: The BMJ

SITE REPORT

VENTILATION SYSTEM READINESS

		Mechanical Ventilation Systems	Control systems	
	HES			
	CES			
	MRMS			
	MRHS			
	Automated controls - needs some checks before winter			
	Systems capable of delivery of proper ventilation			

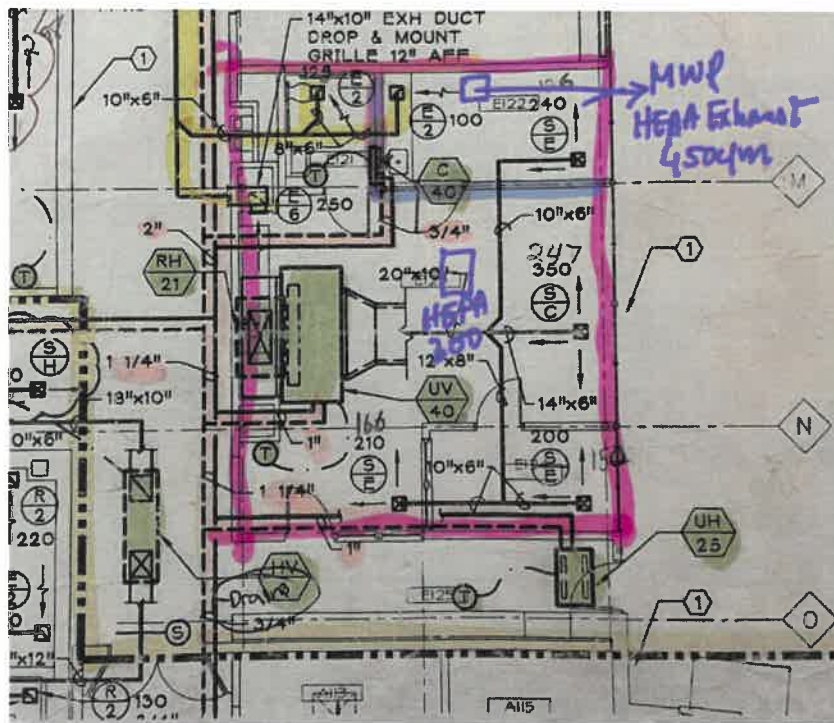
Through a combination of natural ventilation and / or mechanical ventilation, the schools are well ventilated except as indicated in certain areas.

Where HEPA filters are recommended, equivalent makes are acceptable. Please make sure that CADR (Clean Air Delivery Rate) is the CFM that is specified.

HARWICH ELEMENTARY SCHOOL

- Bigger areas like cafeteria and gymnasium will not be used. However they also have mechanical ventilation
- Library also has mechanical ventilation and the minimum outside air can deliver ventilation to about 350 students at any time.
- Guidance room and Admin areas have roof top units with recirculated air and mechanical ventilation.
- Maintenance
 - Filters have been changed for all unit ventilators – MERV 8
 - Controls for all system are functioning,.

HARWICH ELEMENTARY - NURSES ROOM AND MEDICAL WAITING ROOM



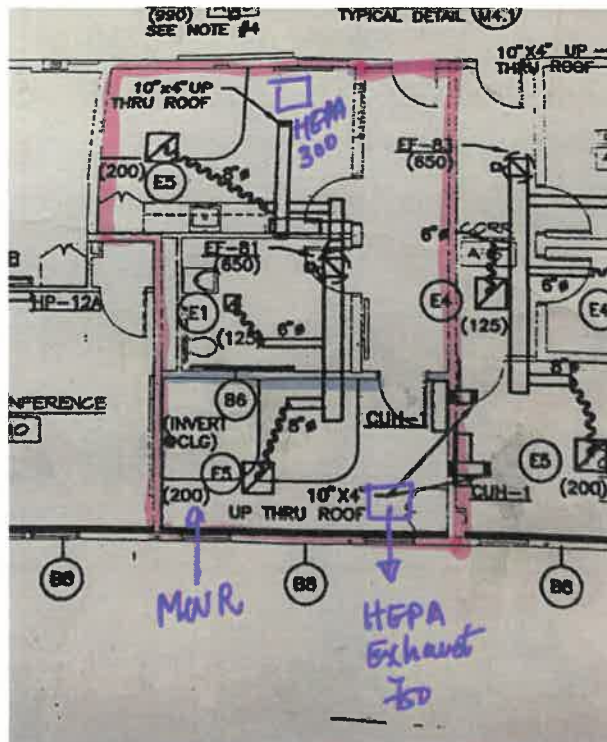
- Install 750 cfm HEPA exhaust machine in room EI22 – Exam Room
- Duct exhaust to outdoors
- Ensure that exhaust duct is 10 feet away from any intakes or people
- Keep at medium setting – 450 cfm
- Install Honeywell HEPA True 300 in Nurses room



