TRANE

ENGINEERS NEWSLETTER

*providing insights for today's HVAC system designer*

# ASHRAE Standard 62-1989R Expands Responsibility For IAQ

ASHRAE Standard 62-1989, "Ventilation for Acceptable Indoor Air Quality," presently defines the "standard of care" to be exercised by ventilation system designers. As such, it's been the model for codes issued by the International Conference of Building Officials (ICBO), the Building Officials and Code Administrators (BOCA), the Southern Building Code Congress (SBCC) and other organizations of building professionals.

The revised version of this standard promises to exert even greater influence on the building and HVAC communities. It not only addresses ventilation system design, but building construction, operation and maintenance as well.

Standard 62-1989R was released for public review on August 15, 1996. To assure that the final version reflects the best possible consensus, it's important that all affected parties acquaint themselves with the draft standard's contents and provide constructive criticism where warranted within the 120 days allotted for that purpose. We hope to aid that process with this issue of the *Engineers Newsletter*. In it, we'll summarize (without commentary) the requirements proposed in Standard 62-1989R and tell you how to obtain a copy of the public review draft from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

## An Overview

As mentioned above, Standard 62-1989R is divided into 10 sections accompanied by several **normative** and **informative** appendices. (A "normative" appendix is considered part of the standard and is required for its use; an "informative" appendix, as its name implies, is provided to educate rather than dictate.)

The "meat" of the draft standard, and the focus of this article, lies in:

- Section 4, "Application and Compliance"
- Section 5, "General Requirements"
- Section 6, "Design Ventilation Rates"
- Section 7, "Constructions and System Start-Up"
- Section 8, "Operating and Maintenance Procedures"
- Section 9, "Requirements for Residential Buildings"
- Normative Appendix F.2, "Carbon-Dioxide-Based, Demand-Controlled Ventilation"
- Normative Appendix G.2, "Multiple-Space System Efficiency"

Before itemizing the prerequisites for compliance set in these sections, let's briefly review the intent of Standard 62-1989R.

**Purpose And Scope.** ASHRAE Standard 62-1989R applies to commercial, institutional and residential spaces. It considers chemical, physical and biological contaminants, as well as temperature and humidity.

The intentions stated at the outset of the standard predicate its requirements:

*"To define the roles of and requirements for ventilation, source management, and air cleaning in providing acceptable indoor air quality.*

*"To specify methods for determining minimum ventilation rates.*

*"To specify ventilation system design, operational, and maintenance requirements for various types of occupied indoor spaces."*


The level of indoor air quality attained in an occupied space results from the decisions and actions of a wide variety of individuals over an extended period of time. Ventilation airflow, contaminant source strengths and air-cleaning efficiency all play a role. Together, these

variables make achieving an **acceptable** level of indoor air quality a complex, multifaceted problem. The requirements set in Standard 62-1989R address this complexity, demonstrating that minimum ventilation rates *can* be calculated and that building systems *can* be designed, operated and maintained to assure proper ventilation, manage contaminant sources and provide suitable air cleaning.

## Application And Compliance

As discussed in Section 4 of the review draft, buildings and areas of buildings used for commercial or institutional purposes must conform with Sections 5, 6, 7 and 9 and, when applicable, to normative Appendices F.2 and G.2 as well. Residential buildings and building areas, on the other hand, must only observe Section 9.

Compliance with Standard 62-1989R means satisfying the obligations of each applicable section and normative appendix. (The flow chart in Figure 1 summarizes these steps.) However, compliance with the standard won't guarantee acceptable indoor air quality for everyone. "Compliance" simply means that all minimum requirements presented in the standard have been met.

## General Requirements

Targeting nonresidential occupancies and their ventilation systems, the draft version of Section 5 presents design requirements that minimize or at least reduce the introduction of contaminants and contaminant sources into the building.

Ideally, indoor air quality is achieved by reducing or eliminating **indoor** contaminant sources (e.g. emissions from furnishings, mold and fungi within the ventilation system and building envelope) as well as potential sources **outside** the building. When sources can't be reduced or eliminated, their emissions often can be controlled by local exhaust or isolation, or by dilution with cleaner air (i.e. outdoor air, cleaned recirculated air, or transfer air from an adjacent space).

Here are some of the mandates Section 5 gives ventilation system designers:

**Documentation.** Record specific design criteria and assumptions.

**Outdoor Air Quality.** Evaluate outdoor air quality and survey the construction site to identify possible local contaminant sources. *(Filtration of outdoor air is not a minimum requirement.)*

