An assessment of the physical condition of the house itself is a complicated part of purchasing an existing house. Costly repairs to structural or mechanical systems can be avoided or at least anticipated by a preliminary inspection of the property before a purchase offer is signed. Even if you are looking for an older house that needs repairs, you will be in a better position to negotiate if you are familiar with the extent of repairs that will be needed.

The inspection of a house is a job that requires specific technical skills. This Fact Sheet will explain some of the most important areas examined during the home inspection process and things prospective homeowners should be looking for. While you can become familiar enough with common problems that will enable you to eliminate certain houses from the purchase consideration, a professional home inspection usually occurs after a purchase offer is accepted. Your purchase offer can contain a clause that the purchase contract is contingent on acceptable inspection results.

**Foundations**
Whether a house is built over a full basement, over a crawl space, or on a concrete slab, it requires a foundation system capable of supporting its weight and distributing that weight evenly to the soil below. In addition, a foundation must be able to withstand the lateral (sideways) forces of soil pushing against it without allowing cracks and leaks to form. Finally, the foundation provides a firm anchor for the building above. These concepts are illustrated in figure 1.

![Figure 1: The forces on a foundation](image)

**Types**
The term *slab-on-grade* refers to a type of construction in which a house rests on a concrete slab. The foundation for this type of home consists of walls beneath the slab and around its perimeter, which extend to the *frost line*, or the maximum depth the earth freezes in the wintertime (the depth of the frost line depends on local climate and soil conditions).
Continuous foundation walls (stem walls) or a pier foundation system may be used for a home built over a crawl space. With either of these types, pillars of concrete block, poured concrete, treated wood, steel pipe, or other appropriate materials are spaced to provide interior support for the walls and floor of the house above. Such pillars extend to the frost line and rest on individual footings. Full-height foundation walls for basements also extend to below the frost line.

The houses you consider for purchase may have one or more foundation types and materials, particularly if additions have been made to the houses. For example, a two story ranch house may be built over a full basement with poured concrete walls and may also have a family room addition built over a crawl space.

Figure 2: Foundation footing

Building Materials

A number of different materials are used to build house foundations. Concrete blocks, or concrete masonry units, are commonly used for this purpose. Their hollow cores may be filled with concrete that is reinforced with metal bars, filled with insulation, or left empty. Foundation walls of fieldstone are typical in older houses and more difficult to inspect. New houses may have poured concrete foundations. All-weather wood foundations are built using conventional framing techniques and pressure-treated wood members. Each of those materials can offer a strong foundation that is also resistant to moisture penetration.

Inspecting for Damage

A careful inspection of a foundation should be made from the outside of the house, to the extent possible, as well as from the inside. Outside the house, look at the overall condition of the foundation system beginning with how it is set in the ground. If it is built into a hillside, check the area around the house for cracks in the earth that run perpendicular to the slope. These could indicate earth slides, which damage foundations by undermining them. Whether the site is on a slope or flat area, check to see whether rainwater can flow away from the foundation on all sides of the house. Roof gutters and downspouts are almost always necessary. If there are no gutters or downspouts and drainage is poor, rainwater can run down a foundation wall and cause structural problems as well as a wet basement.

Look at any exposed masonry foundation walls (concrete block or poured concrete) for cracks. Although it is not always possible to diagnose foundation problems from cracks alone, they could indicate the potential for serious conditions. Cracks at corners and vertical cracks that are wider at the top than at the bottom may indicate that settling has occurred. In concrete walls, hairline cracks are not likely to indicate serious problems, but large cracks may mean that metal reinforcing bars were not used. In either concrete block or poured concrete foundation walls, check for large
horizontal cracks. These usually indicate structural problems and may warrant a professional evaluation.

If the house you are considering was built using foundation piers, examine the piers to see if any shifting has occurred. The house sill plate and any supporting beams should rest squarely and evenly on the piers (see figure 3). Likewise, are crawl space walls straight and free of cracks? Are there any gaps between the wall and sill plate?