MONOMOY REGIONAL MIDDLE SCHOOL

- MS Gymnasium
 - Has mechanical ventilation – air handling unit with recirculated air
 - Minimum Damper OA should be 30% open
 - Capable of delivering enhanced ventilation for 125 people
- Library also has mechanical ventilation and the minimum outside air (30%) can deliver ventilation to about 60 students at any time.
- Cafeteria has air handling unit with minimum 50% outside air. Capable of delivering proper ventilation to 150 students at any time
- Maintenance
 - All UVs have MERV 8 charcoal filters. It is ok to replace with the same filter
 - Exhaust fans have been serviced
 - Controls for all system are functioning..

MONOMOY MIDDLE SCHOOL - NURSES ROOM AND MEDICAL WAITING ROOM



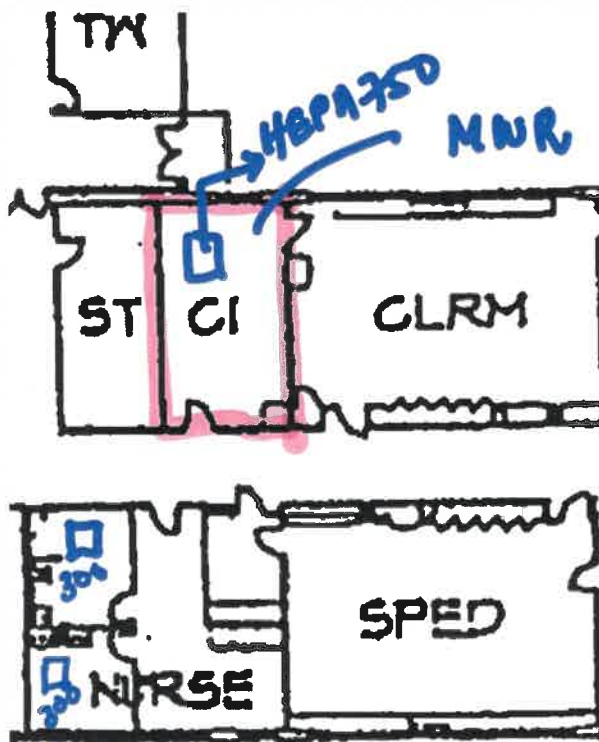
- Install 750 cfm HEPA exhaust machine in room A113 – Exam Room OR E103 Office Space
- Duct exhaust to outdoors
- Ensure that exhaust duct is 10 feet away from any intakes or people
- Keep at medium setting – 450 cfm for A113 or High setting for E103
- Install Honeywell HEPA True 300 in Nurses room



CHATHAM ELEMENTARY SCHOOL

- Bigger areas like cafeteria and gymnasium will not be used. However they also have air handling units with mechanical ventilation. Minimum damper position should be set at 30% for gymnasium and 35% for the cafeteria
- Library is only going to be used for students to walk in and pick up books and leave.
- Maintenance
 - All UVs have MERV 8 filters
 - Exhaust fans have been serviced
 - Controls for all system are functioning,

