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August 27, 2020

Ramapo-Indian Hills Regional HS District
131 Yawpo Avenue
Oakland, NJ 07436

Attention: Mr. Paulinus Egu,
Coordinator of Facilities & Operations

T #201-416-8100 (Ext. 3816)
Via E-Mail: pegu@rih.org

Subject: Ramapo-Indian Hills Reg. HS Dist.
HVAC Analysis & Report for
Ramapo HS & Indian Hills HS
LAN Job #2.2937.99

Dear Mr. Egu:

LAN Associates, Engineering, Planning, Architecture, Surveying, Inc. (LAN) was retained by the Ramapo-Indian Hills Regional High School District (RIH) to review and analyze the existing heating and ventilation (HV) and heating, ventilation, and air conditioning (cooling) (HVAC) systems at Ramapo HS and Indian Hills HS to evaluate their ability to increase ventilation and improve filtration as it relates to the latest recommendations for re-opening schools.

LAN surveyed the equipment in both schools in conjunction with a Testing and Balancing (TAB) contractor to review supply and outside air volumetric flow rates, setpoints of the Building Automation System (BAS), and overall operation of the HVAC systems. Detailed information of these site surveys can be found in Attachment #1 (RHS) and #2 (IHHS) for all equipment. The survey revealed that all equipment is fully operational and now running with code compliant amounts outside air, Discussions with maintenance staff revealed that filters are changed routinely.

1.0 INTRODUCTION:

The latest recommendations for HVAC systems from the Center for Disease Control (CDC) and the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) are as follows:

1. Dilute - Increase outdoor air ventilation as much as the HVAC system will allow:

    a. For heating and ventilation (HV) only systems (no cooling or humidity control), run the systems with as much outdoor air as possible (up to 100%) depending on the season/outdoor air temperature.

    b. For systems with cooling, increase outdoor air only to a point where you are able to maintain space temperature (70°F - 75°F) and humidity (40%-60%RH).

    c. Humidity levels of 40-60% decreases virus survivability, transmissibility and host infectivity.

2. Operate HV/HVAC systems at 100% outdoor air (economizer mode), when possible. Refer to #1.

3. Keep HV/HVAC systems running 24/7 with the outdoor air open ("Occupied Mode", no night setback) to further dilute any pathogens in the air while maintaining temperature and humidity levels in the space.

4. If introducing additional outdoor air is not feasible while occupants are in the space, perform a pre-occupancy and post-occupancy purge to flush the building with outside air. This should be done for two (2) hours before and after occupancy. Allow enough time after the morning purge to let the HVAC system return to normal operation and temperature set points before occupants arrive, this could take up to an hour or longer.

5. Keep local exhaust (bathrooms, kitchens, etc.) running 24/7.

6. Bypass energy recovery ventilation if possible.

7. Disable CO2 Demand Control Ventilation (DCV). CO2 DCV runs HVAC equipment at its lowest outside air flow rate based on occupancy levels within the space. Disable CO2 DCV and introduce as much outside air as possible to conform to Item #1 above.

8. Improve particulate filters to MERV-13, or better, on air handling systems that can handle the increased efficiency and the higher pressure drop that comes with tighter filtration. (COVID-19 is 0.125 micron, but travels in respiratory droplets that are 1 micrometer or larger.)

    a. MERV-8 (standard) = 20% efficient at capturing particles 1 to 3 micron.

    b. MERV-10 = 65% efficient at capturing particles 1 to 3 micron.

    c. MERV-13 = 85% efficient at capturing particles 1 to 3 micron.

    d. MERV-14 = 90% efficient at capturing particles 1 to 3 micron.

9. Add air purification such as UV-C or bi-polar ionization (BPI).

    a. This equipment cleans the air but does not increase pressure drops to the fan system.

    b. UV-C and some BPI require additional electrical feeds. Some BPI can be powered from the air handling equipment.

    c. MERV-8 + BPI = MERV-13. BPI causes particles in the air to agglomerate allowing them to be captured by lower MERV rated filters.

    d. Bi-Polar Ionization's added benefits:

        i. Pathogens: kills virus, mold, fungus, bacteria in the duct & in the space by robbing them of life-sustaining hydrogen.

        ii. Allergens: ions clump particles together forming larger particles to be filtered.

iii. VOCs & Odors: breakdown with electron volt potential to harmless compounds like oxygen, carbon dioxide, nitrogen, and water.

