ASHRAE'S RESIDENTIAL VENTILATION STANDARD: EXEGESIS OF PROPOSED STANDARD 62.2©

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ABSTRACT

In June 2001 ASHRAE's Standard Project Committee on "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings", SPC 62.2P, recommended and the Board of Directors approved ASHRAE's second complete standard on residential ventilation for public review; this was followed by public reviews of independent substantive changes in 2002 . The standard is an attempt by the Society to address concerns over indoor air quality in dwellings and to set minimum requirements that would allow for indoor air quality and energy efficiency measures to be evaluated. The standard has requirements for whole-house ventilation, local exhaust ventilation, and source control. In addition to code-intended requirements, the standard also contains information for the designer and/or user of the standard. The standard has been the focus for a variety of special interests, who have developed various approaches for delaying the development of the standard. This report summarizes the public review draft as currently being finalized for its fourth—and what is hoped to be its last—public review.

KEYWORDS

Ventilation, Standards, Code, Residential, Mechanical

INTRODUCTION

Because of the effects it has on health, comfort, and serviceability, indoor air quality in our homes is becoming of increasing concern to many people. According to the American Lung Association elements within our homes have been increasingly recognized as threats to our respiratory health. The Environmental Protection Agency lists poor indoor air quality as the forth-largest environmental threat to our country. Asthma is leading serious chronic illness of children in the U.S. moisture-related construction defects and damage are on the increase in new houses. Minimum residential ventilation can improve many of these indoor air quality problems.

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[2] This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology of the U.S. Department of Energy under contract No. DE-AC03-76SF00098

ASHRAE's Role

ASHRAE has long been in the business of ventilation, but most of the focus of that effort has been in the area of commercial and institutional buildings. Residential ventilation was traditionally not a major concern because it was felt that between operable windows and envelope leakage, people were getting enough air. In the quarter of a century since the first oil shock, houses have gotten much more energy efficient. At the same time, the kinds of materials and functions in houses were changing in character in response to peoples needs. People were also becoming more environmentally conscious not only about the resources they were consuming but about the environment in which they lived.

All of these factors contributed to an increasing level of public concern about residential indoor air quality and ventilation. Where once there was an easy feeling about the residential indoor environment, there is now a desire to define levels of acceptability and performance. Many institutions both public and private, have interests in Indoor Air Quality (IAQ), but ASHRAE, as the professional society that has had ventilation as part of its mission for over 100 years, was the logical place to develop a consensus standard. That standard is now ready for its first public review.

ASHRAE Standard 62.2P, "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings" defines the roles of and minimum requirements for mechanical and natural ventilation systems and the building envelope intended to provide acceptable indoor air quality. It applies to spaces intended for human occupancy within single-family houses and low-rise multi-family structures and it generally excludes institutional buildings.

The standard appears to be principally about ventilation, but the purpose of ventilation is to provide acceptable indoor air quality. The most effective strategy for keeping exposure to undesirable pollutants low is to keep them from being released to the general indoor environment in the first place. Such "source control" measures actually make up the bulk of the pages in the standard, especially when you consider that local ventilation is intended to exhaust pollutants from specific rooms before they enter the general environment. Whole-house ventilation, is intended to bring fresh air into the general environment to dilute the pollutants that cannot be effectively controlled at the source.

OVERVIEW OF THE STANDARD

In developing this standard the committee recognized that there were many different kinds of houses, many different climates, and many different styles of constructions. To accommodate these differences, the major requirements were designed with several alternate paths to allow users flexibility. Some requirements are performance based, with specific prescriptive alternatives. The standard recognizes that there are several different ways to achieve a specified ventilation rate and allows both mechanical and natural methods.

There are three main primary sets of requirements in the standard and a host of secondary ones. The three primary sets involve whole-house ventilation, local exhaust, and source control. Whole-house ventilation is intended to dilute the unavoidable contaminant emissions

from people, from materials and from background processes. Local exhaust is intended to remove contaminants from those specific rooms (e.g. kitchens) in which sources are expected to be produced by design. Other source control measures are included to deal with those sources that can reasonably be anticipated and dealt with.

