# A Guide to Home Repair and Maintenance

*A collection of handouts provided by the Home Repair Resource Center*


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# HOME SYSTEMS SURVEY

Use this worksheet to evaluate the major repair needs of your house and garage. The information will help you identify and understand the condition of the main systems and to estimate when these systems might need repair or replacement. Repair costs are best determined by obtaining three comparable, well-written bids from reputable contractors. but our accompanying handout, "Cost Information for Major Repairs," will give you a rough idea of what to expect.

**Please note:** This Home Systems Survey covers only the major systems, not everything in a house which might need repair. and is based on Building Code requirements in Cleveland Heights.

| Repair Now | Repair 1-5 Yrs. | No Immediate Need | |
|---|---|---|---|
| ❑ | ❑ | ❑ | Shingled Roofs — Asphalt shingled roofs have an average life expectancy of 20 years. Curling, cracking, torn or missing shingles as a general condition indicate it's time for replacement. If curling is minimal, you may have a couple of years before replacement is absolutely necessary, but leaks won't always show, and leaks can damage the roof frame. Inside, look for signs of leakage (water stains) especially around chimneys and on the attic ceiling. |
| ❑ | ❑ | ❑ | Flat Roofs — Flat roofs (usually over porches and garages) covered with asphalt roll roofing usually last no more than 3 years. Alligator-type cracks, torn paper or split seams are signs that replacement is needed. Water sitting in puddles (or signs of it) could indicate some damage to the wood below the roof. (Newer roofing products have a longer life expectancy, usually 10 - 20 years.) |
| ❑ | ❑ | ❑ | Foundations — Brick walls that appear to be slanting or sinking into the ground may require some footing work below ground level to provide adequate support. In some cases, they will need replacement. Cracks in the mortar between the bricks are usually easily repaired. Cracks that break the bricks, however, usually indicate a structural fault and should be inspected by a qualified person. Check the condition of basement walls, as well as exterior masonry. |
| ❑ | ❑ | ❑ | Exterior Wood — Wood siding and/or wood siding shingles that are severely bowed or cracked need to be replaced. Rotted wood or wood that is soft to the touch indicates replacement is needed. Small piles of sawdust (usually around porches, but sometimes found elsewhere) may indicate the presence of wood-boring insects, such as termites. If you have any concerns, have the house inspected by a professional. |

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| Repair Now | Repair 1-5 Yrs. | No Immediate Need | |
|---|---|---|---|
| ❑ | ❑ | ❑ | Gutters and Downspouts — Galvanized gutters can be identified by their dull gray color when not painted or by signs of rust on the paint. If you see rust, expect to replace the gutter system within a year or two. Aluminum gutters have a much longer life expectancy, if securely nailed in place and not dented by ice, ladders, etc. |
| ❑ | ❑ | ❑ | Exterior Paint — If the paint is deteriorating (such as blistering or cracking) other than from normal wear, there may be some moisture problems that need to be corrected prior to painting. Older homes (in any community) will likely contain lead-based paint. Lead-safe work practices should be used when disturbing painted surfaces. |
| ❑ | ❑ | ❑ | Driveways and Walkways — With proper maintenance, asphalt driveways have a life expectancy of 20 years. If asphalt covers concrete and is breaking up, or if more than a few potholes, large cracks, or chunks of asphalt are missing from the driveway, it is time for the old drive to be dug out and a new drive installed. If cracks are not major, asphalt drives can be resurfaced with 2" of new asphalt; hairline cracks can be sealed to last a few more years.<br><br>Concrete driveways have a life expectancy of 20 years. More than a few craters or large cracks where adjoining sections are not level indicate time for replacement. Concrete can be patched, but patches generally last only a year or two.<br><br>Maintenance of public walks is the homeowner's responsibility. Evaluate walkways using the standards for concrete driveways. Individual sidewalk blocks can be replaced. Blocks that differ in height and pose a trip hazard will have to be leveled.<br><br>*Note: If you receive a violation to "replace" a driveway or sidewalk block, that's what you will have to do.* |
| ❑ | ❑ | ❑ | Electricity — The electrical system is hard to evaluate without experience. Fuses and circuit breakers are equally good, but circuit breakers indicate a more modern system. The more fuses or breakers, the better. Find out how many amps of service the house has; if less than 100 amps (considered minimum for today's use), you should consider upgrading the system.<br><br>Knob and tube wiring (with wire wrapped around porcelain knobs and passing through porcelain tubes) is an older style of wiring, but in good condition is perfectly adequate. A more modern style uses Romex, which has a white or black flat rectangular casing around the wires. A combination of the two systems is common; the major concern is whether connections were made properly. |
| ❑ | ❑ | ❑ | Furnace or Boiler — The life expectancy of a furnace or boiler is about 25 years. It is hard to evaluate the condition of a heating unit from its exterior appearance. Look for signs of excessive rust at the base (where rust would eat holes through the metal). Open up the covers and look inside for excessively rusted burners. If in doubt, have the unit inspected by a heating tradesperson. |

*(continued)*

| Repair Now | Repair 1-5 Yrs. | No Immediate Need | |
|---|---|---|---|
| ❑ | ❑ | ❑ | Plumbing — Older plumbing systems used galvanized pipe, which can be identified by threads on the ends of the pipe, a gray color if not painted, or signs of rust. In most cases, galvanized pipe will clog on the inside and eventually need replacement. Check the water pressure on the second floor for inadequate flow caused by such clogging.<br><br>Copper is the more modern system. It can be identified by its color and the presence of silver-colored solder at joints. Plastic pipe may be used for new and replacement lines (PEX or CPVC for water lines, PVC for drain lines), but adequate electrical grounding should be ensured. Check the water line between the water meter and the street. (The water meter can be found in the basement on the wall closest to the street.) If the line is galvanized, expect to replace it; if copper, it has already been replaced.<br><br>A hot water tank has an average life of 5-10 years. Look for general age and signs of puddles around it on the floor. |
| ❑ | ❑ | ❑ | Basement — Water stains and some mortar missing from between bricks are common, as are cracks in the basement floor. Excessive amounts of water running in through the walls indicate foundation waterproofing problems. To excavate and re-waterproof the exterior basement walls is expensive; however, **this extensive a remedy is seldom needed.**<br><br>Cracks that form in the joints between the bricks indicate normal settling, and aren't generally a cause for concern. Cracks that don't follow the joints, but break the bricks, usually indicate a structural fault and should be inspected by a qualified inspector. These repairs can be very expensive. |
| ❑ | ❑ | ❑ | Sewer System — A depression or valley near the center of the front yard that extends from the house to the sidewalk usually indicates a problem with the sewer system (most often, broken drain tiles under the ground). A yard that floods with unusual frequency may also indicate a problem. (Sluggish drains inside the house can *usually* be cleared by snaking them out .) |
| ❑ | ❑ | ❑ | Garages — From the inside, check the bottom sill (where the walls meet the ground or floor). This is where rot usually starts. Check for rot in the roof deck (the planking or plywood under the roofing material) and in the framing that supports it. Check the condition of the side walls, concrete floor and flat roof, using the standards described previously. Finally, step outside and look to see if the garage is leaning in any direction. |

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# COST INFORMATION FOR MAJOR REPAIRS

The following cost estimates are based on contracted repairs to an “average” two-story, three-bedroom Cleveland Heights house, on a 45 ft. x 140 ft. lot. *Raise or lower the cost of repairs to the home you are assessing by comparing its size to the home just described.*

Shingled Roofs – You can have only two layers of shingles on a roof at one time in Cleveland Heights (and many other communities). If there are two layers now, they will have to be removed before re-roofing. To install new shingles, the cost will run about $360 per 100 sq. ft. area (10 ft. x 10 ft.) The total cost of removal and replacement on an average, fairly simple roof will be $4,800 - $5,600, higher for slate, wood shingle, or tile roofs because the roof usually has spaces or gaps under these materials which must be filled before re-roofing. Extra roof areas, like dormers, will also increase the cost.

Flat Roofs – For a 10 ft. x 10 ft. flat roof area, the cost of removing and replacing the roof will be about $1,100 for cold process modified bitumen. If the roof has leaked, some wood repair may be needed; it’s hard to determine how much until the existing roof is off. For example, to replace an entire wood porch roof frame and decking on a second-floor porch would cost about $2,800 to $3,300.

Foundations – Structural repairs of foundations can be very expensive. If you suspect them, get several estimates from experienced contractors. Replacing the mortar between the bricks is usually inexpensive ($300 to $400). To replace exterior brick steps, expect to pay $2,500 to $5,000, depending on size and adequacy of the foundation.

Exterior Wood – Generally, it isn’t necessary to replace large areas. The cost for small areas is around $400. Siding shingles to replace a 100 sq. ft. area will cost $800 to $1,100, whether all in one place or scattered around the outside of the house. If there is insect damage or rotting wood, it will be hard to determine how much needs to be replaced until the area is opened up. Be sure to plan on some additional cost.

Exterior Paint – Expect to pay $5,000 to $7,000 for a contractor to properly prepare and paint an "average" house using lead-safe work practices. A paint job should last 6-8 years.

Gutters and Downspouts – Aluminum is the standard type used for replacement. The best gauge (thickness) is .032. Expect to pay about $5.00 per foot, installed.

Driveways and Walkways – Concrete driveway replacement costs range from $6,500 to $9,000. Asphalt driveway resurfacing (minimum 2" of asphalt) costs $4,500 to $6,500. Individual sidewalk blocks can be replaced at about $250 per section. Replacement of an entire front sidewalk costs $1,200 to $1,600. Leveling sidewalk blocks costs about $150 per block.

Electricity – Rewiring an entire home usually runs between $3,500 and $6,000. (Count on $500 to $1,000 additional to repair the walls after installation.) It will cost about $2,000 to rewire the basement and add a new circuit breaker box. If additional service is needed, there may be a charge for the utility company to run a higher-amperage line from the pole to the house.

