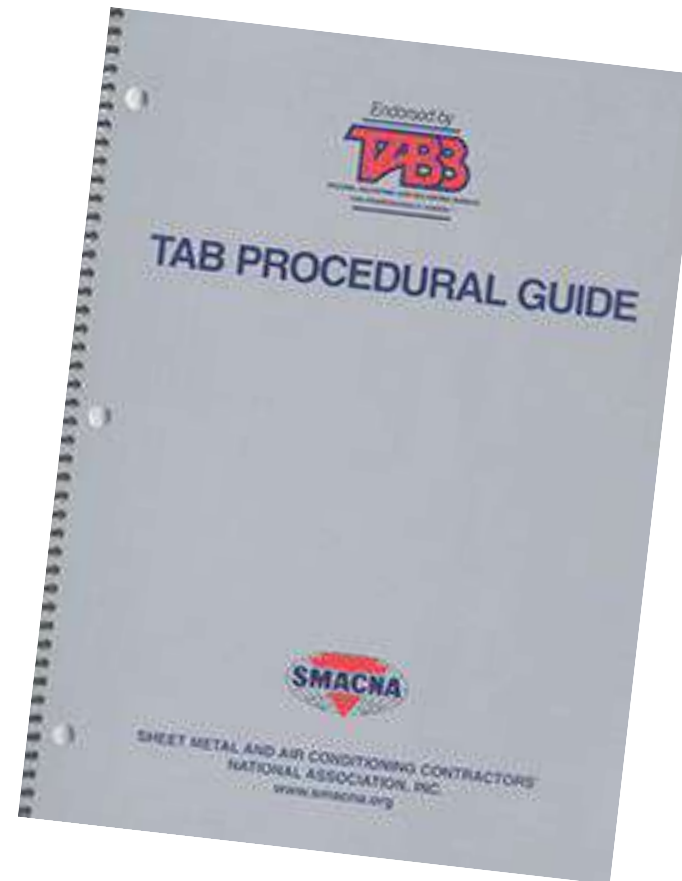


COVID-19

Building Readiness

What is TAB? What is TABB?

- **TAB** (Test, Adjust, and Balance) is the process of measuring, proportioning, and setting HVAC system components to meet design requirements.
- **TABB** (Testing, Adjusting, and Balancing Bureau) is a TAB certifying organization.
- **TABB** certified professionals follow SMACNA TAB Procedures.
- **TABB** is the only ANSI Accredited ISO/IEC 17024 TAB Certification Program



COVID-19 Building Readiness

Industry Expert Recommendations

Ventilation, Airflow, and Pressurization

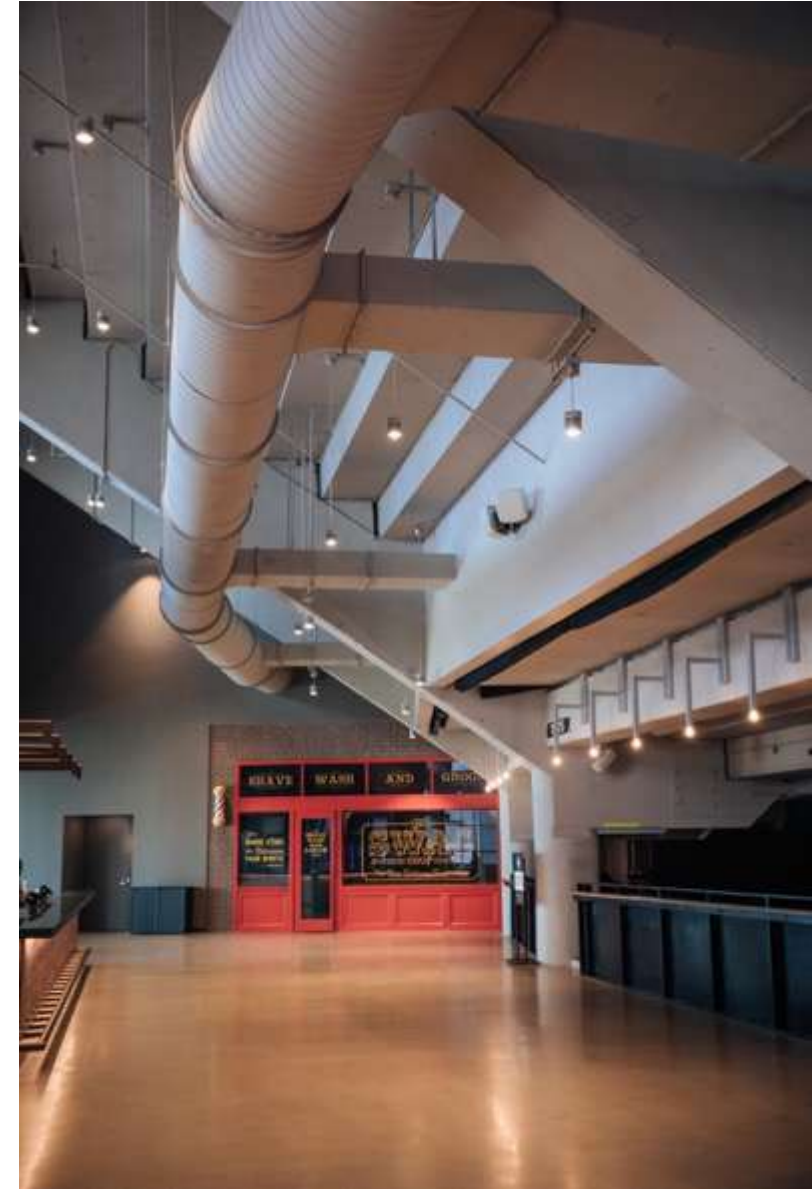
Filtration

Temperature and Humidity

Germicidal Irradiation (UVGI)

Acceptance Testing

CO2 Monitoring



Industry Expert Recommendations



Centers for Disease Control and Prevention

- Interim Guidance for [Schools](#), [Businesses and Employers](#) to Plan and Respond to Coronavirus Disease 2019



- Hierarchy of Controls

ASHRAE

- [Epidemic Task Force](#)
- [Position Document on Infectious Aerosols](#)
- [Building Readiness](#)
- [Reopening Schools](#)



The American Institute of Architects

American Institute of Architects

[Re-occupancy Assessment
Tool V2.0](#)



American Society for Healthcare Engineering

[Recovery Guidance](#) and
[Checklists](#)

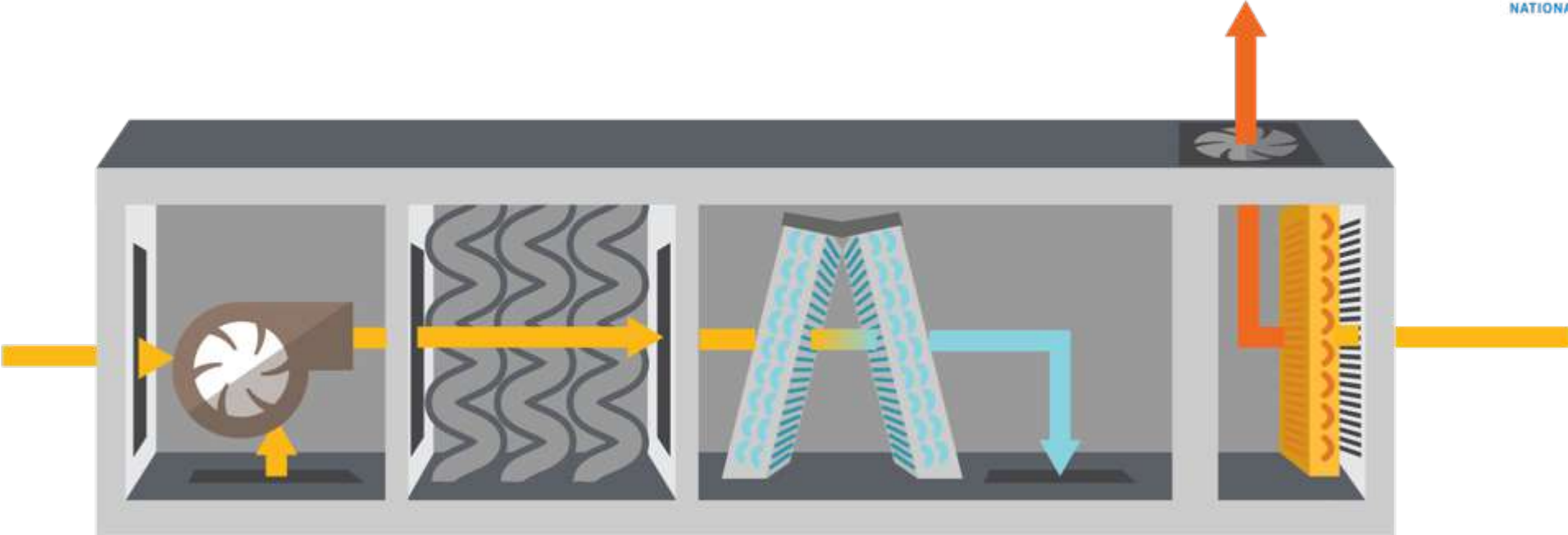
Comprehensive Approach

- IAQ and disease transmission control requires a comprehensive approach that involves many strategies and trades.
 - Infectious doses vary widely among different pathogens.
- Majority of large droplets land on surfaces within 3-7ft.
- Microbiologist now understand that droplets containing pathogens, previously thought to be spread by contact, can shrink by evaporation and become aerosols (droplet nuclei) which spread transmission through airflow patterns.

