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INSULATION

INSIDE

The average Iowa household spends over half of its annual energy bill on heating and cooling. These costs can be drastically reduced by using energy wisely and making energy efficient home improvements. Insulating your home is a major step toward reducing energy costs.

INSULATION

What Is It and How Can It Save Energy?

Insulation is a material used to slow down heat flow through a building's envelope. The **building envelope** consists of the walls, attic/roof and basement of a home — basically everything that surrounds the space you want to keep warm in the winter and cool in the summer.

Insulation works all year long to make your home more comfortable and energy efficient. In the winter it slows heat loss and helps prevent condensation build up in your home. During summer months, insulation reduces heat gain and helps keep your home cool.

Adding insulation to you home can cut your heating and cooling costs anywhere from 15% to 45% depending on such factors as, the original amount of insulation in your home, house size, air leaks and personal energy use and living habits. Many variables affect the amount you'll save, but the fact remains, insulating your home is an energy wise investment.

Insulation Can Pay For Itself

- ***Rebates and Low Interest Loans***

Many utilities offer rebates on insulation materials. These can take the form of discounts on your heating and cooling bills or cash rebates. Some utility companies will even perform a free energy audit on your house and identify areas needing insulation. Consult your local utility for details.

Additionally, many banks throughout Iowa are now offering low-interest loans for energy-saving home improvements like adding insulation. Your home may qualify for such a loan, especially if it is mortgaged to the bank making the loan.

- ***Increases Home Value***

The first goal of an energy-efficiency project is to keep your monthly energy bills as low as possible. However, projects such as insulation, weatherstripping and caulking also extend the life of your home and can increase the resale value of your property.

Tighten Before You Insulate

Before insulating, it's necessary to stop air leaks in your home. While insulation is an important step, controlling air leaks is the best way to extend the life of your home, as well as save energy, money and increase your home's comfort. ***If you don't tighten up your home first, money spent on insulation may be wasted.***

Most people think they should caulk the outside of their home to protect it from the elements. This is true, but it is also important to protect your home from interior air leaks. During the winter months, moist interior air enters the walls and ceiling through cracks and holes causing condensation to build up in the walls, damaging or destroying the insulation, wiring, wood and other building materials.

There are many places where air can leak into and out of your home. A good rule of thumb is to seal the attic and basement air leaks first. The check list below will help you locate common trouble spots. For more detailed information on caulking and weatherstripping, consult the *Home Series* issue "Home Tightening."

Air Leak Trouble Spots

The Attic:

- Holes in the attic floor and walls
- Doors and hatches to the attic
- Plumbing stacks
- Attic knee walls/storage drawers

The Basement:

- Around the sill plate and band joists
- Basement windows
- Ducts/furnace ducts
- Openings in the basement ceiling and other holes

The Main Level:

- Around the chimney and fireplace dampers
- Around windows, doors, trim and baseboards
- Electrical outlets and other exterior wall holes

The Outside:

- Cracks in siding and exterior
- Windows and doors

Before You Get Started

Whether you do it yourself or hire a professional, insulation can be added to almost any home. While every house is different, the basic rule of insulating is the same for all homes: ***insulation should be installed on any surface separating a heated space from an unheated space.*** Figure 4 shows the areas of a house that should be insulated.

Recommendations for the amount of insulation to install vary according to such factors as climate conditions, the area of your home being insulated and the kinds of materials used in your home's construction. The following insulation check list gives recommendations for a typical Iowa

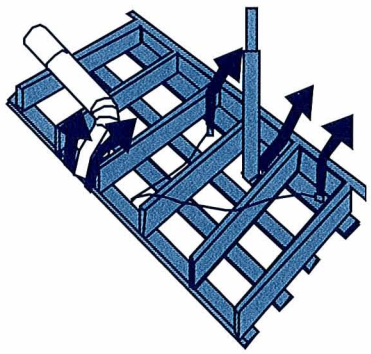


Figure 1: Recessed lights, wiring, plumbing and other openings in insulated ceilings and walls can result in a tremendous amount of heat loss.

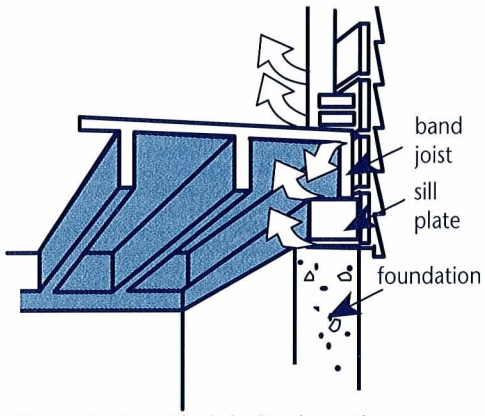


Figure 2: Get rid of drafts along the floor by caulking along the sill plate and band joist in the basement.

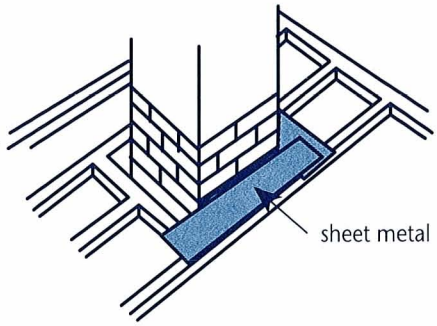


Figure 3: Heat can escape around the chimney if it isn't properly sealed.

home. Of course, not all houses have all of the building elements shown. Note: even if a house already has some insulation in these areas, it may not be enough.