10. For new HVAC systems, HVAC replacements, and renovations, consider Dedicated Outdoor Air Systems (DOAS, no mixing of air with other spaces) or Displacement Ventilation (no mixing of in-room air).

2. HVAC RECOMMENDATIONS

Both Ramapo HS and Indian Hills HS have similar types of HV/HVAC equipment. During the site survey with the TAB contractor all equipment was tested and re-balanced to their original design settings for code compliant outdoor air. Both schools have a robust BAS where the damper that controls the amount of outside air being brought in through the HV/HVAC equipment can be easily and quickly adjusted from any web-enabled device for most equipment. It was found that a several pieces of equipment do not have this operability through the BAS, but these units were set to the design flow rates and set during the site survey. Where the outside air damper is not adjustable through the BAS, these units should run longer hours, up to 24/7 to help dilute any pathogens in the air.

Below is a list of recommendations to increase ventilation and filtration for the various typical pieces of HV/HVAC equipment at each school. Please refer to Attachment #1 & #2 for a full list of all HV/HVAC equipment at each school.

1. Unit Ventilator (UV; HV Only)

Ventilation: Outside air to the UVs has been set to the design setpoint, see Attachments #1 & #2 for settings and CFM. The amount of outside air to these classrooms can quickly and easily be adjusted through the BAS to bring in more outside air by adjusting the outside air damper opening percentage. Since there is no cooling in these spaces, the outside air damper can be opened to 100% to bring in more fresh air as long as outdoor conditions permit. The UVs can run with increased outside air deeper into the colder months since the heating coils are sized to handle outside air temperatures down to approximately 10°F. As the outdoor temperature begins to drop, monitor the UV leaving air temperature and space temperature and reset the outside air damper to its previous set point to avoid cold space temperatures and freezing coils. All outside air setpoints should be recorded prior to making any changes. If it is found that increasing the amount of outside air and maintaining temperature set points is not achievable, the space should be purged with fresh air before and after students and staff occupy the space for the day. This can be done by opening the outside air damper to 100%, opening windows, running the associated general exhaust fan at 100% for two (2) hours before and after the space is occupied. Purging prior to occupancy should be done and completed with enough time to reset system parameters to achieve the desired space temperature before students and staff arrive.

Filtration: The existing unit ventilators have MERV-8 filters and are not capable of increased filter efficiency without having a negative impact on their ability to move air. Filters should be replaced routinely but it is not recommended to increase filter efficiency in these units without checking with the manufacturer.

2. Unit Ventilator (UV; HVAC)

Ventilation: Outside air to the UVs has been set to the design setpoint, see Attachments #1 & #2 for settings and CFM. The amount of outside air to these classrooms can quickly and easily be adjusted through the BAS to bring in more outside air by adjusting the outside air damper open percentage. Since these UVs do provide cooling, it is recommended to increase the amount of outside air incrementally above the minimum setpoint to a point where you are still able to maintain a temperature between 72°F-75°F and humidity in the space between 40%-60%. If the temperature or humidity begins to fall out of these ranges, reset the outside air to its previous set point. All outside air setpoints should be recorded prior to making any changes. If it is found that

increasing the amount of outside air and maintaining these temperature and humidity set points is not achievable, the space should be purged with fresh air before and after students and staff occupy the space for the day. This can be done by opening the outside air dampers to 100%, running the general exhaust fan at 100% and leaving the cooling off during this purge time. Purging prior to occupancy should be done and completed with enough time to reset system parameters and turn cooling on to achieve the desired space temperature and humidity before students and staff arrive.

Filtration: The existing unit ventilators are not capable of increased filter efficiency without having a negative impact on their ability to move air. Filters should be replaced routinely but it is not recommended to increase filter efficiency in these units without checking with the manufacturer.

