Northeast Oklahoma REC's

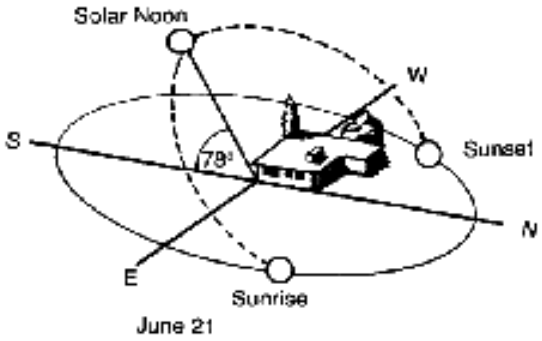
Energy Efficient Tips

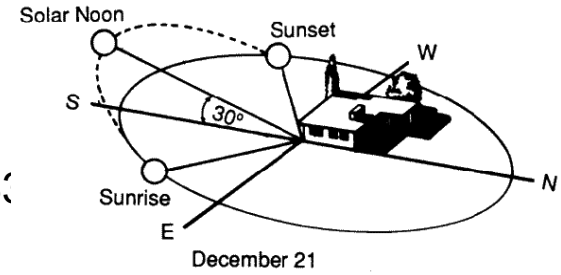
for Home Builders

2017

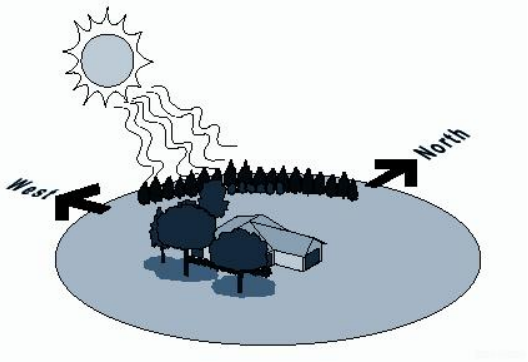
Structural

Orientation of the Home





An easy way to maximize a home's energy efficiency is to place it properly on the site in the beginning. It is generally better to lay the home out so it faces north or south. More windows placed on the south side and less on the remaining three sides is considered a wise choice. In the winter the sun's path is much lower which allows the solar heat to shine under roof overhangs and through the south windows for a nice heat gain. The sun's summer path is much higher so roof overhangs will block a good portion of the sun's rays from penetrating through the windows and reduce the amount of exterior wall heated by the sun.

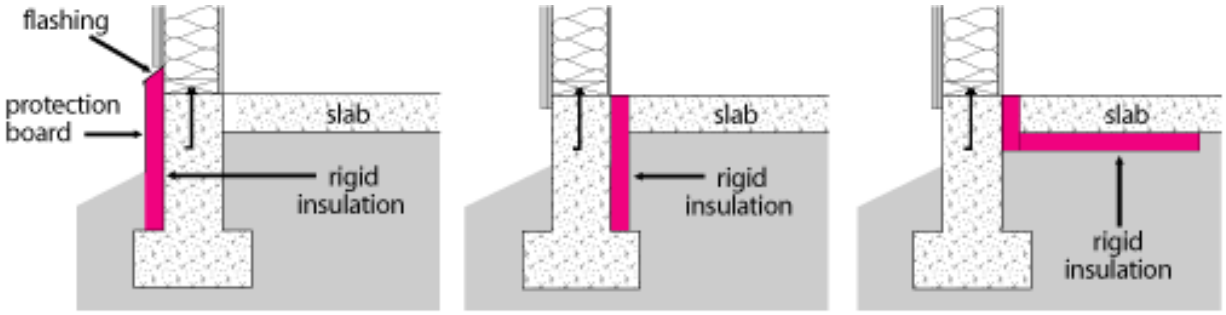


During the summer, tall deciduous trees planted close to the home shade the roof. Broad, shorter trees on the west side block afternoon solar heat. A windbreak consisting of conifer trees on the northwest side can shield the home from prevailing winter winds.

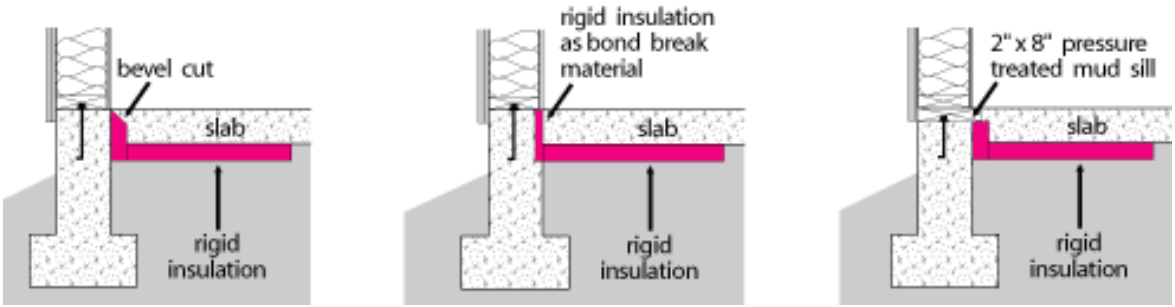
Pad edge insulation

A substantial amount of heat is lost through an uninsulated slab, resulting in cold, uncomfortable floors. Even if the foundation wall is insulated vertically under the slab (illustration left), significant heat is still lost from the slab edge that is closest to the cold outside air. See the illustrations below for slab insulation techniques.

Examples of where and how perimeter slab insulation should be applied.

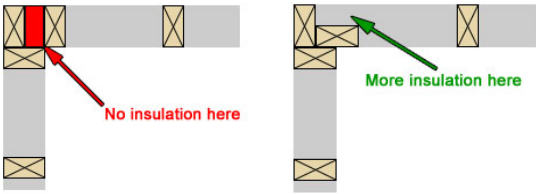


Ways to avoid bringing the insulation to the top of the slab edge so a carpet tack strip can be attached.



