# Home Comfort Solutions Guide

Energy-efficient comfort—how to get the most from your heating and cooling system.

# Welcome

The cost of running your home's heating and cooling equipment probably represents around half of your annual utility bills. If you're looking to maximize comfort and energy efficiency, you've come to the right place.

If your heating and cooling equipment is energy-efficient but your utility bills are still high, air leaks, insufficient insulation, and/or leaky ducts could be the problem. However, if your equipment is more than 10 years old, it may be more cost-effective over the long-term to buy new higher-efficiency equipment now.

A professional HVAC contractor is in the best position to present and explain your options. Most contractors offer numerous alternatives, including equipment that bears the U.S. Environmental Protection Agency's (EPA's) ENERGY STAR label. ENERGY STAR-qualified equipment is the most efficient equipment on the market.

Now is a terrific time to purchase high-efficiency heating and cooling equipment. The American Recovery and Reinvestment Act of 2009 (ARRA) includes a federal tax credit for 30% of the cost of certain high-efficiency equipment installed between January 1, 2009 and December 31, 2010, up to a maximum credit of $1,500. However, some improvements, such as geothermal heat pumps, solar water heaters, and solar panels are not subject to the $1,500 maximum. In addition, local and/or state rebates may be available. Ask your HVAC contractor for more details.

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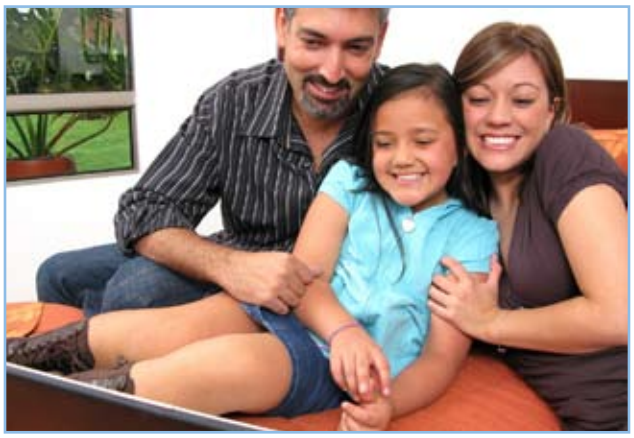


Chapter 1:

# Your House is a System

No matter how efficient your heating and cooling equipment is, if your home is not properly sealed and insulated, you will not be as comfortable as you could be and your system will have to work harder.

In addition, if you have leaky or poorly insulated ductwork, your home might have humidity problems, excessive dust, or rooms that never seem to get comfortable. Windows can present problems as well.

Before you invest in new HVAC equipment, check to make sure that the following areas of your home are in order.

## Seal Leaks

The exterior of your home—the outer walls, ceiling, windows, and floor—is called the "envelope" or "shell." When air leaks out from or enters your home through the envelope, your heating and cooling equipment has to use more energy.

Properly sealing and insulating your home can result in a 20% savings on your heating and cooling costs, or up to 10% on your total annual energy bill.

Many air leaks and drafts are easy to find because they are easy to feel—like those around windows and doors. But holes hidden in attics, basements, and crawlspaces are usually bigger problems. Sealing these leaks with caulk, spray foam, or weather stripping will have a great impact on improving your comfort and reducing utility bills.

Most homeowners can seal leaks themselves; however, you may want to consider asking your HVAC contractor to check your home for hidden leaks. Contractors have special diagnostic tools that will uncover these problematic areas.

## Add Insulation

Insulation keeps your home warm in the winter and cool in the summer. When correctly installed with air sealing, insulation can deliver comfort and lower energy bills during the hottest and coldest times of the year.

Insulation performance is measured by R-value—its ability to resist heat flow. Higher R-values mean more insulating power. Different R-values are recommended for walls, attics, basements, and crawlspaces, depending on your area of the country. Insulation works best when air is not moving through or around it, making it very important to seal air leaks before installing insulation to ensure that you get the best performance from the insulation.

To get the biggest savings, the easiest place to add insulation is usually in the attic. A quick way to see if you need more insulation is to look across your uncovered attic floor. If your insulation is level with or below the attic floor joists, you probably need to add more. The recommended insulation level for most attics is R-38 (or about 12 to 15 inches, depending on the insulation type). In the coldest climates, insulating up to R-49 is recommended.

