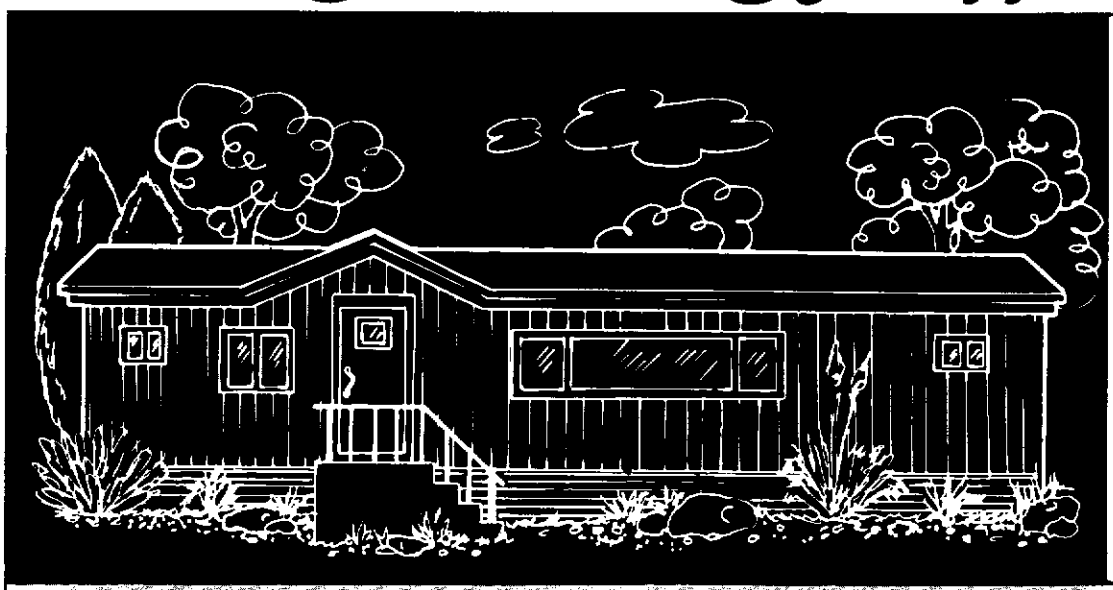
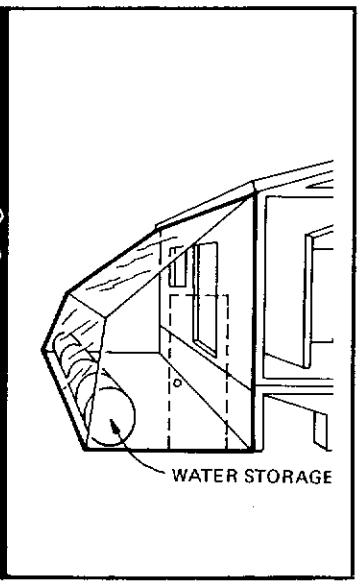
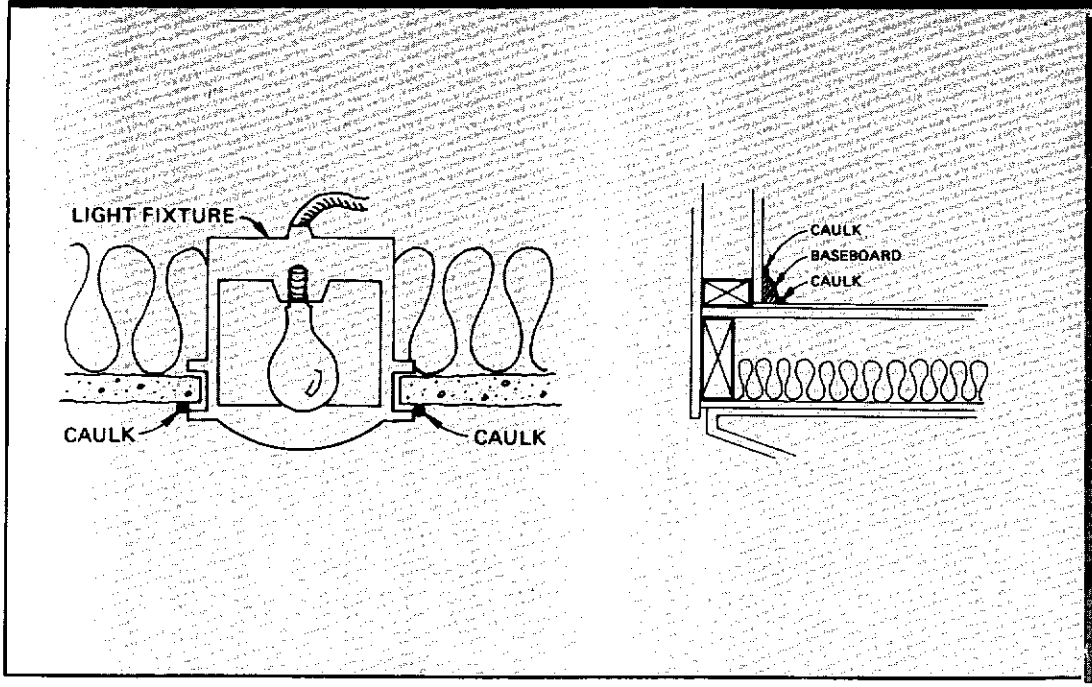
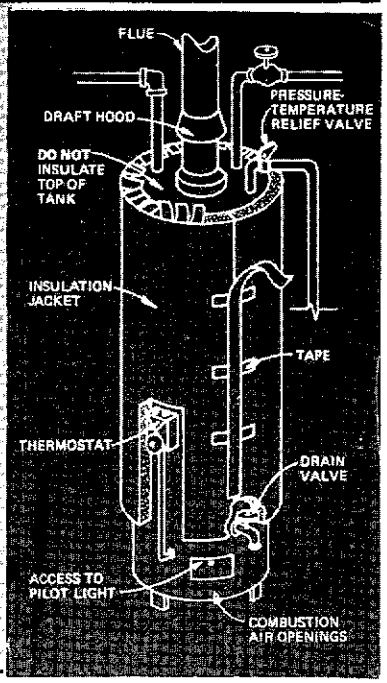
$aving Money in your Manufactured Home through Energy Efficiency









A Guide for South Carolinians

$aving Money in your Manufactured Home Through Energy Efficiency
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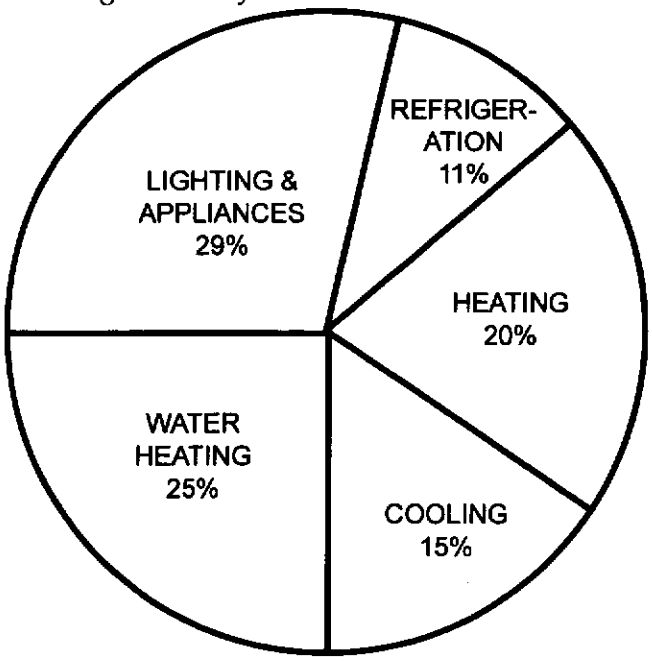
Over 40% of the new single-family homes purchased by South Carolinians are manufactured homes. In some utility areas over 80% of all new hookups are for manufactured housing. About 17% of the residents in South Carolina live in manufactured homes. The homes are built to a national building code standard as prescribed by the Federal Department of Housing and Urban Development (HUD).

In 1976, a national code was developed which set minimum standards for manufactured housing, including:

- minimum insulation levels in walls, ceilings and floors
- ceiling and wall vapor barriers
- construction which limits air infiltration
- minimum furnace efficiency
- HUD date plate with conductance levels (the inverse giving the insulation level) and other important information
- insulated heating ducts
- quality and safety features.

Additionally, effective October of 1994, new higher energy efficiency standards go into effect. The new standards require higher insulation levels and new ventilation standards to minimize moisture as well as improve efficiency.

Choosing the most energy-efficient *new* manufactured home for the money is relatively easy. Specific insulation levels and other information is published on the home's data plate. On top of that, *a special state sales tax incentive* is available to encourage consumers to purchase high-efficiency manufactured homes.



1. Average South Carolina Home Energy Use.
The biggest energy users are space heating and water heating. Because electricity is about three times as expensive as natural gas in the end use, a breakdown by cost would show greater percentages for those areas which primarily use electricity.

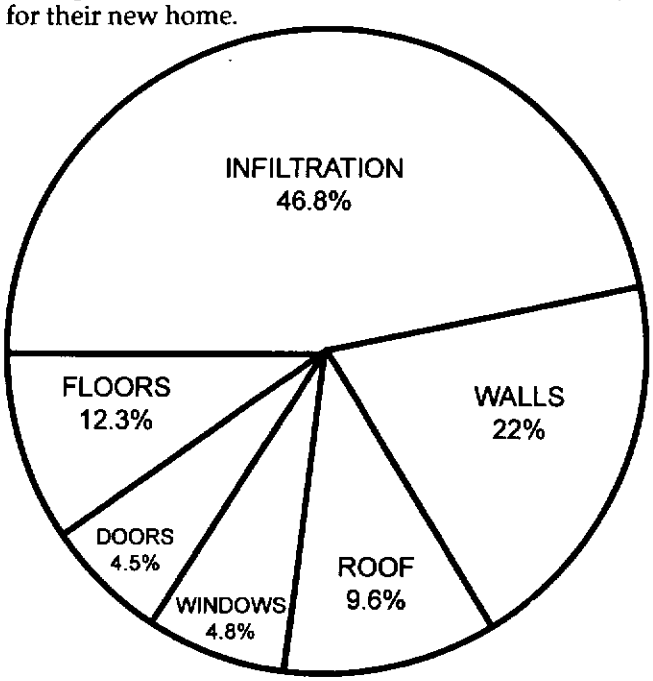
In 1992, Governor Carroll A. Campbell, Jr. signed into law the South Carolina Energy Conservation and Efficiency Act. The Act provides a sales tax incentive for purchasing energy-efficient manufactured homes, under Section 12-36-2110(B) of the 1976 Code. The sales tax incentive is based on a formula which every dealer can fill out.

Ask your retailer which of the homes at the retail center qualify for the tax incentive. If a home qualifies, the manufacturer will have affixed to the kitchen counter a notice stating that the home meets the energy efficiency levels of:

- storm or double pane glass windows
- insulated or storm doors
- an actual installed insulation value of R-11 for walls
- an actual installed insulation value of R-19 for floors
- an actual installed insulation value of R-30 for ceilings.

Variations in the insulation levels for the walls, ceiling and floor are allowed if the total heat loss does not exceed that calculated using the R-11 for walls, R-19 for floors and R-30 for ceilings. The edition of the American Society of Heating, Refrigerating and Air Conditioning Engineers Guide in effect at the time is the source for heat loss calculation.

The higher energy standards are even more attractive for consumers because many power companies offer lower rates to consumers who purchase energy-efficient homes. The standards for the tax incentive are designed to match the power company standards so consumers can receive both a tax break and lower rates to help offset the cost of an energy-efficient "package" for their new home.



2. Typical Home Heat Loss.
Most of a home's heat loss is air infiltration. This chart is for a home with R-19 ceiling, R-11 walls and R-11 floors, typical of current construction.

Energy Consumption and Costs

The energy for heating, cooling, and providing hot water to a family living in a home is typically about 60% of the total energy consumed by that home every year. Most of the money is spent to operate the heating and cooling system and heating water. Much of the energy is wasted through leaks around doors, windows, cracks and even up the flues.

Energy costs are rising and this means that saving energy has become increasingly important. The energy consumption pie charts may give you a better idea of where your energy actually goes and may help you decide where to conserve first. (Figures 1 and 2, page 1.)

This booklet is primarily for manufactured home owners, although many of the energy-saving suggestions will be useful for renters as well. The major part of the booklet deals with energy conservation, followed by a few solar options and remodeling and building addition ideas—things you might consider once you have taken all the fundamental energy conservation steps.

At the back of this booklet you will find a checklist of energy-saving actions you can take, grouped by cost and effectiveness, along with some sources of additional information.

Preliminary Steps

Selecting a Home

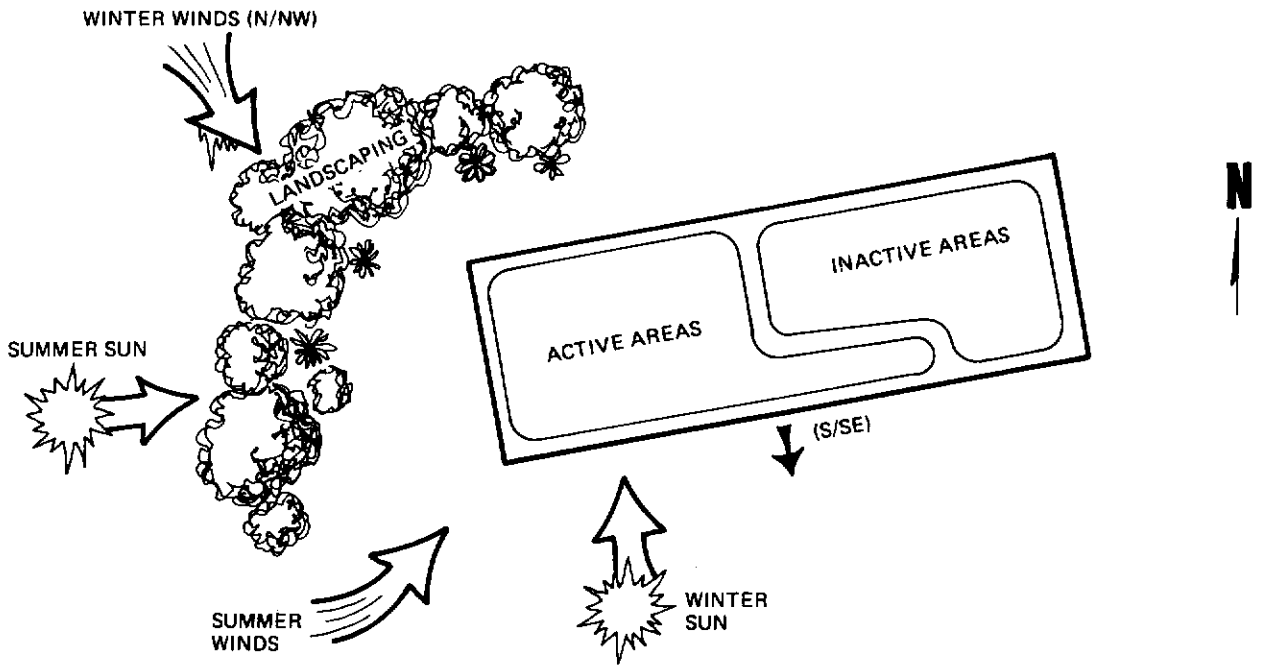
Here are some important questions to ask when shopping for a manufactured home:

1. Are the ceiling, walls and floor well insulated? Does it meet the requirements for the sales tax incentive?
2. Are double-glazed windows and/or storm windows provided (or can they be easily installed)?
3. Are insulated exterior doors provided (and/or storm doors)?
4. Is there a vapor barrier in the ceiling, walls and floor?
5. Does the home appear to be tightly constructed, that is,
   - Is it well sealed?
   - Will it hold up being transported to your site?
   - Are panels likely to come loose during a strong wind?
   - Are gaps filled and sealed where pipes, vents, etc. penetrate the exterior shell, and are there foam pop-open gaskets in the bathroom fan vent?
6. Is there an energy-efficient water heater?
7. Check the home's data plate (usually located inside a closet or cabinet). Are the wind, roof load (snow) and climatic zones correct for your area?
8. Check for the efficiency label affixed to the kitchen counter.
9. Is the heating and cooling system properly sized (not too big or too small) for the weather conditions at your site?

