

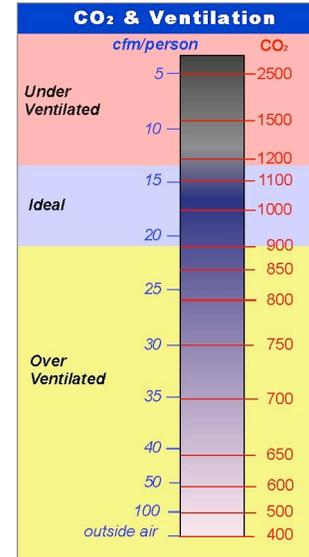
CO₂ VENTILATION CONTROL AND CALIFORNIA TITLE 24

OVERVIEW:

Provisions for CO₂ based ventilation control (also called demand controlled ventilation – DCV) have been in the California Title 24 Building Code since 1996. As a result of the energy crisis here in California, some additional provisions were added to the code effective June of this year. This technical note provides a brief overview of how CO₂ Demand Controlled Ventilation is now addressed in California Title 24. CO₂ DCV is addressed in Section 121 (C) of title 24.

This document also briefly discusses changes to Title 24 that will be complete in June 2003 and take effect in 2005. Voluntary compliance will be encouraged after June 2003 until provisions become mandatory in 2005.

For further general reference to Title 24 the reader can visit www.energy.ca.gov/title24/.



HOW DCV IS APPLIED

- A base ventilation rate of 0.15 cfm/ft² must be provided during all occupied hours. This is intended to control non-occupant related sources since CO₂ is primarily a occupancy parameter.
- A CO₂ sensor can be used to modulate any ventilation requirements over 0.15 cfm/ft².
- The CO₂ ventilation strategy must provide 15 cfm/person of outside air based on actual occupancy.
- All sensors used in California must be on California's approved list of manufacturers (AirTest is an approved manufacturer).

The requirement for 0.15 cfm/ft² means that CO₂ control in low density spaces like offices may not save very much energy because it is equal to providing 15 cfm/person at a density of 10 people per 1000 ft². However for higher density spaces such as conference rooms, schools, restaurants, theaters and churches the base level of ventilation is very low compared to the design ventilation rate normally required in the space, resulting in maximum potential for energy savings. Even if significant energy savings do not exist, CO₂ can provide an excellent method of monitoring and controlling a space to ensure acceptable air quality is maintained at all times.

MANDATORY REQUIREMENTS

The June 2001 change to Title 24 made the application of CO₂ DCV mandatory in certain high density applications. In these applications DCV control can save enormous amounts of energy for a very small initial capital investment. Basically it was made mandatory in these applications because the energy benefit makes it a “no brainer”. CO₂ DCV is mandatory in applications that have both the following characteristics:

1. That primarily serve areas with fixed seating and occupant densities less than or equal to 10 square foot per person (10 people per 100 sq ft), or identified in Chapter 10 of the UBC as either “Assembly Areas, Concentrated Use (without fixed seats)” or “Auction Rooms
2. Spaces that have design outdoor air capacities equal to or exceeding 3,000 cfm. This relates to the total outside air delivered to the space regardless of whether one or several air handlers are used.

MAXIMUM CO₂ LEVEL

Originally, Title 24 had a requirement that for spaces where CO₂ DCV was applied, CO₂ concentrations should not exceed 800 ppm. It is important to note that CO₂ concentrations in buildings are not considered a contaminant where health-threatening levels exist. Rather, it is a measure of the outside air ventilation rate as measured by the dilution of occupant generated CO₂. CO₂ DCV is used to control ventilation so that a target cfm/person can be provided. (See ASHRAE Journal February 2001 for a detailed explanation of the relationship between CO₂ and ventilation)

In the June revision to the standard, the California Energy Commission realized that a level of 800 ppm actually results in a ventilation rate of close to 26 cfm per person, and that under the old provisions, people would actually have to over ventilate to meet the 800 ppm level. While the 800 ppm was not removed from the standard for certain political reasons the wording was changed to read as follows:

“If the device is a carbon dioxide sensor, limit the carbon dioxide level to no more than 800 ppm while the space is occupied only when the ventilation rate is less than required by Section 121 (b) 2 (*15 cfm/person*), control to 800 ppm is not required when the ventilation rate is equal to or greater than that required by Section 121 (b) 2 (*15cfm/person*)”

Since a CO₂ control strategy is designed to provide a specific target ventilation rate per person (e.g. 15 cfm) based on actual occupancy, the 800 ppm can be exceeded in the space. ASHRAE Standard 62-1999 suggests that an indoor/outdoor differential of CO₂ of 700 ppm is considered equivalent to 15 cfm per person. Since outside levels are typically around 400 ppm in California indoor concentrations for spaces ventilated at 15 cfm/person should not exceed 1100 ppm (400 outside + 700 differential = 1,100 ppm). As a result the maximum of 800 ppm does not apply when the ventilation strategy is designed to provide 15 cfm/person.

CHANGES TO BE MADE IN 2003

A number of proposed changes to Title 24 will be made in 2003 which will effect the 2005 version of the code. The changes currently being completed include:

- The 800 ppm maximum will be completely removed from the standard and replaced with a requirement that 15 cfm/person should be maintained.
- The use of CO₂ sensors will become mandatory in all medium density applications having more than 40 sq ft/person (25 people/1,000 sq ft).
- A base ventilation rate of .15 cfm/sq ft must be maintained during occupied hours.

Proposed Standards Language For 2003/2005 Revision

121(c)3 *Required Demand Control Ventilation. HVAC single zone systems with the following characteristics shall have demand ventilation controls complying with 121 (c) 4:*

- A. *That are required to have an economizer per 144(e).*
- B. *That primarily serve areas with design occupant densities less than or equal to 40 square foot per person, or identified in Chapter 10 of the UBC as "Assembly Areas, Concentrated Use (without fixed seats)," "Auction Rooms," "Assembly Areas, Less-Concentrated Use," or "Classrooms."*

121(c)4 *Demand Control Ventilation Devices shall:*

- A. *Allow the rate of outdoor air to be reduced to 0.15 cfm per square foot of conditioned floor area, if the demand control ventilation device indicates that the space conditions are acceptable; and*
- B. *Be approved by the commission; and*
- C. *If the device is a carbon dioxide sensor, limit the ventilation rate to 15 cfm per person; and*
- D. *Include a sensor for the device located (1) in the space; or (2) in a return-air stream from the space with no less than one sensor for every 25,000 square feet of habitable space, or no more space than is recommended by the manufacturer, whichever is less.*