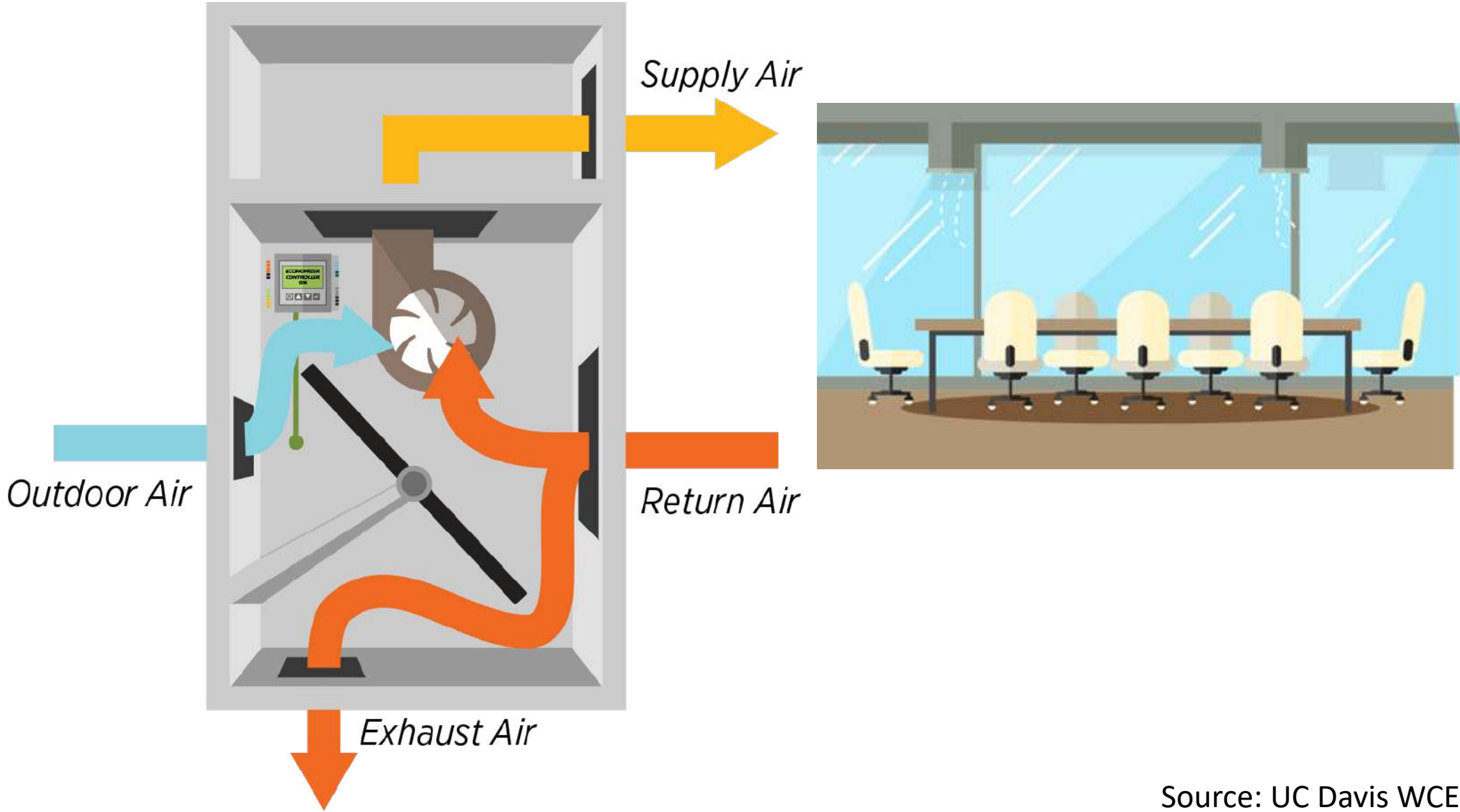
Various HVAC strategies have been found to be effective at controlling transmission

- Optimized airflow patterns
- Directional airflow
- Zone pressurization
- Dilution ventilation
- In-room air-cleaning systems
- General exhaust ventilation
- Personalized ventilation
- Local exhaust ventilation at the source
- Central system filtration
- Ultraviolet Germicidal Radiation (UVGI)
- Controlling indoor temperature and relative humidity

Ventilation

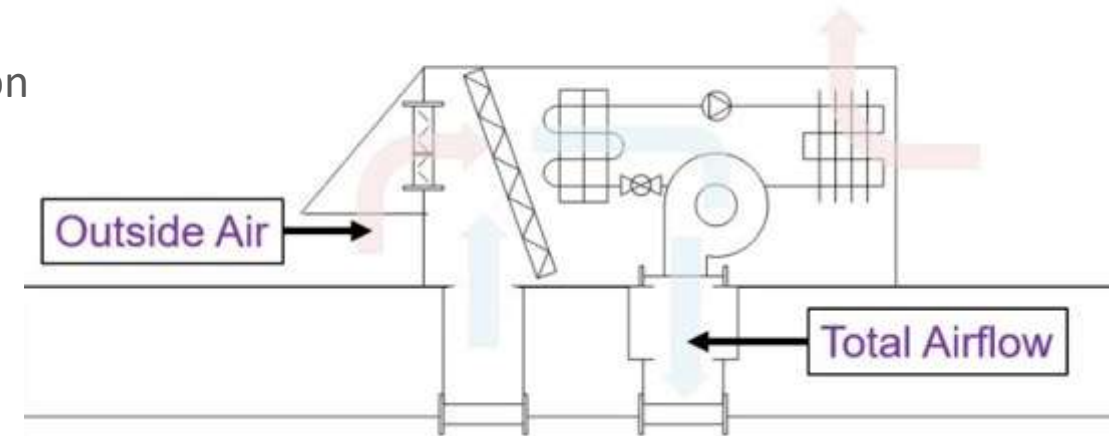


Ventilation



Ventilation

- ✓ Measurement of Outside Air per Section B of NRCA-MCH-02-A – Outdoor Air Acceptance.
- ✓ Survey readings of inlets and outlets to verify all ventilation is reaching served zone
- ✓ Verify proper separation between outdoor air intakes and exhaust discharge outlets.
- ✓ Confirm AHU is bringing in outdoor air and removing exhaust air as intended
- ✓ Determine if additional ventilation can be provided without adversely impacting equipment performance and building Indoor Environmental Quality (IEQ).



