California Schools Healthy Air, Plumbing, and Efficiency Ventilation Program

Limited or No Mechanical Ventilation Pathway

HVAC Assessment Report Worksheets
July 2021

1. CO2 Monitoring
2. Limited or No Mechanical Ventilation

These worksheets are made available to help Program participants gather information for an HVAC Assessment Report as part of the California Schools Healthy Air, Plumbing, and Efficiency (CalSHAPE) Ventilation Program Assessment and Maintenance Grant. These worksheets are intended to be used for optional information gathering purposes only since completion of these worksheets does not constitute an HVAC Assessment Report. To comply with grant requirements and be eligible for funding, participants must submit an HVAC Assessment Report electronically by entering the required information through the CalSHAPE Online System as set forth in the most recent CalSHAPE Ventilation Program Guidelines.

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HVAC ASSESSMENT REPORT WORKSHEET 1
CO2 MONITORING

July 2021

☐	**Verify installation or install a CO_2 monitor.** • All classrooms shall be equipped with a CO_2 monitor. • General Buildings – At least one CO_2 monitor shall per installed in each zone of the building (where a zone is defined by an area of the building with temperature controlled by a thermostat). The number of CO_2 monitor must also meet or exceed at least one CO_2 monitor per 10,000 square feet of occupied floor space. **CO_2 monitors shall**:
☐	Be hard-wired or plugged-in and mounted to the wall between 3 – 6 feet above the floor and at least 5 feet away from the door and operable windows.
☐	Display the CO_2 readings to the occupants through a display on the device or other means such as a web-based application or cell-phone application.
☐	Notify the building operator through visual indicator on the monitor (e.g. indicator light) or other alert such as e-mail, text, or cell phone application, when the CO_2 levels have exceeded 1,100 ppm.
☐	Maintain a record of previous data which includes at least the maximum CO_2 concentration measured.
☐	Have a range of 400 ppm to 2000 ppm or greater;
☐	Be certified by the manufacturer to be accurate within 75 ppm at 1,000 ppm CO_2 concentration and is certified by the manufacturer to require calibration no more frequently than once every five years.
	Is a CO_2 monitor installed that meets the required features listed above? (Yes or No)
☐	If installed but lacking required features, what features are missing?
☐	If installed, document CO_2 monitor nameplate data.

Manufacturer:	Model:
Serial:	

☐	Include relevant photographic documentation

Fan Output Verification:			
Pre-Modification Fan Power:		**Post-Modification Fan Power:**	

HVAC ASSESSMENT REPORT WORKSHEET 2
LIMITED OR NO EXISTING MECHANICAL VENTILATION

July 2021

Ventilation Verification and Energy Optimization Assessment

Collect and document existing HVAC infrastructure to assist the Design Professional in determining ventilation options.	
☐	**Existing HVAC Infrastructure –** Verify the functionality and document nameplate data on any existing HVAC equipment (i.e., heating only units, exhaust fans, etc.)
☐	Verify and document the location of windows and doors that can be opened. • Verify if windows have any switches or controls that initiate exhaust fans, motorized dampers or other devices that operate to provide free cooling.
☐	Verification or installation of the CO_2 sensor as detailed in Worksheet 9.
☐	**Collection the following information, in addition to any information requested by a design professional to evaluate options for adding mechanical ventilation.** ☐ Verify existing mechanical, architectural, structural drawings match current conditions. ☐ Provide a sketch of actual roof penetrations, penetration type (i.e., vent pipe) and approximate locations if different from drawings. ☐ Document locations of any vents could contaminate Outside Air (OSA) intake locations. ☐ Photograph existing building, existing mechanical equipment (if applicable) and potential locations for mechanical ventilation equipment. ☐ Document roof and wall type/material to the best of the technician's ability. ☐ Document if existing mechanical equipment can be altered to provide outside air (OSA) or if a Dedicated Outside Air System (DOAS) is required. ☐ Obtain information on central plant capacity (if applicable) ☐ Document whether outside air conditions may make reliance on windows or other sources of non-filtered outside air potentially hazardous to occupants. ☐ Document recommendations for adding mechanical ventilation and filtration where none currently exists or for replacing a mechanical ventilation system where the current system is non-operational or is unable to provide recommended levels of ventilation and filtration.
☐	Include relevant screenshots and photographic documentation. • Include existing building and potential locations for mechanical ventilation equipment.