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Furnace or Boiler – Average replacement cost for a furnace is $2,800 to $3,500; for a boiler, $4,200 to $5,000.

Plumbing – Installing new copper plumbing (the standard material) throughout the house usually costs $4000 to $5000. Improvements such as new faucets or a new vanity are not included in this estimate. (Count on $1000 additional to repair the floors and walls after installation.) Expect to pay $500 to replace a tub drain and trap; $800 for a hot water tank; and $2,500 to replace the water line from the street to the house.

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# Survey of House
## to determine repair needs

You can use the following form to assess your home (HRRC suggests you do this at least once each year.) The survey questions referring to the age of systems are intended to help you plan upcoming repair needs; if the system is functional, age alone is not a reason to replace it. General tips:

SHINGLE ROOFS:
Two layers of shingles are the maximum that should be laid (slate is heavy and should count as two layers.) If you have two layers on all/part of roof, those layers should be removed before reroofing.

To identify roof leaks: look at interior walls and ceilings under the roof and around the chimney for discoloration, plaster damage, or wet surfaces; look outside at porches and overhangs for peeling paint or rotted or sagging wood.

VALLEYS AND FLASHINGS:
Valleys are areas where different roof slopes come together, and flashings are materials (generally made of metal) that seal against water intrusion – in valleys, between the roof and adjacent house walls, and around chimneys, stack pipes, etc. Both are common areas for leakage. If the leaks are isolated to these areas, you may need to replace only the flashing. If you have the roof redone, be sure the bid includes all new flashing.

FLAT ROOFS:
Flat roofs should be checked regularly; leaks are commonly caused by problems with flashing (see above), ice build-up at the gutter, poorly-attached railing posts, and/or damage from tree limbs. Ideally, flat roofs should not be used or walked on, even if there is a door leading out. Use will cause leakage over time.

FOUNDATION:
Mortar is the cement-like material that holds bricks together. It provides support and must be maintained. If caught early, it is a relatively inexpensive job (called “tuckpointing”) that can usually be a “do-it-yourself” repair.

EXTERIOR WOOD:
Test for rot: If a knife blade can be inserted easily into the wood, you can be fairly certain there is rotted wood to be replaced. Be aware that rot can extend beyond the visible, testable area.

Sawdust: If there is sawdust around exterior wood it might be a sign of carpenter ants – they do eat wood. You may need a professional opinion.

GUTTERS AND DOWNSPOUTS:
Gutters should be cleaned in the fall (after leaves are down), and again in the spring, if needed.

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FURNACE OR BOILER:
Read the manual on your heating system for special care instructions for your unit – they do differ. As a general rule, gas furnaces should be cleaned and checked each year by a professional, and the filters should be changed regularly during heating season. With a boiler, even if you have an automatic feed, still check the water regularly – feeds can malfunction. In some units, the sediment should be cleaned out regularly.

ELECTRICAL:
If your house has circuit breakers, metal pipe (conduit), or flat wiring in a thick plastic casing (Romex™), it indicates some updating has been done. The existence of knob and tube wiring does not necessarily indicate a need for replacement – it may be perfectly functional. However, if any of the conditions asked about in the survey indicate problems, you might want a professional electrician to evaluate your wiring, including whether the fuses are correct for the wire size. All wiring splices must be inside a junction box (work box.)

PLUMBING:
To check for leaks in pipes: check joints, under sinks, and on ceilings/walls/basement floors. To check toilets, put a few drops of food coloring into the water in the tank; wait 15 minutes, then check to see if the water in the stool is tinted the color you added. If so, the valve that seals the outflow of water from the tank into the stool should be replaced (usually, an inexpensive, do-self repair.)

BASEMENT:
Painting basement walls with waterproof paint will not solve a water problem – and, if your walls are wet, the paint is likely to peel.

SEWER SYSTEM:
Red clay drain tile is buried around the outside of your home to carry water from downspouts. Run water from a hose into each downspout for 2 - 5 minutes to check if the line is draining properly.

## Interior Condition

FURNACES OR BOILERS:

1. Estimated age of heating system? _____ Is it in good working condition? ❑ yes ❑ no

Gas Furnace:

1. Does anything block the heat registers or cold air returns? ❑ yes ❑ no
2. Have you ever smelled fumes around the area? ❑ yes ❑ no
3. Does the pilot light go out often? ❑ yes ❑ no
4. Is the blower very noisy? ❑ yes ❑ no
5. Has the furnace been converted from a coal-burning model? ❑ yes ❑ no

Boiler:

1. Do you use extension cords? ❑ yes ❑ no If so, how many? _____
2. Do you have a 3-prong grounded outlet for refrigerator and in the laundry area? ❑ yes ❑ no
3. Do you have a special metal box plug for your electric dryer? ❑ yes ❑ no
4. Are all outlets near sinks or on the outside of the house controlled by ground fault circuit interrupters? ❑ yes ❑ no
5. How many service boxes do you have? _____ Are they ❑ fuses ❑ circuit breakers ❑ both?
6. How is your basement wiring run? ❑ through a metal pipe (conduit) ❑ Romex™
7. Do fuses blow or breakers trip more than very occasionally? ❑ yes ❑ no
8. Do lights flicker or appliances falter when you turn on the switch? ❑ yes ❑ no
9. Are there wires spliced together and wrapped with black tape? ❑ yes ❑ no
10. Is lamp cord used anywhere in place of regular house wiring? ❑ yes ❑ no

PLUMBING:

1. Are basement pipes copper? ❑ yes ❑ no Are the pipes going upstairs copper? ❑ yes ❑ no
2. Are there any signs of leaks or corrosion? ❑ yes ❑ no
3. Do your faucets leak? ❑ yes ❑ no Do your toilets have “ghost flushes”? ❑ yes ❑ no
3. Do you have shut off valves to all fixtures? ❑ yes ❑ no Do they work to stop water? ❑ yes ❑ no
4. Do your sink, tub, and basement drains function well? ❑ yes ❑ no

BASEMENT:

1. Are foundation blocks crumbling, or is the mortar between the blocks missing? ❑ yes ❑ no
2. Are there signs of mildew? ❑ yes ❑ no
3. Does water come in when it rains? ❑ yes ❑ no

SEWER SYSTEM:

1. Does your basement drain ever back up? ❑ yes ❑ no
2. Does your outside drain tile allow water to run freely? ❑ yes ❑ no
3. Do your yard drains drain well? ❑ yes ❑ no

## Exterior Condition

SHINGLE ROOFS (house, porch, and garage):

1. Estimated age of roof? _____ Number of layers of roofing material? _____
2. Are shingles curled, missing, or worn? ❑ yes ❑ no
3. Are there signs of leakage (interior or exterior) ? ❑yes ❑ no
4. Are there signs of rust on valleys or flashing? ❑ yes ❑ no

FLAT ROOFS:

1. Is the covering in good condition? ❑ yes ❑ no
2. Are there signs of leaking in the area directly underneath? ❑ yes ❑ no
3. If so, is any of the wood rotted? ❑ yes ❑ no
4. Are railings or posts rotted or loose? ❑ yes ❑ no
5. Are there depressions that hold water? ❑ yes ❑ no

FOUNDATION:

1. Are there broken, loose, or missing bricks? ❑ yes ❑ no
2. Is the mortar between the bricks crumbling, loose, or missing? ❑ yes ❑ no
3. Is the foundation wall bowed, or are the brick steps and/or porch sinking? ❑ yes ❑ no
4. Are stone treads broken or pitted? ❑ yes ❑ no

EXTERIOR WOOD (walls, porches, steps, garage, etc.):

1. Are wooden areas free of rot? ❑ yes ❑ no
2. Is there any sign of sawdust? ❑ yes ❑ no
3. Are trim pieces or wood shingles or siding boards missing, loose, split, or bowed? ❑ yes ❑ no

GUTTERS AND DOWNSPOUTS:

1. Material: ❑ aluminum ❑ galvanized ❑ other (specify) _____
2. Are there any leaks or spillovers? ❑ yes ❑ no
3. Are there any rust spots? ❑ yes ❑ no
4. If so, are they soft and ready to go through? ❑ yes ❑ no
5. Are the gutters bent or pulling away from the house? ❑ yes ❑ no
6. Do the gutter boards show signs of leaking water or rot? ❑ yes ❑ no
7. Are the downspouts mortared tightly into crocks? ❑ yes ❑ no

DRIVEWAYS, WALKWAYS, AND YARD AREAS:

1. Are these surfaces slanted so rain water drains away from house and garage? ❑ yes ❑ no
2. Are there any large holes, cracks, or depressed areas? ❑ yes ❑ no

GENERAL: Age of house: _____

NOTES: _____

_____

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# Home Maintenance

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# CHECK OUT YOUR FIREPLACE

Most people enjoy sitting in front of a cozy fire on a wintry evening. If you are lucky enough to have a fireplace in your home, it's important to make sure everything is in working order before building that first fire of the season.

This is usually a job for a chimney sweep. Fireplaces should be cleaned every two years, because as little as 1/8" of creosote (produced when wood is burned) can cause a chimney fire. Soot and creosote can cause respiratory problems, too. Clogged flues and other venting problems can cause a deadly build-up of carbon monoxide in the home.

In addition to removing creosote and other residue from the inside of the chimney, a reputable sweep should look at other safety issues:

- Check the condition of both the flue and the firebox to make sure that mortar is not missing from the joints.
- Check for obstructions in the chimney (birds' nests, dead animals, and other things blocking the flue.)
- Check that the damper is working properly. (On a wood-burning fireplace, close the damper when no fire is burning; on a gas fireplace, leave the damper open all the time.)
- Make sure the ashpit door seals completely.

In addition to conventional fireplaces, sweeps will also clean gas-burning fireplaces and fireplaces with wood-burning inserts. They may suggest a chimney cap, to keep animals from taking up residence in your chimney and prevent moisture from entering. (Water that drips down your chimney can combine with built-up creosote to produce acids, and with ashes at the bottom of the chimney to produce lye, both of which can cause expensive repairs.)