Ventilation – Minimum Ventilation

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

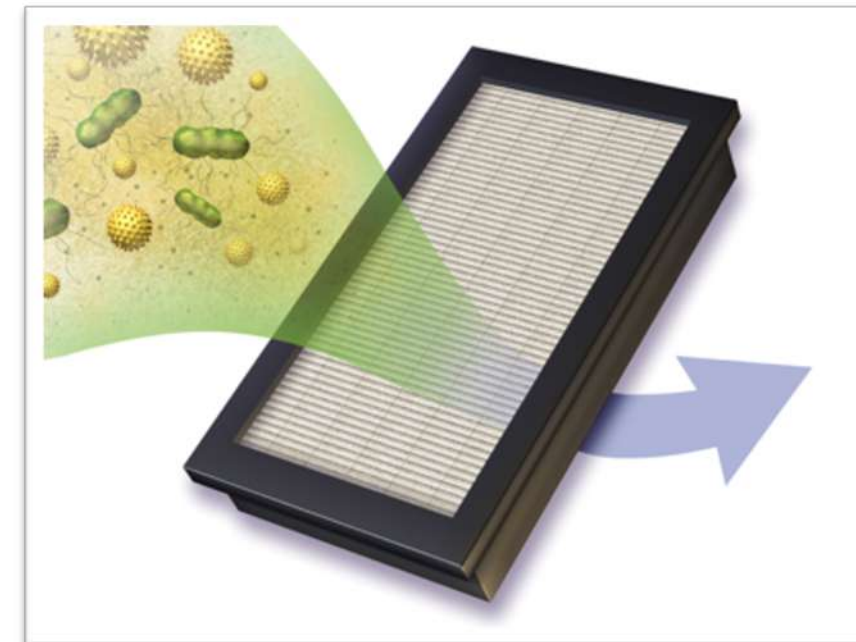
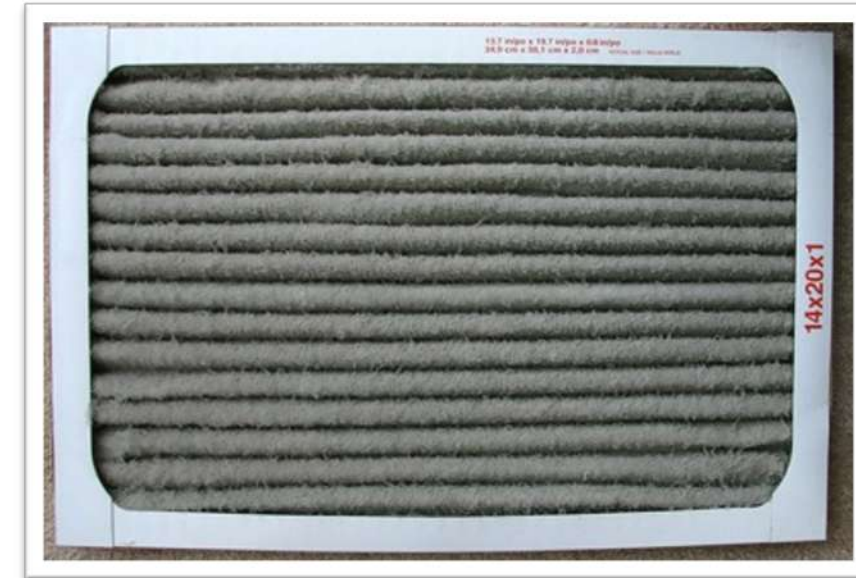
Standard	Method	15 People	25 People	35 People
ASHRAE 62.1 2019	$10 \text{ CFM/person} + 0.12 \text{ CFM/ft}^2$	258 CFM	358 CFM	458 CFM
California T24 (2019)	15 CFM/person	225 CFM	375 CFM	525 CFM
California Title 24 (2019)	0.38 CFM/ft^2	342 CFM	342 CFM	342 CFM

} Use Larger

CFM = Cubic Feet per Minute

Filtration

- ✓ Filtration will not eliminate all risk transmission of airborne particles.
- ✓ Verify filters are installed correctly and replace if needed. Workers should wear proper PPE and follow appropriate containment procedures for filter disposal.
 - A properly-fitted respirator (N95 or higher), eye protection, and disposable gloves
- ✓ Determine if additional filtration can be provided without adversely impacting equipment.
- ✓ Apply the highest Minimum Efficiency Reporting Value (MERV) applicable for the HVAC units considering airflow and conditioning capabilities. MERV 13 or better is recommended.
 - MERV 13 and higher are most efficient at capturing airborne viruses



Airflow

- ✓ Room pressure differentials and directional airflow help control airflow between zones.
- ✓ Ensure airflow patterns are adjusted to minimize occupant exposure to particles
- ✓ Verify coil velocities and coil and unit discharge air temperatures required to maintain desired indoor conditions and to avoid moisture carry over from cooling coils.
- ✓ Perform an initial air flush of all spaces for 1 week prior to the resumption of operations, verify a daily flush is scheduled 2 – 4 hours prior to occupancy.



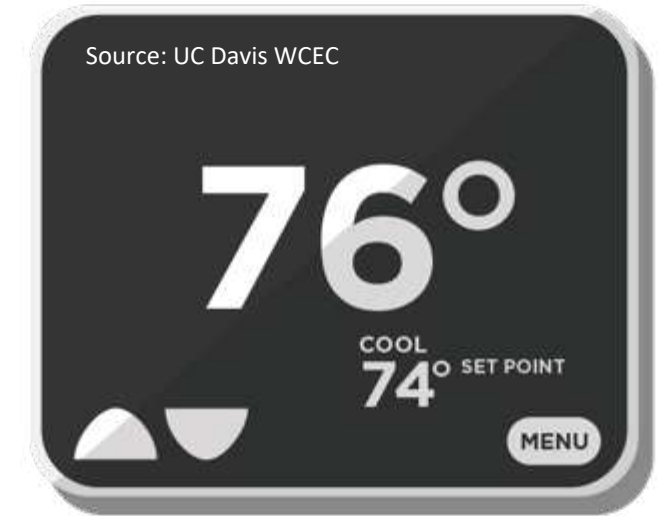
Pressurization

- ✓ Verify building pressure relative to the outdoors. Adjust building air flows to prevent negative pressure differential.
- ✓ Airborne Infection Isolation Rooms (AIIRs)
- ✓ Design and build inherent capabilities to respond to emerging threats.



Temperature and Humidity

- ✓ System maintains design temperature and humidity.
- ✓ Unfavorable survival for microorganisms when Relative Humidity (RH) is between 40% and 60%
- ✓ *Ventilation and filtration provided by heating, ventilating, and air-conditioning systems can reduce the airborne concentration of SARS-CoV-2 and thus the risk of transmission through the air. Unconditioned spaces can cause thermal stress to people that may be directly life threatening and that may also lower resistance to infection. In general, disabling of heating, ventilating, and air-conditioning systems is not a recommended measure to reduce the transmission of the virus. – ASHRAE Statement*



General Maintenance

Systems only function as designed if installed, adjusted, and maintained by a **Skilled Trained and Certified Workforce**.

- ✓ Verify coil condition, condensate drainage, refrigerant charge, heat exchanger operation, and drive assembly.
 - See ASHRAE Guidelines on Maintenance Checks
 - ASHRAE 180
- ✓ Operation and Scheduling
- ✓ Controls Commissioning
- ✓ Repairs and Upgrades if unable to achieve minimum safety requirements.



Ultraviolet Germicidal Irradiation (UVGI)

- Ultraviolet light inactivates viral, bacterial, and fungal organisms
- UV-C (wavelengths of 200-280 nm) is the most effective
 - 265 nm is optimal
 - Shorter Wavelength (185 nanometers) UVGI creates ozone (O₃).
- The ability to deactivate cells depends on the intensity of the UV light, the duration of irradiation, humidity, the target organism, and other factors.

nm = nanometer

UV-C

Upper-Air Disinfection requires air mixing and low UV-reflectivity of walls..

Figure 2. Distribution of UV radiation from a typical wall-mounted UVGI fixture

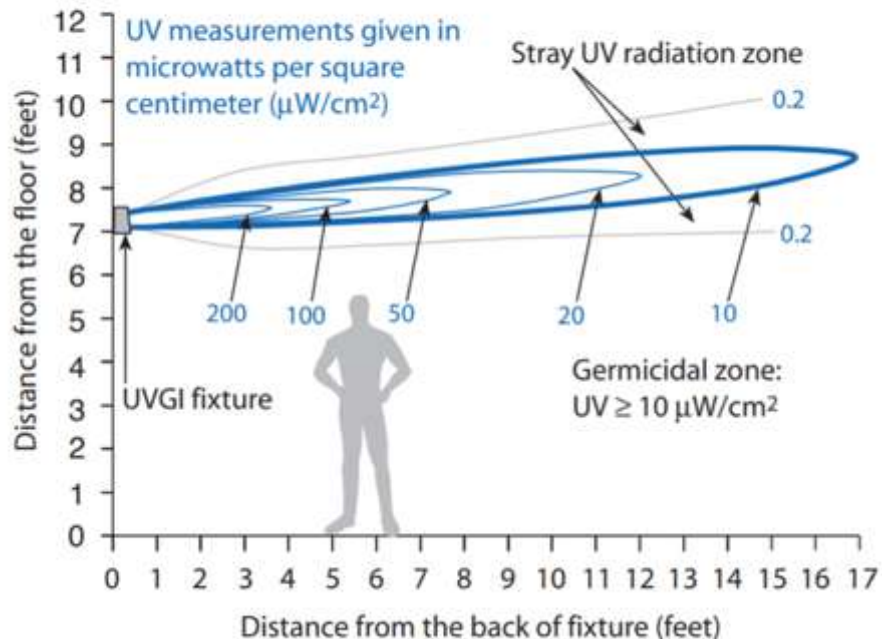


Image source: <https://ultraviolet.com/wp-content/uploads/downloads/2015/12/980904.pdf>



In-Duct Air Disinfection: Effectiveness of UVGI is dependent on exposure time. Typically 500 FPM, 2 feet of irradiance, exposure time of 0.25 seconds

Portable Room Decontamination. Positioning of unit for full exposure along with routine use increases effectiveness.

