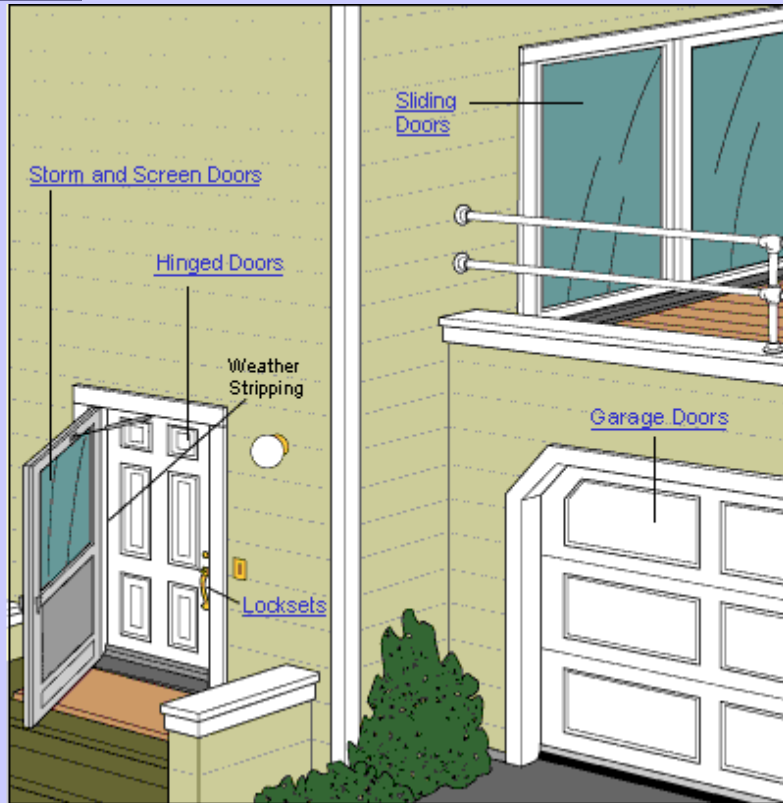




Doors



A door's function determines the materials from which it is made, how it looks, and how it operates.

For example, a door that provides security will be made from heavy materials and have durable, effective locks and hinges. A door that lets in light or looks out onto the yard, such as a French door, will have multiple panes (also called lights) or, like a sliding door, be made almost completely of glass.

Most houses have several different kinds of exterior and interior doors. Exterior doors are far sturdier than interior doors because they need to be weather-tight and provide security for the house. Many are also more decorative than

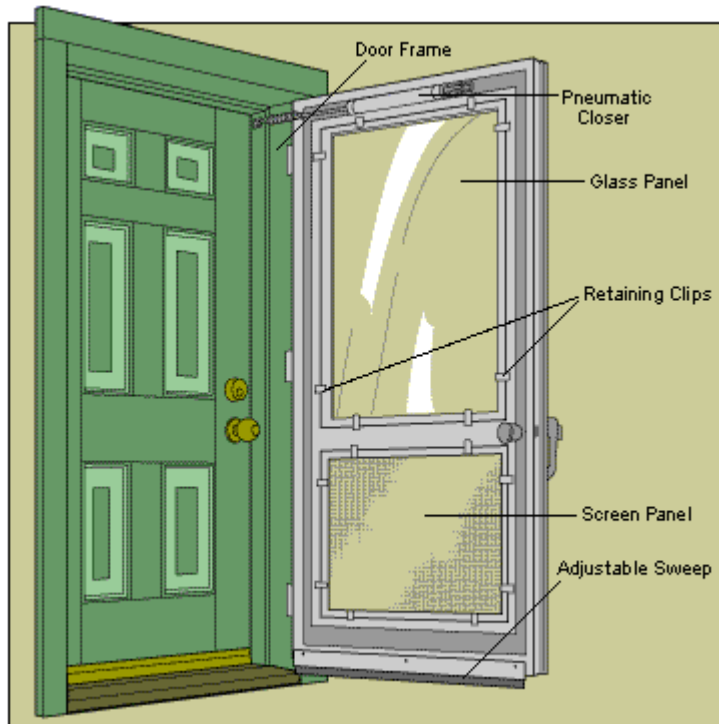
most interior doors. Typical exterior doors include front entry doors, back doors, French doors, Dutch doors, sliding glass doors, and patio doors.

French doors and sliding doors are examples of the two primary ways doors open. French doors swing on hinges; sliding doors glide along a track. Some doors, such as Dutch doors, have tops and bottoms that swing open independently.

Most doors are made of wood or materials made to look like wood. Even fiberglass composite and steel doors often have polymer or vinyl coatings embossed with wood grain; some even have cellulose-based coatings that can be stained like wood doors. Wood doors are made from every kind of wood imaginable, hardwoods being the most durable and elegant. Wood doors insulate better than glass; composite and steel doors provide even more insulation and better security than wood.

Energy-Efficient Doors

When buying glass doors, opt for high-performance glazing and integrated weather stripping if you live in a cold-winter climate.



Storm and Screen Doors

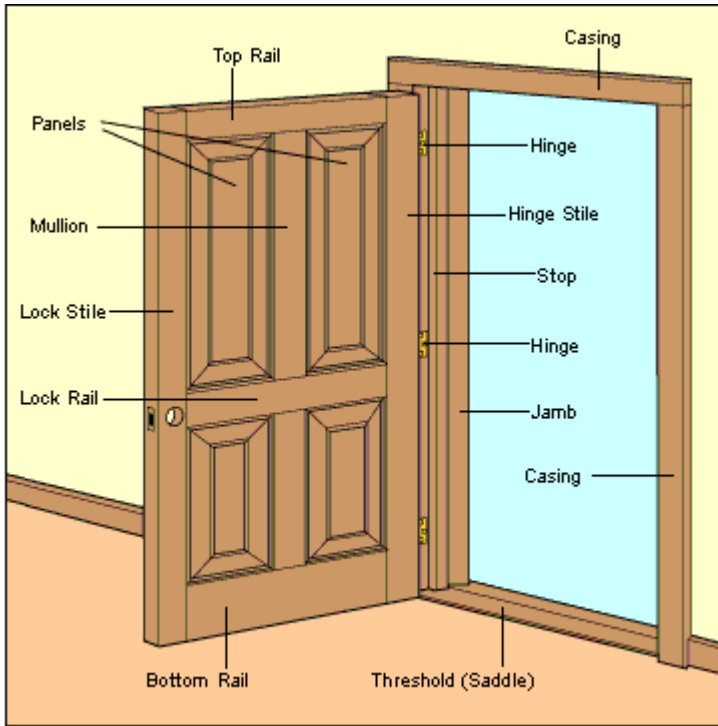
Screen and storm doors are secondary exterior doors—that is, doors that fit over your primary exterior entry doors.

They are often made of metal or vinyl and sometimes of wood. In severe climates, you may have to install a screen door in the summer and swap it for a glass storm door in the winter; some secondary exterior doors come with removable panels that can be changed with the season.

Storm doors may have two glass panels or an upper glass panel and a lower metal panel with a crossbar dividing the two. Screen doors may also have an upper screen panel and lower metal panel.

Storm and screen doors connect to their frames with hinges and have closers that automatically and smoothly close the door. They may also have springs and chain stops that keep them from slamming shut or being pushed open with too much force. Closers may be hydraulic or pneumatic.

Storm doors increase your home's energy efficiency by keeping cold out; screen doors allow natural, bug-free ventilation.



Hinged Doors

While hinged doors come in many types, most have the same basic framework that consists of two [stiles](#) that run vertically and two or more [rails](#) that run horizontally.

The hinges are on one stile (the hinge stile); the latch and lock are on the other (the lock stile). [Panel doors](#) have several panels mounted between the rails and styles. [Flush doors](#) have an insulation core or filler material between the rails and styles and a [veneer](#) that overlays the entire assembly.

Most hinged doors are attached to their frames by two or three hinges. The frame consists of jambs, casing, stops, sill, and threshold. The jambs form the sides and head of the frame; the casing acts as trim and as support for the jambs. The stops are wood strips against which the door fits when closed. With exterior doors, a sill fits between the jambs, forming the frame bottom. The threshold (also called the saddle) and weather stripping are fastened to the sill.

For security, an exterior door's latch plate should be mounted with screws that are at least 3 inches long so the jamb can't be shattered for easy entry.

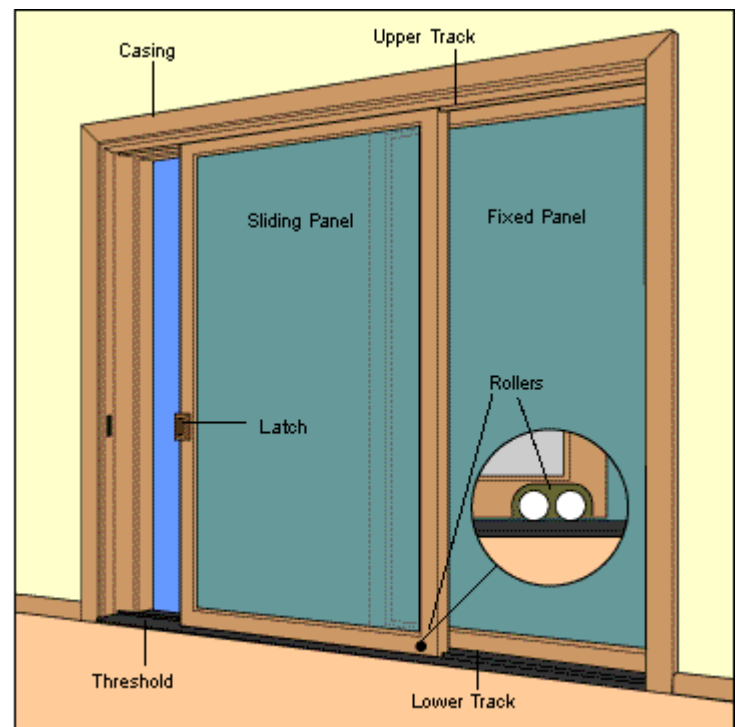
Sliding Doors

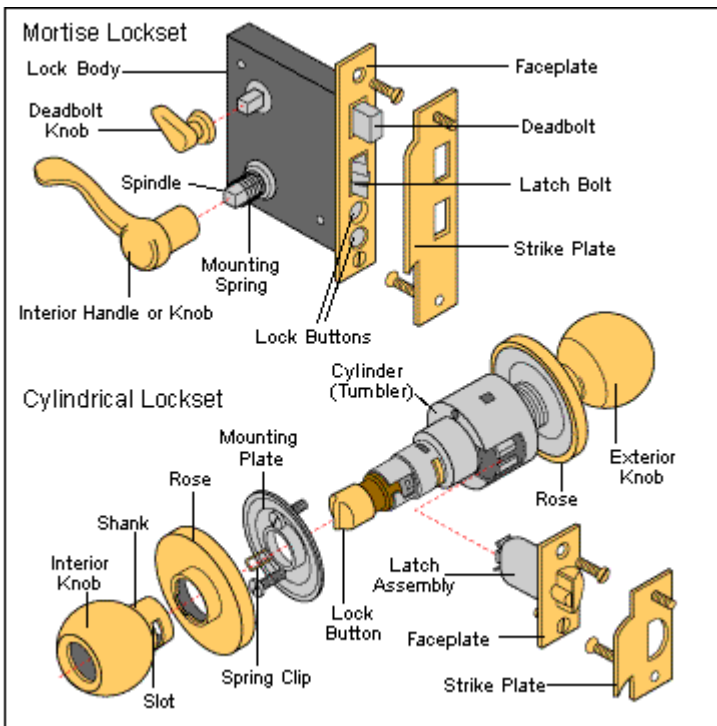
Sliding doors move along metal, wood, or vinyl tracks fitted into their frames at the top and bottom.

To ease their movement, sliding doors often have plastic rollers attached to the top and bottom or to the bottom only. Lightweight doors, such as interior closet doors, are generally hung from the top, while heavier doors, such as exterior patio doors, glide along the bottom rail. Exterior sliding doors usually have one movable panel and one fixed panel.

Sliding windows are essentially small versions of sliding doors. Because they are smaller and lighter in weight than sliding doors, many don't have rollers—their frames simply glide along the tracks.

Rollers can be adjusted so that doors slide more easily, and plastic tracks can be installed (if they're not already present) so that doors stay vertical and aligned on their tracks. Sliding doors are secured with a variety of catches; the type used depends on the manufacturer and whether the doors are made from metal, vinyl, or wood.





Locksets

Two general kinds of locksets are available for doors: cylindrical and mortise.

A cylindrical lockset fits into a large hole bored into the door's face; a mortise lockset fits into a rectangular pocket cut into the door's edge.

Exterior doors may have either cylindrical or mortise locksets. Interior doors usually have a cylindrical lockset operated with a push button, though some older homes may have interior mortise locksets. Exterior cylindrical locksets are operated by a key inserted into the exterior knob; the interior knob is operated either by a key or by a small push- or turn-button on the knob. An exterior mortise lockset normally has a deadbolt that is an integrated part of the locking mechanism—when you turn the key from outside, it releases both the knob and the deadbolt.

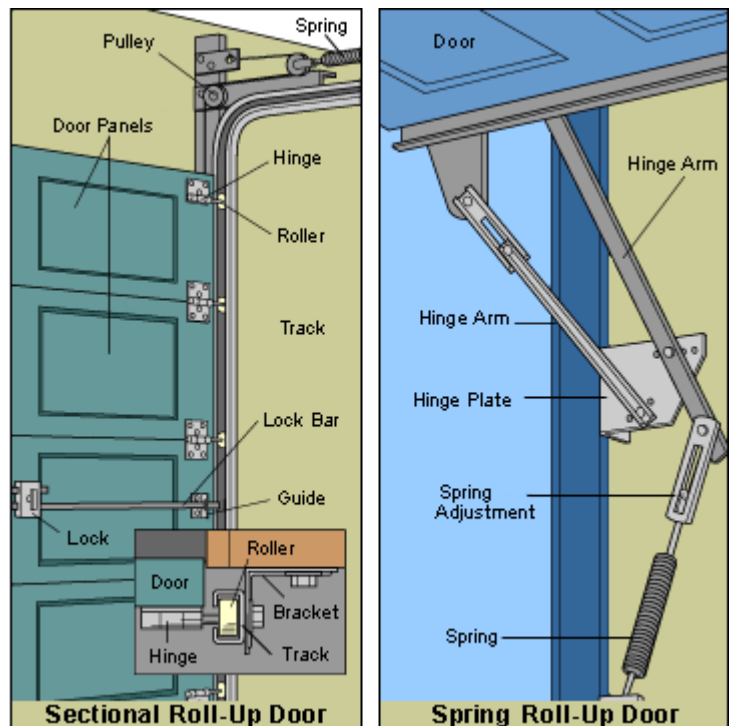
If you are concerned about security, be sure your exterior doors are protected by deadbolts with a minimum 1-inch [throw](#).

Garage Doors

Not only is the garage door one of the most visible elements of a typical house, it's also the largest moving part. As such, it pays to keep it looking good and working properly.

The two main types of garage doors are sectional roll-ups and swing-ups. A swing-up door is made from a single panel that pivots out and upward. A sectional roll-up door, by far the most popular type, is made of four or more horizontal sections that are hinged together and mounted with rollers to tracks on each side. With this type, the door can roll straight up and back. Though these tend to be slightly more expensive, they're worth the extra cost in most cases because they're easier to use and more weather-tight.

Both types of garage doors are manufactured from wood, steel, and fiberglass composites in flush, raised-panel, and recessed-panel designs. They can be purchased with a variety of options such as windows and electric operators.

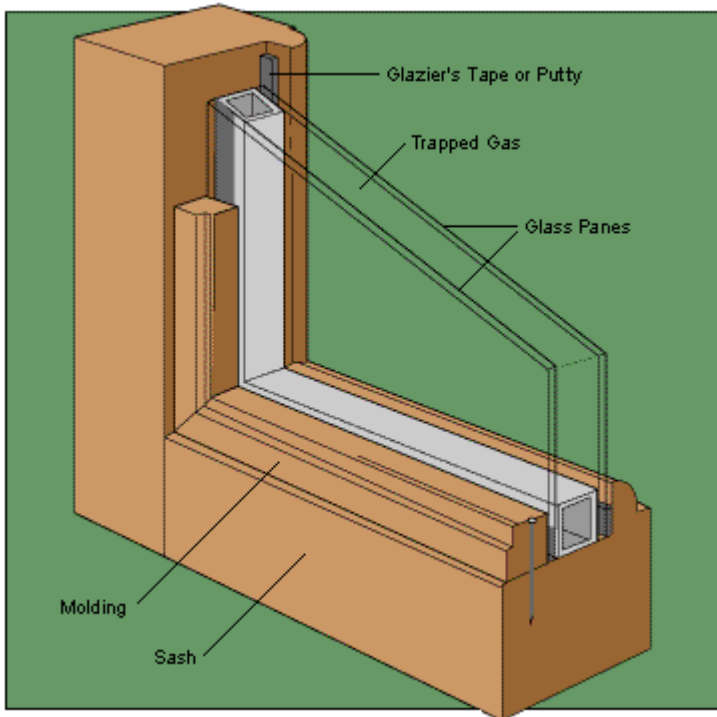
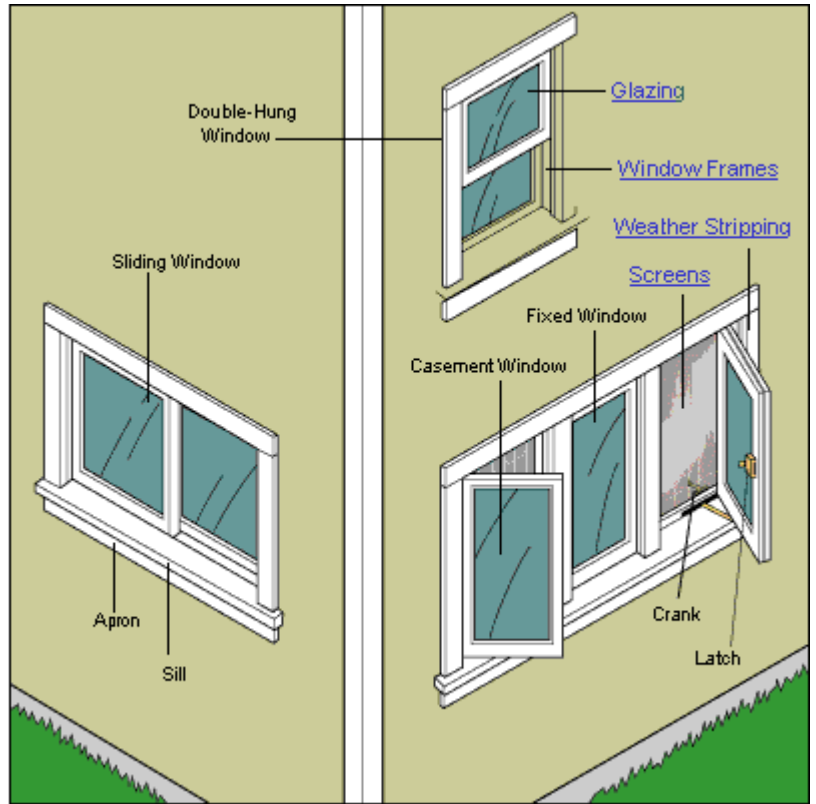


Windows look simple, but they are actually quite complex.

Think about what we ask windows to do: allow us to look outside; let in light and air; keep out wind, rain, and snow; control sunlight; and provide some measure of security. To accomplish all of this, they have many features that work together elegantly.