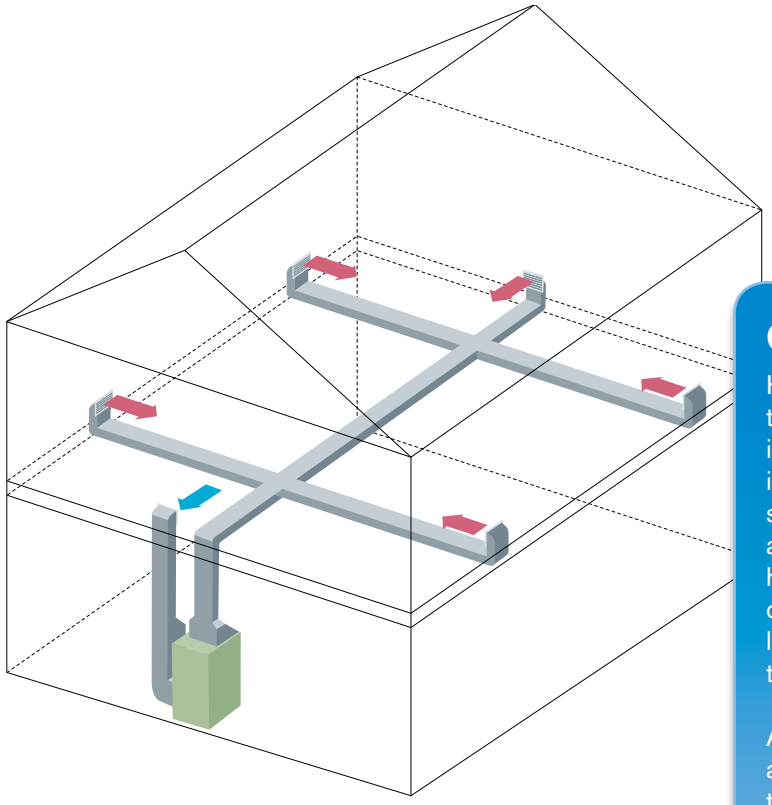
## Simple Ways to Improve Duct Performance

Ducts are used to distribute conditioned air throughout houses with forced-air heating and cooling systems. In typical houses, about 20% of the air that moves through the duct system is lost due to leaks, holes, and poorly connected ducts. The result is an inefficient HVAC system, high utility bills, and difficulty keeping the house comfortable, no matter how the thermostat is set.

### Common duct problems include:

- Leaky, torn, and disconnected ducts
- Poorly sealed registers and grills
- Leaks at furnace and filter slots
- Kinks in flexible ductwork restricting airflow

Because ducts are often concealed in walls, ceilings, attics, and basements, repairing them can be difficult. But there are things you can do to improve duct performance in your house. Start by sealing



leaks using mastic sealant or metal (foil) tape and insulating all the ducts that you can access such as those in the attic, crawlspace, basement, or garage. Do not use "duct tape," as it is not long-lasting.

Also make sure that the connections at vents and registers are well-sealed where they meet the floors, walls, and ceiling. These are common locations to find leaks and disconnected ductwork.

### A Word About Windows

Windows are an important part of your home's envelope. More efficient windows will help you save money and use less energy. Your estimated savings will vary depending on current heating and cooling costs in your region.

Energy-efficient windows do more than just lower energy bills; they help keep your home's temperature consistently comfortable. In the winter, the glass stays warmer and in the summer, they reduce the heat gain into the home without reducing the visible light.

If your house needs new windows, consider ENERGY STAR-qualified models. The ENERGY STAR guidelines for windows are tailored to four climate zones. For example, windows in the North are optimized to reduce heat loss in the winter, while windows in the South are optimized to reduce heat gain during the summer. For optimal results, select ENERGY STAR-qualified windows that are appropriate for your climate zone.

### Still Have Rooms that are Too Hot or Too Cold?

If you've sealed the leaks and ductwork in your home and you have adequate insulation and reasonably efficient windows and you are still experiencing rooms that are too hot or too cold, it could be because of:

- The home's construction—homes that are built on slabs tend to be colder, while two-story and split-level homes tend to have colder lower levels and warmer upper levels
- The direction—a south-facing room gets more sun and is likely to be warmer than a northern-facing room
- The number of windows in the room and the direction they face—changing the window coverings might help; if the room is too cold, add heavier drapes, or if it is too hot, use sheer coverings
- There are not enough air return ducts in the house—in this case, closed doors can cut off air supply and create a pressure imbalance throughout the entire house, affecting the comfort of all rooms

Your HVAC contractor can perform a heat load calculation of your home and may be able to "balance" your system in order to make the entire house more comfortable. If you've done all you can do on your own and you are still experiencing comfort issues, look to your contractor for solutions. In some cases, "zoning" the house (i.e., providing comfort control to individual rooms or specific areas of the house) can be a perfect solution. For more information about zoning, see page 7.

### Can Your House Be "Too" Tight?

Homeowners are often concerned about sealing their house too tightly; however, this is very unlikely in many older homes. A certain amount of fresh air is needed for good indoor air quality, and there are specifications that set the minimum amount of fresh air needed for a house. If you are concerned about how tight your home is, hire a contractor who can use diagnostic tools to measure your home's actual air leakage. If your home is too tight, a fresh air ventilation system may be recommended.