Ideally, the exterior of a foundation wall for a full basement should be treated with a waterproofing layer and protected with drainage tile set beside the footing (see figure 2 on page 2). Most likely, you will not be able to see these items. You can ask the seller about them, but conditions inside the basement can indicate whether water problems exist.

When you examine a foundation wall from inside a full basement, look for any signs of water damage, such as stains on the walls or floor. Specific problems to look for are leakage (water entry through cracks) and seepage (water entry through porous masonry materials). Notice if a sump pump has been installed for water removal. The pump may be removing water adequately, but you may need to ask specific questions or even observe it in operation (by turning the pump on or by filling the sump pit with water). While basement water problems can lead to serious structural defects, their remedies are not always difficult and expensive. You may need to consult a professional house inspector to help you evaluate any basement water problems.

If the house you are examining is located where termites are known to exist, check the exterior and interior sides of the foundation walls for shelter tubes. Termites build these tubes out of mud and often attach them to the foundation walls to provide a path from the soil to wooden house components, such as floor joists.

**Floors**
The floors of a house can serve several functions in addition to providing strong and level surfaces for people and furniture. Depending on the type of house construction, they may be supporting exterior walls and the roof. The floors on every level of a house should be inspected to determine if they are strong and level.

If the house has a full basement with exposed ceiling joists, use the basement as your starting point for checking the floors. First, look at the joists that support the floor above. Test several for signs of decay by forcing a sharp pencil, a screwdriver, or a small blade from a penknife into them. Test the sill plate in the same way. Softwood may indicate moisture or insect damage—conditions that can cause serious structural problems. Other signs of these
problems that you can look for are the growth of fungus on wood and evidence of insects, such as termite shelter tubes and small holes in wood.

If the house is built over a crawl space, it is important to examine the joists and the sill plate in that space as well. Because it may be difficult to move around in a crawl space, be prepared for this by bringing overalls and a flashlight.

Floor surfaces should also be examined. Points to consider include whether they are level and of adequate strength. If the basement has a floor of concrete, look for cracks and other defects, which not only are possible radon entry routes but also complicate the application of tile or carpeting. For floors on other levels of the house, try bouncing on them by lifting yourself on your toes and dropping suddenly to your heels. Do this in several spots of every room. If you feel a bounce to a floor, or if it sags toward the middle of the room, the joists may be too small for their span, or supporting walls or columns may have been removed during alterations by a previous owner. Squeaky floors may indicate that no subfloor was used. Both of these situations may be expensive problems to correct.

The condition of floor coverings is also important. If you think that you will want to sand hardwood floors, lift up a floor register or carefully pry loose a piece of baseboard trim to see how much wood remains. Previous sanding may have reduced floor thickness and excessive sanding can expose floor nails. If a floor is covered with resilient tiles, note if there are excessive gaps between the tiles (more than a dime’s thickness) or if the tile corners are beginning to curl. These conditions may warrant tile replacement. Be aware that old floor tiles may contain asbestos and that precautionary measures and any state or local regulations concerning asbestos removal should be observed.

Check any hard-surface floors such as ceramic tiles or concrete. These may have small cracks as a result of weight or stress.

If rooms are carpeted, you should inspect these areas for stains and indications of excessive wear. Carpeting can hold odors and moisture and may hide conditions which need attention.

**Walls and Partitions**

**Interior**

Walls, generally, form the enclosure of a building or room. The interior walls of a house or apartment are also called partitions. Almost all exterior walls help support the house and roof, and some interior partitions help do this also. These are called load-bearing partitions and can be located by finding the direction in which floor and ceiling joists run. If floor and ceiling joists are perpendicular to a partition, you can assume it is load-bearing. If joists run parallel to a partition, it probably is not load-bearing. If you plan any changes that would involve moving part or all of a partition or wall, consult an engineer or architect for guidance in making your renovations. It is possible that you could weaken the structure of the house without knowing it for some time.

