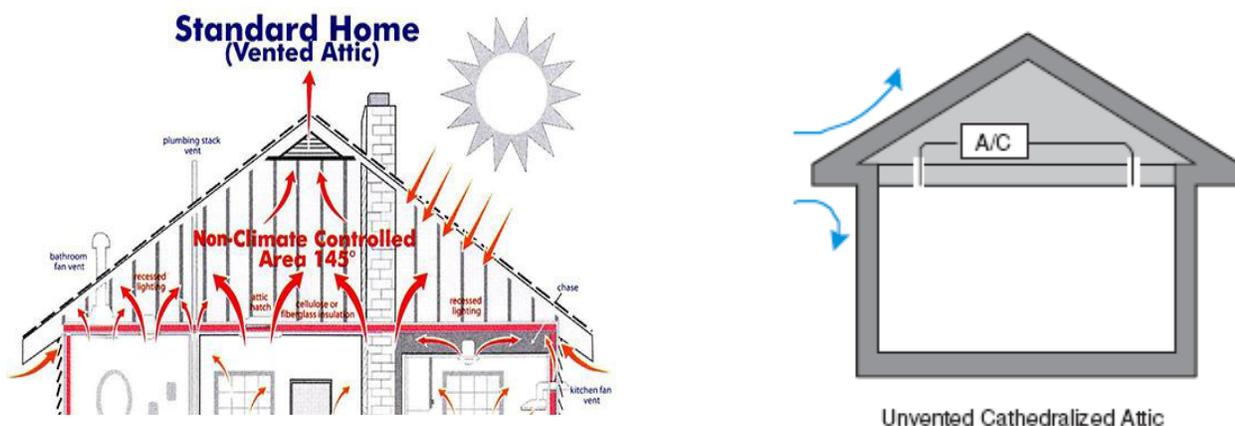


There are two main types of residential attics in Northeast Florida, *vented and unvented (sealed attic)*.

A vented attic is one most of us are familiar with. There are openings around the eaves (eave vents), openings on the roof (ridge vents or off-ridge vents) and/or openings on a flat gable end (gable end vents). These allow air to flow through the attic and remove heat that builds up in the attic from the sun. Although the attic is vented, temperatures in the summer can be around 130 to 150 degrees. These attics have insulation on the attic floor (home's ceiling) and on small wall systems called knee walls to prevent the heat in the attic from coming into the home. Many vented Florida attics also have duct systems installed in them that must also deal with those hot attic temperatures. These attic spaces are considered to be *unconditioned space*.

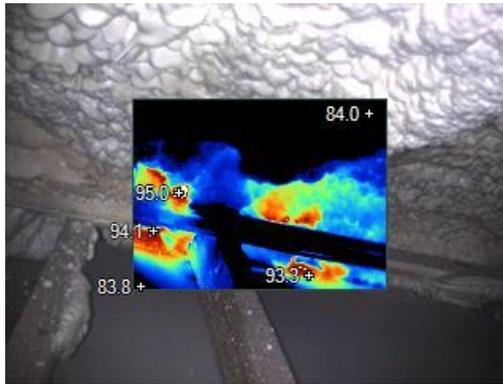
Sealed attic systems seal the attic so that it is no longer being vented by outside air. There are many ways to create a sealed attic assembly but the most popular by far is through the use of spray polyurethane foam. Contractors will spray the foam to the roof deck, eaves and other places to seal off the attic and create the sealed attic assembly. The temperatures in these attics will average about 10 degrees warmer than the temperature in the conditioned space of the home. These attic spaces are considered to be *semi-conditioned spaces*.



Graphs courtesy of cbtofnc.com (vented) and icfresource.com (unvented)

Sealed attic systems can provide quite some energy savings to a home if done properly. Since vented attics are unconditioned space and temperatures can become rather warm and cold compared to indoor temperatures, the air leakage and heat movement between the home and attic can be significant and be responsible for high amounts energy consumption. Also, since the ducts are in the attic, they are exposed to those conditions as well and depending on their condition (insulation and leakage) can add to energy consumption problems. Sealed attics can solve those problems by sealing that space and making it semi-conditioned. It instantly brings ducts into the thermal boundary and eliminates the high temperature differentials between the home and attic. However, there are trade-offs. Since the attic is now within the thermal boundary, that volume of air must now be dealt with by the HVAC equipment. The key is to ensure the new sealed attic will be more efficient than the existing vented attic.

