



Windows on Washington Air Sealing and Insulation

Introduction

Energy efficiency is a key concern for many homeowners. Homes which are not optimized for peak efficiency are more expensive and more difficult to heat and cool leading to inflated utility bills and potentially expensive repairs. Of the many improvements a homeowner can make to boost energy efficiency, air sealing and insulation are two of the most important with the highest return on investment.

Air sealing creates an impermeable shell around a home to prevent conditioned air from escaping, which in turn saves a great deal of energy. Insulation provides an effective barrier against thermal transfer, helping keep a home warmer during the winter and cooler during the summer. Investing in air sealing and proper insulation is a sound strategy for realizing sustained savings on energy costs and it also boosts a property's resale value.

This guide provides comprehensive information on air sealing and insulation. It details strategies for locating and sealing leaks, identifying areas which need insulation upgrades and choosing the right insulation for the Washington, DC-area climate. It also provides checklists for consumers seeking information on what to expect from contractors hired to perform air sealing and insulation upgrades.



What Is Air Sealing?

Many homes have numerous sites where cracks or gaps allow for the exchange of indoor and outdoor air. While these gaps are typically most noticeable during the winter, when cold air seeps into the home, they can cause problems all year round. These problems aren't just limited to energy efficiency. Air leaks can also lead to elevated indoor humidity levels, especially in attics and basements. This can lead to the proliferation of mold deposits, and it can also cause wooden structural elements to warp and/or rot. Both of these problems require expensive professional remediation, making preventive interventions crucially important.

The air sealing process locates and permanently closes these gaps to create an airtight envelope around the house, thus preventing the exchange of air and facilitating more efficient heating and cooling.

While windows and doors are the most noticeable sites where air leaks commonly occur, there are many other places where they can happen. In particular, attics and basements should be carefully checked for air leaks. The following areas should also be monitored:

- All exterior walls, particularly in corners
- Attic hatches
- Attic knee walls
- Wiring holes and electrical outlets
- Plumbing vents and air vents
- Open soffits
- Recessed lights
- Points in the basement where the foundation meets the home's wooden framing (rim joists)
- Furnace flues



Insulation and How It Works

Insulation works to inhibit the transfer of heat. In the winter, it prevents cold air from the outdoors from penetrating the interior of a house, helping keep the home warmer inside. During the summer, insulation helps trap cool, conditioned air inside the home while resisting heat from the outdoors. Thus, it is one of the most important features of an energy-efficient home. It goes a long way towards improving com-fort by maintaining a constant indoor temperature while reducing the frequency and duration of HVAC system operation.

There are four standard types of insulation used in residential buildings:

- Blanket insulation - filled with mineral fibers including rockwool and fiberglass, comes in rolled-up form.
- Polyurethane and polyisocyanurate foam insulation - sprayed into the crevices and cavities of a home by a professional installer.
- Loose fill insulation - consisting of cellulose, rockwool and/or fiberglass, contained in pellets or fibers and installed with pneumatic tools.
- Rigid insulation - typically packaged in boards or pipe fittings and is typically used to insulate wall sheaths and foundations.

In addition to the major insulation types, there are several other products used to seal insulated areas and prevent heat gain and thermal transfer.

Specialty Insulation Products

- Fine fibers - made of fiberglass or cellulose can be sprayed over a newly insulated wall to help keep the insulation in place and prevent it from shifting.
- Reflective insulation - used in wall studs, rafters and floor joists to bounce away incoming heat, and radiant barriers can be installed in attics to prevent hot air from penetrating the home through its roof during the summer.

Insulation Effectiveness

There are many different brands and types within each of the previously mentioned insulation products. The questions then becomes how do you differentiate them within their own categories and how do you know which one is the most effective?

The effectiveness of a given insulation product is measured by a metric known as “R-value.” The R-value expresses the insulation’s ability to inhibit heat transfer, with higher R-values indicating greater effectiveness. Three factors contribute to the R-value of insulation: the material used in the insulation, the thickness and the insulation’s density. With multi-layered insulation materials, the R-value for each individual layer will be given.

