ASHRAE STANDARD 62
Ventilation for Acceptable Indoor Air Quality
Analysis and Recommendations

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INTRODUCTION

ASHRAE Standard 62 is a short, but often misinterpreted, document outlining ventilation requirements for acceptable indoor air quality. The standard is being developed under a "continuous maintenance" protocol and is comprised of a parent document and approved addenda. The parent document at the time of publication was ASHRAE Standard 62-2001.

This paper is a comprehensive summary of ASHRAE 62-2001, Ventilation for Acceptable Indoor Air Quality (IAQ) and approved addenda. Designers should provide an acceptable indoor environment to maintain occupant productivity and health. They should also evaluate the IAQ risk of their design. Standard 62 has been incorporated into many building codes. The International Mechanical Code has adopted a rigid interpretation of the Ventilation Rate Procedure of the parent document and requires devices and controls to maintain per person ventilation requirements at all load conditions. Regardless of local code requirements, designing and operating a building to this standard will minimize IAQ liability and help assure an acceptable indoor environment. Unfortunately there is no "cookbook" solution to ventilation for IAQ.

ANALYSIS AND RECOMMENDATIONS

1. PURPOSE

The purpose of ASHRAE Standard 62, as defined in Section 1, is to "specify minimum ventilation rates and indoor air quality that will be acceptable to human occupants and are intended to minimize the potential for adverse health effects." If local building codes reference ASHRAE Standard 62 the requirements of the standard become an integral part of the code. Ventilation code enforcement has proven to be difficult because it is often misunderstood by the code enforcement agency in the local jurisdiction. Present motivation to design to the standard has been driven mostly by liability and risk management concerns and in some cases the desire of the design professionals to meet their obligation by designing to national, professional standards. An area that only recently has received attention is the owner-occupant's motivation to increase productivity and reduce the adverse impact a poor indoor environment can have on human health and well-being.

2. SCOPE

The scope of Standard 62 "applies to all indoor or enclosed spaces that people may occupy, except where other applicable standards and requirements dictate larger amounts of ventilation than this standard."

3. DEFINITIONS

Section 3 addresses definitions used within the standard. Noteworthy is the standard's definition of acceptable indoor air quality. Acceptable indoor air quality is defined as "air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction." The majority of HVAC systems do not meet the minimum ventilation rates prescribed during operation. The actual occupant dissatisfaction is exponentially greater in practice. It is not uncommon for rates to fall below levels that result in occupant dissatisfaction significantly greater than 50%. Many systems cannot meet the minimum airflow requirements at the occupied space during operation as a result of the dynamic nature of mechanical ventilation system and external factors on the building envelope. The lack of specific guidelines to effectively overcome the effect of changing system dynamics on ventilation rates and distribution for today's HVAC systems is partially to blame for design deficiencies.

If properly executed, one out of five occupants may express dissatisfaction as a result of poor indoor air quality. Unlike thermal comfort, the effect of indoor air quality is difficult to measure. Many believe that the outside air levels specified by ASHRAE are too low and should actually be increased, as indicated by published research and reflected in European standards (CEN Technical Committee 156 and their publication CR1752).

4. CLASSIFICATION

ASHRAE Standard 62 specifies two procedures to obtain acceptable indoor air quality within Section 4, Classification, of the document. Designers must choose and claim compliance under one procedure, not a combination of both. Understanding and assessing the potential risk as well as the ability to provide a functional solution is the duty of the design professional. In the Ventilation Rate Procedure, 4.1, "acceptable air quality is achieved by providing ventilation air of the specified quality and quantity to the space (see 6.1)." In the alternative Indoor Air Quality Procedure, 4.2, "acceptable air quality is achieved within the space by controlling known and specifiable contaminants (see 6.2)"