That is why quality installation of polyurethane foam is critical to the proper operation of a sealed attic system. If the attic is not sealed and insulated properly and even small amounts of air are allowed to infiltrate into the attic, the results could be very negative. The energy savings will not be realized and more damaging is that the moisture that comes in may not be removed by the HVAC system and can build up in the attic and home. Retrofitting a vented attic to unvented with foam is a tedious and difficult process but when done properly can be a value in efficiency, comfort, building durability and provide great storage space.



Thermal image of eave air infiltration

Retrofitting from a vented to a sealed attic means changing the air and thermal boundary of the home and all energy savings are realized in the reduction of heating and cooling costs. About 40% of the annual energy consumed by an average Florida home is in heating and cooling. So, the most an average home could save would be about 40% if they never needed to heat or cool the home again. Some homes may be more and some may be less but the key is to understand the realistic energy savings that may be derived by switching to a sealed attic. Claims of cutting the energy bill in half occur only in homes that had very poor insulation, were very leaky and had severe duct problems that were most likely addressed. The average Florida home should see an energy savings of 20% to 30% (depending on its current condition) by switching to a sealed attic without addressing any other areas of the home. However, energy savings is only part of the value that comes with moving to a sealed attic. The semi-conditioned attic provides great storage space and sealed attics are much less prone to damage from wind and water from strong storms.

Terminologies:

Open Cell and Closed Cell Foam: All foam is urethane based. There are slight differences between the various brands but the main ingredient is polyurethane. The real key to foam projects is to choose the right foam for the right project and the quality of the installation. There are three key ingredients that are used in spray foam applications and they are mixed at the spray nozzle during application. As the ingredients are sprayed and mixed the reaction causes an expansion of little bubbles and creates the foam we see. The technician installing the foam must ensure the temperature and mix of the ingredients is correct to ensure the foam installed will work as expected. The two main types of foam are:

- *Open Cell Foam:* Uses a water based blowing agent and as the reaction occurs, the bubbles expand and “pop” open to create a labyrinth of tiny air pockets that **deters air movement** and provides insulation. This type of foam feels spongy and should not be used in exterior applications or applications where it can be in direct contact with water. Open cell foam has an R-Value of around 3.6 per inch and does not require an ignition barrier.
- *Closed Cell Foam:* Uses an insulating gas based blowing agent and as the reaction occurs the bubbles form and harden before they can “pop” open which creates the hardness exhibited by the foam. Closed cell foam is considered an air and moisture barrier and can improve the structural characteristics of the material it is applied to. It has an R-Value of around 6.8 per inch and may require an ignition barrier depending on the installation.

There are pros and cons to both types of foam but they are both effective products if applied correctly. ***It is absolutely critical that the installer apply the foam correctly especially when converting a vented attic to a sealed attic.*** Neither foam should be used where it can come into direct contact with sunlight since the ultraviolet rays from the sun will break down the foam.

Blower Door Test: A blower door test is a simple test that determines the infiltration (leakiness) of a home. A special fan is used to pull the air out of the home and gauges will determine how much air is coming back in

through all the leak points in the home. Spray foam contractors will use this equipment to determine how much they have sealed the home and to try and ensure they have sealed all the areas in the attic. They will often use a blower door in conjunction with a thermal imager to look for the leaks. The two values that a blower door will provide are:

- *CFM 50*: Cubic feet per minute at 50 Pascals of pressure. This is the amount of air, in cfm, that is leaking into the home at that pressure differential.
- *ACH50*: Air changes per hour at 50 Pascals of pressure. How many times the air in the home is being exchanged, every hour, at that pressure differential.

Smoke Test: A device which creates safe theatrical smoke is placed in the attic. A blower door is used to pressurize the home and the smoke in the attic will be pushed out any and all leak points in the foam. It can provide excellent visual verification of leaky areas in the sealed attic.

Smoke coming from the eaves of a home



Section 1: Pre Installation Diagnostics

One of the main benefits of a sealed attic is that it will reduce the amount of infiltration of unconditioned air into the home by sealing off the attic space. Performing a blower door test before foam is installed will provide a baseline of home performance and let you know how much the foam reduced the air leakage in the home when the post test is done. Knowing the values before the foam is applied can also help ensure something wasn't missed. If the values don't drop that much after the foam job, the contractor may want to investigate to ensure everything is sealed up correctly.

Section 2: Installation

Installation quality is the most important part of a converting to a sealed attic system. The following items help to ensure that the sealed attic will perform as expected.