Site Considerations

The location of buildings, along with hills, trees and other natural barriers to the wind and sunshine should be considered before selecting the site for your home. The best site is one that provides as much natural summer coolness and winter warmth to your home as possible. If they do not already exist, consider planting trees that shade your home in the summer (particularly on the west side), but allow the sunshine to come through to the southerly sides in the winter. Also, locate your home so that landscaping and other wind barriers block the prevailing winter winds, yet channel the prevailing summer winds for free cooling.

The orientation of your home also is important. Orientation is simply the direction the home is placed on the site in relation to the sun and the prevailing wind. The home will be exposed to more warmth in the winter (and less in the summer) if the long side (with the most windows and usually the main entrance) faces to the south or slightly southeast or southwest. Active areas of the home—those that are used a lot during the day, such as the living room or kitchen—should be located on the south-facing side of the home. (Figure 3.)



3. Orientation. In winter, an ideal orientation would expose the home to the sun while blocking the worst of the winds. In summer, it would expose the home to the winds while blocking the worst of the sun.

How to Make Your Home More Energy Efficient

Within the sections ahead (such as "Insulating Your Home"), energy-saving projects are generally listed in the order of cost-effectiveness. The checklist in the back of the booklet also shows the cost-effectiveness of measures in perspective.

No-Cost Measures

There are many things you can do to save energy in your home without spending a penny. For instance:

Thermostat: In cold weather, keep the thermostat setting as low as you can and still be comfortable. Reduce it further at night. In warm weather, reverse the procedure.

Windows and Doors: On cold days, open window shades and drapes on the south side of the home to let in the sun's warmth. On cloudy days and after sunset, keep drapes or insulated shades closed. Keep doors closed as much as possible.

Appliances and Lighting: Use your stove, refrigerator and other appliances as efficiently as possible. Turn off lights when they are not needed.

See the checklist in the back of this booklet for numerous other no-cost measures, some of which are covered in more detail in the pages ahead.

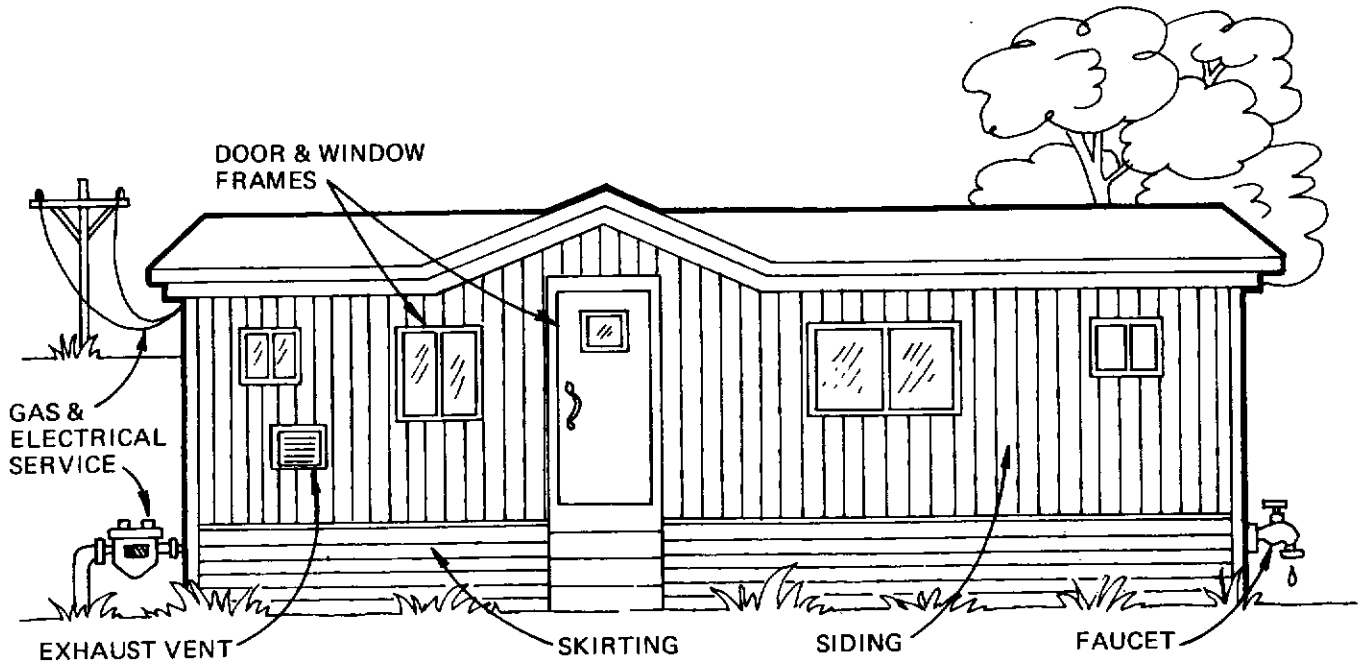
Caulking and Weatherstripping

During both the heating and cooling seasons, it can be costly to have air leaking ("infiltrating or exfiltrating") in and out of your home. Manufactured homes are susceptible to air leakage because they are usually installed off the ground, the outside walls are sheathed with panels, and exterior building components have been jarred around when the unit was transported.

The best time to check for air leakage is on a windy day when you cannot only see cracks and holes but feel the air moving in and out. Places to check include:

- Around door and window frames.
- Wherever penetrations through the home envelope exist, including gas, electric, water, telephone and cable TV penetrations; heating and cooling system flues, supply air ducts, and combustion air ducts; and ventilation fan ducts. (Figure 4.)
- At edges and seams of the belly board.
- Wherever the interior finish is penetrated, as for plumbing fixtures (especially the bathtub) and electrical outlets, switch plates, and fixtures.
- At seams, joints, and holes in the interior paneling, including wall-floor, wall-ceiling, and wall-wall junctures.

There are several things you can easily do to stop air leakage: caulking, weatherstripping, installing gaskets behind electrical outlet and light switch plates, and sealing kitchen and bathroom vents.



4. Sources of Infiltration. Door and window frames and penetrations for utilities and exhaust fans are the worst sources of infiltration.

Caulking

Caulk is a compound used for filling cracks, holes and joints on the inside and outside of the home. Apply caulk where any two different non-moving materials meet, such as a window frame and the wall paneling. It can be done with a few simple tools.

You will find many caulking compounds on the market that vary greatly in cost, durability and ease of application. Common ones are listed in the chart below.

Caulking compounds are available from hardware stores, building suppliers, lumber yards and other dealers. Be sure that the caulk you select will remain elastic after it dries. This allows for expansion and contraction of the different adjoining materials as well as for normal movement and settling of your home.

Before you begin to tighten up your home—particularly before caulking and weatherstripping—be sure it is on a solid foundation and properly anchored and leveled.

Because of its durability and reasonable cost, a good quality latex caulk is suggested for the interior of the home and areas that don't move and shift very much. Silicone may be the best buy for the exterior because it has a lot of elasticity.

The surfaces to be caulked should be clean and dry, free from flaking paint, loose dirt, and deteriorated caulk. Before caulking, apply a filler material (e.g., oakum, cotton, fiberglass) to extra-wide cracks. Caulk should be forced into the crack or opening—deeply enough and widely enough so you are certain that the caulk adheres to both sides completely. It should then be smoothed out on the surface. Caulk should not be applied in cold weather—the temperature should be above 40°F.

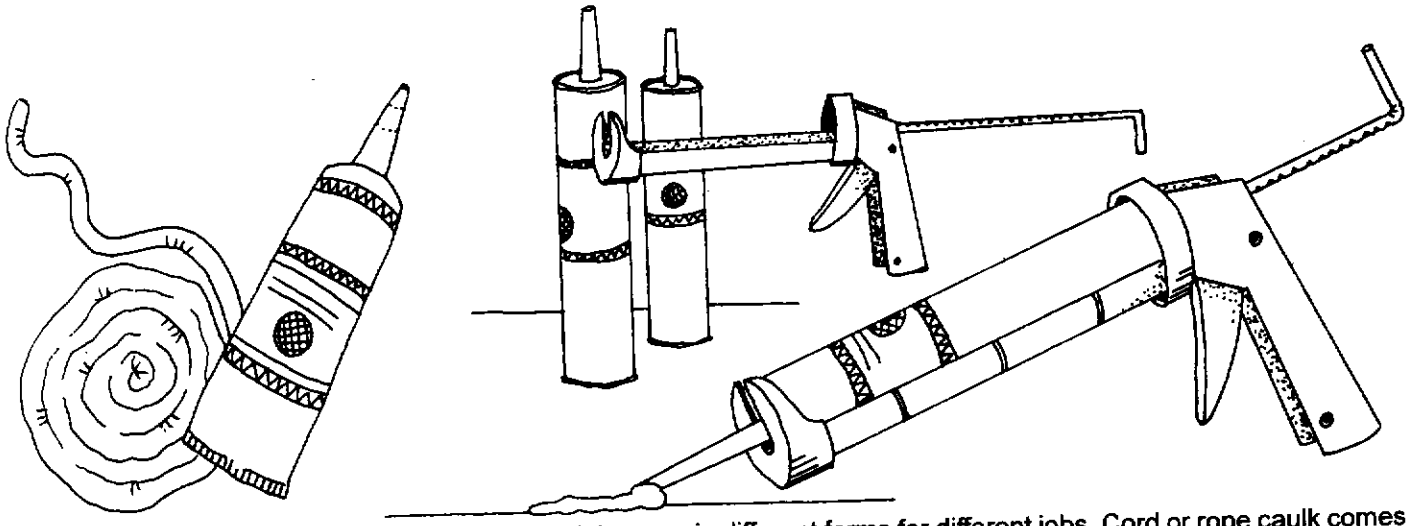
Because of the need for ventilation of the exterior wall and roof siding to remove any accumulated moisture from the insulation cavities, on the *exterior* caulk should be applied only to prevent water entry such as rain. Do *not* caulk seams and joints on the exterior.

On the *interior*, the most important points to caulk are around door and window frames and around envelope and/or interior finish penetrations, such as for pipes, ducts, and plumbing and electrical fixtures. A thorough job would also include all wall, ceiling and floor joints and panel joints. The screws and washers ("rosettes") which hold the ceiling panels in place can also be loosened and caulked.

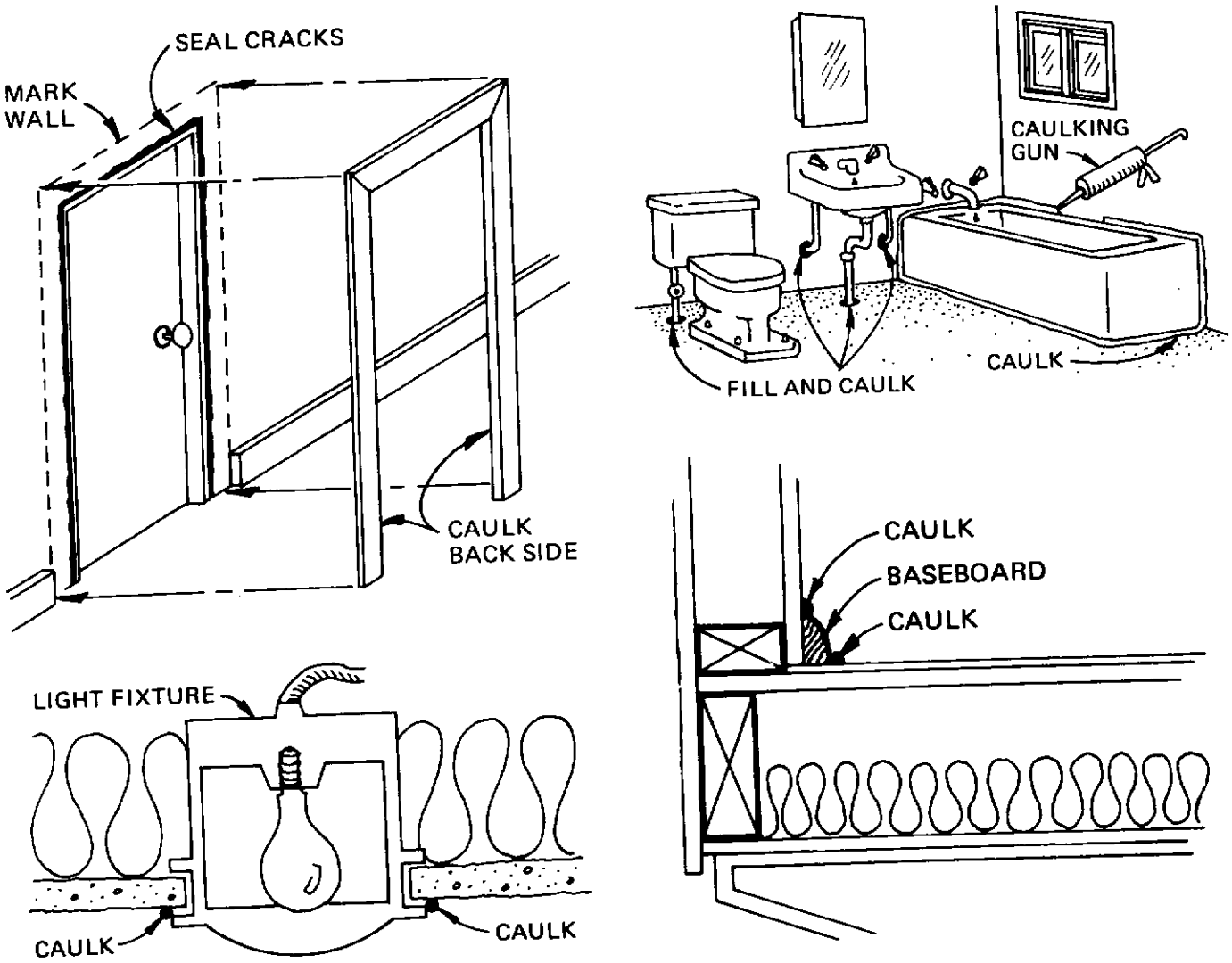
As joints and window and door frames are almost always covered with trim, there are two choices on how to caulk: remove the trim and caulk the gap, or caulk on both sides of the trim. Use either a clear caulk or one that matches the interior finish. (Figures 5 and 6.)