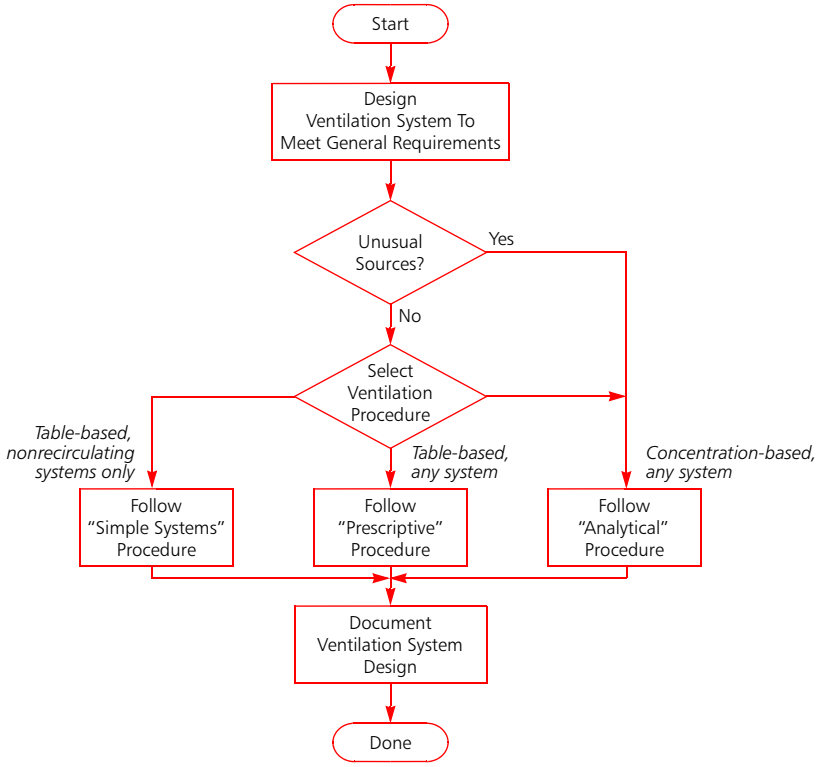
**Outdoor Air Intakes.** Separate outdoor air (OA) intakes from potential outdoor contaminant sources (e.g. the street or property line) by the minimum distances specified. OA intakes must also be:

- Positioned at least 6 feet above landscaped grades, 9 feet above unlandscaped grades and 8 inches above the average maximum snow depth.
- Adequately protected from rain entrainment.
- Covered to keep birds outdoors.

Do not use internal duct insulation within 18 inches of the intake opening.

**Indoor Air Recirculation Limits.** Classify indoor—return, transfer and exhaust—air according to the type of contaminants expected. (Contaminants usually result from activities within the space from which the air is drawn.) Observe the restrictions related to recirculation of air of one classification to a space containing air of another

**Figure 1**
**Compliance "Steps" For Commercial Building Design**



classification, unless the Analytical Procedure (see "Design Ventilation Rates" on page 4 of this newsletter) is used to determine the design ventilation rate.

**Exhaust Air Outlets.** Separate exhaust outlets from the property line, doors and operable windows, and outdoor air intakes by the minimum distances specified in the review draft. (In most cases, Equation 5-1 must be used to account for exhaust velocity.) *For packaged equipment with combustion exhaust vents,* compliance can be deferred two years after the standard's publication to allow manufacturers to redesign their products as needed.

**Mechanical Systems.** All mechanical ventilation systems must meet the requirements stated in this section of Standard 62-1989R. The following list identifies some of these requirements.

- **Conventional And Dehumidifying Cooling Coils:** Finned-tube coils must be no more than eight rows deep. Series coils deeper than eight rows must be separated by an accessible space at least 1.5 feet wide.

  For dehumidifying coils, water droplet carry-over beyond the drain pan must be "no more than negligible," acceptable drain pans must be provided, downstream equipment must be beyond the drain pan, and exposed internal insulation must not be used between the coil and downstream end of the drain pan.

- **Humidifiers, Air Washers, Direct Evaporative Coolers:** Makeup water for these devices must be at least as clean as potable water. Humidifiers and water spray systems must not emit unregistered chemicals or treatment additives into ventilation air.

  Open storage tanks or sumps must include continuous-bleed or automatic periodic draining. Sumps must be sloped and trapped as required for drain pans. Downstream obstructions must be beyond the recommended absorption distance unless acceptable drain pans capture unabsorbed water droplets.

"Standard 62-1989R allows compliance with certain mandates to be deferred for two years after publication while packaged equipment manufacturers redesign their products."

- **Drains, Drain Pans:** Drain pans must be sloped and trapped for proper operation (as specified in Section 8) and the trap's design must permit water seal inspection. The depth of a negatively pressurized trap must maintain the water seal and allow complete drainage.

- **Access:** Provide the recommended service clearance around all ventilation equipment. Specify access doors or panels to permit in-situ inspection and cleaning of these elements: OA intake paths, mixed-air plenums, heating and heat-recovery coils (upstream of coils four rows or less, and on both sides of coils more than four rows deep), cooling coils and heat exchangers (up- and downstream), air cleaners, drain pans, fans, humidifiers and airflow-measuring stations.

  Equipment access doors and panels must be readily operable and allow full access. Ceilings or walls must include doors for access to all equipment and controls requiring routine maintenance or regular calibration.

- **Minimum Air Cleaning, Filtration:** Specify particulate filters or air cleaners at least 60 percent efficient at 3 microns for mechanical ventilation systems with more than 10 feet of duct or with potentially "wet" equipment in the air stream. Filter racks must minimize bypass. *For unitary or packaged equipment,* compliance can be deferred for two years after the standard's publication to allow manufacturers to redesign their products accordingly.

- **Insulation:** Internal duct insulation may be used but must be durable, as defined by erosion tests sanctioned by the American Society for Testing Materials (ASTM). Leading edges must be protected with metal nosing or sleeves, and transverse edges must be sealed. Return and exhaust air paths must not include fibrous glass ducts or liners.