Different windows function in different ways. At their simplest, all windows have frames and glass. Most have some kind of weather stripping. Windows used for ventilation may also have screens to keep insects and debris outside.

Window frames are made of wood, aluminum, vinyl, or a combination of materials. Wood insulates well but it also weathers, so some windows have wood on the inside and vinyl or aluminum on the outside. If you need to replace windows, consider how each material performs in your climate, but take care to choose a replacement that is similar in appearance to your home's other windows.



Glazing

Often the most attractive feature of a house, windows can also be the least energy efficient.

Glass is not a great insulator, which means that windows are a major source of heat escaping or entering a home. How your windows are glazed can make a big difference in this dynamic.

Windows are rated according to how much heat can escape through the glass (measured by R-value) and through an entire window per hour (measured by U-value). Windows with a high R-value allow less heat to escape; a low U-value means a window conserves more energy.

These days, many windows are double-glazed—they have two panes of glass separated by a thin space. Some are even triple-glazed. The space between glass panes may be filled with air or an inert gas such as Argon. This, as well as thin [low-emissivity](#) (low-E) coatings, help reduce heat transfer.

Homeowners in hot, sunny climates frequently choose windows with ultraviolet (UV) coatings that keep the sun's rays from fading curtains, furniture, and carpets. Some UV coatings come tinted, which also helps to keep the house cool. Also available are special polymer coatings that can repel dirt, reducing the need for window washing.

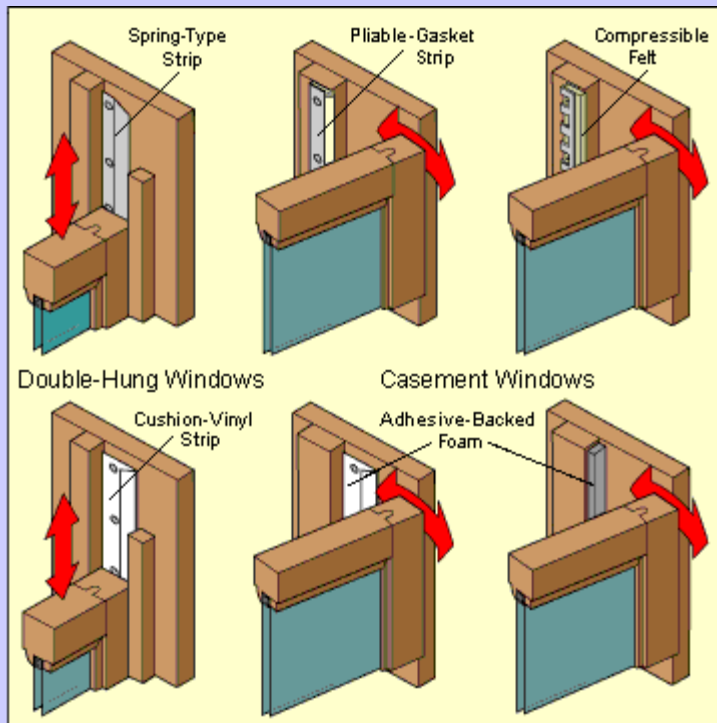
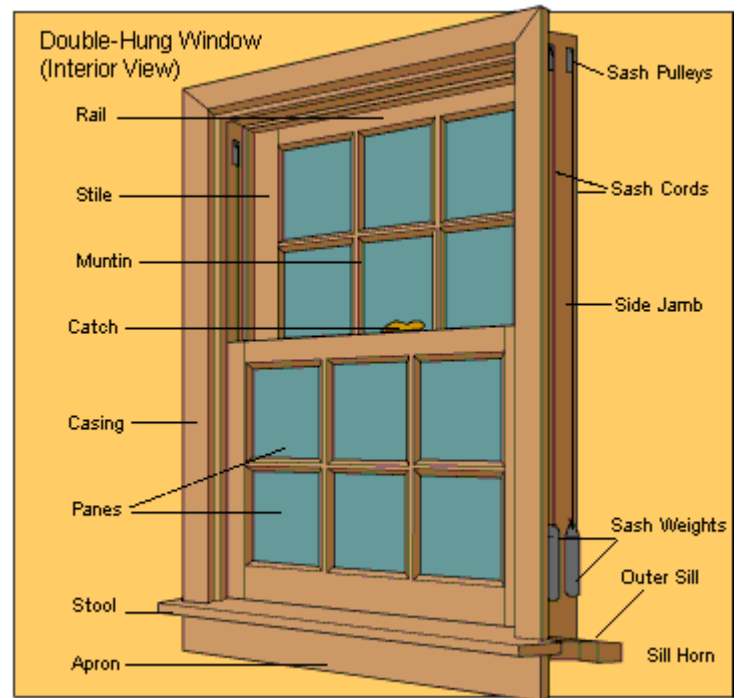
Window Frames

The window frame holds the window sashes in place.

In all but fixed windows, the sashes slide up and down (in [double-hung windows](#)) or swing in or out (in [casement windows](#)) from the frame. The separate panes of glass are held in place by [muntins](#) (a single sheet of glass may be divided by strips of wood that look like muntins).

Wood, the traditional material for window frames, provides the best insulation. Although wood frames are attractive, water and sunlight do take their toll. Even if their integrity isn't compromised by severe weather, wood frames need to be repainted from time to time to keep up their appearance.

Wood frame windows are sometimes clad with metal or vinyl to protect them from weathering. All-weather metal or vinyl window frames are virtually maintenance-free, and some types can be painted.



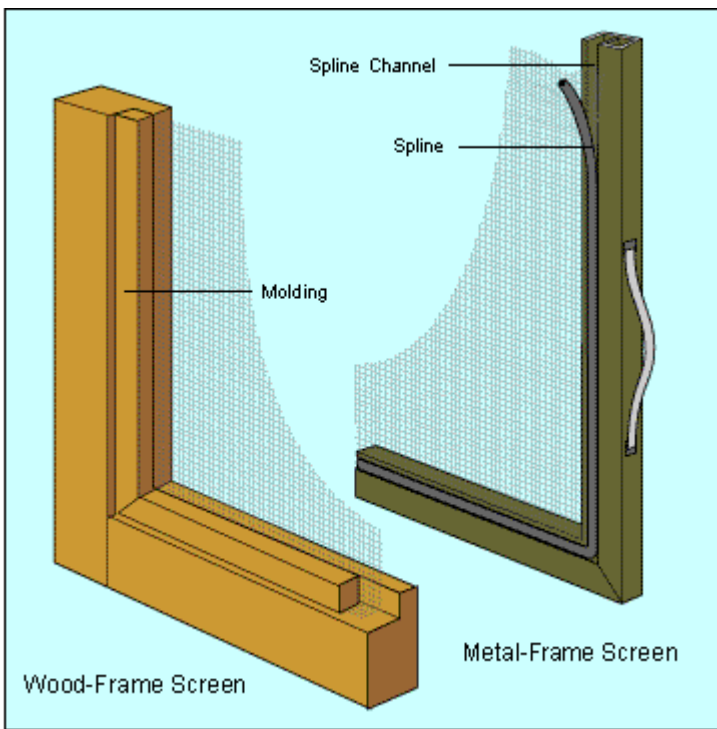
Weather Stripping

Most new windows include factory-installed weather stripping. If your windows don't, you can easily install it yourself.

The money and time you invest in weatherstripping your windows will be more than repaid in your heating and cooling bill savings.

Weather stripping comes in three types: spring-type, pliable gasket, and compressible felt strips. The right type to use depends on the type of window and the situation. And they're not just for windows—these products can be used effectively to provide a weather barrier along door jambs.

- Spring-type weather stripping is made from bronze, aluminum, stainless steel, or vinyl. The angled or V-shaped strips are the best kind to use for double-hung windows.
- Pliable-gasket weather stripping is made of a springy material such as vinyl, foam, felt, or sponge. It is most effective for wood casement or hinged windows.
- Compressible felt strips are the least durable. They are best used only for warped windows that won't accept more rigid stripping or for windows that aren't often opened.



Screens

While screens don't play a role in your windows' main functions, they are handy to have.

Thanks to screens, opening a window doesn't mean letting in flies, mosquitoes, and other unwanted pests. Although barely noticeable when they are in good repair, torn or bowed screens can be eyesores.

In areas where winters are severe, screens are generally stored and replaced with storm windows. You can also buy combination storm and screen windows that you can leave on all year long; their frames are made of wood or aluminum, and the screen fabric is aluminum or fiberglass.

Solar or sun screening, made from vinyl-coated fiberglass, comes in several colors and blocks heat gain through windows and doors.

Siding

Siding, the material that covers the outside walls of your house, is critical to your home's structure, appearance, and weathertightness.

Many types of siding are available including wood, vinyl, aluminum, masonry, brick, and stucco. Though subject to wear over time, manufactured sidings have been engineered to require less maintenance than traditional wood.

Do you know what's underneath your siding? Most walls are framed with 2-by-6 or 2-by-4 wall studs and have insulation placed between the studs. Wood [sheathing](#) is nailed over the studs and covered with building paper if the walls have wood, metal, or vinyl finishes. Stucco is applied over wire mesh nailed to wooden-slat spacers and/or the sheathing. Brick and stone veneers are attached to sheathing with short metal brackets called ties.



If you're considering new siding, choose a material that is appropriate to your climate, your lifestyle, and your home's architectural style. Keep in mind the cost of installation and maintenance. Be aware that some communities have guidelines and by-laws limiting the materials that can be used.

Exterior Paint

Keeping your exterior paint in good condition not only makes your house look better, it is also important general maintenance.

A good coat of paint protects wood finishes from the elements and from insect damage.

You can also paint nearly every type of siding, including vinyl, aluminum, brick, stucco, and other masonry materials—as long as you use the right kind of paint and prepare the surface properly. To paint any kind of siding:

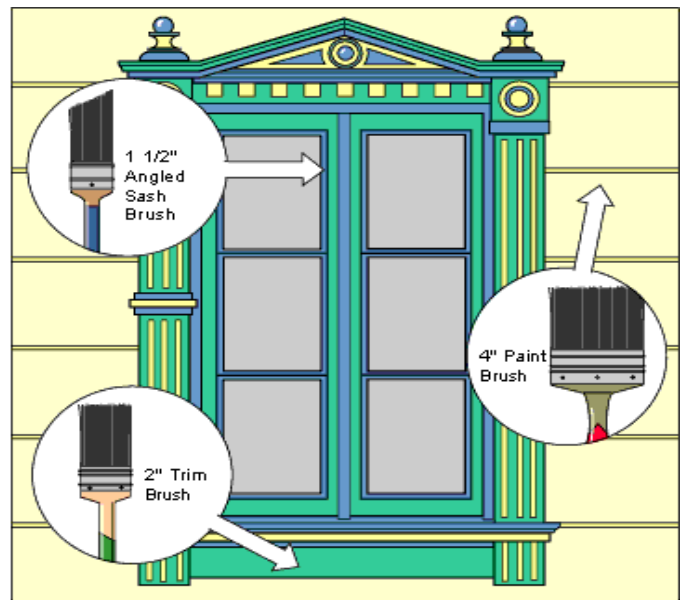
- Start with a clean surface
- Repair any damaged areas
- Fix any problems causing damage
- Paint on a mildly warm, dry day with no rain in the forecast

The right paint to use depends on the surface you are painting and, if there is existing paint, the kind of paint being covered. Most surfaces can be painted with 100% acrylic latex paint, which is water-based. Discuss your particular situation with your paint dealer and ask for recommendations.

Latex paints can cover almost any surface and dry quickly. They hold up well to wind and rain and exposure to the sun; their only drawback is that they don't stand up to wear such as vigorous scrubbing, and they stain more easily than oil-based paints.

Oil-based paints dry more slowly and require that you use a solvent to clean brushes and pans. The dried surface cracks more easily than latex and may fade more quickly. However, oil-based paints tend to adhere better to surfaces that are poorly prepared.

Pay attention to the brushes you choose, too. Choose natural bristles for alkyd paint, and nylon or polyester bristles for latex paint. You'll need a 4-inch straight-edged brush for broad surfaces, and a 2-inch trim brush and 1½-inch sash brush for trim. Be sure to buy high-quality brushes with long, tapered bristles.



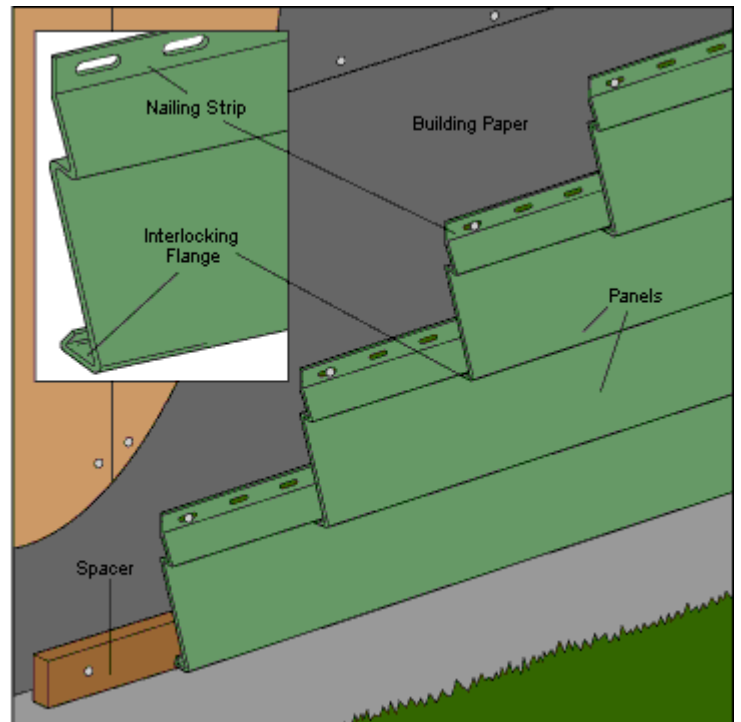
Vinyl Siding

Like other manufactured sidings such as aluminum or composite sidings, vinyl can be applied over existing siding such as masonry or wood to give a house a clean appearance.

Most vinyl siding is textured to look like wood or masonry, is pebbled, or has simulated brushstrokes.

Its virtues are that it does not suffer as much from weather damage, insect damage, and dry rot as wood. Before applying it or having it applied over a wood exterior finish, repair any termite damage or dry rot (or remove the old siding entirely) and make certain that the cause of the problem will not persist.

Like wood siding, vinyl siding is usually applied horizontally, though some types may be installed vertically. Because it sits fairly close to the house, it may show unevenness, bumps, and ridges. Depending on your weather conditions and how well you maintain your siding, it can last from 20 years to the life of the house.



Wood Siding

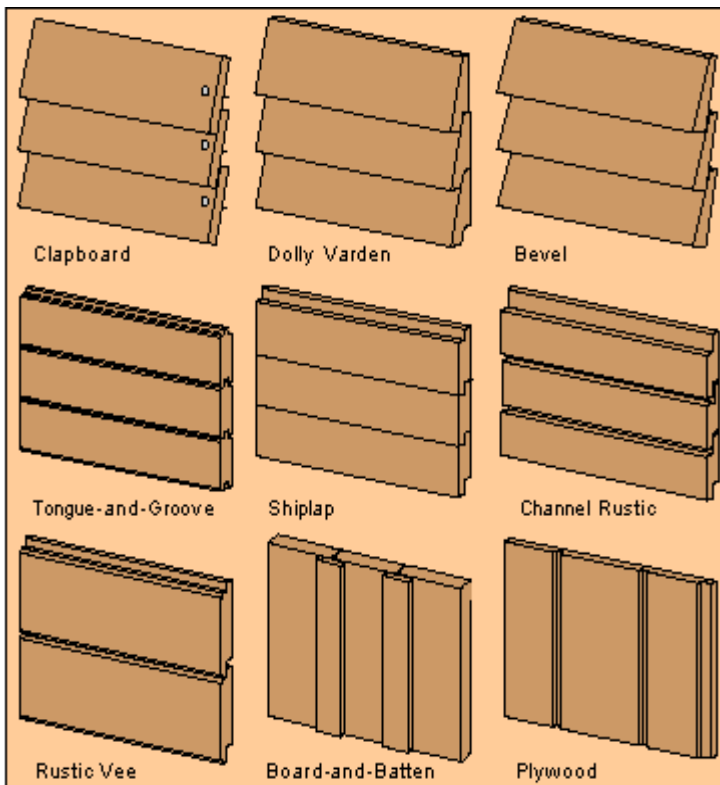
Well-maintained wood siding can last 30 years or more.

Types of wood siding include clapboard and other milled-board siding; plywood and hardwood sheets; and shingles and shakes. Various styles of plywood siding are illustrated above.

Milled-board sidings are cut into a number of styles of patterned board. These are most often installed horizontally, but some interlocking patterns can also be applied vertically or diagonally. Horizontal siding is nailed through the sheathing into the house's studs, and each board overlaps the one below it. Vertical siding is generally nailed to wooden strips that are attached across wall studs.

Plywood and hardwood sidings come in sheets that are 4 feet wide and 8, 9, or 10 feet long, as well as in boards that mimic the look of milled-board siding. Builders generally nail plywood sheets directly to the studs without including a separate layer of [sheathing](#). Sheet siding is often the least expensive siding option.

Shingles and shakes are nailed over wall sheathing or to horizontal wooden strips. All wood siding should be sealed, stained, or painted for protection from decay, insects, and weathering.



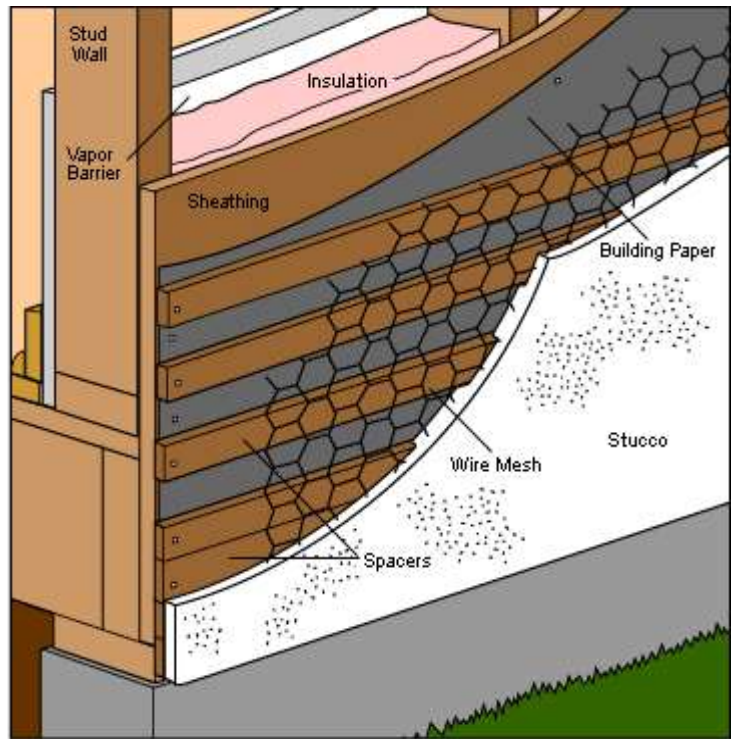
Stucco Siding

Stucco is plaster with a cement base that is typically applied in three layers over framed and solid walls.

Pigment may be mixed in, or stucco can be painted. Stucco can be finished with a variety of textures, including smooth, raked, and swirled. For an extra coarse finish, sand or even pebbles can be mixed in.

Different kinds of cement are used in the stucco mixture depending on the climate and texture desired. Stucco can be applied over some existing surfaces such as concrete block, or reapplied over older stucco.