CAULKING COMPOUND	DURABILITY	ELASTICITY	COST	COMMENTS
OIL BASED	1-5 YEARS	POOR	LOW	PAINTABLE, SHOULD BE PAINTED FOR EXTERIOR USE
ACRYLIC LATEX	2-20 YEARS	FAIR-GOOD	MODERATE	EASY TO APPLY, WATER CLEANUP, PAINTABLE GOOD FOR MOST PURPOSES
BUTYL RUBBER	5-10 YEARS	FAIR	MODERATE	DIFFICULT TO APPLY, SOLVENT CLEANUP
POLYURETHANE	20 YEARS	EXCELLENT	MODERATE-HIGH	SOLVENT CLEANUP, ADHERES WELL TO MOST SURFACES, UNPLEASANT INDOOR ODOR
SILICONE	20 YEARS+	EXCELLENT	HIGH	WATER CLEANUP, ADHERES WELL TO MOST SURFACES, NOT PAINTABLE, GOOD FOR HIGH EXPANSION/CONTRACTION AREAS, CLEAR COLOR AVAILABLE

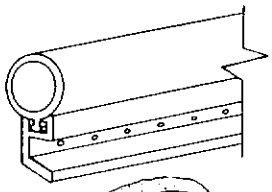
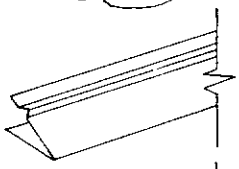
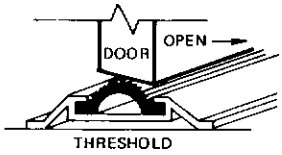
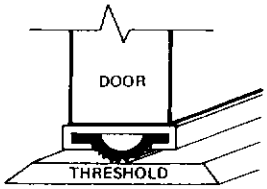
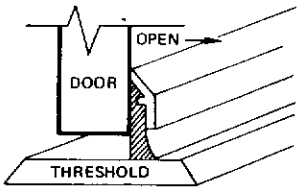
TYPES OF CAULK.
Latex and silicone will take care of most of your caulking needs.



5. Methods for Applying Caulk. Caulking materials come in different forms for different jobs. Cord or rope caulk comes in rolls and is easily pressed-in with the fingers. Convenient plastic tubes of caulk are good for smaller jobs. A caulking gun uses cartridges that fit interchangeably, offer a choice of bead sizes, and can be thrown away when empty.



6. Where to Caulk. Caulk around window and door frames, where water lines and other utilities enter the building, and around plumbing fixtures. A thorough job of caulking also includes the spaces between baseboards and walls and floors, and around electric fixtures.

Weatherstripping		Durability	Comments
Rolled vinyl with rigid metal backing		5 years +	Must make contact for proper seal. Visible when installed. May become brittle with age.
Foam rubber		1–2 years	Easy to apply. Short life span.
Thin spring metal		5 years +	May lose some flexibility with time and therefore lose its sealing ability. Can usually be resprung with a screwdriver.
Fin seal (nylon brush with thin plastic strip down the middle)		5 years +	Used to replace worn weatherstripping on aluminum horizontal sliding windows and sliding glass doors.
Vinyl bulb threshold		5 years +	Usually need to replace threshold. Need to bevel door.
Door shoe		5 years +	Need to trim bottom of door. Need flat threshold.
Door sweep		5 years +	Easy to install. May drag on carpet if door swings in.

Types of Weatherstripping. Use any of a wide variety of weatherstripping types to seal moving joints at windows and doors.

Weatherstripping

Weatherstripping materials include narrow strips of metal, vinyl or foam that provide an airtight seal between the frames and moving parts of doors, windows and access panels.

Check your home for existing weatherstripping and see if it needs to be replaced. If you can feel a draft coming in around any of your doors and windows, or if you can see light shining through, weatherstripping is needed.

Several types are available, as shown above.

To install weatherstripping, follow the manufacturer's instructions, as each type has its own method of installation. Here are a few general suggestions:

Doors

• Home doors are easily weatherstripped with self-sticking cellular foam strips placed between the door and the door frame surface. These strips compress to form a tight seal against the threshold when closed.

• The bottoms of doors can be weatherstripped by applying a rubber sweep seal on the bottom edge of the door. This can be adjusted to seal against the threshold when closed.

• Another door bottom seal is available as a rubber bulb set into a threshold. This requires no application to the door, but does require replacement of the threshold.

Windows

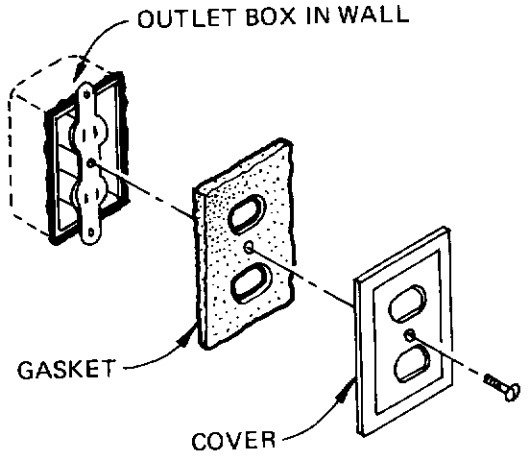
• Window weatherstripping can be complicated, depending on the operation of the window. Most home windows are of the sliding type, with felt or fuzzy strips built into the edges and forming a seal with the aluminum frame. Check these strips—they tend to wear down rapidly and require more permanent replacement.

• Several weatherstripping kits are available for windows. The best types are those that do not hamper the operation of windows, yet seal tightly when windows are closed.

Insulating Gaskets

Buy some insulating gaskets and install them behind electrical outlet and light switch plates as follows:

1. Turn off the electricity at the circuit breaker.
2. Remove the screws holding the wall outlet or switch plate.
3. Place the insulating gasket behind the plate.
4. Reattach the plate and turn the power back on. (Figure 7.)

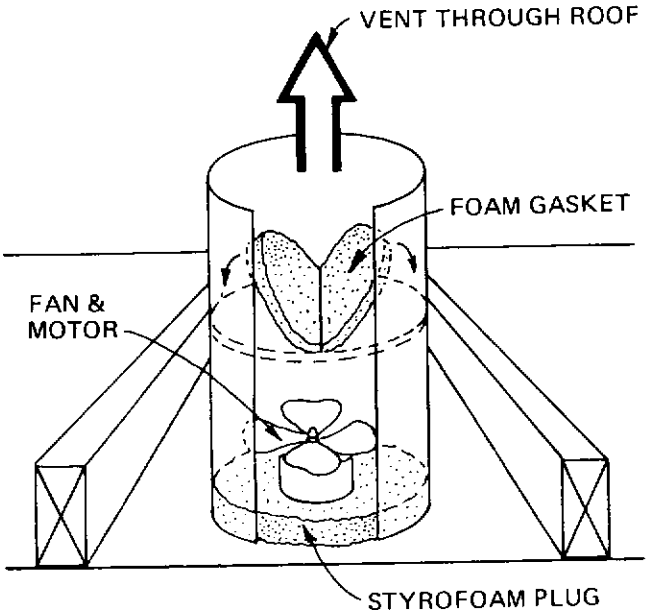


7. Insulating Gaskets. These are inexpensive and easy to install, and they significantly reduce air leakage.

Kitchen and Bathroom Vents

Another common source of air leakage is kitchen and bathroom ventilation fan vents. These often are provided with covers to seal the opening when the fan is not in use; usually the cover is not sufficient to prevent air leakage. Caulk around the vent (between the vent and the interior paneling) and weatherstrip the cover. If the cover is missing, one can be made of wood paneling and weatherstripping.

If moisture buildup inside the home is not a problem and the fans are not used during the winter, an insulating "plug" can be made from rigid insulation or foam rubber and inserted into the duct from either end. Make sure it seals tightly. (Figure 8.)



8. Kitchen and Bath Vents. Vents should have pop-open gaskets, and the whole unit can be sealed with an insulating "plug" in winter.

Indoor Air Quality

There is concern today about indoor air quality and the dangers of making a home "too tight" by caulking, weatherstripping, and so on. This applies to manufactured homes in particular because of the relatively small air volume and the amount of synthetic materials which can produce formaldehyde fumes. However, recent research indicates that a great deal of tightening up of manufactured homes is possible without impacting on safety requirements.

Here are some things you can do to improve your indoor air quality.

• Control your home's ventilation. Open a few windows momentarily for a cross draft that will clear the air without allowing excessive heat loss or gain.

• Make sure there is sufficient combustion air for gas cookstoves, wood-burning heaters, kerosene heaters, etc. This is especially important if your furnace and/or water heater draw combustion air from the home's interior.

• Provide additional ventilation if the indoor humidity level is high, especially when doing such moisture-producing things as cooking, showering, and using a clothes dryer vented to the interior.

• Contact your local health officials if you suspect any health-endangering problems due to the inadequate ventilation of indoor air.

• Air-to-air heat exchangers are devices which ventilate your home and reclaim some of the lost conditioned air.

Improving Windows and Doors

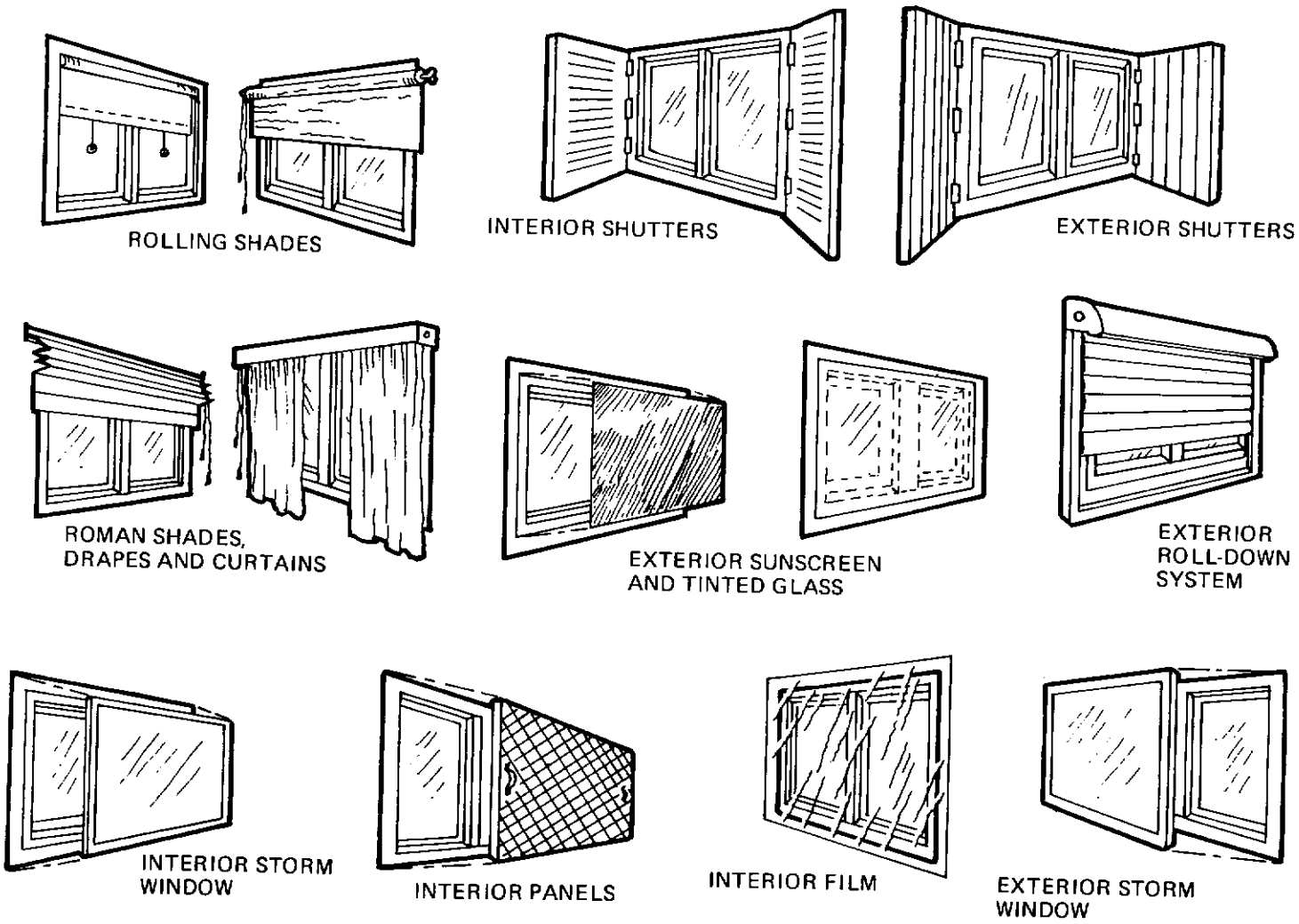
Caulking and weatherstripping will help reduce heat loss *around* windows and doors, but not *through* them. Here are some options for dealing with this major heat loss problem.

Windows

Manufactured homes built to the 1976 HUD standards have storm window panels or insulating (double) glass as standard equipment. But these may need replacement from time to time. And older homes—especially in the colder parts of the state—probably need window improvements. Your options include:

1. **Interior storm panels.** These are made of glass and aluminum extruded frames which you can purchase ready-made to your window dimensions or in kit form. Less costly (and less permanent) interior storm panels are made of plastic and tape, also available in kit form.

2. **Exterior storm panels.** These tend to be more expensive and more difficult to install than the interior panels. They are subject to weather and need drip caps to carry away water running down the face of the exterior wall panels above the window. However, their



9. Window Treatments. Many options are available. The most important part of any window treatment is that it seal tightly around the window.

effectiveness in curbing heat loss or gain can be attractive and, in some cases (such as certain older manufactured homes which have cranked windows), are the only type of storm windows that can be installed.