  Specify insulation for the following cold surfaces within the building envelope to prevent condensation: unlined cooling ducts, chilled water pipes and cold domestic water pipes. If the insulation can be damaged by moisture, it must be properly protected with a vapor retarder.

- **Air Distribution Systems:** Provide for measurement and adjustment of space supply and system outdoor airflows.

- **VAV System Controls:** For variable air volume (VAV) systems, stipulate controls that measure outdoor airflow at the air handler and maintain outdoor airflow (at no less than 90 percent of the required minimum value) over the entire supply airflow operating range. Also specify VAV space (zone) controls that maintain hourly average space supply airflow at no less than the required minimum supply airflow.

- **Ventilation Controls:** Stipulate that ventilation fan controls allow operation during occupancy, and that hourly average ventilation rates are maintained when thermostats control both ventilation airflow and heating or cooling airflow. Spaces occupied intermittently but regularly require ventilation controls that operate the system before an expected occupancy.

- **Optional Ventilation Controls:** If used, ensure that demand-controlled ventilation schemes based on sensed carbon dioxide levels meet the requirements of normative Appendix F.2, and that sensors are accessible for calibration. In addition:

  … Demand-controlled ventilation schemes (based on sensed carbon monoxide, CO, levels) for automobile garages must maintain CO below 35 ppm or below 9 ppm for spaces with long-term occupancy.

  … Occupant-controlled ventilation systems must maintain a minimum ventilation rate and easy access to controls.

  … Ventilation system controls that temporarily reduce space airflow below minimum levels must maintain hourly average airflow at minimum levels.

  … Controls that temporarily reduce outdoor airflow during episodic periods of poor outdoor air quality must not reduce outdoor airflow below minimum levels for more than 4 hours per day.

  … Ventilation airflow control based on contaminant concentration(s) requires an individual sensor for each contaminant of concern.

  … Ceiling-plenum OA distribution schemes must include sufficient duct and discharge outdoor air within 5 to 15 feet of the terminal unit return inlet.

- **Systems In Humid Climates:** Mechanical cooling systems applied in humid climates must maintain the daily average relative humidity in the space below 60 percent during occupancy and below 70 percent when unoccupied. The mechanical cooling system also must maintain a slightly positive or neutral building pressure to discourage infiltration of moist air.

- **Supplemental Exhaust:** Describe how temporary supplemental exhaust can be provided as part of the design documentation.

**Natural Ventilation.** When natural ventilation systems are allowed, include an openable area that's at least 4 percent of the occupiable floor space. Provide building occupants with ready access to the means required to open that area.

**Building Construction.** Design the building envelope in compliance with applicable codes that control water and water vapor penetration, air infiltration and entry of radon.

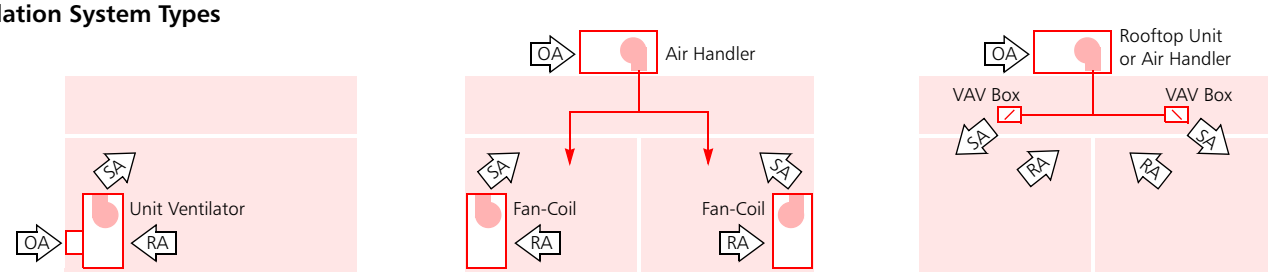
**Fuel-Burning Appliances.** Provide combustion air for indoor fuel-burning devices required by local codes.

## Design Ventilation Rates

Section 6 presents design procedures for determining minimum ventilation rates for mechanically ventilated buildings and spaces. Each building system must receive a minimum **outdoor** airflow (for contaminant dilution) at its OA intake, and each space must receive a minimum **supply** airflow (for contaminant removal) at its diffusers. Note that space supply air may include both outdoor air and recirculated indoor air.

Minimum outdoor and supply airflows must be determined using one of the three procedures described below. System type (Figure 2) and contaminant source strength dictate which method applies. Control systems that vary ventilation rates dynamically to match actual operating conditions may be incorporated to save operating costs.

**Figure 2**
**Ventilation System Types**




**Single-Zone Ventilation System**

- One space, one air handler
- System OA rate = space OA rate

**Dedicated Outdoor Ventilation System**

- One or more spaces, a 100% OA air handler
- System OA rate = sum of space OA rates

**Multiple-Space Recirculating Ventilation System**

- Two or more spaces, outdoor and recirculated air at air handler
- System OA rate = calculated value (Equation 6-1)

**Simple Systems Procedure.** The Simple Systems Procedure (a "special case" of the Prescriptive Procedure summarized next) may be used for single-zone and dedicated outdoor air systems, but **not for multiple-space recirculating systems**. Further, it must not be used if unusual uncontrolled sources of odors, irritants or harmful contaminants (including environmental tobacco smoke, ETS) are present.