Image source: <https://www.americanultraviolet.com/germicidal-healthcare-solutions/documents/AUV-Mobile-UVC-brochure.pdf>





Dynamic Assessment

- Static Determination Versus Dynamic Assessment
- Periodic Acceptance Testing
 - Generic Acceptance Forms

MCH-02-A Outdoor Air Acceptance

STATE OF CALIFORNIA
OUTDOOR AIR ACCEPTANCE
SEE NRCA-MCH-02-A (Previous Edition)

CALIFORNIA ENERGY COMMISSION
SEE NRCA-MCH-02-A (Previous Edition)

NRCA-MCH-02-A
 CERTIFICATE OF ACCEPTANCE
 Outdoor Air Acceptance (Page 1 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System installed or being tested:

Compliance Results: Complies Does NOT Comply Enforcement Agency use: Initial/Date

Intent: Verify measured outside airflow sensor reading is within 10% of the total required outside airflow. Required for all newly installed HVAC units. Reference **NBCC-MCH-1E**. Submit one Certificate of Acceptance for each system that must demonstrate compliance. NRCA-MCH-02-A can be performed in conjunction with NRCA-MCH-07-A Supply Fan VFD Acceptance (if applicable) since testing activities overlap.

A. Construction Inspection

Building	Floor	Room/Room(s)	System/Systems

Prior to Functional Testing, verify and document all of the following

1. Required Documentation (all must be checked)

a. **NBCC-MCH-1E** as approved by the authority having jurisdiction (**§10-102(a)(2)**)

2. System type - Select either Constant Air Volume (CAV) or Variable Air Volume (VAV) below:

a. **VAV only**

i. Outside airflow is either factory calibrated or field calibrated (check one of the following):

A. If factory calibrated, attach calibration certification. (**NA 7.5.1.1.1 (a)**)

B. If field calibrated, attach calibration results. (**NA 7.5.1.1.1 (b)**)

ii. Damper Control (check all of the following):

A. Dynamic damper control is being used to control outside air. (**NA 7.5.1.1.1 (c)**)

B. Dynamic damper is NOT a fixed minimum damper. (**NA 7.5.1.1.1.1 (d)**)

iii. Identify the dynamic control being utilized to control outside air. (**NA 7.5.1.1.1 (e)**)

Describe control. Choose an item:

i. **CAV only** (check all of the following):

I. System is designed to provide a fixed minimum outside air when the unit is on. (**NA 7.5.1.1.1 (f)**)

II. Minimum position is marked on the outside air damper. (**NA 7.5.1.1.2 (a)**)

III. The system has means of maintaining the minimum outdoor air damper position. (**NA 7.5.1.1.2 (b)**)

3. Method of delivering outside air to the heating or cooling unit (check one of the following): (**NA 7.5.1.1.1 (g)** & **NA 7.5.1.1.2 (a)**)

a. **Return Plenum Ducted.** Confirm that outside air is ducted to within 5 or 15 ft, (with direction and velocity requirement) of the heating or cooling unit as specified by **NBCC-MCH-1E, Section II, (8)(3) (a) & (b)**.

b. **Direct VAV Ducted.** Return air plenum is NOT used to distribute outside air to the heating or cooling unit. I.e. outside air is ducted directly to the unit, outside air is provided independent of the unit, or economizer.

4. Pre-occupancy Purge:

a. Verify that the pre-occupancy purge has been programmed for the 1-hour period immediately before the building is normally occupied to provide ventilation as indicated on **NBCC-MCH-1E, (d)(X) - NA 7.5.1.1.1 (f), CAV - NA 7.5.1.1.2 (a) §120 (f)(2)**.

Construction Inspection Compliance Results: Complies Does NOT Comply

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
OUTDOOR AIR ACCEPTANCE
SEE NRCA-MCH-02-A (Previous Edition)

CALIFORNIA ENERGY COMMISSION
SEE NRCA-MCH-02-A (Previous Edition)

NRCA-MCH-02-A
 CERTIFICATE OF ACCEPTANCE
 Outdoor Air Acceptance (Page 2 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System installed or being tested:

B. Functional Testing

Building	Floor	Room/Room(s)	System/Systems

Steps:

1. Disable demand control ventilation (if applicable) Check if NA

2. Verify unit is not in economizer mode during test (economizer disabled) Check if NA

CAV - NA 7.5.1.1.2 Step 1, CAV - NA 7.5.1.1.2 Step 1

3. CAV and VAV testing at full supply airflow

a. Adjust supply air to achieve design airflow or maximum airflow at full cooling. (**NA 7.5.1.1.2 Step 2**)

b. Measured outdoor airflow reading (cfm) cfm cfm

c. VAV - **NA 7.5.1.1.2 Step 2a, CAV - NA 7.5.1.1.2 Step 2a**

d. Required outdoor airflow (cfm) cfm cfm

e. (refer to **NBCC-MCH-1E, Section II**)

f. Time for outside air damper to stabilize after full supply airflow is achieved (minutes): cfm min

g. (**NA 7.5.1.1.2 Step 2b**)

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. (**NA 7.5.1.1.2 Step 3**)

b. Measured outdoor airflow reading (cfm) (**NA 7.5.1.1.2 Step 3a**) cfm

c. Required outdoor airflow (cfm) (**NA 7.5.1.1.2 Step 3b**) cfm

d. Time for outside air damper to stabilize after reduced supply airflow is achieved (minutes): min

e. (**NA 7.5.1.1.2 Step 3c**)

5. Return to initial conditions (**NA 7.5.1.1.2 Step 4**)

6. Calculations

Determine Percent Outside Air at full supply airflow (NOA_{full}) for Step 3. (**§120 (f)(1)**)

a. NOA_{full} = Measured outdoor airflow reading / Required outdoor airflow. % %

b. NOA_{full} is within 10% of design Outside Air. (90% ≤ NOA_{full} ≤ 110%) P / F P / F

c. Outside air damper position stabilizes within 5 minutes. (Step 3d + 5 minutes) P / F P / F

VAV only Determine Percent Outside Air at reduced supply airflow (NOA_{red}) for Step 4. (**§120 (f)(1)**)

a. NOA_{red} = Measured outdoor airflow reading / Required outdoor airflow reading. % %

b. NOA_{red} is within 10% of design Outside Air. (90% ≤ NOA_{red} ≤ 110%) P / F P / F

c. Outside air damper position stabilizes within 5 minutes. (Step 4d + 5 minutes) P / F P / F

Functional Testing Compliance Results: Complies Does NOT Comply

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
OUTDOOR AIR ACCEPTANCE
SEE NRCA-MCH-02-A (Previous Edition)

CALIFORNIA ENERGY COMMISSION
SEE NRCA-MCH-02-A (Previous Edition)

NRCA-MCH-02-A
 CERTIFICATE OF ACCEPTANCE
 Outdoor Air Acceptance (Page 3 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System installed or being tested:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

I, _____, certify that this Certificate of Acceptance documentation is accurate and complete.

Documentation Author Name: _____ Documentation Author Signature: _____
 Documentation Author Company Name: _____ Date Signed: _____
 Address: _____ AT1 Certification identification (if applicable): _____
 City/State/Zip: _____ Phone: _____

FIELD TECHNICIAN'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

- The information provided on this Certificate of Acceptance is true and correct.
- I am the person who performed the acceptance verification reported on this Certificate of Acceptance (Field Technician).
- The construction or installation identified on this Certificate of Acceptance complies with the applicable acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA2.
- I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and signed by the responsible builder/installer and has been posted or made available with the building permit(s) issued for the building.