Stucco is usually applied over a base of wire mesh, wooden-slat spacers, building paper, and plywood sheathing. The stucco may be troweled on by hand or sprayed on. Before applying the second and third coats, you must wait a day or two for the previous layer to dry. After applying the final layer, keep it moist for a few days so it can cure (allowing it to dry too quickly reduces its strength).



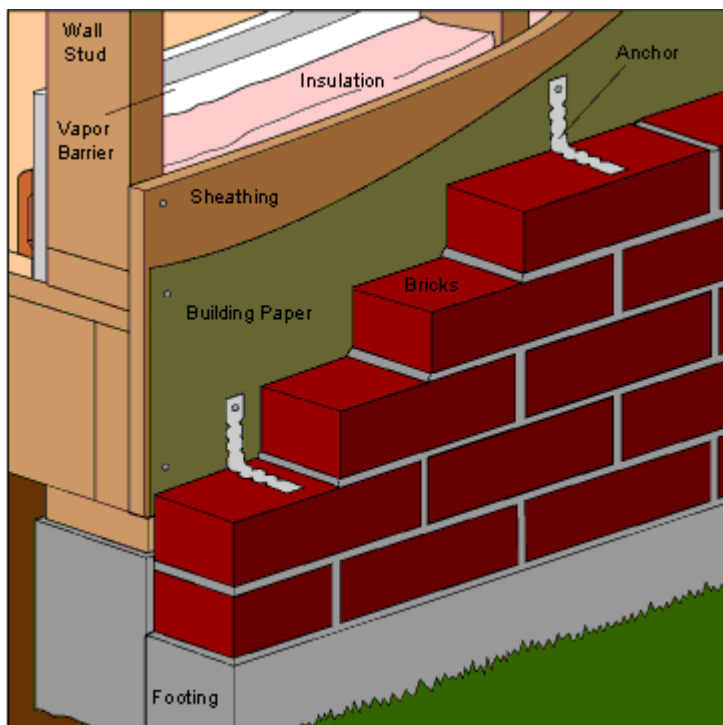
Brick Siding

Brick is one of the most durable siding materials: it doesn't need to be painted, doesn't rot, doesn't fade, and weathers handsomely.

Brick-veneer siding is usually applied to a wood frame wall over building paper. Bricks can be laid in many patterns and come in many sizes, textures, and colors. Brick also provides excellent insulation for your house.

Bricks are held in place with mortar, which is a mixture of cement, sand, lime, and water. The mortar that holds the bricks together can be finished, or "tooled," in a number of ways. It can be:

■ Concave



- Flush with the bricks
- Extruded between them
- Raked
- V-joined

Solid mortar and properly tooled joints are the key to keeping your house weathertight. And although bricks and mortar are solid, they are porous. If you live in a very rainy climate, you may want to consider a clear water-repellant coating for your brick building to preserve the brick, especially if you have several spells of freezing and thawing during the winter.

Roofs vary in their covering materials and design, but most roofs consist of wood framing, wood sheathing, roofing felt, flashing, and the surface roofing material.

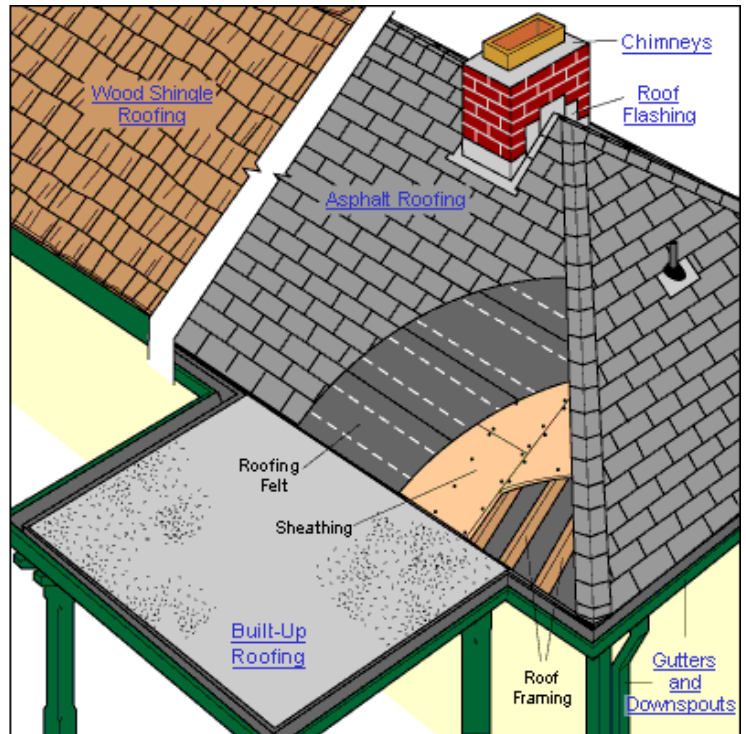
A roof keeps out wind, rain, snow, hail, and the sun's light and heat. To accomplish this, a roof's surface must be watertight and durable as well as flexible enough to adapt to temperature changes without cracking or otherwise losing its integrity. In some areas, roofs must also be fire-resistant.

Roof framing can be simple or complex, depending on the style and decorative elements. It provides the skeleton for the covering materials. Roofs are sheathed with plywood or [oriented-strand board](#) (OSB) panels or, for wood shingles, spaced boards.

Roofing felt, a heavy black paper saturated with asphalt, lies between the sheathing and the finishing material. It keeps out any water that might seep through the finishing material, yet allows moisture from inside the house to escape. Flashing keeps out water wherever finishing material connects with chimneys, dormers, or other roof planes.

Finishing materials may be as simple and utilitarian as asphalt shingles or as functional and decorative as wood shingles or tile.

Proper insulation and ventilation beneath a roof is key to keeping a home comfortable and in protecting the roof's structure from moisture damage.

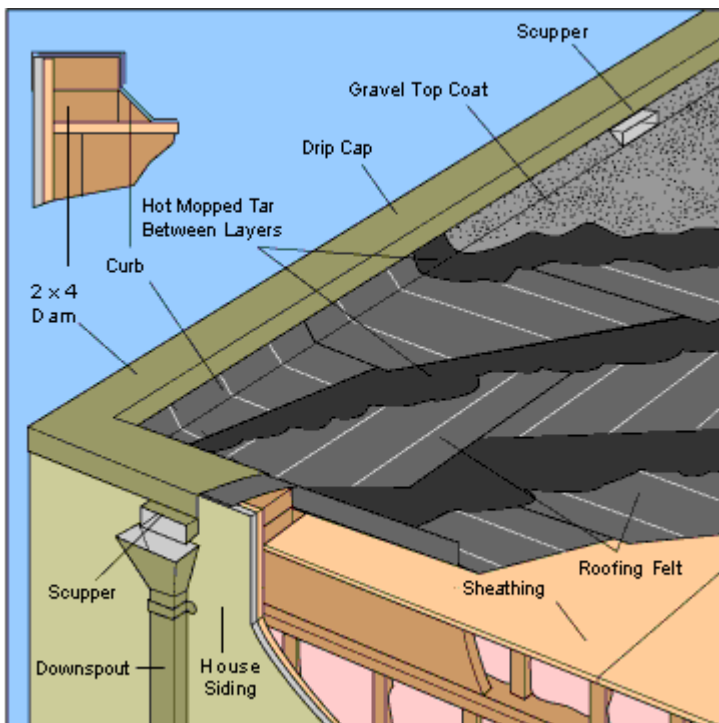


Built-Up Roofing

Most houses with flat or nearly flat roofs are topped with built-up roofing, made from layers of asphalt-coated roofing felt.

The top layer of asphalt on these roofs is usually covered with crushed rock or gravel, which serves to hold the roofing material down and protect it from damage by ultraviolet sunlight. Light-colored gravel also reflects the sun's heat. (Such roofs are also known as tar-and-gravel roofs.) Built-up roofs can last from 10 to 20 years, depending on the severity of the weather.

Similar to built-up roofing is roofing made from a single layer of asphalt-impregnated material, called asphalt roll roofing. This is used more often on garages and outbuildings than on houses because of its relatively short life span—from 5 to 15 years. It is generally the least expensive roofing material available.



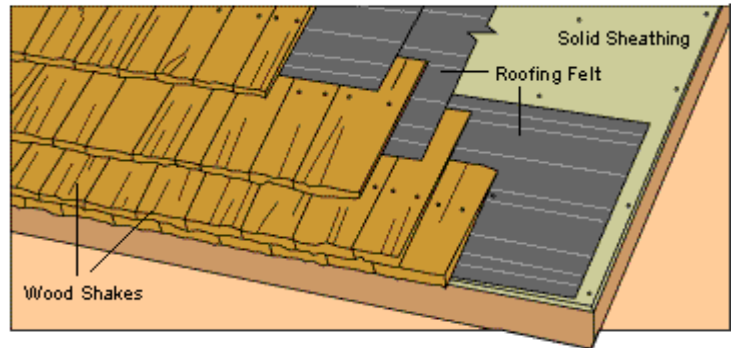
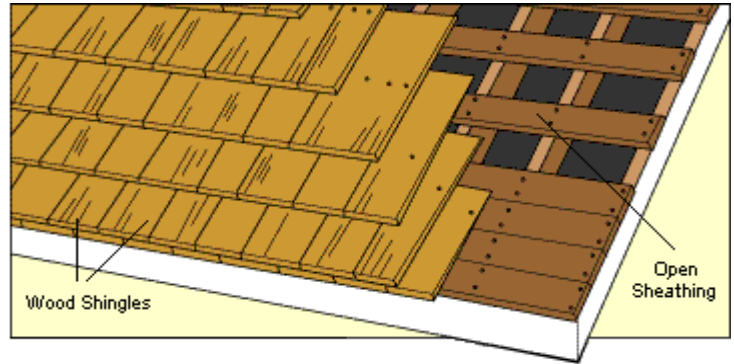
Wood Shingle Roofing

Most wood shingle roofs are made from western red cedar for its durability and resistance to insect damage; some are made from preservative-treated pine or similar species.

Wood shingles are smooth; the more rustic, rough-hewn shingles are called shakes. Shingles and shakes come in varying lengths (usually 16, 18, or 24 inches) and random widths.

Shingles are typically nailed to 1-by-6-inch boards spaced a few inches apart. This form of construction allows air circulation under the wood, preventing the shingles from becoming soggy. Shakes, on the other hand, are laid so that each course alternates with strips of roofing felt, a method that ensures a weather-tight surface.

Shingles and shakes can be applied directly over some existing roofing materials, such as asphalt shingles or a previous layer of wood shingles.



Ladder

Always prop your ladder soundly against the house and be sure it has a solid footing. Be sure it's long enough to extend 2 or 3 feet above the eaves.

Safety

Always prop your ladder soundly against the house and be sure it has a solid footing. Be sure it's long enough to extend 2 or 3 feet above the eaves.

Asphalt Roofing

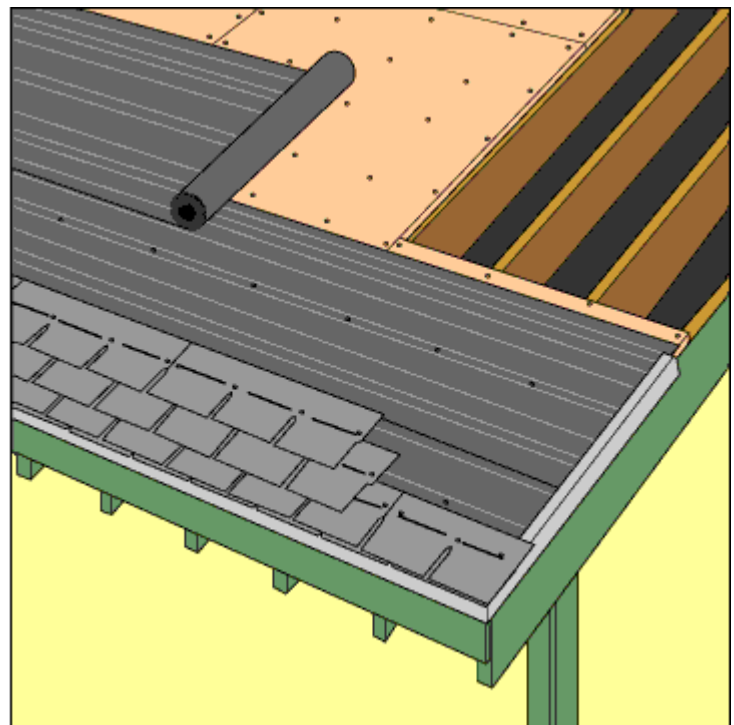
Nearly four-fifths of American homes have asphalt shingle roofs, and for good reason.

Asphalt shingles are economical and fairly easy to install and repair. The two basic types are composition and fiberglass-base shingles.

Composition shingles are made of organic felt manufactured from wood and paper fibers. Fiberglass-base shingles are made of manmade fiberglass mat. Both kinds are soaked in asphalt, but the fiberglass base shingles are more fire-resistant than the organic ones. Asphalt shingles have mineral granules embedded in them; when you find these granules washing away, it's a sign that you need to repair or replace your shingles.

Although asphalt shingles may look like individual tabs, they are generally manufactured in 3-foot-long strips that are notched to look like smaller units. They come in a variety of weights. Generally speaking, the heavier the shingles, the longer they last.

Make roof repairs on a warm day, when shingles are more flexible (and therefore less likely to crack) and roofing cement spreads more easily.



Roof Flashing

You most often see water seepage where surfaces on roofs intersect.

These include where dormer walls and the roof join, around skylights and chimneys, and in roof [valleys](#). Also vulnerable are surfaces where water runoff can be heavy, such as roof valleys and eaves. Flashing provides the extra protection that these spots need.

Most flashing is made of galvanized metal. If you install flashing yourself, you may want to work with aluminum flashing because it is easy to bend.

Step flashing protects the joints between the roof and dormer walls and chimneys. It fits to each course of shingles and looks as if it is stepping up a wall or other surface. Though skylights sometimes have step flashing up the sides, they generally come with their own, integral flashing.

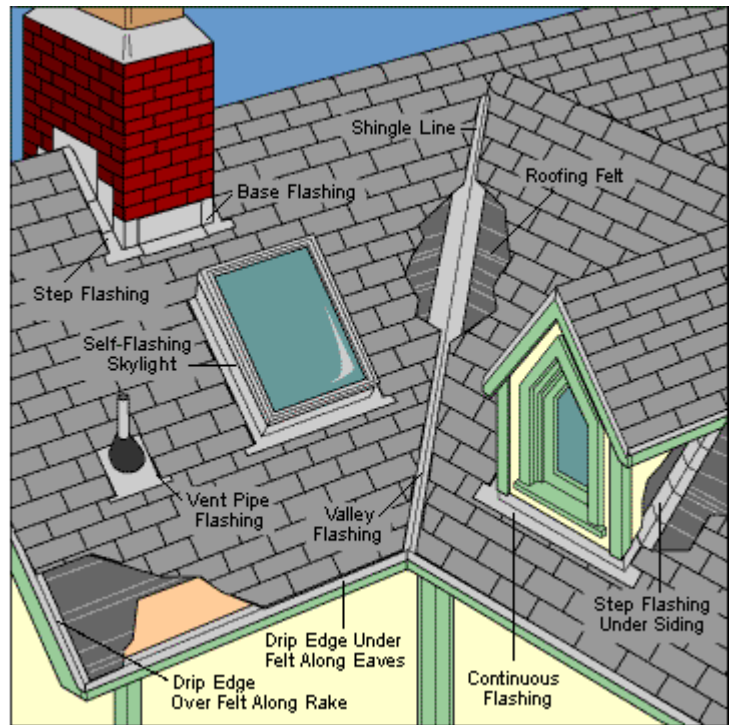
Valley flashing protects the valleys where two roof planes meet. This W-shaped channel is placed over the top of building felt before the roof's finishing material is installed.

Vent pipe flashing fits over [flues](#) and pipes. It is cone-shaped with a flange at the base, which is worked into the shingles as the roofing is applied.

Drip edges are strips that run along the roof's eaves and rakes to prevent water from seeping under the roofing. Two similar metal strips used for flashing walls are Z-flashing and drip caps. Z-flashing seals the horizontal seams between plywood or hardboard siding panels; drip caps are L- or Z-shaped flashing strips that seal frames above doors and windows.

Flashing Materials

You can find flashing made of plastic, roofing felt, and rubber, but your best bet is rust-resistant metal, either galvanized steel, aluminum, or copper.



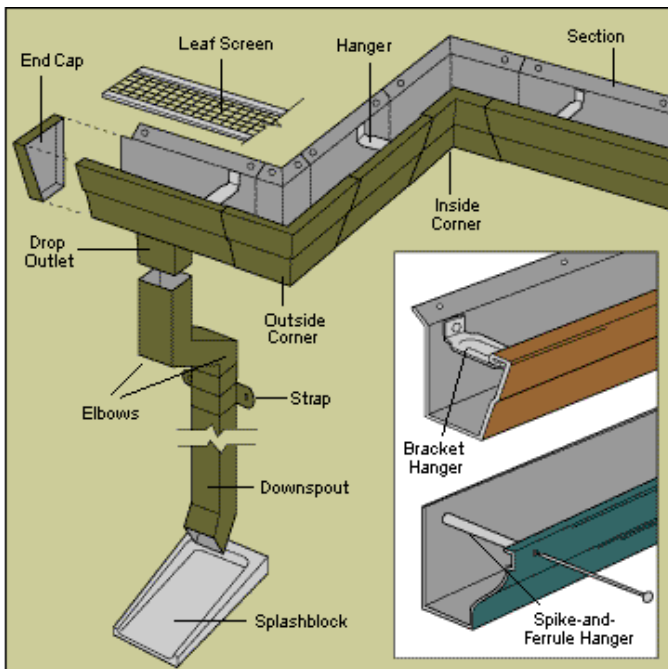
Gutters and Downspouts

Gutters and downspouts drain the water shed by a roof away from the house.

Without them, water would sit on the roof or run down the walls, cracking your paint and otherwise damaging your siding. Water can also cause window frames to swell and decay over time and undermine the your house's foundation.

Gutters are troughs that run along your house's eaves and slope toward downspouts. They may be made of wood, aluminum, galvanized sheet metal, copper, or vinyl. Extruded, seamless aluminum gutters are one of the most popular professionally installed types today; these are fabricated on site. Do-it-yourselfers generally opt for vinyl systems—10-foot sections that are joined by a range of fittings—because they're easy to put together.

Be sure your downspouts expel water well away from your house. If necessary, add downspout extenders that run horizontally and carry the water further from the foundation. Also consider concrete or plastic splashblocks, slightly sloped and extending away from the house at least 4 feet.



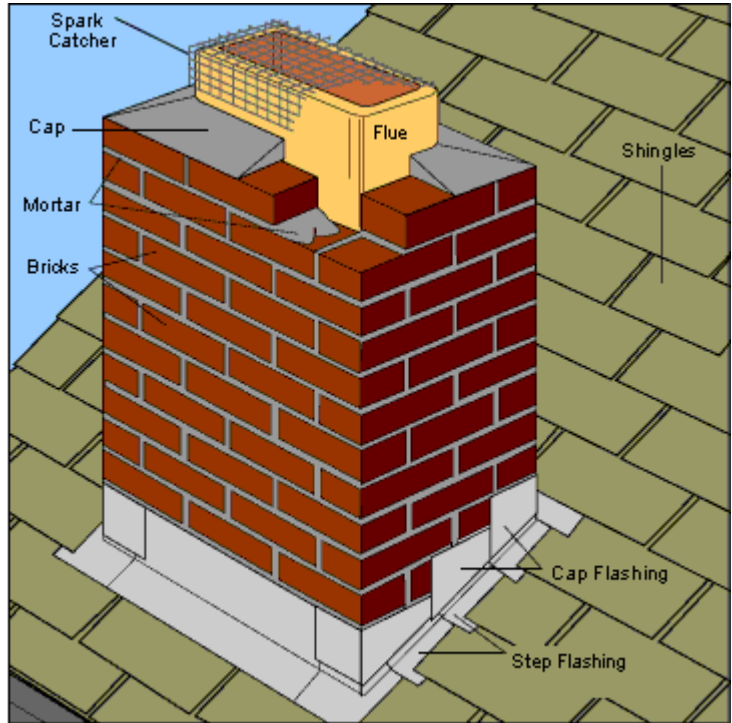
Chimneys

Chimneys are designed to safely funnel smoke and hot gasses away from the interior of your house.