Even after your chimney has been professionally cleaned and checked, remain safety-conscious when you use your fireplace. NEVER leave a fire unattended. Use screens or doors to prevent sparks from igniting materials nearby. Finally, make sure you have a working smoke detector and fire extinguisher on each floor of your home.

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# WHEN SHOULD I THROW IT AWAY?

## Whether to Keep or Discard Common Materials

If your next big project will be cleaning out your garage or basement, you'll probably be faced with lots of decisions – about whether to hang onto that half-full can of paint that you used on the bedroom walls, about whether those never-opened tubes of caulk you bought on sale two years ago are too old to use, about whether the glazing compound you opened this fall will be good when you finish the rest of your windows next spring.... In other words, you'll need to decide when your materials are too old to use anymore.

In part, your decision may depend on the storage conditions. Paint, for example, may be good if it was left over the winter in a heated basement, but not if it was stored in an unheated garage where the temperature fell below freezing. Other materials have a short "shelf life," even under the best of conditions. To help you decide whether to "keep or toss" those cans and containers, here's a general guide to how long common materials will last:

**Paints, stains, and varnishes** should be stored at temperatures above 32°. Under these conditions, opened cans of latex paint will last for 1 year, unopened cans for 2 years; oil-based paint will last 1 year, opened or unopened. Oil-based stain can be kept for 1 year if the cans have been opened, but unopened cans will last 2 - 3 yrs. Water-based stain will last 1 year, if opened, and 2 years, if unopened. Oil-based varnishes will be good for 1 year, opened or unopened.

Opened cans of **glazing compound** will last for 1 year, unopened cans for 2 years, if kept above freezing.

Use opened tubes of **caulk** within two months; unopened tubes can be kept for a year, if stored above freezing.

Don't keep **dry grout mix and mixes that contain cement** (concrete, mortar, vinyl concrete patch, etc.) more than six months, once opened. Return unopened packages that you don't use to where they were purchased.

**Water putty, dry plaster mixes, and dry joint compound** will be good for 1 year, if kept dry (no minimum temperature). **Pre-mixed joint compound** will also last a year, but must be kept above freezing.

**Asphalt sealer and crack filler**, if stored above freezing, will be good for a year (opened or unopened).

**PVC primer** and **Thompson's Water Seal™**, sealed tightly, can be kept indefinitely (no minimum temperature), as can **concrete bonding additive** if stored above freezing.

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# EMERGENCY SHUT-OFFS

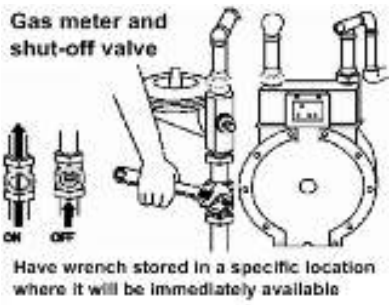
If you suddenly had to turn off the gas, water, or electrical power to your house, would you know how to do it? It's important that every adult and teenager in your home know where the emergency shut offs are and how to operate them.

**GAS**

The supplier adds a distinctive smell to the natural gas sent to your house, so you can tell if gas is leaking from a gas line or fitting. Since the gas is explosive, *if you detect the odor of natural gas, immediately turn off the gas supply to your house and call the emergency phone number for the gas company.* They will check for any leaks and let you know what repair work is needed.

The valve that shuts off all the gas to your home is usually found at the meter, typically located on an exterior wall near the street. (In addition to measuring how much gas your household uses each month, the meter joins the incoming gas line to the individual gas supply pipes that run to your appliances.) To turn off gas to the whole house, find the shut-off valve on the gas pipe on the utility side of the meter. When gas is flowing, the lug on the valve will be in line with the pipe. Use an adjustable or open-end wrench to turn the lug perpendicular to (across) the pipe. Some gas will remain in the line (and should be bled before starting repair work), but with the valve closed, no more gas will flow into the house.

Sometimes it's necessary to shut off the gas to an individual appliance, as when you change your water heater. In that case, locate the appliance gas shut-off valve and turn the handle 90°, so it is perpendicular to the gas line.




*main gas shut-off*


*appliance gas shut-off*

**WATER**

Water lines are typically controlled by several valves, and most people will turn off the one that is least disruptive to water supplied to the rest of the house. If you are lucky, you can find a shut-off valve that controls the water supply to the individual fixture that is leaking – sink faucet, toilet, dishwasher, washing machine, etc. Sometimes, that valve will be on the supply

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line to the fixture; one or more clockwise turns will usually stop the water. If you don't find a shut off at the fixture, check in the basement for a "zone valve" that controls water flow to that area of the house (bathroom, kitchen, etc.)

*shut-off at fixture*

*zone shut-off valve*

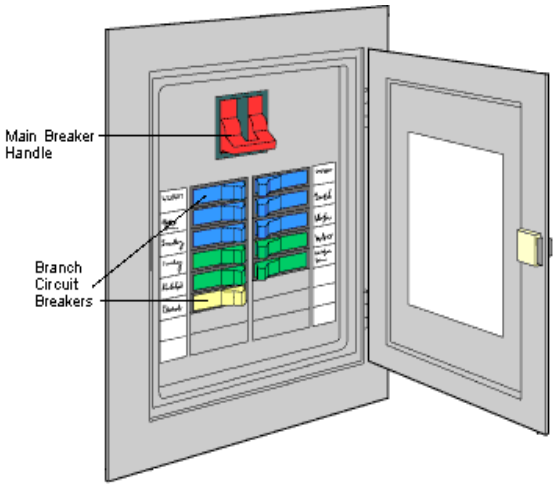
If you can't shut off the water with a zone valve, you'll need to shut off all the water to the house. Locate the main water shut-off valve, usually where the water line from the street comes into the house. (If you have an interior meter, you may have two valves, one on the street side of the meter and one on the house side of the meter.) The valve may be operated with a lever, or a with round handle that you'll have to turn clockwise – often several rotations – to shut off the water flow completely.


*Main Water Shut-off valve*

Failing this, the water can be turned off at the street, but most homeowners won't have the necessary tools to do so. The valve at the water main is several feet underground, usually near the sidewalk or driveway apron. Representatives from the water department (and many plumbers) have a water meter wrench, shaped like a "T", that fits over a lug on the valve to turn the water on and off.

**ELECTRICITY**

To shut off the electrical power, you'll need to find the main service panel, usually on an exterior wall near where the electric meter is located on the outside of the house. (Some houses may have additional "subpanels" that route electrical service to other areas where it's needed.) At the main service panel, large wires coming from the meter enter the box, and the available current is divided among several circuits controlled by fuses or circuit breakers.




Depending on how your house is wired, you'll usually find a breaker or fuse block in the main service that will control all the electricity entering your house; tripping the breaker or pulling out the cartridge fuses will shut off all the power.

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If you want to shut off power to just one circuit, you'll need to locate the fuse or breaker that controls that circuit and remove that fuse or trip that breaker. An electrical map of your house can be helpful when you need to locate that controlling fuse or breaker in a hurry. *(See separate handout on making an electrical map of your house.)*

**CONCLUSION**

In an emergency, don't waste time trying to limit the service you shut off. Just go to the main shut off – gas, water, or electrical – and stop the flow before more damage occurs. Once you've taken that step, you'll have time to determine if there are less restrictive measures that will accomplish what you need to do.

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# BEFORE YOU DIG

Over 20 years ago, a worker using a backhoe to dig a trench in the Slavic Village neighborhood of Cleveland struck a natural gas line that ran alongside a building. He miraculously survived the resulting explosion that flipped his machine over backwards, but suffered some second- and third-degree burns. The pipeline he hit was an uncharted line running to an out-building on the same lot.

In most older cities, including Cleveland Heights, the buried utility lines enter at the front of the property (from the street) and the overhead utilities enter from the rear. But that pattern does not hold true for all properties. A corner property, for example, may have some or all of the buried utilities coming in from the side of the lot, or a neighborhood may have sewer lines that run from the rear.

Don't believe for a moment that utility lines are buried too deep for you to hit! In the years since a house was built, activities such as erosion, landscaping, grading or excavating may have changed the depth at which the utilities lie. It's not unusual to find a gas line only inches under the soil surface!

That's why it's so important that you **call before you dig**. The Ohio Utilities Protection Service (O.U.P.S.) is a nonprofit, formed in the 1970's, that serves as a link between utility companies and contractors and residents planning any digging. Though O.U.P.S. itself does not physically mark lines, they will convey digging and excavation requests to the member network of utilities and underground facilities (such as TV cable, gas, electrical, water, sewer and phone companies), who will each send a representative to mark the location of that utility's lines.

Ohio law requires that everyone MUST contact O.U.P.S. before beginning any digging or excavation work – even for smaller or personal projects such as digging fencepost holes, anchoring supports for decks and swing sets, planting trees, removing tree roots and driving landscaping or electrical grounding stakes into the ground. Your call must be placed at least 48 hours but no more than 10 working days (excluding weekends and legal holidays) before you start to dig.

You can contact O.U.P.S on the internet (web address: www.oups.org), by telephone (800-362-2764), or by dialing 8-1-1. When you call, a staff person will assign a reference number for your job. Keep this number with your property records so it can be referenced later, as necessary. It is proof that you made contact with O.U.P.S., and it's the only way they can look up a past job ticket.

Before the utility companies come out, you'll need to indicate the area where you intend to dig. Usually this is done using white spray paint or white flags to mark the area to be excavated. (Be sure to ask what procedures they want you to follow, as things do change over time.) Each utility company will then mark on the ground the location of any lines buried in the indicated area.

Taking this precaution can save a lot of grief, so it's worth the effort.

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# SPRING HOUSECLEANING

Most people schedule an annual "spring cleaning" inside their house. However, it's also important to clean the exterior of your house each year, to remove dirt, grit, and other abrasives that can damage siding or masonry.