After any project where you reduce air leakage, have a heating and cooling technician check to make sure that your combustion appliances (gas- or oil-fired furnace, water heater, and dryer) are venting properly.

Chapter 2:

# Taking Control

Using a programmable thermostat is one of the easiest ways you can save energy in your home.

The average household spends more than $2,200 a year on energy bills—nearly half of which goes to heating and cooling. Homeowners can save about $180 a year by properly setting their programmable thermostats and maintaining those settings.

The pre-programmed settings that come with programmable thermostats are intended to deliver savings without sacrificing comfort. Depending on your family's schedule, you can see significant savings by sticking with those settings or adjust them as appropriate for your family.

### What to Look for in a Programmable Thermostat

In general, every programmable thermostat comes with four pre-programmed settings and maintains those settings within two degrees. Many qualified models also come with additional features, such as:

- Digital, backlit displays
- Touch-pad screen programming
- Voice and/or phone programming
- Hold/permanent/vacation features
- Indicators that tell you when it's time to change air filters
- Indicators that signal malfunctioning of heating/cooling systems
- Adaptive Recovery/Smart Recovery features—control features that sense the amount of time it will take to reach the next set-point temperature, and reach desired temperatures by the set time

To decide which model is best for you, think about your schedule and how often you are away from home for regular periods of time. Then decide which of the three different models best fits your schedule: the 7-day, 5+2-day, or the 5-1-1-day.

7-day models are best if your daily schedule tends to change. They give you the most flexibility, and let you set different programs for different days—usually with four possible temperature periods per day.

5+2-day models use the same schedule every weekday, and another for weekends.

5-1-1 models are best if you tend to keep one schedule Monday through Friday and another schedule on Saturdays and Sundays.


### Proper Installation

Your programmable thermostat should be installed on an interior wall, away from heating or cooling vents and other sources of heat or drafts (e.g., doorways, windows, skylights, direct sunlight, or bright lamps).

If you're replacing an older programmable thermostat, be sure to read directions carefully and take the proper safety precautions. Programmable thermostats are a low-voltage wiring installation and involve anywhere from 2 to 10 wires, depending on your type of heating and cooling system. The electricity should be shut-off during any replacement. The previous attachment points will reconnect your new unit.

If the job requires more than just a replacement, call your HVAC contractor to ensure proper installation. It's a good idea to upgrade an old manual thermostat to a programmable unit if you're replacing a central air conditioning or heating system, given that programmable thermostats are far more accurate and will maximize the efficiency of your new system. Heat pumps may require a special unit to maximize energy savings year-round.

Also, if you're replacing a manual thermostat that has a mercury switch, be careful not to break the tube that holds this toxic substance. Contact your local recycling/hazardous materials center, or the manufacturer of your new thermostat, for advice on proper disposal.

### How to Use Your Programmable Thermostat

- Keep the temperature set at its energy savings set-points for long periods of time (at least eight hours), for example, through the night after bedtime.
- All thermostats let you temporarily make an area warmer or cooler, without erasing the pre-set programming. This override is cancelled automatically at the next program period. You use more energy (and end up paying more on energy bills) if you consistently "hold" or over-ride the pre-programmed settings.
- Units typically have two types of hold features: hold/permanent/vacation and temporary. Avoid using the hold/permanent/vacation feature to manage day-to-day temperature settings. "Hold" or "vacation" features are best when you're planning to be away for an extended period. Set this feature at a constant, efficient temperature (i.e., several degrees warmer in the summer or several degrees cooler in the winter) when going away for the weekend or on vacation. You'll waste energy and money if you leave the "hold" feature at the comfort setting while you're away.
- Turning your unit up to 90 degrees or down to 40 degrees, for example, will not heat or cool your house any faster. Most thermostats, including ENERGY STAR-qualified units, begin to heat or cool at a set time, to reach set-point temperatures some time thereafter. Units with adaptive (smart/intelligent) recovery features are an exception to this rule. Adaptive recovery units are constantly calculating the amount of time required to heat or cool the house, so that it reaches that temperature when the homeowner programmed it. By "examining" the performance of the past few days the thermostat can keep track of the seasons. In this way, your house is always at the comfort levels when occupied, but saving the most energy when unoccupied.
- Many homes use just one thermostat to control the whole house. If your home has multiple heating or cooling zones, you'll need a programmable setback thermostat for each zone to maximize comfort, convenience, and energy savings throughout the house.
- If your programmable thermostat runs on batteries, don't forget to change the batteries each year. Some units will indicate when batteries must be changed.

### If You Still Have a Manual Thermostat…

Make the most of your manual thermostat by adjusting the temperatures daily before you leave the house and when you go to sleep at night. Typically, adjusting temperatures 5 to 8 degrees (down in the winter or up in the summer) can help save energy if you're going to be away from home for several hours.

