



# Malden Public Schools Indoor Air Quality Study and Recommendations

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## IAQ STUDY SUMMARY

In light of the recent ongoing health concerns worldwide, Malden Public Schools has engaged WB Engineers (WB) to analyze the existing classrooms and offices at the public schools within Malden to develop an understanding of the current HVAC system as well as explore methods to maximum the ventilation and increase Indoor Air Quality to help reduce the spread of COVID-19 within the school(s). In the attached excel file, a description of each room and associated recommendations can be found. Please note this report includes the following buildings: Early Learning Center and Beebe School.

During the study, WB focused on (2) key improvements, increased outdoor air and increased filtration, to better the indoor air quality and adhere to ASHRAE and CDC recommendations. In order to assess each room on a case by case basis, WB determined if the rooms were served by a central HVAC system (i.e. a roof top unit (RTU) or a central air handling unit (AHU)) and if they were not, if any other means of providing ventilation air in the space existed(i.e. unit ventilators, operable windows, or providing portable air filters). A complete breakdown of our findings can be found in the attached excel file. Below is a brief summary of the excel file. Additionally, please refer to Appendix A for more information regarding the approach to this study.

The Early Learning Center is mainly served by heating only unit ventilators, exhaust air fans, and operable windows. Each unit ventilator did have an outdoor air intake and a method of filtration. The Beebe School is served by central HVAC systems via several rooftop units (RTUs). Both buildings discussed in this report are tied into a Building Management System (BMS).

WB recommends that for all unit ventilators the filters be replaced with new and be changed on a regular basis. Additionally, the exhaust air fans speed shall be increased if possible, to account for larger amounts of OA being brought in by the unit ventilators. For outdoor air recommendations for typical school spaces please refer to Table 1 below. Additional outdoor air rates and code requirements can be found in Appendix B.

To ensure proper function of the HVAC systems providing ventilation fresh air to the school(s), it is important to refrain from tampering with the thermostats/temperature sensors located within the classrooms. It is also important to ensure the univents grille discharge is free from obstructions (e.g. books, supplies, decorations, etc.).

	Code Required OA (CFM/SF)		Covid-19 Recommendation (CFM/SF)	
	50% Occupancy	100% Occupancy	50% Occupancy	100% Occupancy
Auditoriums	0.44	0.81	0.57	1.05
Classrooms	0.30	0.47	0.38	0.61
Day Care	0.31	0.43	0.40	0.56
Media Center	0.25	0.37	0.32	0.48
Music	0.24	0.41	0.31	0.53
Science Lab	0.31	0.43	0.40	0.56
Wood/Metal Shops	0.28	0.38	0.36	0.49

Table 1: Outdoor air rates per space type within a school based on Table 2 (in Appendix B)

Please note that along with this, WB also recommends opening the windows during the weather permitting months, even if the room is served by a unit ventilator. When the weather prohibits open windows (i.e. rain, snow, colder temperatures), portable air cleaners may be used to provide added

filtration and air changes even in the rooms with unit ventilators. Please note that for all the spaces served by univents, or heating only AHUs, WB recommends running these units whenever the building is occupied, even if the heating coil is not being utilized, in order to bring in ventilation air.

### **Early Learning Center:**

The Early Learning Center is a 2-story 52,000 SF early PreK to K school. The building is mainly served by unit ventilators (univents) with a central exhaust system. The univents have operating outdoor air dampers and heating coils to provide ventilation and heat to the classrooms. Additionally, each room has an exhaust grille (to ensure proper air changes) and operable windows. Playroom #1 and Playroom #2 are served by dedicated Air Handling Units (AHU). The AHUs have directly ducted outdoor air for ventilation and provide comfort heating and cooling.

Based on this system type, WB recommends opening all operable windows and opening the O/A dampers for the univents and AHU's alike. Additionally, all exhaust fans (and univents) shall operate when the building is occupied. When opening windows is not feasible (i.e. outdoor conditions), WB recommends opening the O/A dampers for the univents and AHU's. For additional measure, a portable air cleaner may be provided (Refer to Table 3 in Appendix C for more information). For rooms that do not have operable windows, WB recommends providing a portable air cleaner whenever this room is occupied or planning to be in use.

### **Beebe School:**

The Beebe School is a 3-story 152,400 SF K through 8 school. The entirety of the Beebe School is served by a central HVAC system via several Roof Top Units (RTU) that provide ventilation fresh air to the school. All RTUs and associated equipment appear to be in excellent condition and all RTUs are provided with MERV 13 filters. All perimeter spaces also have operable windows. Perimeter vertical and horizontal Fan Coil Units (FCUs) and Fin Tube Radiators (FTR) are also provided for comfort heating and cooling (these units do NOT provide ventilation fresh air).