Most handle this important job admirably, but a chimney that is not in good repair can be a safety hazard and can waste energy.

Traditionally, chimneys have been built of brick and mortar, lined with fireproof flue tiles, and capped with mortar to seal the top against the weather. Newer, easier-to-install types are made of metal and come as part of prefabricated kits.

Inspect your chimney at the beginning of each heating season. Shine a flashlight up inside and look for obstructions such as leaves or birds' nests; also check for soot buildup. Burning highly resinous wood such as pine will cause flammable tar to build up on the inner walls of the chimney. Also look for any missing or cracked flue tiles.



Walls



Walls give character to the interior of a house through color, texture, and style.

They can be built and decorated with many materials and finishes, yet the basic structures remain the same. By understanding how a house's walls are put together, you can solve many of the most common problems and hazards you might encounter.

Walls can be surfaced with a variety of materials, including gypsum wallboard or drywall, tile, plaster, and wood paneling. All are durable, but do eventually show signs of wear due to age or activity within the house.

Gypsum wallboard is used as a finished, paintable surface and as a backing for other wall treatments—wallpaper, fabric, tile, and paneling. Standard wallboard is composed of a fire-resistant gypsum core sandwiched between two layers of paper. Some wallboard is water

resistant for use in damp areas.

Plaster walls are composed of three layers: a base coat, a thick coat of plaster for strength, and a finish coat for appearance. These may be applied over wood lath, metal mesh, special gypsum wallboard, or masonry.

Wood paneling is made up of $\frac{1}{4}$ - to $\frac{3}{4}$ -inch-thick hardwood or softwood boards or plywood strips ranging from 3 to 12 inches wide. Boards may have square edges, but most are milled to overlap or interlock along the edges. Paneling is attached to studs, [furring strips](#), or wallboard.

Wallpaper, applied over plaster or drywall, comes in thousands of patterns, colors, and styles that can create just about any look—and do it affordably. Ceramic tile, also available in hundreds of colors and styles, is a practical, durable surface that is particularly appropriate for bathrooms, kitchens, and other rooms subject to moisture.

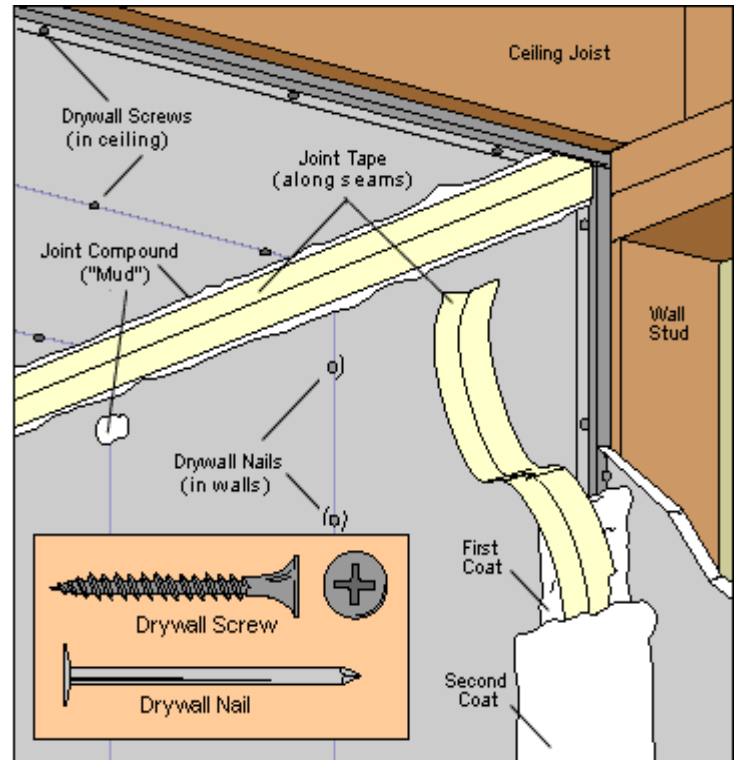
Drywall

Drywall, also known as gypsum wallboard, has replaced plaster as the most common wall surface in American homes.

Drywall can be used as a backing for wall treatments such as wallpaper, fabric, tile, and wood paneling, or it can simply be painted. Drywall has the virtue of being easy and inexpensive to install.

Drywall is sold in 4-by-8-, 4-by-9-, and 4-by-10-foot sheets; the most common thickness is $\frac{1}{2}$ inch or $\frac{5}{8}$ inch (though other thicknesses are available). Standard drywall is subject to moisture damage; choose special green drywall for application in bathrooms or other areas where the material may get wet.

Drywall panels are fastened directly to wall studs or to [furring strips](#) applied over masonry surfaces. The panels are attached using wallboard nails, wallboard screws, or in some cases adhesive. Joints between panels are hidden by wallboard tape and joint compound. In some cases, a texture of special topping compound is applied over the entire surface.



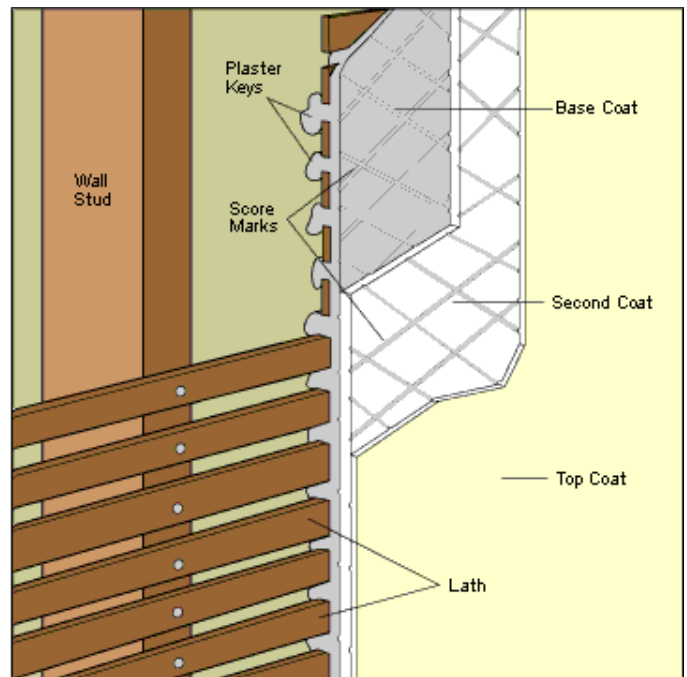
Plaster Walls

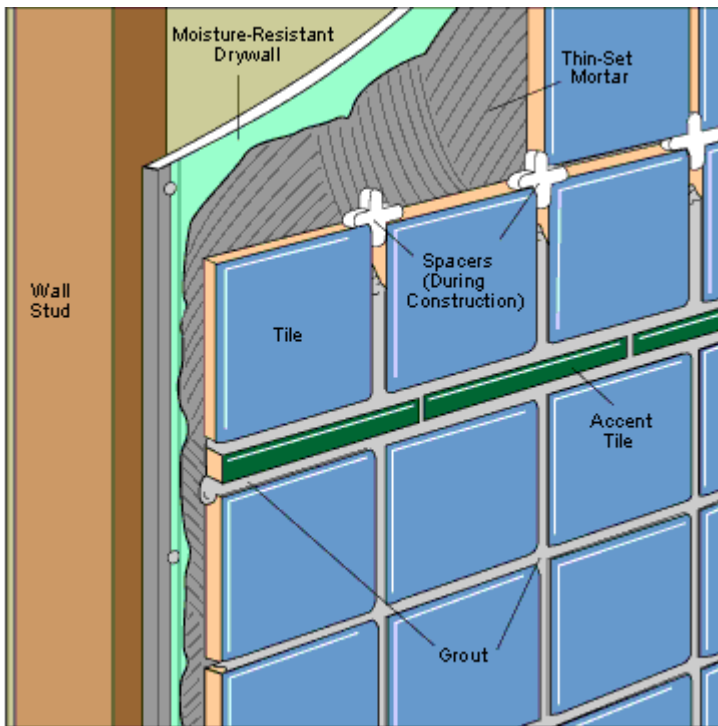
Plaster is made of lime or gypsum, sand, and water and is one of the oldest building materials still in use.

Plaster applied to the Egyptian pyramids four thousand years ago is still hard and holds its integrity. Today it is applied in three layers: a base coat, a thick coat of plaster for strength, and a finishing coat.

Plaster can be applied to many surfaces, including wood lath, metal mesh, wallboard, or masonry. Some homes may even have ornamental plasterwork formed by hand or cast in molds and applied to walls and ceilings. Plaster can be applied to form patterns such as swirls and peaks.

Plaster can be painted, or pigment can be mixed into plaster before it is applied. Wallpaper and tile are also easily applied over plaster.





Tile

Ceramic tile is especially useful in kitchens and bathrooms because it is water-resistant, easy to clean, and extremely durable.

Made from a mixture of clays and fired at high temperatures, tile is used for wall coverings, floors, showers, countertops, bath surrounds, and more. Tiles used on walls and counters are generally glazed.

Grout, a kind of [mortar](#), is spread between tiles to lock them in place and fill the joints between them. Grout may be white or colored with pigment.

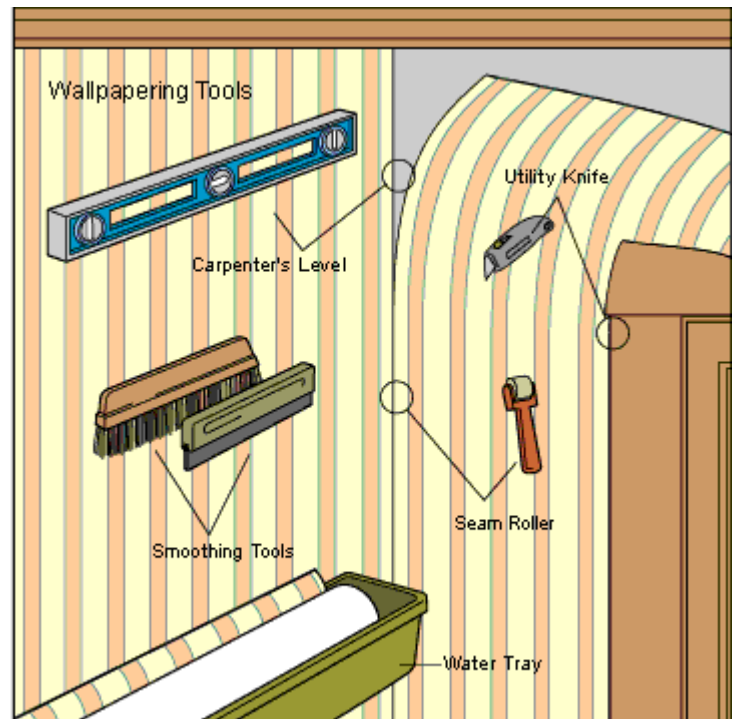
Ceramic tile may be applied directly over drywall—if the room is likely to be damp, special moisture-resistant drywall should be used. Or tile may be applied to a mortar bed or a backer board made of a ceramic aggregate core that is coated with a thin fiberglass mesh. Professionals apply tiles to walls with a thick bed of mortar; home repairs often call for a thinner [mastic](#) or mortar-type adhesive.

Wallpaper

Wallpaper is typically applied over an existing painted wall of drywall or plaster, or may be applied over a lining coat of wallpaper to hide imperfections.

Wallpaper is an easy and inexpensive way to add color, texture, and style to a room. Paper wallpaper, however, is somewhat vulnerable to damage because of the nature of the material and method of application.

Vinyl wallpaper is sturdier than paper, and is well suited for use in a kitchen or bathroom because it resists moisture. Vinyl coverings may be laminated to paper, laminated to cloth, or be made of vinyl-impregnated cloth with a paper backing.



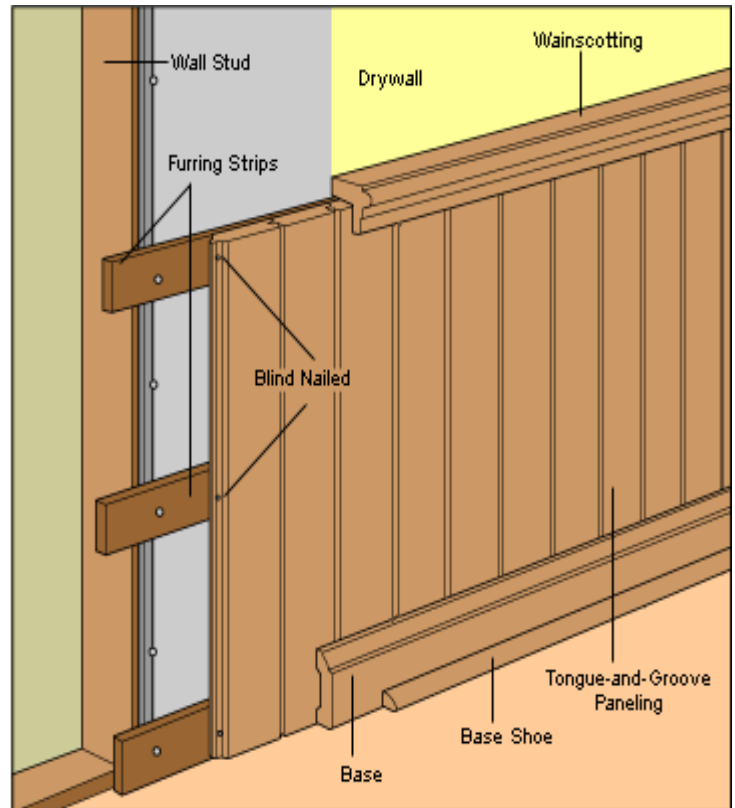
Paneling

Many homes have wood paneling that covers all or part of a wall in a living room, study, family room, or similar space.

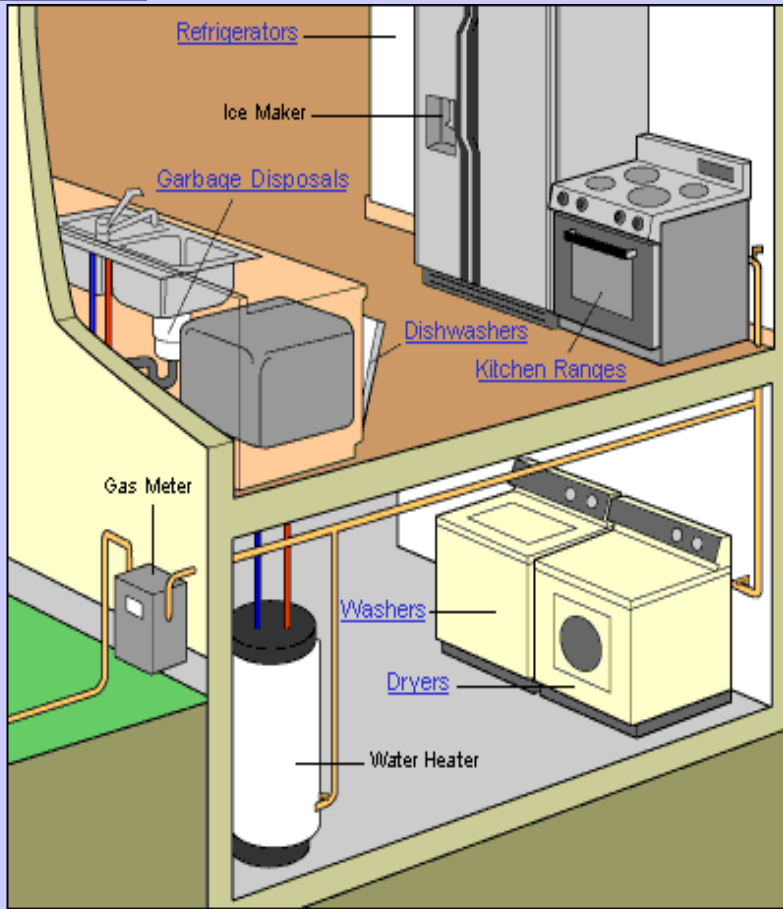
Sometimes paneling is paired with another material on a single wall. It isn't unusual for the top half of a wall to be drywall, and the bottom half to be wood paneling or wainscoting, for example.

Wood paneling is typically installed as solid, interlocking boards. Sheets of wood are fairly thin, normally $\frac{1}{4}$ - to $\frac{3}{4}$ -inch thick, and are made of different kinds of hardwood that can be given a clear finish, or less expensive woods meant to be stained or painted. Boards may be milled to overlap or to interlock with [tongue-and-groove](#) or [shiplap](#) edges. Wood paneling is also sold as a 4-by-8-foot sheet material with a wood veneer or simulated wood surface.

Paneling may be applied to drywall, directly to wall studs, or to [furring strips](#) applied over masonry surfaces. In many areas, building codes require that you install wood paneling over a fire-resistant backing of drywall.



Appliances



As a society, we've come to rely heavily upon major household appliances such as refrigerators, washing machines, dryers, and dishwashers.

But it isn't until they stop working that we realize just how important they are to daily life. Fortunately, most major appliances run repair-free for a long time, though every once in a while one will break down. Calling in a repairperson can be expensive—before you do this, determine whether you could make the fix yourself. (Beyond simple maintenance, there are not many repairs you can make yourself unless you are a skilled do-it-yourselfer and have the right tools.)

When you buy new appliances, purchase ones that have a record of reliability, which you can determine by checking consumer reporting magazines. Be sure your new appliance has a warranty—there's nothing like having your broken washer repaired at no charge.

If an appliance doesn't work, first be sure that it's plugged in. Also check the [circuit breaker or fuse](#) that serves the appliance's circuit and make sure that it hasn't flipped or blown. You can check to see if the outlet is energized by plugging in something that works—a small lamp or a circuit tester. Also check your owner's manual to see if the appliance itself has an overload fuse or reset switch. If it does, check to see if it needs to be reset.

Before you begin any repairs on an appliance, check the owner's manual. If you can't find the manual for a particular appliance, contact the manufacturer and request a new one for your make and model. Always turn the power off and unplug electrical appliances while you are working on them.