California Schools Healthy Air, Plumbing, and Efficiency Ventilation Program

Scheduled for Replacement Pathway

HVAC Assessment Report Worksheets
July 2021

1. Filtration System
2. CO2 Monitoring

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☐	**Existing Filter Data**

Document rating of existing filters.

Document filters size/depth/quantity.

Size:	Depth:	Quantity:	MERV:
Size:	Depth:	Quantity:	MERV:

- Is the filter installed correctly? (Yes or No) *If not document the deficiency and take any measurements required to make the repair.*
- Are the frames and filter bank free of any openings around the filters that would allow for untreated air to bypass the filters? (Yes or No) *If not document the deficiency and take any measurements required to make the repair.*
- Determine type of motor and control (ECM, VFD, Belt, Direct).
  - Document nameplate and installed components as applicable.

Motor

Manufacturer =	Model =	Phase =
HP =	Frame =	RPM =
HZ =	Service Factor =	Amps =
Volts =	ECM = (Y/N)	

Drive Assembly		Belt Driven ☐	Direct Drive ☐
Belt(s) Number=		Belt Type=	Belt Length:
Center to Center =			
Motor Sheave	Model:	Shaft Size:	Position (if Variable):
Fan Sheave	Model:	Shaft Size:	

Variable Frequency Drive (VFD) (Yes or No)		
Manufacturer =	Model =	Operating Hz: • Full cooling or High Fan Speed
	• With unit operating at full cooling, or high fan speed, what is the filter pressure drop?	In. w.c.
☐	**MERV 13 Verification**	
	• MERV 13 or better filtration is installed. (Yes or No)	
	• If MERV 13 or better filtration is not installed, perform the following steps to determine the highest Minimum Efficiency Reporting Value (MERV) filtration that can be installed without adversely impacting equipment.	
	• Obtain the existing filters new and final pressure drop from the manufacturer.	
	• Posture the unit to provide full cooling, or high fan speed, and disable the economizer.	
	• With the existing filters installed, perform, and document a static pressure profile, temperature profile, fan RPM, Motor RPM, voltage, and amps.	
ESP Δ =	TSP Δ =	Filter SP Δ =
Fan RPM =	Motor RPM =	Mixed Air (RA+OSA) Temp =
Supply Temp =	Voltage =	Amps =
Hertz (Hz) =		
	• Using the previously recorded data as a baseline, determine the maximum filter pressure drop, without adversely impacting equipment, by adding material to the filter until the measured or calculated airflow drops by no more than 5%.[1] • Primary Method to verify airflow - Directly measure the change in airflow if accessible and efficient. • Secondary Method – Calculate the change in airflow ○ $CFM_N = CFM_O \times \frac{\sqrt{SP_N}}{SP_O}$	In. w.c
	• With the maximum pressure drop achieved, document static pressure profile, temperature profile, fan RPM, Motor RPM, voltage amps, and note the ability to increase fan speed if needed.	
ESP Δ =	TSP Δ =	Filter SP Δ =
Fan RPM =	Motor RPM =	Mixed Air (RA+OSA) Temp =
Supply Temp =	Voltage =	Amps =

[1] 5% recommendation and maximum pressure drop determination steps derived from: ASHRAE, ASHRAE Epidemic Task Force: Building Readiness (updated May 22, 2020) (https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-building-readiness.pdf)