CHATHAM ELEMENTARY SCHOOL- NURSES ROOM AND MEDICAL WAITING ROOM



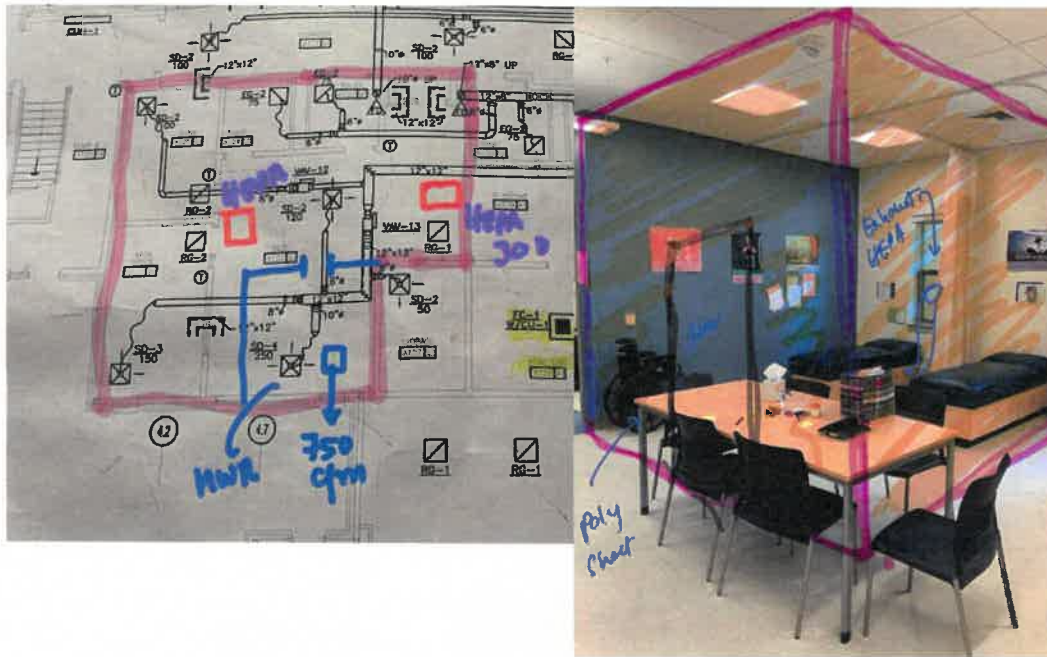
- Install 750 cfm HEPA exhaust machine in room CI – Medical waiting room - Duct exhaust to outdoors
- Ensure that exhaust duct is 10 feet away from any intakes or people
- Keep at high setting– 700 cfm.
- Install Honeywell HEPA True 300 in Nurses room



MONOMOY REGIONAL HIGH SCHOOL

- Larger áreas like, gymnasiums,cafería and auditórium have mechanical ventilation with CO2 sensors. Mechanical ventilation is sufficient. Should change CO2 setpoint to 900 ppm
 - These areas will not be used other than small activity
- Manufacturer services these units 3 times a year.

MONOMOY REGIONAL HIGH SCHOOL- NURSES ROOM



- Decision not yet made on location
 - If tent is used outside – Install PAS 750
 - If medical waiting room is in the Nurses area – create air tight partition – with poly. Install HEPA 750 inside with duct outside
- Install 2 x Honeywell 300HEPA Purifier in Nurses area
- Exhaust duct to outside – 10 feet away from any air intakes or people
- Since there is no RA duct in the medical waiting room and all other rooms will be used for other health related activities, no changes need to be made to the return air grilles

MEDICAL WAITING ROOMS

The medical waiting room is designated for students who the nurses suspect to have COVID-19 symptoms and are asked to wait in this room until the student's parents or guardians pick the student up. The student(s) will always be wearing their masks on. There is no plan for testing in this room.

It is important to have negative pressure at these locations, i.e air from adjacent spaces flows into the room.

1. Be proactive and not reactive
2. Place noisy, portable HEPA exhaust fan units outside whenever possible
3. Pressure inside the medical waiting room should be negative relative to adjacent rooms
4. Do not penetrate fire walls for temporary ducts
5. Do not use existing return air duct system for exhaust
6. Locate the HEPA exhaust units to ensure all exhaust ductwork outside the room is under negative pressure
7. Keep exhaust at least 10 feet away from any populated area, any outside air intake that could return the exhaust air back into the building

HEPA AIR PURIFIERS

https://www.amazon.com/gp/product/B07DD9H6YH/ref=ox_sc_act_title_1?smid=ATVPDKIKX0DER&psc=1



Honeywell True Hepa Allergen Air Purifier, Extra-Large Room, White

Visit the Honeywell Store
4.5 out of 5 stars (1,619 ratings)
Amazon's Choice for "Honeywell TrueHEPA"

Price: \$219.99 & FREE Shipping. Details & FREE Returns
Get \$50 off instantly: Pay \$169.99 upon approval for the Amazon Rewards Visa Card.

