

Broan SmartSense Fan System Overview

ASHRAE 62.2-2007 Ventilation Verification

The following guide explains how Broan SmartSense meets the requirements set forth in ASHRAE Standard 62.2-2007. This standard is the baseline ventilation requirements for the LEED program, National Green Building Standards, many State and Local building codes and other healthy building program requirements.

ASHRAE 62.2-2007 Overview

ASHRAE 62.2-2007 is an ANSI standard that provides minimum ventilation rates to maintain a healthy home.

The standard requires two types of ventilation:

- **Local Exhaust** – A fan in every bathroom and the kitchen to remove humidity and pollutants from the source. The loudness or Sone rating of local exhaust fans cannot exceed 3 Sones as rated by the Home Ventilating Institute (HVI). The minimum flow rate for each type is as follows:
 - Kitchen – 100 CFM
 - Bathroom – 50 CFM
- **Whole Building Ventilation** – Requires a fan or fans that provide ventilation on a continuous basis using a run-time schedule that meets an average rate of flow throughout the day. Whole Building Ventilation shall have a loudness or Sone rating of no more than 1 Sone as rated by HVI.

Whole Building Ventilation Rate

The ventilation rates are calculated using a formula using the size of the home in square feet and the number of bedrooms. The number of bedrooms is used to estimate the number of occupants.

$$Q_{\text{fan}} = 0.01A_{\text{floor}} + 7.5(N_{\text{br}} + 1)$$

Q_{fan} = fan flow rate, CFM

A_{floor} = floor area, ft²

N_{br} = number of bedrooms; not to be less than one.

Realizing this calculation can be cumbersome and time consuming, the ASHRAE Standards committee developed Table 4.1 that can be used to determine average flow rate.

ASHRAE 62.2 Table 4.1					
Average Ventilation ft ³	Bedrooms				
Floor Area ft ²	0-1	2-3	4-5	6-7	>7
<1500	30	45	60	75	90
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150
>7500	105	120	135	150	165

You first find the row that correlates to the floor area of the home in square feet. Then using the column that correlates to the number of bedrooms in the home, you can determine the average ventilation rate for the home.

As you can see from the example, a 3000 square foot home with 3 bedrooms requires an average of 60 CFM of ventilation or 3600 cubic feet per hour.

A single fan running at 60 CFM continuously would technically meet the requirement to satisfy ASHRAE 62.2-2007. Running a single fan does create two impediments for a healthy energy-efficient home.

- A single fan will continue to ventilate without any consideration of other fans being run in the home resulting in potentially millions of cubic feet of excess ventilation per year.
- Many studies have shown that a single fan does not adequately distribute the air throughout the home.

Broan SmartSense

SmartSense provides a number of advantages over other ventilation systems in economically creating a healthy and energy-efficient home.

Typically for a new home, two types of fans would be installed, local exhaust fans and the whole building ventilation. Broan SmartSense fans are both; saving time and money.

Broan SmartSense fans can be installed in bathrooms, laundry rooms, offices and other spaces in the home. They provide the local exhaust required for ASHRAE 62.2-2007. Broan SmartSense fans are available in 80 CFM and 110 CFM models. Both models are less than 1 Sone, making them suitable for local exhaust and whole building ventilation applications.

Broan SmartSense fans use a state-of-the-art home control technology that allows the individual fans to communicate with each other over existing 110V power lines in the home. Digital signals are shared on the power line and transmit usage and operating instructions.

The simple “linking” process during installation creates a network of fans in the home. The second simple step of setting the ventilation rate at a single fan establishes the ventilation target for all the SmartSense fans in the home. The links and ventilation rate is locked in the system even during power outages. When power is restored, SmartSense automatically picks up where it left off.

Smart Ventilation

Once the ventilation rate for a particular home is entered into any of the Broan SmartSense controls, intelligent ventilation takes over. This SmartSense fan control takes charge of the “system”. It knows how much air it needs to ventilate and makes sure ventilation is accomplished in the most energy efficient way.

Unlike other systems, Broan SmartSense does not run all the time. Since most homes may have a 45-60 CFM ventilation rate, an 80 or 110 CFM Ultra-Silent fan can quickly catch up if it needs to. Every time a fan is manually operated, Broan SmartSense deducts the amount of air removed, from the total amount needed. It then will only ventilate what it needs to, without over ventilating. The ability to do this saves millions of cubic feet of unnecessary conditioned air being ventilated from the home.

Let’s see how this works. We will use the earlier example of a 3000 ft² home with 3 bedrooms and 2½ baths. This home is required to ventilate 3600 ft² of air every hour. If a continuously operating fan was installed in one of the bathrooms and was set to 60 CFM, it would ventilate 3600 ft³ of air, 24/7. This would be all the air you would need to ventilate to meet the recommendations of ASHRAE 62.2.

If an 80 CFM fan in each of the other bathrooms is run for 1 hour a day, this would lead to 3,504,000 ft³ of heated or cooled air being unnecessarily removed from the house each year.

80 CFM
X 2 fans
160 CFM
X 60 minutes (equals one hour of operation)
9600 ft³ per day
X 365 days
3,504,000 ft³ per year of excess ventilation

Over 3.5 Million cubic feet of excess ventilation per year!!!