Hertz (Hz) =	
• Verify air volume, under maximum pressure drop condition, is within manufacturers specifications. Commonly specified as: • Minimum CFM per ton (or) • Minimum Supply Air Temperature	☐
• If applicable, document and take any measurements required to increase the filter frames to accommodate deeper filters.	☐
• Remove added material and provide documentation in the assessment report so a licensed professional can determine the highest MERV filtration that can be installed with the existing equipment.	☐
• Return the unit to normal operation and enable the economizer.	
• Include relevant photographic documentation	☐
Ultraviolet Germicidal Irradiation	
Replacement Lamp Wattage:	
Replacement Lamp Quantity:	

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☐	Be hard-wired or plugged-in and mounted to the wall between 3 – 6 feet above the floor and at least 5 feet away from the door and operable windows.
☐	Display the CO_2 readings to the occupants through a display on the device or other means such as a web-based application or cell-phone application.
☐	Notify the building operator through visual indicator on the monitor (e.g. indicator light) or other alert such as e-mail, text, or cell phone application, when the CO_2 levels have exceeded 1,100 ppm.
☐	Maintain a record of previous data which includes at least the maximum CO_2 concentration measured.
☐	Have a range of 400 ppm to 2000 ppm or greater;
☐	Be certified by the manufacturer to be accurate within 75 ppm at 1,000 ppm CO_2 concentration and is certified by the manufacturer to require calibration no more frequently than once every five years.
	Is a CO_2 monitor installed that meets the required features listed above? (Yes or No)
☐	If installed but lacking required features, what features are missing?
☐	If installed, document CO_2 monitor nameplate data.

Manufacturer:	Model:
Serial:	
☐ Include relevant photographic documentation	

Fan Output Verification:			
Pre-Modification Fan Power:		**Post-Modification Fan Power:**	

California Schools Healthy Air, Plumbing, and Efficiency Ventilation Program

HVAC Assessment and Maintenance Pathway

HVAC Assessment Report Worksheets
July 2021

1. System Overview
2. Filtration System
3. Ventilation Rate
4. Economizer Operation
5. Demand Control Ventilation
6. Air Distribution and Building Pressure
7. General Maintenance
8. Operational Controls
9. CO2 Monitoring

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HVAC ASSESSMENT REPORT WORKSHEET 1
OVERVIEW

July 2021

Building and Site Information:			
Building Address:			
Building Age:	**Building Type:**	**Approximate Square Footage of Conditioned Space**	
Climate Zone:	**Utility Account Number:**	**Utility Meter Information:**	
HVAC Equipment Details:			
Unit:			
Model Number:			
Serial Number:			
SEER Rating: Seasonal Energy Efficiency Ratio			
Refrigerant:			
HVAC User Inputs and Set Points:			
Typical Weekly Occupancy Schedule:			
Typical Weekly HVAC Thermostat Heating Setpoint:		**Typical Weekly HVAC Thermostat Cooling Setpoint:**	
Typical Weekly Fan Operation Schedule:			
Holiday/Break Weekly HVAC Thermostat Heating Setpoint:		**Holiday/Break Weekly HVAC Thermostat Cooling Setpoint:**	
Holiday/Break Weekly Fan Operation Schedule:			
Typical Annual Term Schedule: (Dates of Terms)			

HVAC Equipment Capacities:			
HVAC System Heating Input Capacity (kBtuh) Based on Nameplate:		**HVAC System Heating Output Capacity (kBtuh) Based on Nameplate:**	
HVAC System Cooling Capacity: (kBtuh Output)			
HVAC System Supply Fan Types: (Direct Drive, Variable Speed, Pulleys/Belts)		**HVAC System Return Fan Types: (Direct Drive, Variable Speed, Pulleys/Belts)**	
HVAC System Exhaust Fan Types: (Direct Drive, Variable Speed, Pulleys/Belts)			
HVAC System Supply Fan Motor Horsepower Ratings (hp) Based on Nameplate:		**HVAC System Exhaust Fan Motor Horsepower Ratings (hp) Based on Nameplate:**	
HVAC System Return Fan Motor Horsepower Ratings (hp) Based on Nameplate:			