In walls or partitions, minor cosmetic imperfections are no cause for worry, but other conditions may be more important to examine carefully. Large cracks and peeling paint or wallpaper may indicate water penetration from the outside or damage from plumbing system leaks. Some
cracks may be caused by house settling or seasonal movement from temperature and humidity changes. Settling cracks can be repaired as long as movement has stopped. Seasonal cracks can be treated with flexible caulking compounds.

Exterior

Exterior walls are covered with a variety of siding materials. Wood shakes, shingles, clapboards, or panels require either stain or paint for protection. If paint has been used, look for any blisters that expose bare wood. This is often a sign of moisture migration from inside a house to the outside. When this happens, paint is pushed off the wood. In heating climates, a properly applied interior vapor retarder or air barrier prevents this condition from occurring.

Because brick and other types of masonry walls expand in warm weather and contract in cold weather, cracks can form that may need treatment with caulking compounds or expansion joints. Moisture movement from inside the house to the outside can also cause cracks to form. More serious cracks can be caused by foundation problems and uneven house settling. Bulging and leaning of masonry walls may be caused by inadequate attachment of masonry to the structure or by movements in the roof. A structural engineer or a house inspector may be able to assess the seriousness of these conditions.

While aluminum, steel, and vinyl siding materials require little maintenance other than regular cleaning, they may have been used to cover up decayed wood. Check for loose panels and cracks, and with the metal sidings, look at the condition of the paint. Even if local electric codes do not require metal siding materials to be grounded, look for or ask about a grounding connection.

Asbestos shingles are common in many areas. Referred to as cementitious asbestos, this material has asbestos fibers embedded in cement. If left undisturbed, the fibers are not released into the air. But because these shingles are brittle, you may find many shingles that are cracked or broken. State and local laws may regulate the removal of this material from a house and its ultimate disposal.

Regardless of the type of siding material applied to a house, the critical areas that should be inspected are places where materials are joined or where dissimilar building materials meet: the seam formed where wood or metal siding meets a masonry chimney, house corners, and the joint at the foundation wall and sidewall. All of these are potential areas for rainwater to enter a house or for heat to escape. These are best treated with a high quality caulk.

The Roof

The roof of a house is designed to protect the structure underneath from the weather, especially rain water. Roofs are most easily classified by their design. A gable roof has two sloped surfaces that meet at a point known as the ridge. The triangular walls on each side of the roof are known as gables. A hip roof slopes away from the ridge in four directions. Similar to a gable roof, a gambrel roof incorporates a change of slope so that the gable walls at each end are shaped as pentagons. A mansard roof has a change of slope on each of its four sides. Flat roofs, shed roofs, and lean-to roofs are other common types of roof designs. Each of these seven roofs is depicted in figure 4.
Figure 4: Types of roofs
A number of materials can be used to cover a roof. While asphalt shingles with either an organic or fiberglass base are the most common, other materials include asphalt roll roofing, wood shingles or shakes, clay or concrete tiles, slate, metal panels, and asbestos-cement (also called mineral fiber). No matter what the surface covering is, different indications of possible failure may be noticeable. When you inspect a house, a sturdy ladder is useful to get a close look at the roof. A pair of binoculars can help you examine it from the ground.

Look for damaged or missing pieces of roofing material, popping nails, and any irregularities such as lumps or curling shingles. Also examine the condition of metal flashing at joints and in roof valleys. The condition of gutters and downspouts should be evaluated during the roof inspection.

From inside the attic, check the condition of rafters and roof decking. Be careful not to step or crawl on the area between the floor joists, as this is typically the upper side of the ceiling surface of the room below and probably will not support an adult's weight. Look for planks, laid perpendicular to the floor joists, that will allow you to move around the attic. Signs of moisture damage will be noticeable as water stains on the rafters or on the underside of the decking.

Moisture damage can result from either interior or exterior sources. Insufficient attic ventilation will cause moisture damage from the inside; leaks can cause it from the outside. Adequate attic ventilation allows for the removal of moisture-laden air, which can reach the attic spaces of most houses through cracks in ceilings and partitions, as well as through openings made for pipes, wires, and ducts.