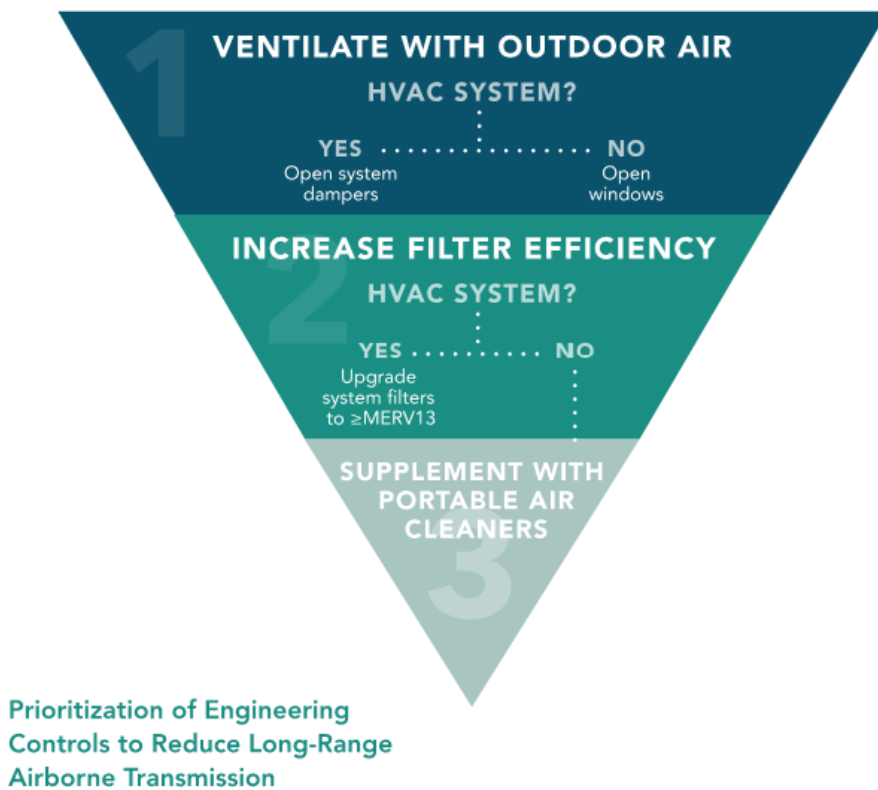
Based on this system type, WB recommends increasing the outdoor air (O/A) damper on all RTUs to maximize the amount of ventilation fresh air provided to the school spaces and continuing the use of MERV 13 filters for the RTUs. Further, WB recommends opening all windows in rooms that have them, weather permitting. When opening windows is not feasible (i.e. outdoor conditions), WB recommends maintaining the O/A damper in the increased position for all RTUs to maximize the amount of ventilation fresh air provided to the school spaces. WB recommends the O/A damper position to be 100% open whenever possible and adjusted accordingly for temperature conditions. WB recommends maintaining a minimum damper position of 30% open. For additional measure, a portable air cleaner may be provided (Refer to Table 3 in Appendix C for more information).

**APPENDICES**

**Appendix A:**

**HEALTHY BUILDINGS** 

Healthy building strategies that improve air quality and clean surfaces should be incorporated as part of a layered defense against COVID-19. For improving indoor air quality, we recommend prioritizing control strategies – ventilation, filtration, supplemental air cleaning – and verifying system performance regularly. For more detailed and technical guidance, we recommend reviewing the materials produced by the ASHRAE Epidemic Task Force. Schools should work with facilities managers and outside professionals to tailor these recommendations for their unique building systems.



**Figure 1: Harvard School of Public Health’s healthy buildings summary.**

**Appendix B:**

**TABLE 403.3.1.1  
MINIMUM VENTILATION RATES**

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT <sup>2</sup> <sup>a</sup>	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, <i>R<sub>p</sub></i> CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, <i>R<sub>a</sub></i> CFM/FT <sup>2</sup> <sup>a</sup>
<b>Education</b>			
Art classroom <sup>g</sup>	20	10	0.18
Auditoriums	150	5	0.06
Classrooms (ages 5-8)	25	10	0.12
Classrooms (age 9 plus)	35	10	0.12
Computer lab	25	10	0.12
Corridors (see public spaces)	—	—	—
Day care (through age 4)	25	10	0.18
Lecture classroom	65	7.5	0.06
Lecture hall (fixed seats)	150	7.5	0.06
Locker/dressing rooms <sup>g</sup>	—	—	—
Media center	25	10	0.12
Multiuse assembly	100	7.5	0.06
Music/theater/dance	35	10	0.06
Science laboratories <sup>g</sup>	25	10	0.18
Smoking lounges <sup>b</sup>	70	60	—
Sports locker rooms <sup>g</sup>	—	—	—
Wood/metal shops <sup>g</sup>	20	10	0.18

**Table 2: IMC 2015 Table 403.3.1.1 Minimum Ventilation Rates**

### Appendix C:

Air Cleaner	SF Range (SF)	Typical Room Height	Air Cleaner Flow rate (CFM)	Air Change Rate (ACH)	Price Point
Blueair Classic 205	Up to 250	10	200	4.8	\$350
Whirlpool WPPRO2000	250-500	10	328	3.9	\$430
Blueair Classic 605	500-900	10	500	3.3	\$830
Blueair PRO L	500-900	10	630	4.2	\$980
Carrier FN1AAF	Up to 3000 SF	10	1500	3.0	Quote from Manuf. Required

**Table 3: Recommended portable air cleaners and associated air change rates.**

Notes:

1. Calculated air change rates were calculated based on max SF range and the typical room height of 10 ft. Actual room heights and square footage may yield a better air change rate than calculated above. Below is the equation used to calculate air changes per hour (ACH).

$$ACH = \frac{CFM \times 60}{Area \times Height_{ceiling}}$$

2. As the air cleaners get larger in size (size of the room increases) they do become louder. The Carrier FN1AAF may not be suitable for a classroom environment but rather a gymnasium or cafeteria.
3. The above units are some of the recommended air cleaners but not all, there are a variety that will work in these circumstances.