3. **Interior insulating panels.** This is simply a form of insulating material, such as rigid insulation cut to size, which covers the inside of the window and is sealed tightly around the edges. So the panels can be removed easily during the day and replaced easily at night, seal the edges with magnetic strips or Velcro strips. Cover the panels with cloth or other material to improve their appearance.

4. **Curtains.** Curtains can help if they have a valence, but their usefulness is limited because they do not seal around the window. (Figure 9.)

If you add interior storm windows and have condensation problems on the regular window, drill small vent holes in the regular window sash to allow moisture to escape to the outside. This will help prevent moisture penetrating the wall and damaging insulation or structural framing.

The windows should be replaced if they do not open and close properly, particularly if they are jalousie (louver-type) windows. Replace them with double-hung or sliding windows.

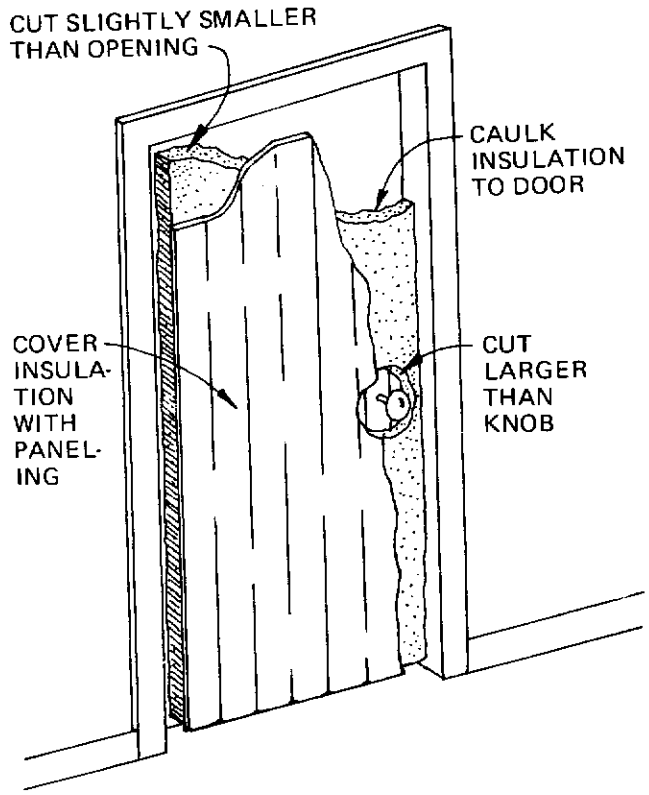
Do not install a storm window panel over a fire escape window without making sure that anyone living in the home can quickly and easily push it out.

Doors

Storm doors are generally cost-effective in homes. Exterior doors can be insulated and this can be worth the expense and effort for the uninsulated doors on pre-1976 manufactured homes. Here's how:

1. Cut rigid insulation (1" polyurethane is fine) slightly smaller than the size of the door.
2. Cut a hole for the door handle with enough clearance so that you can still operate the door.
3. Caulk the insulation to the inside surface of the door.
4. Attach paneling or other finish material over the surface of the insulation and molding around the edges to match your home's interior decor and to reduce any fire hazard from the insulation material. (Figure 10.)

Replacement of doors usually is not cost-effective unless the door is inoperable or does not close properly.



10. Insulation of Exterior Door. Exterior doors can be retrofitted with rigid insulation to reduce heat loss through the door. This is particularly important in pre-1976 manufactured homes.

Insulating Your Home

If your home was built after 1976, you may not have enough insulation for most South Carolina climate conditions in your floor, walls and ceiling. Older manufactured homes usually are not adequately insulated.

Floors and skirting can usually have insulation added without too much expense and difficulty, but re-insulating walls and ceilings may not be worth the money, effort and potential structural damage unless you have a pre-1976 home.

Types of Insulation

Insulation works by resisting the flow of heat through materials. The measure of this resistance is called the R-Value. The higher the R-Value, the better the material's resistance to the flow of heat.

The table on the next page lists the most common types of insulation with information about costs and R-Values.

Fiberglass or rock wool blankets or batts are the most common and inexpensive types of insulation. Fiberglass, rock wool and cellulose also come as loose fill. These materials are usually put between the structural studs or joists of manufactured homes.

The next most common is rigid insulation, usually polystyrene—expanded (beadboard) or extruded—or polyurethane. These materials have a better R-Value per inch than blankets or batts and can be placed in a cavity or on a surface.

A third type of insulation is in-place foam, such as polyurethane. This material is expensive, but it seals whatever it touches. It also can go in cavities or on surfaces. It is usually applied on exterior surfaces, then coated (for roofs) or stuccoed (for walls).

The best insulation materials can be of no help at all if they are not properly installed, or if they are in poor condition (bunched up, sagging, wet, etc.).

How much insulation?

The table below gives some recommended levels of insulation for homes in South Carolina—you might want to insulate more in the colder parts of the state and less in the warmer parts.

A rule of thumb is that if you are going to the trouble and expense of adding insulation, add as much as possible.

Location	Older Home	Minimum Recommended	Highly Energy Efficient
Ceiling	R-14	R-19 (5½" batt)	R-30 (9½" batt)
Walls	R-7	R-11 (3½" batt)	R-11 (3½" batt)
Floor	R-7	R-11 (3½" batt)	R-19 (5½" batt)

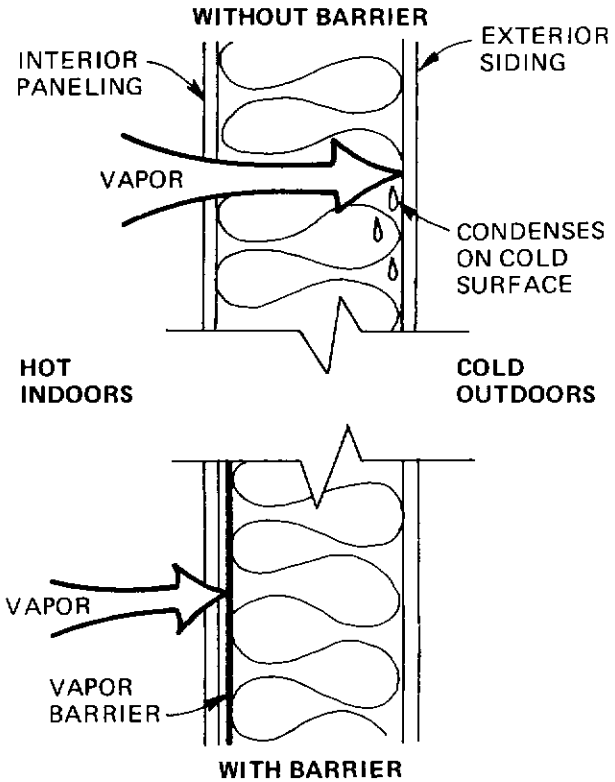
Insulation Levels. These are average recommended values for homes in SC.

	Insulation Type	R-Value (approx.)	Relative Cost (per R per sq. ft.)	COMMENTS
BATT	FIBERGLASS OR ROCK WOOL	3½" (R-11) 5½" (R-19) 9½" (R-30)	1.8¢ to 2.0¢	Inexpensive. Need cavity to place in. Can compact. Must be installed properly. Moisture will reduce R-value.
LOOSE FILL	FIBERGLASS OR ROCK WOOL	R-3 per inch	1.8¢ to 2.0¢	Inexpensive. Need cavity to place in. Can settle and compact. Moisture will reduce R-value. Usually blown in with equipment.
	CELLULOSE	R-3 + per inch	1.6¢ to 1.8¢	Inexpensive. Need cavity to place in. Can settle and compact. Will not tolerate moisture. Usually blown in with equipment. Contains fire retardant.
RIGID	EXPANDED POLYSTYRENE (BEADBOARD)	R-4 per inch	3.6¢ to 4.8¢	Least expensive rigid insulation. No cavity needed. Combustible.
	EXTRUDED POLYSTYRENE	R-5 per inch	4.8¢ to 7.2¢	Most moisture resistant. Good for in-ground use. No cavity needed. Combustible.
	POLYURETHANE OR POLYISOCYANURATE	R-7 to R-8 per inch	4.8¢ to 6.0¢	Very high R-value per inch. No cavity needed. Combustible.
FOAM	POLYURETHANE	R-7 to R-8 per inch	8.4¢ to 12.0¢	Requires equipment to foam in place. Mix must be correct. Very expensive. Seals well and results in rounded appearance. Combustible.

Insulation Types. Use the appropriate material for the job and make sure it is installed properly. Be sure to wear gloves and face mask when handling insulation to avoid skin irritation and prevent breathing-in insulation particles.

Vapor Barriers

If your home is well sealed thanks to good construction, caulking, weatherstripping, storm windows and insulation, the humidity level will increase. If this moisture is allowed to penetrate the interior surface to the insulation cavities, over a period of time it may reduce the effectiveness of insulation and damage other building materials. (Figure 11.)



11. Vapor Barrier. If a vapor barrier is not used, condensed moisture can reduce effectiveness of insulation and damage structural members.

A vapor barrier will help prevent this. To be effective, a vapor barrier must have a high resistance to the flow of moisture and must be installed on the interior-facing side of the insulation. The lower the "perm-rating" of a vapor barrier material, the better its resistance to moisture penetration.

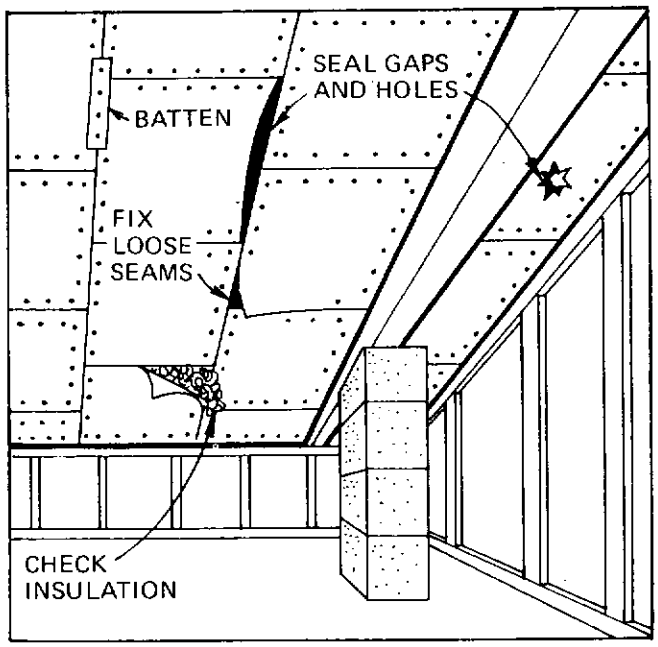
Vapor barrier materials include polyethylene plastic, low-perm-rated paints, vinyl wall coverings, and foil-type wallpapers. Polyethylene vapor barriers are usually installed under the interior finish at the time of manufacture. Check to see if there is one by carefully removing a piece of interior molding around a window or door and looking under the edge of the wall paneling. In many cases, the only practical way to add a vapor barrier to an existing wall or ceiling is to use a low-perm-rated paint (with a perm-rating of one or less).

Batt or blanket insulation is available with attached foil or kraft-faced vapor barriers.

Floor Insulation

If you have installed insulated, seasonally-vented skirting (see the following section), you may not need to insulate your floor. But, in general, if you have an older mobile home (whether skirted or not) and if you can gain access to the floor beneath the home, insulation is worth considering. Here are some guidelines:

- The insulation should be in the R-11 to R-19 range (3½–5½" batts).
- The floor should be sound with no water leakage problems.
- The belly board should be in good repair. (The belly board is designed to prevent air infiltration through the floor and to protect the insulation, wiring and floor support members from damage during moving and after the unit is placed on piers.) In some newer units, the belly board has been replaced by a fabric air infiltration barrier. (Figure 12.)
- If you encounter the heating duct, insulate it if exposed and check duct joints for gaps (see the section, "Heating Your Home").

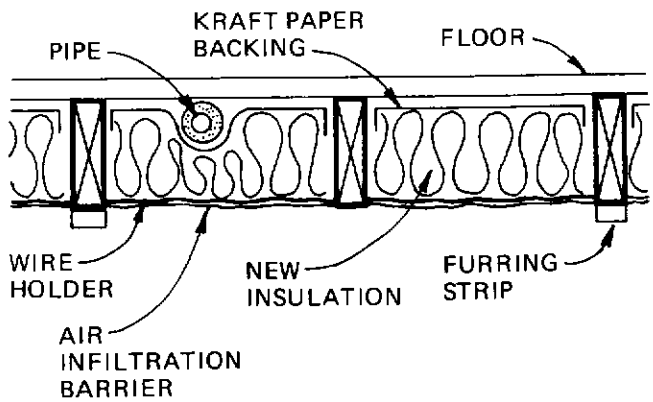


12. Belly Board. Keep the belly board in good repair to protect materials above it and reduce air infiltration through the floor.

Here are your major floor insulation options:

1. **Re-insulate existing floor cavity.**

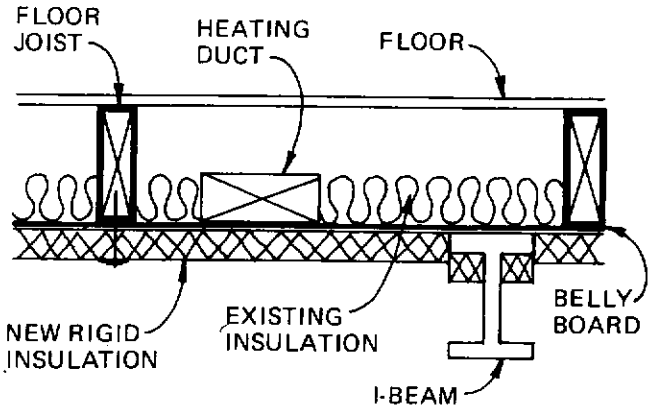
Remove belly board and add batt insulation between floor joists. If there is no existing insulation, or if the existing insulation needs to be replaced, place vapor barrier *up*. If the existing insulation is OK, place the vapor barrier *down* and slash it with a knife to allow moisture to escape. Use wire to hold the insulation in place. Replace belly board or install new air infiltration barrier—*not* a vapor barrier. (Figure 13.)



13. Re-insulation of Floor Cavity. This method is best if there is no existing floor insulation, or if it needs to be replaced.

2. **Insulate under the belly board.**

Attach exterior-grade rigid insulation directly underneath the belly board. Secure fasteners through the insulation and into the floor joists so the belly board does not have to support the added weight. (Figure 14.)



