

Residential Air Infiltration

www.aamanet.org/airinfiltration

Understanding Air Infiltration Related to Windows, Doors and Skylights

Defining Air Infiltration

To some extent, every home, regardless of age or location, needs to “breathe.” You may feel some air coming into your home around windows, doors, skylights, electrical outlets, walls, floors or the roof. This is air infiltration, and it is the result of air pressure differences between the inside and outside of the home. Every home has *some* level of air infiltration. Glass surface temperature, by itself, is not an indication of air infiltration.

Product Types

Different types of products allow different air infiltration rates. For example, fixed products – those that do not open (such as a picture window) – are the most airtight. Those that do open, like casements (commonly referred to as crank-out windows) or double- or single-hung windows that open vertically have the most potential for air infiltration. This is due to design tradeoffs that allow the units to open and close using reasonable effort to move them.

If your windows open, be sure to keep them closed and locked when not being used for ventilation. This will help reduce air infiltration to keep your home warmer in the winter and cooler in the summer.

Location Matters

Your home’s location and climate can impact air infiltration. That’s why it’s important to select the right type of window, door or skylight for your home’s climate conditions and install it properly according to the manufacturer’s instructions.

Different placement of products throughout the home allow for varying air infiltration rates. For example, a window placed on a north wall facing harsh arctic winter winds should have different qualities to help protect from the cold winds as compared to a southern-facing window overlooking a sunny beach. A skylight, because it is roof mounted, is also impacted by location as well as the slope of the roof surface on which it is installed.

No single product design is best for every application. Depending on the direction a wall or roof faces and the local climate, windows, doors and skylights may need to be different from one area to another within a home.

Air Infiltration Testing

Check with the manufacturer to see if a sample of your windows, doors and skylights has been tested to determine they meet industry requirements for air infiltration. To pass this test (as detailed in the industry standard - AAMA/WDMA/CSA 101/I.S.2/A440), a residential product must not allow more than 0.3 cubic feet of air to pass through the entire manufactured unit per minute, per square foot. At an accredited test laboratory, a new product sample is subjected to constant air pressure to simulate 25 mph winds, which represents a time-averaged weather condition. Since air flow depends upon temperature and barometric pressure, these are taken in account to determine total air infiltration.

More details are provided within the Frequently Asked Questions that follow.

Air Infiltration Frequently Asked Questions

General Information

Q: What is air infiltration?

A: Air infiltration is a term that relates to air moving into a home through small spaces in doors, windows, skylights, electrical outlets, walls, floors or the roof. This is the result of pressure differences between the inside and outside of the home.

Q: Is air infiltration bad?

A: No. To some extent, every home, regardless of age or location, needs to “breathe” so that it is not completely airtight. Well-placed and installed windows allow for natural ventilation in the home. Fresh air is needed inside the home to help eliminate odors and pollutants harmful to human health. Fresh air also helps eliminate excessive moisture that harms the building structure and furnishings and is the source of mold and mildew growth. However, concerns can arise when homeowners perceive that too much air is entering the home through openings.

Q: What is the most airtight window?

A: A fixed window – a product type that does not open – provides the least chance for air to infiltrate the home.

Q: What factors affect the air infiltration rate in a window?

A: Different types of windows allow for different air infiltration rates. A fixed window that does not open is the most airtight. Compression-sealed operable units, such as casements, are the next most airtight. Operable windows with sliding seals such as hung and slider units are traditionally the least airtight, although all AAMA certified windows are designed to meet or exceed the air infiltration standard. The location of the window in the home also plays a role in the level of air infiltration. For example, a window on a wall facing a harsh north arctic winter wind should have different qualities than a southern-facing window overlooking a sunny, warm beach. No single window type is best for every application.

Industry Testing for Air Infiltration

Q: How can someone know if a window, door or skylight will allow in too much air?

A: The two recommended options in determining if a window, door or skylight will allow in too much air: 1) Look for an AAMA certification label on the window to determine that the product has been designed to meet air infiltration standards. 2) Determine if the product has been tested and authorized for AAMA certification by researching the product in the [AAMA Certified Products Directory](#).

A third option available option involves contacting the manufacturer of your specific product to request test data. Note that certification programs offer enhanced quality that is not built into the basic testing process. Certification quality control measures include two unannounced manufacturer plant inspections by a third-party validator.

Q: How does a manufacturer perform the Air Leakage Resistance Test?