The secondary requirements focus on properties of specific items that are needed to achieve the main objectives of the standard. Examples of this include sound and flow ratings for fans and labeling requirements. Some of the secondary requirements as well as the guidance help keep the design of the building as a system from failing because ventilation systems were installed. For example, ventilation systems that push or pull moist air into the building envelope can lead to material damage unless the design of the envelope is moisture tolerant.

Whole-House Rates

The first things people tend to look at in a ventilation standard are the rates, specifically the whole-house ventilation rates. In standard 62-01 the whole-house rate was set at 0.35 air changes per hour, but no less than 15 cfm/person (7.5 l/s/person). The default number of people was assumed to be two for the first bedroom plus one for every additional bedroom.

In 62.2P the committee decided to make the target ventilation rate comprise a sum of the ventilation necessary to dilute background sources and sources attributable to occupancy. To find the total amount of outside air needed one needs to add 3 cfm/100 sq. ft. (15 l/s/100 sq. m.) to the 7.5 cfm/person (3.5 l/s/person). Thus the air change rate requirement will vary by the size of the house and the occupancy. For larger houses the 62.2P value comes out smaller than the 0.35 ACH of 62-01, but for small houses the 62.2P rates are higher

Mechanical Ventilation

With some exceptions, 62.2P requires that a fan be used to provide minimum ventilation rates. To size the fan the standard allows credit to be taken for infiltration (including natural ventilation). The standard has a default infiltration credit (of 2 cfm/100 sq. ft. [10 l/s/100 sq. m.]) that can be used in lieu of an air tightness measurement.

Natural Ventilation

There is also a requirement that each room have the capacity for additional ventilation.. A dwelling that has 4% of the floor area as operable openings would meet this requirement, provided the openings do not present a hazard when used to provide ventilation. Such hazards need to be evaluated locally, but could include proximity to local sources of air or noise pollution (e.g. a freeway, an airport, industrial sites, etc.). Security and operability may be other reasons to exclude this as an option. In lieu of a window (e.g. for completely interior habitable spaces), a local mechanical ventilation system may be provided.

OTHER REQUIREMENTS

The standard is more than just whole-house rates. It contains requirements to control local

pollution either by direct source control or by local exhaust. It contains requirements to assure that any systems intended to meet the ventilation requirements can and do deliver ventilation without in themselves causing additional problems.

Local Exhaust

Houses are designed to have certain activities in certain rooms. Kitchens, bathrooms, laundries and toilets are all built to accommodate specific functions. These functions produce pollutants such as moisture, odors, volatile organic compounds, particles or combustion by-products. The purpose of local exhaust requirements is to control the concentration of these pollutants in the room they were emitted in and to minimize the spread of the pollutants into other parts of the house. Local exhaust ventilation is source control for the sources of pollution that are expected in certain rooms.

Unlike the whole-house rates, which are most effective when continuous, source control through exhaust is best operated when the source of pollution is active. The basic rates in the standard are for intermittently operated exhaust fans. For kitchens the basic rate is 100 cfm (50 l/s) and for the rest of the rooms requiring local exhaust the rate is half that. Because of the concern over capture efficiency, vented range hoods are required in kitchens if the required air flow rate yields less than five kitchen air changes per hour. In the current draft kitchens and bathrooms are the only rooms that require exhaust fans.

62-01 allowed operable windows as a substitute for exhaust ventilation requirement; 62.2P does not in kitchens and bathrooms. 62.2P requires natural ventilation in all habitable spaces (that do not have local ventilation), because of the low pollutant removal efficiency of operable windows (e.g. a window could just as easily blow moisture into the rest of the house as out of the bathroom or kitchen).

Ventilation System Requirements

The ventilation system, whether it be natural or mechanical has to meet some basic requirements:

Capacity and Distribution

Because there will be activities that in the normal course of use of a house produce pollutants in excess of what is handled by the basic rates, the standard requires that each room have either a window or a local exhaust system. These kinds of activities might include cleaning, smoking, parties, painting, etc. The requirement would usually be met by the code-required amount of window area. There is no explicit requirement, however, for air distribution.