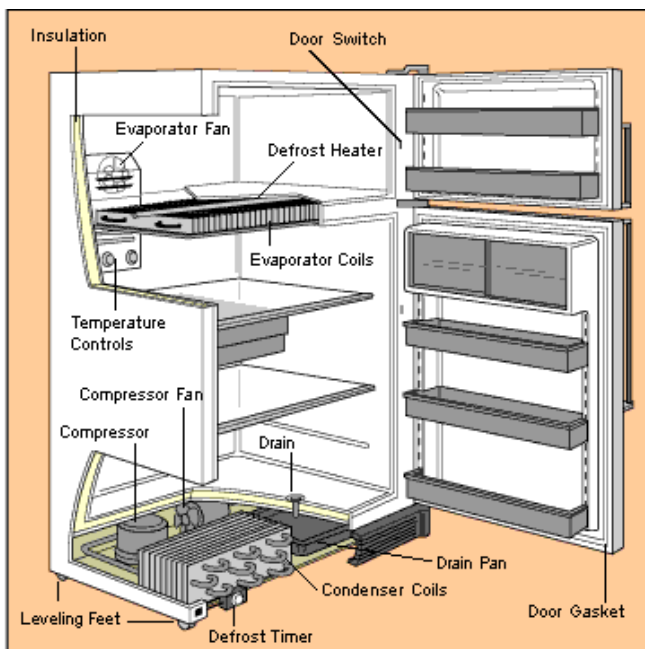
Refrigerators

A refrigerator uses basic refrigeration principles to extract the heat from air.

Refrigerant circulates between an evaporator and a condenser in a closed system that provides a continual cycle of cooling. The refrigerator box is heavily insulated so that very little heat is absorbed from the outside air, and little cold air escapes. Most combination refrigerator-freezer units introduce chilled air into the freezer section; from there the cold air can pass into the refrigerator. Controls regulate how much cold air may pass.

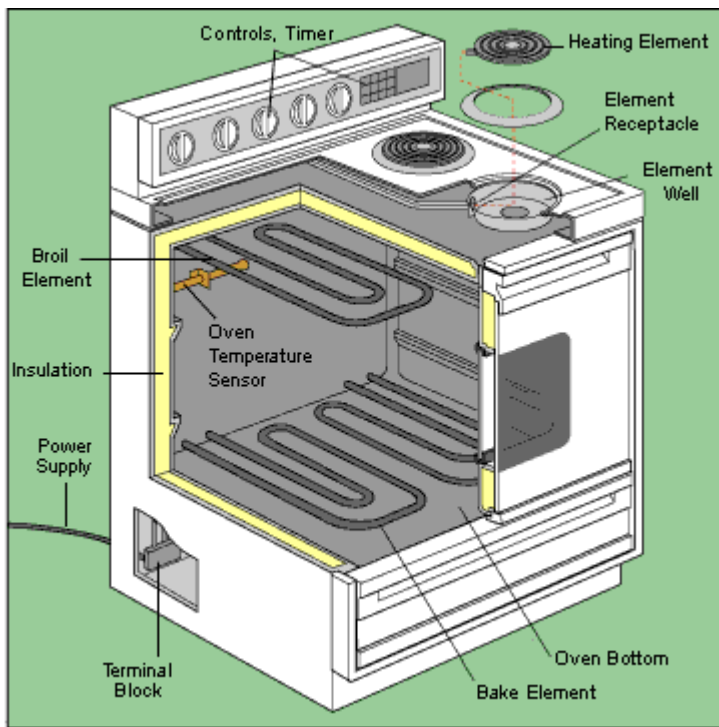
Today, most refrigerators are frost-free. Having an automatic defrosting system means that you don't have to take everything out of your refrigerator to melt built-up ice in the freezer. An automatic defrost system includes a timer, a limit switch, and a heater that melts away frost.

When refrigerators fail, it is probably not the refrigeration system but rather the unit's electrical controls (such as the timer or temperature control) that are at fault.



Ideal Temperature

The ideal temperature for a freezer ranges between -5° and 5°F , and between 36° and 38°F for the fresh food section



Kitchen Ranges

A range is the heart of a kitchen; as such, it's critical to have one that operates properly and efficiently.

Fortunately, kitchen appliance designers have developed a wide variety of both gas and electric kitchen ranges in all shapes, sizes, and colors, and with an enormous array of features. Options found on ranges include:

- Computerized baking and roasting switches
- Different numbers of heating elements or burners
- Varying burner sizes
- Digital or analog clocks and timers
- Griddles, woks, and grills

You can also buy glass and ceramic cooktops to build in flush with a counter (the oven mounts in cabinets elsewhere in the kitchen) or ranges that include ventilation hoods and microwaves.

Gas ranges are similar to the electric range shown here, but instead of electrical elements, they have gas burners, gas valves, and require a hookup to a gas pipe.

Dishwashers

Despite the magic it performs in the kitchen, a dishwasher is actually quite simple.

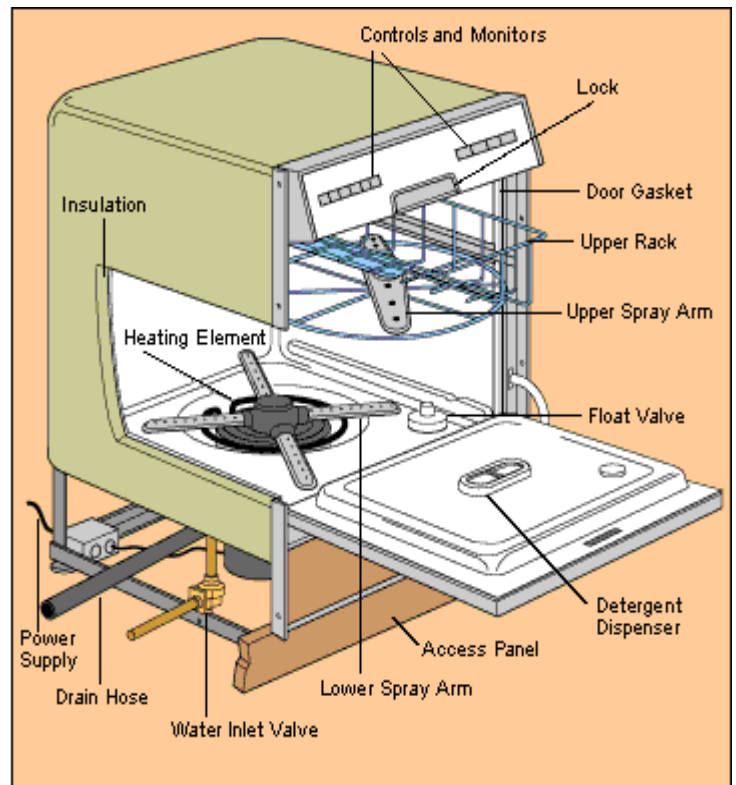
A dishwasher is essentially a watertight box that sprays dishes with hot water and soap, drains out the dirty water, and then dries the dishes.

Hot water is delivered through a supply hose to a valve that controls the water's distribution to spinning spray arms. A pump gets rid of the dirty water, and an electric heating element dries the dishes. All of this is operated by controls that may be very simple or quite complex.

When working on a dishwasher, follow a few important precautions. Always unplug it before working on it. Turn off the hot water supply valve (usually located under the sink) before disconnecting any hoses or working on the supply valve. And don't work on the dishwasher just after it's finished washing—some parts, particularly the heating elements, may be very hot.

How Hard is Your Water?

Contact your local utility to find out how many grains of hardness your water has. When operating the machine, use the right amount of soap for your water type—1 teaspoon per grain of water hardness.



Garbage Disposals

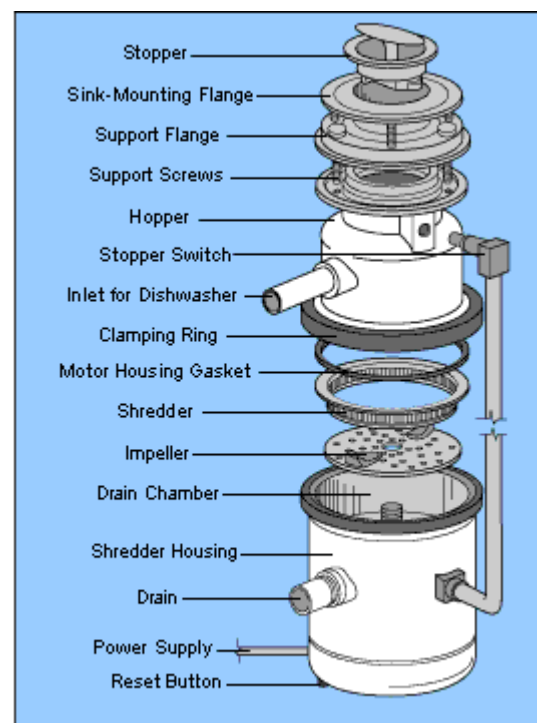
Indispensable in the modern kitchen, a garbage disposal helps make food preparation and cleanup easy and fast.

Attached to the underside of a kitchen sink's drain, a garbage disposal works by chewing up food scraps that are fed down the drain with a heavy flow of water. A shredder breaks the food down in the grinding chamber, then an impeller arm and plate force the liquid and particles down the drain. Dishwasher drain water also runs through the garbage disposal so that any large particles are chewed up and drained away.

Two types of garbage disposal are commonly available: the familiar continuous-feed style, activated by a switch as you run the water, and the batch-feed type, activated by turning a stopper after loading the disposal with garbage. Most garbage disposals have electric-powered motors, but one new type operates solely on the force of water from the sink spout. These are particularly practical where there is no electrical outlet for a disposal beneath the sink.

Garbage disposals work best if you:

- Use cold water when grinding food (hot water can melt fats in food, which clog the mechanism and pipes)
- Do not overfill the unit
- Do not pour bleach, drain cleaners, or other chemicals into the unit
- Do not grind overly fibrous materials, bones, or coffee grounds (check the owner's manual) or materials like glass, metal, or rubber
- Run water before, during, and after you use the disposal

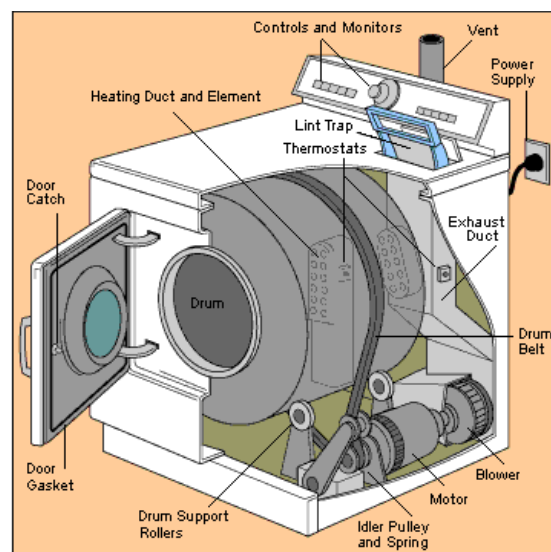


Dryers

Both gas and electric clothes dryers work by heating air that is blown through a duct into a rotating drum.

A gas dryer has a gas burner that does the heating; an electric dryer has electric heating elements. Both types utilize electricity for the controls and the motor that turns the drum.

You'll want to take great care when working on dryers. Unplug the dryer and turn off the gas supply to a gas dryer at the appliance shutoff valve. If you smell a strong odor of natural gas, stop what you're doing and call the gas utility from outside the house.



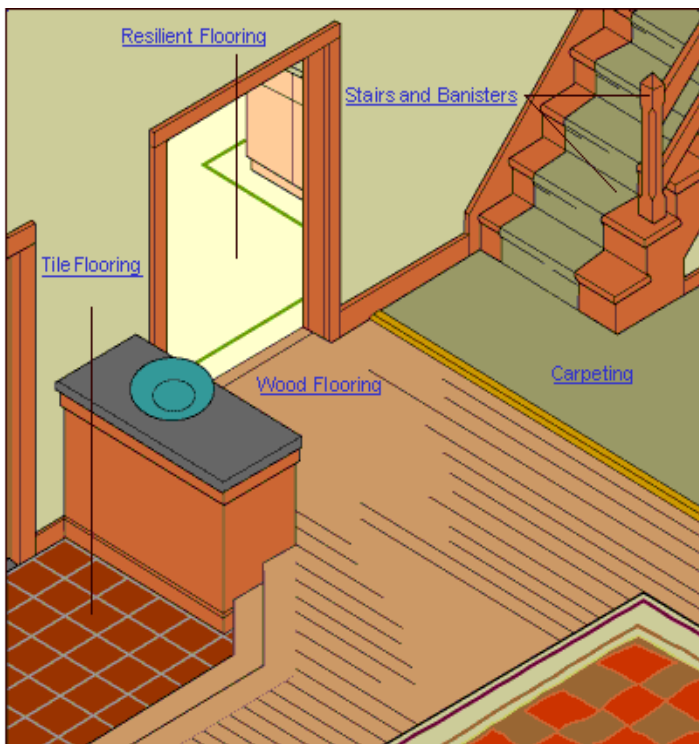
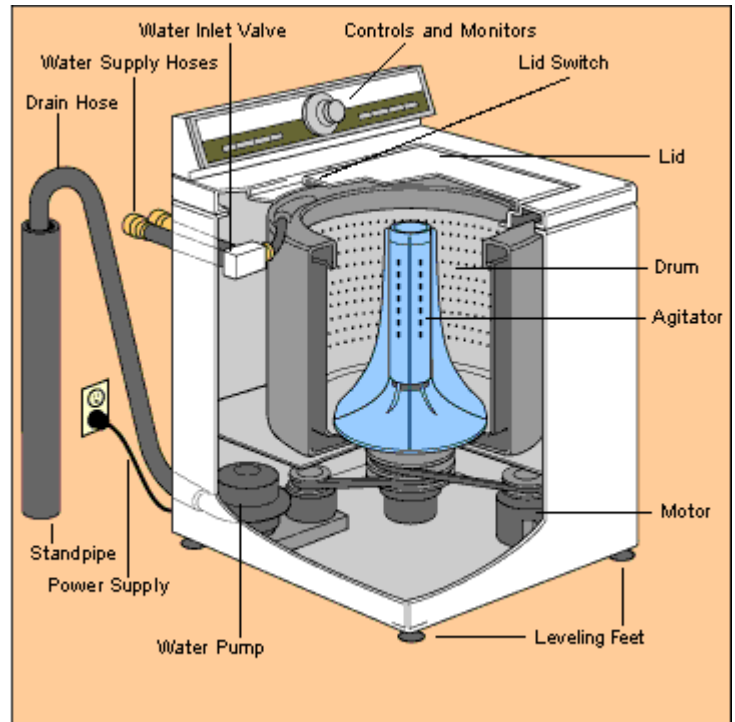
Washers

There are a few variations in washing machines.

Some washers load from the top, others from the front—but all are basically big tubs that fill up with water, agitate to scrub clothes, and spin to wring out the water. Of course, in addition to these basic functions, they may have any number of sophisticated functions, particularly with the controls. (Most new types incorporate some type of electronic timer and control.)

When buying a new washer, pay attention to the warranty. You should understand both the terms and the extent of its coverage. And be aware that some washing machines are much easier to work on than others. Some new types have a cabinet that is easy to detach and lift off for access to the parts.

There are a number of problems that you can fix quite simply when your washing machines starts to act up, but washers have a variety of devices that, when they go wrong, are best left in the hands of an experienced technician.



Flooring sets the tone for the look and feel of a room. But beyond appearance, the choice of flooring material should be based on how a room is used.

If you must walk through a room from the front door to get to the rest of the house, the flooring in that room should stand up to heavy foot traffic—including the possibility of tracked-in mud. If you like to cook elaborate meals, the kitchen's flooring should be kind to your feet.

There are two main types of floors: raised floors that are wood framed, and floors built on concrete slabs. Beneath a raised, finished floor there is generally a subfloor, supported by joists and beams, posts, and, in a two-story house, bearing walls. Joists may have solid or diagonal bridging between them to provide extra strength. A slab is just a flat, thick surface of concrete poured on the ground.

If you are installing new flooring or making repairs to existing floors, you may need to know what kind of subfloor you have. A raised subfloor is typically constructed from 1-by-4 or 1-by-6 lumber or 4-by-8-foot plywood panels. With a lumber subfloor, boards are laid diagonally across joists. A plywood subfloor's panels are nailed to the joists, laid with the ends butted together. On a concrete slab, a plywood subfloor is typically laid over 2-by-4 wood sleepers that are fastened to the slab.

Wood Flooring

Wood floors are among the most practical of all floors—they are durable, tough, and natural.

Innovations in wood floor construction and installation also make newer floors easier to clean and repair. A good wood floor, well-maintained, will last the life of your home.

There are three main kinds of traditional solid wood floor:

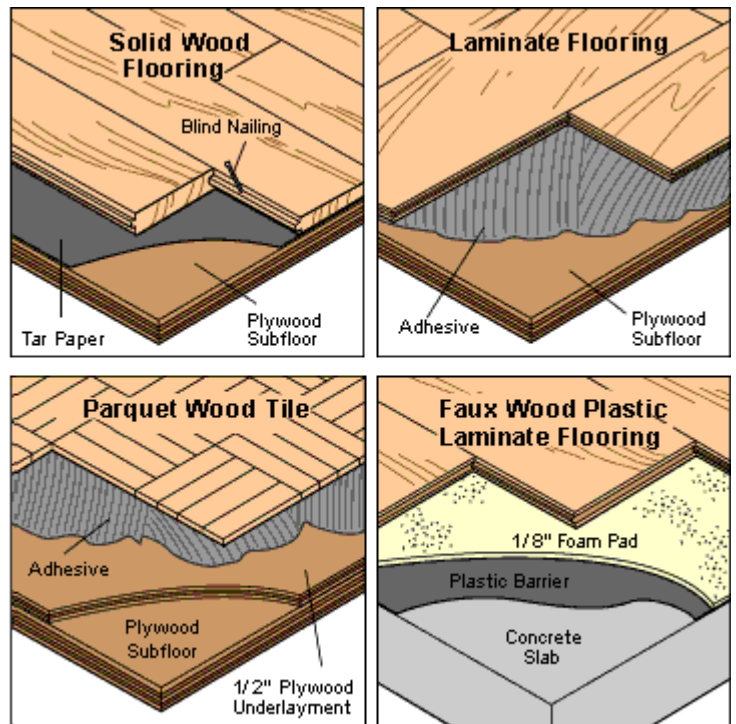
Strip floors: Boards come in various lengths and widths of 1½, 2, 2¼, and 3¼ inches.

Plank floors: Boards come in random lengths and widths, usually 3, 5, and 7 inches.

Parquet floors: Short pieces of wood are arranged in patterns—typically 12-inch tiles.

The finished floor may be any of several hardwoods, such as red or white oak, maple, beech, or birch, or it may be made of a quality softwood, such as pine or fir.

Laminated wood flooring provides a convenient alternative to solid wood. It's less expensive because a thin layer of hardwood is bonded to a less costly wood, and it is easier to install because it is prefinished. Additionally, because laminates are made of several layers, they do not have the expansion and contraction troubles of solid floors. The downside is that, unlike solid floors, laminates cannot be sanded and refinished.



Tile Flooring

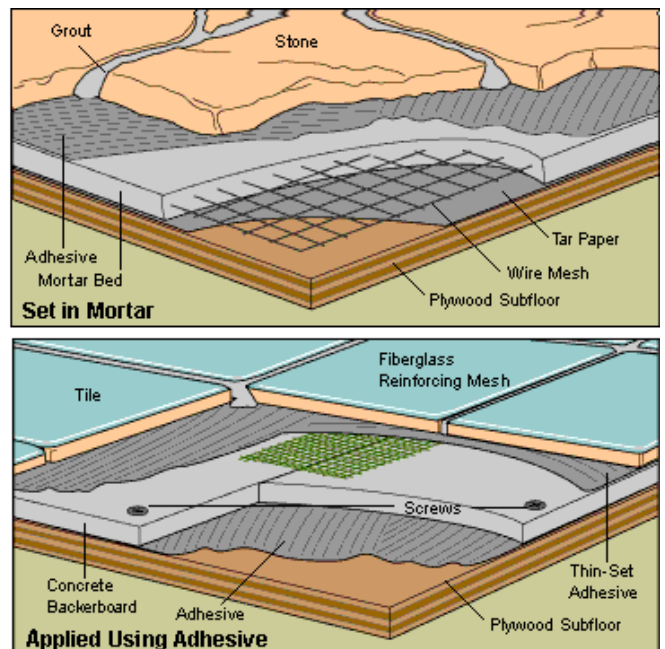
Glazed and unglazed ceramic and stone tile are the most durable floor coverings.