## Zoned Temperature Control: Is it Right for Your Home?

A zoned comfort system is one that consists of more than one thermostat. The thermostats are connected to a control panel that operates a number of "dampers" in your comfort system. Conditioned air is then distributed to the "zoned" rooms or areas as needed.

Zoned systems are easier to install during new construction; however, they can be installed in existing homes as well.

If you have a cold basement, a zoned system would enable you to keep only the basement warmer than the rest of the house. If you have a large house with certain rooms that are not used very often, you can keep those rooms at lower temperatures than the rest of the house.

The primary benefits of a zoned system are comfort and energy savings. According to the U.S. Department of Energy (DOE), zoning, combined with programmable thermostats, can save homeowners up to 30% on their energy bills.

Chapter 3:

# Replacing Equipment

All too often, homeowners wait to replace their equipment until they experience a breakdown. However, if your equipment is more than 10 years old, it may be more cost-effective over the long-term to buy new, higher-efficiency equipment. In any case, it's wise to research your options before your current system fails, so you can make an informed decision if you need to act quickly.

Before you invest in a new HVAC system, make sure that you have addressed the air leaks in your house and the duct system. Sometimes, these are the real sources of problems rather than your HVAC equipment.

There are many replacement options available on the market. Your HVAC contractor can help you sort through the options and conduct an energy-usage/payback analysis to help you choose the right equipment for your own particular needs.

## Furnaces

Furnaces are the most commonly used residential heating system in the U.S. Running most often on gas, but sometimes on oil, propane, or electricity, furnaces deliver heat through a duct system. Furnace efficiency is measured by Annual Fuel Utilization Efficiency (AFUE)—the higher the AFUE rating, the more efficient the furnace.

"Condensing" furnaces are among the most efficient on the marketplace. In these furnaces, the transfer of heat is so thorough that water or condensate is a byproduct of combustion. This condensing occurs with systems that are more than 90% efficient. Another feature of efficient furnaces is a highly efficient blower motor—commonly called an Electronically Commutated Motor (ECM)—or another type of "advanced main air circulating fan."

## Boilers

A boiler heats your home by burning gas, propane, or oil to heat water or steam that circulates through radiators, baseboards, or radiant floor systems. Boilers do not use a duct system. Boiler efficiency, like furnace efficiency, is measured by AFUE; the higher the AFUE rating, the more efficient the boiler. Features that improve boiler efficiency include electronic ignition, which eliminates the need to have the pilot light burning all the time, and technologies that extract more heat from the same amount of fuel.

## Heat Pumps

Heat pumps provide both heating and cooling in one integrated system.

### *Electric Air-Source Heat Pumps (ASHPs)*

ASHPs, often used in moderate climates, use the difference between outdoor and indoor air temperatures to cool and heat. Higher Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER) ratings mean higher efficiency. Heat pump efficiency also is measured by Heating and Seasonal Performance Factor (HSPF), which measures the unit's heating efficiency.

### *Geothermal Heat Pumps (GHPs)*

GHPs are similar to air-source heat pumps, but use the free energy from the ground instead of outside air to provide heating, cooling,

and often water heating. Because they use the earth's natural heat, they are among the most efficient heating and cooling technologies currently available. GHPs also can be coupled with solar panels or wind energy systems to further reduce the amount of electricity required to operate them. Although initially expensive, GHPs often produce significant cost savings on energy bills and pay from themselves after a reasonable number of years.

### Central Air Conditioners

Most residential central air conditioners are called "split-systems" because they have an outdoor component with a condenser and compressor and an indoor component with an evaporator coil. It's very important to replace both of these units at the same time. Installing a new outdoor unit without replacing the indoor unit is likely to result in low efficiency, and may lead to premature system failure.

High-efficiency models have higher SEER and EER ratings than other models. SEER is the most commonly used measurement of efficiency for air conditioners. It measures how efficiently a cooling system will operate over an entire season. EER measures how efficiently a cooling system will operate when the outdoor temperature is at a specific level.

The central air conditioner also needs a blower motor—which is usually part of the furnace—to blow the cool air through the duct system. To ensure that your new air conditioner will perform at its rated efficiency, it's a good idea to replace your heating system at the same time. It's especially recommended if your furnace is more than 15 years old. If you purchase a new energy-efficient air conditioner but connect it to an older furnace and blower motor, your system will not perform to its rated efficiency.

### Ductless Split-System Air Conditioners and Heat Pumps

Ductless split-system air conditioners and heat pumps, sometimes called "mini-splits," are air conditioners or heat pumps that do not use ductwork to distribute air. Mini-splits are used mostly for smaller area cooling. They may consist of one, two, three, or even four indoor units acting as a single system. Mini-splits are common in Europe and Asia but represent less than 5% of the U.S. market. They are an option for older homes that do not have ductwork to accommodate a conventional ducted system or homes or businesses that have hot or cold spots.