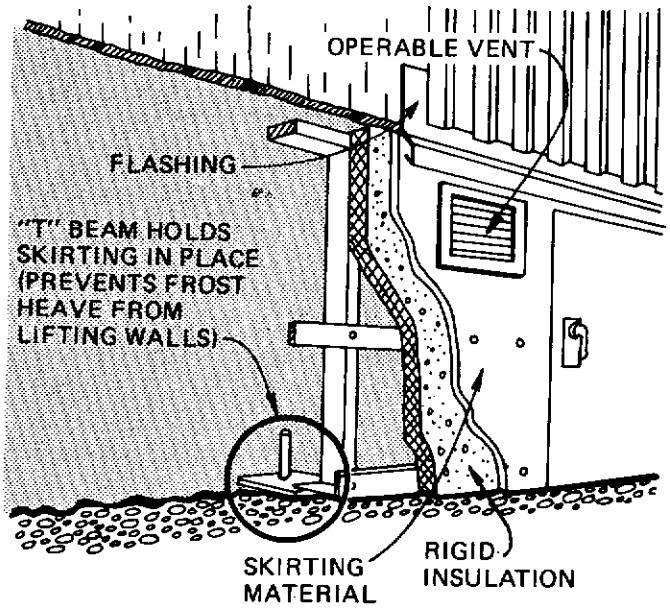
14. Addition of Rigid Floor Insulation. This is one way to supplement the existing floor insulation.

Floors also can be insulated with loose fill insulation (by drilling holes in the band-joist of the floor and blowing insulation over the top of the existing insulation or blowing insulation into a "sack" under the belly board), but these methods are usually more difficult than the options listed above.

Skirting

Skirting, which encloses the space between the home and the ground, can enhance the appearance of your home, serve as a windbreak, help reduce the chances of frozen pipes in winter, and help reduce floor heat loss. Uninsulted, ventilated skirting may have little effect on energy conservation, but insulated skirting with operable vents (closed in winter, open in summer to prevent moisture buildup) can be an effective, although relatively costly, conservation measure.

Installing insulated skirting should be done when the floor cannot be adequately insulated or when skirting is being installed for other reasons. (Figure 15.)



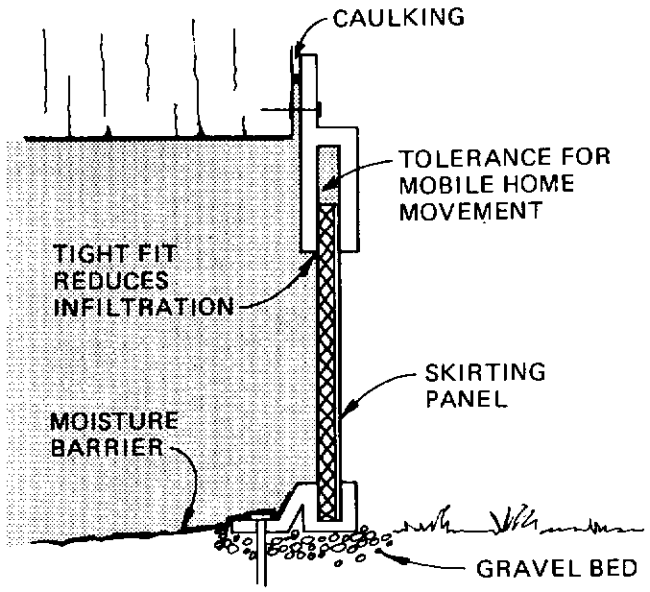
15. Framed Skirting. The best skirting system is well-sealed and well-insulated and has operable vents which are closed in winter and open in summer to reduce moisture buildup under the home.

Before adding skirting, the home should be properly anchored, leveled, and blocked. The materials used for skirting are the sheathing (or covering) and the framing to which the sheathing is attached. Sheathing materials range from fiberboard to plywood to steel, aluminum or polyethylene panels. The most common is embossed aluminum which matches the siding. Whatever

framing materials you choose—wood, steel or aluminum—make sure they are fireproof, moisture-proof and installed according to local codes.

Here are some pointers about skirting:

1. The skirting should seal against the ground and against the edge of the mobile home, but also should have some play—some ability to move slightly up and down, especially in areas where there is danger of severe frost heaving. One way to allow for this is to provide a slip joint where the sheathing is attached to the home. Make sure the slip joint also seals well. (Figure 16.)

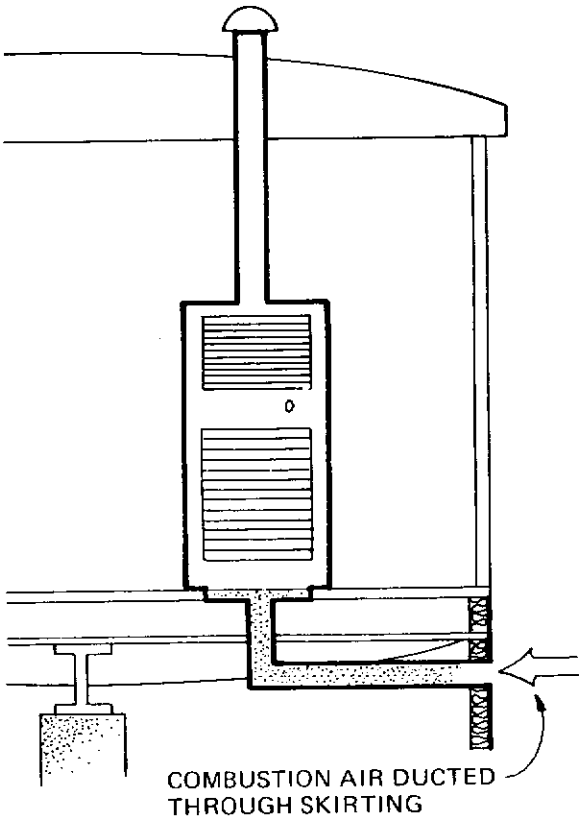


16. Skirting with Slip-Joint. Where frost heaving is a problem, the skirting should be able to move up and down slightly, yet provide a tight seal against air infiltration.

• If moisture buildup is a problem, place a vapor barrier covering the ground under your home. Use 6-mil polyethylene plastic sheeting or 15- or 30-lb. asphalt rolled roofing material, with seams overlapped 12 inches and the entire cover weighted down.

• If no ground vapor barrier is used, make sure the crawl space under your home is adequately ventilated during the year.

• In some homes, fresh air for the combustion of gas furnaces and water heaters is drawn from underneath the home. If you are installing a well-sealed skirt, be sure to duct the combustion air in from outside the skirt to the furnace and/or water heater. (Figure 17.)

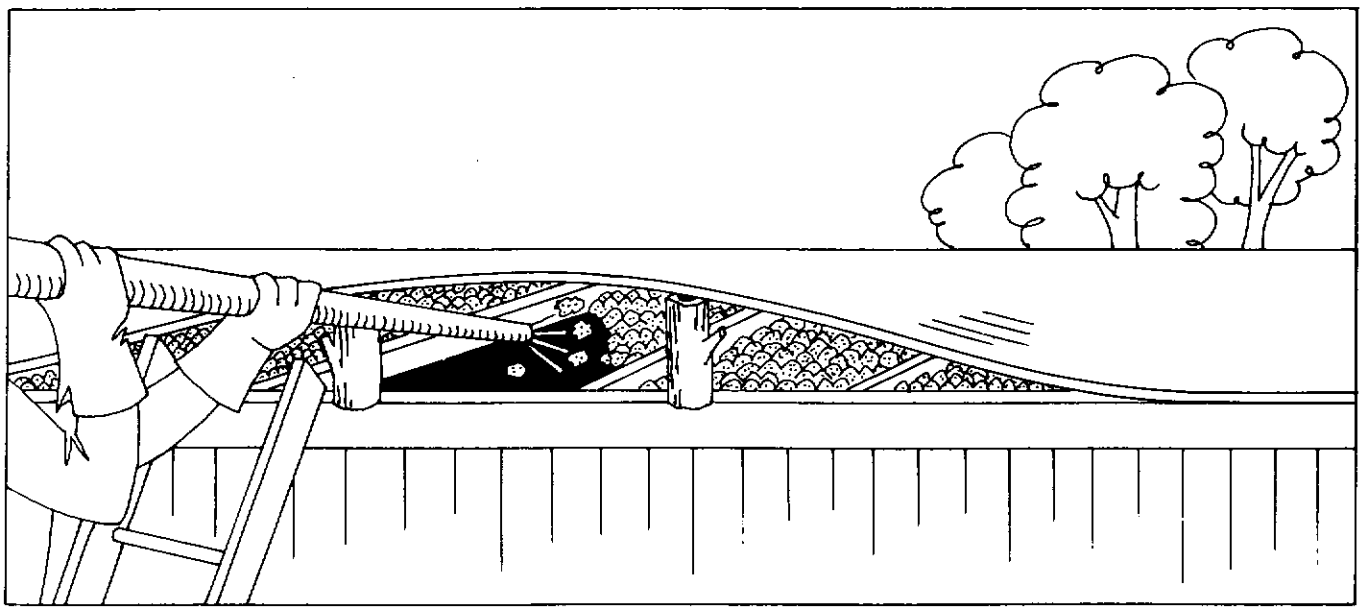


17. Combustion Air Duct. If the furnace and/or water heater draw combustion air from beneath the home, and the skirting is not ventilated, air must be ducted to these appliances. Newer homes draw combustion air through a sleeve around the exhaust flue.

• Make sure to comply with all local code requirements before doing any work with skirting, vents or ducts. Once you have met all the code requirements, proceed with insulating the skirt, using batts or blankets or rigid board insulation, all in the R-11 to R-19 range.

Ceiling and Wall Insulation

Insulating the ceilings and walls can be extremely difficult and, unless you are an expert, can result in structural problems—bulging, poor fitting of reinstalled siding or roof panels, etc. Insulating ceilings and walls is generally advisable only when you are doing other work that requires removing siding or roof panels.



18. Re-insulation of Walls and Ceilings. These are difficult projects and require an expert to avoid major structural damage. One way to re-insulate a ceiling is to prop up the roof and blow in loose fill. Commercially-available external insulating blankets also can be installed on mobile home roofs.

The three basic insulating methods are (1) blowing loose fill insulation into the existing roof and wall cavities; (2) removing the siding and the roof panels, adding insulation to the existing cavities, then reattaching the siding and panels; or (3) installing insulation and new exterior finish directly over the old exterior and constructing a new roof. (Figure 18.)

If you decide to insulate your ceilings and walls, make sure your home can bear the additional weight or be supported to bear the weight. In any event, if you have not done this type of work before, get the advice of a manufactured home dealer, building materials supplier, or building contractor who has experience in manufactured home insulation.

Heating Your Home

Your heating system probably accounts for nearly 15-30% of your overall energy cost, so you need to keep it operating as efficiently as possible.

Virtually, all of the new manufactured homes sold in the state now contain a central heating and air conditioning unit. Both standard and high-efficiency units are available. Many utilities offer incentives—in the form of lower rates or monthly rebates—to make purchasing the more efficient units more affordable.

Older homes often are heated and cooled by other combinations such as electric furnaces and window air conditioners, the overall inefficiency will cause the monthly utility bills to be high. Implementation of many of the recommendations in this booklet can reduce the annual power bill by up to 40%. The ideal approach, if economics permit, would be to change out the older units with a heat pump or other high-efficiency unit. In some areas of the state, converting to a natural gas furnace is more viable. The cost to heat could be reduced by up to 50%. Most importantly, follow the procedures listed under "Ducts" further on in this book.

Furnace size

Most furnaces are oversized for the job they need to do, especially in a well-sealed and well-insulated home. Here's how to test for oversized gas furnaces:

1. On a winter night that is very cold for your area, set the thermostat at 70°F.
2. Wait a while for the home to settle down at 70°F, then sit by the furnace and pay close attention to the burner (not the fan). Time the total number of minutes the burner is lit during a one-hour period.
3. The burner should stay lit for a total of at least 40 minutes during the hour. If it stays lit for much less than 40 minutes, the furnace is oversized. A serviceman can make the needed adjustments, such as changing the burner orifice.

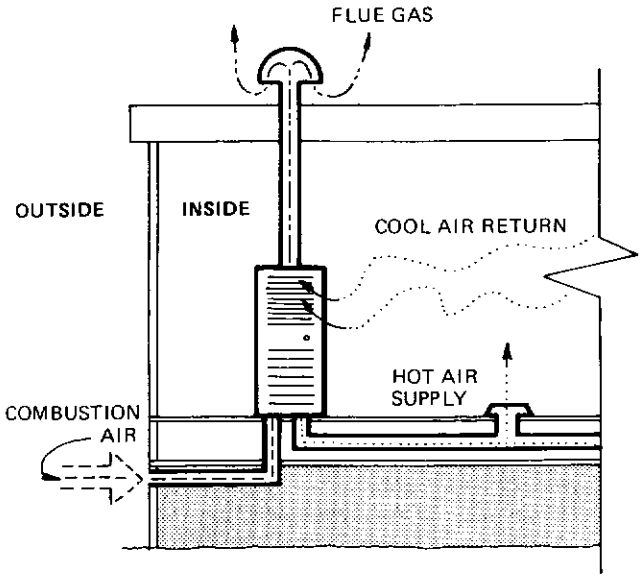
Combustion air

Some homes in South Carolina have gas (natural gas or propane) forced-air heating systems. This type of system produces heat by burning a mixture of gas and air in the combustion chamber of the furnace.

It is important to make sure you have enough combustion air for your furnace to operate efficiently and safely. In most older mobile homes, this air is drawn from beneath the home. If the home is skirted, there should be enough ventilation through ducts or vents in the skirting to allow adequate air for complete combustion of the and thus to prevent any buildup of dangerous carbon monoxide.

Many newer homes have heat pumps or furnaces with sealed combustion units. These furnaces have a venting system using two vents in one pipe which extends through the ceiling—a pipe within a pipe. The exterior pipe brings in fresh outdoor air for combustion. The inner pipe (or flue) is the exhaust pipe for the products of combustion (carbon dioxide, water vapor, etc.) to escape to the outdoors. *Make sure both pipes are properly connected.*

If you have any doubts about the adequacy or safety of your heating system's combustion air supply (or the combustion air supply for such other gas appliances as water heaters), have it checked by a qualified professional. (Figure 19.)