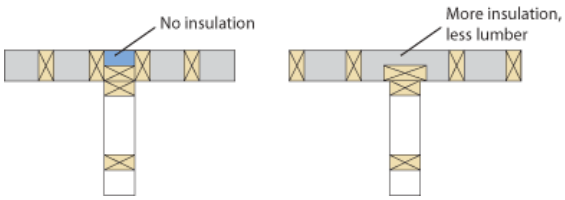
Bevel cut perimeter slab insulation. R-10 extruded polystyrene.

Corner Studs



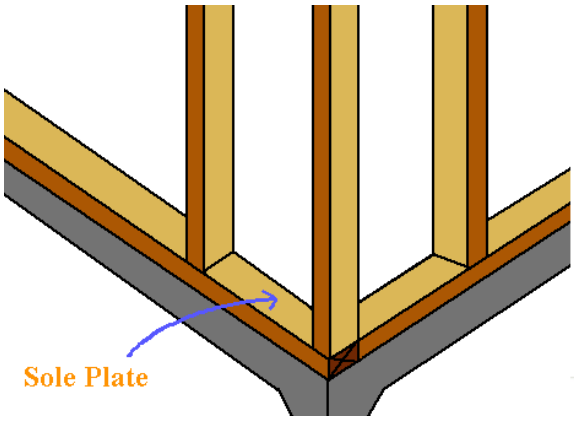
When framing the corners of a home, turn one of the 2x4's by 90 degrees and move it slightly as in the diagram. This will allow you to insulate more resulting in a more energy efficient home.

Interior Wall "T's"



When framing an interior wall "T" of a home, use a 2"x6" or 2"x8" stud (turned 90°) to attach the inside walls as shown in the diagram. You will use less lumber and will be able to add more insulation, resulting in a more energy efficient home.

Sealing Sole Plates

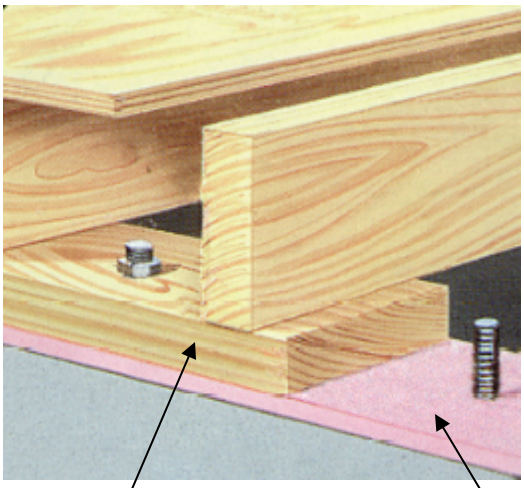


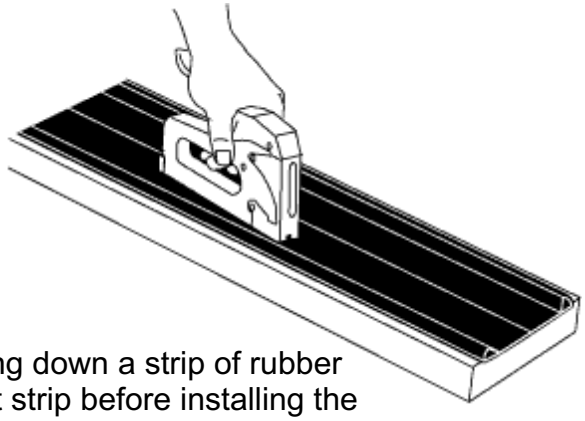
This tip could save you from drafty rooms and costly energy efficiency problems.

If the builder does not seal the sole plates of the exterior walls to the floor you could easily have air infiltration in and out of your home via the gaps in the baseboard area of the wall. A hefty wind will blow unwanted air into your home through the gaps but if the wind is not blowing it still leaves a problem to deal with. When the climate control unit is running the rooms become pressurized and forces conditioned air to the outside via the same gaps.

You can use a double bead of silicone as a seal or a rubber gasket made specifically for this purpose (see below).

You can also use the foam strips as seen on the left (pink).

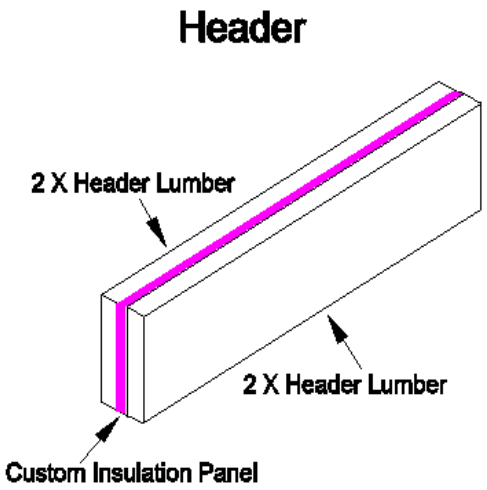




Stapling down a strip of rubber gasket strip before installing the exterior wall section on the floor.

Cross section view of a rubber gasket strip.

Header Insulation

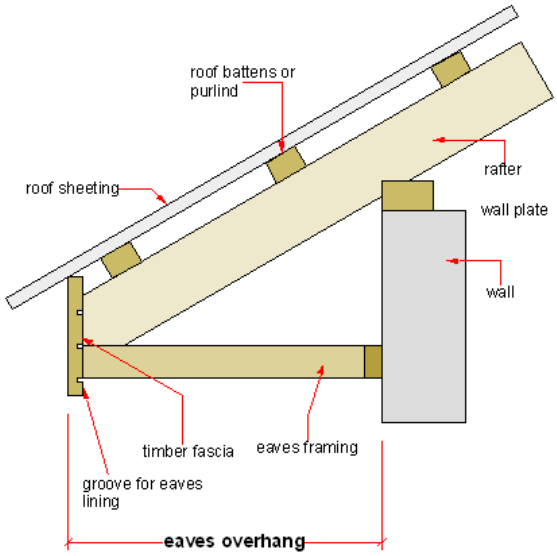


The headers (beams) over doors and windows can be a point of increased heat loss because they are usually made from laminated framing lumber with no insulation. This simple technique used for a home laminates a layer of rigid foam between 2X s (where structurally possible) to create insulated headers. This reduces heat transfer to keep the home warmer in winter and cooler in summer.