Ductless systems are made up of four components: The condensing unit, located outside the building; the indoor unit, or units, which can be wall-mounted, suspended from the ceiling, or mounted in the ceiling; refrigerant lines, which connect the outdoor unit to the indoor unit; and a hand-held wireless remote or wall monitor that controls the entire system. High-efficiency models are available.

### Humidifiers/Dehumidifiers

Some homes need more moisture added to the air, while others need to have excess moisture removed. If your house is too dry, you may experience itchy skin, irritated sinuses, and too much static electricity—you may even notice chipped paint or cracked wood floors. If your house is too damp, you run the risk of developing problems with dust mites, mold, mildew, bacteria, and insects.

Although portable units are available on the marketplace, you may want to consider a whole-house unit that attaches to your central heating and cooling system. Portable units provide relief only in the room they are placed in. Whole-house units provide comfort to the entire living environment.

### Air Filtration and Ventilation Solutions

There are many options for keeping the air in your home clean, from portable, cord-connected air cleaners to central filtration products that work with your heating and cooling system, to UV air disinfection equipment that uses light to reduce airborne bacteria, viruses, and allergens. If allergies are a concern, or you are just interested in learning more about better indoor air quality, ask your HVAC contractor about today's advanced options.

### Fans

Fans can be an important part of your energy-efficiency strategy.

Whole-house fans, not to be confused with attic fans, are mounted in the attic floor and pull cooler air from outside into the house through windows to lower the temperature of the house. Whole-house fans work well in climates where the days are hot but the evenings cool off quickly and there is low humidity (such as in the desert).

In some cases, whole-house fans can be used instead of air conditioning to cool off a house after a hot day. For example, when the temperature inside the house is 80 to 85 degrees and the temperature outside is 60 to 70 degrees after the sun goes down, the fan can be used to pull the cool, dry outdoor air in through

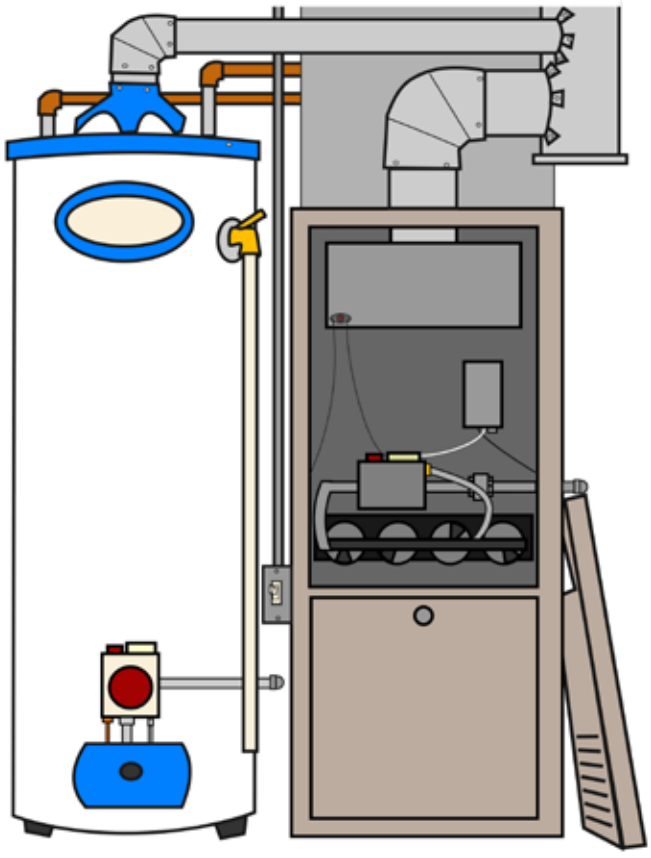
the windows to quickly cool off the house instead of using the air conditioner. In a few minutes the house cools down and the fan can be turned off. The fan works quickly and uses much less energy than air conditioning.

Ceiling fans can be used in the summer with the blades run downward to create a cool breeze. If you raise your thermostat by only two degrees and use your ceiling fan, you can lower air conditioning costs by up to 14% over the course of the cooling season.

Even in the winter, your ceiling fan can help improve comfort. Most fans have a switch that allows you to reverse the motor and operate the ceiling fan at a low speed in the opposite direction. This produces a gentle updraft, which forces warm air near the ceiling down into the living space.

Ceiling fans cool only people, not the room, so when you leave the room, turn the ceiling fan off.

Not all homes have whole-house fans or ceiling fans, but most every home does have ventilating fans, at least in the bathrooms. If you need to replace a ventilating fan, keep in mind that ENERGY STAR-qualified models, which use 70% less energy than standard models, are available. These high-efficiency fans provide better comfort with less noise and use high-performance blades and motors that work better and last longer than motors used in conventional models.