Color: White



Design: Purifier

- **Hepa air purifier from Honeywell:** Recommended for x-large rooms (465 square feet.) this air purifier help capture up to 99.97% of airborne particles as small as 0.3 micron, like pet dander, pollen, dust, mold & smoke. Also helps capture certain germs & odors.
- **Reduce allergens:** Do you or your kids have allergies? Do you have pets, or live with a smoker? Using an air purifier that helps remove allergens from the air may help you breathe easier, so you can enjoy sleeping & relaxing more comfortably in your home. Uses pre-filter HRC-AP1 and True HEPA filter HRF-RS.
- **Filter and circulate air 5 times an hour:** Honeywell air purifiers filter and circulate air 5 times an hour.

300 cfm of clean air delivery. Can use combination of these in several rooms - \$220

Install these inside classrooms, library etc.

The units should be installed in the **MIDDLE** of the classroom or any room near a wall on the opposite side of a window

Alternate makes are acceptable

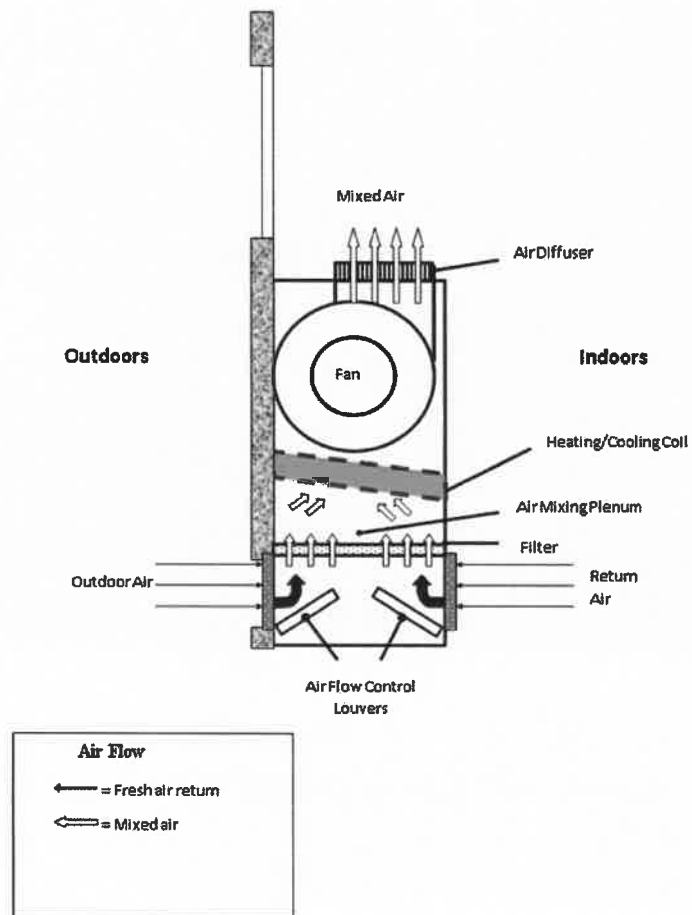
	Actual CFM	PAS 750	Honeywell 300
HES	210	1	1
MRMS	700	1	12
CES	800	1	1
MRHS	600	1	2
		4	16
	Buy some extras	5	25
		\$900	\$225
		\$4,500	\$5,625