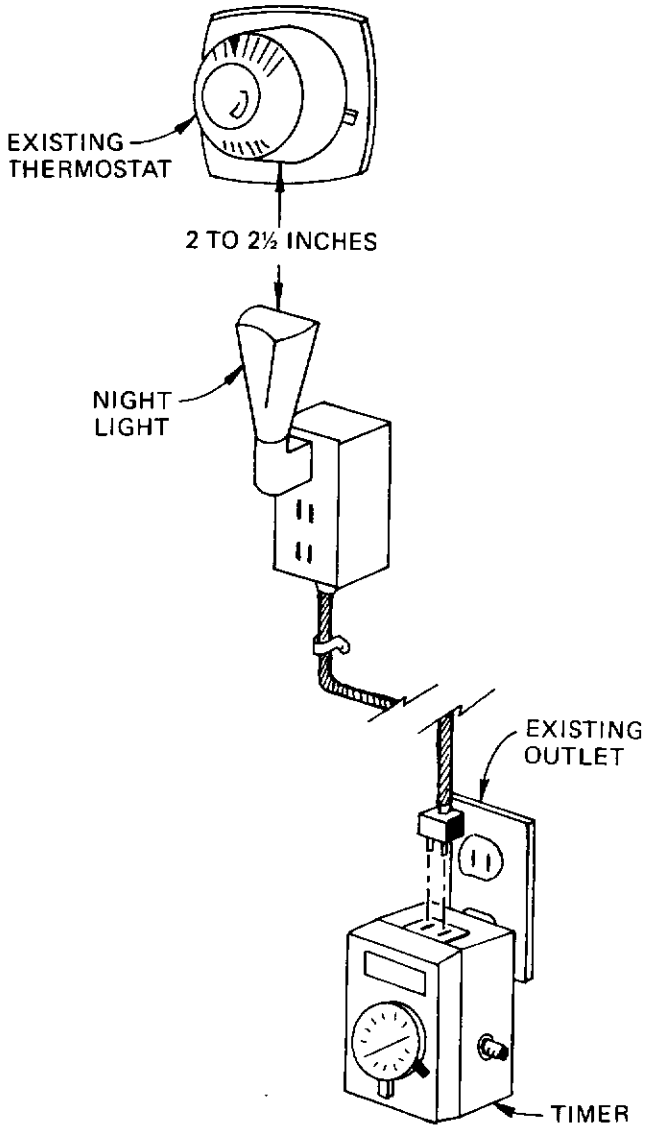


19. Furnace Operation. There are two distinct air flows in the operation of a gas-fired, forced-air furnace: (1) combustion air intake and flue gas exhaust and (2) the heating air supply and return.

Thermostats

Automatic setback thermostats reduce the temperature setpoint at night and cause the furnace to burn less fuel. These are a good idea if you are not in the habit of adjusting your thermostat at night, but they are expensive—about $50–60. A simple device which costs about $10 can be used to trick your thermostat instead. Install a nightlight on a time a few inches below the thermostat. This effectively lowers the setpoint during the hours the nightlight is on. (Figure 20.)

Sometimes thermostats are improperly located—for example, on an outside wall or near windows or exterior doors. This causes the furnace to come on more frequently and waste heat. In extreme situations, the thermostat should be relocated to an interior wall away from exterior windows and doors, particularly doors. It is best to have a qualified serviceman do the job.

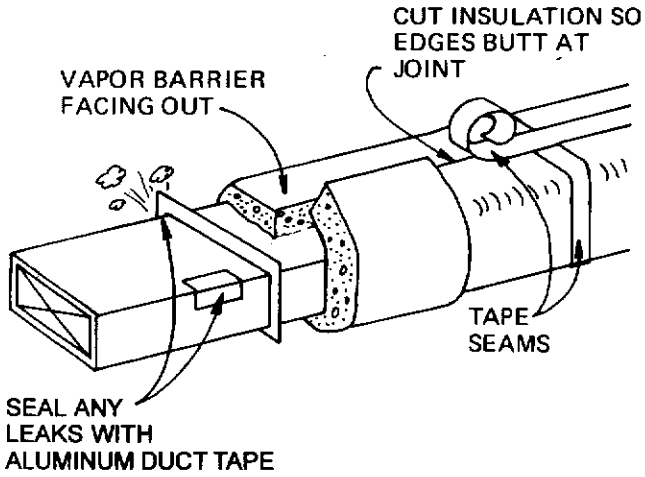


20. Do-It-Yourself Clock Thermostat. This is an inexpensive way to automatically set back your thermostat at night. Adjust the height of the night light until you get the right amount of setback.

Ducts

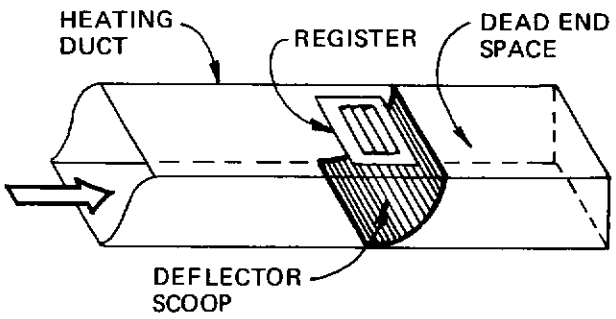
Single-wide homes have one long heating duct extending the length of the home, while double-wides have two long ducts plus a crossover duct. Make sure the crossover duct is properly connected and is strapped up off the ground. If not, attach 1" perforated steel banding to hold it in place, making sure there are no kinks in the ducts which would restrict the free flow of air.

If your home's ducts are exposed and easy to get to, check for air leaks and insulate them. Repair leaks with aluminum duct tape. To insulate, wrap batt insulation (with the vapor barrier facing outward) around the ducts and seal insulation joints with aluminum duct tape. (Figure 21.)



21. Heating Duct Repair. If the duct us exposed, seal any leaks and insulate it well.

In some older homes, there are "dead ends" beyond the last register at each end of the heating duct. To prevent heat from being wasted here, a sheet-metal scoop can be placed just past the last register to direct the heated air through the register. Check this situation by removing the register and inspecting with a flashlight and mirror. (Figure 22.)



22. Heating Duct Scoop. To eliminate wasted heat at duct dead-ends, put in deflectors before the dead-ends to direct the supply air through the registers. Insulation also could be stuffed in the dead-end space.

Heating System Maintenance

You can do much of the maintenance on your heating system yourself, but call on a professional if you are unsure about it. Before doing any work on your furnace, turn off the electric power to the unit and follow the manufacturer's instructions.

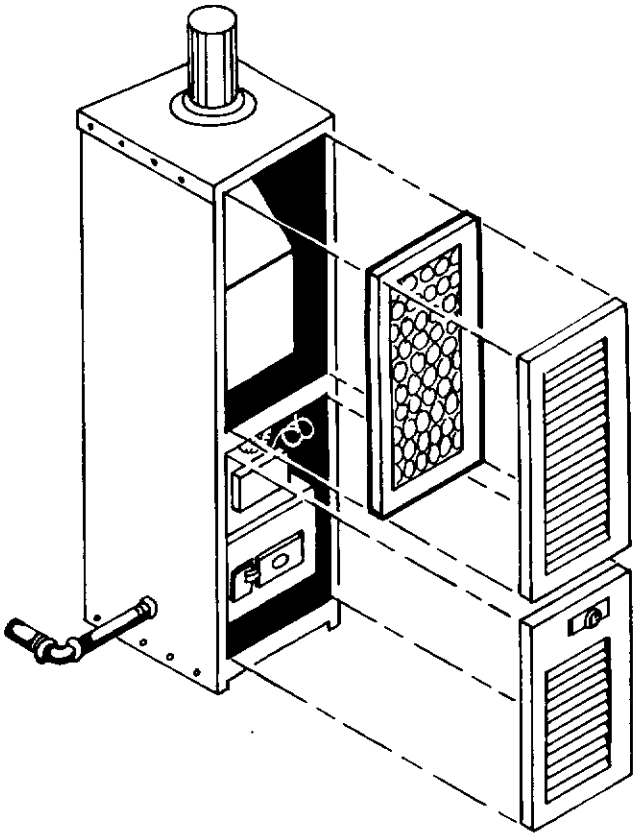
Basic Energy-saving procedures:

Pilot

• Turn off furnace pilot light in the summer.

Filters

• Replace your furnace filter(s) monthly during the heating season and clean if necessary. (Figure 23.)



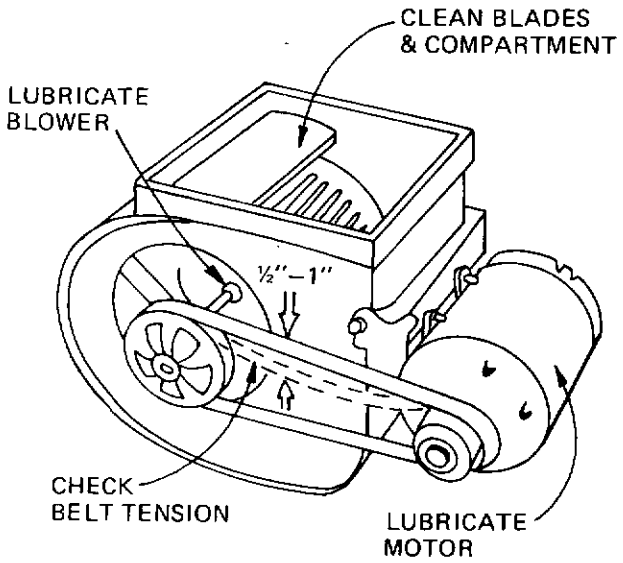
23. Furnace Filter. Check your filter and replace it monthly. The filter is located between the return air grille and the furnace blower.

Blower

• Clean the blower blades and blower compartment at least once a year.

• Lubricate the blower and blower motor at least once a year or according to manufacturer's instructions. (This is not necessary if your blower and motor have sealed bearings.)

• Check the blower belt for wear and tension. Replace if necessary, or adjust only enough to keep the belt from slipping. (Figure 24.)



24. Furnace Blower. Service the blower once a year. If the blower and blower motor have sealed bearings, lubrication is unnecessary.

Registers

• Keep all heating registers clean and free of dust. Make sure they are not covered with carpeting or otherwise blocked, and that they can be freely opened and closed so you can regulate (to some extent) the heat coming into each room.

Return Air

• Make sure the return air is not impeded. Check the grille on the furnace closet door. Interior doors are cut short so return air can move back to the furnace. (Figure 25.)

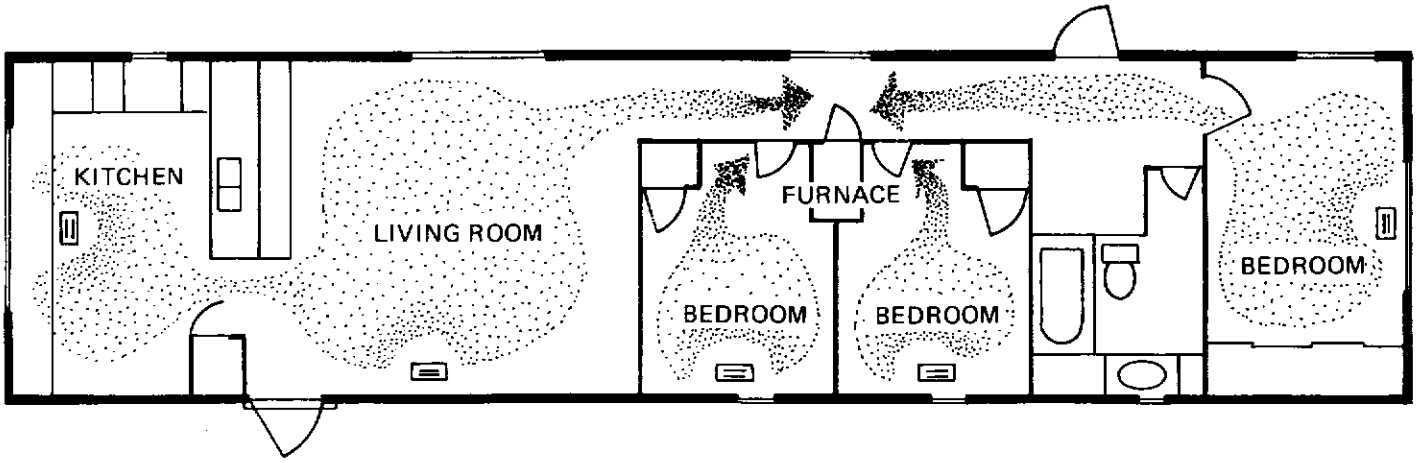
Portable Heaters

Before purchasing a portable heater for your home (such as an electric heater, a radiant quartz electric heater or a kerosene heater), make sure its use in a manufactured home is both safe and legal (check with your local building officials when in doubt). Electric heaters should be used only for small spaces and for intermittent periods of time, due to the high operating cost. Make sure there is a sufficient supply of combustion air and adequate ventilation for kerosene and other fuel-burning heaters.

Woodburning Stoves & Fireplaces

If you decide to purchase a woodburning stove, make sure it is approved by your local building officials, then install and operate it in accordance with the manufacturer's specifications.

Both woodburning stoves and fireplaces should have the combustion air ducted into the firebox from outside the home. If not, there must be proper ventilation to reduce the problems of oxygen depletion and pollution of the air inside the home. In the case of a fireplace, always close the damper after the fire is out and keep it closed when the fireplace is not in use. Keep in mind that fireplaces are typically very inefficient.



25. Return Air Pathways. The warm air supplied by the furnace to floor registers in each room must be able to return to the furnace's return air grille.

Water Heating

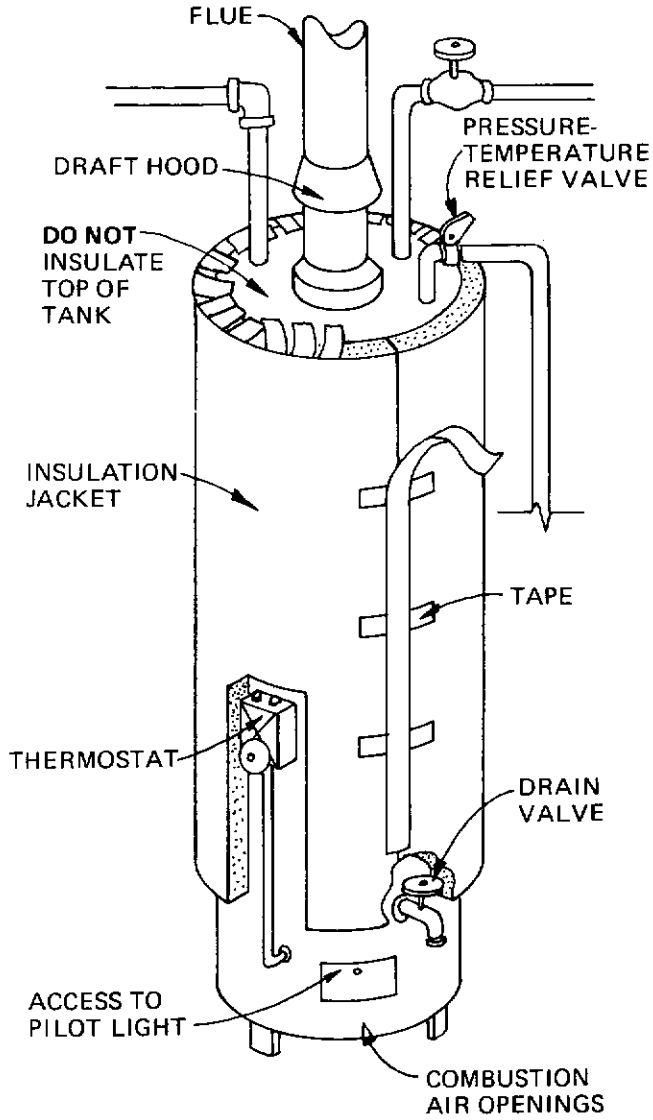
Next to your furnace, your water heater probably uses more energy than any other appliance in your home. Here are some ways you can operate it more efficiently, and some safety tips:

• Repair any leaks in your faucets and hot water pipes. One drip per second from a faucet can waste 200 gallons of water a month.