It is important to understand how to read the label attached to an insulation product. The R-value must be clearly displayed, according to federal law; as mentioned, if the insulation is a multi-layered product, all layers must be rated separately. Labels also contain information regarding approved applications of the product and must detail any health, safety or fire hazards associated with its use. Be sure that the insulation is approved for its intended application prior to purchase.

R Value Guidelines

The insulation industry has also created standardized guidelines by geographical location so that consumers know what R-values to install in specific areas of their homes.

Washington, DC has a “mixed” climate, with heating and cooling needs in the “moderate” range. In homes which have electric heating, the following minimum R-values are recommended:

- Ceiling: R-38
- Wood-frame wall: R-11 to R-22
- Floor: R-13 to R-25
- Basement or crawlspace walls: R-11 to R-19
- Attic ducts: R-4 (return ducts), R-8 (supply ducts)
- Basement or crawlspace ducts: R-2 (return ducts), R-8 (supply ducts)

In homes which have oil, natural gas or heat pump systems, the following minimum R-values are recommended:

- Ceiling: R-49
- Wood-frame wall: R-11 to R-28
- Floor: R-25
- Basement or crawlspace walls: R-11 to R-19
- Attic ducts: R-4 (return ducts), R-8 (supply ducts)
- Basement or crawlspace ducts: R-2 (return ducts), R-8 (supply ducts)

As a general rule of thumb, insulating towards the higher end of the given range is recommended. The investment made in superior insulation will pay dividends for years to come, in the form of sustained energy savings.



Air Sealing: Best Practices

The essential first step in sealing air leaks is to locate the source of each and every leak in a house, from major ones right down to small or narrow cracks and gaps. Getting a home energy audit from a professional contractor is the most reliable way to pinpoint the location of all leaks. During an energy audit, a technician will use advanced diagnostic procedures including blower door tests and/or thermographic scans to identify areas where the home is not airtight. While it may be possible to detect large leaks and gaps without the help of a contractor, these tests are the most comprehensive option available.

Do-It-Yourself Air Sealing

There are many areas in a home where air leakage is easy to discover and to fix yourself. Some of these areas include:

- Windows and Doors** The weather stripping and caulking around windows and doors.
- Electrical outlets** Any outlet located on outside facing walls are commonly overlooked, but notorious for air leakage. Simply install foam gaskets behind the outlets and switch plates for an easy, affordable fix.
- Air Ducts** Conditioned air escapes through improperly sealed joints and is lost to the unconditioned space where the duct is located. Relatively inexpensive and easy to apply, duct mastic should be used to seal these joints to prevent air leakage and increase efficiency.
- Attic Hatch** Adding weather stripping around the frame of the attic hatch and 4-inch foam board to the hatch can help reduce this energy loss. If your attic hatch has attached stairs, an attic tent can also be effective.



Air Sealing and Insulation: Problems Requiring Professional Remediation

For those homeowners with little to no experience working with the aforementioned materials, hiring a professional contractor is recommended. They have the specialized knowledge, tools and equipment to comprehensively seal a residential building in a relatively short period of time. The professional can maximize energy while still allowing for proper airflow throughout the home. This additional investment in professional expertise will pay dividends for years to come.

Examples of air sealing and insulation-related problems that should be brought to the attention of a contractor include:

- Water-saturated insulation caused by a roof leaks
- Vents which release moist or humid air into the attic instead of the outdoors
- The presence of knob and tube wiring, which creates an elevated risk of fire if it lies within close proximity to fiberglass insulation*
- Recurrent ice dams in gutters and attics during the winter
- Attic rafters and floor joists which are showing signs of rot or mold infestation
- Inadequate attic ventilation
- Recessed light fixtures which require insulation

All these problems can potentially lead to costly structural damage or the need for major repairs in the future. Not only will professional attention vastly improve the energy efficiency of the home, but it will also help to raise the overall resale value of the house and make it more attractive to potential future buyers.

*Note: If the home has knob and tube wiring, it should be updated by an electrician or qualified contractor. Like other home efficiency improvements, updated wiring will significantly enhance the home's market value while reducing the risk of fire.



Insulation: Best Practices

As with air sealing, professionals can use advanced diagnostic tests to determine where to add insulation, and how much insulation is required. Those in doubt should defer to the judgment of an experienced technician. Insulation checks are included with residential energy audits.