Location and qty of HEPA filter purifiers

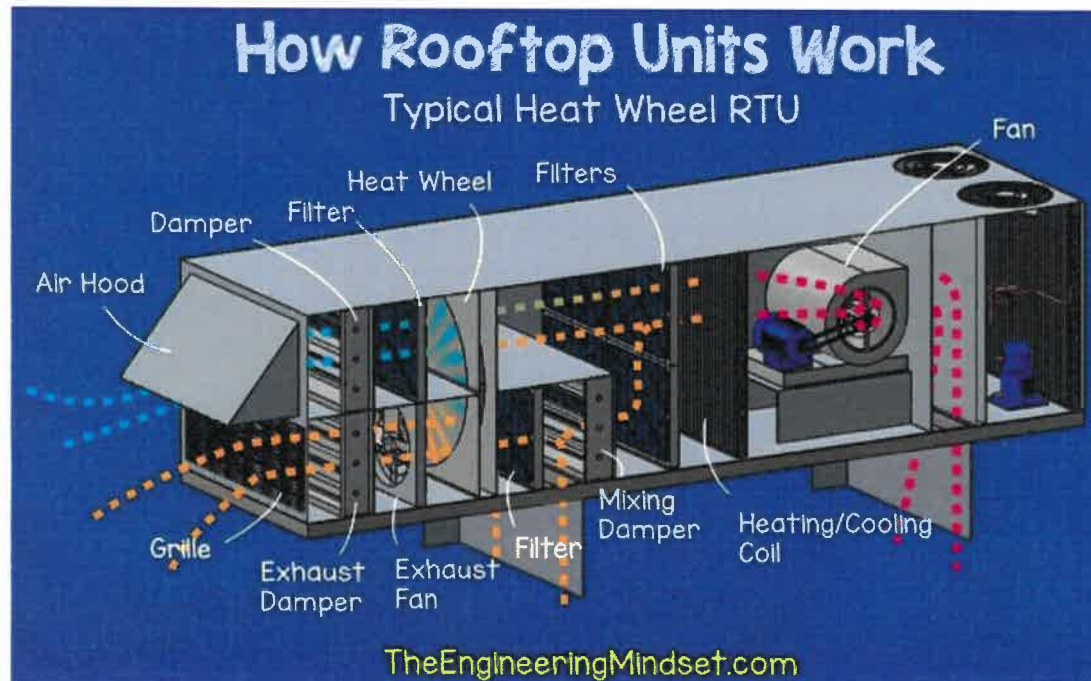
Equivalent makes are acceptable.
Please make sure that CADR (Clean Air Delivery Rate) is the CFM that is specified.

FAQ AND HOW SYSTEMS WORK

UNIT VENTILATIONS



Recirculation with Heat Wheel
- 50% outside air

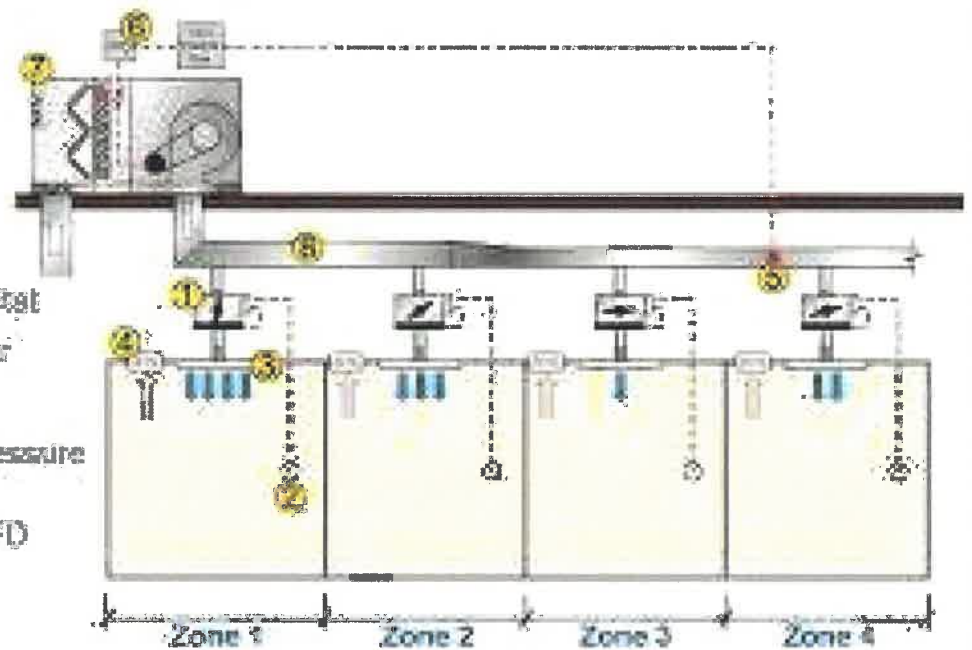


VAV systems – Offices and
admin areas – High School
classrooms.



**System
Components:**

1. VAV Box with Heating Coil
2. Zone Thermostat
3. Supply Diffuser
4. Return Grille
5. Duct Static Pressure Sensor
6. Supply Fan VFD
7. Air Handler
8. Supply Duct



FAQ

Q. I'm concerned about COVID-19 and the air quality in my work area. How do I know my work area has adequate ventilation? Contd..