Overhang

A 30 inch overhang will keep much of the wall heating at bay in Oklahoma.

No more puny 12” overhangs. Insist on 18” to 30” overhangs to shade your home. A wide overhang will help keep an exterior wall from warming up the interior of a home during the summer. In the winter the sun’s path is low-enough so the rays can heat up the walls and shine its warming rays through south-facing windows.

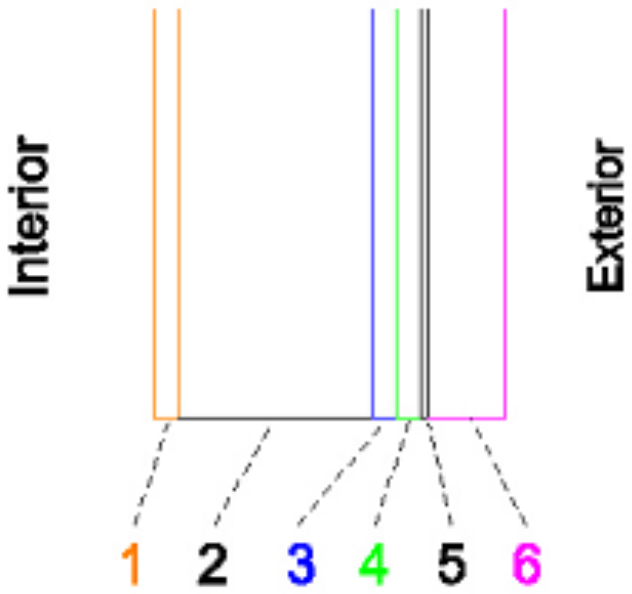


Ceiling Height

Ceiling heights of 9 or even 10 feet throughout a home are very desirous. They give a home a palatial look but this added height leaves the homeowner with the burden of heating and cooling 12% -- 25% more space. You can build the ceiling at 8 ½ feet which gives the illusion of a much taller space with only 6% more space to heat and cool.

The “Excellent Wall”

The Excellent Wall



Cross Section

Goal: Keep the inside moisture in and keep the outside moisture out.

The “excellent” wall.
6 steps to a moisture-barring, super-insulated, and extreme-outdoor weather-blocking wall. The Excellent Wall originates from a professor of Residential Building Technology from a university in the upper US.

1 Drywall with paint that has PVA (poly vinyl acetate) additive. The acetate additive will keep most of the interior moisture inside.

2 Stud with cellulose insulation inside the cavity. Allow the cellulose to dry to less than 10% moisture content before applying drywall.

3 OSB sheathing. (Zip System OSB sheathing does not require house wrap but the joints will need to be taped with the specially designed tape.)

4 Closed-cell foam panel. You must tape the joints with the appropriate tape.

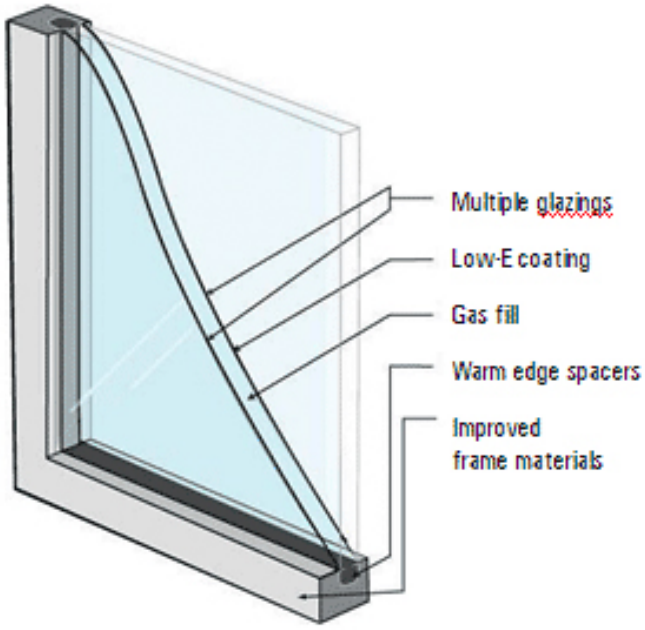
5 Tyvek or similar house wrap.

6 Siding.

Notes: For stucco, Dryvit, and cultured stone do not apply directly to the OSB. Use15# felt behind the masonry.

When choosing lath, buy the vinyl variety because moisture in the wall deteriorates the steel lath.

Windows



Fiberglass insulation should not be used to seal around windows or doors. Packed fiberglass has little R-value and absorbs moisture which reduces the R-value even more. Use a low-expanding foam spray insulation instead.

Percentage of glass. For a more energy efficient home, the less windows the better. When building a new home, try to keep glass area at 10 percent to 12 percent of the floor area of the house (example: 2,000 sq.ft. x 10% = 200 sq.ft. of glass). Glass doors should be included in this calculation.

Placement of Windows. Most of the windows should be on the south side to take advantage of the heat gain in the winter. You must also use trees, awnings, or overhangs to help block the high summer sun.

Energy efficient Windows. Building a new home is the time to invest in the best windows available. Try to get double or triple-paned windows with a low-e coating (most effective on west-facing windows—they can cut heat-gain by up to 25% without changing the window's appearance) and argon filled. Also insist on vinyl or vinyl-clad construction to provide a thermal barrier and to reduce the amount of condensation.

Best Windows. Casement windows are the best type since they close like a door and are weather stripped like a door to seal completely.