The next step is to determine the R-values of insulation already in place, then decide whether to add more insulation to bring the total R-value up to recommended levels for that area of the home, or to remove the existing insulation altogether and replace it. If existing insulation is damaged, loose or moist, it may be better to remove it outright and refinish the area with new insulation of the correct R-value.

When adding insulation, be sure that the R-value of the new insulation, when combined with the R-value of the existing insulation, will total the recommended level. It is also recommended that all pipes which transport hot water through the home be protected with insulation as well, as this prevents thermal energy from escaping the hot water while it's en route to a faucet or water heater.

While some DIY insulation upgrades are certainly possible, bear in mind that it is quite difficult to add insulation to existing walls without specialized training and equipment. If major exterior walls are deemed in need of an insulation upgrade, consulting a professional contractor is likely the most time-and cost-effective solution.

In addition to having a detailed knowledge of the work which will be performed during the air sealing and insulation process, consumers should also understand how to protect themselves when dealing with HVAC contractors.

- It is important to get a price quote in writing before any air sealing and insulation upgrades are undertaken. The contractor should have an accurate idea of the costs involved at the conclusion of the initial energy audit.
- Consumers should also understand what recourse they have if they are dissatisfied with the work for any reason, or if energy efficiency improvements do not result from the work.
- The validity of the contractor's credentials and licensure should be confirmed before any work begins and consumers should also check with their local Better Business Bureau (BBB) branch to see if there are any outstanding complaints on file against the contractor.

Air Sealing and Insulation – The Process

Consumers should be aware of the exact steps an HVAC professional will take in order to complete residential air sealing and insulation upgrades. The job begins with blower door tests and concludes with safety tests for combustion appliances. Here is one example of the process, broken down into steps:

- The contractor will perform an energy audit, including a complete blower door test
- Before the air sealing process begins, an additional blower door test will be done to ensure that the original data falls within 10 percent of this confirmation test
- Air sealing materials to be used around heat sensitive areas will be photographed to ensure compliance with ASTM 136 standards for sealing heat sources
- All thermal bypasses (areas where heat is leaking) will be sealed; these areas include B-vents, chases, chimneys, skylights, knee walls, plumbing gaps and electrical wiring gaps
- Seal all recessed lighting areas with either inserts or covers
- Winterize any whole-house air circulators (Note: the contractor might recommend upgrading to whole-house air circulators with insulated doors)
- The home's foundational perimeter will be inspected for inconsistencies in grading as well as extensions of downspouts
- Interior foundation walls will be evaluated for evidence of mold, excess moisture or high levels of dirt and debris; these problems will be corrected if present
- Crawl Spaces will be inspected for high humidity and mold. If problematic moisture is present, the contractor will recommend the installation of active ventilation equipment
- Foundation walls will be sealed to a height of 12 inches with a moisture, dirt and vapor barrier
- Foundation plates and rim joists will be insulated and air sealed with either foam board insulation or spray foam insulation
- If there is exterior access to the home's crawlspace, it will be insulated and air sealed
- If the crawlspace is linked to the home's HVAC system, exterior vents will be sealed and closed off
- All foundational walls will be insulated to the proper R-value with rigid foam board, fiberglass blankets or spray foam or a combination of these materials
- Joist cavities will be sealed and insulated
- Six-sided air barriers will be installed around cantilevers
- Soffit boards will be sealed and blocked, on both the exterior and interior sides
- Return air ducts connected to the garage will be sealed and insulated
- Water pipes residing in the floor joist will be insulated
- Exterior frame walls will be upgraded with fill tube insulation, then plugged and sealed
- The interior side of all exterior walls will be upgraded with proper insulation, if necessary
- Switch boxes and electrical outlets will be sealed and insulated
- Attic knee walls and all structures connecting to the attic, including skylights, will be sealed and outfitted with air barriers
- If any existing attic insulation is compromised or disturbed, it will be replaced with new insulation of the correct R-value
- Foam board insulation and drywall will be added to the attic hatch
- The lid of the attic hatch will be sealed with high-density foam tape
- An insulation curb will be installed around the entire perimeter of the attic hatch, to full depth
- Soffit vent baffles will be insulated to full depth
- If the home has any cathedral ceilings, they will be densely insulated with fiberglass or cellulose insulation
- Light boxes and fan boxes will be fully sealed and, if necessary, insulated
- Foam board, spray or vinyl blanket insulation will be installed around skylights and attic knee walls
- All remaining shafts and uninsulated interior walls will be upgraded with insulation of the correct R-value
- Any problems with the HVAC ducts in the attic will be corrected, as per the initial energy audit report
- Communicate any necessary repairs to the homeowner in regards to any inconsistencies or potential issues uncovered during the worst-case scenario combustion tests
- All work which was performed will be summarized, and the homeowner will be asked to sign off on it