Particulate Filtration

The standard requires 60% filtration efficiency of 3 micron particles in air handlers principally to keep the duct system, the air handler and the heat exchange components from becoming pollutant sources as dirt builds up on them. (This is an MERV 6 filter in the ASHRAE Standard 52.2 designation.) The filtration also benefits the thermal performance of the system as well as reducing airborne particles that the occupants are exposed to. Any other dedicated

supply air system would also require filtration.

Source Control

While many of the potential sources of pollution are beyond the control of a standard such as 62.2, there are various measures that can reasonably be taken to reduce pollutant sources at the design stage and thus reduce the need for excessive ventilation. Indeed, for some sources, ventilation may make them worse and not better. This section summarizes some of the source control measures in the standard.

Outdoor Air

The outdoor air can be a source of pollution. The ventilation rates in the standard assume that the outdoor air is relatively clean and able, therefore, to improve indoor air quality by diluting indoor pollutants. When outdoor air quality excursions are foreseeable (e.g. excessive ozone) the standard requires that the occupants be able to reduce whole-house ventilation rates by having operable controls on equipment.

Ventilation Inlets

Even if the outdoor air is of good quality, pollution in the building's microclimate can make the air that comes in through windows or other intakes of low quality. The standard requires that there be adequate separation between inlets and exhausts or other known sources of pollution.

Garages

Attached workspaces or garages can be a source of significant pollution. Carbon monoxide is of particular importance when combustion (e.g. from cars) is taking place. The standard requires than any air handling equipment placed in these spaces be demonstrably sealed to prevent entrainment of these contaminants.

Clothes Dryers

62.2P requires that clothes dryers be vented directly to outdoors both to minimize moisture and laundry pollutions. Laundry rooms intended to have clothes dryers (i.e. with installed vents) are exempt from requirements for exhaust fans or windows.

Moisture Migration

If moisture is forced into building cavities or the building envelope and allowed to condense molds and other microbiological contamination can become a threat to indoor air quality and material serviceability. The standard restricts the use of ventilation methods (e.g. supply ventilation in very cold climates) that would contribute to that effect unless the building envelope has been designed to accept it.

Combustion Safety

Keeping combustion appliances from becoming indoor pollutant sources is a concern of the standard. Vented combustion appliances can become a problem if there is any significant backdrafting. 62.2P is not a standard about combustion safety, but indoor combustion sources can be a significant source of pollution and the requirements of 62.2P could have adverse impacts on those sources. The standard mostly considers the impact that envelope tightness and/or ventilation systems could have on the operation of a combustion appliance and requires that a backdrafting test be done if the uncompensated amount of installed exhaust equipment is above a specific threshold.

To minimize the potential for backdrafting the standard requires that naturally aspirated combustion appliances in the conditioned space pass a specific backdrafting test if the total of the largest two uncompensated exhaust appliances exceed about 1 air change per hour of ventilation (not counting any summer cooling fans). Many new houses would be exempt from these considerations either because all their vented combustion appliances are outside the pressure boundary or are sealed combustion or because their two biggest exhaust appliances fall below the limit.

PUBLIC REVIEW

Taken as a package, ASHRAE standard 62.2P represents a significant step forward for ASHRAE in applying professional consensus standards to the residential area. Houses meeting this standard will have improved indoor air quality, reduced moisture problems, and provide better value to the home owner and occupant than those that do not.

The last (3rd) public review was completed in summer 2002 In August 2002 the committee met and recommended that a 4th public review be released in the fall. That public review only contains a small number of independent substantive changes from previous drafts. The review is only on those changes, so the committee is hopeful that the 4th public review will be the last one. Even under an optimistic scenario, the standard could be approved by ASHRAE no earlier than summer of 2003. The current status of the standard can be found in the Standards section of ASHRAE's website, http://www.ashrae.org

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