



Assessing Your Home's Heating and Cooling Systems

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The goal of *Home•A•Syst* is to protect your health and the environment from pollutants in and around your home.

The following checklist is designed to help you pinpoint potential problem areas in your home that may affect the efficiency and safety of your home heating and cooling system. If a statement reflects the cur-

rent situation in your household, check "Agree." If the statement does not describe your household, check "Disagree."

If you disagree with any of these statements, or if you are unsure, you may have a situation in your home that could affect the environment or your health. Refer to the fact section with the same number as that

Agree **Disagree**

- | | | |
|-----------------------|-----------------------|---|
| <input type="radio"/> | <input type="radio"/> | 1. All my combustion appliances (those that burn fuel) are properly ventilated. |
| <input type="radio"/> | <input type="radio"/> | 2. I have my chimneys and flues inspected once a year. |
| <input type="radio"/> | <input type="radio"/> | 3. My combustion equipment is located in a large, well-ventilated area. |
| <input type="radio"/> | <input type="radio"/> | 4. My heating or cooling system is less than 15 years old. |
| <input type="radio"/> | <input type="radio"/> | 5. I change air filters regularly <i>and</i> have my equipment serviced by a professional every year. |
| <input type="radio"/> | <input type="radio"/> | 6. I keep the thermostat at a relatively low temperature in the winter, and at a relatively high temperature in the summer. |
| <input type="radio"/> | <input type="radio"/> | 7. The ductwork in my house is sealed <i>and</i> is insulated if it runs through unheated space. |
| <input type="radio"/> | <input type="radio"/> | 8. The temperature in all the rooms of my house is comfortable no matter whether doors are shut or open. |
| <input type="radio"/> | <input type="radio"/> | 9. My air intake/handler is not located in my garage. |

Continued on p.2

Agree Disagree

10. My attic, basement, crawl spaces, and windows are all well-sealed.
11. My attic, floors, and walls are insulated, *and* the **R-value** of my insulation (a measure of how well it resists the flow of heat energy out of the house) meets the recommended standard for my region.

statement (under the heading, “What you should know about . . .”) for more information.

Don’t be alarmed if you disagreed with many or even all of these statements. That does not automatically mean you have a problem. It may, however, tell you that change is needed to avoid potential problems. In the same way, agreeing with every statement does not mean you are *not* at risk or cannot make improvements.

Why should you be concerned?

By properly maintaining your home’s heating and cooling systems, you can keep your indoor air safe to breathe, reduce your energy bills, prevent structural damage to your home, and have a comfortable place to live all at the same time. Proper maintenance includes taking care of your home heating and cooling mechanisms, the duct system, and the house **envelope** (the foundation, floors, walls, ceilings, and roof).

The average American home wastes 30 to 50 percent of the energy it uses. The reduction of energy use is good not only for the environment—it’s good for your wallet, too. Energy bills are lowest when the home is tightly air-sealed, properly insulated, and heated and cooled efficiently and safely. However, above all else, your home should be a healthful place to live. The quality of your indoor air depends on the safe operation of your heating and cooling equipment.

Home•A•Syst is only for your own use and benefit. It is a voluntary program intended to provide general information about protecting your health and the environment. Information from a *Home•A•Syst* assessment will not be collected by Extension or any other outside agency and should remain in your private records.

What you should know about . . .

1. Venting combustion appliances

If your furnace, wood stove, boiler, or water heater burns gas, oil, wood, or coal, it is vitally important that the venting system function properly. (This is not an issue for electric heating systems.) The venting system carries the gases produced by **combustion** (burning) out of the house.

Whenever a fuel like gas, oil, coal, or wood is burned, carbon dioxide and water vapor are emitted. If the combustion appliance is not functioning perfectly, carbon monoxide and other harmful pollutants are also produced. Most combustion appliances are vented to ensure that combustion by-products are removed from the home.

There are three types of venting, or exhaust, systems. The first, called **natural draft**, or “atmospheric vent,” relies on the natural tendency of warm gases to rise. Natural draft appliances always vent into a vertical flue of either masonry or metal. A special caution: When exhaust equipment such as a clothes dryer, a central vacuum, or kitchen/bathroom exhaust fans are operating, they draw air out of the house and can create a negative pressure or vacuum inside. If a natural-draft appliance is in the house, combustion by-products can then be pulled into the house instead of rising naturally out the flue. This phenomenon is known as **backdrafting**. Backdrafting is dangerous because it can fill indoor air with harmful gases and combustion by-products. It can be prevented with adequate ventilation in the home.

The second type of exhaust system is a **power-vented** system, often used with a furnace. In such a system, a small blower is used to exhaust combustion by-products from the house. Flue gases from power-vented appliances rarely spill back into the house.

The third type of system is known as **sealed combustion**. The newest furnaces and water heaters employ this system and are immune to backdrafting (as long as they are not blocked or damaged) because they are completely sealed and isolated from inside air. They bring in the air needed for combustion from outside through an intake pipe. Flue gases are vented outside through a second pipe. No chimney is needed.

