EE 12:
PROVIDE VENTILATION AIR ONLY AS NEEDED IN LARGE SPACES

New York City Mechanical Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:
HVAC systems typically provide outdoor air based on maximum occupancy, wasting energy when rooms are partially occupied or empty. Demand control ventilation adjusts the amount of air pumped into rooms as needed.

Recommendation:
Require demand control ventilation for large spaces of variable occupancy.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code

1. Amend Section 403.3.1 as follows:

   403.3.1 System operation. The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 403.3 and the actual number of occupants present. Intermittent exhaust shall be permitted where an individual exhaust duct and fan are provided and the operation of the fan is controlled by occupants of the space being vented.

   Exception: In intermittently occupied spaces that do not have processes or operations that generate dusts, fumes, mists, vapors or gasses and are not provided with local exhaust ventilation in accordance with Chapter 5, the rate of outdoor air may be reduced if the ventilation system serving the space is controlled by a demand control ventilation device complying with Section 403.3.5.

2. Add a new Section 403.3.5 as follows:

   403.3.5. Demand control ventilation. Demand control ventilation shall be provided as follows:

   1. Demand control ventilation shall be required, and shall have demand ventilation sensors and controls complying with this section, in single-zone HVAC systems where:

      1.1. Such system has an outdoor air economizer; and

   1.2. The demand control ventilation serves a space with an estimated occupancy load greater than or equal to 25 persons per 1000 square feet (less than or equal to 40 square feet per person).

   Exceptions:

   1. Natatoriums, classrooms, R-2 and R-3 occupancies and healthcare facilities shall not be required to have demand control ventilation.

   2. Demand control ventilation shall not be required where space exhaust is greater than the outdoor airflow rate required by Table 403.3.

   3. Spaces that have processes or operations that generate dusts, fumes, mists, vapors, or gases and are not provided with local exhaust ventilation in accordance with Chapter 5 shall not be required to provide demand control ventilation.

2. Where demand control ventilation is required by this section, sensor and control devices shall be required as follows:

2.1. CO2 sensors shall be installed in each room, between one foot and six feet above the floor.

2.2. In each room with CO2 sensors, demand ventilation controls shall maintain CO2 concentrations less than or equal to 600 parts per million plus the outdoor air CO2 concentration.
Exception: The outdoor airflow rate is not required to be larger than the outdoor airflow rate required by Table 403.3, regardless of CO2 concentration.

2.3 Outdoor air CO2 concentration shall be determined by one of the following:

i. CO2 concentration shall be assumed to be 400 parts per million without any direct measurement; or

ii. CO2 concentration shall be dynamically measured using a CO2 sensor located within six inches of the outdoor air intake.

2.4 When the system is operating during hours of occupancy, the controls shall maintain system outdoor airflow rates no less than the rate listed in Table 403.3 times the conditioned floor area for spaces with CO2 sensors, plus the rate required by Section 403.3.1 for other spaces served by the system, or the exhaust air rate, whichever is greater;

2.5 CO2 sensors shall be certified by the manufacturer to have an accuracy within 75 parts per million and to require calibration no more frequently than once every 5 years, and shall be factory-calibrated or calibrated at start-up.

3. A special inspection shall be required in accordance with department rules to verify that the demand control ventilation system meets the requirements of this section.

Supporting Information

Issue – Expanded
Demand-controlled ventilation reduces energy use by reducing the amount of air that gets heated or cooled. Instead of ventilating all the air in a given space at its maximum capacity at all times, only the amount of air that is actually needed by the occupants gets drawn into and exhausted from the space. Since fresh air must be heated or cooled a good portion of the year, execution of this proposal will reduce heating and cooling costs for the spaces in question. If the space is occupied on an irregular basis, the savings can be substantial.

Various mechanisms are available for controlling the amount of air. The most straightforward may be a carbon dioxide sensor, since the presence of carbon dioxide indicates that people are present and correctly measures how hard they are breathing - useful, for example, in a gymnasium.

Environmental & Health Benefits
This carries the benefits of lowered emissions from boilers and electric generators.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost / Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.04%. It was thus categorized as incurring a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in about four years. (Unfortunately, this measure was mis-represented in the Executive Summary as having a payback period greater than ten years.)

Precedents
Demand-controlled ventilation has become more feasible and cost-effective in recent years, and state energy departments such as in Oregon have promoted DCV as a means of cutting energy costs and usage. The conservation division of the Oregon Department of Energy has issued a design guide for Demand-Controlled Ventilation, which can be found here:

ASHRAE 90.1 2007 includes a section (6.4.3.9) requiring DCV in high-occupancy areas. This measure extends the coverage to lower occupancy levels, and is necessary because the mechanical code would pre-empt the ASHRAE requirement.
LEED
LEED does not provide credit for utilizing a demand-controlled-ventilation system, although it does cite the logic of implementing a DCV system in certain large spaces. LEED does provide credit for installing Carbon Dioxide sensors. Therefore, this proposal will assist projects in complying with LEED under the following subsections (including various pilot programs):

- LEED NC-EQ cr.1, Outdoor Air Delivery Monitoring
- LEED CI-EQ cr.1, Outdoor Air Delivery Monitoring
- LEED for Schools EQ cr.1, Outdoor Air Delivery Monitoring
- LEED EB-EQ cr.1, Outdoor Air Delivery Monitoring

LEED for Homes requires Carbon Monoxide detection devices, and thus does not correlate with the requirements of this proposal.

Implementation and Market Availability
There are no known implementation issues for this proposal. CO₂ based demand control ventilation systems are technically mature and widely available.

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