Walkthrough Checklist:	
☐	**Filtration -** Review system capacity and airflow to determine the highest Minimum Efficiency Reporting Value (MERV) filtration for eliminating contagions, replace or upgrade filters where needed, and verify that such filters are installed correctly.
☐	**Ventilation Rate** - Calculation of the required outside air rates for each occupied area based on the anticipated occupancy and physical verification that the ventilation rate meets or exceeds the minimum ventilation set forth by the local jurisdiction in all modes of operation. • Outside Air • Exhaust Air

☐	**Ventilation System Operation** - Physically test all ventilation components for proper operation. • Economizer • Demand Control Ventilation
☐	**Air Distribution** - Verify all ventilation is reaching the served zone, how air isdistributed, and that there is adequate distribution. • Inlet Total • Outlet Total
☐	**Building Pressure -** Verify a slight positive building pressure and a negative pressure for contaminant rooms temporarily occupied by sick patrons.
☐	**General Maintenance.** Verify coil condition, condensate drainage, cooling coil air temperature differential (entering and leaving dry bulb), heat exchanger operation, and drive assembly. Recommendations for additional maintenance, replacement or upgrades shall be recorded in the HVAC Assessment Report
☐	**Operational Controls -** Review of HVAC control sequences to verify systems will maintain intended ventilation, temperature, and humidity conditions during operation. Verify ventilation systems are programmed to flush the building for 2 hours prior and following occupancy.
☐	**CO_2 Monitoring -** To ensure proper ventilation is maintained during building operation, at least one CO_2 monitor shall be installed in each zone of the building.
☐	**HVAC Assessment Report -** Preparation of an HVAC Assessment Report that includes documentation of all verifications and deficiencies.
☐	**Energy and Ventilation Upgrades -** Upon completion of the HVAC Assessment Report, a Mechanical Engineer shall review and determine if upgrades can be made to the HVAC system to increase energy efficiency, filtration, disinfection, and ventilation.

HVAC ASSESSMENT REPORT WORKSHEET 2
FILTRATION

☐	**Existing Filter Data**

Document rating of existing filters.			
Document filters size/depth/quantity.			
Size:	Depth:	Quantity:	MERV:
Size:	Depth:	Quantity:	MERV:

• Is the filter installed correctly? (Yes or No) *If not document the deficiency and take any measurements required to make the repair.*	
• Are the frames and filter bank free of any openings around the filters that would allow for untreated air to bypass the filters? (Yes or No) *If not document the deficiency and take any measurements required to make the repair.*	
• Determine type of motor and control (ECM, VFD, Belt, Direct). ○ Document nameplate and installed components as applicable.	

Motor			
Manufacturer =		Model =	Phase =
HP =		Frame =	RPM =
HZ =		Service Factor =	Amps =
Volts =		ECM = (Y/N)	
Drive Assembly		Belt Driven ☐	Direct Drive ☐
Belt(s) Number=		Belt Type=	Belt Length:
Center to Center =			
Motor Sheave	Model:	Shaft Size:	Position (if Variable):
Fan Sheave	Model:	Shaft Size:	

Variable Frequency Drive (VFD) (Yes or No)			
Manufacturer =	Model =	Operating Hz: • Full cooling or High Fan Speed	
	• With unit operating at full cooling, or high fan speed, what is the filter pressure drop?		In. w.c.
☐	**MERV 13 Verification**		
	• MERV 13 or better filtration is installed. (Yes or No)		
	• If MERV 13 or better filtration is not installed, perform the following steps to determine the highest Minimum Efficiency Reporting Value (MERV) filtration that can be installed without adversely impacting equipment.		
	• Obtain the existing filters new and final pressure drop from themanufacturer.		
	• Posture the unit to provide full cooling, or high fan speed,and disable the economizer.		
	• With the existing filters installed, perform, and document a static pressure profile, temperature profile, fan RPM, MotorRPM, voltage, and amps.		
ESP Δ =	TSP Δ =	Filter SP Δ =	
Fan RPM =	Motor RPM =	Mixed Air (RA+OSA) Temp =	
Supply Temp =	Voltage =	Amps =	
Hertz (Hz) =			
	• Using the previously recorded data as a baseline, determine the maximum filter pressure drop, without adversely impacting equipment, by adding material to the filter until the measured or calculated airflow drops by no more than 5%.[1] • Primary Method to verify airflow - Directly measure the changein airflow if accessible and efficient. • Secondary Method – Calculate the change in airflow ○ $CFM_N = CFM_O \times \frac{\sqrt{SP_N}}{SP_O}$		In. w.c
	• With the maximum pressure drop achieved, document static pressure profile, temperature profile, fan RPM, Motor RPM, voltage amps, and note the ability to increase fan speed if needed.		
ESP Δ =	TSP Δ =	Filter SP Δ =	
Fan RPM =	Motor RPM =	Mixed Air (RA+OSA) Temp =	
Supply Temp =	Voltage =	Amps =	