3. Air Handling Unit (AHU; HV Only)

Ventilation: Outside air to the AHUs has been set to the design setpoint, see Attachments #1 & #2 for settings and CFM. The amount of outside air to spaces that many of these units serve can quickly and easily be adjusted through the BAS to bring in more outside air by adjusting the outside air damper opening percentage. Some of the smaller fan coil units (FCU) only have two position dampers and cannot be adjusted between open to design setpoint or off. These are typically small spaces and should remain open to the setpoint 24/7. Since there is no cooling in these spaces, the outside air damper can be opened to 100% to bring in more fresh air as long as outdoor conditions permit. The AHUs can run with increased outside air deeper into the colder months since the heating coils are sized to handle outside air temperatures down to approximately 10°F. As the outdoor temperature begins to drop, monitor the AHU leaving air temperature and space temperature and reset the outside air damper to its previous set point to avoid cold space temperatures and freezing coils. All outside air setpoints should be recorded prior to making any changes. If it is found that increasing the amount of outside air and maintaining temperature set points is not achievable, the space should be purged with fresh air before and after students and staff occupy the space for the day. This can be done by opening the outside air damper to 100%, opening windows, running the associated general exhaust fan at 100% for two (2) hours before and after the space is occupied. Purging prior to occupancy should be done and completed with enough time to reset system parameters to achieve the desired space temperature before students and staff arrive.

Filtration: The existing AHUs have MERV-8 filters but may be able to handle increased filter efficiency. If filters are increased from a MERV-8 to a MERV-13, this should be done with a TAB contractor to make any necessary adjustments to the fans, motors, belts, etc. to ensure the design airflow is maintained. The AHU CFM, motor RPM, and electrical ratings should be measured before and after the filter change. Increasing filter efficiency will increase the power consumption on the fan.

4. Air Handling Unit (AHU; HVAC)

Ventilation: Outside air to the AHUs has been set to the design setpoint, see Attachments #1 & #2 for settings and CFM. The amount of outside air to the spaces these units serve can quickly and easily be adjusted through the BAS to bring in more outside air by adjusting the outside air damper open percentage. Some of the smaller fan coil units (FCU) only have two position dampers and cannot be adjusted between open to design setpoint or off. These are typically small spaces and should remain open to the setpoint 24/7. Since these AHUs do provide cooling, it is recommended to increase the amount of outside air incrementally above the minimum setpoint to a point where you are still able to maintain a temperature between 72°F-75°F and humidity in the space between 40%-60%. If the temperature or humidity begins to fall out of these ranges, reset the outside air to its previous set point. All outside air setpoints should be recorded prior to making any changes. If it is found that increasing the amount of outside air and maintaining these temperature and humidity set points is not achievable, the space should be purged with fresh air before and after students and staff occupy the space for the day. This can

be done by opening the outside air dampers to 100%, running the general exhaust fan at 100% and leaving the cooling off during this purge time. Purging prior to occupancy should be done and completed with enough time to reset system parameters and turn cooling on to achieve the desired space temperature and humidity before students and staff arrive.

Filtration: The existing AHUs have MERV-8 filters but may be able to handle increased filter efficiency. If filters are increased from a MERV-8 to a MERV-13, this should be done with a TAB contractor to make any necessary adjustments to the fans, motors, belts, etc. to ensure the design airflow is maintained. The AHU CFM, air velocity, motor RPM, and electrical ratings should be measured before and after the filter change. Increasing filter efficiency will increase the power consumption on the fan. If the increased filter efficiency results in too slow of air movement, DX coils can freeze.