A: At an accredited test laboratory, a representative sample is subjected to the prescribed constant air pressure differential. The level of leakage is determined by a high precision mass flow meter. Since air flow depends on temperature and barometric pressure, these are factored out to determine total air leakage.

Homeowner Concerns

Q: Should I be able to feel air leaking into my home?

A: The building industry recognizes that natural ventilation (a controlled air exchange) will occur through all openings. A Double Hung window, for instance, has four sides on two sashes which are intended to move. This part of the designed window movement may allow some minimal amount of air in.

If you place your hands by areas of weatherstripping, it may be possible to feel some air. AAMA-certified windows are designed so that the total amount of air movement will be less than that prescribed in the AAMA/WDMA/CSA industry standard. Normal air movement within the room is another issue that some mistake for air infiltration.

Q: What is the relationship of negative air pressure and air infiltration?

A: The air being pulled out of your home by appliances such as bathroom fans, central vacuums, range hoods, clothes dryers and others can be significant. When this happens, there is often too much resistance for equal amounts of replacement air to get back into your home. As a result, your house tries to "inhale" air. This means that more air will enter your home in areas where natural ventilation is present.

Q: Why do newer homes appear to have less air infiltration?

A: Building techniques have evolved during the past several decades to help create a firmer, more reliable "seal" in the envelope of the home. Products such as house wrap, insulation wraps and spray foam insulations are now being more commonly used on new homes during the building stages to reduce the number of openings in the envelope where air can move in and out.

Q: Why am I only experiencing air infiltration on one side of my home?

A: There are several variables that can contribute to varying air infiltration rates in different parts of your home. The prevailing winds blow directly on one side of your home, increasing the effective pressure differential and chances for more infiltration on that side than the side of the home that is sheltered from direct wind. The style of the product also plays a role.

Q: Is there anything I can do to reduce the air coming through my windows, doors, and skylights?

A: First, be sure that your operable units are clean, operate smoothly and are properly closed and locked. Second, review how your units were installed. Insulation and flashings should have been installed between the frame and the rough opening to provide a tight, secure envelope in the home. Proper installation practices play a vital role in how effective a window, door or skylight is at resisting air leakage.

Installation screws and jamb adjuster screw holes should be caulked and capped. Windows and doors should be installed plumb, level and square; if not, air could enter your home around the outside of the frame. Inspect all weatherstripping to ensure that it is present and intact. Properly sealing and flashing a product per the manufacturers' instructions is vital. If you suspect questionable installation, it's a good idea to have a professional inspect your home. If you have siding on the exterior of your home's walls, be sure it provides a proper seal up to the window frames. If you have brick, the mortar should be intact. Check for caulking integrity and replace cracked or missing caulk.

Q: What are some things to look for to determine if the air is coming around my windows?

A: A good place to start is to look for caulk against the interior trim and around the molding that goes around the frame of the window. Typically, missing or damaged caulk (dried up, shrunken or molded) will allow air infiltration. Whistling wind or a "humming" sound through the siding can indicate an installation problem or a problem that occurred as the house settled.

Q: Why do some windows have more air infiltration than others?

A: The design of the window may be different, such as a picture window or casement, allowing less air to pass through. It may also be in a part of your home that does not get direct wind contact. All windows have some level of air infiltration. AAMA-certified products are designed to meet or exceed the industry standard of less than 0.3 cubic feet per minute.

Q: What three factors most affect air infiltration through windows, doors or skylights?

A: The first is proper installation of the unit, per the manufacturer's instructions. It should be installed square, level and plumb, with insulation present around the rough opening and tucked up to the main frame. The second is outside conditions that include the location of the product on the home, air temperature difference from inside to outside, wind speed and other weather factors. Third is product type. A double hung unit or other operable unit will usually allow more air to pass into the home than a fixed unit (such as a picture window) because it's designed to open. Remember, when closed tightly, even certified operable units permit acceptable levels of air infiltration that may seem excessive to a particular individual.

Q: Are there any steps that homeowners can take to lessen air infiltration?

A: Care and maintenance of your windows is extremely important to ensure performance. Reference AAMA's [Caring for your Windows and Doors brochure](#) for further details.

The proper installation of the unit per manufacturer's instructions is also integral to ensuring performance. Refer to the [AAMA InstallationMasters™ Program](#) for a list of certified installers.