Air Sealing and Insulation Checklists

Below you will find checklists of areas in your home where you may need Air Sealing and Insulation. Be sure to discuss these areas with your energy auditor and your air sealing and insulation contractors before the work begins. Then, use it to verify that all agreed upon areas of work, from the top down and inside and out, have been completed.

Air Sealing Checklist

Attic

- Attic Hatch

- HVAC penetrations

- Electrical and cable lines

- Plumbing shafts and stacks

- Gas Lines

Living Space

- Window and door frames

- Air and heating vents

- Perimeter of electrical outlets

- Under baseboards

- Plumbing penetrations

- Gas penetrations

- Electrical penetrations

Basement and Crawl Spaces

- Floor wall junction

- Headers

- Rim joist

- Sill plate

- Window and door frames

- Gas penetrations

- HVAC penetrations

- Water penetrations

- Sewer penetrations

- Electrical penetrations

Home Exterior

- Vents

- Garage doors and walls

- Water penetrations

- Gas penetrations

- Electrical penetrations H

- VAC penetrations

Air Sealing and Insulation Checklists

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Insulation Checklist

Attic

- Ceilings

- Attic Hatch

- Kneewall

- Dormers

- Ductwork

Side Walls

- Side Walls

Overhangs

- Overhangs

Crawl Space

- Floor

- Walls

Entry Doors

- Entry Doors

Garage – co-located with living space

- Ceiling

- Walls

Basement

- Walls

- Hot Water Tank

- Ductwork

Summing It All Up

Quantified Savings Potential Resulting from Air Sealing and Insulation Upgrades

While the cost of air sealing an existing home depends on the extent of the air leakage and the size and age of the house, the potential for considerable cost savings is very significant. Air sealing, when combined with an insulation upgrade, help homeowners reduce annual heating and cooling costs by an average of 20 percent, according to the Environmental Protection Agency. Additionally, air sealing and insulation will help the average homeowner cut total household energy consumption by up to 10 percent.

Consider that the average American household spends about \$175 per month on energy, which totals \$2,100 per year. A 10 percent reduction would lead to \$210 in annual savings, allowing the homeowner to recover the investment in the air sealing and insulation upgrade in about 5 to 7 years, depending on the characteristics of the home. These savings also do not reflect the boosted resale value of a home with recent energy efficiency upgrades. In short, air sealing and insulation are among the wisest investments a homeowner can make.



In Conclusion

While home air sealing and insulation upgrades do require a significant up-front investment, the benefits pay off for years to come. Not only will the home improvements result in vastly improved energy efficiency and dramatically reduced heating and cooling costs, but a newly air sealed and insulated home will also command a higher resale value. In fact, many homeowners find that air sealing and insulation effectively pay for themselves within a relatively short period of time, in the form of sustained savings on home energy costs.

Homeowners in the Washington, DC area can trust the expertise and professionalism of the air sealing and insulation experts at Windows on Washington. This locally owned company has won numerous awards for service excellence, including consecutive appearances on the Angie's List Super Service Awards, which honors local contractors who provide the best value for homeowner investment.

Windows on Washington takes a different approach to customer service. The company's experts never use high-pressure sales tactics to entice homeowners to sign up for expensive repairs. Instead, they provide honest advice and comprehensive answers, taking the time to discuss the advantages and costs involved with all jobs. In addition to air sealing and insulation, Windows on Washington provides comprehensive line of exterior home improvements, including a full line of energy-efficient windows and entry doors, roofing, siding and insulation products.

Contact us

To schedule a consultation, or to learn more about how these products and services can increase the comfort, beauty and energy efficiency of your home, contact Windows on Washington today.