Based on dilution ventilation for typical contaminants, this procedure (represented in Figure 3) provides an uncomplicated approach for determining space and system minimum outdoor airflow rates for single-zone and nonrecirculating systems. Table 6.1 of the review draft prescribes space ventilation rates (*Rsb,* outdoor airflow per unit area) and space minimum supply rates (*Rss,* supply airflow per unit area) for 88 types of indoor spaces.

System outdoor airflow (*Vot,* minimum total outdoor airflow rate) **at the outdoor air intake** must be calculated using the prescribed space ventilation rates, *Rsb* and Equation 6-1. Space minimum supply airflow, *MSR,* **at the diffusers** must be calculated using the prescribed space minimum supply rates, *Rss,* and Equation 6-2.

**Prescriptive Procedure.** The Prescriptive Procedure depicted in Figure 4 may be used for any system type if no unusual uncontrolled sources of odors, irritants or harmful contaminants (including ETS) are present. It provides a general approach for determining space and system minimum outdoor airflows and space minimum supply airflows for multiple-space systems, as well as for single-zone and nonrecirculating systems.

The prescriptive method is predicated on control of comfort-related odors and irritants via dilution ventilation. Table 6.1 of the draft prescribes space ventilation rates for occupants and their activities (*Rp,* outdoor airflow per person), and for the building and its furnishings (*Rb,* outdoor airflow per unit area) for 88 different indoor spaces. The design ventilation airflow required, *DVR,* for each space must be calculated using these prescribed rates and Equation 6-3, which includes an occupant diversity adjustment, *D*.

For each space, minimum supply airflow, *MSR,* **at the diffusers** must be calculated using *DVR* and Equation 6-4 (to properly account for space air change

**Figure 3**
**Simple System Procedure**

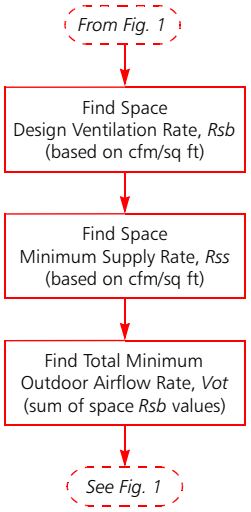
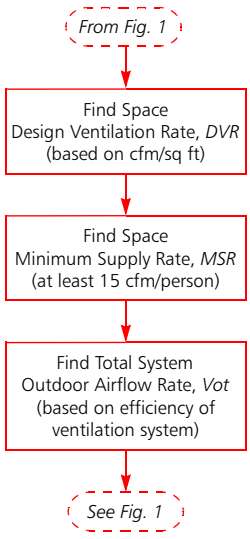



**Figure 4**
**Prescriptive Procedure**



effectiveness). System outdoor airflow (*Vot,* minimum total outdoor airflow rate) **at the outdoor air intake** must be calculated using space *DVR* values and Equation 6-7. Ventilation system efficiency must be determined based on system type.

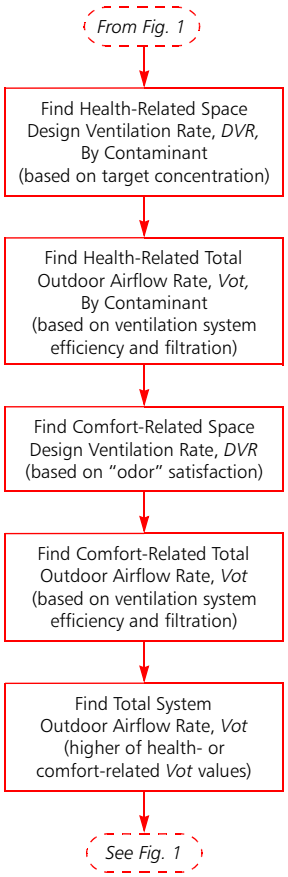
**Analytical Procedure.** The Analytical Procedure may be used for any system type, and it **must** be used in any of the following circumstances:

- When unusual uncontrolled sources of odors, irritants or harmful contaminants are present.
- When credit for air cleaning is taken.
- When especially low contaminant levels are anticipated. Or …
- When odor comfort levels higher (or lower) than those assumed for the Prescriptive Procedure (i.e. which satisfies 80 percent of the adapted occupants) are desirable.

Shown in Figure 5, the Analytical Procedure provides a very general approach for determining minimum outdoor airflows for the space and system as well as minimum supply airflows for individual spaces. It attempts to control contaminant concentration levels that affect health and comfort (odors, irritants) via contaminant removal (air cleaning) and dilution.

Compliance with the Analytical Procedure requires that criteria for health and comfort be established and satisfied. It also requires identification of specific contaminants of concern and determination of the acceptable indoor concentration, average outdoor concentration and indoor source strength for each. Using this information, the design ventilation airflow required, *DVR,* is calculated on a space-by-space basis for each contaminant. The largest *DVR* for a given space becomes the minimum supply airflow, *MSR,* at the diffusers.

**Figure 5**
**Analytical Procedure**




To determine the minimum system outdoor airflow, *Vot,* at the OA intake, the outdoor airflow required for each contaminant (accounting for filtration efficiency) must be calculated.