5. SYSTEMS AND EQUIPMENT

Section 5 specifies the systems and equipment recommended under Standard 62. Addendum u was approved for incorporation into the parent document at the ASHRAE winter meeting in January 2002 and adds a new section, 5.3, that states, "Ventilation System Controls. Mechanical ventilation systems shall include either manual or automatic controls that enable the fan system to operate whenever the spaces served are occupied. The system shall be designed to <u>maintain</u> the supply airflow and minimum outdoor airflow as required by section 6 <u>under any load condition</u>. Note: VAV systems with fixed outdoor air damper positions may not meet this requirement." The standard recognizes that changes in mixed air plenum pressure, up to 0.5 in.w.g. variation, on VAV systems can significantly influence outside air intake flow rates. However, it neglects the significant influence of external pressure variations on all systems that result from changes in wind and stack pressures, which often exceeds 0.5 in.w.g. Therefore, maintenance of minimum outdoor airflow defined in section 6 essentially requires the use of permanent devices capable of maintaining outdoor airflow rates for compliance.

Not requiring airflow measurement is analogous to ignoring the requirement for temperature measuring devices to maintain automatic temperature control. Because many systems, especially VAV, have thermal load requirements that differ from the ventilation requirements for acceptable IAQ, the requirements of this section can only be realized if the multi-space equation (6-1) is calculated under design and minimum supply flows to individual zones using the minimum outdoor air requirements to each zone. The designer must assume that the critical zone is at its minimum supply airflow or use airflow measurement suitable for accurate monitoring in each zone which may go critical to continuously calculate then reset outside air intake flow rates at the AHU. Note: airflow measuring devices provided with commercial VAV boxes may not meet the accuracy requirement due to the inaccuracy of DDC controller pressure transducers.

As a result of the requirements set forth in the standard for compliance "under any load condition", section 5 should require airflow measurement with automatic controls at the intake of all air-handling units that function to provide a building or space with outside air, regardless of the size or the type of system. Acceptable airflow measuring devices should have a "total installed accuracy" better than 5% throughout the measurement range. It must also include individual sensor and transmitter uncertainties. In addition, the section should strongly encourage the use of airflow measuring devices in critical zones of VAV systems for the continuous calculation and reset of the multi-space equation defined in section 6. Although this may sound impractical to some designers, the productivity and health benefits is far greater than the cost to satisfy the requirements for acceptable indoor air quality.

At the writing of this document, addendum x was still under public review. This addendum addresses humidity control and building pressurization. Whenever the temperature of a building envelope is lower than the dew point of air migrating across it, there will be condensation. Moisture is a prerequisite for mold and fungal growth and the condition should be avoided. The proposed addendum, only addresses positive pressure during periods of dehumidification.

"5.10 Dehumidification Systems. Mechanical systems with dehumidification capability shall comply with the following:
5.10.1 Relative Humidity. Such systems shall be designed to limit occupied space relative humidity to 65% or less at peak outdoor dew point design conditions.
5.10.2 Building Pressurization. Such systems shall be designed to maintain the building at net positive pressure with respect to outdoors, in the absence of wind and stack effect, during all hours of dehumidification.

The statement, "in the absence of wind and stack effect" is of concern since external factors can significantly influence infiltration and exfiltration across the building envelope. As with section 5.3, the standard must eventually address wind and stack effect and provide guidelines that reflect conditions that influence buildings in their native environment. In addition, increased humidity combined with wind and stack driven infiltration during periods when the ventilation system is not operating may be a significant factor influencing mold and fungal growth. Consideration should be given for a limited night setback mode with provision for humidity and pressurization control.

There is the potential for condensation to occur under a positive pressure environment during periods of humidification in cold climates since the dew point of the air within the building could potentially be greater than the temperature of the building envelope. Maintaining a building at net neutral pressure under these conditions would be more appropriate. Net neutral control requires more precise instrumentation and the margin of error is much smaller.

"Building pressure" is accomplished by creating a pressurization flow. Anything that changes the pressurization flow will result in fluctuations in building pressure. The pressurization flow is generally manipulated with the HVAC system by controlling either the intake/relief air differential or the supply/return air differential. HVAC system control strategies that ignore this relationship have inherent pressurization problems.