• Install low-flow showerheads (these generally work better than showerhead flow restrictors).

• Use cold or warm water to wash clothes; rinse with cold.

• Turn down the water heater thermostat to the lowest acceptable level (somewhere around 120ºF), keeping in mind that dishwashers often require higher temperatures—check the dishwasher manufacturer's instructions.



26. Gas Water Heater. Here are the points that should **not** be covered. Particularly important are the combustion air inlets, the draft hood, and the flue.

• Insulate the water heater tank and exposed pipes.

• Drain sediment from the bottom of the tank periodically. To do this, drain about a bucketful of water from the drain valve at the bottom of the tank about once a month—but do this only if your water heater is less than one year old or if it has been drained on a regular basis. Water heaters that have not been drained regularly may have drain valves that become clogged and will not close once opened. *If the drain valve does not open easily, do not force it.*

• With gas water heaters, make sure the combustion air supply and exhaust flue are not blocked. If air is drawn from inside the home, consider ducting it in from outside.

• With electric water heaters, turn off the electricity to the heater before you do any work or make any adjustments, including adjusting the thermostat.

Adjusting the Water Heater Thermostat

Gas Water Heaters

To adjust the temperature, turn the thermostat dial to the desired setting. ("Warm" is usually about 120°F, and "Normal" is usually about 140°F.) Some heaters have a cover over the dial; this can be easily removed by lifting in and out.

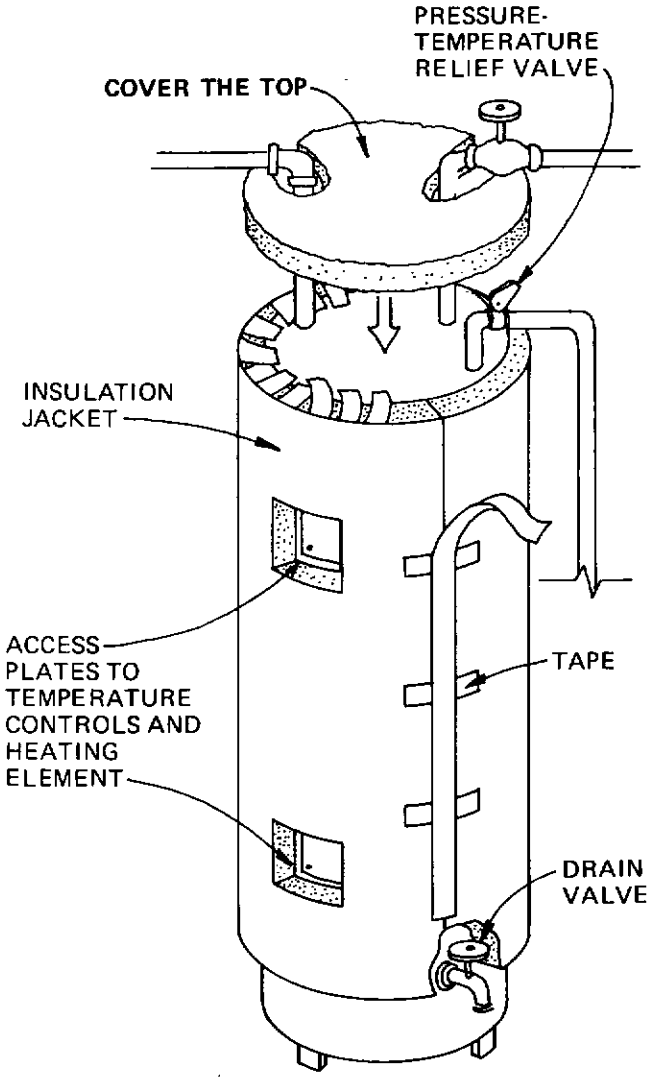
Electric Water Heaters

1. Turn off the electricity to the heater.
2. At the front of most electric water heaters there are one or two panels that cover the temperature controls. Unscrew and remove these panels.
3. Carefully part the insulation so you can see the temperature dial (or dials—there may be two).
4. Using a screwdriver, turn the indicator to the desired setting. If there are two controls (one behind the top panel and one behind the bottom panel), turn the indicator to the same setting on each, or set the top control slightly lower than the bottom control.
5. Carefully replace the insulation as you originally found it, then screw the panels back on and turn on the electricity.

Insulation

Some of the newer water heaters are manufactured as energy-saving models with adequate built-in insulation. Other heaters may need some extra insulation around the tank to reduce heat loss.

You can buy and install a ready-made water heater insulation blanket kit, or you can make your own wrap-around blanket from part of a roll of 3½" (R-11) or 5½" (R-19) fiberglass insulation. When you wrap the tank, be sure to tape all seams. If using a homemade insulation wrapper, wrap some wire around the insulation to held it together, but be sure not to compress it too tightly. With a gas heater, be sure not to obstruct the combustion air supply or flue, and do not store flammable materials near the burner or flue. (Figures 26 & 27.)



27. Electric Water Heater. Here are the points that should not be covered. Be sure to turn off the power to the unit when accessing the temperature controls.

You can also insulate all exposed water pipes to protect the water inlet from freezing and to reduce heat loss to some extent. Pipe insulation is usually found in wrap-around insulation kits, flexible tubing or rigid foam type. Choose a size that fits your pipes snugly. If you live in a colder part of the state and decide to use heat tape for added freeze protection, be careful not to overlap the tape—and follow the manufacturer's instructions to minimize any fire hazards. It is best to use a heat tape that is thermostatically controlled rather than one that is on all the time.

Cooling Your Home

If you have weatherized your home with caulking, weatherstripping, and so on, you have taken an important step toward reducing your summertime cooling costs. Effective landscaping can also help—well-placed trees that provide shade, particularly on the west side of your home, but that do not get in the way of the winter sunshine.

Low-Cost Cooling Options

In addition to natural sunshine barriers, you can install shading devices both inside and outside your home (outside is more effective). For the exterior, consider awnings, shutters, bamboo slat shades, overhangs, and trellises. Large window areas can be shaded on the exterior with greenhouse cloth (available from greenhouse suppliers) that can be removed in winter. For the interior, use white-lined drapes or insulation panels (also used on winter nights). Open the drapes and windows at night during the summer to allow cross ventilation; close the drapes during the day. Whether or not you leave the windows open during the day depends on your home's cooling system.

Air Conditioners

Although window air conditioners are more effective in cooling your home on relatively humid days, they are also expensive. If you have a window air conditioner, use it only when necessary and keep the thermostat setting as high as you can tolerate. Clean the condenser (the outside portion) each year, keep the fins and coils free of dust with a vacuum cleaner, check the filter monthly and clean or change it as needed, *and keep windows and doors closed when the air conditioner is on.*

Additions to Manufactured Homes

Once installed, most manufactured homes are never moved and become fixed dwellings. Because of this, it is common for home owners to build such additions as entryways, carports, ramadas, extra bedrooms, utility or work rooms, storage rooms, and so on.

The original home then provides a service core of plumbing, electrical and mechanical systems. Extension of these systems to connecting additions is far less expensive than building detached structures with separate service systems.

No addition is recommended solely as an energy-saving measure, but if you are planning an add-on project, make energy conservation part of your plan. Additions which connect to the home provide, at the very least, a buffer between the home and the weather. If an add-on is well insulated and has good solar access, it can heat itself and also provide a net heat gain to the home. (Figure 29.)

Here are some points to consider as you plan your additions:

• A vestibule, or air-lock entryway, is one of the most practical additions you can make since it can prevent the heated or cooled air you have paid for from being let out as people come and go, provide a buffer zone and provide additional space. The entryway door should be far enough away from the main door so people do not open them both at the same time. It is not necessary to insulate a vestibule/air-lock entryway, but it will help and it does not cost much.

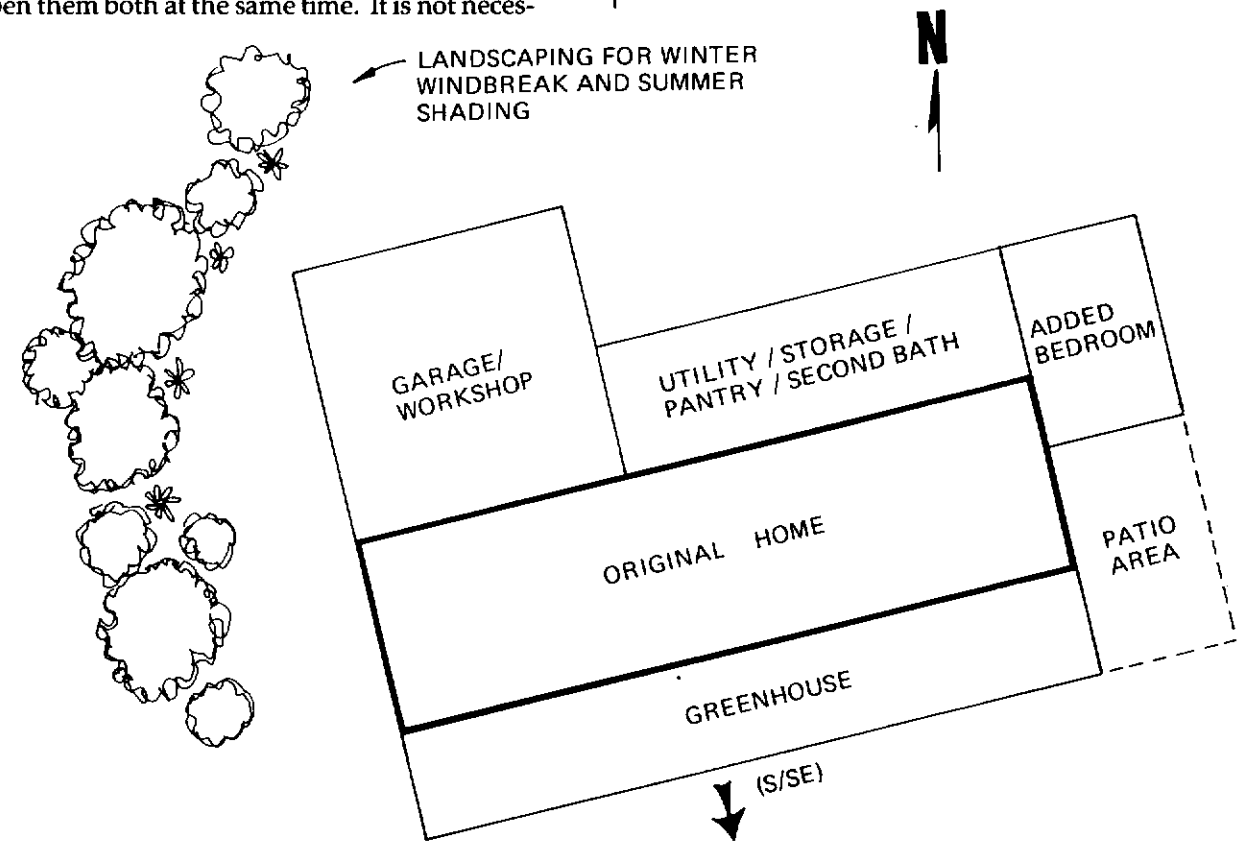
• If your main entrance (the one you use most often) faces anywhere from southeast to southwest, consider making the entryway into a solar greenhouse or sunspace. You can do this for little or no extra cost, and you will be getting some free solar heat (see next section on solar energy).

• Place an unheated space, such as a garage or storage room, on the north side of the home, where it will provide a buffer zone to the coldest weather and not block access to sunlight on the south.

• Extra bathrooms can tolerate slightly lower temperatures (they can be heated up quickly with a small heater when in use) and can be placed between the unheated areas and the active areas of the home, or off to the east or west.

• Outside patio areas should be placed toward the east, where they will be warmer on winter mornings and cooler on summer afternoons.

• A number of owners in South Carolina have built additions to their homes, then insulated the remaining exposed portions and bricked or placed vinyl siding along the entire home, giving the home the appearance of a more conventional site-built home and providing a continuous insulated envelope.



29. Home Additions. Well-designed and well-placed additions can result in an energy-efficient site-built home. The greenhouse and garage can be used as air-lock entryways.

Solar Energy for Manufactured Homes

Solar energy can be used to provide year-round water heating and wintertime space heating. Here are a few solar basics:

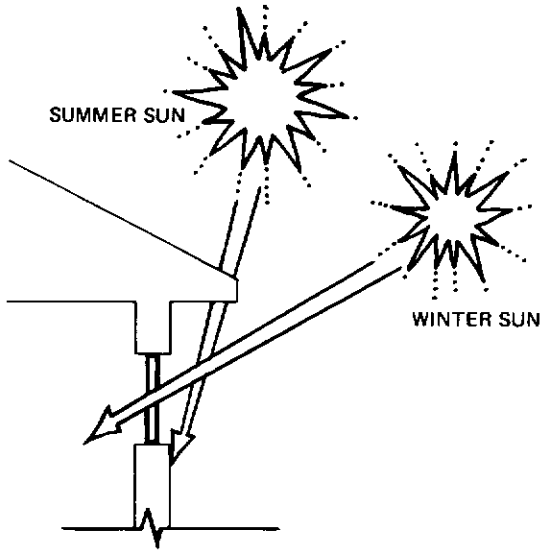
• All solar systems have three components: the *collection* of heat, the *storage* of heat, and the *distribution* of heat throughout the home. Without storage, a solar system can provide daytime heating only.

• *Passive* solar systems use the building itself for the three components; for *active* solar systems, the components are parts of the installed system.

• Manufactured homes have two problems when it comes to solar energy: (1) the structure provides little or no thermal mass for the nighttime storage of heat for passive solar systems, and (2) they may not provide adequate space or structural strength for an active solar installation.

• Most solar measures are expensive with five to seven year payback periods. This is not true, however, for passive solar new construction, which involves little or no more cost than conventional construction.

• Other than incorporating passive solar features at the time of new construction, solar water heating is the most cost-effective measure because the equipment is utilized throughout the year rather than only during the heating season.



30. Windows. Windows are ideal solar collectors and a small overhang will reduce summer heat gain.

• Before adding solar to your home, take all the weatherizing and energy-saving steps you can. Adding solar heating to a leaky home is like pouring water into a bucket with holes in it.