Windows and Doors
In addition to serving as visual links between a home's interior and exterior environments, windows and doors provide a means of physical movement and allow for natural ventilation and day lighting. Most building codes require windows or doors as a means of emergency escape in case of fire. An inspection of windows and doors should involve an examination for operability and thermal efficiency. Check windows individually; each should open and close easily. No matter what type of window it is, there should be a complete seal when closed. Because the types of windows in place and their condition can significantly affect the level of energy efficiency in a home, this topic is covered separately in this Fact Sheet under the section on energy efficiency.

Doors should also be examined for ease of operation and a tight fit. Exterior doors should not allow air infiltration. When a door is closed, it should fit in its frame so that no outside light is visible through cracks from the inside. For energy efficiency, exterior doors should, at a minimum, consist of solid wood. Better exterior doors are built of metal or fiberglass with insulated cores. All the doors of a household should swing without scraping the floor. Check exterior door hardware: cylinder locks, deadbolt locks, and hinges.
Plumbing Systems

Type of System: Private or Public?
Critical to the habitability of any house is its plumbing system, which consists of two subsystems: the water supply system and the drain-waste-vent (DWV) system. If a home's water needs are served by a municipality, a water meter will be located at the point where the water supply pipe enters the house and the main house drain will lead to a waste treatment plant. A private system, on the other hand, will begin with a well or some other type of supply and end with a septic system or some other type of private waste disposal system.

In a house served by a private system, ask important questions about the well: its location, depth, capacity, and type of pump used. In many cases, the driller of a well will leave a well log with the house, a document that contains this information. The most important issues concerning a private water supply system are the quality and safety of the water itself. Appropriate tests used in a determination of safety and quality are critical components of the home inspection process.

A private water supply system, as illustrated in figure 5, may be served with a submersible pump, located in the well. This will be connected to a pressure tank, usually located in the house, basement, or crawl space. If it is a metal tank, check its condition for any signs of rust. Whether the pressure tank is made of metal or plastic, look for a main shut-off valve and a pressure regulating mechanism. These should be free of rust, operable, and easily accessible. Some private water supply systems have the pump located at the pressure tank instead of in the well. Look at it for its overall condition and observe it

Figure 5: Private well water supply systems
Source: Driscoll, Groundwater and Wells, p.626
while it operates. Electrical connections near a pressure tank should include a main shut-off switch for the pump, which is equipped with fuses or circuit breakers.

When a well is used for a water supply, the system should be equipped with a pitless device. The pitless device (shown in figure 5 on page 8) is used to extend the casing above ground while providing a discharge to the home below the frost line.

Before the use of pitless devices became common, a well pit was used to provide a discharge below the frost line. Well pits provide routes for contamination of the water supply and accelerate the deterioration of pumping equipment. If you are considering a house with a well pit, your negotiation with the seller should include upgrading the system by installation of a pitless device. A local well driller can provide an estimate to upgrade the system.

Components to Inspect
With a public water supply system, service to a house begins at the curb valve. This is located at the junction of the public water main line and the house service main line, usually near the street. Although its location and accessibility are important to know, usually the municipal water department has the responsibility for maintaining this valve. The house service main line leads to a water meter, a pressure-regulating valve, and a main shut-off valve. All of these should be in good condition without any leaks at the connections.

Water supply pipes and fixture risers comprise the distribution piping in a house, shown in figure 6. These can consist of a number of different materials, all of which deserve a close look. In an old house, you may find galvanized steel piping, which is more likely to rust and accumulate mineral deposits than other types of pipe. Brass piping may also be found in old houses. This type of material can develop pinhole leaks from pitting, caused by the chemical removal of zinc by minerals in water.

Copper lines and joints are very durable, but where lead solder has been used, contamination of a water supply system can occur. The degree of risk depends on the water temperature and pH level as well as the length of time that water sits in the pipes.