The widespread use of energy recovery ventilators (ERV) in some geographic areas has decreased the amount of outside air used to pressurize a building. Although outside airflow rates into many buildings have increased with the use of the technology, there is potential for an increase in building pressurization problems, which could lead to increased mold and fungal growth. Designers should exercise caution when implementing strategies that rely on ERV units for outside air and result in building pressures that are close to net neutral by design. Wind, stack, and filter loading can easily result in net negative buildings and increased condensation within the building envelope.

Regardless of the system used, an effective method for maintaining the pressurization flow is to monitor and control either intake/relief airflow differentials or supply/return airflow differentials using airflow measuring stations. Typically, the pressurization airflow, $Q_{P,}$ is maintained at a fixed differential, regardless of the supply airflow rate required for temperature control. The pressurization airflow relationship is as follows:

$Q_P = Q_{SA} – (Q_{RA}+Q_{EX(local)}\}$ or $Q_P = Q_{OA} – \{Q_{EX(AHU)}+Q_{EX(local)}\}$

where

Q_P = pressurization airflow
Q_{SA} = supply airflow
Q_{RA} = return airflow
$Q_{EX(AHU)}$ = exhaust/relief at AHU
$Q_{EX(local)}$ = sum of local exhausts for zones served by AHU

6. PROCEDURES

Section 6, Procedures, is the heart of the standard. Designers must claim using either the Ventilation Rate Procedure or the Indoor Air Quality Procedure. Great care should be given to the selection between these procedures.

The Ventilation Rate Procedure "prescribes the rate at which ventilation air must be delivered to a space and various means to condition that air." The key phrase is "prescribes the rate" which implies airflow measurement. The alternate Indoor Air Quality Procedure "uses one or more guidelines for the specification of acceptable concentrations of certain contaminants in indoor air but does not prescribe ventilation rates or air treatment methods." Analysis of this procedure clearly discusses airflow rate requirements based on various contaminant levels so it is unclear why the statement "does not prescribe ventilation rates" is included.

According to the current parent document of ASHRAE 62 – 2001, the Ventilation Rate Procedure prescribes:

- the outdoor air quality for acceptable ventilation
- outdoor air treatment when necessary
- ventilation rates for residential, commercial, institutional, vehicular, and industrial spaces
- criteria for reduction of outdoor air quantities when recirculated air is treated by contaminant-removal equipment
- criteria for variable ventilation when the air volume in the space can be used as a reservoir to dilute contaminants.

Section 6.1.1, "Acceptable Outdoor Air", describes a three-step process to evaluate outside air for acceptability. If the outdoor air quality is not acceptable section 6.1.2, "Outdoor Air Treatment", must be followed. Outdoor air treatment must be utilized that can remove either the particulates and/or gases encountered, if the air was deemed unacceptable per 6.1.1.

Ventilation Rate Procedure

The Ventilation Rate Procedure is a rate based standard. Designers claiming this procedure must be able to substantiate that rates are maintained during all load conditions. Rates can be determined either directly using airflow measuring devices or indirectly by other means (i.e. temperature balance, mass balance, steady-state CO_2 concentration, etc.). However, the uncertainty of indirect techniques introduces a significant level of risk. The designer, occupants, and facility owners should carefully consider the method employed prior to implementation.

Section 6.1.3 also attempts to clarify the misconceptions associated with CO_2 measurement. CO_2 is an indicator of human activities and hence "bioeffluents" and not a measure of indoor air quality. Studies have indicated that a ventilation rate of 15 CFM per person is adequate to dilute body odor. Using the steady-state model described in Appendix C of the Standard, 15 CFM per person would be the resulting quantity of outside air introduced into a space if a.) steady-state conditions exist, b.) each person has the same CO_2 generation rate (0.31 l/min), c.) the outside CO_2 level can be accurately determined, and d.) the indoor CO_2 level can be accurately determined and maintained at approximately 700 ppm above the outdoor CO_2 level. The statement below merely indicates that human body odor will most likely be acceptable if the conditions above are true. It does not state the "indoor air quality shall be considered acceptable."