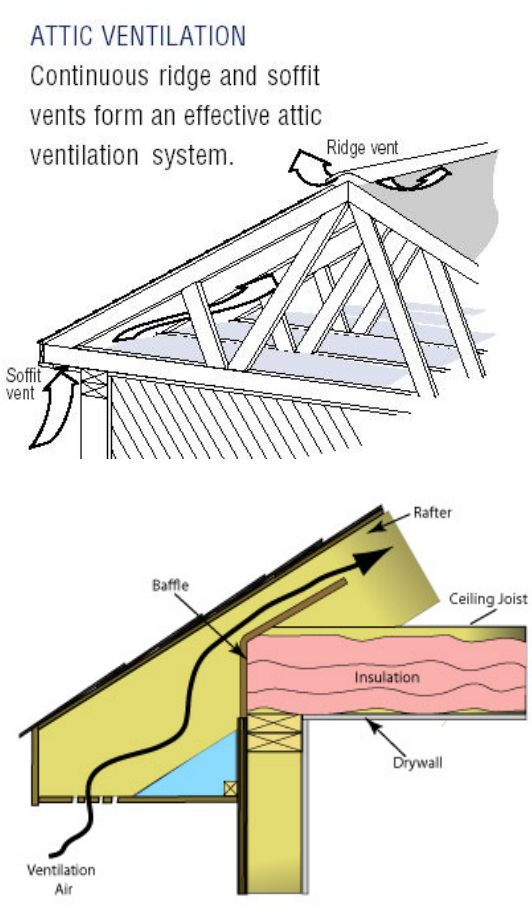
Roof/Attic

Radiant Barrier Sheathing for Roofs

Radiant barrier sheathing for roofs features a layer of highly-reflective aluminum foil that adds an energy-efficient dimension by reflecting up to 97 percent of radiant heat from entering the home. Installation is performed with the foil face down.

The product helps lower cooling energy consumption by up to 17 percent. It can lower attic temperatures (by up to 30°F) and improve energy efficiency. You can increase indoor comfort while potentially reducing cooling energy costs.

Radiant-barrier sheathing has found the most success in warm-weather areas where cooling energy consumption can be affected by hot summer temperatures.

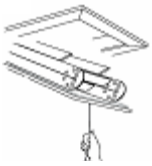


Experts agree the best attic ventilation is a combination of Soffit and Ridge vents. You won't need turbine or power vents which both have repair issues.

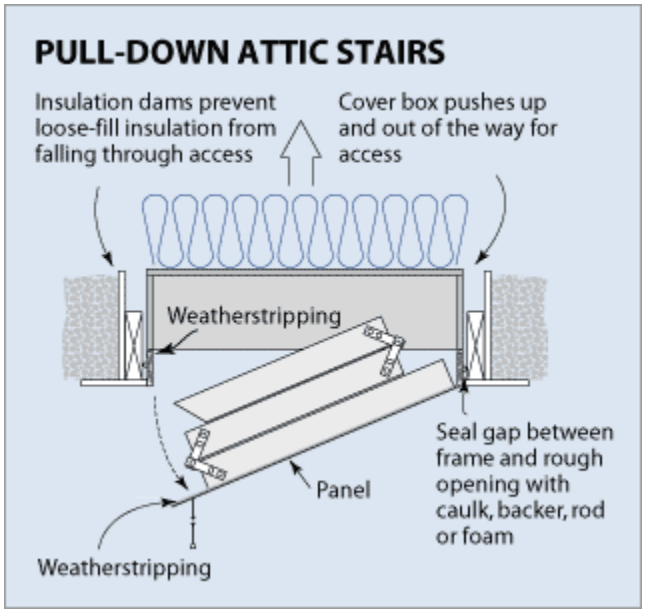
Follow the manufacturer's suggestion on how much ridge vent to use on your home. The general rule is to have one square ft of ventilation for every 150 square feet of attic floor. There should be the same amount or more of Net Free Vent Area (NFVA) in the soffit vents as there is in the ridge vents. Also follow their suggestions for the size of open slot at the top of the roof sheathing at the ridge. As a general rule, the slot should be cut 1 1/2" down from the center of the ridge on both sides.

Make sure the attic insulation will not cover the soffit vents or fill the space between the rafters as this will stop the air flow.

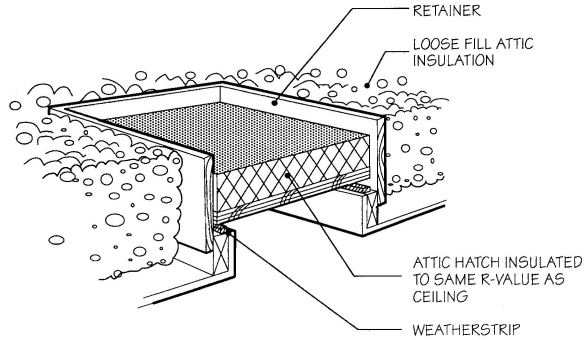
Attic Entrances



Typical gap left by a pull-down stair which will allow an enormous amount of air infiltration into and from a home.



Insulating & weather stripping an attic stair.



You must weather strip & insulate the attic access panel to stop energy loss.

Insulated attic hatches are available on the Internet.

Attic Entrances. If the attic entrance is inside the climate-controlled part of the home, you must make sure it is properly sealed and insulated. If you do not, it can act as a chimney and draw the conditioned air from your home. The reverse is also true. Harsh attic air can enter your home by the same means.

Attic entrances can be a panel, a pull-down stair, a walk-through door, or a knee-wall door. All of these should be treated as an exterior door. They should be insulated and weather stripped.

Pull-down attic stair:

Install weather stripping where the panel of the stair meets the frame.

Install a latch to reduce the size of the gap and to force the panel against the weather stripping.

Construct a box or cut a rigid panel to completely cover the attic stair. Weather strip the bottom perimeter of the panel/box where it meets the attic floor or top of the framing for the opening. Then cover this with the same amount of insulation required for your attic.

Ceiling Panel:

Install weather stripping where the panel rests on the frame.

Cover the panel with the same amount of insulation required for your attic.

Doors

Knee-wall or regular walk-through doors need to be weather stripped on all four sides.