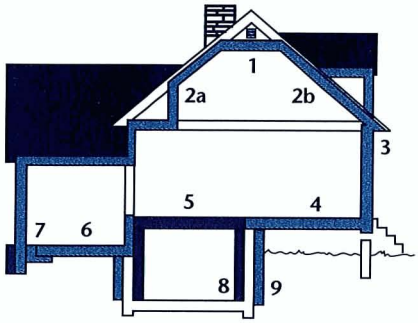


Figure 4: Where to insulate.

1—Ceilings/Attics (also Dormer ceilings) with cold spaces above; R-38-44.
2a-2b—Rafters and/or knee walls of a finished attic; R-19+.
3—Exterior walls; walls between heated and unheated spaces; dormer walls; R-19+.
4—Floors over open or unheated basement/crawl spaces; R-19+.
5—Top of foundation walls; box sill; R-19.
6—Under a slab-on-grade during construction; R-10+.
7—Perimeter of a concrete slab close to grade level; R-10+; interior or exterior.
8/9—Interior or exterior of a finished or heated basement; R-10+.

Understanding R-Values

Insulation is rated by R-values. The R-value (or thermal resistance) of insulation is a measure of its ability to resist heat loss or heat gain. The higher the R-value, the better it insulates. It is important to note that an insulation's R-value is based on its performance in a 70°F environment with no air movement. Ironically, when you need insulation the most it is not under those ideal temperatures or conditions.

Therefore, the *rated* R-value may be much higher than the *effective* R-value if the insulation is not properly installed and/or if air leaks are not stopped before the insulation is added. Some types of insulation, such as blown-in wet cellulose and polyurethane and polyicynene insulation combine both air sealing and insulation in one step. These products' rated and effective R-values are very similar and they have a good performance record.

Insulation Check List

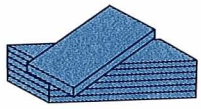
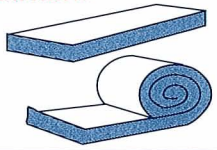
Shown below are different surfaces which, if found in your home, should be insulated to the suggested R-values for Iowa.

- ☐ **Ceilings/Attics (also dormer ceilings) with cold spaces above; R-38 to R-44.**
- ☐ **Rafters and knee walls of a finished attic; R-19 or more. *Note: can by-pass knee walls and follow the length of the rafters. Use extra caution to get insulation to the outer ends of the rafters to create a sealed area.**
- ☐ **Exterior walls; walls between heated and unheated spaces; dormer walls; R-19 or more.**
- ☐ **Floors over open or unheated crawl spaces; R-19 or more.**
- ☐ **Floors over unheated basements (basements with no boiler, furnace or woodstove); R-19 or more.**
- ☐ **Under a slab-on-grade during construction; R-10 or more.**
- ☐ **Perimeter of a concrete slab close to grade level; R-10 or more. Interior or exterior.**
- ☐ **Interior of a finished or heated basement; R-10 or more.**
- ☐ **Exterior of a finished or heated basement; R-10 or more.**
- ☐ **Top of foundation walls; box sill; R-19.**

Choosing the Right Insulation

Any material with a relatively high resistance to heat flow can be considered an insulator. See **Table A** for more details on the various forms and types of insulation.

TABLE A: INSULATION TYPES AND CHARACTERISTICS

Type	Model	Rated-Value Per Inch	Where To Use
Sprayed 	Polyurethane Polyicynene (Icynene) Wet denser packed cellulose	R-4.7 per inch R-3.6 per inch R-3.7 per inch	Open frame walls; floors and ceilings; around windows and doors; used both during construction and renovation.
Loose fill 	Fiberglass or Rock Wool Vermiculite Cellulose	R-2.7 per inch R-1.8 per inch R-3.7 per inch	Unfinished attics; uninsulated and existing walls
Rigid board 	Expanded Polystyrene (Beadboard) Extruded Polystyrene Polyurethane or Polyisocyanurate	R-4.2 per inch R-5 per inch R-7.2 per inch	Basement walls; new construction frame walls; commonly used between siding and studs; cathedral ceilings
Batts & Blankets 	Fiberglass Rock Wool	R-3/in.—low density R-3.8/in.—medium density R-4.3/in.—high density	Unfinished attics; rafters; underside of floors; between studs

Sources: Cooperative Extension Service, U.S. Dept. of Energy.

Sprayed Insulation: Includes polyurethane, polyicynene and wet, dense-packed cellulose. Requires professional installation. Wet cellulose is used in open walls and attics. Polyurethane and polyicynene can be used for both finished and open walls, attics and on the undersides of floors. Both seal air leaks and insulate in one step and have a high effective R-value.

Loose Fill (poured in): Fiberglass, mineral wool, cellulose, vermiculite, perlite. Vapor barrier is installed separately. Used for unfinished attic floors.

Loose Fill (blown in): Fiberglass, mineral wool or cellulose (dry). Vapor barrier is installed separately. Used for unfinished or finished attic floors, undersides of floors and finished frame walls. There can be problems with settling.

Rigid Board: There are four main types:

- Expanded polystyrene (Bead Board)
- Extruded polystyrene (Styrofoam)
- Polyurethane
- Polyisocyanurate

Used primarily on wall framing, under concrete slab floors and on masonry basement walls. To ensure fire safety, these materials must be covered with fire-rated gypsum wallboard. To achieve a high effective R-value seams must be taped.

Batts/Blankets: Includes fiberglass and mineral wool, with or without vapor barriers. Used to insulate unfinished attics, undersides of floors and open walls. Blankets are more difficult to handle than batts because of their size. A tight fit is necessary to gain a high effective R-value; not appropriate around windows and doors.