Before you start the cleaning process, cover the lawn and plantings around your house with plastic sheeting. Seal up all vents, electrical outlets, and exterior light fixtures. Move lawn furniture away from the house, and make sure all windows and doors are closed.

Next, clean by hand any areas stained by rust, mildew, or heavy grime. In many cases, detergent and a scrub brush will be sufficient. Remove rust stains with a solution of **oxalic acid**. (Follow up with a **rust-inhibiting primer**, or the stain will reappear.) A **bleach** solution will kill mildew spores. Organic stains can be removed with a solution of **ammonium sulfamate** powder. White, powdery deposits of crystallized salts *("efflorescence,")* commonly found on masonry surfaces, can be removed with a solution of **muriatic acid** applied with a wire brush. Rinse off all these products with clear water, and remember to wear protective clothing and goggles.

After you have tackled the "trouble spots," it's time to begin the general cleaning of the house surface. For light cleaning, an automobile brush that threads onto the end of an ordinary garden hose will work well. (You can attach an extension wand to reach higher areas.) Many brush units have a reservoir for detergent, if you need it to remove the dirt.

For houses that are more heavily soiled, use a gas-powered pressure washer. Make sure you rent one that can be adjusted to spray water at 1000 to 1500 psi. (Water delivered at a higher pressure can remove paint chips from your house. If your house was built before 1978, this process can contaminate the soil with lead-based paint. So, a pressure washer should not be used to remove peeling paint from older homes – just to wash off dirt and grime.) If you plan to use detergent and/or an extension wand, check that the unit has those capabilities.

Follow all safety precautions when using a pressure washer, as it can cause injury to you or damage to the house if not handled properly. Work from top to bottom, cleaning overlapping sections about 5 feet wide. Do not spray directly at windows, as the water pressure can break them, and angle the spray down to avoid penetrating under lap siding or shingles.

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# AVOIDING HEAT DAMAGE

Most of the time, we focus on the damage that cold and wet weather can do to the systems of a house – but it's important to remember that the "Dog Days" of summer can also be destructive. By understanding the problems that can result from excess heat and humidity, you can take preventive measures to protect your home.

In recent years, we have become more aware of the damage done to asphalt roofing shingles by excess heat that moves through the roof from the attic below. This heat can drastically shorten the life of a shingled roof. The remedy is adequate venting. Most roofers now recommend installing roof vents when you re-roof; there are numerous systems available, so you can choose the one that best suits your house. However, you can extend the life of your existing roof by adding a power vent to your attic, or even by installing a thermostatically-controlled window fan to move the hot air out.

Over time, asphalt roll roofing on flat roofs over garages and porches is damaged by the sun. You can use roof coating *once* to renew the oils in the roofing material and seal hairline cracks. You might also consider using aluminized roof coating to reflect the heat of the sun, especially on roofs over living areas where heat builds up (such as enclosed porches or sun rooms.)

Wood, both untreated and treated, is also susceptible to sun damage. All finishes on decks, fences, and varnished porch floors should be U-V resistant.

Although the sun will inevitably take a toll on exterior paint, a good-quality paint will give you the longest life. However, paint can fail earlier on certain areas of the house – usually outside kitchens, bathrooms, or other rooms where excess humidity develops – when water vapor passes through the exterior wall. Miniature vents can be inserted at the top and bottom of each stud cavity outside problem areas, so air can circulate.

Basement walls and cold water pipes are susceptible to condensation during the summer, as humid air comes in contact with these cool surfaces. You might consider using a dehumidifier to control excess humidity in your basement. Cold water pipes can be covered with insulation jackets; and, if your toilet sweats excessively, you can insert a Styrofoam liner into the tank.

Damage from heat and humidity can be prevented, or at least reduced, by these relatively inexpensive measures. So, take the "bite" out of those Dog Days – and extend the life of your house systems.

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# PREPARING FOR EMERGENCIES

It's not too long ago that people were obsessed with Y2K and the "Millennium bug," the fear that all computer-controlled systems would shut down at the beginning of 2000. Although those fears never materialized, the northeast regional blackout in August 2003 taught us that multiple systems can be affected when the electricity goes out for any reason. It's a good idea to have certain emergency preparations in place at all times, to stave off hunger and cold in case our power, water, or other support systems are interrupted for an extended period. The first step is to consider alternatives to our usual ways of doing things.

Many of us have gone without power (and natural gas, for that matter,) for several days after a winter storm. Most boilers and furnaces will not function without electricity. An alternative power source, such as a portable 5000-to-8000 watt generator, can keep the heat going (so long as you have fuel for the generator,) plus power the refrigerator and some lights. There are switching panels that can be installed in the main service box by a licensed electrician, which will allow the house wiring to distribute output from the generator. For many people, however, the cost of this system will be prohibitive; a small generator and panel will run well over $2000.

One low-tech and fairly low-cost method for heating is the living room fireplace. (Not to mention those lucky folks who have a fireplace in the bedroom, too). The heat will be localized, but you'll have at least one warm room. If you'll be using this source of heat, have the chimney checked and cleaned, if necessary, before winter. Make sure the damper is in good condition, too. Stock up on firewood early enough to allow it to season properly.

If you do not have a fireplace, in an emergency you will probably be looking for other ways to keep warm. One common misconception is that you can use a gas stove as a source of heat. That's not a good idea – the stove can add a lot of carbon monoxide to the air, and the heat can melt the control handles of the appliance. Similarly, kerosene heaters and ventless (natural gas or propane) space heaters can pose dangers. Our city fire and building departments prefer to see vented units that minimize the risk of carbon monoxide poisoning, and units that are fastened to the wall or floor and can't be knocked over. If you are forced to use a portable unit in an emergency situation, be sure to keep all combustibles well away from the heater, provide ventilation (such as a slightly-opened window), secure the heater to the floor (with nails or screws, for example), and follow all instructions from the manufacturer for its use.

Emergency lighting is important, but it's a good idea to avoid items that burn to provide light, such as candles, hurricane oil lamps, or propane lanterns. Consider battery-powered lanterns and flashlights to prevent accidental fires. New LED flashlights use less power, running for a longer period of time on a set of batteries.

Provisions need to be purchased in advance, and stored. Choose alkaline over the regular or "heavy-duty" batteries, as the alkaline models can be stored for a longer period of time – check the expiration date on the package when you purchase them – or buy alkaline batteries that can be recharged. Another battery-powered item to have on hand is a portable radio. Besides some entertaining diversion, it can warn you of emergencies (like school closings) and incoming weather.

*(continued)*

Jugs of distilled drinking water can be purchased and stored for long periods of time. We're normally urged to drink 8 glasses of water daily (in addition to all those cups of coffee!) Plan for the amount your entire household will need for one or two weeks – pets, too. Another source of drinking water you might consider is a small water purification unit, carried by camping supply and some sporting goods stores. Melted snow (make sure it's not "yellow") or collected rainwater can be made "potable" for cooking, washing, and drinking with a purification unit.

As for eating, that propane grill stored all winter out in the garage can roast, grill, or even boil foods for you. A small portable propane camp stove can be useful, as well. Both must be used outdoors to prevent problems, but either one can heat water for washing, as well as for cooking. Keep your pantry stocked with pre-cooked canned goods (i.e., vegetables, meats, soups, ravioli, and spaghetti,) to eliminate the need to keep a lot of food refrigerated during a prolonged power outage. (Don't forget that you'll need a hand-powered can opener!) A 48- or 60-quart picnic cooler can keep milk and fresh produce chilled, so long as you have ice.

Another thing to keep on hand is a supply of essential medications. If you must take prescription drugs, talk to your doctor or pharmacist about how long they can be stored, and under what conditions.

If the heat is off for an extended period of time in winter, it will be important to prevent frozen pipes. Shut off the water at the meter, and then open all the faucets to drain out as much water as possible. The last item of concern – and the one some people may consider the most important – is the toilet. Even if there is no water service, there will still be a need to eliminate body wastes. Short of digging a primitive latrine in your back yard (you'll find directions in an old scouting manual), water already used for washing or cooking (called "gray water") can be stored for re-use to flush a toilet. 1-1/2 gallons will flush through solid wastes when poured quickly into the bowl; keep a bucket on hand to hold the water.

Even though the millennium came without complicating our lives, sooner or later we'll almost certainly have to deal with a winter power outage of some sort. Preparations like these can make our lives easier during such times, but the most important thing is to PLAN AHEAD.

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# TEN OLD HOUSE TABOOS

For owners of older homes, it can be a challenge to keep your house safe, sound and secure. Here are some things to avoid when you are updating your home:

1. **Don't** cover exterior steps with indoor-outdoor carpeting

   Carpeting holds moisture, which causes the mortar between the bricks to deteriorate more rapidly. Once the mortar deteriorates, the bricks will loosen and fall out. Before you know it, your stone treads will crack and break, and they'll need much more substantial work to get them back into good shape.

2. **Don't** buy the wrong toilet

   Many homeowners are replacing old-style toilets with new water-saving models. Since styles of toilets vary in how far they sit away from the wall, you need to be aware of the "rough-in" measurement (the distance between the center of the flange around the drain opening and the wall behind it.) You can select a toilet designed for a shorter rough-in measurement (you'll just need to add some supportive blocking between the back of the tank and the wall), but you can't install a fixture designed for a longer rough-in measurement without some complicated alterations to the drain line. Be aware that, for some rough-in measurements, you will have to special order your toilet.

3. **Don't** replace a two-prong outlet with a regular three-prong outlet

   In older homes with knob and tube wiring (a two-wire system), the outlets have only two openings. Many homeowners are tempted to replace those old outlets with ones that will accept a three-prong plug. The problem is that a three-prong plug indicates that the outlet is grounded, but knob-and tube wiring does not have a ground wire. If you don't want to run a ground wire from the service panel to the outlet, you can replace the two-prong plug with a Ground-Fault Circuit Interrupter (the *only* three-prong outlet that should be installed in a two-wire system.)