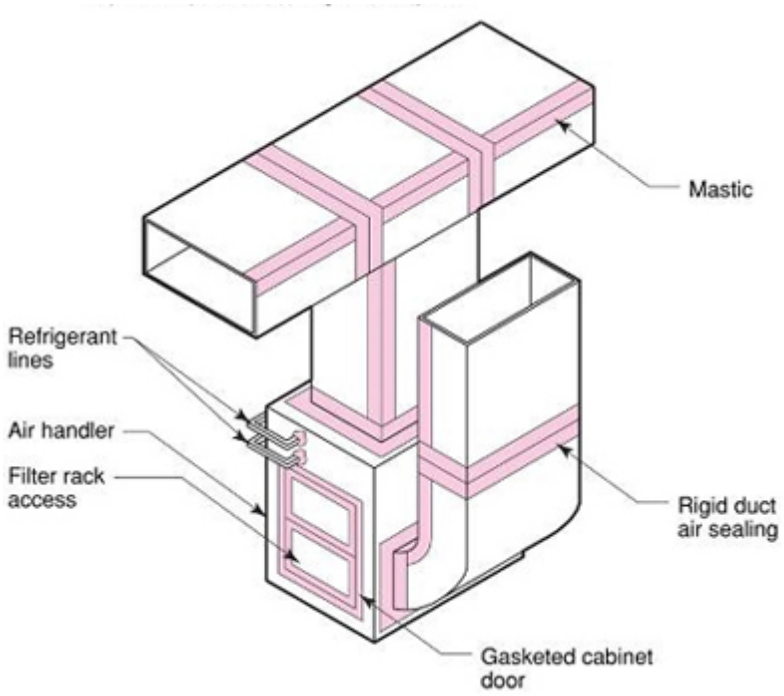
Adhere thick panels of rigid foam insulation on the attic side of the door to equal the R-value of the exterior walls of your home.

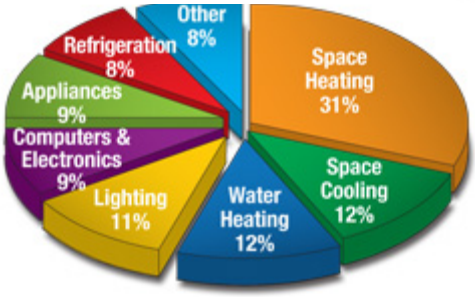
Attic Fans

Attic Fans. Attic fans can be a great cooling tool, but if you only use it a few times a year, it might not be worth a hole in your ceiling. Attic fans have no insulation so there is no R-value in this part of the ceiling which should be R-38. They also leak air around the louvers even when they are closed and rob you of energy efficiency. Try to imagine all the warm air you are losing in the winter through the gaps in the louvers. Like an attic entrance, attic fans usually act as a chimney with the flu open.

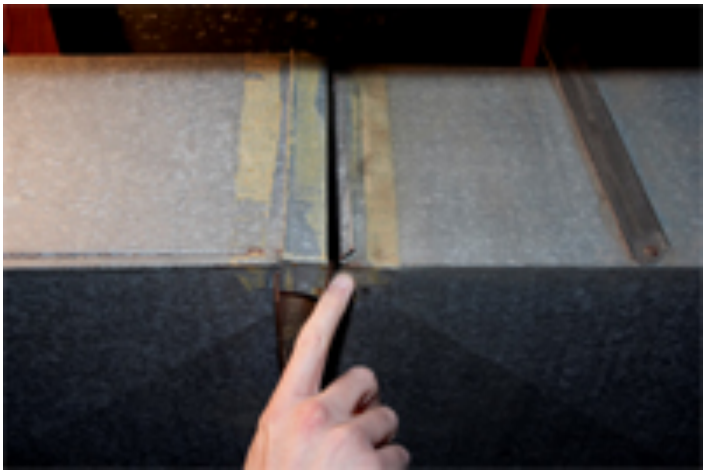
Attic fans can be installed in an attached garage with a screen door between the house and the garage. This keeps the air infiltration in an unconditioned part of the home.

Ductwork





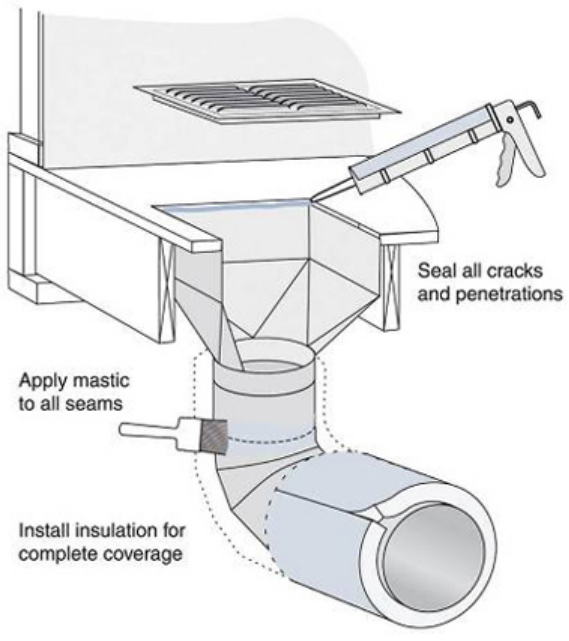
A home's typical energy usage.



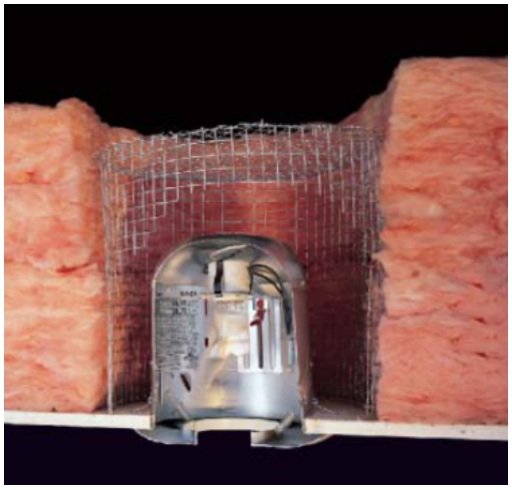
Quality ductwork, correctly installed and properly sealed, is a major concern for a new home builder. Heating and cooling can amount up to 31% of a home's energy consumption so you want to make sure it is done right.

Rigid ductwork sealed with mastic is considered the best. Flex ducts are popular because they cost less and are much easier to install. Pay more up front for the good ductwork and it will cost much less in the long run. The savings come from not having to pay to replace the ductwork and from loss of efficiency through cracks, gaps, and disconnected sections.