"Comfort criteria, with respect to human bioeffluents (odor) are likely to be satisfied if the ventilation results in indoor CO_2 concentrations less than 700 ppm above the outdoor air concentration."

CO_2 measurement, at best, can be used as an indicator of changes in occupancy. Its value as an indicator of actual ventilation rates is questionable. Designers should be cautious when using CO_2 measurement as the sole source of verification of outdoor airflow rates. Especially in facilities with variable occupancy and activity levels.

According to this procedure, 6.1.3 states that "Indoor air quality shall be considered acceptable if the required rates of acceptable outdoor air in Table 2 are provided for the occupied space." Table 2 specifies outdoor air requirements for specific applications and is based on ventilation rates per person as CFM/person. Therefore, systems that meet the minimum requirements of Table 2 and the outside air requirements set forth in 6.1.1 and 6.1.2, under "any load condition", can claim that the indoor air quality is "acceptable" according to the standard.

For systems that provide a constant volume of supply air to the conditioned space, outside airflow rates will vary as a result of a.) changes in wind and/or stack conditions on the intake system, b.) changes in filter loading and c.) changes in airflow requirements during an economizer cycle. All of these variations can be compensated for by using an airflow measuring station at the intake to the air-handling unit with automatic controls.

Systems that provide a variable volume of supply air to the conditioned space are influence by everything previously mentioned. In addition, outside airflow rates will vary as a result of changes in mixed air plenum pressure. Outside airflow rates may require reset on variable volume systems based on calculations of the multi-space equation (6-1) defined under 6.1.3.1, "Multiple Spaces", if the design did not assume the worst-case scenario when the outside airflow rate for the air handler was determined.

"6.1.3.1 Multiple Spaces. Where more than one space is served by a common supply system, the ratio of outdoor air to supply air required to satisfy the ventilation and thermal control requirements may differ from space to space. The system outdoor air quantity shall then be determined using Equation 6-1 (see References 23 and 24).

$Y = X/[1 + X - Z]$

Where

Y=Vot/Vst = corrected fraction of outdoor air in system supply
X=Von/Vst =uncorrected fraction of outdoor air in system supply
Z=Voc/Vsc =fraction of outdoor air in critical space. The critical space is that space with the greatest required fraction of outdoor air in the supply to this space.
Vot =corrected total outdoor air flow rate
Vst =total supply flow rate
Von =sum of outdoor air flow rates for all branches on system
Voc =outdoor airflow rate required in critical space
Vsc =supply flow rate in critical space"

Advanced VAV control strategies can satisfy the requirements of 6.1.3.1 dynamically and therefore more efficiently than static strategies. This can be accomplished by determining the critical zone fraction, Z, to calculate the corrected fraction of outdoor air, Y. The calculation requires that the total supply airflow rate measured, Q_{SA}, usually with an airflow measuring station in the total supply air circuit and the airflow rate of the critical zones is measured with an airflow measuring station capable of accurate measurement. Airflow sensors provided with VAV boxes should not be used for this calculation. Although these devices may be adequate for modulating a box for thermal comfort, the combination of low quality airflow pickups and low cost pressure sensors in the DDC controller will not result in the measurement accuracy necessary for proper calculation of equation 6-1. Accurate airflow measuring devices having a total installed accuracy better than 5% of reading at maximum system turn-down, should be installed in critical zones. After determining the corrected fraction of outdoor air required, Y, the new outside airflow setpoint is determined by multiplying Y by the supply airflow rate, Q_{SA}.

The multi-space equation can result in wide variations in outside airflow requirements in some systems. Increasing the critical zone supply flow by providing reheat can reduce total outside airflow rates. Outside airflow rates can also be reduced if the critical zones have variable occupancy. Variable occupancy can either be detected by a.) occupancy sensors, b.) occupancy time scheduling or c.) employing a binary (occupied/unoccupied) sensor to set the outside air requirement of the space.