Various types of plastic piping may be

![Figure 6: Water distribution piping](Source: Vila, This Old House Guide to Building and Remodeling Materials, p.225)
found in new houses and in houses with new plumbing systems. As long as plastic piping is properly installed, supported, and protected from sunlight, it should last indefinitely. In very old houses, lead piping may be found. Because of the health hazard this poses, it will need replacement.

Check all water distribution lines for exposure to freezing conditions. Pipes can freeze if they are located in or too close to exterior walls. Resulting burst joints will cause water damage that you may be able to detect. The use of heat tape on distribution pipes may also indicate that prior freezing problems have occurred.

Check the water heater for types and capacity. An oil-or gas-fired water heater for a single-family home should hold at least 40 gallons. Because an electric water heater has a longer recovering time, its size should be between 50 and 60 gallons. Necessary features on a water heater are a shut-off valve and a temperature and pressure relief valve. As a safety measure, you should not test the relief valve unless you have a spare ready. This is because valves on poorly maintained systems may be blocked or corroded, and if you release it, you may not be able to turn it off. This is also true for the drain valve, which should be opened regularly (every three months or so) to drain the sediment. You should ask the owner how frequently this has been done.

Water flow from all fixtures in a house should be checked for pressure and leaks. You can often see evidence of leaks by looking for stains on sinks, around handles, and in cabinets under sinks. Turn on the water in a kitchen sink and look under the sink for any leaks. Test shut-off valves. In a bathroom, flush the toilet while water in the kitchen sink or the tub in another bathroom is turned on. Do you notice any pressure or temperature changes? If so, this may indicate low pressure from the pump or municipal system, incorrect pipe sizes, or mineral deposits or rust in pipes. Low water pressure can also be caused by clogged faucet aerators, showerheads, and toilet valves.

The DWV system, shown in figure 7 (page 11), drains waste from sinks, baths, and toilets and provides a means of venting the system to the atmosphere. Test drains by filling up sinks and releasing the stoppers and by flushing toilets. If some fixtures drain slowly or not at all or if waste material returns, there may be blockage somewhere along the drain lines. In a public system, a blockage may exist in the connection to the municipal lines. In a private system, slowly draining fixtures may indicate that a septic system has not been maintained adequately through regular pumping. Venting is necessary to prevent siphoning of fixture traps, which would cause sewer gas to be released into the house. An odor of sewer gas in a house may be a sign of inadequate plumbing system vents. This odor can also result from drain traps that have dried out from evaporation. Fixture traps that siphon their water seals could indicate an improperly designed venting system or blocked vents.
Septic Tank-Absorption Field

If a private plumbing system is served by a septic tank and absorption field, ask the present owner for records that indicate tank and field location and size, as well as information regarding the most recent tank pumping. Figure 8 shows a septic tank-absorption field.

Septic systems require maintenance and may require a change in life style if you are moving from a home with a municipal wastewater connection. Some waste easily handled by a municipal system should not be disposed of through a septic system. The septic tank needs to be pumped every 3-5 years depending on the septic tank size, the number of persons in the family, and the amount of waste generated. Table 1 (pg. 12) can be used to estimate how often a septic tank should be pumped.

Some problems with a septic tank soil-absorption field system may be noticed during the home inspection. Signs of a failing system occur in the home or in the area of the absorption field. Sewage—a black or gray liquid with a disagreeable odor—backing up into sinks or bathtubs is a sure sign of a problem. Water draining slowly from sinks or bathtubs may also be a sign of a failing system.

The absorption field is designed to allow water to infiltrate to the underlying soil.

Figure 7: Drain-waste-vent system
Source: Wing, The visual Handbook of Building and Remodeling, p. 240

Figure 8: Septic system
If the area around the absorption field has standing water, there is a serious problem with the system. If the grass over the absorption field is more lush than grass of the surrounding area, there may be a problem. Other signs of a failing septic system include nitrates in area groundwater or excessive growth of aquatic weeds in adjacent ponds or lakes.