Field Technician Name: _____ Field Technician Signature: _____
 Field Technician Company Name: _____ Position with Company (Title): _____
 Address: _____ AT1 Certification identification (if applicable): _____
 City/State/Zip: _____ Phone: _____ Date Signed: _____

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

- I am the Field Technician, or the Field Technician is acting on my behalf as my employee or my agent and I have reviewed the information provided on this Certificate of Acceptance.
- I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Acceptance and attest to the declarations in this statement (responsible acceptance person).
- The information provided on this Certificate of Acceptance substantiates that the construction or installation identified on this Certificate of Acceptance complies with the acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA2.
- I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and is posted or made available with the building permit(s) issued for the building.
- I will ensure that a completed, signed copy of this Certificate of Acceptance shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a signed copy of this Certificate of Acceptance is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Acceptance Person Name: _____ Responsible Acceptance Person Signature: _____
 Responsible Acceptance Person Company Name: _____ Position with Company (Title): _____
 Address: _____ City/State: _____
 City/State/Zip: _____ Phone: _____ Date Signed: _____

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

MCH-03-A CONSTANT VOLUME, SINGLE ZONE, UNITARY (PACKAGED AND SPLIT) AIR CONDITIONER AND HEAT PUMP SYSTEMS

STATE OF CALIFORNIA
CONSTANT VOLUME, SINGLE ZONE, UNITARY (PACKAGED AND SPLIT) AIR CONDITIONER AND HEAT PUMP SYSTEMS
CALIFORNIA ENERGY COMMISSION
MCH-03-A (Page 1 of 4)

CERTIFICATE OF ACCEPTANCE

Project Name: _____
Enforcement Agency Use: Checked by Date: _____

Compliance Results:
 Complies Does NOT Comply

Notes: Submit one Certificate of Acceptance for each room, area, or zone that is directly or indirectly served by a thermostat control system. Includes construction inspection for an optional document that has been certified to the Energy Commission.

A. Construction Inspection

Prior to Functional Testing, verify and document all of the following:

1. Required Documentation (check all of the following):
 - a. A permit issued by the enforcing building jurisdiction is available for reference. (See 91001.0)
 - b. A printed copy of the OSM or OSM-R 2.0 Virtual End Node (VEN) certificate for the demand response control system is provided. (See 91001.0)
 - c. A certificate from the manufacturer stating that the demand response control system is capable of responding to a demand response signal from a certified OSM or OSM-R 2.0 Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment's control. (See 91001.0)
2. Thermostat controls for each zone served by the system check one of the following:
 - a. A thermostat is located within the space conditioning zone that is served by the OSM system. (See 91001.0)
 - b. An Energy Management Control System is installed to comply with the requirements of one or more thermostats. (See 91001.0)
 - c. An independent perimeter heating or cooling system that serves more than one zone without individual thermostats controls is installed. (Check all of the following): (See 91001.0)
 - i. All zones served by the perimeter system are also served by an interior ceiling system, and
 - ii. The perimeter system is designed solely to offset additional heat losses or gains, and
 - iii. The perimeter system has at least one thermostat controller each building orientation of 90 feet or more, and
 - iv. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.
3. Check for Thermostat zone control (check one of the following):
 - a. Set points and dead band controls are as follows:
 - i. The thermostat control is ceiling control ceiling only and is capable of being set, locally or remotely, down to 65°F or higher. (See 91001.0)
 - ii. The thermostat control is ceiling control ceiling only and is capable of being set, locally or remotely, up to 81°F or higher. (See 91001.0)
 - iii. The thermostat control is ceiling control both ceiling heating and ceiling cooling and requires manual changeover between heating and cooling modes. (See 91001.0)
 - iv. The thermostat control is ceiling control both ceiling heating and ceiling cooling and does NOT require manual changeover between heating and cooling modes and is capable of all of the following: (See 91001.0)
 - i. A minimum heating setpoint of 65°F or lower, and
 - ii. A maximum cooling setpoint of 81°F or higher, and
 - iii. A temperature swing or dead band of at least 3°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.
 - b. ADDITIONAL THERMOSTAT CONTROL (check one of the following):
 - i. The heating or cooling system is NOT a heat pump system and is NOT controlled by an Energy Management Control System, and has a check mechanism that allows the building occupant to program the temperature setpoints for at least four periods within 24 hours by either thermostat. (See 91001.0)
 - ii. Thermostat control NOT required.
 - iii. The heating or cooling system is NOT a heat pump system and is NOT controlled by an Energy Management Control System, and is one of the following (check one of the following): (See 91001.0)
 - A. Gravity gas wall heater.

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
CONSTANT VOLUME, SINGLE ZONE, UNITARY (PACKAGED AND SPLIT) AIR CONDITIONER AND HEAT PUMP SYSTEMS
CALIFORNIA ENERGY COMMISSION
MCH-03-A (Page 2 of 4)

CERTIFICATE OF ACCEPTANCE

Project Name: _____
Enforcement Agency Use: Checked by Date: _____

Compliance Results:
 Complies Does NOT Comply

Notes: Submit one Certificate of Acceptance for each room, area, or zone that is directly or indirectly served by a thermostat control system. Includes construction inspection for an optional document that has been certified to the Energy Commission.

A. Construction Inspection

Prior to Functional Testing, verify and document all of the following:

1. Required Documentation (check all of the following):
 - a. A permit issued by the enforcing building jurisdiction is available for reference. (See 91001.0)
 - b. A printed copy of the OSM or OSM-R 2.0 Virtual End Node (VEN) certificate for the demand response control system is provided. (See 91001.0)
 - c. A certificate from the manufacturer stating that the demand response control system is capable of responding to a demand response signal from a certified OSM or OSM-R 2.0 Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment's control. (See 91001.0)
2. Thermostat controls for each zone served by the system check one of the following:
 - a. A thermostat is located within the space conditioning zone that is served by the OSM system. (See 91001.0)
 - b. An Energy Management Control System is installed to comply with the requirements of one or more thermostats. (See 91001.0)
 - c. An independent perimeter heating or cooling system that serves more than one zone without individual thermostats controls is installed. (Check all of the following): (See 91001.0)
 - i. All zones served by the perimeter system are also served by an interior ceiling system, and
 - ii. The perimeter system is designed solely to offset additional heat losses or gains, and
 - iii. The perimeter system has at least one thermostat controller each building orientation of 90 feet or more, and
 - iv. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.
3. Check for Thermostat zone control (check one of the following):
 - a. Set points and dead band controls are as follows:
 - i. The thermostat control is ceiling control ceiling only and is capable of being set, locally or remotely, down to 65°F or higher. (See 91001.0)
 - ii. The thermostat control is ceiling control ceiling only and is capable of being set, locally or remotely, up to 81°F or higher. (See 91001.0)
 - iii. The thermostat control is ceiling control both ceiling heating and ceiling cooling and requires manual changeover between heating and cooling modes. (See 91001.0)
 - iv. The thermostat control is ceiling control both ceiling heating and ceiling cooling and does NOT require manual changeover between heating and cooling modes and is capable of all of the following: (See 91001.0)
 - i. A minimum heating setpoint of 65°F or lower, and
 - ii. A maximum cooling setpoint of 81°F or higher, and
 - iii. A temperature swing or dead band of at least 3°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.
 - b. ADDITIONAL THERMOSTAT CONTROL (check one of the following):
 - i. The heating or cooling system is NOT a heat pump system and is NOT controlled by an Energy Management Control System, and has a check mechanism that allows the building occupant to program the temperature setpoints for at least four periods within 24 hours by either thermostat. (See 91001.0)
 - ii. Thermostat control NOT required.
 - iii. The heating or cooling system is NOT a heat pump system and is NOT controlled by an Energy Management Control System, and is one of the following (check one of the following): (See 91001.0)
 - A. Gravity gas wall heater.

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
CONSTANT VOLUME, SINGLE ZONE, UNITARY (PACKAGED AND SPLIT) AIR CONDITIONER AND HEAT PUMP SYSTEMS
CALIFORNIA ENERGY COMMISSION
MCH-03-A (Page 3 of 4)

CERTIFICATE OF ACCEPTANCE

Project Name: _____
Enforcement Agency Use: Checked by Date: _____

Compliance Results:
 Complies Does NOT Comply

Notes: Submit one Certificate of Acceptance for each room, area, or zone that is directly or indirectly served by a thermostat control system. Includes construction inspection for an optional document that has been certified to the Energy Commission.