Section 6.1.3.2, “Recirculation Criteria”, clarifies the misconception that ventilation rates can be reduced using the Ventilation Rate Procedure as suggested in the bullets under 6.1. According to this section, “Under the ventilation rate procedure, for other than intermittent variable occupancy as defined in 6.1.3.4, outdoor air flow rates may not be reduced below the requirements in Table 2. If cleaned [filtered], recirculated air is used to reduce the outdoor air flow rate below the values shown in Table 2, the [Indoor] Air Quality Procedure, 6.2 must be used.”

Ventilation effectiveness is discussed in 6.1.3.3. Because the values in Table 2 are based on well-mixed conditions where the ventilation effectiveness in near 100%, designers must be careful when evaluating air distribution into each occupied space. Depending on the distribution arrangement, ventilation efficiency can be reduced to as much as 50%. In such cases, twice the amount of outside air as indicated in Table 2 would be required for acceptable indoor air quality.

Section 6.1.3.4, “Intermittent or Variable Occupancy” addresses conditions when the outside air required may either lead or lag occupancy.

“When contaminants are associated only with the occupants or their activities, do not present a short-term health hazard, and are dissipated during unoccupied periods to provide air equivalent to acceptable air, the supply of outdoor air may lag occupancy.”

Unfortunately, almost every facility has contaminants generated from within the space (i.e. molds, fungus, off-gassing of materials, etc,). As a result, this condition rarely, if ever, exists. Therefore methods that lag occupancy (such as CO_2 DCV) should be carefully considered prior to implementation. For example, studies have shown that gases such as formaldehyde, which are present in many common office materials, may not be adequately diluted under CO_2 DCV strategies without an extensive pre-purge cycle prior to occupancy.

Conversely, “When contaminants are generated in the space or conditioning system independent of occupants or their activities, supply of outdoor air should lead occupancy so that acceptable conditions will exist at the start of occupancy.”

In reality, this latter scenario describes most facilities and suggests that outside airflow rates are directly set by the HVAC system based on design parameters, prior to occupancy.

A revised procedure, addendum 62n, was under its third public review when this document was created. If approved, it will replace the entire Ventilation Rate Procedure in the parent document. A key distinction over the existing procedure will be the requirement for ventilation rates to be determined based on both occupant and space ventilation requirements. This will be a significant improvement since a large portion of the dilution air required for acceptable IAQ is needed to dilute contaminants generated independently of the occupants and their activities. A base ventilation rate will always be required, regardless of occupancy, to dilute such contaminants. Other distinguishing factors include a provision for zone distribution effectiveness based on the air distribution configuration, the modification of the multi-space equation (6-1) for multi-zone recirculating systems, the consideration for varying operating conditions, the provision for dynamic reset, and specific requirements for exhaust ventilation.

Indoor Air Quality Procedure

The Indoor Air Quality Procedure begins by referencing the Ventilation Rate Procedure. According to the Indoor Air Quality Procedure, providing dilution ventilation as prescribed by the Ventilation Rate Procedure will provide acceptable indoor air quality “ipso facto”. The following excerpts stress the potential risk of “claiming” the Indoor Air Quality Procedure.

“6.2 INDOOR AIR QUALITY PROCEDURE: … The Ventilation Rate Procedure described in 6.1 is deemed to provide acceptable indoor air quality, ipso facto… The Indoor Air Quality Procedure provides a direct solution by restricting the concentration of all known contaminants of concern to some specified acceptable levels. It incorporates both quantitative and subjective evaluation.”

The concept of providing “a direct solution” is desirable in principle. However, there are numerous risks associated with both the quantitative and subjective evaluations provided within the procedure that every designer should be aware of.

“6.2.1 Quantitative Evaluation: Table 1 furnishes information on acceptable contaminant levels in outdoor air… Table 3 contains limits for four other indoor contaminants… The limit for CO_2 was selected based on the rationale outlined in Appendix C. Other potential contaminants for which definite limits have not been set are discussed in Appendix B. Tables B-1 and B-3 do not include all known contaminants that may be of concern, and these concentration limits may not, ipso facto, ensure acceptable indoor air quality with respect to other contaminants.”