Appendix B of Standard 62-1989R illustrates the calculation procedure for nonrecirculating systems; multiple-space recirculating systems are not addressed.

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## Construction And System Start-Up

Properly designed ventilation systems can be compromised by improper installation or incomplete start-up procedures. With that in mind, Section 7 sets requirements related to system construction and start-up, seeking to avoid the introduction of IAQ problems into properly designed ventilation systems. These requirements apply to renovations as well as new construction, and address the system installer and party (or parties) responsible for initially starting the system.

The following list identifies some of the specific mandates established in Section 7 of Standard 62-1989R.

- **Construction Filters:** When ventilation fans operate during construction, install filters with at least 60 percent efficiency at 3 microns.
- **Protection Of Materials:** Safeguard materials susceptible to moisture damage prior to installation; discard any that are accidentally damaged by moisture.
- **Isolation Of Major Construction Area:** In occupied buildings, take specific measures (e.g. install air barriers, negatively pressurize the construction area, seal or add filters to

the return air ducts) to separate construction and nonconstruction areas.

- **Notification Of Construction:** Before any major construction activity begins in an occupied building, the ventilation-system operator/"maintainer" must be notified in writing.
- **Substitutions:** Before replacing material or equipment that may affect the ventilation system, review it for consistency with design assumptions. For example, if the designer assumed installation of a low-emission-rate carpet, a high-emission-rate carpet cannot be substituted arbitrarily.
- **Air Balancing:** After installation, balance the air distribution system to assure delivery of design airflow. Record balance settings and measured values.
- **Drains, Drain Pan Testing:** After installation, test condensate drains and drain pans to assure they work properly.
- **Ventilation System Prestart-Up Cleaning:** After installation, but before occupancy, ensure that the ventilation system is "substantially free of dirt and debris" and replace the filters used during construction.
- **Purging Of Major Construction Areas:** After installation, but before occupancy, operate the ventilation system to provide at least design outdoor airflow for a minimum of 48 hours.
- **Testing Damper Controls:** Check the outdoor air dampers to verify proper operation. For VAV systems, test the outdoor airflow controls to

## Key Equations In BSR/ASHRAE Standard 62-1989R …

This *Engineers Newsletter* refers to a number of equations that appear in the public review draft of Standard 62-1989R. They're shown here, along with an explanation of the variables.

**Equation 5-1.** Used to determine *S,* the exhaust-outlet minimum separation distance (ft):

$$S = 0.09\sqrt{Q} \bullet \left(\sqrt{d} - \frac{V}{400}\right)$$

**Equation 6-1.** Determines *Vot,* the minimum total outdoor air rate (cfm) supplied by the ventilation system:

$$Vot = \sum_{\text{all spaces}} Rsb\ Ab$$

**Equation 6-2.** Determines *MSR,* the per-space minimum supply rate (cfm) to be provided at the supply air outlet(s):

$$MSR = Rss\ Ab$$

**Equation 6-3.** Determines *DVR,* the design ventilation rate (cfm) needed in the occupied zone of each space:

$$DVR = Rp\ Pd\ D + Rb\ Ab$$

**Equation 6-4.** Determines *MSR,* the minimum space design supply air rate (cfm) based on design occupancy and the design ventilation rate adjusted for the air change effectiveness of that space:

$$MSR \geq \frac{DVR}{Eac} \text{ and } \geq \frac{15\ Pd\ D}{Eac}$$

**Equation 6-7.** Determines *Vot,* the minimum outdoor air rate (cfm) supplied by the ventilation system:

$$Vot = \frac{Vou}{Ev}$$

**Equation 6-11.** Determines *Ev,* ventilation system efficiency for systems that recirculate air from multiple zones:

$$Ev = 1 + \frac{Vou}{Vs} - Z$$

**Equation Variables.** Variables in the preceding equations are defined below.

*Ab* = occupiable floor area in space (sq ft)

*d* = dilution factor (Eq 5-1)

*D* = occupant diversity factor (Eq 6-3, Eq 6-4)

*DVRc* = critical-space design ventilation rate (cfm)

*Eac* = air change effectiveness

*Ev* = ventilation system efficiency

*MSR* = per-space minimum supply rate (cfm) to be provided at the supply air outlet(s)

*Pd* = design occupancy (typical maximum number of people)

*Q* = exhaust volume (cfm)

*Rsb* = per-space outdoor air supply requirement (cfm per sq ft)

*Rp* = outdoor air requirement per person (cfm per person)

*Rss* = space supply air requirement (cfm per sq ft) for occupancy type

*S* = exhaust-outlet minimum separation distance (ft)

*V* = exhaust velocity (fpm)

*Vot* = minimum total outdoor air rate (cfm) supplied by the ventilation system

*Vou* = uncorrected outdoor air rate (cfm) defined as the sum of the space DVR's

*Vs* = total system supply air rate, (cfm) including recirculated air

*Vsc* = critical-space supply air rate (cfm) at worst-case operating conditions

*Z* = critical-space ventilation fraction, *DVRc* / *Eac Vsc*

assure that minimum outdoor airflow rates can be maintained.