Unvented appliances should be used only in open, well-ventilated areas.

2. Chimney and flue inspection

As your heating system ages, vents can become blocked (by a bird's nest, for example) and flues can begin to crack. This creates a dangerous situation if combustion by-products start to leak and accumulate inside your house. Vents and flues should be checked annually for such problems.

3. Location of combustion equipment

It is critical that combustion appliances have enough air to work properly. National Fire Protection Association (NFPA) codes (or more stringent local codes) must be followed to ensure safe installation and operation of combustion equipment. Call your county courthouse for more information about local building codes.

Sealed-combustion units draw air directly from outside the home. However, natural-draft and power-vented units draw air from the indoor space in which they are located. The best place for such units is in a well-ventilated space like the attic or garage. However, if your combustion equipment is in a closet or other small space, air must be allowed to reach the appliance. Louvered doors, for example, can allow air inside a closet. Do not place anything inside or outside the confined space that may block air flow.

Combustion equipment in a well-sealed basement runs the risk of backdrafting, especially if exhaust appliances (like a clothes dryer) are also in the basement.

4. Age of the system

If your primary heating/cooling unit is more than 15 years old, it is probably not very energy-efficient. Models made within the last five years are likely to save you the most money. Even if your older unit still works, you can probably benefit by replacing it with a new energy-efficient model. A new model can pay for itself in fuel savings in only a few years. Or, if you

choose to finance the new equipment over time, the dollar value of the monthly energy savings may exceed the monthly payment for the equipment—you will still save money.

5. Equipment maintenance

All machines work more efficiently and safely if they are inspected regularly. Your furnace, air conditioner, and other heating/cooling equipment should be checked and serviced by a qualified professional every year.

Regular maintenance—which includes changing air filters—is recommended during the heating and cooling seasons. A forced-air system's filter removes dust and debris before it reaches the air blower and the heat-exchange coils. Dirt on the coils reduces the efficiency of the machine, so you should change or clean your air filters on a regular basis.

6. Your thermostat

One of the easiest ways to save energy is simply to set your thermostat at a relatively low temperature (68°F) in the winter, and at a higher temperature (76°F) in the summer so that the heating or cooling system runs less often.

If a house is caulked and weatherstripped to prevent cold drafts, most people—when dressed appropriately—are comfortable at 68°F during the winter. To save even more energy, temperatures can be adjusted to 50°F or 60°F while everyone is sleeping or when the house is empty.

Digital or clock thermostats (also known as **automatic setback thermostats**) can adjust the temperature automatically. For example, they can turn the heat down every night at 11:00 p.m., and then bring the temperature back up by 6:00 a.m. before you get out of bed. The newest kind of residential thermostat, or **home energy manager**, allows many temperature settings throughout the week. Depending on your lifestyle, these setback thermostats can pay for themselves in energy savings in as few as one or two years.

7. Ductwork

Unless there is a heating/cooling unit in each room of your house, you probably have a system to distribute hot or cool air from a central heater or air conditioner. Over 90% of central heating systems and virtually 100% of residential cooling systems in America have **forced-air-distribution systems**, which use air ducts to move warm or cold air to each room.

If this duct system leaks, it can waste large amounts of energy.

Any ductwork located in an unheated space (such as an attic or crawl space) has a high potential for heat loss. Ducts in such spaces should be insulated. All joints in the system should be properly sealed to make sure all the warm or cool air reaches its destination; air registers in each room should also be sealed. *Have this done by a professional.* While sealing a leaking duct system will reduce energy consumption, it will also reduce the amount of fresh air that leaks into the home. This may affect your combustion appliances, and, hence, your air quality. A qualified professional will know the proper precautions to take.

The second most common heat distribution system uses hot water, which is distributed through pipes to radiators. Any of these pipes carrying hot water should be insulated wherever they pass through unheated spaces.

8. Air-return ducts

Besides just the supply registers in each room which deliver heated or cooled air, there must be a central return duct to allow indoor air to get back to the heating/cooling unit. Many newer homes do not have a return register in every room, but instead rely on the space under closed doors to allow supply air to return to a central location. If you have a room that is uncomfortable (hard to heat or cool) when the door is shut but is fine when the door is open, you probably have an air distribution problem. Increase the cut under the door or call a heating/cooling specialist to solve the problem.

9. Location of the air intake/handler

The air intake/handler should be located in a heated space. If your air handler is in the garage, *never* leave your car running in the garage. The air handler can pick up car exhaust fumes, which contain carbon monoxide and other harmful pollutants, and distribute them to the house through the duct system.

10. Air-sealing

Once you have reached a comfortable temperature indoors, your goal is to keep it that way. Preventing unwanted air leaks and blocking heat transfer are two important steps in making your home energy-efficient.

Every house has openings through which outside air can enter. Some openings, such as windows and doors, are obvious pathways for air entry. Others, such as cracks around window frames, are unintentional. This uncontrolled leakage of air, known as *infiltration*, can account for a large portion of the total heat loss in a home—typically, about 30% of the total heating bill.

