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Jason (714) 330 – 3944

www.BestTechsContracting.com

Penny (714) 330 – 4500

www.BEST-Techs.org

The Proper Installation of Air Sealing and Insulation in Attics

Many residential homes have “drafts,” or what BPI Certified Professionals call air leaks, which usually don’t come from your doors and windows, but instead are unnoticed holes in an attic, basement, crawlspace, and walls. To find these air leaks properly, you need to have the right tools and equipment for the job. A main tool to use is a blower door kit, which includes a frame, shroud, fan, manometer, hoses, pressure pan and a smoke pencil. These items, and the experience it takes to use them properly, can’t be found at your local hardware store.

Most people think they already have enough insulation in their attic and/or basement, but if there are holes under it, or imperfections in the installation of insulation, then in most cases, your insulation is only averaging around 25% of what the rated R-value should be.

Air Sealing and Insulation Installation Process

Following are the steps that I take, as a BPI Certified Professional, to make sure that air sealing and insulation is properly installed in an attic space. This technique is what I use when applying air sealing and insulation in attics, but these steps may differ between contractors. Use this as an example of what you might see when a contractor works on your home:

- 1) I educate the owner(s) about air sealing and insulation, and inform them that the two go together, then I provide a complete home evaluation to be certain that the attic insulation can be installed properly in the home in the first place. This is about homeowner health and safety, comfort, energy efficiency and lowering utility bills. If incentives are available, then they are a reward to help offset the costs to the owner for doing the project properly with a trained, educated and BPI-certified home performance contractor.
- 2) Testing of all combustion appliances, ducts, and more before, during, and after all work is performed to the BPI Standards will make sure that the air sealing and insulation does not affect the combustion appliances’ performance and that the air sealing and insulation were installed properly.
- 3) Use of a blower door to measure house leakage and to locate all holes, leaks, and pressure differences allows professional recommendations for improvements to be made. A homeowner then decides what measures they would like completed. Testing after the work has been completed proves that the contracted changes have been completed.
- 4) If the HVAC ducts are designed properly (usually not the case), make sure the ducts are air sealed, so insulation does not get distributed through the ducts and into the home, possibly giving the occupants difficulties breathing. Ducts should be buried in the new insulation to meet or beat the minimum code requirements. See J. Lstiburek’s pictures below.

- 5) A proper attic insulation proposal could include removing existing insulation (if any), when it is discovered that the old is not in proper working order, or not installed properly. Some insulation could have rodent/bug issues, and/or have carcinogens (yellow or pink in color) in it as a preservative. A thorough preparation of surfaces may include a vacuum clean and sanitizing of the area where the new insulation will be installed to allow for proper air sealing techniques and materials to be applied.
- 6) Recommendations are made to correct any wiring deficiencies, such as exposed wires, open junction boxes, wire splices, etc. and replace all non-insulation contact air tight (ICAT) ceiling/attic light fixtures with ICAT LEDs, due to potential heat/moisture/fire concerns. This process will require a thorough investigation of the attic and since the existing insulation will be in the way, the insulation will need to be removed anyway. Often, it may be recommended that new insulation is not installed over old insulation.
- 7) I then fix, repair, and/or replace all water leaks and moisture accumulation problems in attic as needed. Insulate all exposed hot/cold water lines to a minimum of R4 code requirements with the proper water pipe insulation wrap. This is to prevent future condensation issues on your newly installed insulation.
- 8) I install any missing kitchen/bath exhaust mechanical ventilation, venting it properly to outside and per ASHRAE 62.2-2016 and minimum code requirements.
- 9) I then ensure that all exhaust vents (kitchen, bath, etc.) are sealed, vented to the outside, and insulated to according local code requirements. During the inspection the auditor will test and measure the air flow of these exhaust fans to make sure they are meeting or exceeding the minimum manufacturer requirements.
- 10) Installation of insulation baffles in attics in locations such as soffit/eave vents, and around combustion appliance vents (fireplace, DWH, furnace, etc.), will be made as needed. The intent is to protect against fire safety issues that are common when insulation is installed, and to ensure it is providing the minimum code requirements for air flow and clearance from flammable materials.
- 11) If air leaks are discovered hidden above dropped ceilings, or in cabinet soffits, wall chases, shafts, open stud walls, or plumbing walls, a recommendation will be made to air seal them so that insulation can be installed properly.
- 12) Depending upon the condition and location of insulation, recommendations may be made to install proper dams to maintain insulation levels at an attic access, combustion appliances, edge walls, knee walls, skylights, light fixtures, etc.
- 13) Additional air sealing recommendations may include sealing all accessible top/bottom plates, gypsum board seams, sub-floor seams, rim joist perimeters, electrical wire holes, gas/plumbing line holes, duct boots, etc. to decrease air leakage and to prevent heat loss and heat gain.
- 14) Installing insulation attic rulers every 6-8 feet apart, per manufacturer requirements provide a quick visual reference of how much insulation is located in an attic.
- 15) Insulation recommendations to apply spray foam, loose fill cellulose, or fiberglass insulation in the attic, with proper air density and height will be made according to specifics regulated by the Authority Having Jurisdiction (AHJ) where a home is located.