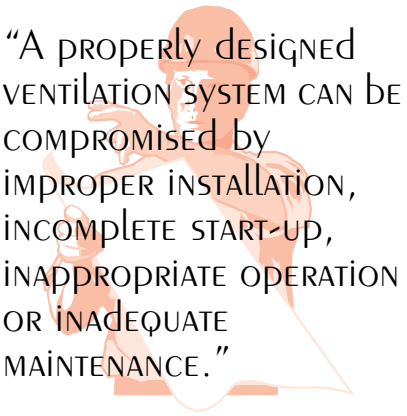
- **Inspection:** Conduct, and document the results of, an inspection to verify that: all drain pans and humidifier drains were tested; access doors and panels are in place; air cleaners are properly installed; and minimum separation distances for EA outlets and OA intakes have been satisfied.
- **Documentation:** Provide the building owner with documents describing various aspects of the ventilation system, including: an operation-and-maintenance manual, HVAC system control diagrams and descriptions, an air-balancing report, construction records, and design criteria and assumptions.

## Operating And Maintenance Procedures

Like Section 7 of Standard 62-1989R, Section 8 recognizes that inappropriate operation or inadequate maintenance can jeopardize an otherwise properly designed and installed ventilation system. Therefore, it establishes requirements for ventilation system operation and maintenance, and addresses the party (or parties) responsible for those functions.

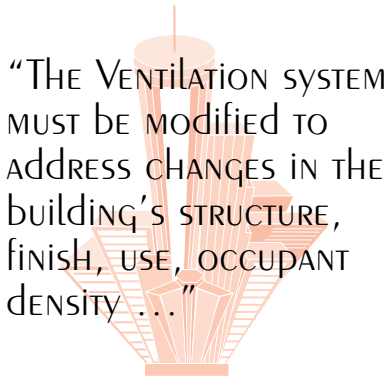
Section 8's requirements include these:

- **Responsible Party:** Identify the person, company, agency or department responsible for operating and maintaining the ventilation system.
- **Alterations Or Change Of Use:** Modify the ventilation system as needed to address changes made to the building's structure or finish, how it's used, its occupant density, etc.
- **Mechanical Ventilation Systems:** Operate it as it was designed to be operated!
- **Preoccupancy Ventilation:** Circulate air through the ventilation system for a period of time prior to occupancy.
- **Normal-Occupancy Operation:** Operate the ventilation system to provide minimum system outdoor airflow and minimum space supply airflows during normally occupied periods.
- **Natural Ventilation Systems:** "Activate" natural ventilation systems during normal periods of occupancy.
- **Ventilation System Maintenance Procedures:** Using the operation/maintenance manual(s) as a guide, inspect, adjust, clean, calibrate or replace ventilation system components as needed to assure proper operation.




- **Documentation:** Retain all system design documentation provided by the installer for the life of the system equipment or component. Record all inspection and maintenance activities. Also record changes to operating procedures, system balancing settings or values, interior finishes or furnishings, and any other changes related to ventilation system operation and maintenance as design documentation addenda.
- **Particulate Filter Maintenance:** Change filters periodically (or immediately if they become wet or damaged), based either on demand or according to a regular schedule. When basing filter changes on demand (pressure drop), inspect them at least once each month.
- **Gaseous Filter Maintenance**: Change gaseous filter media periodically as specified.
- **Electronic Air Cleaner Maintenance:** Clean electronic air cleaners periodically as specified.
- **Outdoor Air Dampers:** Inspect or monitor outdoor air dampers and actuators at least once every 3 months to assure proper operation.
- **Plenums:** Inspect supply and return plenums at least once every 2 years.
- **Coils:** Inspect dehumidifying cooling coils at least once every 6 months or as specified; clean them if fouled.
- **Drain Pans:** In humid climates, inspect and (if necessary) clean drain pans at least once every 6 months. In other climates, inspect and (if necessary) clean drain pans at least once each year or as specified. Physically remove any visible microbial growth; do not simply apply a surface disinfectant.
- **Outdoor Air Intake Louvers:** Inspect OA intakes at least once every 6 months and clean them as needed or as specified.

- **Demand-Controlled Ventilation Sensors:** Recalibrate sensors used for demand-based ventilation control at least once every 6 months or as specified.
- **Airflow Measurement:** Measure supply, exhaust and outdoor airflows at the air handler at least once every 5 years.




- **Cooling Towers:** Treat cooling-tower water to control microbial growth.

## Requirements For Residential Buildings

Residential ventilation needs differ from those of commercial and institutional occupancies. To address this distinction, Section 9 of Standard 62-1989R sets ventilation-related requirements for designing, installing, operating and maintaining buildings or building areas with residential occupancy.

Here are some of the subjects specifically cited in this section's requirements:

- **Local Exhaust:** All dwelling units must include mechanical means (with local controls) for drawing air from kitchens, baths and toilets at the rates specified in Table 9.1 of the standard.
- **Outdoor Air:** Living areas must be ventilated with outdoor air at the rates specified in Table 9.2, using mechanical, demonstrated and/or natural ventilation. (See "Residential Ventilation Methods below.)
- **Strong Sources, Sensitive Individuals:** Occupants must monitor and control contaminant sources in indoor spaces, and must operate "the dwelling unit" as necessary to satisfy individual needs.
- **Clothes Dryers:** Clothes dryers must vent outdoors unless devices are installed to manually switch to indoor venting of filtered exhaust airflow.
- **Residential Ventilation Methods:** The outdoor air requirements cited above must be provided using at least one of the following three methods.