4. **Don't** forget the fascia board

   When you replace your gutter, be sure to check the fascia board behind it. If it is sound, put two coats of paint on it and let them dry before installing the gutter. If the fascia is loose, and longer replacement nails don't seem to secure it adequately, the ends of the roof rafters have probably rotted. If this is the case, remove the fascia board completely to expose the rafters, and nail a new piece of wood alongside each deteriorated rafter end to reinforce it. If the fascia board itself is rotted and deteriorated, replace it with outdoor treated wood or untreated wood that has been primed and painted or wrapped with aluminum or vinyl fascia wrap.

5. **Don't** expose structural clay block along your foundation

   The large red tile blocks used for the foundations of many older homes were not meant to be exposed to the elements. You shouldn't see them on the outside wall of your basement, so make sure your landscaping plans include keeping these blocks covered with soil.

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6. **Don't** let tree branches get too long

   Each season, check whether any limbs have grown long enough to reach your roof or siding. Wind-blown branches that repeatedly rub against a surface can cut through shingles and other roofing materials; damage paint; destroy wood, vinyl or aluminum siding; and even scar masonry, stucco and concrete. Identify any branches that should be trimmed back from the house or garage. Then, look for dead and dying trees and limbs, particularly those overhanging the house or garage, which could cause damage if felled by high winds. If you don't feel capable of removing them yourself, hire a professional tree trimmer for the job.

7. **Don't** mount a ceiling fan in the wrong kind of box

   If you are replacing an existing light fixture with a ceiling fan, check how the light was originally installed in the ceiling. Most ceiling-mount boxes for lights were not secured to the wood framing; in fact, the box for a lightweight light fixture may only have been attached to the ¼" lath behind the plaster. It's important that you replace the old box that held the light with a new metal junction box able to support the weight of the fan motor and the vibration of the moving blades. There are various ways to install the new box, depending on the weight of the fan and how much access you have to the ceiling joists to which the box will be attached.

8. **Don't** ignore a drum trap

   Some older bathroom drain lines contain a drum trap (a coffee-can-shaped reservoir commonly located in the floor alongside the tub or mounted in a closet or behind an access panel) that was designed to collect hair and other debris in the drain line. Not only do drum traps make snaking an obstructed line more difficult, but they can also rust through and cause leaks. Replacing these devices with a regular trap can prevent water damage to the ceiling below.

9. **Don't** cover the outside walls of a basement with drywall

   Drywall on the exterior walls of a basement will prevent you from seeing signs of water intrusion (usually caused by clogged sewer lines, sagging gutters, or other problems that are easily remedied) that can cause expensive damage if the problem goes undetected. Use exterior latex paint on basement walls, with the expectation that you'll have to repaint periodically. A stain-killing, mildew-resistant primer and paint can reduce the likelihood of mold growth and mildew odor.

10. **Don't** forget to locate your shut-offs

    If you suddenly had to turn off the gas, water, or electrical power to your house, would you know how to do it? It's important that every adult and teenager in your home know where the emergency shut offs are and how to operate them.

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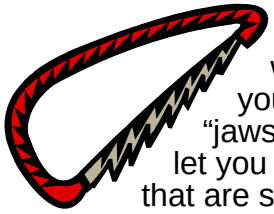
# TREE TRIMMING AND REMOVAL

Almost every year, storms occur that are strong enough to bring down trees and branches. It's important to look carefully at the trees around your property – both old and dying trees and younger, healthy specimens – to determine how they might impact your house or garage. This inspection is often easiest in the spring, when you can readily identify dead branches because they don't have leaf buds.

With healthy trees, check whether any limbs have grown long enough to reach the roof or siding. It's amazing how much damage they can do! Wind-blown branches that repeatedly rub against a surface can cut through shingles and other roofing materials; damage paint; destroy wood, vinyl or aluminum siding; and even scar masonry, stucco and concrete. Identify any branches that should be trimmed back from the house or garage. Then, look for dead and dying trees and limbs, particularly those overhanging the house or garage, which could cause damage if felled by high winds.

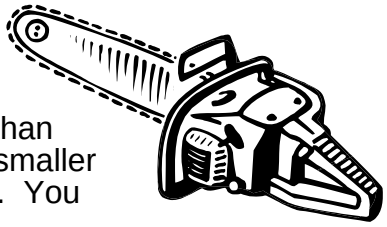
*Pruning saw*

*Bow saw*



Once you have made your inspection, decide whether you can do the work yourself. To trim smaller branches (up to 1-1/4 inches in diameter), you can use **loppers** (a tool that resembles hedge shears, but with smaller "jaws" and longer handles). A **pole saw** with a 12-foot extension handle will let you reach high branches and trim small ones from the ground. For branches that are slightly thicker, try a **bow saw** or **pruning saw**.

For heavier branches, you will probably need a **chain saw**. Make sure that the saw you'll be using will be powerful enough for the job, so you don't burn out the motor. For example, the smaller electric chain saws that homeowners often purchase are designed to cut branches less than 8 inches thick (about the size of a roll of paper towels or a paint can), and smaller gas chain saws won't cut branches more than about 14 inches in diameter. You can usually find models that will cut larger limbs at commercial tool rentals.



*Chain saw*

Because chain saws are so powerful, it's important to use them safely – especially if you'll be high off the ground. Plan ahead. Think about where you'll be standing and how far you'll have to reach. (Hanging onto a ladder with one hand while you reach out with the other to saw off a limb is asking for trouble.) Make sure you'll be able to handle the weight of the saw, *before* you climb a ladder or go out onto a roof. Will you need both hands to control it? If so, how will you keep your grip on the ladder? Ensure that you'll be stable while making the cut. You may feel more secure standing on a porch roof than on a ladder. If a ladder is the only option, you can use a rope to tie both you and the ladder to the tree, but make sure the ladder is positioned so you'll be able to keep your hips centered between the two rails as you use the saw. Avoid loose clothing that can become entangled in the chain, and wear eye protection to guard against flying debris.

Before you start, analyze the cut you'll be making. Is there any danger that the chain saw will become jammed in the notch of the tree and start to "kick back" into your face? Are there any nails or wire on the tree that can damage the saw? When you cut through the limb, where will it fall? (It's a good idea to use ropes to control the descent of any large limbs, so they don't crash into your neighbor's car or take out your electric lines.)

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Once the limb is on the ground, you may wish to cut it into smaller lengths. Prop the branch up on something, like a block of wood, which will hold the branch high enough that the end you're cutting off can drop freely. When you have cut through the wood (and there is suddenly less resistance), it will be important to control the saw and keep the blade from touching the dirt – at the very least, the dirt will dull the blade in short order; in a worst-case scenario, the motor can overheat and destroy all the moving parts!

If the problem limb is too high, too big, or too close to the house, or if the entire tree must be removed, it's time to call in a professional. Many communities (including Cleveland Heights) require that companies doing tree trimming and tree removal in must be registered with the city. Look for a company that has been in business for a while, check references, and ask to see a copy of the company's liability insurance certificate, to protect you if someone is hurt or property is damaged as a result of their work. Get a detailed description of what they will do and the price they will charge. (You will usually be better off with a "flat price" than paying on a time-and-materials basis.) No down payment should be necessary.

Some companies may use a cherry picker and chain saws, with a crane to support and bring down the lumber, while others may use a rope and climbing saddle and hand saws. Either way, they will usually remove the branches first, from the bottom up, and then take the tree down in sections from the top. Make sure that you have discussed how the company will dispose of the wood and brush (for example, you may want to have them cut the branches into firewood and chip the remaining brush for mulch). You should also arrange for the company to grind out the stump – 6 to 8 inches down if you want to plant grass over the area, but about 12 inches down for a paved driveway.

One final note: **In Cleveland Heights, as well as some other communities, it is illegal for homeowners to trim or remove trees on their tree lawn.** Check with your city if you need them to remove a tree in poor condition and plant a replacement. If you are not sure if a tree elsewhere on your property can – or should – be saved, many of the professional tree removal companies offer free consultations. In northeastern Ohio, you might also talk with one of the Master Gardeners at the OSU Extension Service (216-429-8200); if they are not able to answer your question, they have a list of certified arborists whom you can call for professional advice.

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# HOW COLD IS TOO COLD?

If you still have unfinished repairs late in the fall, be aware of the temperature requirements for the materials you are using. As a rule, most products for exterior repairs need a minimum of 50° to cure properly.

For example, concrete needs a month to cure, while the water evaporates from within it. Once we have snow and freezing weather, that curing doesn't occur at the proper rate, and the new concrete can crack and crumble. For that reason, try not to pour concrete less than 30 days before the first anticipated freeze. You should also pour concrete only on a day when the temperature is above 40°; if the overnight temperature will drop below 40°, cover the concrete with plastic and hay or straw to retain the heat created by the curing process. The addition of calcium chloride (a chemical sometimes used by contractors when they do cold weather pours) is not permitted under the Building Code of many communities, including Cleveland Heights, because it shortens the life of the concrete.

Asphalt driveway sealer needs 24 to 48 hours to dry. If the temperature goes below 50° (even at night), then the sealer won't cure properly. Crack filler should be used a few days before the sealer is applied, so that the filler can cure properly. It’s important to have two or three days of dry weather after applying the sealer or filler, so the rain doesn’t wash away these materials.

Unless you use one of the new paints designed for use down to 35°, you shouldn’t paint when the temperature is expected to drop below 50° that night. Regular paint needs some warmth to dry, so it can cure and adhere the way it's supposed to.

If you're looking to replace your roof, wait until spring if at all possible. If you re-roof late in the year, the materials may not last as long as they should. The roofing materials may not lay down properly, causing “bubbles” when the temperature warms up again. Roll roofing and shingles will become very brittle under 50° and can develop hairline cracks as they are handled. These cracks will cause the materials to fail much sooner than they would otherwise. If you must patch in cold weather, keep the materials inside where they can stay warm until you are ready to nail them in place.