Sealing your home against air leakage is not difficult. However, you should seek the advice of an energy-service professional. Air-sealing saves energy, but it can cause unhealthy air to be trapped inside the house and can reduce the air available for combustion appliances. Do not attempt to air-seal your home until you have addressed the following problems:

- Gas or kerosene heaters (or gas fireplaces, if unvented) must be either removed or vented outdoors.
- If you have a gas range or cooktop that is not vented to the outside by a power-vent hood, you should not attempt to air-seal your home.
- High levels of radon must be reduced before sealing.
- Natural-draft appliances may pose problems; consult your energy professional about your particular situation.

For more information, contact your local Extension office or the U.S. Department of Energy's Energy Efficiency and Renewable Energy Clearinghouse (EREC) at the number listed in the reference section at the end of this factsheet.

11. Attic insulation

Even if you air-seal your house, you still must prevent the transfer of hot or cold air through walls, floors, and ceilings. Insulation acts like a blanket to retain the heating or cooling your system produces. Insulation materials are assigned an "R-value," which is a measure of how well they resist the flow of heat energy into or out of your home. The larger the R-value, the more heat (or cool air) is kept where you want it.

The recommended amount of insulation for a home varies with geographic location. The more ex-

treme a location's temperatures, the more insulation is needed. The recommended minimum values in Tennessee:

Attic	R26
Walls	R19
Floor	R13

Your local building supplier should be able to tell you how much insulation to use. Also, the EREC publication *Insulation Materials and Strategies* describes the insulation products on the market and provides recommendations for all areas of the United States by zip code. This publication also helps you decide whether to install insulation yourself or have it done professionally.

Make a note:

The table on page 6 of SP508M, *Assessing Your Homesite*, provides a space for you to list all the problem areas in your home that you find while completing *Home•A•Syst*. Take a few minutes now to list any heating/cooling problems you discovered as you completed *Assessing Your Home's Heating and Cooling Systems*. Later, when you complete *Assessing Your Homesite*, you will include these items on the map you draw of your property. Potential items from this factsheet include:

- uninsulated, unsealed ductwork
- unvented combustion appliances
- aging equipment

Remember:

- Make sure all combustion appliances are vented.
- Avoid operating a natural-draft combustion unit and an exhaust appliance such as a clothes dryer together in a confined space.
- Be alert to the possibility of backdrafting.
- Use unvented appliances only in open, well-ventilated areas.
- Have vents and flues checked annually.
- Make sure all natural-draft and power-vented appliances have access to a good air supply.

- If your system is older, invest in a new energy-efficient heating/cooling unit to save energy and money.
- Have your heating/cooling equipment checked by a professional every year.
- Change air filters regularly during the heating and cooling seasons.
- Set your thermostat low in the winter, and high in the summer. Or better yet, switch to a thermostat that can be programmed to different settings throughout the week.
- Insulate ductwork that passes through unheated space.
- Have a professional seal any leaks in the system.
- Keep bedroom doors open at night, especially if you have only one central air-return duct.
- Locate your air intake/handler in a heated space, preferably not in the garage.
- Contact an energy services professional before air-sealing your home.
- Make sure your insulation has the appropriate R-value.

If you want more information . . .

Contact:

- Your local Extension office
- Your local heating/cooling contractor
- U.S. Department of Energy
Energy Efficiency and Renewable Energy
Clearinghouse (EREC)
(800)DOE-EREC
(toll-free, 9:00 a.m. to 7:00 p.m. EST)
Call to obtain information on the topics in the assessment and much more.

- American Council for an Energy-Efficient Economy
2140 Shattuck Ave #2002
Berkeley CA 94704
For information on energy-efficient appliances.

Read:

- *Homemade Money: How to Save Energy and Dollars in Your Home.* Richard Heede. Brick House Publishing, 1995. 280 pp, \$14.95.
To order, write:

Rocky Mountain Institute
1739 Snowmass Creek Rd
Snowmass CO 81654

Download:

- <http://funnelweb.utcc.utk.edu/~utext>
The University of Tennessee Agricultural Extension Service home page.
- <http://www.homesafe.com/coalert/index.html>
Carbon Monoxide Alert. A complete guide to the dangers of carbon monoxide, backdrafting, and more.
- <http://www.stayout.com/fire.html>
A guide to preventing house fires. Covers hazards presented by heating systems.
- <http://www.csia.org>
The Chimney Safety Institute of America's home page.
- <http://www.cpco.com/energyedu/safety3.html>
Consumers Energy: Energy Safety. Includes information about carbon monoxide, including the steps to take if your carbon-monoxide detector sounds an alarm.
- <http://www.webdirectory.com>
Comprehensive environmental search engine/bulletin board—a great way to find information about any environmental topic.

This *Home•A•Syst* assessment does not cover all potential health or environmental risks related to combustion appliances or indoor air quality. It is meant to be a starting point for identifying and addressing the most apparent risks.

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Agricultural Extension Service

Billy G. Hicks, Dean