5. Roof Top Unit (RTU; HV Only)

Ventilation: Outside air to the RTUs has been set to the design setpoint, see Attachments #1 & #2 for settings and CFM. Many of the RTUs have adjustable outside air dampers through the BAS and the amount of outside air to spaces these units serve can quickly and easily be adjusted to bring in more outside air by adjusting the outside air damper opening percentage. Some units do not have adjustable outside air dampers through the BAS and are either open or closed depending on the BAS mode of occupied or unoccupied. These units should be run in occupied mode 24/7 to continually flush the space and dilute the air. Since there is no cooling in these spaces, the outside air damper can be opened to 100% (for units with adjustable dampers) to bring in more fresh air as long as outdoor conditions permit. The RTUs can run with increased outside air deeper into the colder months since the gas furnaces are sized to handle outside air temperatures down to approximately 10°F. As the outdoor temperature begins to drop, monitor the RTU leaving air temperature and space temperature and reset the outside air damper to its previous set point to avoid cold space temperatures. All outside air setpoints should be recorded prior to making any changes. If it is found that increasing the amount of outside air and maintaining temperature set points is not achievable, the space should be purged with fresh air before and after students and staff occupy the space for the day. This can be done by opening the outside air damper to 100% (for units with adjustable dampers), opening windows, running the associated general exhaust fan or RTU exhaust fan at 100% (economizer mode) for two (2) hours before and after the space is occupied. Purging prior to occupancy should be done and completed with enough time to reset system parameters to achieve the desired space temperature before students and staff arrive.

Filtration: The existing RTUs have MERV-8 filters but may be able to handle increased filter efficiency. If filters are increased from a MERV-8 to a MERV-13, this should be done with a TAB contractor to make any necessary adjustments to the fans, motors, belts, etc. to ensure the design airflow is maintained. The RTU CFM, motor RPM, and electrical ratings should be measured before and after the filter change. Increasing filter efficiency will increase the power consumption on the fan.

6. Roof Top Unit (RTU; HVAC)

Ventilation: Outside air to the RTUs has been set to the design setpoint, see Attachments #1 & #2 for settings and CFM. Many of the RTUs have adjustable outside air dampers through the BAS and the amount of outside air to spaces these units serve can quickly and easily be adjusted to bring in more outside air by adjusting the outside air damper opening percentage. Some units do not have adjustable outside air dampers through the BAS and are either open or closed depending on the BAS mode of occupied or unoccupied. These units should be run in occupied mode 24/7 to continually flush the space and dilute the air. Since these RTUs do provide cooling, it is recommended to increase the amount of outside air incrementally above the minimum setpoint to a point where you are still able to maintain a temperature between 72°F-75°F and humidity in the space between 40%-60%. If the temperature or humidity begins to fall out of these

ranges, reset the outside air to its previous set point. All outside air setpoints should be recorded prior to making any changes. If it is found that increasing the amount of outside air and maintaining these temperature and humidity set points is not achievable, the space should be purged with fresh air before and after students and staff occupy the space for the day. This can be done by opening the outside air dampers to 100% (for units with adjustable dampers), running the general exhaust fan or integral RTU exhaust fan at 100% (economizer mode) and leaving the cooling off during this purge time. Purging prior to occupancy should be done and completed with enough time to reset system parameters and turn cooling on to achieve the desired space temperature and humidity before students and staff arrive.

Filtration: The existing RTUs have MERV-8 filters but may be able to handle increased filter efficiency. If filters are increased from a MERV-8 to a MERV-13, this should be done with a TAB contractor to make any necessary adjustments to the fans, motors, belts, etc. to ensure the design airflow is maintained. The RTU CFM, air velocity, motor RPM, and electrical ratings should be measured before and after the filter change. Increasing filter efficiency will increase the power consumption on the fan. If the increased filter efficiency results in too slow of air movement, DX coils can freeze.

7. Windows

Windows in both schools are operable and can be opened while the HV/HVAC system in the space is operating. For spaces with cooling, opening windows should be only if the HVAC system serving the space is able to maintain the temperature and humidity in the space. Windows should be opened during any purging of the space. The opening of windows will be dictated by the outside air temperature.

3.0 SUMMARY:

In summary, and to reiterate the recommendations in the Introduction:

1. Bring in more fresh air through the HVAC system where possible. Since most spaces have cooling, only increase outside air to a point where you are able to maintain space temperature between 70°F-75°F and humidity between 40%-60%. This is achievable through the BAS for schools that have it. Outside air should be increased in small increments to a point where you are able to bring in more fresh air and maintain the temperature and humidity required in the space.

2. Run systems 24/7 in “Occupied” mode which will provide fresh air to spaces through the HVAC system to further dilute any pathogens. This can be done with the preset outside air amount, or with the increased amount of outside air when possible.