There are a few exceptions to the 50° rule. One is caulk, which doesn't require as high a temperature to cure to provide an effective seal. Glazing compound is another product that can be used at a lower temperature. You can also do tuckpointing and masonry work, since mortar will cure below 50° (but not at freezing temperatures).

Remember – you're paying good money for these jobs, whether contracted or do-self. It may be tempting to take advantage of an Indian Summer day to finish up those repairs you'd planned to do, but you need to think beyond one sunny afternoon. For products that need a higher temperature to cure, using them when it's too cold may make your repair shorter-lived, at best, and ineffective at worst. Make sure you have enough warm weather ahead for the materials to cure as they're meant to do, and they'll give you the life span you've paid for.

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# YEARLY HOME MAINTENANCE SCHEDULE

The following is HRRC's suggested schedule for home maintenance inspections and repairs:

**SPRING (April - June)**

- ❑ Clean gutters; make sure they are flowing properly.
- ❑ Inspect roof for damaged shingles.
- ❑ Check flashing, and re-seal as needed.
- ❑ Renail any loose siding or trim boards.
- ❑ Check house and garage for any rotting wood, and repair as needed.
- ❑ Check porch flooring, and repair as needed.
- ❑ Check and replace any bad caulking around windows, doors, siding joints, or anywhere else needed.
- ❑ Scrape loose window glazing, and replace as needed.
- ❑ Clean windows and their frames when installing screens. Wash and repair screens at this time.
- ❑ Check caulk or seal between house and drive, and repair as needed.
- ❑ Oil garage door tracks.
- ❑ Trim trees, bushes, and shrubs. (Wait until spring-flowering shrubs have finished blooming.)
- ❑ Clean flower beds out around the house.
- ❑ Drain off sediment from hot water tank and steam heating system.
- ❑ Add copper sulfate to basement floor drain and downspout drains to control tree roots in main sewer.

**SUMMER (July - August):**

- ❑ Scrape, prime, and paint any areas on house or garage that are in need, especially any bare wood. *(Note: Observe precautions for reducing exposure to lead-based paint.)*
- ❑ If the house or garage doesn't need paint, wash exterior off at least once.
- ❑ Look for visible signs of carpenter ants, termites, or any other destructive insects.
- ❑ Check all flat roofs, and recoat or seal as needed, especially flashing.
- ❑ Check for mortar that needs repair (including chimney mortar and inside fireplace,) and tuckpoint or repair as needed.
- ❑ Check concrete drive, sidewalks, patios, and landings for condition and level; patch cracks, level, and/or replace, as needed.
- ❑ Clean carpets and wax tile and hardwood floors.
- ❑ Add copper sulfate to basement floor drain and downspout drains to control tree roots in main sewe

*(continued)*

**FALL (September - October):**

- ❑ Patch and seal driveway (asphalt or concrete), and concrete steps/ landings.
- ❑ Check tuckpointing on all brick areas, then seal masonry with a silicone sealant.
- ❑ Check weatherstripping on all doors and windows, and repair as needed.
- ❑ Check all areas that need to be caulked, and repair as needed.
- ❑ Make sure all garage floor or driveway drains are flowing properly.
- ❑ Clear gutters of leaves, check for leaks, and repair as needed.
- ❑ Inspect roof for loose or missing shingles, and check flashing seals; repair as needed.
- ❑ Clean and reseal decks, fences, or other structures made of pressure-treated wood.
- ❑ Oil garage door tracks.
- ❑ Prune bushes, trees, and shrubs (except spring-flowering shrubs.)
- ❑ Have furnace checked or tuned up, and change filter; have boiler checked every few years (every year if boiler is more than 20 years old.
- ❑ Have chimney cleaned (yearly, if wood burning; every 5 years if just for gas appliances.)
- ❑ Check damper in fireplace for obstructions, such as birds' nests.
- ❑ Drain off sediment from hot water tank and steam heating system.
- ❑ Add copper sulfate to basement floor drain and downspout drains to control tree roots in main sewer.

**WINTER (November - March):**

- ❑ At beginning of winter, shut off interior valves supplying outdoor water pipes to prevent them from freezing.
- ❑ Change furnace filters monthly.
- ❑ Repair any interior wall damage; touch up or repaint as needed.
- ❑ Check and re-grout tile in all bath and kitchen areas, as needed, and apply a silicone sealer.
- ❑ Add copper sulfate to basement floor drain and downspout drains to control tree roots in main sewer.
- ❑ Develop plan for next summer's home improvements.
- ❑ At winter’s end, re-open interior valves supplying outdoor water pipes.

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# 3.

# Home Security

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# HOW SECURE IS MY HOME?

There are many elements that contribute to home security. Some – like alarm systems – can be expensive. Security doors can create a sense of living in an armed camp, instead of a neighborhood. They may even foster a false sense of security – windows, especially those at the rear of a house, can be equally vulnerable as doors. On the other hand, there are many strategies that can increase your safety without compromising the attractiveness of your home or emptying your pocketbook.

**Lighting:**

Visibility is your first defense against intruders. You might consider connecting an exterior light to a motion sensor. At a minimum, switch on exterior lights in the front and back of your home – and at least one light on the inside – whenever you leave the house. If your house is hidden by bushes, cut them back. Landscape lighting can beautify your home's exterior while adding security.

**Doors and Windows:**

The composition and design of your exterior doors affects how well they protect against intruders. A hollow wood door is most susceptible; a door with a solid wood core or one made of metal is much more resistant. Windows in an exterior entry door, or next to it, should be sized and located so that access to the door lock cannot be gained by breaking the glass.

Equally important are the types of locks on your doors and windows. Deadbolt locks provide much more security than the traditional spring lock in the doorknob. However, make sure the model you choose allows for easy exit in case of fire. (You don't want to be searching through a smoky room for a key that has fallen somewhere on the floor.) Install a heavy-duty strike plate, with four screws; it will be stronger than the more common two-screw variety. And, for the deadbolt to be effective, make sure that the screws for the strike plate and at least one screw per hinge are long enough to go through the door jamb and into the rough framing *(see Illustration 1).*

Metal "wrought-iron look" security doors are *not recommended* by most fire departments – including Cleveland Heights' – due to the difficulty of fire personnel gaining entry to the home in an emergency. (Many security doors don't allow for any ventilation in the summer, either.)

Windows are more secure with two standard locks on each window, or a better quality system. Nails inserted into holes drilled through the lower sash and into the upper sash will give extra security *(see Illustration 2);* you can drill additional holes in the upper sash to allow the window to be locked in an open position.

**Alarm Systems:**

If your "risk analysis" indicates that you would benefit from an alarm system, make sure you check out thoroughly the credentials of the company selling and installing the equipment. With some systems, an alarm sounds and/or lights go on; other systems will automatically dial the local

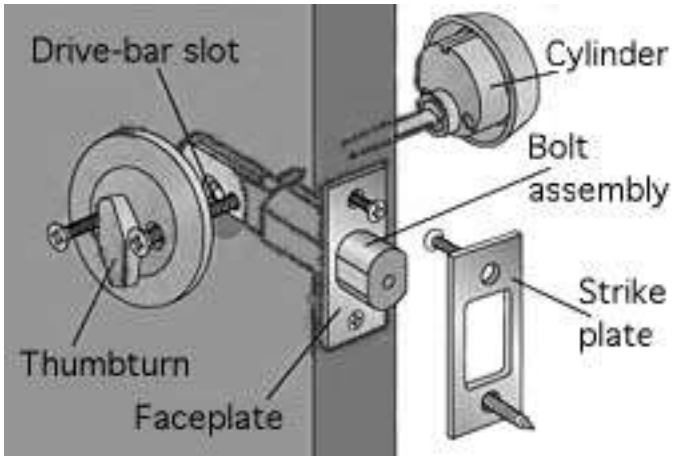
*(continued)*

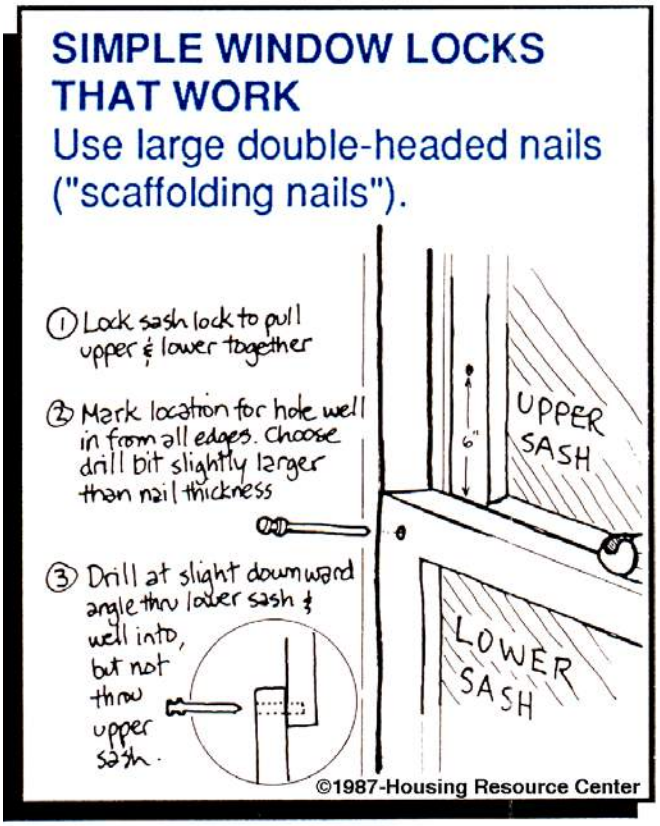
police department when the alarm is triggered. Make sure you know whether the system you're considering has any ongoing costs after the initial purchase and installation of the equipment.

