INTERPRETATION IC 62.1-2010-3 OF
ANSI/ASHRAE STANDARD 62.1-2010
VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY

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Reference: This request for interpretation refers to the requirements presented in ANSI/ASHRAE Standard 62.1-2010, Sections 6.2.6.1 and 6.2.6.2, regarding ventilation fan cycling.

Background: We have developed a sequence for single zone unitary air conditioners that combines DCV control with fan cycling to maintain an average ventilation rate equal to or greater than the prescriptive ventilation rate. This concept was presented in an ASHRAE conference paper in January 2011 in Las Vegas (attached). The sequence calls for increased ventilation above the prescriptive rate during operation of heating and cooling, and provides for additional fan operation as necessary to provide an average ventilation rate equal to or greater than the prescriptive rate based on CO_2 sensor readings. When there are no calls for heating or cooling operation for 30 minutes (or a lower maximum fan off limit to meet space conditions), the fan will operate to provide required average ventilation. The sequence provides for the area rate based on setup inputs, and adjusts the people rate based on CO_2 measurements at the end of the last fan cycle. Outside air percentage during fan ventilation operation can be up to 100% and is adjusted during outside temperature extremes to avoid exceeding design heating or cooling capacity of the unit. Fan operation time is based on the ventilation required and the calculated ventilation rate.

Field studies[1] have found that 40% of unitary air conditioner controls have fan switches in the "Auto" position, and the attached ASHRAE conference paper shows this results in inadequate ventilation during low thermal load conditions. The proposed sequence maintains average ventilation with fan cycling but does not allow switching to "Auto" operation; so ventilation is expected to be improved overall when the advanced control sequence is installed.

Fan energy is a significant portion of unitary HVAC energy in some climates, and it is more cost effective to cycle the fan to save fan energy than to provide a variable speed drive for the fan, especially on smaller units. Upgrading ventilation controls with demand controlled ventilation also provides significant energy savings during building warm up and when buildings are not occupied at design conditions.

Related information:

- 6.2.6.2 (b) allows intermittent ventilation as long as the average outdoor airflow is not less than the breathing zone outdoor airflow (*Vbz*) calculated using Equation 6-1.
- On page 30, the 62.1-2010 user's manual suggests that to combat the inadequate ventilation that can occur when the fan switch is in the auto position, a designer may: "Provide excess outdoor air when the system is running and a minimum fan-on timer

when the space is occupied (see §6.2.6.2)." This is essentially the approach taken in the proposed sequence.

- Interpretation IC 62.1-2007-03 indicated that 5 continuous hours without ventilation during a 6 hour time period is not a short term condition, even where averaging requirements of 6.2.6.2 were met.
- Interpretation IC 62.1-2007-21 indicated that suspending ventilation for 10 to 15 minutes for heat pump defrost would be acceptable.
- To comply with 6.2.6.2, the sequence should also restrict the fan off time to a time period that allows adequate fan operation after the off period to measure CO_2 concentration and calculate the average ventilation rate relative to Cr (ppm) in time T. While not a part of the standard, it is likely that an upper limit of 2/3 * T (Where T is calculated per equation 6-9a or 6-9b in Section 6.2.6.2) would provide adequate time for stable control.
    - For example, a typical classroom with an 8 foot ceiling might have a calculated averaging time T of 51 minutes. In this example under interpretation 1 if the average ventilation rate were maintained, fan off time of the lessor of 34 minutes (2/3 * T) or an absolute limit of 30 minutes would be appropriate.
    - In another example, a fixed seat lecture hall with a 12 foot ceiling might have a calculated averaging time T of 30 minutes. In this example under interpretation 1, maximum fan off time of 20 minutes (2/3 * T) would be appropriate.

The control sequence would also need to balance fan off and on time to provide adequate ventilation to average out during the time T. For example, in a system where the maximum actual outside air that could be delivered was 70%, 35% ventilation is required at full occupancy to meet the prescriptive ventilation rate, and the calculated averaging time T is 50 minutes, the maximum fan off time should be (35%/70%) * T = 25 minutes so that average ventilation can be delivered in compliance with Section 6.2.6.2 when the space is fully occupied.

[1] Jacobs, P. (2003). "Small HVAC system design guide." Architectural Energy Corporation (AEC).

Interpretation No.1: A ventilation fan may be turned off for up to 30 minutes, when a zone is occupied as long as the ventilation rate is increased during fan operation and average ventilation is maintained in compliance with Section 6.2.6.2.

Question No.1: Is this interpretation correct?

Answer No.1: Yes.

Interpretation No.2: A ventilation fan may be turned off for up to 20 minutes when a zone is occupied as long as the ventilation rate is increased during fan operation and average ventilation is maintained in compliance with Section 6.2.6.2.

Question No.2: Is this interpretation correct?

Answer No.2: Yes.

Interpretation No.3: A ventilation fan may be turned off for up to 15 minutes when a zone is occupied as long as the ventilation rate is increased during fan operation and average ventilation is maintained in compliance with Section 6.2.6.2.

Question No.3: Is this interpretation correct?

Answer No.3: Yes.

Interpretation No.4: If interpretation 1 is correct, this interpretation holds true for ANSI/ASHRAE Standard 62.1-2010 and ANSI/ASHRAE Standard 62.1-2007.

Question No.4: Is this interpretation correct?

Answer No.4: Yes

Interpretation No.5: If interpretation 2 is correct, this interpretation holds true for ANSI/ASHRAE Standard 62.1-2010 and ANSI/ASHRAE Standard 62.1-2007.

Question No.5: Is this interpretation correct?

Answer No.5: Yes

Interpretation No.6: If interpretation 3 is correct, this interpretation holds true for ANSI/ASHRAE Standard 62.1-2010 and ANSI/ASHRAE Standard 62.1-2007.

Question No.6: Is this interpretation correct?

Answer No.6: Yes