[1] 5% recommendation and maximum pressure drop determination steps derived from: ASHRAE, ASHRAE Epidemic Task Force: Building Readiness (updated May 22, 2020) (https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-building-readiness.pdf)

Hertz (Hz) =	
• Verify air volume, under maximum pressure drop condition, is within manufacturers specifications. Commonly specified as: • Minimum CFM per ton (or) • Minimum Supply Air Temperature	☐
• If applicable, document and take any measurements required to increase the filter frames to accommodate deeper filters.	☐
• Remove added material and provide documentation in the assessment report so a licensed professional can determine the highest MERV filtration that can be installed with the existing equipment.	☐
• Return the unit to normal operation and enable the economizer.	
• Include relevant photographic documentation	
Ultraviolet Germicidal Irradiation	
Replacement Lamp Wattage:	
Replacement Lamp Quantity:	

HVAC ASSESSMENT REPORT WORKSHEET 3
VENTILATION RATE

July 2021

☐	**Determine Minimum Required Outside Air (OSA)**		
	• If available, obtain the design documents and obtain the minimum required OSA		CFM
	• Determine if the zones actual use and occupancy matches the designs expected use and occupancy (Yes or No)		
Original Occupancy (Design):	Occupancy Category (Use):	Occupancy:	
How was original occupancy determined?			
Actual Occupancy	Occupancy Category (Use):	Occupancy:	
How was actual occupancy determined?			
	• If Yes, proceed to outside air measurements.		
	• If No, calculate the new minimum outside air rate based on ASHRAE 62.1 or Table 120.1-A of the 2019 Title 24 California Building Energy Efficiency Standards, as required by your local jurisdiction • See Example at end of document		CFM

☐	**Verify Minimum Required Outside Air (OSA)**			
Steps			**CAV**	**VAV**
1	Disable demand control ventilation (if applicable)	☐ Check if NA	☐	☐
2	Verify unit is not in economizer mode during test (economizer disabled)		☐	☐
3	CAV and VAV testing at full supply airflow			
a.	Adjust supply air to achieve design airflow or maximum airflow at full cooling			☐
b.	Measured outdoor airflow reading (cfm)		cfm	cfm
c.	Required outdoor airflow (cfm)		cfm	cfm
d.	Time for outside air damper to stabilize after full supply airflow is achieved (minutes):			min
4	VAV testing at reduced supply airflow			
a.	Adjust supply airflow to either the sum of the minimum zone airflows, full heating, or 30% of the total design airflow			☐
b.	Measured outdoor airflow reading (cfm)			cfm
c.	Required outdoor airflow (cfm)			cfm
d.	Time for outside air damper to stabilize after reduced supplyairflow is achieved (minutes):			min
5	Return to initial conditions		☐	☐
6	Calculations			
Determine Percent Outside Air at full supply airflow ($\%OA_{FA}$) for Step 3.				
a.	$\%OA_{FA}$ = Measured outdoor airflow reading /Required outdoorairflow. 100 x (Step3b/Step3c)		%	%