## Having a Home Built?

New home construction is the perfect time to install today's latest technologies. Many renewable sources of energy–such as solar, wind, and geothermal–are available to power your home's heating and cooling equipment.

If you are building a new house and you do not have an existing relationship with an HVAC contractor who can help you understand all of your options for the home's mechanical systems, ask your architect or builder. A growing number of consumers are asking for state-of-the-art, energy-efficient equipment in their homes. Some architects and builders are very progressive and well-versed on today's "green" options, while others are just learning. Ask them who the HVAC contractor will be if you are not requesting a specific company. Talk to the contactor about the system before it is installed rather than after. Ask whether the contractor provides service and maintenance and at what annual costs. And get all the warranty information on the equipment that will be installed in your house.

### Water Heaters

There are many highly efficient water heaters on the market today. These include gas condensing tank units, heat pump water heaters, solar water heaters, and gas tankless water heaters. While state-of-the-art options almost always cost more up-front, they usually save money in the long run depending on your family's water usage patterns.

Chapter 4:

# What to Look for in an HVAC Contractor

Hopefully, you've established a good working relationship with a local comfort professional—if not, use the following tips to identify the right company in your area:

**Do your homework—**Research the license and insurance requirements for contractors in your state. Before you call a contractor, locate the model number of your current system and pull your maintenance records. Also make note of any uncomfortable rooms. This will help potential contractors better understand your comfort system needs.

**Ask for referrals—**Ask friends, neighbors, and co-workers for contractor referrals. You can also contact local trade organizations for names of members in your area.

**Call references—**Ask contractors for customer references and call them. Ask about the contractor's installation or service performance, and if the job was completed on time and within budget.

**Ask about high-efficiency products—**ENERGY STAR-qualified products meet strict energy efficiency guidelines set by the EPA and offer significant long-term energy savings. Contractors should be able to show you calculations of savings for ENERGY STAR heating and cooling equipment.

**Find special offers—**A heating and cooling system is one of the largest purchases you'll make as a homeowner. Keep your costs down by checking for available rebates on energy-efficient ENERGY STAR-qualified heating and cooling equipment. Begin your search at www.energystar.gov.

**Expect a thorough home evaluation—**The contractor should spend significant time inspecting your current system and home to assess your needs. A bigger system isn't always better; a contractor should size the heating and cooling system based on the size of your house, level of insulation, and windows. A good contractor will inspect your duct system (if applicable) for air leaks and insulation and measure air flow to make sure it meets manufacturer specifications.

**Be open to suggestions—**The owners and managers of the best contracting firms keep up on all the latest technologies available. Even though you may have spent a lot of time researching systems prior to calling in an expert, keep an open mind if the contractor makes suggestions you hadn't previously thought of.

**Get written, itemized estimates—**When comparing contractors' proposals (bids), be sure to compare cost, energy efficiency, warranties, and the contracting firm itself. A lowest price may not be the best deal if it's not the most efficient because your energy costs will be higher.

**You pay for what you get—**Professional contracting firms may need to charge more because they invest in high-quality employees and ongoing training. Check to see if the company's technicians are NATE-certified (North American Technician Excellence, Inc.) and whether the firm is a member of industry associations.

**Get it in writing—**Sign a written proposal with a contractor before work begins. It will protect you by specifying project costs, model numbers, job schedule, and warranty information.

Chapter 5:

# A Quality Installation is Key

When you purchase a new heating or cooling system, you expect high performance. Unfortunately, more than half of new systems installed in U.S. homes do not perform to their rated efficiency as a result of improper installation. In fact, improper installation can reduce performance by as much as 30%. This not only affects your utility bills, but can lead to a variety of comfort problems, including insufficient dehumidification, dust from leaking ductwork, and poor air distribution.

Make sure to ask your contractor if their work meets guidelines set by ENERGY STAR and the Air Conditioning Contractors of America (ACCA). These guidelines include:

## Proper Sizing of Equipment

Installing the right size equipment for the home is essential to getting the best performance and comfort. Many homeowners believe that bigger is better when buying new heating and cooling equipment. But in reality, a system that is too large will not keep your home comfortable because of frequent on-off cycling. Incorrect sizing also can put stress on system components and shorten the equipment's life.

To ensure proper sizing, your contractor should calculate your home's heating and cooling loads using ACCA's Manual J or equivalent. The contractor should provide a copy of the home's heat gain/loss calculations for your records.

## Sealing Ducts

To ensure that ducts are properly sealed your contractor should test the leakage rate. If the ducts are very leaky (i.e., more than 20% of the air moving through the system is leaking into spaces you do not want heated or cooled) your contractor should use duct sealant (mastic), a metal-backed (foil) tape, or an aerosol sealant to seal the seams and connections of ducts. After the ducts are sealed ask your contractor to wrap them in insulation.