16) When a contracted work scope is finished, a contractor may leave a certificate of completion in the attic with the manufacturer's specifications, warranties, MSDS sheets, so that any technician that enters the area in the future knows what they are looking at and working with.

All pictures are compliments of Joseph Lstiburek, Ph.D., P.Eng., of Building Science Corporation

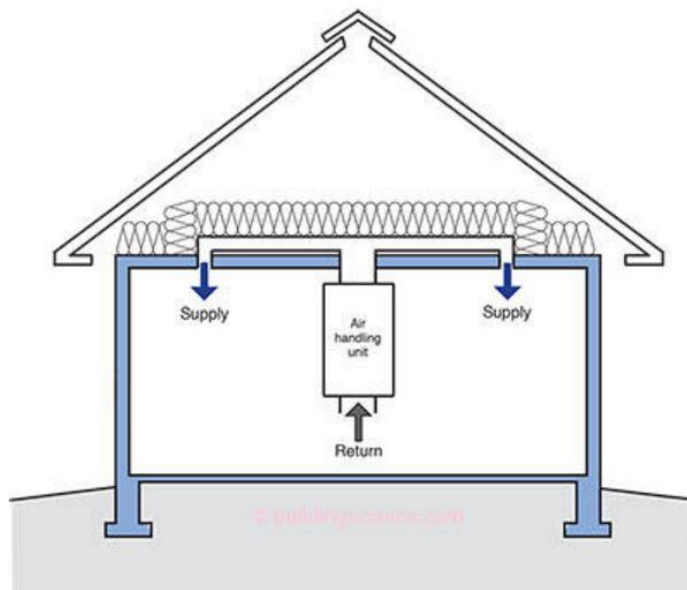


Figure 1: "Buried Ductwork" Concept - Ductwork located under attic thermal insulation in traditional vented attic.