Since there are numerous contaminants that either will not be detected or for which “definite limits have not been set”, this portion of the procedure has significant risk associated with it. It is unlikely that all contaminant’s of concern will be evaluated or reduced to acceptable levels. It is also not practical to measure all potential contaminants and in some cases, such as with fungus or mold, measurement may not be possible.

“Where only dilution ventilation is used to control indoor air quality, an indoor to outdoor differential concentration not greater than about 700 ppm of CO_2 indicates comfort (odor) criteria related to human bioeffluents are likely to be satisfied. Using CO_2 as an indicator of bioeffluents does not eliminate the need for consideration of other contaminants.”

Once more the Standard attempts to clear up the misunderstandings about CO_2. As stated in the discussion of the Ventilation Rate Procedure, a 700 ppm rise in CO_2 levels represent the equivalent of a ventilation rate of 15 CFM/person, which has been demonstrated to be the ventilation requirement to dilute body odor. The assumptions made to conclude that a 15 CFM per person rate is actually maintained when the 700 ppm rise is detected are considerable. CO_2 monitoring should only be considered “where only dilution ventilation is used to control indoor air quality.” It must never be used if the contaminant removal system reduces CO_2 levels in the building.

“6.2.2 Subjective Evaluation: Various indoor air contaminants may give rise to odor that is unacceptable intensity or character that irritates the eyes, nose, and throat. In the absence of objective means to assess the acceptability of such contaminants, the judgment of acceptability must necessarily derive from subjective evaluations of impartial observers.”

Section 6.2.2 emphasizes the risk associated with the Indoor Air Quality procedure. “Subjective Evaluation” combined with the uncertainty of the “Qualitative Evaluation” may be too great for many designers to “claim” this procedure for standard compliance although the concept of controlling the source of the contaminants makes perfect sense.

“6.2.3 Air Cleaning. Recirculation criteria are defined in 6.1.3.2 for use with the Ventilation Rate Procedure. Recirculation with air-cleaning systems is also an effective means for controlling contaminants when using the Indoor Air Quality Procedure. The allowable contaminant concentration in the occupied zone can be used with various system models in Appendix [D] to compute the required outdoor air flow rate. The air cleaning system efficiency for the troublesome contaminants present, both gaseous and particulate, may be adequate to satisfy the Indoor Air Quality criteria of 6.2.1 and 6.2.2. However, contaminants that are not appreciably reduced by the air-cleaning system may be the controlling factor in design and prohibit the reduction of air below that set by the Ventilation Rate Procedure.”

The principal comment regarding 6.2.3, Air Cleaning, is that the designer must use “Appendix [D] to compute the required outdoor air flow rate.” Many proponents of the Indoor Air Quality Procedure claim that the procedure does not specify airflow rates. Clearly airflow rates are part of this procedure. Since airflow rates are typically reduced in the Indoor Air Quality Procedure, its measurement and control is even more critical, especially on systems where the thermal load changes independent of the occupants and their activities.

Also, caution should be exercised when reducing outside airflow rates since outside air is required to maintain proper building pressure.

Design Documentation Procedures

Section 6.3, Design Documentation Procedures, states: "Design criteria and assumptions shall be documented." Providing instruments and controls that result in, and verify, compliance with ASHRAE Standard 62 is perhaps the best reason to provide such devices as part of any HVAC system design.

7. CONSTRUCTION AND SYSTEM START-UP

Section 7 addresses the construction and start-up phases of the project and has been included because a significant number of documented IAQ cases were a result of activities, which took place during these phases of the project. The construction phase, section 7.1, of the standard applies to "ventilation systems and the spaces they serve in new buildings and additions to or alterations in existing buildings." The standard addresses both the protection of materials and protection of occupied areas.