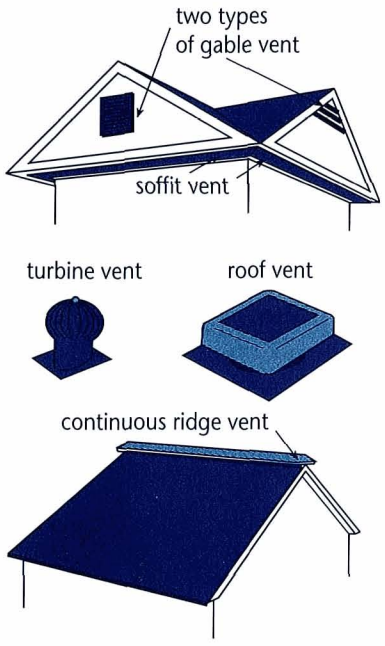


Figure 5: Five common attic vent types.

Shopping for Insulation

It is important to remember when buying insulation that the product with the highest R-value per inch may not be the most cost-effective. For example, when insulating a basement wall to an R-12 value, using 3" of an R-4 per inch insulation material might be less expensive than using 2" of an R-6 per inch product. To get the most insulating value for your money, compare the total costs of insulating an area to a specific R-value.

Should You Install Your Own Insulation?

For many insulating jobs, such as those in your attic and basement, doing it yourself can save you money. However, some jobs — insulating walls and foundations, for example — are more difficult and time-consuming, and in those cases professional installation may be a wise choice.

The Importance of Vapor Barriers

As you've seen with a glass of ice water, condensation occurs when warm, moist air touches a cold surface. When this happens in your home, it can cause water or frost damage, mold and mildew.

Vapor barriers slow the movement of water vapor through building materials. A good vapor barrier will allow very little moisture to pass through it. If you're installing insulation, you should always include a vapor barrier. Investing time and money in a vapor barrier is insurance against future moisture damage. If you are building a new home, a vapor barrier should be placed under the concrete slab.

Types of Vapor Barriers

Sprayed-In Insulation such as polyurethane and polyicynene insulation does not need a vapor barrier when installed.

Foil or Kraft Paper is often part of the fiberglass batt or blanket insulation. It is installed in new walls or top-floor ceilings. The vapor barrier should face the warm side of a wall, floor or ceiling surface.

Rigid Board Insulation acts as a vapor barrier when installed under an interior covering material, such as sheet rock. Contrary to earlier beliefs, the seams of rigid foam board should be taped to improve its performance. This will prevent moisture condensation problems because the foam keeps the temperature in the wall cavity above the dew point temperature. Seams should be taped for both interior and exterior use.

VENTILATION

Carbon Monoxide Poisoning:

Tightening up a house with caulking and weatherstripping, sealing ducts and insulating can have a significant effect on the way a house operates and greatly increase your comfort. However, sometimes you can get a house too tight and it won't vent properly. If your home does not vent correctly it can lead to a number of problems including carbon monoxide poisoning and even death.

Some signs of carbon monoxide poisoning are:

- Entire family is sick at the same time with flu-like symptoms
- Flu-like symptoms decrease while away from the house
- Illness is present when gas appliances are in use
- Excess moisture on the interior windows

To protect yourself from carbon monoxide poisoning, first have all gas heating appliances checked by a qualified heating contractor every year. Next, purchase carbon monoxide detectors. Finally, if you are replacing the heating units in your home, use only direct-vent sealed combustion units or consider installing an electric unit such as a ground source heat pump.

Ventilation in Attics and Crawl Spaces:

Proper ventilation is also important to protect your home from moisture damage. It reduces problems with ice dams on the roof during the winter and can reduce cooling costs in the summer by 10% or more.

Much of the moisture that accumulates in attics during cold weather comes from air leaks between the home and the attic. Warm moist air from the home rises through unsealed holes and water vapor condenses out of the air as it cools. Moisture in an unvented attic won't be able to pass through the roofing materials and will be trapped in your attic where it can damage building materials.

It is most effective to seal the leaks in the ceiling rather than to rely on attic ventilation to remove the moisture condensation caused by air leaks.

Ventilation, however, is necessary to ensure proper air flow through the attic. First, vents are needed at or near the top of the roof (use roof, gable, turbine or continuous ridge vents.) Second, vents should be at the lower edge of the roof (use soffit vents) (Fig. 5) to allow air to circulate naturally.

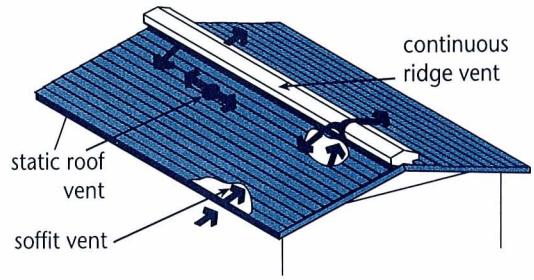


Figure 6: Effective attic ventilation. Intake venting low through the soffit and exhaust venting high through a continuous ridge vent is the most effective way to ventilate an attic without fans.

A combination of high and low vents or continuous soffit vents and continuous ridge venting is the most effective option (Fig. 6).

Good natural ventilation makes attic fans unnecessary for most homes. Attics with a ceiling vapor barrier should have a minimum of one square foot of vent area for every 300 square feet of ceiling area. If your ceiling doesn't have a vapor barrier, your attic needs twice the amount of vent area, or one square foot for every 150 square feet of ceiling area.

Crawl spaces containing water pipes or other utilities should have vents to the outdoors that can be opened in the summer and closed tightly in the winter to reduce heat loss. Vents at each corner of the crawl space or basement area provide the best air circulation.