3. For spaces with no mechanical ventilation or as an added step to turn the air over in the space, purge the facility prior to occupants arriving and after they leave for the day to dilute and eliminate any pathogens in the space. Purging with 100% outside should be done when outside conditions allow it as to not bring in too much humidity inside the building, or in the future not to freeze spaces in the winter.

4. Increase filtration on HVAC equipment that can handle it. Unit ventilators and ductless AC units cannot accommodate higher filter efficiency. Larger air handling units and roof top units should be able to increase filter efficiency to a MERV-13, but this should be done with caution as this higher filter efficiency will restrict the airflow. Air flow readings should be taken before and after filter improvements and any adjustments to the fan, motors, or pulleys should be made to overcome this added pressure drop. Increasing filter efficiency will have a higher electrical draw on the system.

5. If any HVAC equipment has CO2 Demand Control Ventilation (DCV), this should be disabled. CO2 DCV is typically found on HVAC equipment serving large spaces that do not see full occupancy frequently, e.g. Gymnasiums, Auditoriums, Media Centers, Cafeterias. CO2 DCV runs HVAC equipment at its lowest outside air flow rate based on occupancy levels within the space. Disable CO2 DCV and introduce as much outside air as possible while maintain space temperature and humidity requirements.

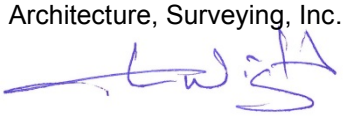
6. It should be noted that any recommendations listed above for increasing outside air, running systems 24/7, increasing filter efficiency, disabling CO2 DCV, bypassing energy recovery units, etc. which are achievable with existing equipment and controls already in place will come with increased energy consumption and in turn increased utility bills.

7. Air purification devices such as UV-C or Bipolar Ionization, can be added to HVAC equipment to further treat and clean the air in the spaces.

After you have had a chance to review this report, should you have any questions or comments, please do not hesitate to contact us.

Respectfully submitted,

LAN Associates, Engineering, Planning, Architecture, Surveying, Inc. (LAN)



Thomas Wighard, PE, HBDP, LEED AP BD+C
Vice President

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Attachments: 1 – Ramapo HS HVAC Equipment Operation Log
2 – Indian Hills HS HVAC Equipment Operation Log