b.	$\%OA_{FA}$ is within 10% of design Outside Air. (90% ≤ $\%OA_{FA}$ ≤ 110%) (Pass or Fail)		
c.	Outside air damper position stabilizes within 5 minutes. (Step 3d < 5 minutes) (Pass or Fail)		
VAV only: Determine Percent Outside Air at reduced supply airflow ($\%OA_{RA}$) for Step 4.			
a.	$\%OA_{RA}$ = Measured outdoor airflow reading /Required outdoor airflow reading. 100 x (Step4b/Step4c)		%
b.	$\%OA_{RA}$ is within 10% of design Outside Air. (90% ≤ OA_{RA} ≤ 110%) (Pass or Fail)		
c.	Outside air damper position stabilizes within 5 minutes. (Step 4d < 5 minutes) (Pass or Fail)		

☐	**Increased Outside Air**	
	• Document if the ventilation components can provide increased outside air if recommended.	
	• Document unit model and serial number	
	• Provide documentation, including relevant photographic documentation, in the assessment report so a licensed professional can determine if the minimum outside air can should be increased and can be without compromising the system's ability to maintain space conditions and pressurization.	

Sample calculation of a new minimum outside air rate based on ASHRAE 62.1 or Table 120.1-A of the 2019 Title 24 California Building Energy Efficiency Standards, as required by your local jurisdiction.

- Sample requirement for a 900 square foot meeting room or assembly area.

Standard	Method	15 People	25 People	35 People
ASHRAE 62.1 2019	$10\ CFM/person + 0.12\ CFM/ft^2$	258 CFM	358 CFM	458 CFM
California T24 (2019)	$15\ CFM/person$	225 CFM	375 CFM	525 CFM
California Title 24 (2019)	$0.38\ CFM/ft^2$	342 CFM	342 CFM	342 CFM

Use Larger

HVAC ASSESSMENT REPORT WORKSHEET 4
ECONOMIZER OPERATION

July 2021

Economizer Information:			
Economizer Temperature:		**Economizer Enthalpy:**	
Single or Differential:		**Demand Control Ventilation:** (Yes or No)	
Economizer Control Type:		**Economizer Changeover Setpoint:**	
Economizer Minimum Damper Position:			

☐ **Verify Economizer Operation**

Step		Passing this test verifies the DCV and associated CO_2 sensor operates as designed.	Results (Pass, Fail, NA)
Step 1:		Disable demand control ventilation systems (if applicable)	
Step 2:		Enable the economizer and simulate a cooling demand large enough to drive the economizer fully open (record all of the following):	
	a.	Economizer damper modulates 100% open and that the return air damper modulates 100% closed.	
	b.	All applicable fans and dampers operate as intended to maintain building pressure.	
	c.	The unit heating is disabled (if applicable).	
Step 3:		Disable the economizer and simulate a cooling demand (record all of the following):	
	a.	Economizer damper closes to its minimum position.	
	b.	All applicable fans and dampers operate as intended to maintain building pressure.	
	c.	The unit heating is disabled (if unit has heating capability).	
Step 4:		If unit has heating capability, simulate a heating demand and set economizer so that it is capable of operating (i.e., actual outdoor air conditions are below lockout setpoint). (record all of the following):	
	a.	Economizer is at minimum position.	
	b.	Return air damper opens.	
Step 5:		Turn off the unit. Record if the Economizer damper closes completely.	
Step 6:		Restore demand control ventilation systems (if applicable) and remove all system overrides initiated.	
Step 7:		Economizer functions as designed (Yes or No)	
☐		If economizer does not function as designed and requires adjustment or repairs: • Document Required Repairs and Adjustments • Document information required for a repair or adjustment (i.e. measurements, model, serial, etc.)	
		• Include relevant photographic documentation	☐