Mechanical Ventilation:

Power Attic Ventilators are effective, but expensive, and are often used as a last resort to solve moisture problems and to cool attics. The best place for a power attic ventilator is near the top of the roof on the side facing away from the prevailing winds. These fans are controlled by thermostats.

Whole-House Fans can be good substitutes for air conditioning. They should reduce indoor temperatures 3°F to 8° F during summer months and you can expect lower air conditioning costs through the prudent use of a whole-house fan.

Indoor Air Quality Specialists:

If you have concerns about your house venting properly, consider having a blower door test performed. This test determines if you have proper air pressure in your home and identifies air leaks and ventilation problems. Many utilities in the state can perform a proper test. If your utility does not have the ability to do a blower door test, contact your local heating and cooling professional.

A Safe Ending

After you have tightened and insulated your home consider a blower door test. This test will check to see if there is any back drafting or possible danger of carbon monoxide poisoning. Many local utilities, as well as heating and cooling professionals, can perform blower door tests.

THE ATTIC

Because a significant amount of heat can be lost through the roof, the best place to begin insulating is the attic. This is also usually the easiest place for "do-it-yourselfers" to begin. Access to the attic is usually easy and loose-fill or batt/blanket insulation can be installed over existing insulation. Other ceiling types, such as cathedral ceilings or finished attics, can be more difficult, and professional installation may be necessary. If you choose to install spray-in insulation, such as polyurethane, polyicynene or wet cellulose, you will need to have it professionally installed. Different types of attics require different methods of insulating. The following pages include information to help you successfully install insulation in your home.

Things to Remember

Before you begin, examine the work area for water leaks or possible hazards, such as protruding nails and exposed wiring. Seal all air leaks and water leaks before adding any insulation. If you find old, brittle wiring, leave it alone and call an electrician to inspect it. Also, make sure your work area is adequately ventilated.

Read the manufacturer's instructions before installing any insulating material. Some of these materials are highly flammable and require special handling. As a fire precaution, do not smoke while working with insulation. You will need the following:

- In an attic without a floor, you'll need pieces of lumber long enough to span several joists and wide enough to walk on. The ceiling between the joists is not sturdy enough to support a person.
- Portable light, such as a mechanic's trouble light, and an extension cord.
- Sharp knife or sissors; a rake to push and pull blankets to the edge of the eaves; caulk.
- A long-sleeved shirt with collar and cuffs buttoned, gloves, hat, safety glasses and dust mask are advisable in all do-it-yourself insulation projects.

Insulating an Unfinished Attic

Step 1: Prepare the area. If necessary, lay lumber across ceiling joists to create a platform to work from. Use your portable light to illuminate the work area.

Step 2: Assess the condition of the area.

- If the existing insulation is water damaged, remove it. Examine the roof for leaks and repair. Also, look for any openings in the walls or floor where air could enter. Seal any of these openings with caulk before insulating. When warm, moist air from the home rises it can condense at the insulation level where it meets the cooler attic air.
- Be on the lookout for wiring that looks old and brittle. Have such wiring checked and replaced, if necessary, by a qualified electrician.

Step 3: Calculate area to be insulated.

Measure the area to be insulated. Multiply the length by the width to find the area (see Area Table in Appendix.) After taking into account any existing insulation, calculate how much new material is needed to insulate to the desired R-value. **In Iowa, unfinished attic floors should be insulated to a minimum of R-38 and up to R-44.**

IMPORTANT: If some insulation already exists, the additional insulation **should not** have a vapor barrier. If batts or blankets without facings are not available, you must remove the vapor barrier facing or slash it with a knife

before installing it. If you don't do this, the vapor barrier will trap moisture in the insulation.

Insulation is necessary not only over the main part of the floor, but also above stairways and pull-down stairs, around plumbing vents, flues, electric wiring and other holes in the attic floor.

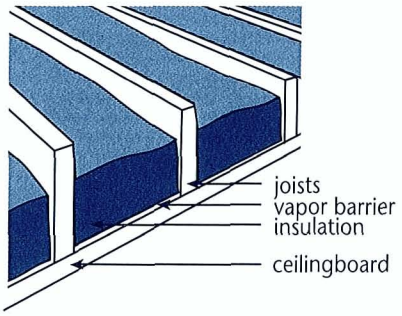


Figure 7:

Step 4: Check existing insulation. Before adding additional insulation over existing material, check to see whether the old insulation has a vapor barrier and whether it is in the right place. The vapor barrier should face downward, toward the heated portion of the house. If it's been installed incorrectly, check its condition. If it's dry, turn the insulation over before adding more. If it's wet, it must be thrown away.

Step 5: Installing the insulation. Insulation should form a snug, continuous barrier over the attic floor, with the only openings around recessed light fixtures and soffit vents.

Figure 8: Begin laying insulation at the outer edge of the attic.

IMPORTANT: Avoid insulating closer than three inches to any recessed light fixtures, motors, chimneys or other heat sources. The insulation will prevent the heat from becoming a fire hazard.

When using loose-fill insulation, construct sheet metal barriers around recessed light fixtures and other such heat producing protrusions (Fig. 11). Also, never block the soffit vents with insulation. If you are using loose-fill material, install cardboard or wood baffles to prevent insulation from being poured or blown into the soffit vents. Blocked vents will lead to moisture problems.

Figure 9: Insultion may be layered over and at right angles to, the joists.

For Batts or Blankets

- Begin laying insulation at the outer edge of the attic and work toward the center, placing the insulation between ceiling joists (Fig. 8).
- Lay insulation in long runs first, using leftover pieces for shorter spaces. Cut ends of batts or blankets to fit snugly around cross bracing and around plumbing stacks (Fig. 10).
- If adding more than one layer, place the second layer over and at right angles to the first layer (Fig. 9).