The downside is that they are cold to bare feet (this can be a plus in warm climates). Other detractions: Anything fragile dropped on them is likely to break, and some tiles are slippery when they're wet.

Glazed ceramic tiles come in a huge variety of colors and surface textures. They are thicker and less glossy than tiles used for walls and counters. The glaze is water repellent and can be treated so that it has a nonskid surface. Glazed tiles can have glossy, satin, matte, and dull finishes and can be anywhere from a foot square in size to tiny mosaic pieces.

Unglazed ceramic tiles come in the color of the clay or can be colored with the addition of pigment before the clay is fired. Stone tiles are quarried slate, limestone, flagstone, marble, or granite. Unglazed and stone tiles can be installed unfinished or can be sealed so that they have increased moisture and stain resistance. All tiles are jointed with grout.

Tile and stone floors are installed using a couple of different methods, as shown above. They may be set directly in mortar over a concrete slab or plywood subfloor, or they may be applied to a concrete backerboard or subfloor, using a thin-set adhesive. The first method is the sturdiest, and the most expensive.



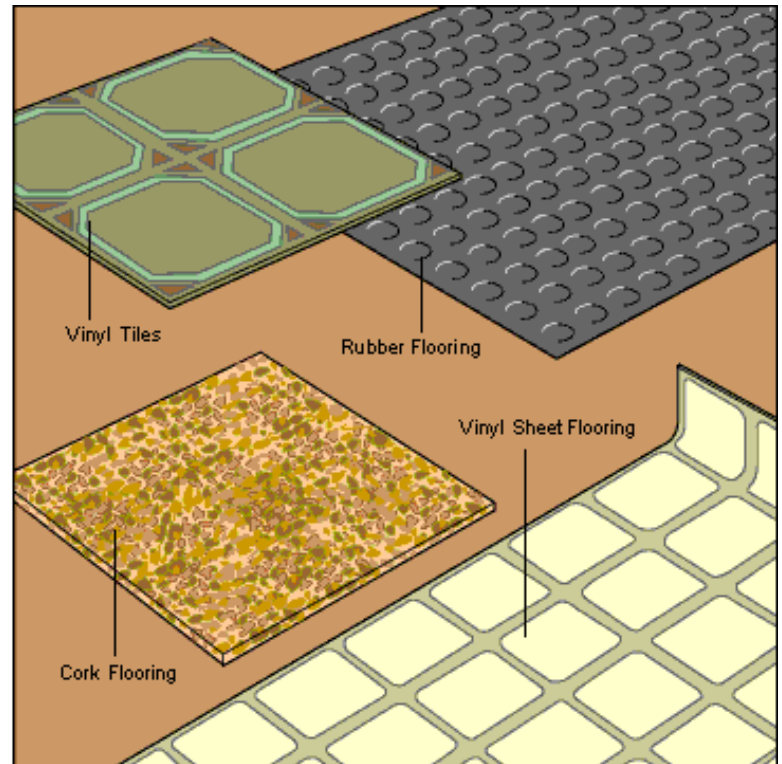
Resilient Flooring

Linoleum, cork, polyurethane, rubber, and asphalt composites all fall within the category of resilient flooring, though vinyl is by far the most common resilient flooring material.

Vinyl comes in sheets up to 12 feet wide or as individual tiles. It is one of the most practical of all floor coverings because it is comfortable underfoot, easy to clean, skid resistant, and relatively inexpensive.

Resilient flooring is not only manufactured from several materials, it comes in a huge variety of colors, patterns, and surface textures. Many kinds are given a protective surface layer that shines, so they don't require waxing.

Resilient flooring may be applied over a variety of surfaces, including plywood subfloors and concrete. And, as long as the surface is flat and sound, it may be applied over existing floors such as wood or linoleum.



Though resilient flooring is very durable, styles change and it does tend to show wear over the long run. More often than not, it needs to be replaced every 10 years or so, depending on the amount of wear and tear it receives.

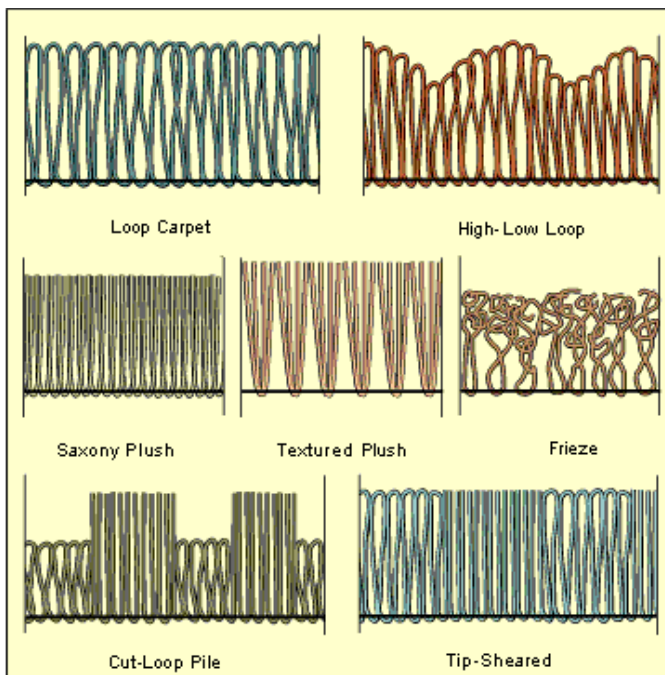
Carpeting

Wall-to-wall carpeting is warm and comfortable underfoot. It can be very affordable, easy to install, and far more sound-absorbent than other flooring materials.

Carpeting can also be less durable than other flooring materials, depending on the wear it receives and the material it is made from. It also can be more difficult to keep clean, depending again on the material and the height of the pile.

Carpeting is made of synthetic or wool yarn sewn through a backing of canvas or other material. The loops can be of varying heights and are often cut to make the carpet's pile. Some carpets are a combination of cut and uncut loops.

The most durable and common synthetic carpeting material is nylon, which wears well and can be quite stain resistant. Other synthetic materials are olefin, polyester, and acrylic—the latter, more expensive fiber has a texture more like natural wool and is more expensive. Wool has the most pleasant and natural texture, and is also the most expensive carpet material.

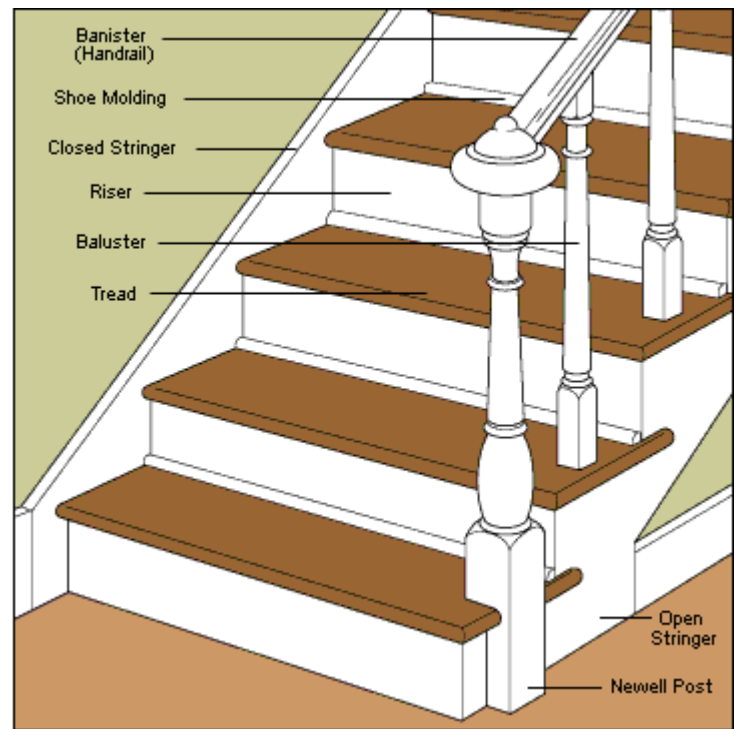


Carpet can be applied over almost any subfloor or existing flooring (except for old carpet!). A thick pile will hide irregularities in subflooring in a way that most other floorings won't

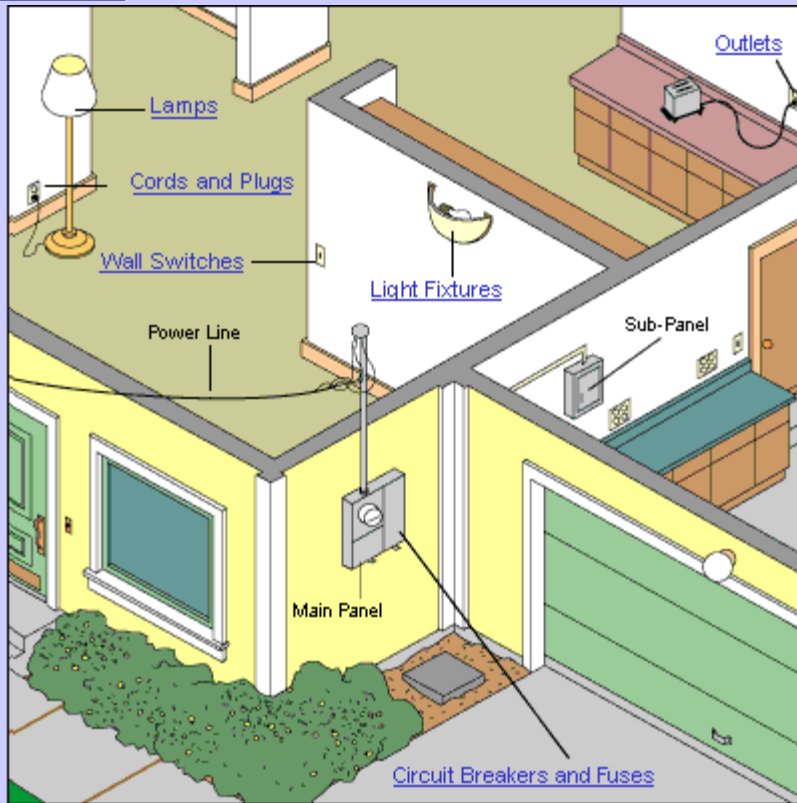
Stairs and Banisters

Staircases come in all heights, widths, and configurations. The form they take is determined by the builder's taste, the amount of space available, and the budget for building them.

A grand circular staircase can be very impressive as it sweeps down from the floor above. A staircase that runs straight from one floor to the next is easy to build but takes up space unless the risers are very steep. Stairs that stop at a landing and turn 180 or 90 degrees take up less space and can be safer. A spiral staircase is economical, but it is not easy to climb and is not practical for moving large objects from one floor to another.



Electrical



Electricity is an essential part of contemporary life, energizing lights, heat, air conditioning, cooking appliances, televisions, telephones, computers, and many other modern conveniences.

Electricity arrives at your house from your local utility company by way of a power line, or underground through a conduit. Most homes have three-wire service—two [hot wires](#) and one [neutral](#). Throughout the house, one hot wire and one neutral wire power conventional 120-volt lights and appliances. Both hot wires and the neutral wire make a 240-volt circuit for large appliances such as an air conditioner or an electric furnace. An electric meter, monitored by your electric utility company, is generally mounted where the electricity enters your house.

The main panel is usually right beside or under the meter. This is the central distribution point for electrical circuits that run to lights, [outlets](#), and appliances throughout the house. A circuit consists of:

1. A hot (usually black) wire that goes from a primary circuit breaker at the main panel to a series of lights, outlets, or appliances.
2. A neutral (usually white) wire that returns to the [neutral bus bar](#) at the main panel.
3. A grounding wire that returns to the main panel and, from there, to the earth. The grounding wire serves to divert electricity from any short-circuiting hot wires into the earth, preventing electric shock.

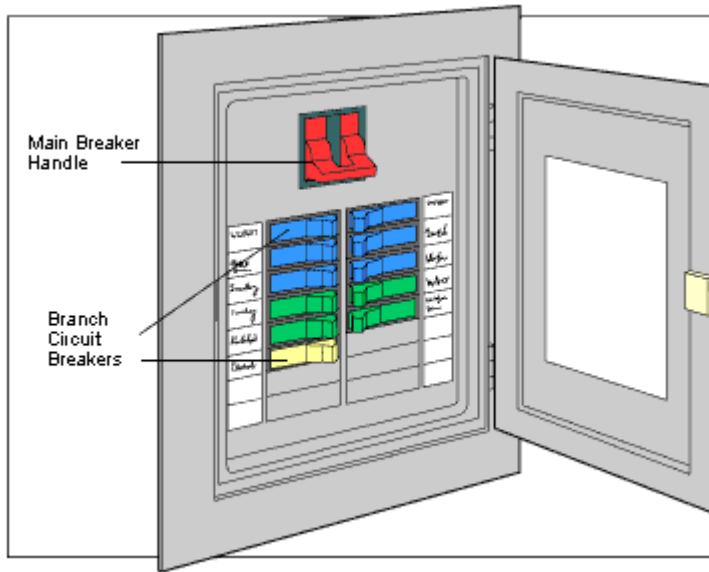
Sub-panels in other locations of the house, connected to the main panel, provide power to areas that have a number of different circuits or large appliances, such as the kitchen or laundry room. They also are equipped with a secondary set of circuit breakers.

Low-voltage electrical systems are also commonly used to power doorbells, intercoms, sprinkler timers, outdoor lighting, and some types of low-voltage indoor lighting. Relative to conventional voltage wiring, these systems are much safer for homeowners to work on.

Shutting Off the Power

Making electrical repairs? There are three ways to shut off the power to the entire house. You can either:

1. Push the main breaker handle to the OFF position.
2. Flip the main lever switch at the main panel to OFF.
3. Pull out the fuse block.



Circuit Breakers and Fuses

Electricity is distributed at the main electrical panel to lights, outlets, and appliances throughout the house via circuits.

Main circuit breakers shut off power to the whole house. Individual circuit breakers connect to circuits throughout the house. Each circuit is protected by a circuit breaker (or fuse) at the main panel that will automatically shut off the power to the circuit in the event of a dangerous electrical overload or short circuit. A circuit breaker can also be used manually to disconnect a circuit from incoming power so that you can repair or upgrade your outlets and fixtures. When you work on your home's electrical systems, it's important to shut off the power before handling electrical wires or components. Label circuits to identify which parts of the house they serve.

GFCI Circuit Breakers

Ground-fault circuit interrupters (GFCIs) are outlets or circuit breakers that shut off power instantly when a circuit shorts or overloads. They are often required for kitchen, bathroom, and outdoor circuits.

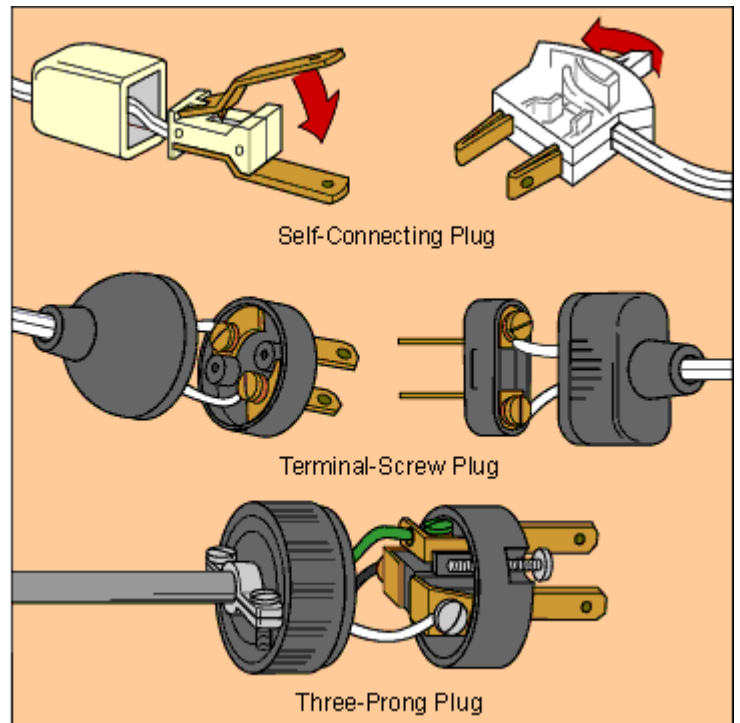
Cords and Plugs

Age and heavy usage can take their toll on cords and plugs.

Common victims are cords and plugs of appliances you use frequently, such as irons and blow dryers; appliances you've had a long time, such as toasters, lamps, and refrigerators; and vintage models whose electrical systems are simply wearing out.

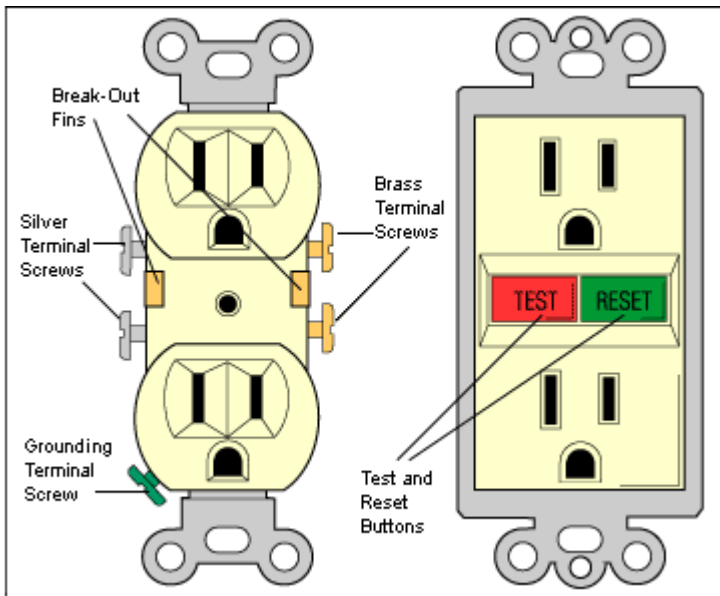
There are several types of electrical cords; they vary in their construction depending upon how they're used. For example, lamps and fixtures typically have molded plastic-insulated cords. Power tools and vacuum cleaners often have similar plastic-insulated cords but, because they carry more power, the cords are larger in size. If you buy a new cord for an appliance, be sure to get one that is the proper size and type for the appliance.

The three basic kinds of plug are self-connecting, terminal-screw, and three-prong. Lamps and small appliances most often use self-connecting plugs, the prongs of which clamp onto the wires of the cord, making an automatic connection.



With terminal-screw plugs, the wires attach to screws inside the cord body; this type of plug is usually found on older appliances. An older terminal-screw plug often has a removable insulating disk covering the terminals and wires. Newer plugs have rigid insulating barriers.

Three-prong plugs are used for larger appliances such as washers, dryers, refrigerators, and power tools, and include a prong that grounds the appliance. When planning where you are going to place a large appliance, be sure you have the appropriate kind of outlet available, or [plan to install one](#).



Outlets

Outlets, also known as receptacles, are the places where you plug in your lamps, computers, toaster ovens, and blow dryers.

Some include a half-round hole for the grounding plug on a cord. Older houses may not have outlets with grounding holes, in which case you probably have two-prong adapters to ground your appliances and lighting. If you have to replace an outlet, install a grounding box unless the system isn't grounded with a grounding wire or metal conduit.