Make sure the duct work is insulated and that duct boots are sealed where they pass through the floor or ceiling.



Recessed Lighting
Recessed Lights



A ring of wire mesh keeping the insulation away from a vented recessed light fixture.

A non-vented or sealed recessed light fixture.

Recessed Lights. There are a couple of different types of recessed lights (canned lights). The original has vents in the dome to allow the heat of incandescent bulbs to escape into the attic. The slots also draws air out of you home much like a chimney. The other type is not vented so the conditioned air inside your home will not escape. With the much cooler compact fluorescent bulbs gaining popularity the vented cans are no longer necessary as long as you only use fluorescent bulbs.

If you use incandescent bulbs in canned lights, they will create heat which requires you to keep insulation away from the dome on the attic side for safety purposes.

A recessed or canned light fixture as it appears from a homes interior living space.

Doors

Sliding Glass Doors.

Sliding glass door

Sliding glass doors.
They all leak. Some are better than others, but they all leak. They allow air infiltration where the two doors meet, along the jam, and along the top and bottom track.

The best alternative is a French door. They have the same basic look but they are weather stripped like a regular door so they won't leak. A French door with one opening door and one stationary door is much better than one with two opening doors. The latter is tougher to seal out the air due to more gaps and the poor design of attempting to get the two doors to attach securely together.

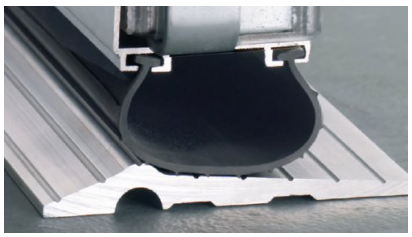
French door

Thresholds

Threshold with dome gasket.

Fine-tuning an adjustable threshold.

Garage door threshold.



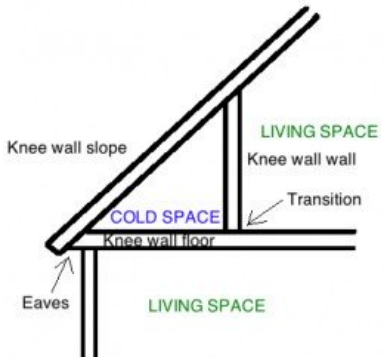
Example of a properly installed threshold.

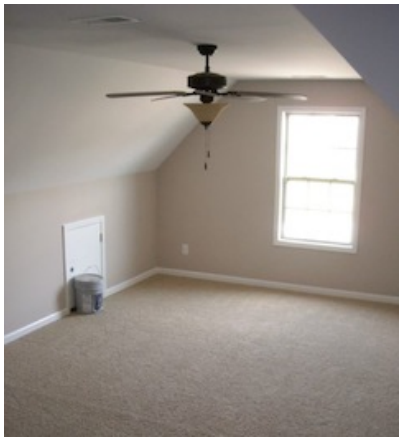
Gaps at the bottom of an exterior door will allow air infiltration. Harsh outside air can blow through to the conditioned indoors forcing your heating/cooling unit to operate much more often than necessary. An area of air infiltration will also allow conditioned air to escape from the inside to the outdoors as rooms become pressurized when the heating/cooling unit is running.

Gaps at thresholds usually happen as a house settles or as the threshold deteriorates over time, but a new threshold (even on a new home) will leak if it is not installed properly. The three main causes of this are poor installation (door installed out of square), threshold is not adjusted after installation, or if there are parts missing (either the seal at the bottom or the seal on the threshold itself).

Another area of concern is becoming more prevalent. Air infiltration under the threshold has become fairly common. This happens when the installer of the new door fails to properly seal the area between the bottom of the threshold and the surface of the floor.

Knee Walls

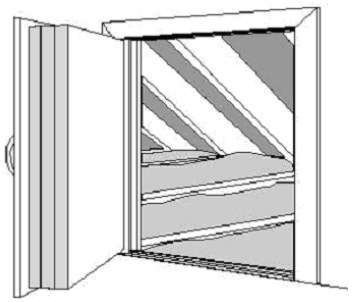




Knee Walls
Knee walls can be a big energy hog if they are not constructed properly. If you have existing ones, you can take measures to improve them. Newer homes have upper bonus rooms and many of those have knee walls. Insulation and air infiltration are the two big concerns.

Here is a photo of a knee wall with insulation batts in place before the drywall is installed. You must treat this wall as an exterior wall. Use a high-quality gasket or a double bead of silicone under the sole plate. Block the joist cavities with solid sheets of rigid insulation board (cut to fit) under the knee walls.

To achieve the maximum value of the insulation a knee wall must be totally enclosed. There is usually drywall on the interior side but nothing on the attic side of the knee wall. Consider enclosing the back side with a solid insulating sheet material.



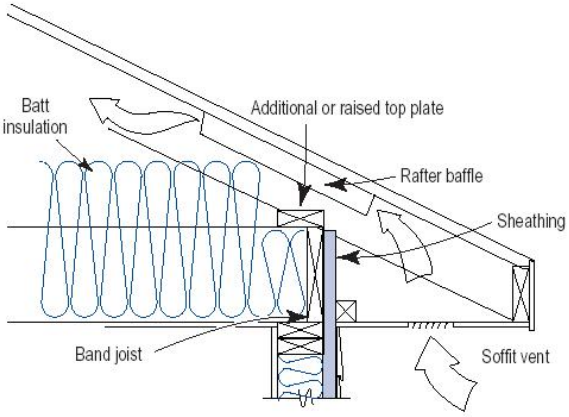
Add R-value to the knee-wall door, by adhering rigid insulation board (sandwiched together with construction adhesive and screws) to the back of the door. The door should be considered an exterior door so it will require weather stripping <u>all</u> the way around. If you choose a regular walk-through door, it must be insulated, and weather stripped complete with a sealed threshold seal.

Attic Insulation for NE Oklahoma

Attic Insulation.