For Loose Fill

- To prevent filling soffit vents with insulation, place pieces of batt or blanket insulation between the ends of joists or use commercial baffles installed according to the manufacturer's directions.
- If using a blower, start at the far end of the attic and use the blower's hose to fill all the areas between the joists. For a floored attic, use the same procedure, but begin by removing enough center floorboards to allow the blower's hose to be inserted under the floor.
- If using hand-poured material, start at the outer edge of the attic and work toward the center. Periodically level the insulation with a rake or short board and measure its depth.

Insulating a Finished Attic

The same basic methods used for an unfinished attic can be used when insulating a finished attic. It's just more difficult to get the insulation where it's needed.

Follow the first four steps under **Insulating an Unfinished Attic.** Then:

Step 5: If there is no access to the areas behind knee walls and above ceilings, you will need to cut access panels.

Step 6: Install batts behind the knee walls (minimum R-19) and between the floor joists (minimum R-38) in the attic's unfinished portion behind the knee walls. As always, any attached vapor barriers should face toward the heated part of the house.

Step 7: Blow or pour loose-fill insulation from the top of the sloping portion of the ceiling. The top of the knee-wall batts should hold the insulation in place.

Step 8: Install loose-fill or batt insulation above the flat portion of the ceiling (minimum R-38).

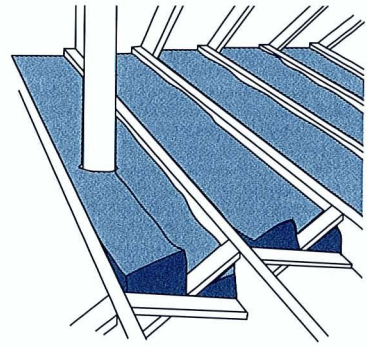


Figure 10: Install insulation snugly around cross braces and protruding objects that don't produce heat.

Insulating Cathedral Ceilings

Insulating cathedral ceilings, A-frame houses or flat roofs is an especially difficult job because there is little or no space between the ceiling and roof. With these type ceilings, professional installation is recommended. These types of ceilings are also ideally suited to spray-in insulation such as polyurethane, polyicynene and wet cellulose.

- Insulated ceiling panels are a possible solution. The panels are made of insulation batts covered with a vapor barrier.
- Another solution is to build a wood framework to hold the insulation, which is installed against the ceiling, covered with a polyethylene plastic vapor barrier and new drywall. Ventilation of the space between the cathedral and new dropped ceiling may be necessary to avoid condensation.

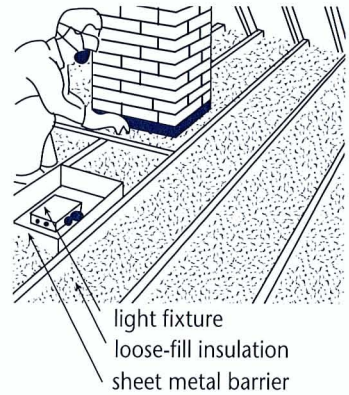


Figure 11: Take preacautions when insulating around chimneys and heat-producing protrusions, such as light fixtures. Additionally, make sure the insulation doesn't block vents.

THE BASEMENT

Uninsulated basements can account for as much as 30% of a home's total heat loss. Most Iowa homes have basements with either concrete block or poured-concrete walls. While such walls make sturdy foundations, they are poor insulators and have a very low R-value.

Before you begin any insulation projects in the basement, check for moisture problems and air leaks. You can repair minor problems on the inside of the foundation wall with sealant or waterproofing compounds, but any serious water leaks will require more extensive repair. In addition,

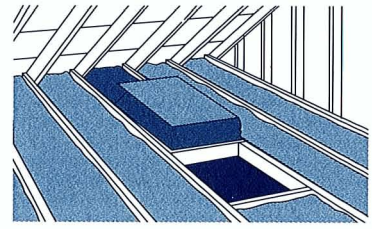


Figure 12: Cover sliding panels and attic doors with insulation.

down spouts should be in good order and there should be a sufficient amount of fill dirt around the foundation to ensure water drains away from the house.

Band Joists

The band joist area (where the house's wooden structure rests on the cement foundation) is the best place to begin not only because it's the simplest and least expensive basement area to insulate, but also because it brings the fastest return on your investment.

The wooden joists and other building materials offer only token resistance to heat flow from your basement. The band joist area should be insulated to R-19 (Fig. 13, 14).

How-To Instructions:

On walls that run at right angles to the floor joists.

Step 1: Caulk any air leaks.

Step 2: Measure and cut insulation to cover the joist and sill area between each floor joist.

Step 3: Press the insulation pieces into place, covering the sill and band joist.

Step 4: Staple the insulation to the sides of the joists and to the sill, with the attached vapor barrier facing you.

On walls running parallel to the floor joists.

Step 1: Because the full length of the band joist is exposed, use long insulation strips.

Step 2: Lay the insulation in place along the band joist, cutting off the excess width, but leaving it slightly wider than the band joist.

Step 3: Staple the insulation to the sill and the floor above at 4" intervals. Again, the vapor barrier should be facing you. Caulk the vapor barrier edges to prevent condensation behind the insulation.