☐	**Verify DCV Operation**	
Step	Passing this test verifies the DCV and associated CO_2 sensor operates as designed.	Results
1	Prior to functional testing, record the following:	
a.	Disable economizer controls.	
b.	Set CO_2 concentration setpoint at 800 ppm or less.[1]	ppm
2	Simulate a signal at or slightly above the CO_2 concentration setpoint required (Step 1b).	
a.	Apply CO_2 calibration gas at a concentration at or slightly above the setpoint to the sensor.	ppm
b.	For single zone units, verify that the outdoor air damper modulates open to satisfy the total required ventilation air called for in the Mechanical Schedule. (P/F/NA)	
c.	For multiple zone units, the zone damper (or outdoor air damper when applicable) modulates open to satisfy the zone ventilation requirements. (P/F/NA)	
3	Simulate signal well below the CO_2 setpoint.	
a.	Apply CO_2 calibration gas at a concentration well below the setpoint to the sensor or ventilate the sensor as necessary.	ppm
b.	For single zone units, outdoor air damper modulates to the design minimum value. (P/F/NA)	
c.	For multiple zone units, the zone damper (or outdoor air damper when applicable) modulates to satisfy the reduced zone ventilation requirements. (P/F/NA)	
4	Verify DCV operation with economizer	
a.	Restore economizer controls and remove all system overrides initiated during the test.	
b.	Apply CO_2 calibration gas at a concentration slightly above the setpointto the sensor.	ppm
c.	Verify that the outdoor air damper modulates open to satisfy the total ventilation required air. (P/F)	
5	Remove all system overrides initiated during the test and return system to normal operation.	
Y/N	**DCV functions as designed with a setpoint of 800 ppm**[1]	
☐	**If No, and the DCV requires adjustment or repairs:** • Document Required Repairs and Adjustments • Document information required for a repair or adjustment (i.e. measurements, model, serial, etc.) • Include relevant photographic documentation	
If the demand control ventilation system does not maintain average daily maximum CO_2 levelsbelow 1,100 ppm, it shall be disabled until such time as the LEA determines that the COVID-19 crisis has passed, unless disabling the control would adversely affect operation of the overall system.		

[1] The CO_2 set point of 800 ppm is recommended by the UC Davis Western Cooling Efficiency Center. The purpose of the 800 ppm set point for demand control ventilation systems is to prevent the automated control system from overshooting a maximum 1,100 ppm CO_2 concentration.

Verify Air Distribution and Building Pressurization			
☐	**Supply Outlets –** Measure and document supply air volume (CFM). • Include individual outlet test report • Include duct pitot traverse report (if available)		
	Return Inlets – Measure and document return air volume (CFM). • Include individual inlet test report • Include duct pitot traverse report (if available)		
☐	**Exhaust Inlets** – Measure and document return air volume (CFM). • Include individual inlet test report • Include duct pitot traverse report (if available)		
☐	**With Power Exhaust disabled (if applicable), determine if Measured Supply Air = Measured Outside Air + Measured Return Air** • Document any discrepancies and determine the cause of significant discrepancies (i.e. leakage, ductwork serving other zones, inaccurate measurement location). • Document Building Pressure - Verify a slight positive building pressure and a negative pressure for contaminant rooms temporarily occupied by sick patrons.		
Supply Air		**Outside Air**	**Return Air**
	=		**+**
Building or Zone Pressure		**In w.c.**	**In relation to:**
☐	**With Power Exhaust enabled (if applicable), determine if Measured Supply Air slightly greater than Measured Return Air** • Document any discrepancies that do not match design intent. Determine the cause of significant discrepancies (i.e. leakage, ductwork serving other zones, inaccurate measurement location, power exhaust requires adjustment). • Document Building Pressure - Verify a slight positive building pressure and a negative pressure for contaminant rooms temporarily occupied by sick patrons.		
Supply Air		**Outside Air**	**Return & Powered Exhaust Air**
	=		**+**
Building or Zone Pressure		**In w.c.**	**In relation to:**
(Y/N)	**Air Distribution -** Verify that inlets and outlets are balanced within tolerance of the system design as listed within design documents. • If the original system design values are not available, document available information and note unavailability of system design values in the HVAC Assessment Report.		
☐	**Air Distribution Notes.** – Note how the air moves from supply to return.		
☐	**Repairs and Adjustment.** • Document Required Repairs and Adjustments		
☐	Include relevant photographic documentation		