  … **Mechanical ventilation**, i.e. a mechanical system with sufficient capacity.

  … **Demonstrated ventilation.** If a combination of infiltration and mechanical ventilation is used, the overall performance of the ventilation system must be substantiated.

  … **Natural ventilation.** If natural ventilation is used, spaces must be permanently open to an operable outdoor opening whose opening area is at least 4 percent of the floor area; operating means must be accessible. For interior spaces connected to outdoors via adjoining doors, the opening between rooms must be permanently unobstructed and must have an area not less than 25 sq ft nor less than 8 percent of the interior room area.

- **Air Intakes:** For mechanical ventilation systems, OA intakes must be located at least 10 ft from known outdoor contaminant sources and must include a rodent screen.
- **Outdoor Air Distribution:** For mechanical ventilation systems, outdoor air must be provided to all habitable rooms.
- **Ventilation Systems, Equipment:** For mechanical ventilation systems, device selection must be based on certified equipment performance ratings. Ventilation equipment must be installed as specified by the manufacturer.
- **Sound Ratings For Kitchen Exhaust Fans:** For mechanical ventilation systems, kitchen exhaust fans must emit no more than 1.5 sones at the minimum exhaust airflow specified in Table 9.1 of the review draft. Compliance with this requirement is deferred for 2 years after the standard's publication to allow manufacturers to redesign their products accordingly.
- **Climatic Suitability:** For mechanical ventilation systems, device selection must be based on local climatic conditions.
- **Instructions, Labeling:** The occupant must be provided with information related to proper installation, operation and maintenance of the mechanical ventilation system, if used.
- **Multifamily And Mixed-Use Buildings:** Dwelling units must be designed and constructed to provide ventilation air from outdoors, not from adjacent dwelling units. Specific measures (including sealing) must be used to prevent unintended air movement.
- **Pressure Management:** Mechanical ventilation systems must not lead to continuous spillage of combustion appliances.

- **Building Construction:** Gasketed, self-closing doors must be used between living areas and attached garages.
- **Operation, Maintenance:** Ventilation systems must be operated as required in accordance with design intent. Mechanical ventilation systems must be operated during occupied periods. Demonstrated ventilation systems must be operated as validated. For naturally ventilated systems, operable openings must be open during occupied periods to the extent determined by the occupant.

## $CO_2$ Demand-Controlled Ventilation

Appendix F.2 of Standard 62-1989R is entitled "Requirements for $CO_2$ Demand-Controlled Ventilation System," and is **normative**—that is, it's part of the standard and is required for its use.

This appendix presents prerequisites for designing ventilation system controls that reset system ventilation airflow based on sensed carbon dioxide ($CO_2$) levels. If the designer opts for a $CO_2$-based, demand-controlled ventilation (DCV) system, the design must comply with Appendix F.2's requirements.

Specific requirements include, but are not limited to:

- **DCV Basis:** The DCV system must adjust the "people component," *Vp,* of the space ventilation calculation as a function of $CO_2$ concentration.
- **Space Sensor Location:** Room $CO_2$ concentration must be sensed in the occupied ("breathing") zone.
- **Outdoor Sensor Location:** The outdoor $CO_2$ concentration must be sensed within 10 feet of the OA intake.
- **Sensing Accuracy:** For separate indoor and outdoor $CO_2$ sensors, concentration levels must be measured to within 50 ppm. If a single sensor samples both indoor and outdoor air, concentration levels must be measured to within 100 ppm.
- **Control System Accuracy:** Operation of the overall DCV control system must result in space outdoor airflow no more than 10 percent below set point.
- **Building Ventilation:** The DCV system must maintain outdoor airflow above the minimum required to properly dilute building-related contaminants, *Vb,* during periods of scheduled occupancy or preoccupancy purge.

## Multiple-Space System Efficiency

Another **normative** appendix—Appendix G.2, "Multiple-Space System Efficiency—presents the derivation of equations for determining overall ventilation system efficiency, *Ev,* for several different multiple-space systems.

Section 6 of the review draft requires the use of ventilation system efficiency, *Ev,* for calculating minimum total outdoor airflow, *Vot,* for the system.

For single-duct, multiple-space systems (single-duct VAV and constant-volume reheat systems, for instance), the designer can calculate ventilation system efficiency using the simple equation presented in Section 6 …

$$Ev = 1 + Vou / Vs - Z$$

… Or the more general equation derived in this appendix.

For either **dual-duct, two-fan systems** or **fan-powered VAV systems**, the more general (and complex) equations derived in Appendix G.2 yield lower outdoor airflows than the conservative values (and overventilation) obtained with simple Equation 6-11.

## Impact

Ventilation requirements in mechanical codes have historically paralleled ASHRAE Standard 62. The revised standard now in public review is written in "code" language, increasing the likelihood of its adoption or adaptation by code-writing authorities. Standard 62-1989R also contains requirements for system start-up, operation and maintenance in addition to design, so its regulatory influence is likely to extend beyond design to these aspects of the life of the ventilation system.

Building system designers, installers and owners who choose to provide the best possible indoor air quality for building occupants can use the minimum requirements presented in Standard 62-1989R as a touchstone—i.e. the minimum set of norms for achieving the desired IAQ level.