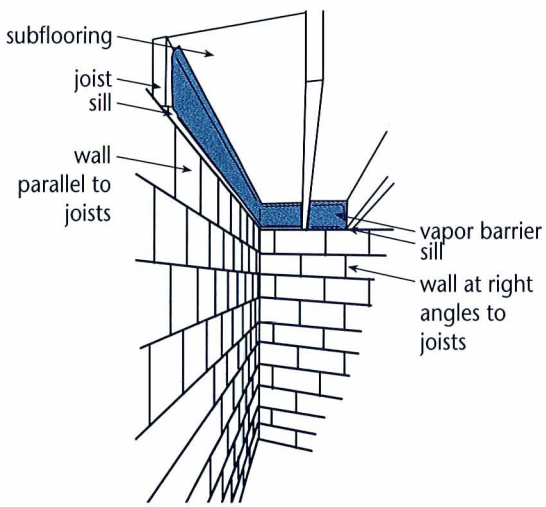


Figure 13: Band joist areas to be insulated.

Interior Basement Walls (using batts or blankets)

Before beginning, check your local fire code for any special insulation requirements. Insulating the interior of your basement's perimeter walls is usually less expensive and less involved than insulating the outside of the perimeter walls. Though these techniques require some carpentry, they are generally within the means of the average do-it-yourselfer.

How-To Instructions:

Step 1: Correct any extensive water problems before insulating. A continuous layer of 4- or 6-mil polyethylene plastic can also be installed against the wall before insulating for additional moisture protection. Install the sheeting by stapling it to the sill and letting it drape down along the wall.

In basements used only for storage:

Step 2: Using nailing strips (1/2" by 1 1/2" lumber), nail 24- or 36-inch widths of blanket insulation to the sill or band joist (Fig. 15).

Step 3: Cut the insulation so it cascades down the wall onto the floor for approximately 16 inches.

In basements used for living space:

Step 2: You will need to build a stud wall against the masonry to hold the insulation. Begin by measuring the space and figuring the amount of material you will need. You will need:

- 2" X 4" lumber for vertical nailers (Fig. 16).
- R-11 or R-13 batts or blankets.
- Polyethylene plastic sheeting, 4- or 6-mil thick for use as vapor barrier.
- Gypsum wallboard or paneling to cover insulation and frame

Begin by building a stud wall inside the masonry foundation wall. Studs should be spaced so there's either 16 or 24 inches from the center of one to the next. This is to allow use of standard-width insulating materials.

Step 3: Place 3 1/2 inch blanket or batt insulation (R-11 or more) between the studs, making sure that the insulation fits snugly at top and bottom. Also, make sure any attached vapor barrier faces the living area. If you place the stud wall 2 inches away from the masonry wall, you can use R-19 insulation materials.

Step 4: Finish with drywall or paneling fastened to studs.

Interior Perimeter Basement Walls (using rigid insulation panels)

Step 2: Attach 2" X 2" nailing strips to the wall and space the vertical strips 24 inches apart to permit efficient use of standard 4' X 8' paneling sheets and drywall.

Step 3: Cut panel insulation to fit between nailing strips and top and bottom plates and press it into place.

Step 4: Finish with drywall or paneling fastened to studs.

Crawl Spaces

Crawl space foundation walls should be insulated to reduce heat conduction through the floors of living areas. In a crawl space with water pipes or other utilities in it, the outer walls and floors should be insulated to R-10 or more.

How-To Instructions:

Step 1: Correct any water leaks or drainage problems in the crawl space.

Step 2: If you're insulating an unconditioned crawl space with a dirt floor, place 6-mil polyethylene plastic sheeting on the ground to prevent

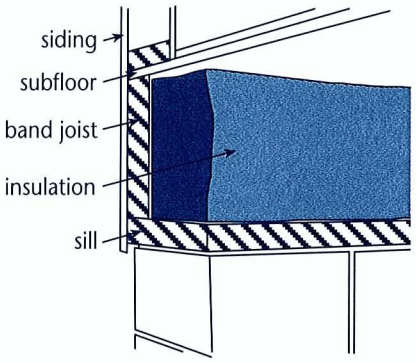


Figure 14: Cut insulation to fit band joist between the sill and subfloor.

Figure 15: Nail long pieces of insulation to the band joist.

Figure 16: Cut insulation to extend from the top plate to at least 2 feet below ground level.

moisture from being drawn up into the house. Extend the sheeting several inches up the wall and secure.

Step 3: On walls that run at right angles to the floor joists, press short pieces of insulation between and against the band joists.

Step 4: Using nailing strips (1/2" X 1 1/2" lumber), nail longer pieces of insulation to the sill (Fig. 17).

Step 5: Cut the insulation so it drapes down the walls and falls 16 inches onto the floor. Make sure the blankets fit snugly side-by-side.

Step 6: On walls that run parallel to the joists, nail longer pieces of insulation directly to the band joists. Cut and drape insulation as described above.

Step 7: Lay lumber or bricks along the wall on top of the blankets to hold them in place.

In a crawl space that does not have utilities (i.e. no water pipes or furnace), either the walls or the floor above the crawl space can be insulated. Spray foam insulation is an ideal material to use, but requires professional installation. If you choose to use batts, follow the steps below.

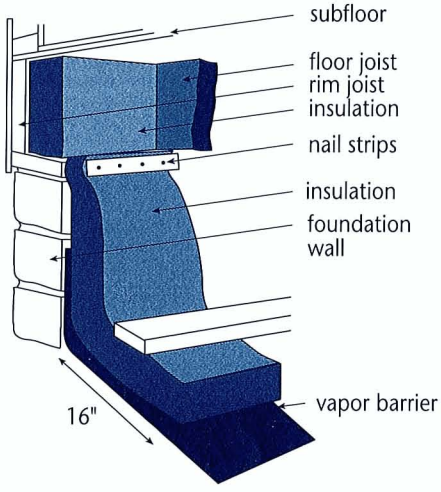


Figure 17: Heated crawl space insulation.