A Better Way

Let us look at how Broan SmartSense would handle ventilation in the same home. A SSQTXE080 SmartSense fan is installed in every bathroom.* Once the power is applied, a simple linking process takes place and the fans are now a network. A couple more pushes of the button and the 60 CFM ventilation rate is locked into the system.

The SmartSense system takes the ventilation rate entered into the system and calculates how much air it needs to ventilate over an hour. For this example, it would be 3600 ft³. It then divides that value by the number of fans in the system. It would be 1800 ft³ for a 2-fan system, 1200 ft³ for a 3-fan system, 900 ft³ for a 4-fan system and so on. Each fan is responsible to ventilate their assigned ventilation requirement when instructed by the managing fan control. The run rate for each fan depends on the size of the fan. A 110 CFM fan will accomplish its required ventilation faster than an 80 CFM fan.

The accompanying spread sheet shows the Broan SmartSense run-time values based upon the fan system and amount of air required to be ventilated.

This method of splitting up the ventilation requirement creates the situation where you are ventilating from multiple locations throughout the home rather than from a single fan. This creates cross-currents of distribution that provides exceptional ventilation in the home.

No Over-Ventilation

Broan SmartSense not only improves ventilation effectiveness but does so in the most energy efficient manner. The earlier example of a single fan in a 2 1/2 bath home showed how you can quickly add up to over 3.5 million cubic feet of excess ventilation per year. Broan SmartSense takes that manual usage and applies it to the total amount required.

This is how it works:

- 3600 ft³ required ventilation per hour.
- Three fans in the system.
- Each fan is initially assigned 1200 ft³ of ventilation.

The homeowner is getting ready for work in bathroom #1. They turn their 80 CFM fan on during that period of time for a period of 30 minutes. The 80 CFM fan will ventilate 2400 CFM of air during that period of time. That is the equivalent of 2/3 of the required ventilation for the entire home during that period.

The managing SmartSense fan control takes that 2400 ft³ and deducts it from the 3600 ft³ total, leaving a remainder of 1200 ft³ needed to be ventilated. It then

recalculates and divides the 1200 ft³ among the 3 fans in the system. Each fan then ventilates its 400 ft³ of ventilation responsibility and waits for the next hour.

If a 110 CFM fan is used, the system will carry ventilation over into the next hour if necessary. For example, if a 110 CFM fan was operated in one of the bathrooms for 45 minutes. This fan would ventilate 4,950 ft³ during this 45 minute time-frame. This is 1,350 ft³ over what is required during that hour.

The managing SmartSense fan control applies this 1,350 ft³ to the following hour. This means the entire system will have to ventilate 2,250 ft³ or 750 ft³ per fan during the next hour to meet the requirement.

Broan SmartSense ensures that recommended distributed ventilation is achieved in the most energy efficient manner without over ventilating the home.

Verification

Run-Time

We have included a spreadsheet that has tables to assist in the verification of the system. That tables included are the ASHRAE 62.2-2007 Table 4.1 that indicates the amount of ventilation needed for virtually any size home.

The timing aspect of the Broan SmartSense system is hard coded in the firmware and can be verified using the attached spreadsheet. This spreadsheet shows the pre-programmed run-time of each fan based upon the quantity and CFM performance of the fans installed in the system. In some cases when using a single SmartSense fan, large average ventilation requirements may not be attainable. For example, an 80 CFM fan in a 4,000 ft² home with 4 bedrooms would require 90 CFM of average ventilation. An 80 CFM fan would not be able to achieve that level and is indicated by a **X**.

An example would be using the 3000 ft² home with 3 bedrooms. It requires 3600 ft³ of ventilation. If a two fan system is used consisting of a SSQTXE080 and SSQTXE110 fan, you would find the correct table for this mix of fans. Going to the 60 CFM column you will see that the 80 CFM fan will run an average of 22.5 minutes per hour and the 110 CFM fan will run an average of 16.4 minutes per hour. This does not take into consideration any manual usage of fans. Manual usage of fans during this period will reduce the total automatic run time of both fans.

CFM Performance

Broan SmartSense uses 6" duct that provides optimum performance in virtually every installation. ASHRAE Standard 62.2-2007 provides further guidance on

the amount of duct that can be used based upon air flow and size of duct. It is called the prescriptive method.

For example, **Prescriptive Duct Sizing** table 7.1 of ASHRAE 62.2-2007 allows no more than 3 feet of 4" round flex duct when ventilating an 80 CFM fan. An 80 CFM fan designed to use 6" duct would be allowed to use an unlimited length of flex duct. Six inch duct creates lower pressure in the duct, making it less likely that any restriction such as length or elbows will reduce the total air being moved.

The prescriptive method in most cases will prevent the need for further testing unless otherwise required for specific programs. If the prescriptive method is not used, in most cases a building science specialist would need to test each fan for compliance using an expensive flow-hood.

The Intelligent Choice

Broan SmartSense takes the guess work and calculations out of providing superior ventilation. SmartSense installs as easily as normal fans with no extra wiring*.

**Superior ventilation and energy efficiency to meet today's
building ventilation requirements can be a breeze with
Broan SmartSense**

* Since SmartSense communicates over the power lines of the home, fans installed on separate power phases must have a SMCPLR to "bridge" communication between phases. The SMCPLR is sold separately.

If all fans are installed on the same phase, no phase coupler is needed.