cc: Mr. Frank Ceurvels, via E-Mail (fceurvels@rih.org)
File #2.2937.99

Unit Name & Location	Pretest Damper Position Setpoint	Control To Damper	Adjustable Damper or On/Off	Design SA CFM	Design OA CFM	Tested OA CFM	Balanced Damper Position for Design OA	HV	HVAC
AHU-1 Lower Gym	10%	Yes D.C.V.	ADJUSTABLE	6500	1000		5%	X	
AHU-2 Lower Gym	10%	Yes D.C.V.	ADJUSTABLE	6500	1000	1139	5%	X	
AHU-3 Locker Rooms	0%	Yes D.C.V.	ADJUSTABLE	2800	900	825	15%	X	
FCU-1B Auditorium Corridor	N/A	100% Outside Air	ON/OFF	1400	700	110	ON	X	
FCU-2B Auditorium Corridor	N/A	100% Outside Air	ON/OFF	1400	700	105	ON	X	
FCU-3B Child Dev.	5%	Yes	ADJUSTABLE	3225	900/3225	873	70%	X	
FCU-4B Maintenance Corridor	N/A	100% Outside Air	ON/OFF	1400	0		ON	X	
FCU-1 Office 219	N/A	100% Outside Air	ON/OFF	400	100	94	ON	X	
FCU-2 Office 222B	N/A	100% Outside Air	ON/OFF	200	100	67	ON	X	
HV-1D Boys Locker Room	N/A	No	ON/OFF	7000	3500	0	FULL CLOSED - UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT	X	
HV-2D Girls Locker Room	N/A	No	ADJUSTABLE	7000	3500		UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT	X	
HV-3D Gym	N/A	No	ADJUSTABLE	11000	5500	0	FULL CLOSED - UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT	X	
HV-4D Gym	N/A	No	ADJUSTABLE	11000	5500	0	FULL CLOSED - UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT	X	
RTU-1 Main Office (Integration)	10%	Yes	ADJUSTABLE	2400	240	337	10%		X
RTU-1A Auditorium	3%	Yes	ADJUSTABLE	25000	10000	10276	30%		X
RTU-1H Old Science Wing	7%	Yes	ADJUSTABLE	7000	4240	4122	50%		X
RTU-2N Cafeteria	N/A	No	ADJUSTABLE	10000	3000	1865	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)		X
RTU-2A ABOVE AUDITORIUM			ADJUSTABLE	10000	4000	4097	55%		X
RTU-3 Faculty Lounge (Integration)	10%	Yes	ADJUSTABLE	1400	160	821	25%		X
RTU-3A TV Studio	0%	Note: Valuable equipment in this roo	ADJUSTABLE	8100	3200	3162	50%		X
RTU-1C Library	N/A	No	ON/OFF	10085	2000		UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT		X
RTU-1D Dance Rm-900	No	No	ADJUSTABLE	1800	500	505	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)		X
RTU-2D Nurse & AD	N/A	No	ADJUSTABLE	4800	1000	1016	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)		X
RTU-2C CST	N/A	No	ADJUSTABLE	4400	1000		FULL CLOSED - UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT		X
RTU-3C Guidance	N/A	No	ADJUSTABLE	3185	840	815	18%		X
RTU-3D Fitness 909	N/A	No	ADJUSTABLE	4950	1000	0	FULL CLOSED - UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT		X
RTU-1-2A Back 700/800 Wing	N/A	Yes FAI Setpoint = 2,000 CFM	ADJUSTABLE	26000	9000	9800	85%		X
RTU-2-2A Front 700/800 Wing	N/A	Yes FAI Setpoint = 4,000 CFM	ADJUSTABLE	28000	10000	10318	50%		X
RTU Rooms 209/211	N/A	No	ADJUSTABLE			725	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)		X
RTU-4C Rooms 216/217	N/A	No	ON/OFF	3295	1000		ON		X
UV-1 Team Locker Room	10%	Yes	ADJUSTABLE	1500	400	382*	55%	X	
UV-2 Team Locker Room	10%	Yes	ADJUSTABLE	1500	400	382*	55%	X	
UV-2 Faculty Room	10%	Yes	ADJUSTABLE	1500	450	382*	55%		X
UV-1C Rm-502 (UV with DX Cooling)	5%	Yes	ADJUSTABLE	1360	390	382	40%		X
UV-2C Rm-504	5%	Yes	ADJUSTABLE	1360	390	382*	55%		X
UV Rm-101	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-102	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-103	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-104	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-105	10%	Yes	ADJUSTABLE	1250	375	340*	55%	X	
UV Rm-106	10%	Yes	ADJUSTABLE	1250	375	340*	55%	X	
UV Rm-107	10%	Yes	ADJUSTABLE	1250	375	340*	55%	X	
UV Rm-108	10%	Yes	ADJUSTABLE	1250	375	340*	55%	X	
UV Rm-110	10%	Yes	ADJUSTABLE	1500	375	382*	55%	X	
UV Rm-112	10%	Yes	ADJUSTABLE	750	375	358	80%	X	
UV Rm-212	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-213	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-214	10%	Yes	ADJUSTABLE	750	375	358*	80%	X	
UV Rm-215	10%	Yes	ADJUSTABLE	1000	375	399	55%	X	
UV Rm-217B	10%	Yes	ADJUSTABLE	500	125	135	55%	X	
UV Rm-218	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-220	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-221	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-222	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-223	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	

Unit Name & Location	Pretest Damper Position Setpoint	Control To Damper	Adjustable Damper or On/Off	Design SA CFM	Design OA CFM	Tested OA CFM	Balanced Damper Position for Design OA	HV	HVAC
UV Rm-224	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-225	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-227	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-301	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-303	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-304	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-305	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-306	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-307	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-308	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-309	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-310	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-311	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-312	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-313	10%	Yes	ADJUSTABLE	1250	375	340	55%	X	
UV Rm-314	10%	Yes	ADJUSTABLE	1000	375	373	55%	X	
UV Rm-315	10%	Yes	ADJUSTABLE	1500	375	377	55%	X	
UV Rm-316	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-318	10%	Yes	ADJUSTABLE	1250	375	340*	55%	X	
UV Rm-320	10%	Yes	ADJUSTABLE	1500	375	382*	55%	X	
UV Rm-401 (High Wall Mounted)	10%	Yes	ADJUSTABLE	1500	375	387	55%	X	
UV Rm-402			ADJUSTABLE	1250	375	340*	55%	X	
UV Rm-407			ADJUSTABLE	1250	375	340*	55%	X	
UV Rm-501	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-503	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-505	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-506	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-507	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-601	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-602	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-603	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-604	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-605	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-606	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-607	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	
UV Rm-608	10%	Yes	ADJUSTABLE	1000	375	386*	55%	X	