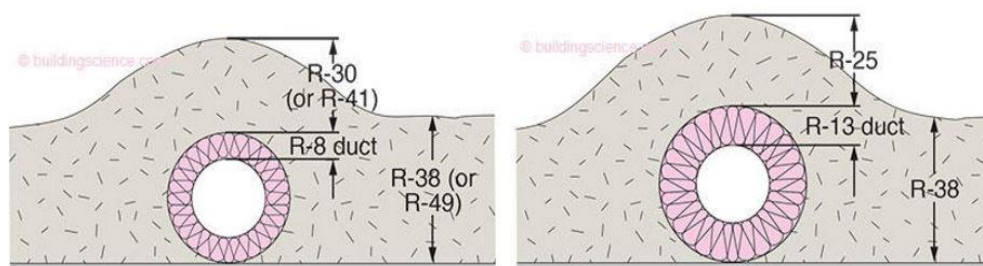
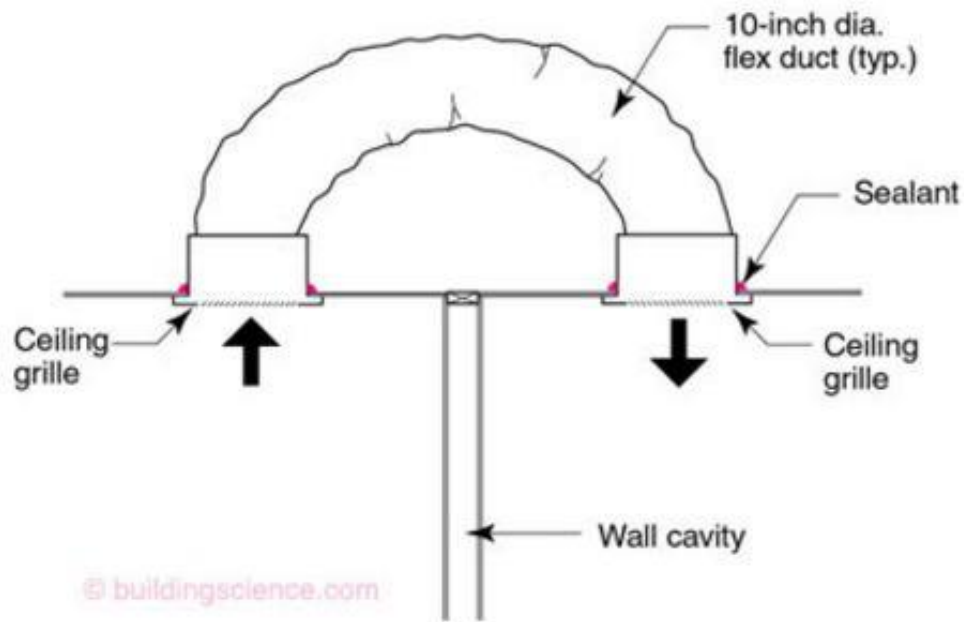
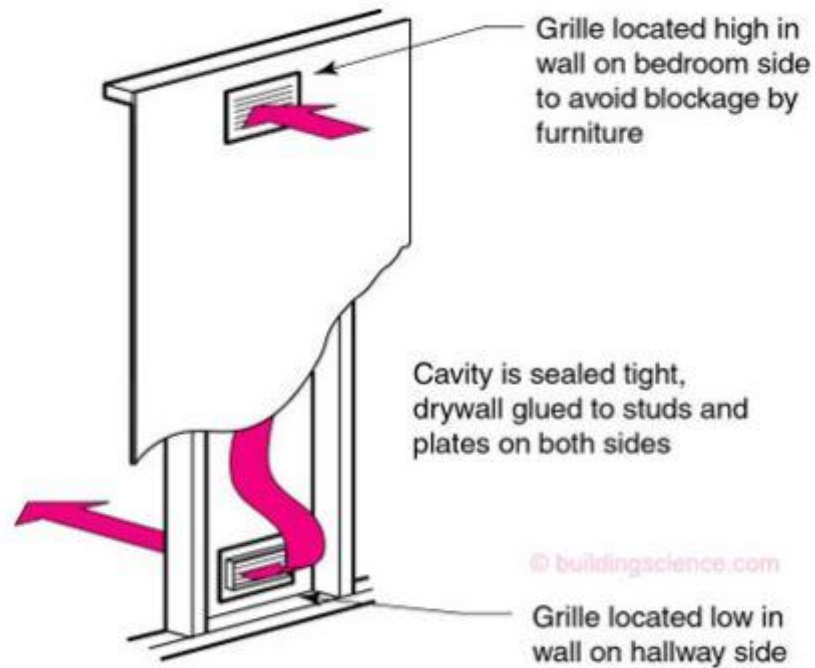


Figure 3: R-8 Buried Duct (above left) - Say your ductwork is R-8 and if you bury it in insulation with R-30 above the top of the ductwork the arithmetic is pretty obvious. This is equivalent to an R-38 attic with the ductwork located "inside". Recall the two "catches" - the ductwork has to be tight and we need to wrap the ductwork with a low perm layer. Oh, and don't forget about the boots and penetrations. Figure 4: R-13 Buried Duct (above right) - If your ductwork is R-13 and you bury it in insulation with R-25 above the top of the ductwork this is equivalent to an R-49 attic with the ductwork located "inside".