## Proper Refrigerant Charge (Central Air Conditioners and Heat Pumps)

A properly charged system will operate more efficiently and help prolong the life of the heating and cooling system. To ensure the system has the correct amount of refrigerant a contractor must test and confirm that the system is properly charged. If the system is not properly charged the contractor should make the appropriate adjustment by adding or removing refrigerant.

## Optimizing Air Flow

If air flow in your heating and cooling system is too high or too low, you may experience problems and higher utility bills. A contractor should test air flow and make any needed adjustments for optimal performance.

## Quality Installation Checklist

When installing your new heating and cooling equipment, your contractor should:

- Provide adequate room around the equipment for service and maintenance.
- Install and set up a programmable thermostat (if not already in use).
- Show you how to change the filter(s).
- Test and verify proper air flow (if working with a furnace or heat pump).
- Verify that your furnace or boiler has been tested for proper burner operation and proper venting of flue gases. The vent piping should be inspected for leaks or deterioration and repaired or replaced as necessary.
- Install a properly matched indoor coil when replacing an outdoor unit. An old coil will not work efficiently with a new outdoor unit. Your contractor should provide an Air-Conditioning, Heating, and Refrigeration Institute (AHRI) certificate to document that your system was properly matched.
- Confirm that the level of refrigerant charge and the air flow across the indoor coil meets the manufacturer's recommendation. It's estimated that more than 60% of central air conditioners are incorrectly charged during installation.
- Place the condenser in an area that can be protected from rain, snow, or vegetation, as specified by the manufacturer. If you have a central air conditioning unit, cover your outside equipment during the winter to protect it from snow and ice. Heat pumps need to be left uncovered to properly operate during the winter.
- If you've purchased equipment that qualifies for a tax credit or other rebates, your contractor should provide you with an AHRI certificate verifying the system's efficiency to keep with your tax records.

Chapter 6:

# Maintaining Your Equipment

Your heating and cooling equipment needs regular inspections and maintenance to keep it operating effectively and efficiently. If your equipment is new, keep in mind that warranties only cover certain functional parts for a specified length of time. Failure to maintain your system may void the warranty.

Dirt and neglect are the top causes of heating and cooling system inefficiency and failure. To prevent problems, stay on a regular maintenance schedule. Have your HVAC contractor inspect and clean the system twice a year, in the spring and fall.

Most contractors offer discounted annual maintenance contracts. Customers who sign up are often offered discounts on parts and labor and priority scheduling as well. In most cases, these agreements are transferable if you sell your home.

**The benefits of regular maintenance include:**

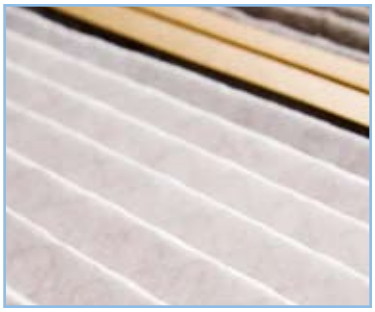
- Improved system efficiency
- Extended equipment life
- Improved capacity
- Savings on your utility bills

In addition to regular tune-ups, the most important thing you can do to ensure efficient operation is replace your filters regularly. A clean filter will prevent dust and dirt from building up in the system, which can lead to expensive maintenance and/or early system failure. Check your filter every month, especially during the winter and summer months, when use tends to be heavier. Change your filter if it's dirty—or at least every three months.

Every contracting firm has its own maintenance checklist, but here are some general guidelines on what to expect. Remember to always ask for a written copy of all functions performed and file it with your records.

## Biannual System Maintenance Checklist

- Check thermostat settings to ensure the heating and cooling system turns on and off at the programmed temperatures.
- Tighten all electrical connections and measure voltage and current on motors. Faulty electrical connections can cause your system to operate unsafely and reduce the life of major components.
- Lubricate moving parts. Parts that lack lubrication cause friction in motors and increase the amount of electricity you use. Lack of lubrication also can cause equipment to wear out more quickly, requiring more frequent repairs or replacements.
- Check and inspect the condensate drain in your central air conditioner, furnace, and/or heat pump (when in cooling mode). If plugged, the drain can cause water damage in the house, affect indoor humidity levels, and breed bacteria and mold.
- Check system controls to ensure proper and safe operation. Check the starting cycle of the equipment to assure the system starts, operates, and shuts off properly.
- Inspect, clean, or change the air filter in your central air conditioner, furnace, and/or heat pump. Your contractor can show you how to do this yourself. Depending on your system, your filter may be located in the duct system versus the heating and cooling equipment itself.