Experts say Northeast Oklahoma homes need 12” total of attic insulation and that is all. You can install more than 12” and it will do incrementally more good but attic insulation past the 12” mark will not pay for itself.

Insulation Dams/Rafter Chutes/ Rafter Baffles



Soffit vents and ridge vents are the best combination for attic ventilation and they work very well as long as the soffit vents stay unclogged.

If you have soffit vents, and you should, blown insulation can be packed into the soffit areas. This usually happens when it is installed or later on by drafts or the cable guy. Packed insulation will block the soffit vents and keep them from functioning. If you install rafter chutes (a three-sided Styrofoam form about 3 feet in length) between the rafters next to the soffit vents, it will keep the vents clear.

Cellulose Insulation

Cellulose insulation is preferred for the following reasons:

Ease of application

Slightly better R-value than fiberglass

Seals much better than fiberglass

Fire retardant

Repels insects, rodents and mold

Very Green….made mostly of recycled newspaper

Cellulose shows little change but fiberglass insulation loses its R-value as the outside air gets cooler

Fiberglass insulation contains formaldehyde glues which can create noxious fumes if your home ever catches on fire

You can blow-in cellulose insulation over the top of fiberglass insulation

Cellulose insulation forms a seamless blanket unlike fiberglass batts which can easily leave gaps.

Cellulose insulation has an R-value of 3.8 per inch (nearly twice as much as typical blown fiberglass)

Cellulose has a favorable cost compared to spray-in foam with a similar R-value

Sealing Electrical Outlet & Switch Boxes

After the electrical wire is roughed in and before the insulation is installed in the walls, use spray foam insulation to seal the holes and gaps on the top, back, bottom and sides on the outside of the electrical outlet boxes and the electrical switch boxes. This will reduce the amount of air infiltration into and from the home.

Note: Once the drywall is in place, the gap between the drywall and the outlet/switch box should be caulked to stop any possible air infiltration.

Incorrectly installed batt insulation. The insulation has been compressed around the wiring box.

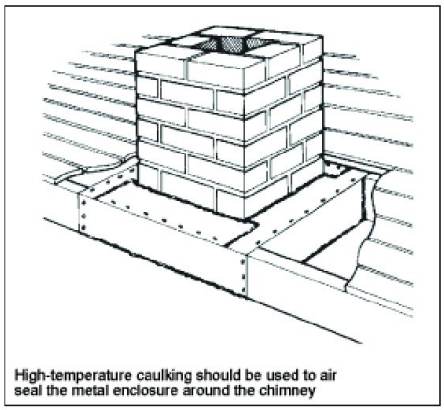
Sealing Around Doors

Incorrect air sealing around a door.

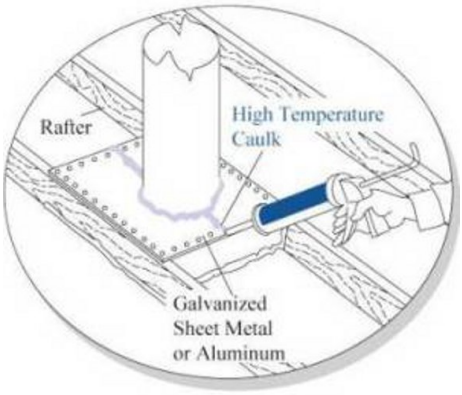
Fiberglass insulation does not meet code requirements for air sealing. Fiberglass insulation should not be used to seal around windows or doors. Packed fiberglass has little R-value and absorbs moisture which reduces the R-value even more. Use a low-expanding foam spray insulation instead.

Chases in the Attic

An open chase that has not been sealed.



A chase of a chimney that has been capped off in the attic

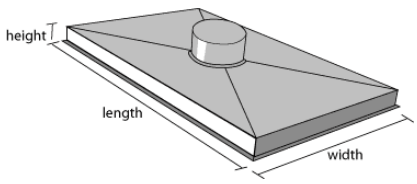


Using high-temp caulk to seal the seams of a metal cap to close-off a chase around a flue.

When building a house, it may be necessary to build chases. Chases are long areas where chimneys, exhaust pipes, and plumbing may run through a structure. The problem is there are open areas along the length of the chase that are not insulated leaving exposed channels where air can flow and heat can radiate from a conditioned part of the home into the attic.

Codes commonly require a 2-inch space between the chimney/flu/duct and any combustible including wood framing and insulation (consult your building codes for your area). You can use thin sheet metal to construct a barrier along the length of the fireplace/flu/duct on all sides to separate them from the insulation. This should enable you to insulate the voids of the chase.

Some types of insulation will not stop the movement of air so it will be necessary to seal both ends of the chase with metal sheets of stainless steel, aluminum or galvanized metal. Use a high-temperature caulk to seal the edges, seams, and gaps. Custom-made chase covers are available on the internet.



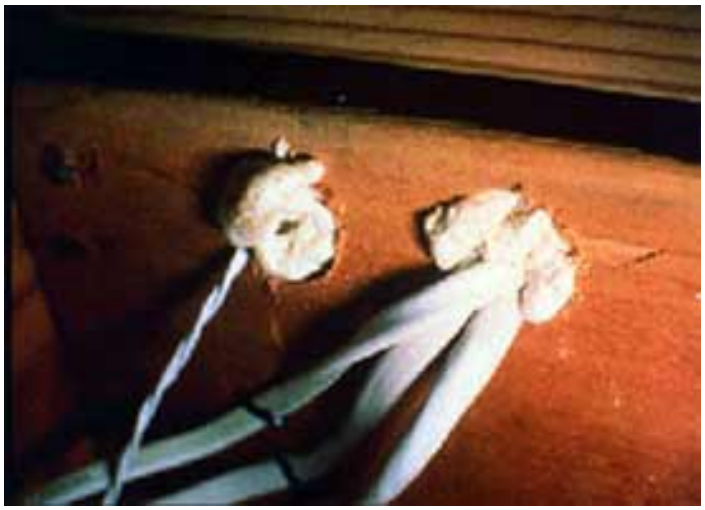
Custom-made chase covers are available on the internet.