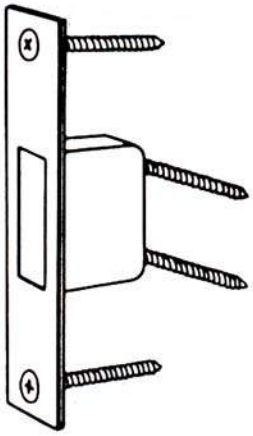
**Personal Habits:**

Even the best designed system cannot provide security if the homeowners do not take some common sense precautions in their daily life. Never leave a key outside, no matter how ingenious you think your hiding spot is – burglars know them all. Inform the police if you'll be away, so they know to watch for unusual happenings. Have someone pick up your mail, papers, and trash, and in winter, drive into your snow-covered driveway, so it isn't evident the house is vacant. And, agree with your neighbors to watch out for one another—either informally, or through an organized "block watch."

Finally, you might decide that a dog would be a good addition to your household.....

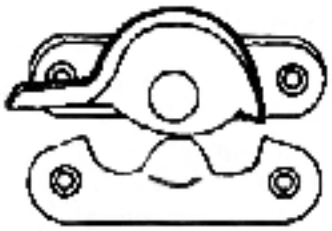


Heavy-duty strike plate

***Illustration 1***



Window lock and Keeper

***Illustration 2***

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# 4.

# Tools

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# CHOOSING QUALITY TOOLS

Have you ever bought a hammer where the claws broke the first time you tried to pull a nail out? Or, how about a screwdriver that did nothing but strip the head of the screw? Did you ever see a drill bit that straightened out the first time that you drilled a hole through some aluminum? At some point in life, we all learn the lesson that you get only what you pay for. This lesson is as true for tools as in any other area.

There are a few keys to what makes a good tool that are common across the board, no matter what type of tool you are thinking about buying. Start by looking at the tool. Does it look like the toy hammer that you used to pound pegs with? Take a look at the brand name – do you recognize it? Then, touch and feel and hold the tool. How does it feel to you? Does it fit your hand, is it comfortable, does it feel as if you could hold it all day – some day you may have to. Look at the way the tool is designed – does it seem like a good design to you? How about the structural material of the tool? Is it a cheaper smooth plastic, or a tougher textured plastic that won't crack the first time it is dropped. Generally, with hand tools, these are the things you should consider when deciding if this is the best tool to buy.

With power tools, you start by looking at the same things. However, since most power tools are a little more involved, there are more things to consider than just these factors. The most important variable, and the one that you are paying the most money for, is the power source for the tool. There are four basic categories of power tools that you will probably be exposed to.

Cordless tools tend to be the weakest category of power tools. These tools are operated by self-contained or removable, rechargeable batteries. They generally have less torque than corded tools, but recent advancements have made them much stronger. They are very handy to use in awkward or out-of-the-way locations, where power is not readily available. What you need to consider when purchasing them is the capacity of the battery (rated in volts and amp-hours), the features you desire (such as a driver clutch), availability of replacement batteries (usually rated for 1000 charges), the amount of RPM's (revolutions per minute) that the motor will generate, and the weight of the tool.

Next come the electric-operated tools. They come in many shapes, sizes and purposes. The size of the motor (rated in amperage or horsepower) is usually most important here. In most applications, if you try to use a tool that is underpowered, you will not only get a poor job from the tool, you will also damage the material that you are using. (If the tool doesn't have the power to go through what you are working with, it will slow down and start to burn or make a jagged cut.) Another area to consider is how the motor shaft of the tool is supported – does it have a bronze sleeve, or the superior ball-bearing system? Most of the best quality tools have not only ball bearings, but also a way for the owner to grease and maintain them.

Then, you have gasoline-powered tools. Because they operate with a much larger motor, they are more powerful. They are usually more expensive and require more maintenance. Again, the motor is the most expensive part of the tool; in most cases, the reputation of the motor manufacturer will be the most telling consideration. Watch out for weight here, too, as some gas power tools can be real monsters when it comes time to work with them.

*(continued)*

Finally, there are air-powered tools. These are gaining a lot of popularity in the construction industry, for good reason. First, they don't have their power source built into the tool. That means that you can buy one motor (called an air compressor) to operate many different tools. And these air tools are generally much lighter than their electric- or gas-powered counterparts. (Imagine struggling with a heavy power tool and extension cord on a 40 ft. ladder!) Second, with this system, the tools themselves have fewer moving parts to break down. Third, they can generally develop many more RPM's than an electric or gas-powered tool. The biggest drawback is the initial cost, which is higher than for a comparable electric tool. But, if you are buying tools to use for a lifetime, check into air-powered tool systems.

As you can see there are some common threads running through all purchase decisions, no matter what type of tools you are seeking. Spend some time researching and looking at tools before you buy. Purchasing an expensive tool may be a better option than renting it, if you have to use it over a week or so – and you might look at it as one of the costs of completing your project. (That's how many contractors acquire their tool collection.) Finally, consider quality over the long haul. While you may not need a more expensive professional-grade tool, it's better to have three good tools that will last a lifetime than twenty tools that don't last till the end of the year.

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# GAS-POWERED TOOL MAINTENANCE

Giving regular attention to tools with gasoline engines (snow blowers, weed trimmers, edgers, and lawn mowers) will prolong their lives and simplify yours – with lower repair and replacement costs. It's especially important to prepare these tools properly before using them each season, and to store them properly when the season for their use comes to a close.

BEFORE YOU USE A TOOL AT THE BEGINNING OF THE SEASON:

Make sure the tool is clean. For mowers, sharpen or replace any blade that is worn, bent or damaged, so the grass will be cut cleanly, not torn. Clean any old grass from under the mower deck, and coat the area with a rust-inhibiting spray lube (**WD-40™,** Teflon, or silicone spray), so you can easily clean the deck between cuttings to prevent rusting or pitting. Be sure to lubricate any moving parts (wheels, throttle control and cable, etc.)

If you didn't clean or replace the air filter before storing it at the end of last season, do so now. If it's a sponge-type filter, wash it with some liquid dish soap, then squeeze about a teaspoon of motor oil into it so it will collect dust effectively. Install a new spark plug (take the old one with you to the store, so you can buy the proper replacement) and, on four-stroke engines, change the oil – even if you changed it at the end of last season – to clean from the crankcase the acids and impurities caused by combustion, and moisture from condensation.

If the motor will not start, despite the above maintenance, here are a couple of things to check. First, ensure that there is "spark" (the voltage that arcs across the spark plug gap). One way to test is to remove the wire from the spark plug, remove the plug from the motor, and then replace the wire onto the end of the freed plug. With insulated pliers, hold the plug against the motor fins, and pull the starter cord several times. If there is no spark, ignition parts will need to be replaced (this will probably be a repair shop job). If there is a spark, then it's likely that the problem is in the fuel delivery.

If you didn't drain the gas tank before last winter's storage, or didn't use a fuel stabilizer (like **Stabil™**), the gas may have evaporated into a varnish-like coating – and clogged the carburetor. Before taking the mower to a repair shop, try the following routine:

Start by ensuring that the work area is well ventilated, with no flames or smoking items nearby. Gasoline and fuel additives are extremely flammable. Put down some cardboard and paper to absorb any gas and/or oil that gets slopped. Remove the air filter and the spark plug. Drain the old fuel, and pour a little fresh gas into the tank. Pour an ounce of carburetor cleaner additive (like **GumOut™**) into the tank and mix it with the gasoline. Also, pour some of the cleaner directly into the carburetor and brush it around. (An old toothbrush will do, so long as it's clean.) Pull the starter cord repeatedly, so that the fuel/cleaner mixture gets pulled through the carburetor. Drain the mixture from the tank, and then fill it with fresh fuel. Replace the spark plug and air filter, and start the mower.

DURING THE SEASON:

Inspect the air filter frequently, and clean or replace it when necessary. Check the oil level before each use, and change the oil when it becomes dirty. Before refueling the mower or any

*(continued)*

other tools, let the engine cool down to prevent an explosion or fire. Wipe off any fuel spillage and move the gas can well away from the motor before attempting to start the engine. Clean the tool before putting it away after each job, paying special attention to removing all grass from the area beneath the mower deck.

STORING THE TOOL AT THE END OF THE SEASON:

Clean the tool thoroughly before putting it away at the end of the season. On mowers, be sure to clean out all the old grass from under the deck, and coat the area with a rust-inhibiting lubricant (WD-40™, Teflon, or silicone spray).

A lot of people suggest running the engine out of gas before storing at the end of the season, but residual gasoline can turn into a varnish-like coating that can plug up the fuel system when you try to start it next season. Instead, you can add a fuel stabilization product (like Stabil™) to a full gas tank and run the motor for a few minutes to ensure that the mixture has made it into the carburetor. (The additive will prevent the varnish build-up during storage.) Then, clean or replace the air filter.

If you have a four-stroke engine, change the oil to clean out the acids and combustion by-products from the crankcase and prevent rusting and pitting of the engine internals. On both two-stroke and four-stroke engines, remove the spark plug and pour a small amount of oil into the cylinder. Leave the ignition off, pull the rope several times to circulate the oil, and replace the spark plug. The oil will keep the piston and cylinder from rusting together.

Several minutes of maintenance labor at the beginning and end of the season will help keep your gas engine tools running well for years to come – and save you from repair shop bills.