Verify General Maintenance	
☐	**Verify coil condition** - Note downstream and upstream condition
☐	**Verify condensate drainage**
☐	**Temperature Differential -** Measure and Document cooling coil air temperature differential (entering and leaving dry bulb) • If applicable, measure GPM
☐	**Verify heat exchanger operation – Measure and document** air temperature differential (entering and leaving dry bulb) • If applicable, measure GPM
☐	**Verify condition of drive assembly**. (if applicable)
☐	**Deficiencies** - Document deficiencies, general condition of unit, and make recommendations for additional maintenance, replacement, or upgrades.
☐	**Repairs and Adjustment.** • Document Required Repairs and Adjustments
☐	Include relevant photographic documentation

Conditioning Unit Details:			
Pre-Modification			
Pre-Modification Unit Airflow:		Pre-Modification Unit Supply Fan Power:	
Pre-Modification Unit Return Fan Power:		Pre-Modification Unit Exhaust Fan Power:	
Post-Modification			
Post-Modification Unit Airflow:		Post-Modification Unit Supply Fan Power:	
Post-Modification Unit Return Fan Power:		Post-Modification Unit Exhaust Fan Power:	

Review control sequences to verify systems will maintain intended conditions during building operation.	
☐	**Temperature –** Setpoints match design.
Setpoint	**Design**
☐	**Humidity (if applicable) –** Setpoints match design. • Licensed professional to determine if setpoint should be adjusted to maintain a relative humidity between 40% and 60%.
Setpoint	**Design**
Ventilation Schedule Operation	
☐	**Ventilation operates continuously during occupied hours.** • Occupied hours to include **all** hours building is occupied by staff or patrons (i.e. teachers, security, janitorial staff, night shift, etc.). • Includes all exhaust fans and fans used to distribute outside air.
☐	**Daily Flush** • Verify a daily flush is scheduled for 2 hours before and after scheduled occupancy **(or)** • Demonstrate calculation of time for 3 air changes to reduce concentration of airborne infectious particles by 95% per ASHRAE Guidance for Building Readiness[1] or otherwise applicable local or state guidance **Calculated Flush Time =**
☐	**Deficiencies** - Document deficiencies, options for adjustment (i.e. Humidity) and recommendations for additional maintenance, replacement or upgrades.
☐	Include relevant screenshots and photographic documentation

[1] ASHRAE, ASHRAE Epidemic Task Force: Building Readiness (updated May 22, 2020) (https: /www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-building-readiness.pdf)

☐	**Verify installation or install a CO_2 monitor.** • All classrooms shall be equipped with a CO_2 monitor. • General Buildings – At least one CO_2 monitor shall per installed in each zone of the building (where a zone is defined by an area of the building with temperature controlled by a thermostat). The number of CO_2 monitor must also meet or exceed at least one CO_2 monitor per 10,000 square feet of occupied floor space. **CO_2 monitors shall**:
☐	Be hard-wired or plugged-in and mounted to the wall between 3 – 6 feet above the floor and at least 5 feet away from the door and operable windows.
☐	Display the CO_2 readings to the occupants through a display on the device or other means such as a web-based application or cell-phone application.
☐	Notify the building operator through visual indicator on the monitor (e.g. indicator light) or other alert such as e-mail, text, or cell phone application, when the CO_2 levels have exceeded 1,100 ppm.
☐	Maintain a record of previous data which includes at least the maximum CO_2 concentration measured.
☐	Have a range of 400 ppm to 2000 ppm or greater;
☐	Be certified by the manufacturer to be accurate within 75 ppm at 1,000 ppm CO_2 concentration and is certified by the manufacturer to require calibration no more frequently than once every five years.
	Is a CO_2 monitor installed that meets the required features listed above? (Yes or No)
☐	If installed but lacking required features, what features are missing?
☐	If installed, document CO_2 monitor nameplate data.

Manufacturer:	Model:
Serial:	
☐	Include relevant photographic documentation

Fan Output Verification:			
Pre-Modification Fan Power:		**Post-Modification Fan Power:**	