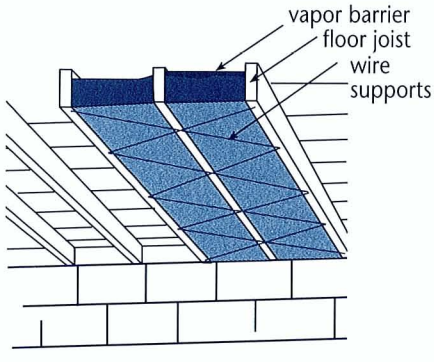


Figure 18: Cut insulation to fit band joist between the sill and subfloor.

How-To Instructions:

Step 1: Purchase R-19 batt or blanket insulation with an attached vapor barrier. Buy the width that best fits the floor joist spacing and look for insulation labeled "**friction fit.**" This means the product is slightly wider, a feature that makes installation easier. To secure the insulation in place, use a wire spring clip or wire mesh (Fig. 18).

Step 2: Begin installing insulation at one end of the floor joists and work out, pressing insulation up between the joists. The attached vapor barrier should face **up**, toward the heated portion of the house. The insulation doesn't have to be flush with the bottom of the floor.

Step 3: Cut wire and staple or nail it at right angles to the floor joists to hold the insulation in place. Friction alone won't hold insulation in place, it will be necessary to install wire or screen.

Step 4: Insulate heating or air-conditioning ducts and water pipes running through the unheated space.

Step 5: Covering any exposed ground in your crawl space with a 4- or 6-mil polyethylene vapor barrier will reduce crawl space moisture. Vents with insulated, weatherstripped covers should also be added to allow proper ventilation. These vents should be open in the summer and closed during the winter.

The Outside Walls

Exterior foundation insulation is usually done during construction. It is a difficult job to perform on a finished house. It requires trenching around the foundation to allow work space. Rigid panel insulation is glued to the exterior wall of the basement. Above the ground level, the insulation is

covered with cement board or pressure-treated plywood to protect the insulation and secured to the foundation. The dirt is then replaced around the house (Fig. 19).

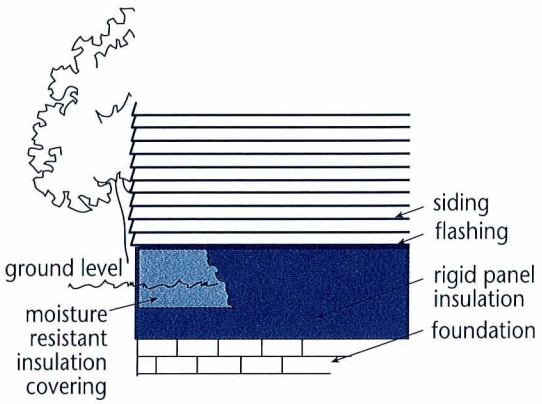


Figure 19: Insulating around the foundation of a house is best done during construction. If insulating after construction you will need to trench around the foundation to install insulation board.

FLOORS

Floors over unheated areas can be the source of considerable heat loss. Your floors will fall into one or more of the types listed below and should be insulated accordingly. Floors over basements that have heat sources, such as furnaces, boilers or wood stoves do not need to be insulated.

Cantilevered Floors

Cutting heat loss through a floor cantilevered over an exterior wall is just as important as insulating a floor over an unheated basement. These floors are exposed directly to the outside and often have many air leaks, are poorly insulated and are the source of drafts. Depending on how the floor is built, there are a few ways to make cantilevered floors more comfortable. One way is to hire a professional to spray in polyurethane or polyicynene insulation. If you choose to insulate this area yourself, follow the below directions below.

How-To Instructions

Step 1: Determine whether the cantilevered floor adjoins a basement, suspended ceiling or other ceiling type where there is easy access to the space below the floor.

Step 2: If easy access is found, insert R-19 batt or blanket insulation into the space below the floor. The vapor barrier should face up, toward the heated part of the house.

If easy access isn't found:

Step 1: Working from outside the house, remove portions of the siding or other covering from the bottom of the cantilevered floor (Figs. 20, 21).

Step 2: Insert R-19 batt or blanket insulation into the space under the floor, or attach rigid foam insulation.

Step 3: Replace siding or other materials.

Floors Over Unheated Spaces

Because your unheated garage, porch or crawl space may get as cold as the outside during winter months, floors above these areas should be insulated to R-19 levels.

To insulate these areas, follow the instructions for insulating unconditioned crawl spaces found earlier in this booklet.

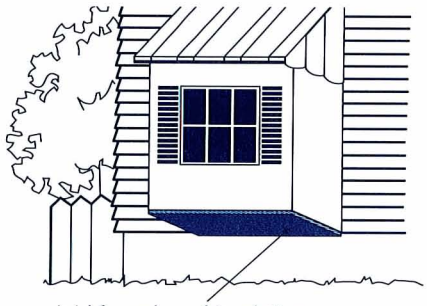


Figure 20: Insulate under bay windows.

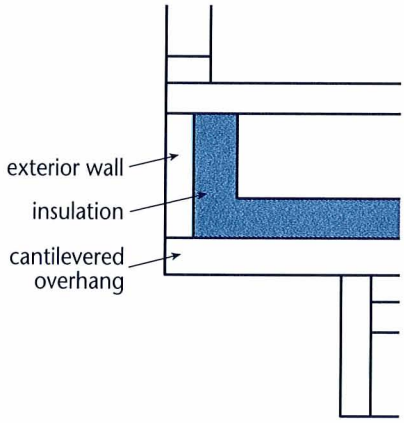


Figure 21: Insulating cantilevered area with batt insulation.