ASHRAE Standard 62-1989 is widely considered the standard of care for ventilation system designers. Because of its broader and more concise set of requirements, ASHRAE Standard 62-1989R could conceivably become the standard of care for those who install, operate and maintain ventilation systems as well as for those who design them.

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## Public Review Process

This standard is expected to have considerable and long-lasting effect on the HVAC industry, including architects, designers, manufacturers and contractors, as well as building owners and operators. **Everyone involved with our industry has a professional obligation to review the revised standard and submit constructive comments** as appropriate. Review the draft carefully. Your comments can shape your ventilation future!

> "Forward your written comments on Standard 62-1989R to ASHRAE headquarters before the public review comment period ends on December 12, 1996"

The public review comment period for Standard 62-1989R began August 15, 1996, and ends December 12, 1996. A copy of the draft standard and instructions for submitting comments can be purchased for $25 by calling ASHRAE headquarters at **404.636.8400** or **800/5-ASHRAE**. The draft standard can also be accessed at ASHRAE's Web site, **http://www.ASHRAE.org**, and downloaded free of charge.

As a member of the project committee, I encourage you to obtain and review a copy of the draft standard; then **forward your written comments to ASHRAE headquarters before December 12, 1996.** Be sure to follow the comment instructions carefully to assure consideration of your comments. The committee will respond to all comments received during the public review period. If public review comments result in extensive changes, a second public review of a revised draft of the standard will be scheduled in 1997. ■

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*If you'd like to comment on this article, send a note to The Trane Company, Engineers Newsletter Editor, 3600 Pammel Creek Road, La Crosse, WI 54601, or e-mail comfort@trane.com.*

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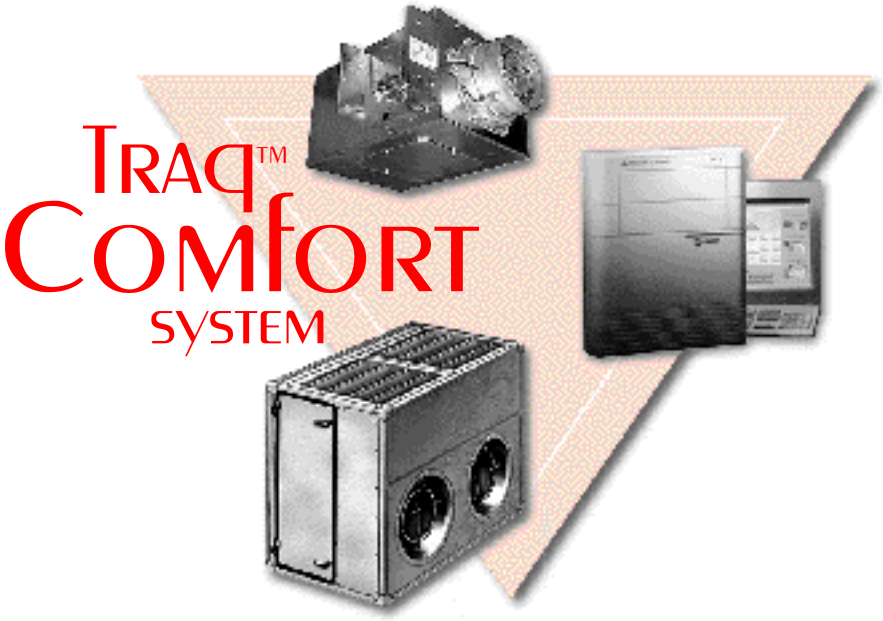


## An Integrated Approach To Ventilation Reset

Trane IAQ-ready Modular Climate Changer® air handlers with Traq™ dampers, combined with VariTrane® DDC/VAV air terminal units and a Tracer Summit® building management system, create a complete **Traq comfort system** … A system that stands above others in the industry in terms of reliability, economy and the control and documentation of operating conditions.

The Traq comfort system answers indoor air quality challenges with a broader approach; effectively controlling and monitoring outdoor air, performing to ASHRAE Standard 62-1989 and addressing other related issues.

The factory-mounted Traq damper monitors and controls outdoor air supplied to the system, and DDC/VAV boxes control supply air and track space ventilation requirements. Tracer Summit coordinates the effort. This enables constant ventilation reset as space conditions require, while maintaining compliance with ASHRAE guidelines.

The ease of the Traq comfort system's single-source approach to ventilation reset mirrors the ease of Tracer Summit. You can operate your entire HVAC system from a single PC and document the process in various forms (e.g. databases, spreadsheets, system reports, trend logs).

ASHRAE Standard 62-1989 formulas are integrated into the controls to modulate system outdoor airflow given individual space requirements. The amount of outdoor air required in each space will change periodically. Total system integration is required to match the amount of outdoor air delivered with current operating conditions.

Bringing more outdoor air into the system to satisfy ventilation needs increases energy costs by requiring additional treatment such as dehumidification and reheat. Use of the Traq comfort system accommodates system outdoor airflow requirements with the lowest possible increase in outdoor air supply. In this way, ASHRAE standards are met and cost increases are minimal.

For additional information on the Traq comfort system—or any of Trane's broad line of products, systems and services—contact your local Trane sales engineer. ■