## Additional System-Specific Maintenance Activities For Heating Systems

- Inspect the flue piping for rusting and any disconnections or evidence of back drafting.
- Check all gas (or oil) connections, gas pressure, burner combustion, and heat exchanger. Improper burner operation can be caused by a dirty burner or a cracked heat exchanger—either can cause the equipment to operate less safely and efficiently. Leaking gas (or oil) connections are also a fire hazard and can contribute to health problems.

## Additional System-Specific Maintenance Activities For Cooling Systems

- Clean indoor and outdoor coils before warm weather starts. A dirty coil reduces the system's ability to cool your home and causes the system to run longer, increasing your energy costs and shortening the life of your equipment.

- Check your central air conditioner's refrigerant charge and adjust it if necessary to make sure it meets manufacturer specifications. Too much or too little refrigerant charge can damage the compressor, reducing the life of your equipment and increasing costs.

- Clean and adjust blower components to provide proper system air flow. Proper air flow over the indoor coil is necessary for efficient equipment operation and reliability.

## Basic Troubleshooting

If you're experiencing problems with your system, there are a few things you can check before calling your HVAC contractor.

If your system won't start, check to see that the power switch is on and that the fuses are good. Make sure the thermostat is set correctly and that it is operating properly. Sometimes a programmable thermostat is the problem.

If there is too little air coming out of the ducts, check for blocked ducts, loose connections, closed dampers, crimps, and bends. Check the air blower for dirt and debris and if the filter is dirty, replace it immediately.

## Call Your Contractor…

If you've tried the suggestions above to no avail, contact your HVAC contractor. Other reasons you may need service include:

- Your system is operating, but it is cycling on and off more frequently than it should
- Stale odors are coming from the ductwork
- Breakers keep tripping or fuses keep blowing
- Ice appears on your air conditioner or piping
- Your home is drier than it used to be, or you are experiencing more odors and/or moisture than normal (e.g., foggy windows, musty smells)

Chapter 7:

# For More Information

Upgrading to higher efficiency heating and cooling equipment does more than help you save on your utility bills—it helps reduce greenhouse gas emissions that harm the environment.

According to the EPA, your home can cause twice the greenhouse gas emissions of a car. To learn more about how you can help combat this problem—all while reducing your energy costs—consult the following resources:

### The Air Conditioning Contractors of America

An association of more than 4,000 air conditioning contractors that has issued standards for quality installations throughout the U.S. www.acca.org

### The Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

AHRI is the trade association representing more than 300 manufacturers of air conditioning, heating, and commercial refrigeration equipment. AHRI offers homeowners information about how different types of equipment work; system maintenance tips; buying guidance; and more. www.ahrinet.org

For information on the efficiency requirements necessary in order to claim federal energy-efficiency tax credits, go to: http://ahrinet.org/Content/FederalTaxCredits_896.aspx

### Database of State Incentives for Renewables & Efficiency (DSIRE)

A comprehensive source of information on state, local, utility, and federal incentives and policies that promote renewable energy and energy efficiency. www.dsireusa.org

### ENERGY STAR

ENERGY STAR is a joint program of the EPA and the DOE, helping us all save money and protect the environment through energy-efficient products and practices. Products that bear the ENERGY STAR label meet strict energy efficiency guidelines set by the EPA and DOE. Energy-efficient choices can save homeowners about a third on their energy bill with similar savings of greenhouse gas emissions, without sacrificing features, style, or comfort. www.energystar.gov

### ENERGY STAR Home Energy Yardstick: What's Your Score?

This calculator will help you compare your household's energy use to others across the country and get recommendations for improvements. http://tinyurl.com/yk6n973

### ENERGY STAR'S Guide to Energy-Efficient Heating and Cooling

This 24-page guide explains how much you can expect to save by using ENERGY STAR-qualified heating and cooling equipment. http://tinyurl.com/yc39snm

### ENERGY STAR's Heating & Air Conditioning Installation Bid Comparison Checklist

A form that helps you compare three contracting firms. http://tinyurl.com/y8ckce2

### ENERGY STAR Publications

Links to publications offered free of charge. http://tinyurl.com/yhfe4ms

### Heating and Cooling Tips and Resources

NATE (North American Technician Excellence, Inc.) is the nation's largest independent, third-party nonprofit certification organization for HVACR technicians. This subsite of the NATE website features an energy savings calculator to determine if you should upgrade your system; guidance on HVAC maintenance; information on carbon monoxide; a heating and cooling checklist; and more. www.hvacradvice.com

### U.S. Department of Energy (DOE)

DOE's primary website features information about energy sources, energy efficiency, the environment, prices and trends, national security, and safety and health. www.energy.gov

### U.S. DOE's Energy Savers Website

Learn how to save energy and use clean, renewable technologies at home, while driving, and at work. This website features a comprehensive section on heating and cooling equipment and includes information about rebates, tax credits, and financing. An interactive map shows you what rebates are available in your state for new high-efficiency appliances. www.energysavers.gov