How do you know if the system has a grounding wire? First turn off the power. Check an outlet with a circuit tester to make sure it's off, and remove it from the wall. It should have three different-colored terminal screws: brass screws for black (hot) wires, silver screws for white (neutral) wires, and a green screw for the ground wire. The green terminal screw should be connected either to a bare wire or to a metal electrical box. If it isn't, consult an electrician to find out whether your system is properly grounded.

Outlets for 240-volt appliances that draw a lot of current (such as dryers, ranges, and air conditioners) have different configurations. Never force a plug into an outlet that doesn't accommodate it. Always replace old outlets with new ones that have the same amperage and voltage.

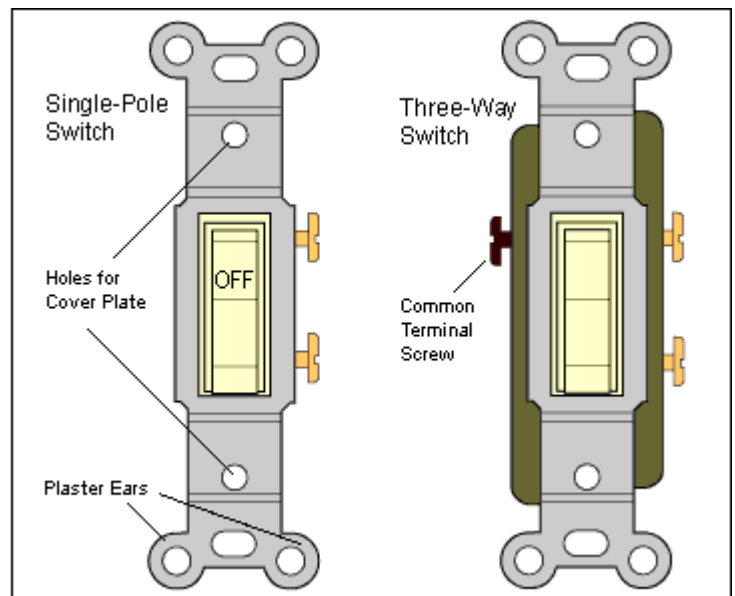
Wall Switches

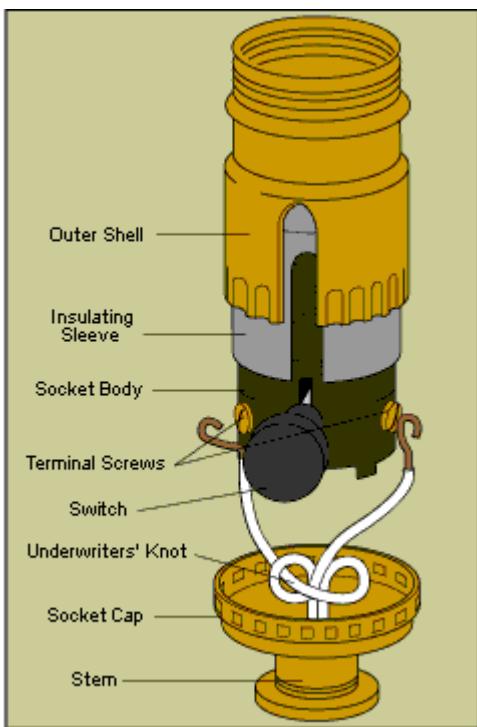
There are many kinds of switches to choose from.

We take switches for granted. But if you have ever remodeled a room, you probably know that it takes some thought to choose the right kind of switch.

The basic switch is known as a [single-pole switch](#). If you have lights operated from two places you'll need a [three-way switch](#). [Photoelectric switches](#) sense the amount of light in a room or outdoors, and [dimmers](#) control the amount of electricity that flows and the amount of light available. Dimmers can be operated with a toggle, dial, slide, switch, touch pad, or button.

Central lighting control stations allow you to operate all of the lights in the house from one room, such as the master bedroom or living room, and can be programmed for lighting in different zones in the house at different times.





Lamps

Regardless of how sophisticated or elaborate the design, most lamps have the same basic wiring and construction.

A typical lamp includes a shade that sits on a frame called a harp. A socket holds the light bulb, or several sockets may hold several bulbs, and a cord runs through a hollow channel, called a stem, inside the body of the lamp.

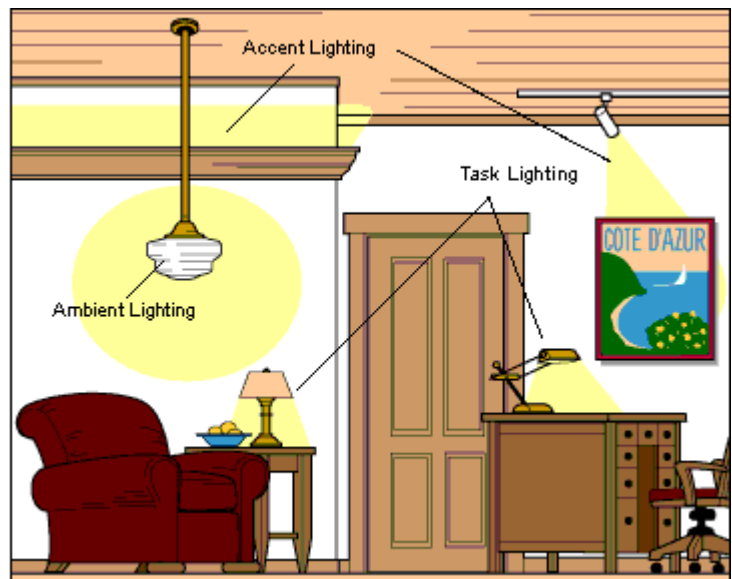
If a table or floor lamp doesn't work, do the obvious: Put in a new bulb. If it still doesn't light, check the circuit breaker or fuse that serves the lamp's outlet. If the circuit is working, you may need to replace the lamp socket or plug. Be sure to replace cords and sockets with parts that are identical to the originals.

Light Fixtures

Lighting can make a huge difference in the way a room feels, and it can dramatically affect how a room functions.

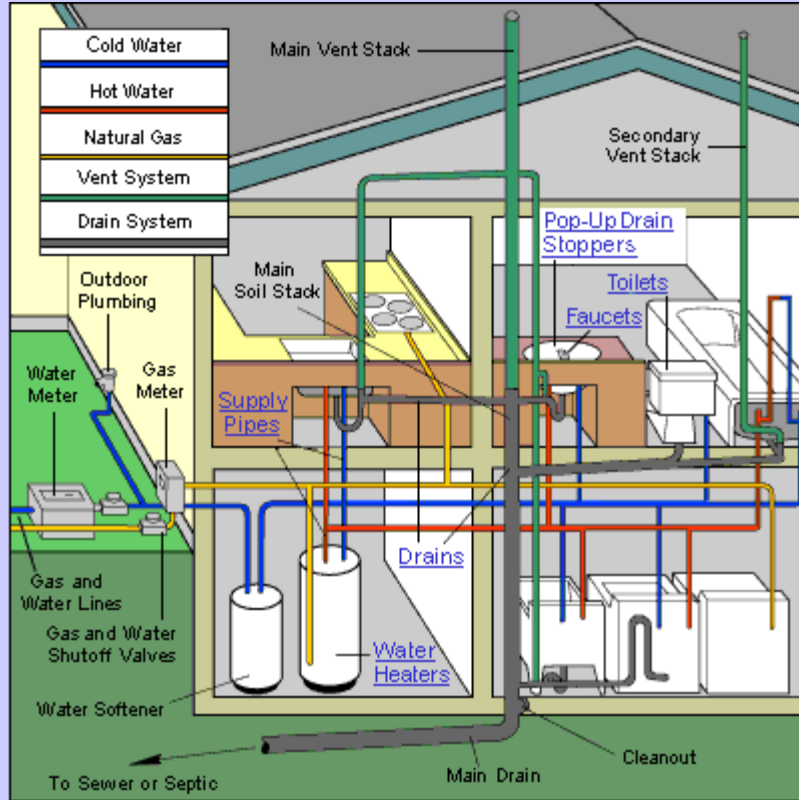
Properly planned lights should illuminate housework, reading, hobbies, playing, homework, meal preparation, and the many other activities that take place in a home. Unfortunately, many older homes and apartments have completely inadequate lighting—a single ceiling-mounted fixture at best.

Replacing an old-fashioned light fixture is a quick way to update the look of a room, apartment, or house. Here is a closer look at home lighting and how proper lighting techniques are categorized:



- Ambient lighting provides illumination for the whole room through ceiling or wall fixtures, chandeliers, or track lighting.
- Task lighting provides directed light for washing dishes, cooking, or working at a computer.
- Accent lighting highlights objects or interesting architectural features.

Plumbing



If you have ever gone camping for a weekend, you know it doesn't take long to miss running water, flushing toilets, clean clothes, and hot showers. These modern conveniences are the benefits of plumbing systems.

Your house has several separate plumbing systems. Water-supply pipes bring pressurized water from the water utility or a well to your house, where it is piped to sinks, toilets, washers, bathtubs, and related fixtures. Larger pipes drain waste and vent sewer gases. And many homes have piped-in natural gas for gas-burning appliances such as dryers and furnaces. In an emergency, you should know how to turn water off quickly before it ruins floors and walls. The main [shutoff](#)

[valve](#) is located either outside where the main water supply enters, or just inside—particularly in cold climates. Turn the valve clockwise to shut it off. Call your utility company if the problem involves a valve between the street and the house.

Drains

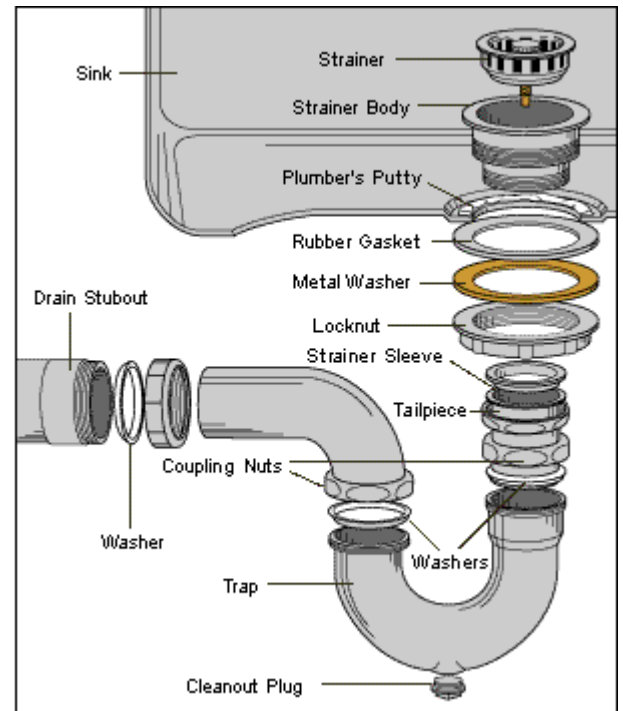
The drains in our sinks and tubs lead to a largely concealed system of pipes, traps, and [cleanouts](#).

Most drains lead to a trap that keeps waste from washing back up the pipes. These pipes, in turn, lead to branch drains, which connect to the main drain into a sewer or septic system.

If you've ever washed a contact lens or piece of jewelry down the drain, you've met the sink trap. Unscrewing a [sink trap](#) can reveal lots of sink-clogging hair, in addition to hidden treasures (such as your contact lens).

All drains clog occasionally—usually inconveniently and unpleasantly. First, try to remove the clog through the fixture or drain itself. If that fails, most plumbing systems have cleanouts: usually Y- or T-shaped fittings set at a 45-degree or 90-degree angle from the drainpipes and capped with threaded plugs that unscrew. It's usually relatively easy to run a [drain auger](#) into drainpipes from these access points.

Preventing clogged sink, tub, and toilet drains is the best course of action. Strainers placed over kitchen and bathroom drains can help. Even kitchen drains equipped with garbage disposals, however, can get clogged by coffee grounds and grease.



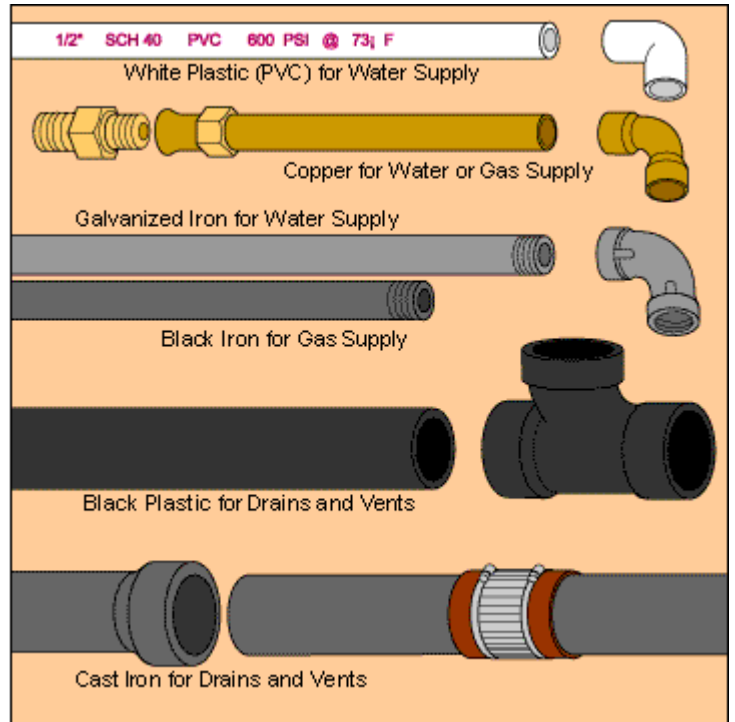
Supply Pipes

If you've ever seen water gushing from a fire hydrant, you have some idea of the pressure moving the water along.

A main supply pipe connected to the water company's main or to a well on your own property supplies water to your house. Once the water arrives at your house, the main supply divides into one system of pipes for cold water and another for hot water. Parallel hot and cold water pipes slope slightly so the pipes can be drained at the lowest points through a valve or faucet.

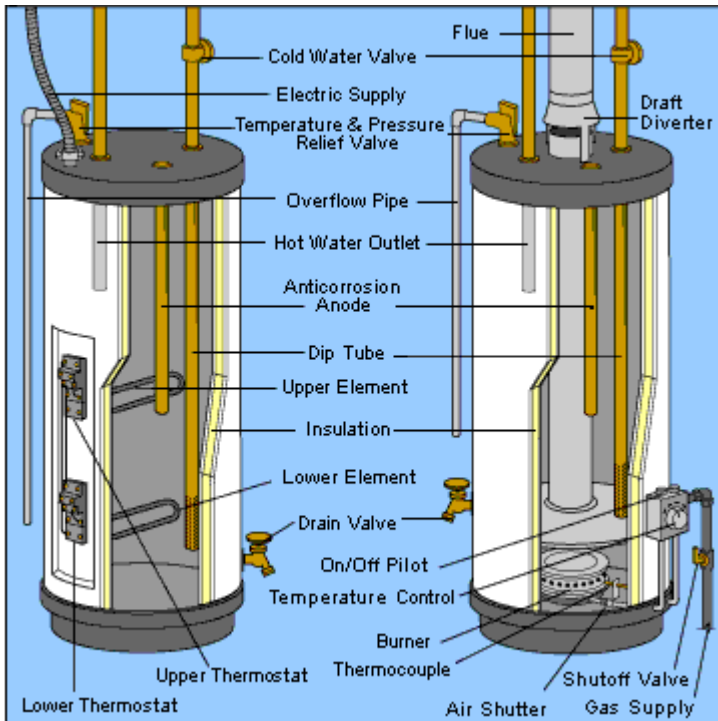
Waste drainage systems take advantage of gravity to channel waste to the sewer line. The soil stack, a vertical run of pipe three to four inches in diameter, carries waste to a main drain usually underneath the house, which empties to a sewer or septic tank.

Vents prevent sewer gases from seeping into your house, while traps—water-filled bends in pipes—keep gases from escaping up the drain. Vents branch off below the soil stacks while gases vent through the roof. Plumbing generally is vented with a main vent stack, or there may be a vent stack for each fixture, if fixtures are widely separated.



Identifying Pipes

A pipe's size and material can serve as a fairly good indicator of its function. White plastic, copper, and galvanized (silver-toned) pipes smaller than 1 inch in diameter generally carry water, though some galvanized steel, black steel, and flexible copper pipes of the same sizes may carry gas. Large-diameter (1 1/2 inch and larger) black plastic, cast-iron, and copper are often drain, waste, or vent pipes.



Water Heaters

Although there are two types of water heater, storage tank and on-demand, the chances are good that you have the conventional storage tank type.

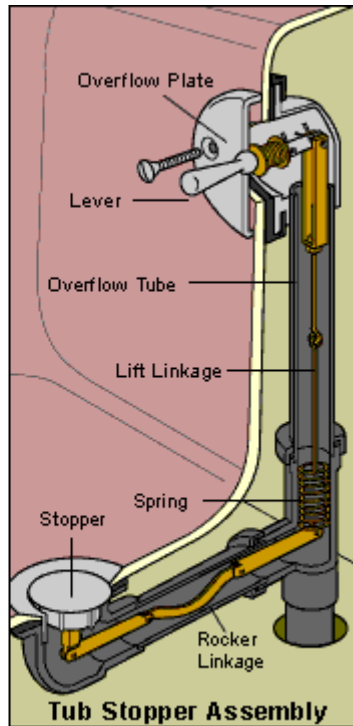
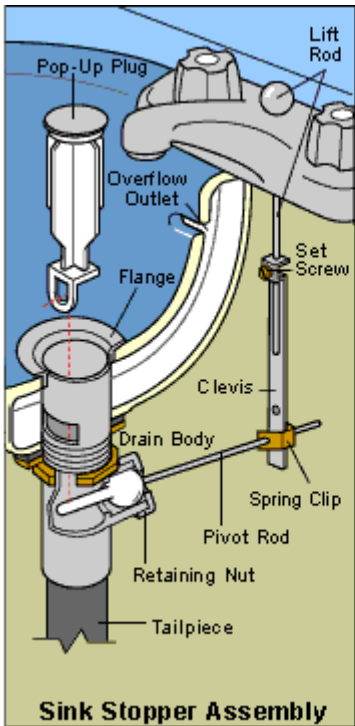
On-Demand Water Heaters

On-demand heaters are efficient and economical because they heat water only as it is required, rather than continually heating and storing it. It is best to leave the installation and maintenance of on-demand water heaters to professionals.

Storage Tank Water Heaters

Both gas and electric storage tank water heaters operate in similar ways: When you turn on a hot water faucet or use hot water in a dishwasher or clothes washer, water pipes draw hot water from the tank. The heated water is drawn from the top of the tank and is replaced by cold water that is carried to the bottom by a dip tube. When the thermostat signals that the water temperature has dropped, a burner in a gas heater or a heating element in an electric heater starts up to heat the water.

Be conservative when you set the temperature control; 120°F is usually hot enough. A hotter setting wastes energy and could cause serious burns to an unwary bather. To maximize your water-heating energy, it's a good idea to insulate your water pipes if they run a long way from your heater to faucets.



Pop-Up Drain Stoppers

Pop-up drain stoppers move up and down to open or close drains in sinks and tubs.

Although the stoppers in sinks and baths look similar from the outside, the mechanisms hidden within the drains are somewhat different.

You raise and lower sink pop-ups with a knob usually located near a faucet handle. The knob is actually the head of a lift rod fastened to a [clevis](#), or connecting pin. The clevis connects to a [pivot rod](#)—and-ball assembly, that is, a rod that runs through a rubber pivot ball and slopes slightly uphill to the tailpiece of the stopper. Pushing the knob and lift rod down causes the pivot rod to push the stopper up; pulling the knob causes the pivot rod to pull the stopper down. If you need to remove the stopper, you may be able to pull it right out of the drain. If it doesn't lift right out, you may have to twist it to unhook it from the clevis.