Prior to closing on a home, the septic system should be examined by a specialist. If the system is failing, the buyer should negotiate with the seller concerning payment for repairing the system. A failing septic system should not necessarily result in rejecting the house. Even if the site conditions do not allow the installation of the traditional system shown in figures 8 (page 11), several alternative systems may be used. Check with the local health department or Cooperative Extension in your area for further information on septic system evaluation and maintenance. The local health department may have regulations concerning septic systems and specialists who can evaluate the system.

If a house has been vacant for some time, a professional inspection may not uncover a failing system. Also, septic systems are designed to handle the waste generated by a specific number of persons. If your family size exceeds the capacity of a septic system, a problem may occur after extended use. Inspections in the winter—when snow is on the ground or when the soil above the absorption field is frozen—may not uncover problems.

It may be wise to negotiate with the seller to protect yourself from potential problems with a septic system. The only way to assure the septic system will work is to use it. The sale agreement should include a stipulation that the septic system must work properly for 30-60 days with you living in the home. If the system fails, the stipulation should outline the limit of the seller’s liability.

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**Table 1:** Estimated septic tank pumping frequencies in years (for year-round residence)

Note: More frequent pumping needed if garbage disposal is used.
Electrical System
The inspection of an electrical system should begin on the outside of a house. For an overhead service, you will see three wires attached to the house somewhere near or just above the roof. Three wires indicate 220-volt service. Two of these wires will be covered with a black insulating material, and one wire will be bare metal. If there are only two wires, the home has 110-volt service and will need to be rewired. If the black insulating material is worn and ragged, you can have this replaced by the electric utility company at their expense.

The three wires form *drip loops* near the *weatherhead* (to prevent rainwater from entering the system) and then lead to the meter (see figure 9). If the house is served by an underground service, the wires will be in a metal conduit pipe that leads from a transformer to the meter. In either case, wires then go from the meter to the *service panel* inside the house. The wires should be contained within a heavy cable or conduit. Depending on how the system is grounded, a separate wire may lead from the meter to one or more *grounding* rods set into the ground. A method of grounding an electrical system in older homes was to attach this wire to a water or gas supply pipe. The main circuit breaker or building fuse in the service panel will list the electrical service capacity in *amperes* (*amps*). One hundred (100) amps is the minimum necessary service capacity, but 150 amps is preferable. If the house is heated electrically, 200-amp service is required.

Safety features of a home’s electrical system include circuit breakers or fuses, which protect the system, and grounding connections and *ground fault circuit interrupters* (GFCIs), which protect users. All components of an electrical system should be grounded. This is accomplished with a grounding connection at every switch, receptacle (outlet), and fixture. Receptacles are easy to test for grounding. Every outlet should be able to accept a three-pronged plug. But do not rely on a visual inspection alone. For about five dollars, you can buy a receptacle tester at a hardware store. When you plug this into an outlet, it will signal whether that outlet is grounded. It will also signal whether the outlet is wired with correct *polarity*. This means that the hot wire (usually black) is attached to the correct terminal screw of the outlet, the neutral wire (usually white) is attached to its correct terminal screw, and the ground wire (usually bare or green) is attached to its terminal screw and the grounding system.

A GFCI receptacle, shown in figure 10, is a device that is very sensitive to leaks of elec-

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**Figure 9: Drip loops and weatherhead**
Source: Wing, The Visual Handbook of Building and Remodeling, p. 268
trical current in faulty appliances. A GFCI turns off a circuit before a dangerous shock can hurt or kill someone. GFCIs are useful in bathrooms, kitchens, garages, utility rooms, and outdoor circuits. Different types of GFCIs are available: they can be mounted in a service panel as circuit breakers, they can be incorporated in receptacles themselves, or portable ones are also available. Although GFCIs are not required by code in all existing homes, it would be to your advantage to replace conventional kitchen, bath, garage, and outdoor receptacles with GFCIs.

