

When was the last time you went up into your attic? If it was during the summer you probably learned one of Florida's best kept secrets, a free sauna with the purchase of every home! Kidding aside, poor performing attics have a huge impact on a home's energy consumption. Since they get so hot, especially during the summer months, that heat will find its way into the house and cause the HVAC system to run much longer than it should. This results in high energy bills and possibly even an uncomfortable home. Attic air is not only hot, but it can be very humid and full of dust and insulation fibers. This air can cause indoor air quality issues that create much more serious problems than high electric bills.

The good news is that air sealing and insulating your attic can be a very cost effective upgrade measure. Comparatively, it's not very costly to do and the energy savings can be substantial so that it provides a great return on investment. However, the job must be done right. Just having a contractor come and put more insulation in the attic may not give you the benefits you're looking for. In fact, if you have a lot of places for air to leak into the home, you may just have added a fresh batch of insulation fibers to breathe in.

The key to effective attic insulation is ensuring the attic has been air sealed. This means finding any and all places in the attic where air has the ability to get into the home and sealing them up. Heat moves into and out of your home in three ways: Conduction, convection and radiation. Insulation stops conduction but typical attic insulation is not effective against convection, or air movement. Areas where air can move from the attic to the home are called ***infiltration points*** and they must be sealed with an air barrier material. Some typical infiltration point culprits are:

- Pipe and wire penetrations into the attic.
- Chases (open framed cavities) for pipes, wires and ducts.
- Architectural soffits that weren't framed properly and are open in the attic.
- Interior walls that were framed higher than the ceiling level (very typical in homes built prior to the early 70's).



Wall framed higher than ceiling



Plumbing chase



Open soffit

Once the attic has been air sealed and separated from the conditioned portion of the home, the insulation can be added and will achieve maximum performance. That is why the first step any insulation contractor should do is to examine the attic, find all the infiltration points to the home and seal them up.

Terminologies:

Loose fill insulation: Refers to any type of insulation that is not packaged in any way. It is applied in its raw form and is either installed with a blowing machine or by hand. The two types of loose fill insulation are:

- *Cellulose:* This insulation is made up of ground up paper material and sometimes also has ground up bits of plastic shopping bags. Borates are added to inhibit mold growth and repel insects and fire retarders are added to inhibit flammability. In horizontal applications it is installed dry and in vertical applications a water/starch mix is sprayed with it so it bonds and holds until dry. Cellulose has an R-Value of about 3.7 per inch and its density does limit some air movement, but it is not an air barrier. The main drawback of cellulose is that it absorbs water at a high rate so if exposed to water or high humidity, it will become wet.
- *Fiberglass:* Is made up of fine particles of glass, about the diameter of the human hair. It can also be applied dry (horizontally) or wet (vertically). It has an R-Value of about 3 per inch. Since it is glass, it has no issues with insects, mold or holding moisture. Its main drawbacks are the small glass fibers are human irritants and it must be installed at a precise density. If it's too fluffy or too compressed, it loses its rated R-Value and will not provide the performance it was designed for.

Batt insulation: This is fiberglass insulation that has been molded into rectangular sections. Batts come in various lengths and R-Values for the appropriate application. Since its fiberglass, its R-Value is about 3 per inch, however to achieve that value, it must be installed very well and can't have any voids, gaps or compressions. Batts can be "faced" with a paper backing that allows for ease of installation and to reduce air and moisture movement or "un-faced" which is just a rectangular block of fiberglass insulation.

Kneewalls: sections of interior walls which have the back side facing the attic space. There are 3 types of walls in homes:

- *Interior:* Both sides face the interior conditioned portion of the home.
- *Exterior:* One side faces the interior, the other side faces the exterior of the home.
- *Kneewalls:* One side faces the interior, the other side faces the attic.

Soffit: An architectural feature that looks like a "box" was built from the ceiling to the wall or just from the ceiling. Soffits are used to install lights, ducts, cabinets, etc or to simply be an architectural feature. Soffits are many times used as chases for ductwork and wiring so can be open on the attic side. Depending on how they were built, soffits can be interior walls or kneewalls. Many soffits are built believing they are interior walls when they are actually kneewalls and this is the primary cause of their inefficiency.

Chase: Any type of wall cavity that is used to run pipes, wires, ducts or other components through. Chases come in all shapes and sizes and are usually not noticeable from the interior of the home

R-Value: A value that denotes resistant to **conductive** heat flow. R-Value is a measure of resistance to heat flow through a material only and will not stop radiant or convective heat flow. The higher the R-Value, the more resistant the material is to conductive heat flow. There are 3 main ways heat can move through a home:

- *Conduction:* Heat flow through a material that is reduced with insulation.
- *Convection:* Heat flow through air movement that is reduced/stopped by air sealing with an air barrier.
- *Radiation:* Heat flow from solar radiation waves that is reduced by radiant reflectors like attic radiant barriers and Low-E coatings on glass.