Clothes Dryer Exhaust Vents

Not all clothes dryer exhaust vents are created equal. Most are made of cheaper materials and are easily knocked off the exterior wall of a home by mowing equipment or a large pet.

If the vent is disconnected, it will leave a 4 inch hole allowing vast amounts of air infiltration to and from the home. The gravity or floating cup model, pictured on the left, is made of heavy-duty materials and is securely fastened. When the dryer is not operating, an internal cup rests at the bottom of the chamber and seals the exhaust duct. It stops the air infiltration and keeps the wildlife outdoors.

Utility/HVAC Closets



Sealing gaps with spray foam insulation.

Closets or rooms that contain HVAC equipment, water heaters, clothes washers and dryers, often have holes in the walls, ceilings, and floors where mistakes are hidden or where plumbing and/or wiring enters to the appliance. These holes and gaps must be sealed (exceptions for gas appliances—see a professional before you begin sealing) to stop any possible air infiltration into and from the home.

Gap where copper line enters.

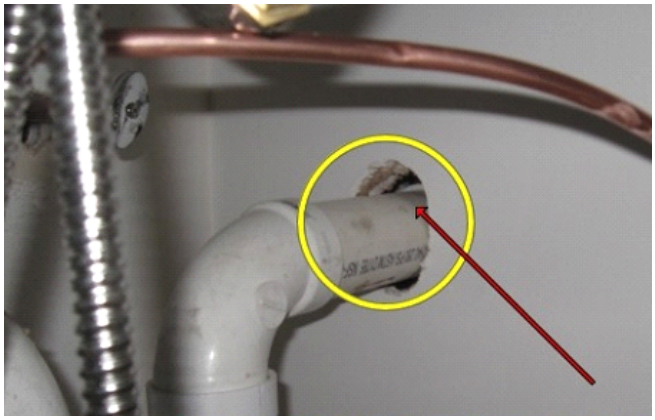
Common mistake left behind.

An entire panel left open allowing air infiltration into the home.

Sealing Plumbing Gaps Under Sinks

Plumbing holes need to be sealed under sinks.

Check under sinks for holes made by plumbers where water inlet and drain pipes enter the cabinet either through the wall, floor, or both. The gaps around the pipe will allow a lot or air infiltration to and from the home. Use spray foam insulation to seal the gaps. Trim the excess insulation and install flanges to complete the project.



This hole through the drywall under a sink needs to be sealed to prevent air infiltration.

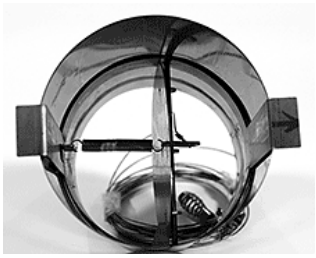
This installation was not completed when first done so it has allowed air infiltration for years costing the home owner energy efficiency.

Chimney Dampers

Standard wrought-iron damper

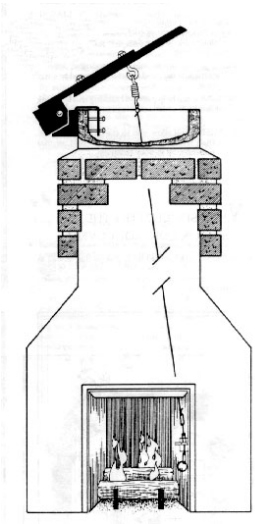
Chimney dampers are not created equal and they are one of the most important considerations when building a new home with a fireplace. A fireplace without a damper or with a leaky damper can rob your home of iits conditioned air. A faulty damper will draw heated air as well as cool air to the outside causing your climate control system to run more often than necessary and costing you more.

Most dampers, when closed, still leak around the perimeter, but some have asbestos rope or silicone to seal them tight.



An in-line circular damper

A top-fitting damper installed on a clay tile



Full view of a top-fitting damper.

A standard damper with an asbestos rope seal installed

A close-up of a damper with a silicone seal

Hot Water

Insulating Pipe Wrap

Installing an insulating blanket on a water heater

Tank-less water heaters have maintenance issues and many times cannot keep up with the demand for hot water.

Hot water circulators waste energy

Hot water is a major consideration when building a new house.

Consider installing the water heater near the center of the structure so the hot water won't have to travel so far to any one location.

Wrap as much of the hot water pipes you can with sleeves of foam insulation so the water will stay warmer longer.

For an ordinary electric water heater, install a blanket on the tank to keep the water hotter longer. Plus don't set an electric water heater directly on a slab or the heat will conduct from the tank to the concrete. Consider installing rigid board insulation under the tank (not for gas).

Reconsider the thought of purchasing a tank-less water heater. The gas and electric models both have high energy concerns and maintenance issues. If you insist on having one, purchase the gas model. It will service three areas where the electric model will only serve two.

Air-to-air heat-pump water heaters are not recommended as they are usually installed inside the home where they will rob btu's your climate control system has created. They are better if installed in a garage. Generally, a hot water system in association with a ground source heat pump works very well.

Circulators waste tons of energy as the water travels through pipes 24 hours per day. If you must have one, lessen the loss by using a timer to start the circulator an hour before you get out of bed and shut off when you go to bed at night.

Install Heat Traps on a water heater tank for energy savings.

Setting your heater on no more than120° saves energy.

Exterior Penetrations

Gap around water hydrant

/Gap around plumbing penetrations

Gap around electrical conduit

It is ironic when everyone involved in building a house is striving to have a tight envelope but after it is built you can easily find more holes than you think would be humanly possible.

Exterior Penetrations and Gaps
Consider filling in the gaps on the exterior walls and where utility wires and pipes enter the home with caulk or canned spray foam insulation to stop air infiltration. These areas of concern are:

Gaps at the bases of the light fixtures

Gaps between the vertical wood trim of the overhead door and the brick

Gap where the suction line of the climate control system passes through the brick

Gaps around the utility boxes

Gap around the gas line penetration

Gap around the conduit of the electrical service entrance

Gaps around the GFCI outlet boxes

Gaps around the wall water hydrants

Gaps in mortar joints of brick or stone

Gaps under brick sills

Gaps around windows and doors