Floor Over an Open Space

A tremendous amount of heat is lost from mobile homes or homes supported by piers above the ground. These floors should be insulated to R-19 or higher.

To insulate these areas, follow the instructions for insulating floors above crawl spaces discussed earlier in this booklet. Some points to note:

- Check mobile home duct work for disconnections and leaks.
- If batt or blanket insulation is used, cover the insulating materials to protect against moisture, wind and animals.
- Enclose crawl spaces as tightly as possible with vented, insulated skirting.
- Avoid moisture problems by covering the ground below the space with 4 to 6 mil polyethylene.

Slab-on-Grade

Slab-on-grade refers to a concrete block that sits above the frost line where temperatures can quickly become extremely cold. Cold slabs can damage wood and carpets if water and ice condense on the floor.

During construction, rigid board insulation should be installed around its entire perimeter. Though insulation is difficult and expensive to install after your house is built, existing slabs can be insulated using rigid board and plywood flooring installed on top. This type of insulation should be done by a professional.

WALLS

Insulating the walls of an existing home is difficult and generally should be done by a professional insulating contractor. Because of the high cost of blowing insulation into exterior walls, this job should be considered only after your home has been thoroughly tightened and the attic and basement/crawl space have been insulated. Generally, those efforts will reward you with significant energy savings and an improved comfort level.

However, if your walls are exposed to cold winds or if they conduct too much heat out of your home, insulating them may be necessary.

When to Consider Wall Insulation

- Insulating your walls is a good idea when there is less than one inch of insulation in the walls. Typically, walls have space for 3 1/2 inches of insulation. If you already have some insulation, the cost of adding more may outweigh the benefits.
- When replacing your home's siding is a good time to consider insulating your walls. Insulation can be blown into empty stud cavities before new siding is installed. Another option is to install flexible fan-fold foam board insulation under new siding.
- When doing extensive interior renovation is another good time to consider adding insulation. If you plan to gut the walls of your house for

a remodeling project, you definitely should spend the time and money to fill the wall cavities with insulation as long as they're already open.

Determine Level of Insulation

Generally, the walls in homes built in the mid-1950s and earlier do not have insulated walls. There are a few ways to determine whether your walls have insulation.

- Turn off the electricity and remove an electrical outlet switch plate on an exterior wall. Using a flashlight, you can look behind it for insulation.
- Remove a section of baseboard molding or paneling to expose an exterior wall cavity and check for insulation.
- Cut a hole in the wall of a closet or cabinet that faces an outside wall. If you find insulation, use a piece of wire to determine its thickness.

Adding Insulation

If you decide to insulate your walls, obtain bids from several contractors and compare the R-values provided, as well as the cost to complete the job. Walls should be insulated to a level of R-19 or more. The recommended method to insulate is to use loose-fill insulation or spray-in insulation. It can be blown in through holes drilled into walls. This can be done from inside or outside your home and is best done by an insulation contractor. Blowing insulation in from the interior can be less expensive, but may be messy.

AIR DUCTS

If the ducts for your heating and cooling system run exposed through your unheated attic, garage, crawl space or basement, they should be sealed and insulated (See Fig. 22).

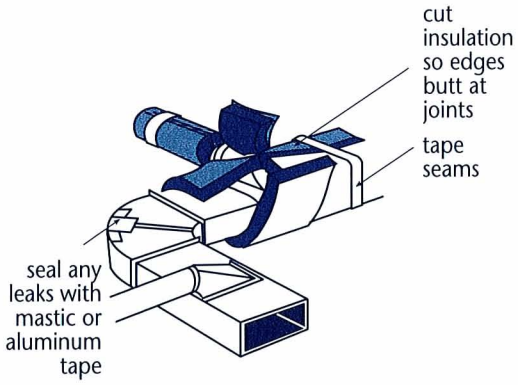


Figure 22: Re-tighten and seal leaky ducts before insulating with foil- or paper-faced batts. Tape seams with mastic tape.

Getting Started

Here's a list of the materials you'll need:

- Latex-based mastic tape
- Duct insulation. It comes in blankets one- or two-inches thick. Get the thicker variety
- Duct tape

Step 1: Before insulating, check the ducts for leaks. Leaky ducts can raise a typical home's heating and cooling costs by as much as 30%. The loss can be even higher in homes with uninsulated ducts. Seal the leaks with latex-based mastic tape. Despite its name, duct tape will harden and crack after prolonged exposure to the duct's high temperature.

Step 2: Wrap the ducts with foil- or paper-faced fiberglass insulation. Make sure the backing faces out, away from the duct. Tape the joints and any exposed fiberglass with duct tape.

Step 3: Seal return ducts, too, so you won't be breathing crawlspace air.

APPENDIX

Area To Be Insulated Worksheet

Level Ceiling (Attic Floor)	_____ length	x	_____ width	=	_____ area to be insulated	
Exterior Walls	_____ perimeter (distance around)	x	_____ height	=	_____ area to be insulated*	
Basement Walls	_____ perimeter (distance around)	x	_____ height	=	_____ area to be insulated*	
Crawlspace Walls	_____ perimeter (distance around)	x	_____ (height + 16 inches)	=	_____ area to be insulated**	
Floor over Cold Space	_____ length	x	_____ width	=	_____ area to be insulated	

* *Does not include band joist area.*

** *The additional 16 inches added to the crawlspace wall height allows for the insulation that extends onto the crawlspace floor.*

RESOURCES

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