A. Construction Inspection

Prior to Functional Testing, verify and document all of the following:

1. Required Documentation (check all of the following):
 - a. A permit issued by the enforcing building jurisdiction is available for reference. (See 91001.0)
 - b. A printed copy of the OSM or OSM-R 2.0 Virtual End Node (VEN) certificate for the demand response control system is provided. (See 91001.0)
 - c. A certificate from the manufacturer stating that the demand response control system is capable of responding to a demand response signal from a certified OSM or OSM-R 2.0 Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment's control. (See 91001.0)
2. Thermostat controls for each zone served by the system check one of the following:
 - a. A thermostat is located within the space conditioning zone that is served by the OSM system. (See 91001.0)
 - b. An Energy Management Control System is installed to comply with the requirements of one or more thermostats. (See 91001.0)
 - c. An independent perimeter heating or cooling system that serves more than one zone without individual thermostats controls is installed. (Check all of the following): (See 91001.0)
 - i. All zones served by the perimeter system are also served by an interior ceiling system, and
 - ii. The perimeter system is designed solely to offset additional heat losses or gains, and
 - iii. The perimeter system has at least one thermostat controller each building orientation of 90 feet or more, and
 - iv. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.
3. Check for Thermostat zone control (check one of the following):
 - a. Set points and dead band controls are as follows:
 - i. The thermostat control is ceiling control ceiling only and is capable of being set, locally or remotely, down to 65°F or higher. (See 91001.0)
 - ii. The thermostat control is ceiling control ceiling only and is capable of being set, locally or remotely, up to 81°F or higher. (See 91001.0)
 - iii. The thermostat control is ceiling control both ceiling heating and ceiling cooling and requires manual changeover between heating and cooling modes. (See 91001.0)
 - iv. The thermostat control is ceiling control both ceiling heating and ceiling cooling and does NOT require manual changeover between heating and cooling modes and is capable of all of the following: (See 91001.0)
 - i. A minimum heating setpoint of 65°F or lower, and
 - ii. A maximum cooling setpoint of 81°F or higher, and
 - iii. A temperature swing or dead band of at least 3°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.
 - b. ADDITIONAL THERMOSTAT CONTROL (check one of the following):
 - i. The heating or cooling system is NOT a heat pump system and is NOT controlled by an Energy Management Control System, and has a check mechanism that allows the building occupant to program the temperature setpoints for at least four periods within 24 hours by either thermostat. (See 91001.0)
 - ii. Thermostat control NOT required.
 - iii. The heating or cooling system is NOT a heat pump system and is NOT controlled by an Energy Management Control System, and is one of the following (check one of the following): (See 91001.0)
 - A. Gravity gas wall heater.

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
CONSTANT VOLUME, SINGLE ZONE, UNITARY (PACKAGED AND SPLIT) AIR CONDITIONER AND HEAT PUMP SYSTEMS
CALIFORNIA ENERGY COMMISSION
MCH-03-A (Page 4 of 4)

CERTIFICATE OF ACCEPTANCE

Project Name: _____
Enforcement Agency Use: Checked by Date: _____

Compliance Results:
 Complies Does NOT Comply

Notes: Submit one Certificate of Acceptance for each room, area, or zone that is directly or indirectly served by a thermostat control system. Includes construction inspection for an optional document that has been certified to the Energy Commission.

DOCUMENTATION AUTHORITY'S DECLARATION STATEMENT

I, _____, certify that this Certificate of Acceptance documentation is accurate and complete.

Documentation Authority Name: _____ Date Signed: _____
Address: _____
City/State/Zip: _____ Phone: _____

FIELD TECHNICIAN'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Acceptance is true and correct.
2. I am the person who performed the acceptance verification reported on this Certificate of Acceptance (Field Technician).
3. The construction or installation identified on this Certificate of Acceptance complies with the applicable acceptance requirements included in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix 3A-F.
4. I have confirmed that the Certificate of Acceptance for the construction or installation identified on this Certificate of Acceptance has been completed and signed by the responsible subcontractor and has been posted or made available with the building permit issued for the building.

Field Technician Name: _____ Field Technician Signature: _____
Field Technician Company Name: _____ Position with Company (Title): _____
Address: _____ APT/ Certification Identification (if applicable): _____
City/State/Zip: _____ Phone: _____ Date Signed: _____

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. I am the Field Technician, or the Field Technician is acting on my behalf as my employee or my agent and I have reviewed the information provided on this Certificate of Acceptance.
2. I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction or installation of features, materials, components, or manufactured devices for the scope of work identified on the Certificate of Acceptance and listed in the Declaration in this statement (responsible acceptance person).
3. The information provided on this Certificate of Acceptance substantiates that the construction or installation identified on this Certificate of Acceptance complies with the acceptance requirements included in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix 3A-F.
4. I have confirmed that the Certificate of Acceptance for the construction or installation identified on this Certificate of Acceptance has been completed and is posted or made available with the building permit issued for the building.
5. I understand that a signed copy of this Certificate of Acceptance is required to be included with the documentation the builder provides to the building owner or occupant.

Responsible Acceptance Person Name: _____ Responsible Acceptance Person Signature: _____
Responsible Acceptance Person Company Name: _____ Position with Company (Title): _____
Address: _____ CSB License: _____

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

MCH-05-A AIR ECONOMIZER CONTROLS ACCEPTANCE

STATE OF CALIFORNIA
AIR ECONOMIZER CONTROLS ACCEPTANCE
 CEC-NRCA-MCH-05-A (Revised: 01/20)

CALIFORNIA ENERGY COMMISSION
 NRCA-MCH-05-A
 Air Economizer Controls Acceptance
 (Page 1 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System Location or Area Served: _____

Compliance Results:
 Complies Does NOT Comply Enforcement Agency Use: Checked by/Date: _____

Intent: Construction inspection and functional testing for an air economizer to verify that the HVAC system can use outdoor air to satisfy space-cooling loads. Intended for air economizers that are **NOT** already certified to the Energy Commission. Submit one Certificate of Acceptance for each system that must demonstrate compliance. (NA7.5.4.130, 5.4.130)

A. Construction Inspection

Building	Room	Remarks/Notes	Inspector/Notes

Prior to Functional Testing, verify and document all of the following:

- Required documentation must be available for review (check **all** of the following):
 - All documentation shipped with the economizer including manuals and performance curves.
- Verify the economizer is set to the Required High Limit setting according to the economizer Device Type and Climate Zone where installed (check **one** compliance path and **all** applicable NOTEs). (Tables 140.6.6, NA7.5.4.130, 5.4.130, 5.4.130)

Device Type	Climate Zone	Equation	Description
Fixed Dry Bulb	1, 3, 5, 13-16	$T_{oa} > 75°F$	Outdoor air temperature exceeds 75°F.
	2, 4, 10	$T_{oa} > 73°F$	Outdoor air temperature exceeds 73°F.
	6, 8, 9	$T_{oa} > 71°F$	Outdoor air temperature exceeds 71°F.
Differential Dry Bulb	1, 3, 5, 13-16	$T_{oa} > T_{rs}$	Outdoor air temperature exceeds return air temperature.
	2, 4, 10	$T_{oa} > T_{rs} - 2°F$	Outdoor air temperature exceeds return air temperature minus 2°F.
	6, 8, 9	$T_{oa} > T_{rs} - 4°F$	Outdoor air temperature exceeds return air temperature minus 4°F.
Fixed Enthalpy and Fixed Dry-bulb	All	$H_{oa} > 28 \text{ Btu/lb}$ or $T_{oa} > 75°F$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air or Outdoor air temperature exceeds 75°F.

NOTE: Devices with selectable (rather than adjustable) setpoints must be set to within 2°F and 2 Btu/lb of the setpoint listed.

NOTE for Fixed Enthalpy and Fixed Dry-bulb devices: All altitudes substantially different than sea level, the Fixed Enthalpy limit value must be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at approximately 4,000-foot elevation, the fixed enthalpy limit is approximately 30.7 Btu/lb.