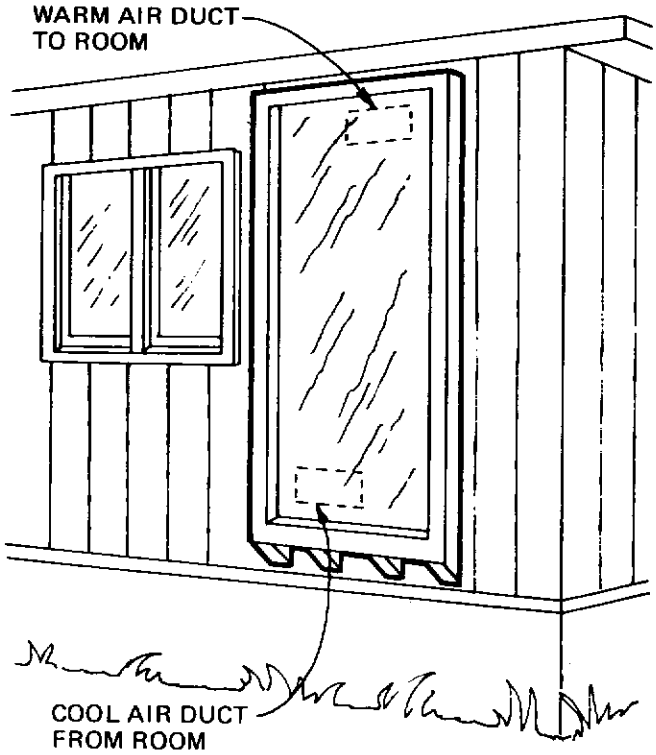
There are three general solar options: daytime heating systems, day- and nighttime heating systems with storage, and water heating.

Daytime Heating

Daytime heating with solar energy is easily achievable and particularly appropriate for buildings which have little thermal mass, such as manufactured homes. Windows are an ideal daytime heating source (and probably the cheapest source, too). Let the sun warm your home through south-facing windows during the day, then close the drapes or insulate the windows at night. (Figure 30.)

A *thermosiphon air panel* (TAP) can be mounted on the south wall—a good do-it-yourself project. (Figure 31.)

Roof-mount air collectors are gaining in popularity. They are ducted directly to and from the room below. These units contain a thermostatically-controlled blower. Make sure your structure can handle the added weight and wind loads.



31. Thermosiphon Air Panel. A TAP can be made easily and cheaply and it will auto-matically supply heated air to the adjacent room during sunny days.

Day- and Nighttime Heating Systems with Storage

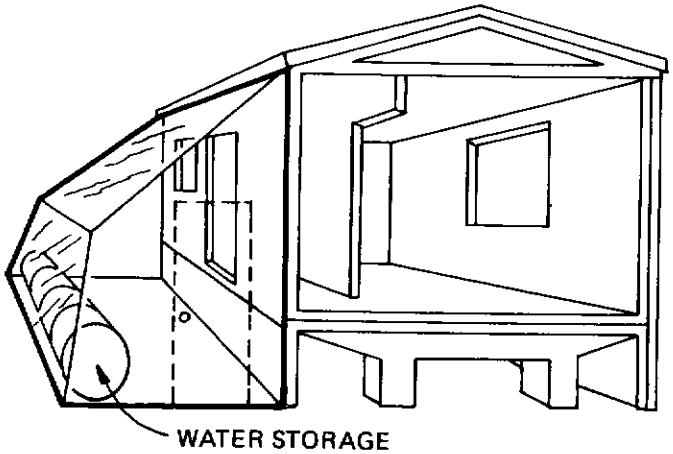
Greenhouse /sunspaces have been popular in other states for years because they are relatively inexpensive and are highly effective, and they provide:

- Added space at relatively low cost.
- High solar gain.
- Ease of including added thermal mass for heat storage.
- Ease of construction, normally requiring limited skills.

A greenhouse /sunspace can be combined with (or used as) an air-lock entryway to reduce heat loss. The thermal mass in the greenhouse /sunspace can be any heavy material, such as rocks, water-filled drums (use rust inhibitor if metal), etc., which can also be used as a base for planters.

Excess heat from the greenhouse /sunspace can be let into the home through doors and windows, with or without a fan, or ducted to other rooms in the home. A return air path is necessary.

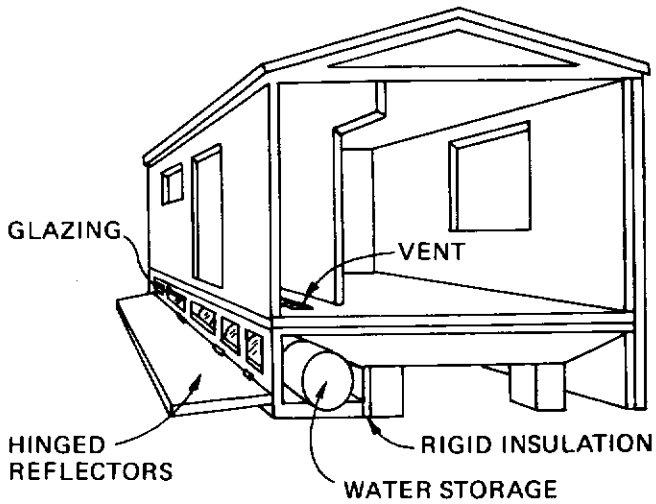
Vertical glazing is best for greenhouses /sunspaces to help reduce summer cooling problems. Always provide adequate summertime ventilation. (Figure 32.)



32. Greenhouse / Sunspace. These are relatively easy to build at reasonable cost, provide high solar gain and add living space.

A passive solar *underskirt* replaces the home skirt on the sout side with glazing. Hinged panels which provide a daytime reflector and nighttime insulation can be added over the glazing. This system does not provide additional usable space and does not have a large collector area like a greenhouse /sunspace, but can help heat your home at little cost.

Place drums filled with water (and rust inhibitor if metal) in the space under the home. Provide vents into the home to let the heat in through the floor. (Figure 33.)



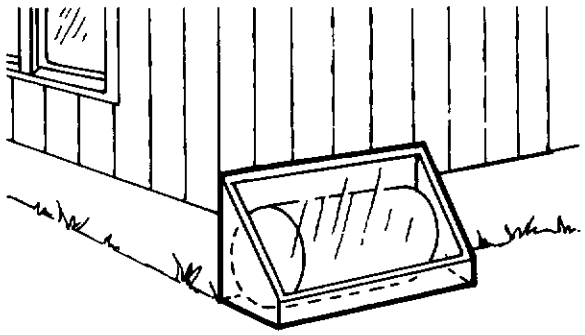
33. Underskirt Solar System. This is cheaper than a greenhouse but does not provide as much heat or additional living space.

Water Heating

A solar water pre-heater is simply a tank between the cold water supply and the conventional water heater. It can be placed in a greenhouse /sunspace or in an insulated box with a glazed cover. Anything you can do to increase the typical average 65°F cold water inlet temperature will help.

Building a solar water pre-heater can be a good do-it-yourself project—it can be done cheaply with free discarded conventional water heater tanks. (Figure 34.)

A complete commercial solar water heating system can be expensive, although in the long run many are cost-effective, particularly if you currently use electricity to heat water. There are many different designs and manufacturers—check with the SC State Energy Office for a list of dealers.



34. Solar Water Pre-Heater. This is an easy, low-cost project which can greatly increase the typical 65°F cold water supply temperature to 120°F plus.

Sources of Information and Assistance

South Carolina Energy Office
1201 Main Street, Suite 430
Columbia, SC 29201
1-800-851-8899
Educational materials and technical assistance are available on residential, commercial and industrial energy technologies.

Energy Efficiency and Renewable Energy Clearinghouse (E^2 REC)
Post Office Box 3048
Merrifield, Virginia 22116
1-800-363-3732 (Anywhere in US)
Provides three primary services: general information responses, engineering/scientific technical assistance, and commercialization technical assistance. This service is funded by the U.S. Department of Energy and operated by the NCI Information System.

Weatherization Assistance Program
Governor's Office,
Office of Economic Opportunity.
This program is designed to assist low-income citizens with repairs and energy conservation improvements to their homes.
The Program is operated by local contract organizations.
For information about eligibility for the program and about program services, contact the organization serving your area or call **(803) 734-0665.**

Manufactured Home Energy Conservation Checklist

Items to Consider When Purchasing and Setting Up a Manufactured Home

- ❑ Buy a model with extra insulation and other energy conservation features.
- ❑ Check the data plate for the correct wind, roof load, and climatic zones.
- ❑ Make sure your furnace size is correct for your area.
- ❑ Place the home on a foundation that is adequate for your area.
- ❑ Make sure the home is properly leveled.
- ❑ Locate the home so the active areas (kitchen, living room) are to the south and inactive areas (bedrooms) are to the north.
- ❑ Situate the home correctly with respect to landscaping, particularly winter windbreaks and summer shading on the west.

Items That Cost Nothing

- ❑ Keep doors and windows closed and latched in winter.
- ❑ Set furnace thermostat as low as comfortable.
- ❑ Set back furnace thermostat at night and when away.
- ❑ Close fireplace or woodstove damper when not in use.
- ❑ Open drapes on winter days.
- ❑ Perform routine furnace maintenance.
- ❑ Keep furnace return air paths free from obstructions.
- ❑ Turn off furnace pilot in summer.
- ❑ Open windows for natural cooling.
- ❑ Close drapes on summer days.
- ❑ Perform routine air conditioner maintenance.
- ❑ Set water heater thermostat as low as convenient.
- ❑ Wash clothes with cold or warm water and rinse with cold water.
- ❑ Drain water heater sediment periodically.
- ❑ Turn off lights and appliances when not in use.
- ❑ Use task lighting.
- ❑ Dry full loads in clothes dryer and use clothesline when acceptable.
- ❑ Cook with small appliances rather than oven.
- ❑ Turn off cookstove pilots in summer, or year-round if acceptable.
- ❑ Clean refrigerator coils regularly.
- ❑ Maintain refrigerator at 35–37°F and freezer at 0–5°F.
- ❑ Keep refrigerators and freezers full and defrost regularly.

Items That Are Inexpensive and Usually Have Quick Paybacks

- ❑ Fix broken window glass.
- ❑ Fill large holes, particularly around penetrations.
- ❑ Make sure windows and doors close properly.
- ❑ Repair siding, roofing and belly board.
- ❑ Caulk windows frames, door frames, around other openings and at interior panel joints.
- ❑ Weatherstrip windows, doors and access panels.

- ❑ Install insulating gaskets at electric switches and outlets.
- ❑ Seal kitchen and bathroom exhaust systems in winter.
- ❑ Install plastic storm windows.
- ❑ Install nightlight on timer to trick thermostat.
- ❑ Repair gaps in heating duct if accessible.
- ❑ Install heating duct insulation if duct exposed.
- ❑ Install scoops at heating duct "dead ends."
- ❑ Replace furnace filters monthly during the heating season.
- ❑ Seal air conditioning system penetrations in winter.
- ❑ Fix water leaks.
- ❑ Install low-flow showerheads.
- ❑ Install additional water heater insulation.
- ❑ Install hot water pipe insulation where pipe is exposed and heat tape if necessary.
- ❑ Use fluorescent lighting where acceptable, and use low wattage bulbs.
- ❑ Buy efficient light bulbs—the more lumens produced per watt, the more efficient the bulb—check the ratings on the package.
- ❑ Replace refrigerator gasket if needed.

Items That Are Expensive Yet Usually Have Quick Paybacks

- ❑ Replace doors and windows that will not close.
- ❑ Insulate floor if existing floor insulation is inadequate.
- ❑ Replace furnace burner orifices if oversized.
- ❑ Install automatic night setback thermostat.
- ❑ Provide outside combustion air for furnace and water heater if not present (natural gas, oil and propane).
- ❑ Use room heaters and turn down central heating system.
- ❑ Replace electric resistance heaters with gas-fired heaters (room heaters, water heaters and furnaces).
- ❑ Replace refrigerator and freezer with very efficient models.

Items That Are Expensive and Usually Have Long Paybacks

- ❑ Install permanent storm windows.
- ❑ Install draperies (with valences) or nighttime insulation systems for windows.
- ❑ Replace exterior doors with units that are insulated and have thermal break.
- ❑ Install storm doors.
- ❑ Install well-sealed, well-insulatied skirting with operable vents.
- ❑ Change furnace thermostat location if improperly located.
- ❑ Install summer exterior shading and/or landscaping.
- ❑ Install air-lock entryway, particularly at main entrance.
- ❑ Solar water heating.
- ❑ Passive or active solar heating retrofits.
- ❑ Re-insulate ceiling.
- ❑ Re-insulate walls.

Radiant Barrier Advisory

Caution should be used when considering the purchase of radiant barrier home energy products. A radiant barrier is a sheet of aluminum foil installed in the attic which may be useful in reducing ceiling heat gain on summer days by resisting downward heat flow. However, it is the ability of the aluminum foil to save energy in the winter by resisting upward heat flow that has been questioned.

Some radiant barrier sales literature has shown heat flowing down through roofs or up through ceilings, only to be turned back by a radiant barrier. The fact is that roof and ceilings alone are barriers to radiant heat flow.

Studies conducted by the Florida Solar Energy Center show that reasonably priced radiant barrier products can be worthwhile in hot climates where cooling requirements are high. In cooler climates, however, radiant barriers would not be as worthwhile because the main concern is heating, not cooling.

Some studies show that radiant barriers may save up to 8 percent on the total cooling load. These studies show that savings vary significantly with climatic and building conditions.

Passive Ventilation System Advisory

Caution should be used when purchasing a manufactured home with passive ventilation systems promoted as being energy-saving devices. The system consists of basically two components: a roof-mounted thermally-controlled vent which opens at about 80ºF and closes at about 60ºF, and ceiling grilles with thin plastic flaps on top to serve as a one-way passage from the living space directly to the attic. Each room in the home has a ceiling grille.

The system works fine during the months when air-conditioning or heating is unnecessary, which is usually during the months of April and October. However, in the summer when the air-conditioner is operating and the attic temperature is in excess of 120ºF, the hot air exhausts out of the roof vent which has to be replaced with other air which comes directly from inside your home. The cool air that has been removed from inside the home is replaced with unconditioned outside air through infiltration leakage points, the air then has to be cooled again. As you can well imagine, this could have a detrimental effect on your cooling bill.

In the winter time the warm air is drawn into the cool attic which causes the moisture in the air to condense onto the cooler surfaces. Those surfaces are usually the underside of the metal roof, the insulation and the wood trusses. The condensation, when present, will reduce the effectiveness of the insulation, cause the metal roof material to rust and the wood to decay.

[Sections of this advisory were taken with permission from an article in the January 1990 issue of Energy Design Update, Editor Ned Nisson, 37 Broadway, Arlington, MA 02174-5539. 1-800-964-5118.]

About This Book . . .

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