Baffles: Baffles are products that are installed in the eaves of the roof system to allow insulation to be placed all the way to the edge of the ceiling at the wall-roof connection and provide a channel for the outside air to flow and "vent" the attic. Without baffles flowing air can push the insulation away from the edge uncovering that portion of the ceiling. This is called "wind washing". Or, the insulation can cover the eave and reduce air flow preventing proper attic venting and removal of the hot air that builds up in the attic.

Section 1: Existing Insulation

Getting a good assessment of the existing insulation and attic condition will determine what products are best suited for that attic and how much is needed. Knowing the existing condition of the attic and insulation also helps to gauge what efficiency improvements can be expected from the upgrade. This is also a perfect time to inspect the attic for any and all air infiltration points that need to be sealed.

Section 2: New Insulation

This is a Record of the types, amounts and R-Values of the insulation that was installed. Remember, it is **critical** that all of the air infiltration points were sealed so make sure that the contractor lists those areas for you.

Section 3: Installation

Installation quality is the most important part of performing air sealing and upgrading attic insulation. The following items help to ensure that the attic upgrade will perform as expected.

- Chases are capped and air sealed: Ensure any chase cavities have been capped and air sealed. Foam board, OSB, plywood or any other air barrier will suffice and that cap should be sealed with foam or caulk if necessary. If there are any wires, pipes or ducts extending through the chase into the attic, the cap should be fitted around them and sealed with foam.
- All wiring & plumbing penetrations through ceiling & kneewall planes air sealed: Typically extending through the top plate of a wall, the holes drilled or cut out to allow wires and pipes to run through should be sealed with foam or caulk. Large holes may need to be capped with an air barrier material.
- Insulation makes complete contact with air barrier (ceiling or kneewall gypsum board): Leaving any gaps between the insulation and the air barrier reduces the effectiveness of the insulation. This is mostly an issue when using batt insulation since it can easily shift, slide or get jammed in the cavity it's in. Particular attention should be placed on kneewalls since these are vertical applications of batts and gaps can easily occur between the drywall and insulation.
- Kneewall batts are secured in wall cavity with additional support than only staples: This ensures the batts remain firmly in place and do not shift, sag or fall over time.
- Kneewalls were backed with an air barrier material: Although this is optional, it is highly recommended for excellent performing kneewalls. Install an air barrier (foam board, plywood, OSB, thermo-ply board, etc) on the attic side of the kneewall. Even materials like Tyvek house wrap or Reflectix radiant barrier will help make the kneewall perform much better, but a true air barrier is preferred. The best backing material is polystyrene foam board with a foil covering. It is easy to install, is a great air barrier, and adds additional R-Value to the wall. If the kneewall was designed as part of the roof trusses and there is no top plate along the wall (typical in homes with bonus rooms), it is also a good practice to install something along the top of the wall to stop air movement in the kneewall.



Foam board backed kneewall (picture courtesy of www.energyvanguard.com)

- All wall cavities connected to the interior of the home insulated and sealed: Many older homes (pre-1970) were built to allow air movement in the walls to help the home vent and stay cooler. These designs came from a time before air conditioning was prevalent. In these homes, there may be some walls that extend up past the ceiling and go into the attic. These walls may have insulation in them or be empty but either way, they allow huge amounts of attic air to move through them and enter the home. These walls need to be completely air sealed to stop this air movement.
- All open soffits capped or air sealed: When soffits are framed, many times they are not sealed and insulated properly. These must be capped or air sealed and insulated to stop the heat in the attic from moving through them and into the home.
- Attic accesses in conditioned space are weather stripped and insulated (optional): Attic accesses are usually just a hole cut into the ceiling with a piece of drywall or plywood fitted in to cover the hole or an attic access staircase. Either way, they have a very small R-Value and can also leak quite a bit. If you spend the time upgrading the attic, take a little extra time and money and seal that up as well. A few pieces of foam board glued together and attached to the back of the fitted attic access board and some weather stripping to make a tighter seal can make a big difference. **Do not use batt insulation.** It will tear up rapidly when the access is used. For attic staircases, attic staircase tents do a great job in sealing and insulating the access.
- Baffles installed in all eaves: Ensuring baffles are installed allows the insulation to be installed at full depth all the way to the eave without limiting air movement for attic venting and ensuring wind washing does not occur to the insulation.



Insulation wind washing



Missing kneewall insulation



Kneewall thermal image