You raise and lower tub pop-ups with a lever at the tub's [overflow plate](#). The lever operates a striker rod that pulls on the striker spring. The spring pulls a rocker arm that raises and lowers the stopper. It is usually very simple to pull out the stopper and rocker arm.

Faucets

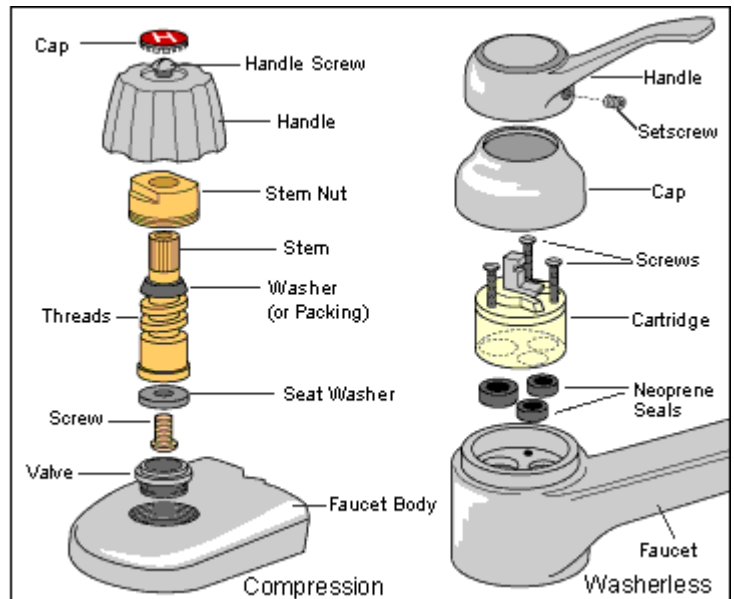
Faucets come in a staggering array of styles, colors, and shapes, but they all do the same thing, turn water on and off, in pretty much the same way.

Compression Faucets

Compression faucets, common in older homes, have a washer or seal that cuts off the water flow by closing against a valve when the faucet is turned off. These faucets tend to drip from the spout when the washers wear out. With compression faucets, hot and cold are controlled with two separate handles.

Washerless Faucets

Other faucets have [O-rings](#) instead of washers that provide a seal, and a cartridge, ball, or disc mechanism that controls the water flow. Disc faucets have a movable upper disc and a fixed lower disc; raising the upper disc makes the water flow, and lowering the disc shuts it off. Cartridge faucets have a metal or plastic insert that seals the spout. Ball faucets are operated by a lever that aligns a slotted ball with inlets in the faucet. Most washerless faucets mix cold and hot water and have a single handle, though disc faucets may have two separate controls.



Toilets

Toilets have two main parts: a tank and a bowl.

The tank, which houses all the working parts, is where various types of toilets differ the most. Several different types of mechanisms are used to accomplish a toilet's basic operation—to flood the bowl with enough water to flush waste down the drain and then refill the tank and bowl with fresh water.

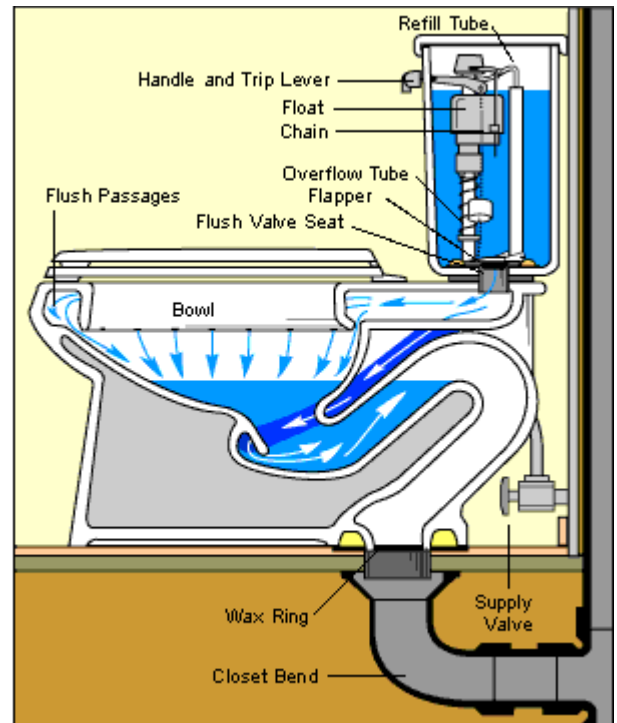
Here is how the most common mechanism works: When you flush the toilet, the handle lifts and a stopper, called the [flush valve](#), releases the water from the tank into the toilet bowl. The resulting water pressure forces the contents of the bowl into the [drainpipe](#).

As the tank empties, a [float ball](#) that floats on the top of the tank water drops. This activates a [ball cock](#) or water valve, which opens a water-supply valve that refills the tank. (Some toilets do not have the float ball and work through water pressure.) As the water fills the tank, the ball floats back up, and when the water reaches the right height in the tank, it shuts off the valve.

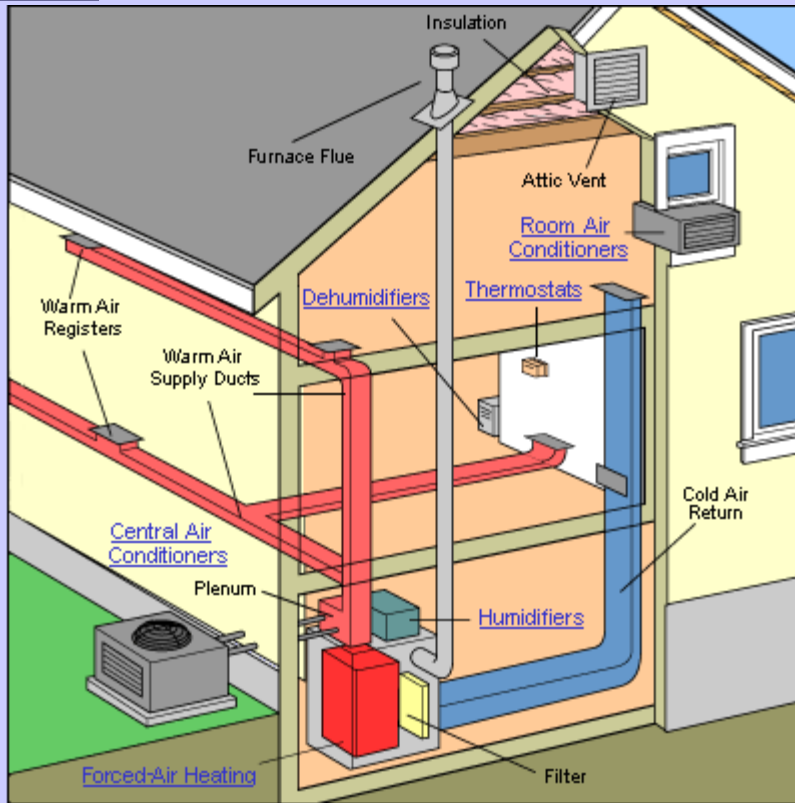
A bend in the pipe just below the toilet serves as a water-filled [trap](#) that blocks the rise of sewer gases. Waste drains to a municipal sewer or to a septic tank.

Low-Flow Toilets

Almost one third of a household's water is flushed down the toilet. Older toilets use from five to seven gallons of water; newer toilets use only one or two. Some water utility companies offer rebate programs if you replace your toilet with a more efficient model.



Climate



Depending upon where you live and how your house was built, your home may have any of several different types of climate systems that help you to enjoy your interior spaces year-round.

Forced-air heating (fueled by gas, oil, or electricity) is a very common type of central heating. Other types of heating include radiant electric and hot water. Houses may be cooled by central air conditioning, room air conditioners, heat pumps, or the old-fashioned way—with ceiling fans. And in some areas where too much or too little humidity is a problem, the interior air is brought into balance with the help of humidifiers or dehumidifiers. A good barrier of insulation helps to keep hard-won heated or cooled air inside your home where it belongs.

When planning, maintaining, and repairing home climate systems, keep simple physics principles in mind. First, heat seeks a balance. Heat will move from a warm place to a colder place. The greater the temperature difference, the faster it moves, which explains those drafts we feel sitting in front of a cold window. Second, warm air rises. That's why the second floor of a home is usually warmer than the main floor or basement.

Insulation

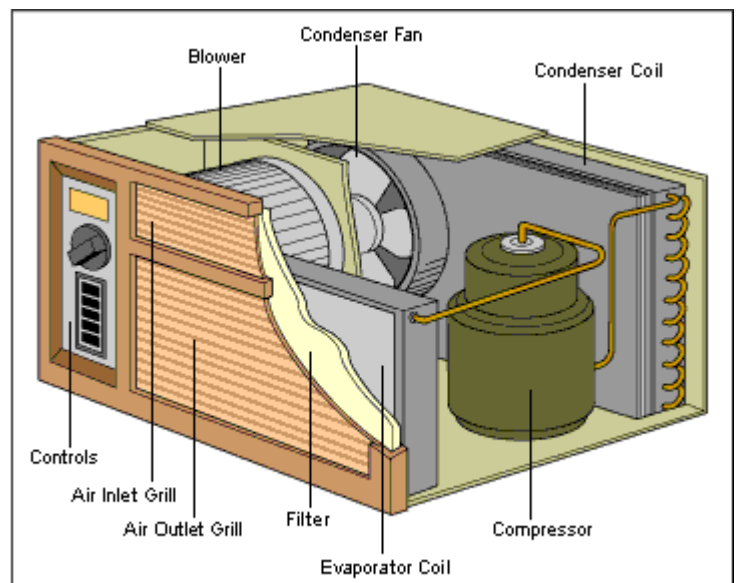
Attic insulation can significantly reduce loss of heat through the roof. Over time, the cost of insulation pays off in heating and air conditioning savings. If your home's attic isn't insulated, consider installing insulation or hiring an insulation contractor to do the job.

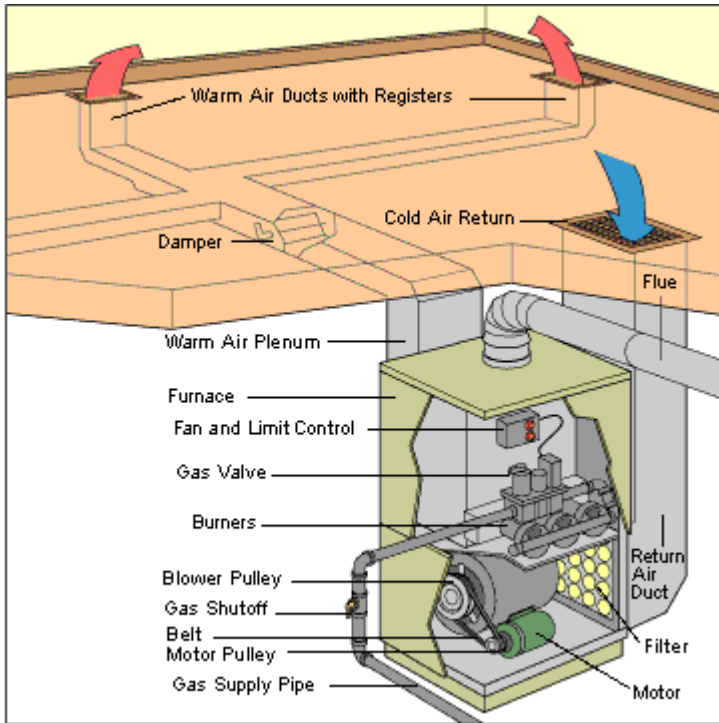
Room Air Conditioners

Room air conditioners are a sensible cooling solution for apartments or situations where you only want to cool one or two rooms.

Like central air conditioners, room air conditioners extract heat and moisture from the room air, cool and dehumidify it, and return the air to the room. A blower pulls warm room air through a filter.

The main difference between a room and a central air conditioner is that a room air conditioner is a single, self-contained unit with [evaporator](#) or cooling coils, a [condenser](#), and refrigerant-filled tubing all in one box. Air conditioner units mount in a window or through an opening in a wall, since they need to expel hot air.





Forced-Air Heating

Most homes are heated by central forced-air heating systems.

Ductwork carries air to the furnace (or [air-handling unit](#) in the case of a heat pump), where the air is filtered, warmed, and blown back through ducts to rooms throughout the house. Older-style gravity furnaces, usually located in basements, offer central heating but don't force the air—instead, they allow heated air to rise naturally into rooms through large ducts.

Furnaces can be fueled by natural gas, oil, propane, coal, wood, or electricity. Today, most use gas because it is clean-burning, commonly available, and relatively inexpensive. In a few regions, electricity is unusually affordable—in these areas, electric furnaces or electric [radiant heating](#) may be sensible. One advantage of electric heating over gas and other combustion fuels is that electric heating doesn't require a [flue](#) to carry [combustion gases](#) outside, so its installation can be more affordable.

One of the benefits of a forced-air system is that it can include an air-conditioning unit, a humidifier, and an air filter—and all of these can take advantage of the system's ducts for delivery of conditioned air to rooms.

Gas Forced-Air Heating Systems

When a room's air temperature drops below a preset level, the [pilot light](#) ignites a burner in the furnace's heat exchanger, around which air flows and is heated. The warmed air moves into the rooms through ducts. [Combustion gases](#) are vented through a flue.

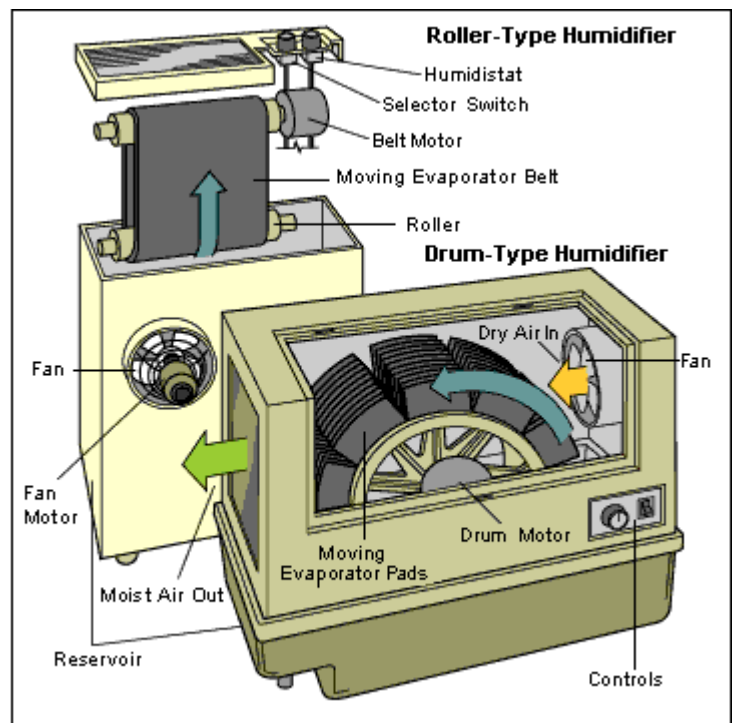
Humidifiers

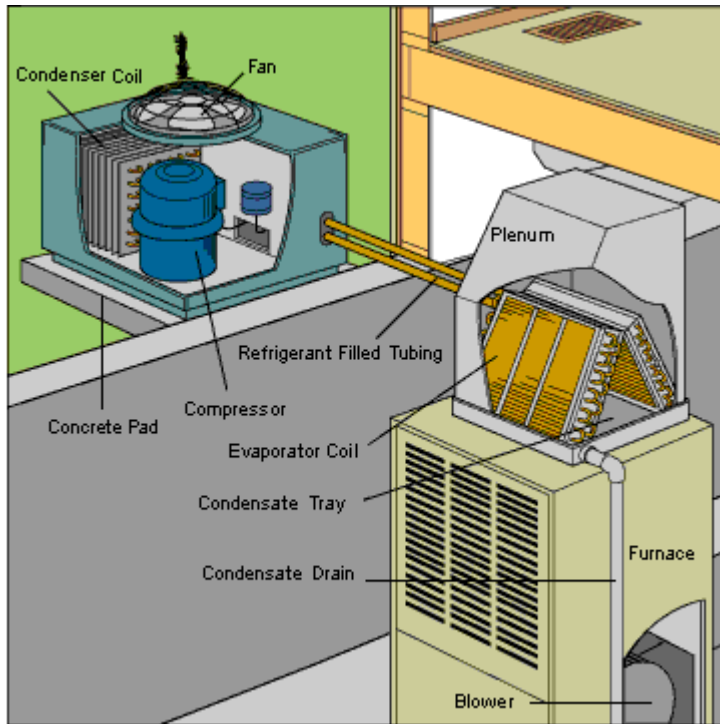
The humidity level in your home has a dramatic effect on comfort.

To achieve a comfortable interior environment, the humidity levels should be from 30 to 50 percent in the winter and 40 to 50 percent in the summer. Lower levels of water vapor in the air can dry out and irritate skin and higher levels can feel damp and may encourage mold and mildew, both of which can cause allergies and damage to your house.

In some parts of the country, notably the Southwest, the air is dry most of the time. In other regions, winter heating robs the air of humidity. To solve these problems, humidifiers put water vapor into a home's air. They are available as tabletop units, consoles, or units connected to central heating and cooling systems.

Tabletop humidifiers serve one room, while console or central humidifiers can serve a whole house. Tabletop and console models are relatively inexpensive, easy to hook up, and easy to move from one room to another. The downside is that they must be filled manually—sometimes every day.





Central Air Conditioners

In a typical air conditioning system, a refrigerant circulates through a loop of copper tubing that runs between an outdoor coil (the [condenser](#)) and an indoor coil (the [evaporator](#)).

Refrigerant travels between the two coils, absorbing heat from the room and releasing it outside. In the process, the refrigerant cools the evaporator coils. A blower sends the chilled and dehumidified air into the room. The cooling effect causes the warm air to release its moisture, which drops into a drain pan and is carried away. A heat pump works just like an air conditioner but has a valve that can be reversed to deliver heat (instead of cooled air) to the house.

Central air conditioning is often combined with a forced-air furnace—both share the same blower and [ductwork](#). The furnace's air filter removes dust, hair, and lint and should be checked every month when air conditioning or heating are in use to be sure it is clean. Air conditioners are powered by electricity, and they can use a lot of it, depending on the size of the house and its general weather-tightness. Proper maintenance and service can help reduce the high cost of keeping your house cool.

Thermostats

Thermostats measure your home's ambient temperature and use that information to activate your furnace or your air conditioner, depending on the thermostat's setting.

A mechanical thermostat works when its [bi-metal coil](#) contracts and expands with the room temperature. The movement of this coil activates a switch that opens or closes a [circuit](#) to make the furnace, heat pump, or air conditioner turn on or off.

Programmable electronic thermostats make it possible to automate the way your thermostat works and use your home climate systems more efficiently, resulting in lower energy bills. Their timers allow you to warm up your house before you get out of bed in the morning or come home after work, and can be set at different temperatures for different times of the day. If you have a mechanical thermostat, you might consider switching to a programmable electronic model. Look for thermostats that allow you to program daily cycles, weekly schedules, and override default settings.

Zone-Controlled Climate Systems

Sophisticated zone-controlled home climate systems divide the house into several separate zones or areas that may each be controlled by separate settings and times on individual thermostats. With zone controls, thermostats open and close dampers, sending warm or cool air when and where it's needed.