3. Economizer reliability features are present as specified in the Energy Code (check **all** of the following): (NA7.5.4.130, 5.4.130, 5.4.130)

- 5-year manufacturer warranty of economizer assembly (5.4.130.4a)(1)(i))
- The economizer assembly (including but not limited to outdoor air damper, return air damper, drive linkage, and actuator) have been tested and are able to open and close against the rated airflow and pressure of the system for 90,000 damper opening and closing cycles. (5.4.130.4a)(1)(ii))
- The outdoor air and return air dampers have a maximum leakage rate of 10 cfm/ft² at 250 Pascals (1.0 inch of water) when tested in compliance with AMCA Standard 500-D. (5.4.130.4a)(1)(iii))
- If the high-limit control is fixed dry-bulb or fixed enthalpy + fixed dry-bulb, then it must have an adjustable setpoint. (NA7.5.4.130, 5.4.130, 5.4.130)

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
AIR ECONOMIZER CONTROLS ACCEPTANCE
 CEC-NRCA-MCH-05-A (Revised: 01/20)

CALIFORNIA ENERGY COMMISSION
 NRCA-MCH-05-A
 Air Economizer Controls Acceptance
 (Page 2 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System Location or Area Served: _____

A. Construction Inspection

Building	Room	Remarks/Notes	Inspector/Notes

- Outdoor air, return air, mixed air, and supply air sensors must be calibrated as follows (check **all** of the following): (NA7.5.4.130, 5.4.130)
 - Dry-bulb and wet-bulb temperatures accurate to ±2°F over the range of 40°F to 80°F
 - Enthalpy accurate to ±3 Btu/lb over the range of 20 Btu/lb to 36 Btu/lb
 - Relative humidity (RH) accurate to ±5% over the range of 20% to 80% RH
- Sensor performance curve(s) is provided with the economizer instruction materials that provide data used for economizer control as well as plotted sensor output value measurements during calibration. (NA7.5.4.130, 5.4.130, 5.4.130)
 - Sensors used for high-limit control shall be located to prevent false readings, including but not limited to being properly shielded from direct sunlight. (NA7.5.4.130, 5.4.130, 5.4.130)
- Economizer additional features (check **all** of the following):
 - Economizer damper moves freely without binding. (NA7.5.4.130)
 - Unitary systems with an economizer have control systems, including two-stage or electronic thermostats, that cycle compressors off when economizers can provide partial cooling. (NA7.5.4.130)
 - Systems have return fan speed control, relief dampers, or dedicated relief fans to prevent building over pressurization in full economizer mode. (NA7.5.4.130)
- For systems with DDC controls, sensor used for economizer lockout has been factory or field calibrated. (NA7.5.4.130)
- For systems with non-DDC controls, manufacturer's startup and testing procedures have been applied. (NA7.5.4.130)

Construction Inspection Compliance Results: Complies Does NOT Comply

B. Functional Testing

Building	Room	Remarks/Notes	Inspector/Notes

Step 1: Disable demand control ventilation systems (if applicable). (NA7.5.4.2 Step 1)

Step 2: Disable the economizer and simulate a cooling demand large enough to drive the economizer fully open (record **all** of the following): (NA7.5.4.2 Step 2)

- Economizer damper modulates 100% open and that the return air damper modulates 100% closed. (NA7.5.4.2 Step 2a) P / F
- All applicable fans and dampers operate as intended to maintain building pressure. (NA7.5.4.2 Step 2b) P / F
- The unit heating is disabled (if applicable). (NA7.5.4.2 Step 2c) P / F

Step 3: Disable the economizer and simulate a cooling demand (record **all** of the following): (NA7.5.4.2 Step 3)

- Economizer damper closes to its minimum position. (NA7.5.4.2 Step 3a) P / F
- All applicable fans and dampers operate as intended to maintain building pressure. (NA7.5.4.2 Step 3b) P / F
- The unit heating is disabled (if unit has heating capability). (NA7.5.4.2 Step 3c) P / F

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): (NA7.5.4.2 Step 4)

- Economizer is at minimum position. (NA7.5.4.2 Step 4a) P / F / NA
- Return air damper opens. (NA7.5.4.2 Step 4b) P / F / NA

Step 5: Turn off the unit. (NA7.5.4.2 Step 5) Record if the Economizer damper closes completely. (NA7.5.4.2 Step 5c) P / F

Step 6: Restore demand control ventilation systems (if applicable) and remove all system overrides initiated. (NA7.5.4.2 Step 6)

Functional Test Compliance Results: Complies Does NOT Comply

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
AIR ECONOMIZER CONTROLS ACCEPTANCE
 CEC-NRCA-MCH-05-A (Revised: 01/20)

CALIFORNIA ENERGY COMMISSION
 NRCA-MCH-05-A
 Air Economizer Controls Acceptance
 (Page 3 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System Location or Area Served: _____

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

I, certify that this Certificate of Acceptance documentation is accurate and complete.

Documentation Author Name: _____ Documentation Author Signature: _____
 Documentation Author Company Name: _____ Date Signed: _____
 Address: _____ All (Certification identification if applicable)
 City/State/Zip: _____ Phone: _____

FIELD TECHNICIAN'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

- The information provided on this Certificate of Acceptance is true and correct.
- I am the person who performed the acceptance verification reported on this Certificate of Acceptance (Field Technician).
- The construction or installation identified on this Certificate of Acceptance complies with the applicable acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.
- I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and signed by the responsible builder/installer and has been posted or made available with the building permit(s) issued for the building.

Field Technician Name: _____ Field Technician Signature: _____
 Field Technician Company Name: _____ Address with Company (if any): _____
 Address: _____ All (Certification identification if applicable)
 City/State/Zip: _____ Phone: _____ Date Signed: _____

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

- I am the Field Technician, or the Field Technician is acting on my behalf as my employee or my agent and I have reviewed the information provided on this Certificate of Acceptance.
- I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Acceptance and attest to the declarations in this statement (responsible acceptance person).
- The information provided on this Certificate of Acceptance substantiates that the construction or installation identified on this Certificate of Acceptance complies with the acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.
- I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and is posted or made available with the building permit(s) issued for the building.
- I will ensure that a completed, signed copy of this Certificate of Acceptance shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a signed copy of this Certificate of Acceptance is required to be included with the documentation the builder provides to the building owner. #1 occupancy.

Responsible Acceptance Person Name: _____ Responsible Acceptance Person Signature: _____
 Responsible Acceptance Person Company Name: _____ Address with Company (if any): _____
 Address: _____ City/State/Zip: _____ Phone: _____ Date Signed: _____

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

MCH-06-A DEMAND CONTROL VENTILATION SYSTEMS ACCEPTANCE

STATE OF CALIFORNIA
DEMAND CONTROL VENTILATION SYSTEMS ACCEPTANCE
CEC-NRCA-MCH-06-A (Revised 1/2020) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE NRCA-MCH-06-A
 Demand Control Ventilation Systems Acceptance (Page 1 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System Location or Area Served: _____

Compliance Results: Complies Does NOT Comply Enforcement Agency Use: Checked by/Date: _____

Intent: Verify that systems required to employ Demand Controlled Ventilation (refer to §120.11060) can vary outside ventilation flow rates based on maintaining interior carbon dioxide (CO₂) concentration setpoints.
 NOTE: Submit one Certificate of Acceptance for each CO₂ sensor in the system that must demonstrate compliance.

A. Construction Inspection

Article	Item	Pass/Fail/Not Test	Comments/Notes
Prior to Functional Testing, verify and document the following:			
1.	Required Documentation (check all of the following):		
<input type="checkbox"/>	a. NRCA-MCH-06-A as approved by the authority having jurisdiction. (§120.11060)		
<input type="checkbox"/>	b. Factory Calibration Certificate(s)		
<input type="checkbox"/>	c. Compliance NRCA-MCH-06-A (maybe conducted concurrently)		
2.	CO ₂ control sensor is factory calibrated as specified by §120.11064 (NAF 5.5.10x):		
<input type="checkbox"/>	a. Factory Calibration Certificate(s) shows (check all of the following):		
<input type="checkbox"/>	i. Sensor is accurate to within plus or minus 75 ppm at a 600 and 1000 ppm concentration when measured at sea level and 25°C. (§120.11064)		
<input type="checkbox"/>	ii. Sensor is certified by the manufacturer to require calibration no more frequently than once every 5 years. (§120.11064)		
<input type="checkbox"/>	iii. Upon detection of sensor failure, the system must provide a signal which resets the system to supply the minimum quantity of outside air to levels indicated by approved design (NRCA-MCH-06-A, Section I, §120.11061). (§120.11064)		
<input type="checkbox"/>	iv. If the system includes Direct Digital Control, then the CO ₂ sensor(s) reading for each zone must be displayed continuously and accurately. (§120.11064)		
3.	Sensor location within each zone:		
<input type="checkbox"/>	a. Each sensor is located in the high-dry space between 3 ft and 6 ft above the floor or at the anticipated level of the occupants' heads. (NAF 5.5.10x, §120.11064)		
4.	DCV control setpoint is at or below the CO ₂ concentration permitted (check all of the following):		
<input type="checkbox"/>	a. Demand ventilation controls maintain CO ₂ concentrations less than or equal to 800 ppm plus the outdoor air CO ₂ concentration in all spaces with CO ₂ sensors. (§120.11064)		
<input type="checkbox"/>	b. The outdoor air ventilation rate is not larger than the approved outdoor air ventilation design rate (NRCA-MCH-06-A, Section I, §120.11061) regardless of CO ₂ concentration. (Exception to §120.11064)		
5.	Outdoor air CO ₂ concentrations are determined by one of the following (check one of the following):		
<input type="checkbox"/>	a. The system assumes that CO ₂ concentrations are 800 ppm. (§120.11064)		
<input type="checkbox"/>	b. CO ₂ concentrations are dynamically measured using a CO ₂ sensor located within 4 ft of the outdoor air intake. (§120.11064)		
6.	CO ₂ sensor installation requirements (check all of the following):		
<input type="checkbox"/>	a. CO ₂ sensors are installed to no less than one sensor per 10,000 ft ² area in a zone or space. (§120.11064)		
<input type="checkbox"/>	b. If a zone or a space is served by more than one sensor, then sensors must be configured such that a signal from any sensor indicating that CO ₂ is near or at the setpoint within the zone or space will trigger the system to increase ventilation. (§120.11064)		