NOTES:
1. **Control to Damper = Point is mapped to the controller to send a signal to the damper.**
2. **N/A = Not Available**
3. **D.C.V. = Demand Control Ventilation**
4. *** = The CFM for each typerof UV was tested; OA CFM for similar typical units is assumed to be the same or an average of the same.**
5. **Damper Position % is not the % of outside air CFM. This is the physical percentage that a mechanical damper is open.**

Unit Name & Location	Pretest Damper Position Setpoint	Control to Damper	Adjustable Damper or On/Off	Design SA CFM	Design OA CFM	Tested OA CFM	Balanced Damper Position for Design OA	HV	HVAC	VAC
AC-1 (ROOF "RTU-20") BOE Suite	5%	Yes	ADJUSTABLE	11000	2200	2400	20%		X	
AC-2 (ROOF) Tech & Woodshop	5%	Yes	ADJUSTABLE	6300	3200/1400	1366	45%		X	
AC-3 (ROOF) Rm-406	0%	Yes	ADJUSTABLE	2500	460	845	30%		X	
AHU-1 SGI / Office 502	7%	Yes	ADJUSTABLE	800	200	24	100%		X	
AHU-2 Teacher Resource	7%	Yes	ADJUSTABLE	600	180	229	60%		X	
AHU-1N Auditorium	10%	Yes	ADJUSTABLE	18000	12000	-	UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT		X	
AHU-2N Stage	N/A	100 % Outside Air	ON/OFF	1425	1425	1400	ON		X	
AHU-1C Cafeteria Center	30%	Yes	ADJUSTABLE	7000/10500	3600/10500	6878	100%	X		
AHU-2C Cafeteria South	30%	Yes	ADJUSTABLE	2400	800	-	UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT	X		
AHU-3C Cafeteria North	30%	Yes	ADJUSTABLE	2400	800	780	30%	X		
FC-1 Little Theater	N/A	100% Outside Air	ON/OFF	1500	325	469	ON	X		
FC-2 Little Theater	N/A	100% Outside Air	ADJUSTABLE	1500	325		UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT	X		
FC-3 Little Theater	N/A	100% Outside Air	ON/OFF	1500	325	407	ON	X		
HV-2 (ROOF) Home Ec	N/A	No Damper Control	ADJUSTABLE	5700	5700	-	UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT	X		
HV-3 Home Economics	10%	Yes	ADJUSTABLE	4400	1100	2737	100%	X		
HV-9 Upper Gym	N/A	Yes	ADJUSTABLE	20000	20000/10000/0	9252	100%	X		
HV-10 Trainer	10%	Yes	ADJUSTABLE	3500	3500			X		
HV-11 Boys Locker Room	10%	Yes	ADJUSTABLE	3500	3500			X		
HV-12 Team Room	10%	Yes	ADJUSTABLE	4500	4500			X		
MUA for Hoods (CEILING) Rooms 805 & 805A	N/A	100% Outside Air	ADJUSTABLE	-	-	FAI LOUVER	50%	X		
RTU-1 Science Wing	7%	Yes	ADJUSTABLE	10400	4040	3967	52%		X	
RTU-1 Nurse (Integration)	10%	Yes	ADJUSTABLE	1600	300				X	
RTU-1G Guidance	10%	Yes	ADJUSTABLE	3900	390		UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT		X	
RTU-2 Conference (Integration)	10%	Yes	ADJUSTABLE	1600	500				X	
RTU-2A LL Science Wing	10%	Yes	ADJUSTABLE	9025	3900	3935			X	
RTU-2M Main Office	5%	Yes	ADJUSTABLE	1700	170	187	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)		X	
RTU-3 Rooms 101/103	N/A	No Damper Control	ADJUSTABLE	2400	800	770	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)			X
RTU-3 Faculty Lounge	10%	Yes	ADJUSTABLE	2400	600	619				X
RTU-3 Aux Gym	0%	Yes D.C.V.	ADJUSTABLE	10000	1500	3900	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)	X		
RTU-4 Science Wing	5%	Yes	ADJUSTABLE	4550	3000	3615	65%		X	
RTU-4 Weight / Locker Rooms	0%	Yes D.C.V.	ADJUSTABLE	10000	5000			X		
RTU-5 Science Wing	15%	Yes	ADJUSTABLE	4550	3000	2950	60%		X	
RTU-5 Rooms 600 / 800 (Integration)	0%	Yes	ADJUSTABLE	2000	710				X	
RTU-6 CST	N/A	No Damper Control	ADJUSTABLE	2525	830	863	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)			X
RTU-6 Music 068	10%	Yes	ADJUSTABLE	5400	1000			X		
RTU-8 Bio Labs	0%	Yes	ADJUSTABLE	3300	2000	1914	75%		X	
RTU-9 Bio / Chemistry Labs	N/A	No Damper Control	ADJUSTABLE	3000	1230	-	UNIT OPERATIONAL - NOT ACCESSIBLE AT TIME OF VISIT			X
RTU-10 Main & LL Labs	7%	Yes	ADJUSTABLE	3700	1100				X	
RTU-11 Library	N/A	No Damper Control	ADJUSTABLE	9000	2520				X	
RTU-12 SGI Teachers	N/A	No Damper Control	ADJUSTABLE	1050	315	212	MANUAL DAMPER AT UNIT (NO DAMPER CONTROL THRU BMS)			X
UV-1-2-3 Pre-School (Rm 105 - 3 UVs)	N/A	No Damper Control	NOT ON BMS	1500	375	127	VALUES FOR (1) UV ONLY - NOT ON BMS	X		
UV Faculty Lounge	7%	Yes	ADJUSTABLE	1500	375	396	50%	X		
UV Rm-096	10%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-097	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-102	7%	Yes	ADJUSTABLE	1000	375	399	60%	X		
UV Rm-104	7%	Yes	ADJUSTABLE	1000	375	420	65%	X		
UV Rm-106	7%	Yes	ADJUSTABLE	1000	375	392	57%	X		
UV Rm-108	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-109	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-111	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-202	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-204	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-206	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-208	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-301	5%	Yes	ADJUSTABLE	1000	375	399*	60%	X		

