INSTALLER and INSPECTOR QUICK-REFERENCE: 2022 NRCA-MCH-02-A Variable Air Volume Systems Outdoor Air Acceptance

Purpose and Scope of the Test

This test ensures the provision of adequate outdoor air ventilation through the variable air volume air handling unit at two representative operating conditions. The test consists of measuring outdoor air values at maximum flow and at or near minimum flow. The test verifies the introduction of a minimum volume of outdoor air, in accordance with section 120.1(f), into the air handling unit and is within 10 percent of the required volume when the system is in occupied mode at these two conditions of supply airflow.

Perform this test in conjunction with NA7.5.6 Supply Fan Variable Flow Controls Acceptance test procedures (NRCA-MCH-07-A) to reduce the overall system testing time as both tests use the same two conditions of airflow for their measurements.

Related acceptance tests for these systems include:

- NA7.5.4 Air Economizer Controls.
- NA7.5.5 Demand Control Ventilation (DCV) Systems (if applicable).
- NA7.5.6 Supply Fan Variable Flow Controls.

Test trigger

Newly constructed and additions/alterations: Applies to new variable air volume (VAV) systems.

Relevant Energy Code References and Required Compliance Documents

Title 24, Part 6 of the California Building Code, Building Energy Efficiency Standards (Energy Code) sections 120.1(f), 120.5(a)1, 140.4(c)2, 160.2(c)5, 160.3(d)1A, 170.2(c)4Aii and NA 7.5.1.1.

Who Can Perform the Test

This test must be performed by an acceptance test technician certified by a CEC-approved Acceptance Test Technician Certification Provider, using compliance document NRCA-MCH-02-A.

Required Tools

Performance of this test will require measuring outdoor air flow. When the system includes an airflow monitoring system (AFMS) on the outdoor air, then it may be used for the measurements if it has a calibration certificate or is field-calibrated. The instrumentation needed to perform the test may include, but is not limited to:

- An airflow measurement probe (for example, hot-wire anemometer or velocity pressure probe).
- A watch or some equivalent device to measure time in minutes.

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Estimated Time to Complete Test

Construction Inspection: 0.5 to 2 hours, depending on complexity and difficulty in calibrating the "system" controlling outdoor air flow.
Functional testing: 1 to 3 hours, depending on the type of zone control and the number of zones.

Potential Issues and Cautions

Use caution when performing test during winter months in cold climates. Since outdoor airflow must remain constant with reduced supply fan flow, total supply flow can approach 100 percent outdoor air. Be sure that all freeze protection and heating coil controls are functioning before performing test.

Coordinate test procedures with the controls contractor who may assist with manipulation of the building automation system (BAS) to achieve the desired operating conditions.

Ensure disabling of economizer and demand-controlled ventilation controls before performing the test.

Inspection Enforcement

Prior to functional testing, verify and document the following:

- Reference the supporting documentation as needed. Reference NRCC-MCH-E or the mechanical equipment schedules to determine the total required outdoor airflow for the system.
- Indicate method and equipment used to measure airflow during the functional test (for example, hot-wire anemometer) on the acceptance document. Note calibration date; calibration date must be within one year.
- Verify that the sensors used to control outside air (OSA) flow is either factory- or field-calibrated. Attach the calibration certificate or field calibration results to the acceptance test document NRCA-MCH-02-A.
- Verify that a fixed minimum damper set point is not controlling OSA. The field technician shall review the operation sequences to ensure the system performs dynamic control of minimum outdoor air and reviews the installation to confirm all of the devices of that sequence are present.
- Indicate the dynamic control method used to control OSA in the system. There are several means to dynamically control minimum OSA for VAV systems, and many ways for the designer to specify an active ventilation air control "system" intended to maintain a constant outdoor air flow rate as supply fan flow rate decreases. For example, an installed flow station

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Inspection Enforcement (cont.)

measures outdoor air flow rate and modulates the outdoor air dampers accordingly. Or dampers can be modulated to maintain a constant differential pressure across a dedicated outdoor air damper assembly. The sensors, equipment, and control strategy necessary to achieve the desired control shall be calibrated as a "system," regardless of the control method of the outdoor airflow.

- Indicate the method used to deliver outside air to the unit (for example, duct, return air plenum). For systems using return air plenums to distribute outside air to a zonal heating or cooling unit, confirm that outside air supply connects either:
  - Within 5 feet of the unit.
  - Within 15 feet of the unit, with the air directed substantially toward the unit, and with a discharge velocity of at least 500 feet per minute.
- Verify the system program includes a preoccupancy purge for the 1-hour period immediately before normal occupancy of the building per the Energy Code. This confirmation is most easily accomplished by scheduling the unit to start one hour before actual occupancy. The purge amount must be the lesser of the minimum outdoor air rate or three complete building air changes (ACH).

Acceptance Criteria

- Verify that the sensor controlling outdoor air flow is field or factory calibrated, with documentation attached.
- Verify that the measured outdoor airflow reading is within 10 percent of the total value found on the Energy Code Mechanical Plan Check document NRCC-MCH-E, under the following conditions:
  - Minimum system airflow or 30 percent of total design flow; 20 percent if the system has Direct Digital Controls (DDC).
  - Design supply airflow.
- Verify that the OSA damper returns to stable operation within 5 minutes of settings being changed.

Follow the **Construction Inspection** and **Functional Testing** instruction on NRCA-MCH-02-A.