Construction Inspection Compliance Results: Complies Does NOT Comply

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
DEMAND CONTROL VENTILATION SYSTEMS ACCEPTANCE
CEC-NRCA-MCH-06-A (Revised 1/2020) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE NRCA-MCH-06-A
 Demand Control Ventilation Systems Acceptance (Page 2 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System Location or Area Served: _____

B. Functional Testing

Step	Instructions	Results
1	Prior to functional testing, record the following:	
a.	Disable economizer controls. (NAF 5.5.202a, 1D)	<input type="checkbox"/>
b.	Record outside air CO ₂ concentration from dynamic measurement or	ppm
c.	Assume outside air concentration if dynamic measure is not include with the system	800 ppm
d.	Record interior CO ₂ concentration setpoint (may not exceed Step 1b + 800 ppm) (§120.11060)	ppm
2	Simulate a signal at or slightly above the CO ₂ concentration setpoint required (Step 1c). (NAF 5.5.202a, 2)	
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 ventilation air called for in the Certificate of Compliance. If a compliant NRCA-MCH-06-A has been completed any open setting above minimum is acceptable, otherwise measure outdoor air flow and refer to NRCA-MCH-06-A, Section I (NAF 5.5.202a, 2a)	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. If a compliant NRCA-MCH-06-A has been completed any open setting above minimum is acceptable, otherwise measure outdoor air flow and refer to NRCA-MCH-06-A, Section I for the sum of all zones served. (NAF 5.5.202a, 2a)	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. If a compliant NRCA-MCH-06-A has been completed any open setting including minimum is acceptable, otherwise measure outdoor air flow and refer to NRCA-MCH-06-A, Section I (NAF 5.5.202a, 2a)	P / F / NA
c.	For multiple zone units, the zone damper (or outdoor air damper when applicable) modulates to satisfy the zone ventilation requirements. If a compliant NRCA-MCH-06-A has been completed any open setting including minimum is acceptable, otherwise measure outdoor air flow and refer to NRCA-MCH-06-A, Section I for the sum of all zones served. (NAF 5.5.202a, 2a)	P / F / NA
4	Verify DCV operation with economizer	
a.	Restore economizer controls and remove all system overrides initiated during the test. (NAF 5.5.202a, 3)	<input type="checkbox"/>
b.	Apply CO ₂ calibration gas at a concentration slightly above the setpoint to the sensor. (NAF 5.5.202a, 3)	ppm
c.	Verify that the outdoor air damper modulates open to satisfy the total ventilation air called for in the Certificate of Compliance. If a compliant NRCA-MCH-06-A has been completed any open setting above minimum is acceptable, otherwise measure outdoor air flow and refer to NRCA-MCH-06-A, Section I for the sum of all zones served. (NAF 5.5.202a, 3)	P / F
5	Remove all system overrides initiated during the test and return system to normal operation.	

Functional Testing Compliance Results: Complies Does NOT Comply

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

STATE OF CALIFORNIA
DEMAND CONTROL VENTILATION SYSTEMS ACCEPTANCE
CEC-NRCA-MCH-06-A (Revised 1/2020) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE NRCA-MCH-06-A
 Demand Control Ventilation Systems Acceptance (Page 3 of 3)

Project Name: _____ Enforcement Agency: _____ Permit Number: _____
 Project Address: _____ City: _____ Zip Code: _____
 System Name or Identification Tag: _____ System Location or Area Served: _____

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

I certify that this Certificate of Acceptance documentation is accurate and complete.

Documentation Author Name: _____ Documentation Author Signature: _____
 Documentation Author Company Name: _____ Date Signed: _____
 Address: _____ A/E/C Certification Identification (if applicable): _____
 City/State/Zip: _____ Phone: _____

FIELD TECHNICIAN'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

- The information provided on this Certificate of Acceptance is true and correct.
- I am the person who performed the acceptance verification reported on this Certificate of Acceptance (Field Technician).
- The construction or installation identified on this Certificate of Acceptance complies with the applicable acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.
- I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and signed by the responsible builder/installer and has been posted or made available with the building permit(s) issued for the building.

Field Technician Name: _____ Field Technician Signature: _____
 Field Technician Company Name: _____ Position with Company (Title): _____
 Address: _____ A/E/C Certification Identification (if applicable): _____
 City/State/Zip: _____ Phone: _____ Date Signed: _____

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

- I am the Field Technician, or the Field Technician is acting on my behalf as my employee or my agent and I have reviewed the information provided on this Certificate of Acceptance.
- I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Acceptance and attest to the declarations in this statement (responsible acceptance person).
- The information provided on this Certificate of Acceptance substantiates that the construction or installation identified on this Certificate of Acceptance complies with the acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.
- I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and is posted or made available with the building permit(s) issued for the building.
- I will ensure that a completed, signed copy of this Certificate of Acceptance shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a signed copy of this Certificate of Acceptance is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Acceptance Person Name: _____ Responsible Acceptance Person Signature: _____
 Responsible Acceptance Person Company Name: _____ Position with Company (Title): _____
 Address: _____ C/E/C License: _____
 City/State/Zip: _____ Phone: _____ Date Signed: _____

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance January 2020

CO₂ – Indicator



- Proper Ventilation
- Dilution of Indoor Contaminants
 - Formaldehyde, volatile organic compounds (VOC), particles, pesticides, radon, fungi, bacteria, and nitrogen oxides
- Body Odor

CO2 – Indicator

- Patrons complain immediately on feeling too hot or too cold.
- Not feeling alert during an exam is attributed to the subject matter.



CO2 – Effect on Body

- **250-350 ppm** – Normal Outdoor Levels
- **350-1000 ppm** – Typical in occupied space with proper ventilation
- **1000-2000 ppm** – Complaints of drowsiness and “Poor Air”
- **2000-5000 ppm** – Headaches, Sleepiness, “Stuffy Air”, Poor Concentration, Loss of Attention, Increased Heart Rate, Nausea
- **>5000 ppm** – Serious Oxygen Deprivation resulting in permanent brain damage, coma, and death.

CO₂ – Effect on Body

- **15% - 33%** of population show symptoms when CO_2 levels are between 600 ppm and 800 ppm
- **33% - 50%** of population show symptoms when CO_2 levels are between 800 ppm and 1000 ppm.
- **100%** of population show symptoms when CO_2 levels are above 1500 ppm.

CO₂ – Cognitive Performance, Productivity, and Health

- 2017 literature review summarized that 8 studies reported statistically significant improvements in some measures of student performance associated with increased ventilation rates or lower CO₂ concentrations, with performance increases up to 15%. – Fisk 2017
- Reducing student absences caused by illness by **3.4 percent**. Given attendance based funding could result in an increase **\$33 million** in state funding. – Lawrence Berkeley National Labs/2013

CO₂ Monitoring



Helps ensure proper ventilation is maintained throughout system operation:

- (1) Is 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.
- (2) Displays the CO₂ readings to the teacher through a display on the device or other means such as a web-based application or cell-phone application.
- (3) Notifies the teacher through visual indicator on the monitor (e.g. indicator light) or other alert such as e-mail, text, or cell phone application, when the CO₂ levels in the classroom have exceeded 1,100 ppm.
- (4) Maintains a record of previous data which includes at least the maximum CO₂ concentration measured.
- (5) Has a range of 1 - 2000 ppm or greater;
- (6) Is certified by the manufacturer to be accurate within 75 ppm at 1,000 ppm CO₂ concentration and is certified by the manufacturer to require calibration no more frequently than once every five years.



Thank you!

Questions...

Contact Information

TABB

- www.tabbcertified.org

Christopher Ruch

- cruch@nemionline.org
- (916)280-6281