Unit Name & Location	Pretest Damper Position Setpoint	Control to Damper	Adjustable Damper or On/Off	Design SA CFM	Design OA CFM	Tested OA CFM	Balanced Damper Position for Design OA	HV	HVAC	VAC
UV Rm-302	7%	Yes	ADJUSTABLE	1000	375	415	60%	X		
UV Rm-303	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-304	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-305	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-306	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-401	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-402	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-403	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-407	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-500	0%	Yes	ADJUSTABLE	1250	375	392	63%	X		
UV Rm-501	7%	Yes	ADJUSTABLE	500	125	122*	55%	X		
UV Rm-504	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-507	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-508	7%	Yes	ADJUSTABLE	500	125	122	55%	X		
UV Rm-509	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-511	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-512	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-513	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-515	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-517	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-601	10%	Yes	ADJUSTABLE	500	125	122*	55%	X		
UV Rm-604	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-606	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-607	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-608	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-609	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-610	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-611	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-612	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-613	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-615	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-617	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-702	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-703	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-704	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-706	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-708	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-710	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-712	5%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-714	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-802	7%	Yes	ADJUSTABLE	1250	375	392*	63%	X		
UV Rm-805	7%	Yes	ADJUSTABLE	1250	375	392*	63%	X		
UV Rm-810	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-812	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-814	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		
UV Rm-816	7%	Yes	ADJUSTABLE	1000	375	399*	60%	X		

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