Instead of copper, the electrical wiring in some houses may consist of either copper-clad aluminum or pure aluminum. While copper-clad aluminum is an acceptable alternative to copper, all aluminum wire has been found to be dangerous in some situations. Problems have developed because of chemical reactions that occur when aluminum wire is connected to brass terminals in receptacles and switches and when aluminum wire oxidizes upon exposure to air. In both cases, the chemical reactions result in a film on the aluminum wire that can cause overheating when electrical current passes through it. Aluminum wire can be as safe as copper if it is used with special receptacles and switches. These are marked CO-ALR for devices of 15 or 20 amperes, and CU-ALR for higher ampere ratings. If the house you are considering to purchase has aluminum wire, check receptacles and switches for these markings.

**Heating, Ventilating, and Air Conditioning Systems**
For most existing single-family homes, the heating, ventilating, and air conditioning (HVAC) systems are relatively simple in design and operation. The evaluation of a home's HVAC system is a specialized task and is best performed by a professional. You can, however, conduct a preliminary examination before a professional is called in. You may even be fortunate enough to be looking at a house with a heating system that has been tested regularly. Ask for results of these tests. Other records that should be examined are fuel or utility bills. These may give you some idea of the cost to heat and cool the house. But remember that people use houses differently, so your energy costs may be quite different from those of the present occupants.

**System Components**
Four components of each system (or combinations of the systems) that need to be examined are the fuel supply, the main unit, controls, and the distribution network.

Combustion-based heating systems burn either gas or fuel oil, which may be stored on-site or delivered to the unit through pipes from a utility company. On-site storage requires a tank that may be either inside or outside. Examine this tank for any signs of rust or other damage. Sometimes fuel oil tanks are buried. If this is the case,
determine its location and condition, either by asking the owner or the company that delivers fuel. A leaking underground fuel tank may contaminate groundwater; the property owner may be responsible for environmental damage.

The main unit of a heating plant will be either a boiler (if it is a hot water or steam system) or a furnace (if it is a forced warm-air system). Part of a professional heating system inspection is a combustion efficiency test for this part of the unit. This test determines how well the burner converts fuel to usable heat. Serious problems with a heating system, such as a cracked heat exchanger or faulty flue, will be uncovered in a combustion efficiency test. If the system has been well maintained, a combustion efficiency of about 75% can usually be achieved. Manufacturer claims should not be substituted for a combustion efficiency test.

The control components of a heating system include the thermostat, valves, flue, switches, and pumps. A professional inspection is also useful to determine the condition of these components. The distribution network consists of ducts and registers for a furnace and pipes and radiators or convectors for a boiler. You can visually inspect the distribution system to see if ducts or pipes are insulated and if registers, radiators, or convectors are clean.

During your inspection of a heating system, you may notice wrapping containing asbestos on ducts or pipes or as a cover on a boiler. Be careful not to disturb asbestos, or you may release dangerous fibers into the air. If you decide to buy the house, you may wish to negotiate removal of any asbestos with the seller.

Some homes are heated electrically, using resistance units in each room, an electric furnace, or a heat pump. Combustion efficiency tests are not necessary for electric units; instead, simple tests to observe their operation should suffice. Turn on thermostats to see if heating elements start, and check baseboard-heating elements for any damage to heating fins. Look at radiant surfaces of any embedded heating panels for surface or structural damage.

Cooling Systems

The home you are considering for purchase may have a cooling system. The two types of central air conditioning systems are integral systems and split systems. In the integral system, all mechanical components are contained in a single unit. If this unit is located outside the building, cold air ducts lead to the home’s interior. If the unit is inside the building, exhaust air ducts lead to the home’s exterior. In a split system, the compressor and condenser are located outside the home and are connected by refrigerant lines to an evaporator inside the home’s air distribution network, which may be the same ducts used by a forced warm air heating system.

HVAC service technicians using specialized equipment can test the overall condition and operational efficiency of central air conditioning systems. Pressure in refrigerant lines and the condition of the compressor, condenser, and evaporator coils will be examined as part of this test.