4. In most cases, exhaust fans in restrooms operate continuously when buildings are occupied. Some restrooms are equipped with a wall switch operated by the occupant, in which case it's suggested to keep toilet exhaust fans operating continuously. For restroom exhaust fans to work best, it is recommended to avoid opening operable windows in restrooms and keep restroom doors closed (or mostly closed for single restrooms not in use).
5. In naturally ventilated areas, operable windows should be open while spaces are occupied.
6. In mechanically ventilated areas, operable windows may also be opened to supplement mechanical ventilation when outside temperatures are moderate.
7. When possible, keeping conference room doors open can help promote good ventilation.

FAQ

Q What is being done to building HVAC given COVID-19?

Facilities is checking HVAC systems to ensure that buildings are ready for reoccupation, including but not limited to the following:

1. Fan systems are functional and operating.
2. Central HVAC fan filters are within acceptable operating ranges and replaced as necessary.
3. Changing the filters as recommended by the manufacturer
4. Outside air ventilation rates are being increased in recirculating HVAC systems where possible.
5. Adjusting control set points to provide more ventilation
6. Running the systems 2 hours after and 1 hour before any occupancy to provide for good air changes

FAQ

Q Can every piece of HVAC equipment be replaced with MERV 13 filters?

A. Unfortunately no. If equipment is not designed for MERV 8, installing a MERV 13, will cause additional problems like bringing in lesser outdoor air ventilation and lesser cooling or heating. Most units ventilators can only take MERV 8 filters. MERV 8 are still good filters. The difference between MERV 8 and MERV 13 is the efficiency of capture between 0.5microns and 1 microns. For MERV 8 it is 40% and for MERV 13 it is about 60%. In my opinion it is better to dilute the air more if filtration cannot be changed. Bigger rooftop units generally have MERV 8 and MERV 13 filters.

FAQ

Q. In some of the classrooms, there are different types of AC units that are not connected to the larger HVAC system. For example, some classrooms have “ductless mini-splits” and some have portable air conditioners with vent hoses.

- Can you speak to best practice for these types of air conditioning units?
 - If able to use these units, is the best practice to still have an open window for outdoor air ventilation?
 - Do you know the MERV filtration level of the filters on these different types of units?
- A. If a room does not have mechanical ventilation – its ok to run the window AC units as long as the room is not crowded (no more than 2 people). For example a conference room, or teachers lounge. Recommend keeping window open for natural ventilation. If the classrooms have unit ventilators, so best for it to be running to bring in outside air. If it does not have natural ventilation or mechanical ventilation, then install HEPA air purifiers
- B. Window AC and split units have very low MERV rating. Some are just metallic filters or catch dust or smoke.
- C. If there is a room with a window AC or split unit AND there is not mechanical ventilation and you are expecting more than 2 or 3 people in that room after social distancing – then HEPA air purifiers are recommended

FAQ

- What specific criteria will be used to determine that a room, floor, or even entire building has sufficient ventilation to open safely? Will administration close a room, floor, or entire building if it does not meet that criteria?

Weekly checks of CO2 levels in classrooms will help determine adequate ventilation. If a classroom is stuffy or muggy and felt by the teacher, then facilities should be informed who should check if the outside air damper is operational. Other schools have automated systems that monitor CO2 and will ventilate properly. We are changing the set point to 900 ppm, that gives the assurance that we are over ventilating.

Carbon dioxide (CO2) is often used as an indirect measure of ventilation. When a building is occupied, the CO2 concentrations indoors are elevated by CO2 exhaled by occupants. When occupants leave and no other CO2 sources are present (e.g. people, combustion sources, etc.), the rate of decay of the CO2 concentration can be used to estimate how fast air from outdoors (at approximately 450ppm CO2) replaces the indoor volume of air.

FAQ

- Q How to improve ventilation in stairwells
- Answer: Stairwells are never ventilated unless it is a high rise. They are not designed for people to “hang out”. As long as mask is worn and people are crossing each other with contact less than 6 feet for less than a few minutes or even seconds – it is not an issue.

FAQ

Q - Effect of humidity - especially in winter

A – HVAC systems are not designed to maintain humidity in winter. ASHRAE 62.1 which applies to non-residential buildings has no lower humidity requirements at all.

- **ASHRAE standard 170 requires a minimum of 20% RH for most hospital areas. Patient rooms and nursing facilities have no minimum requirements**
- **RHEVA – European standard - Evidence does not support that moderate humidity (RH 40% -60%) will be beneficial in reducing the viability of SRAS-COV-2. Small droplets under interest(0.5 micron – 10 micron) will evaporate fast under any RH level”**