Mechanical barriers should protect occupied areas to protect them from construction-generated contaminants. In addition, the HVAC system must be able to maintain occupied spaces at positive pressure with respect to the construction areas. In many cases, the HVAC system does not have adequate capacity and/or controls to provide a pressurization barrier. Designers must consider the condition of the existing ventilation system and its ability to maintain a pressurized environment prior to initiating the construction phase of a project.

The start-up phase, covered in section 7.2, applies to "(a) newly installed air-handling systems; (b) existing air-handling systems undergoing supply air or outdoor air flow reduction – only the requirements of 7.2.2 shall apply to these altered systems; or (c) existing air-handling distribution systems undergoing alterations affecting more than 25% of the floor area served by the systems – only the requirements of 7.2.2 shall apply to these altered systems." This portion of the standard addresses start-up issues that if ignored can sabotage even the best system design. The section provides guidelines for air balancing, testing of drain pans, ventilation system start-up, testing of damper controls, and documentation requirements.

Section 7.2.2, Air Balancing, requires that systems be balanced "at least to the extent necessary to verify conformance with the total outdoor air flow and space supply air flow requirements of this standard." Unfortunately, the air flow rates of the system will vary after balancing in most systems for reasons discussed in the analysis of Section 5, Systems and Equipment. **In reality, most systems require permanent airflow measurement devices to assure compliance with the standard.** When applied in accordance to manufacturer's recommendations, airflow measuring devices such as those manufactured by EBTRON, only require the verification of operation by test and balance professionals. Requiring only a "snap-shot" of airflow rates is analogous to providing a one-time setup for temperature control, which obviously would not be very effective. Providing permanently mounted airflow measuring stations would also support the requirements set forth in 7.2.6, Documentation.

8. OPERATIONS AND MAINTENANCE

All systems constructed or renovated after the adoption date of the 2001 parent document are required to be operated and maintained in accordance to the provisions set forth in this section of the standard. It is important to recognize that if the building is altered or its use is changed, the ventilation system must be reevaluated. Buildings that are likely to change use or be altered should consider a robust HVAC system design that could take into account changes in airflow rate requirements imposed by this standard. Of course, provision for permanently mounted airflow measurement devices and controls would significantly reduce both the cost and time associated with such changes as long as the HVAC load capacity could accommodate future requirements.

Section 8.4.1.7 addresses sensors. "Sensors whose primary function is dynamic minimum outdoor air control, such as flow stations …" is discussed in this section even though it was not included under section 5, Systems and Equipment. Section 8.4.1.7 requires that sensors have their accuracy verified "once every six months or periodically in accordance with the Operations and Maintenance Manual." The EBTRON Operations and Maintenance Manual for its airflow measuring devices do not specify or recommend periodic recalibration. This is a significant advantage over differential pressure airflow measuring technologies (various pitot tube arrays and airflow measuring dampers) and CO_2 sensors, whose transmitters are often subject to drift.

Section 8.4.1.8, Outdoor Air Flow Verification, only requires the verification of outdoor airflow rates "once every five years." Since external and system factors clearly influence outside air flow rates, this requirement essentially does little to assure proper ventilation rates for acceptable indoor air quality and effectively places the burden of verification on the building operator who is often not in a position to make such a decision. Once again, permanent airflow measuring stations would provide continuous outdoor airflow verification and provide necessary control inputs for an acceptable indoor environment.

CONCLUSIONS

ASHRAE Standard 62 prescribes ventilation rates for acceptable indoor air quality. Whether or not it explicitly requires airflow measuring devices or not is irrelevant. It should be clear to the design profession that the dynamic nature of mechanical ventilation requires dynamic control. Being a rate based standard, continuous airflow measurement should be a central component of any effective control strategy to assure acceptable indoor air quality.

Not all airflow measurement techniques or devices are equal. EBTRON airflow measuring devices were specifically designed to meet the requirements of ASHRAE Standard 62. The Company has been specializing in airflow measurement and control for IAQ since 1984.

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