Ventilation

Ventilation is important in any house, not just in an airtight, energy-efficient one. Ventilation removes air pollutants and excess moisture, and some systems bring fresh air into a house as stale air is being removed. At a minimum, a house should have exhaust fans leading to the outdoors.
in bathrooms and over kitchen ranges. Test these for their operation by turning them on. If it is accessible, check the duct cover at the exterior of the building for its condition. A damper, which should be located at this point, should open when the fan is turned on and close when it is turned off.

Some houses may have air-to-air heat exchangers, also called heat recovery ventilators. These devices remove stale air from a house and bring in fresh air. The incoming fresh air is warmed by heat removed from the outgoing air stream. The fresh air duct and the exhaust duct, which will be located somewhere on the home’s exterior, should be separated by a minimum of six feet, to prevent contamination of the fresh air. The unit itself should be securely attached to a structured member of the house, and all ducts should be secure.

Look at the location and condition of registers throughout the house and observe the system in operation. Pay attention to the points of fresh air delivery and whether the air flows might feel uncomfortable. Have a more detailed inspection performed by an HVAC specialist.

**Energy Efficiency**

While a home’s overall level of energy efficiency is affected by a number of factors, the amount and type of insulation used is one of the most important. You may be able to inspect this yourself in some places in the house, such as the attic, basement, or crawl space. In the attic, be sure to check for adequate ventilation, which can be achieved in different ways. The best way to ventilate an attic is with soffit and ridge vents (shown in figure 11 on page 17), but you are not likely to find these on an old house. Most commonly seen on older houses are gable vents (openings in the gable ends). Other possibilities are roof caps and turbine ventilators. Whatever is used, you can get an idea of the adequacy of attic ventilation by noting any evidence of moisture damage from excessive condensation. Such evidence would be water stains on the underside of roof decking or compacted insulation on the attic floor.

Walls may be somewhat difficult to examine for insulation. One way to examine insulation in walls is to remove a faceplate from one or more electric receptacles on an exterior wall. Turn off the power before removing the faceplate. A small gap between the receptacle box and the wall often allows you to see inside the wall cavity. Use a flashlight, if necessary, to determine the type of insulation and whether a vapor retarder is present. Wall thickness can be determined by looking at the width of window and doorjambs.

Check the exterior of windows and doors for the condition of caulking and weather-stripping. All windows should have at least two layers of glass; sealed double-pane units are more efficient than storm windows over single-pane windows. Remember that a window’s energy efficiency is affected by more than the glass. The type of material in which the glass is set is also important to examine. Vinyl or aluminum window frames filled with insulation are more efficient than plain aluminum frames without a thermal break. All-wood frames also perform well but require periodic painting. Look around window frames and sills for any evidence of water stains, which could have been caused by excessive condensation.

A more detailed test for energy efficiency can be performed by a specialist using a blower door test and infrared scanner.
These tests may be expensive, but they will point out major heat leaks with great accuracy. In some cases, an energy audit on a house may have been performed by a utility company. Ask for results of the audit and see whether the auditor’s recommendations have been implemented. Remember that you cannot rely on fuel bills alone for an assessment of energy efficiency, because they reflect only the energy used to support the life style of the current occupants.

**Figure 11:** Soffit and ridge vents for attic ventilation

While many potential problems that can possibly be detected in an existing house have been discussed in this chapter, none of them is necessarily a reason for rejecting a place you are seriously interested in. Depending on your situation and resources, it may be reasonable to purchase a house, even though it needs considerable work. You may even have the time and skills to perform much or all of the work yourself. Even if you do not, an understanding of what needs to be done is useful so that you can renegotiate the selling price or require the seller to undertake repairs before closing.

**Table 2:** Inspection tools checklist

<table>
<thead>
<tr>
<th>A list of tools and other things you will most likely need when you perform a preliminary inspection of a house</th>
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<tbody>
<tr>
<td>Receptacle tester</td>
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<td>Ladder</td>
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<td>Binoculars</td>
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<td>Paper and pencil</td>
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<tr>
<td>Tape measure</td>
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<tr>
<td>Hammer</td>
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Reviewed and reformatted 2005