- All eaves sealed properly: ***It is imperative that the eaves are sealed properly for the sealed attic to work right.*** Improperly sealed eaves are the most notorious culprits of poor performing sealed attics. The entire perimeter of the roof has eaves that were designed to vent and now they must be sealed. The sheer number of them and their relative difficult accessibility create a major area of trouble for the spray foam contractor. Some contractors will use a rake to pull the existing insulation away from the eaves to have clear access to them when installing the foam. Others may even recommend removing and reinstalling the soffits around the home in order to access the eaves better. This may cost a little more but will help ensure the eaves were sealed.
- Minimum of R-19 applied evenly to surfaces used to create new sealed attic: To ensure the new attic performs properly it needs to have a minimum insulation level throughout the roof. For a number of reasons, this sometimes does not occur and areas of the roof deck have foam insulation applied but not to a sufficient level.
- Attic accesses to unconditioned spaces sealed and insulated: Having an attic access in an unconditioned space that isn't sealed and insulated properly is like having a poorly insulated and leaky door for your home. These accesses should be sealed and insulated as best as they can be. High quality weather stripping, foam board and attic tents are ways to seal and insulate the access.
- Adjacent Unconditioned Spaces: Since vented attics are considered unconditioned spaces, unconditioned areas under the roof like garages, porches and lanais were connected and just not insulated. This is a normal design for a vented attic and not a problem at all. However, when converting to a sealed attic, these areas must be addressed. There are two ways to do this:
 - Separate the area with a boundary of some sort, seal and insulate: This is the preferred method but also the costliest. Some type of boundary like a makeshift wall is created and then sprayed

with foam to isolate the garage, porch or lanai area from the rest of the attic. This reduces the area and volume of the sealed attic and places that could create problems.

- *Include the unconditioned area and insulate:* If the area is included within the perimeter of the new sealed attic, it must be air sealed completely and insulated to ensure the attic will function properly. This will mean insulating the previously un-insulated garage, porch or lanai ceiling.
- *All existing roof ventilation penetrations (off-ridge, ridge vents, gable vents) and roof penetrations sealed:* Just like the eaves, these areas must be sealed properly. There are fewer of these and much more accessible so not quite as problematic as eaves, but if not sealed properly can cause the same amount of trouble.
- *Existing insulation on attic floor removed: It is completely the homeowner's discretion as to whether or not they wish to have the existing insulation removed.* Most foam manufacturers recommend removing the existing insulation when creating a sealed attic. Sealed attics have been defined as “semi-conditioned” spaces since there is conditioned air in there, but the amount of air flow and movement is based on the air that leaks through the ceiling between the home and attic. This reduction in air movement means that any moisture in the air may or may not be taken out and if moisture levels become too high, water may begin to form and collect in the insulation and other areas. Leaving the existing insulation can reduce the amount of air exchange and provide a “sponge” for the moisture to collect. Another issue is duct leakage. If your ducts are very leaky, a lot of air is being delivered to the attic and if it can't return through the homes HVAC system to be dehumidified, attic humidity's can rise and cause moisture problems.

If the attic was sealed properly, the ducts are tight, the home does not generate too much moisture from cooking and showers and there is enough air movement, leaving the insulation should not be a problem and can add to efficiency. Discuss these issues with your contractor and ensure they have addressed your concerns and you are aware of all your options.

Section 3: Post-Installation Diagnostics

The post-installation diagnostics help ensure that the attic was sealed properly. Either a smoke test or blower door test should be performed.

- *Blower door test:* if the contractor uses a blower door, a pre-installation test should have been performed. The blower door test is most effective when coupled with a thermal imaging camera but not necessary.
- *Attic Smoke test:* A smoke test of the attic after the foam has been installed will provide clear visual identification of any leakage areas that need to be sealed.
- *Ducts tested to less than 10% total leakage (optional):* Now that the attic is sealed, if the ducts are very leaky, all of that conditioned air leaking out of the ducts builds up in the attic and slowly makes its way back into the home through leak points. Although not as inefficient as leakage in a vented attic, it is not as efficient as it could be to have that air in an unoccupied space. Sealing the ducts will help improve the efficiency of the home and provide higher returns on your investment.

If the existing insulation was left in the attic, it is highly recommended that the ducts be sealed to less than 10% total leakage.

Section 4: Notes

This section is for any additional notes concerning the installation process or product description. The installer may provide additional information about any issues encountered while installing the new product that may have prevented a best-practice from being followed.

Section 5: Homeowner Orientation

This section is a reminder for the contractor to review the checklist with the homeowner and discuss how the home should perform with the new sealed attic system. Two key discussion points should be the effects on the HVAC system and any and all issues with the existing insulation if it was left in the attic.