Jumper Ducts Need To Be Installed For Balancing The HVAC Either Through The Wall Or Attic



Attic Must Be Completely Sealed Like A Bathtub

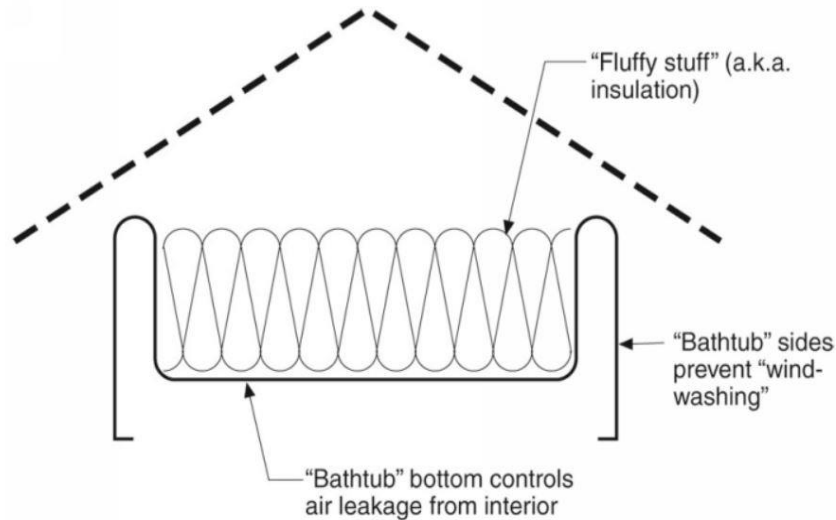


Figure 5: "The Bathtub Principle"—With vented attics it is real important to have a continuous air control layer (aka "air barrier") at the ceiling plane. It is also real important to prevent wind from blowing through the insulation at the roof perimeter (aka "wind washing"). Think of the roof as a bathtub that is filled with insulation. The sides of the bathtub control wind washing and the bottom of the bathtub controls air leakage from the interior.

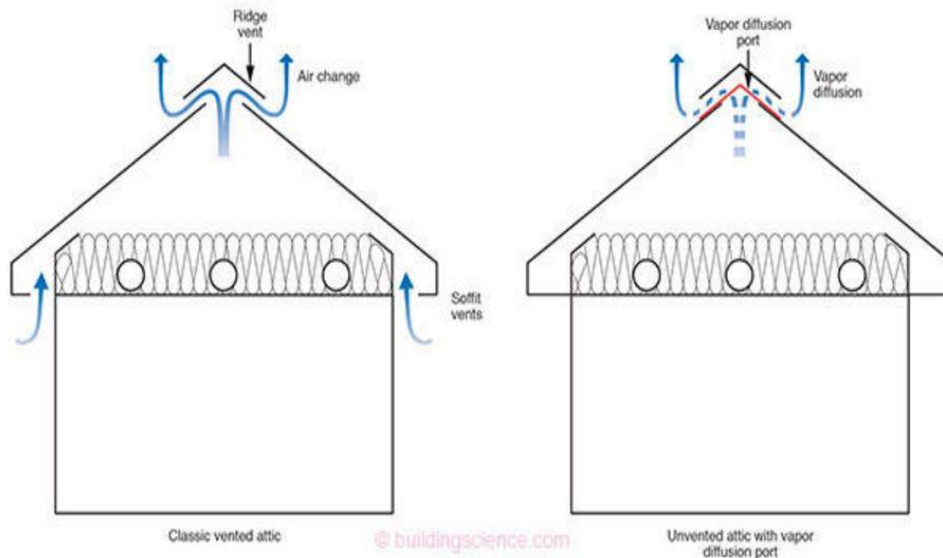


Figure 5: Vented vs Unvented Attic With Vapor Diffusion Port – In the classic vented attic air change removes water vapor from the attic. In an unvented attic with a vapor diffusion port water vapor is removed via vapor diffusion rather than air change.

Jason Scheurer- Building Scientist | Forensic Building Investigator, GC
I can be reached at cell (714) 330 – 3944, or
email - Jason@BestTechsContracting.com