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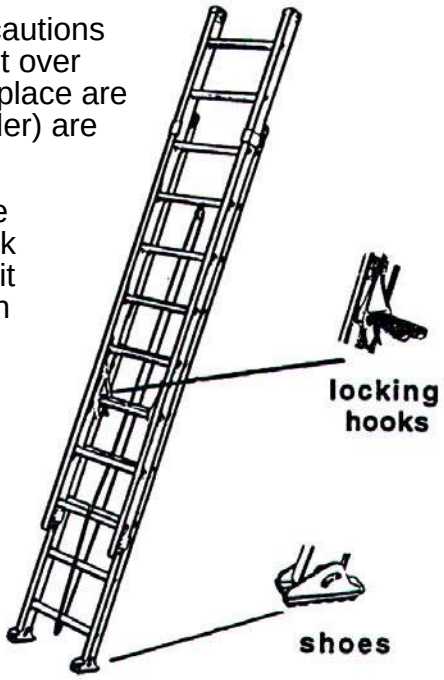
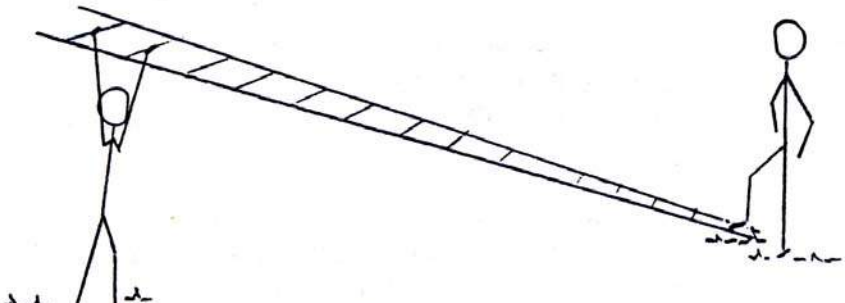
# LADDER SAFETY

When you pull out that ladder to work around your home, a few precautions will help ensure a safe experience. Every time you use a ladder, look it over before you set it up. Make sure the **hooks** that lock the top section in place are secure. Check that the **shoes** (the rubber pads at the base of the ladder) are firmly attached. Make sure the **rope** is securely fastened.

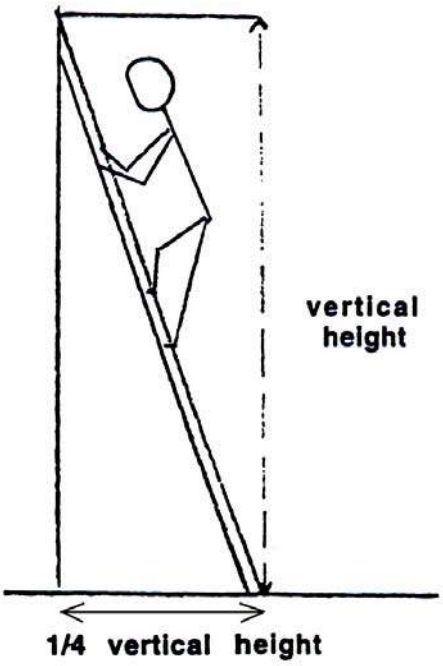



Next, look at the area where you'll be using the ladder. Look for tree branches in the way. Look for adequate room to raise the ladder. Look at what might be in your path if the ladder accidentally falls, and move it out of the way. And most importantly, LOOK FOR POWER LINES. An aluminum ladder that contacts overhead power lines can give you a deadly shock.

To erect a ladder, place the base near where you want the ladder to stand. Then, have a helper hold down the base or, if you're working alone, place the base against a house wall. Now, move to the opposite end, lift the top of the ladder above your head, and walk toward the base, moving your hands from rung to rung as you go until you have the ladder standing straight up *(see illustration below).* To move the ladder into place, keep it balanced upright while lifting it slightly off the ground. If the ladder is too heavy for you to lift in this way, hold the ladder in a “bear hug,” put each foot along side a ladder shoe, and "walk" the ladder into position. If the ladder becomes off-balance while you're moving it, set it down and start again.



erecting a ladder




Once you have the ladder where you want it, lean it against the building. Then, bring the base out from the wall a distance equal to 1/4 the height of the ladder. (For instance, position the base of a 40 foot ladder 10 feet away from the house – *see illustration to right).* This is the strongest and most secure angle from which to work.

*(continued)*

Other safety tips:

1. Make sure the ladder you will be using will support your weight. Read the side label to determine its rating and capacity. Ladder types range from light duty (supports 200 pounds) to extra-heavy duty (supports 300 pounds).

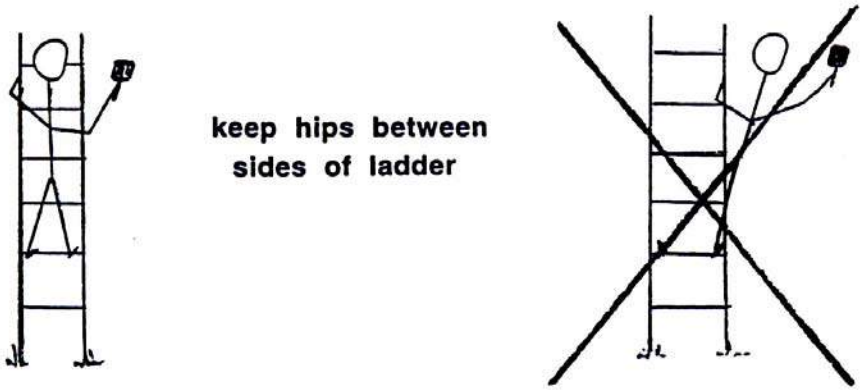
2. If you will be working on a roof, extend the ladder at least 3 feet above the roof, so you can transfer safely from the ladder to the roof and back.

3. Never stand on the top three rungs of a ladder, or on the top platform of a step-ladder; it will be too top-heavy and likely to tip over.

4. Check that the ladder you are using is locked open (if a step ladder) or latched together (if an extension ladder).

5. Make sure the base is firmly planted. If the base of the ladder will stand on concrete or other hard and/or smooth material, place the ladder shoes down, so the rubber grips the surface. If you are using a ladder on grass or other soft surface, tip the shoes up and stick their pointed edges into the ground.

6. Keep your hips between the two side rails as you work *(see illustration).* Trying to reach too far to one side or the other can cause the ladder to become unstable and fall. It's wiser to move the ladder instead.




There are accessories that, in certain situations, can make your ladder more secure. A **"stand-off"** *(see illustration)* is a U-shaped device that, when bolted to an extension ladder, helps to stabilize the ladder and make it less likely to tip. (It can also allow you to bridge windows or work on gutters without damaging them from the weight of the ladder leaning against them.) If you're working on a wide area, you can run a **scaffold board** between two ladders using **"ladder jacks"** *(see illustration*). You can also lay the plank upon a pipe framework for alternate or additional access to larger work areas.

**stand-off**

**ladder jacks**

When it's time to lower your extension ladder, again secure the base, and then reverse the actions you used to raise it. Grab the ladder near its base and, holding it overhead, walk toward the top, lowering the ladder as you go.

If parts of your house are not accessible using conventional ladders, you will have to look at other possibilities. For most home repair projects, however, following the above tips will be enough to keep you out of the emergency room.

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# FILLING YOUR TOOLBOX
## Suggested Tools for the Homeowner

### Basic Hand Tools (everyone should have):

claw hammer, 16 to 20 oz.
slip joint pliers
large slotted screwdriver
medium slotted screwdriver
small slotted screwdriver
medium Phillips screwdriver (#2)
small Phillips screwdriver (#1)
handsaw, 8 or 10 point crosscut
caulking gun
24” level
tape measure, 3/4" x 16'
2” putty knife
utility knife w/ replacement blades
14” pipe wrench
10” adjustable (Crescent™) wrench
circuit tester
wire cutter-stripper tool
flat pry bar (WonderBar™)

### Optional Tools:

7-1/4” circular saw with fine-cut blade and crosscut blade
3/8” electric drill with
1 set metal drill bits and
1 set wood drill bits and
#2 Phillips driver bits
14 ga. 50' heavy-duty extension cord
staple gun
surform plane
18” pipe wrench
adjustable pliers (Channelock™)
vise-grip pliers
keyhole saw
24” framing square
tin snips
chalk line
24” crow bar
set of wood chisels

And, don’t forget a strong, durable toolbox that can be locked to keep children from injuring themselves with the sharper items.

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# TOOL SMARTS

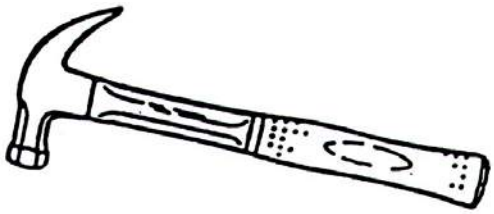
At some point, all of us have run into a job that we just couldn't get done. We have had to call in a tradesperson. And often the only difference that allowed the tradesperson complete the job successfully was the way the job was approached. This is also true when it comes to using tools. The amount of physical strength that you have doesn't always mean that you are going to be able to best use the tool. How well you use your body and your muscles is going to determine how well the job will turn out, how sore you'll be afterward, and sometimes if you'll be able to get the job done at all.

Hopefully, as we grow older, we grow wiser; we depend on our minds more, and on our bodies less. So, before using a tool, start with your mind. First, based on your past experience, you have to select the tool that you feel will best achieve the end result that you want. The tool that you use will have a lot of bearing on how well the job goes for you. People in the trades generally have a large selection of tools to draw from, because they have learned from experience which tools work best in each situation. You probably don't have the benefit of that experience, so you'll need to take a little more time to think about what you are going to do.

Most tool functions fall into a few categories: fastening, cutting, turning, or finishing. The best tool for each job will depend on such things as the type of materials you are dealing with, the size of that material, and the degree of strength and flexibility your body can provide to help the tool.

The real trick behind using a tool is to let the tool do the work – not you. Our muscles tend to work easier when we use our bodies for leverage. For example, when we push away from ourselves, we are able to create more concentrated force than when we pull. This is because the weight of our bodies aids us.

As a general rule, the more muscle groups we can employ when using a tool, the less any individual group will have to work. It's a way of spreading the work around. For example, consider the common task of hammering a nail. If you grab the hammer near the head and move only your wrist up and down, it will take a lot of wrist motion to get that nail hammered into the board. However, if you grab the hammer near the end of the handle, you can dramatically increase your leverage. And, if you swing the hammer using the muscles in your wrist, lower arm, upper arm, and shoulder, and if, while swinging, you shift your body weight slightly to add some more force – you can get the same result while straining each muscle much less. The difference may not be noticeable if you drive only one nail, but if you multiply that by a hundred nails for a large job, you'll appreciate the savings to your body.



Now, think about the act of installing a screw. If you use a screwdriver with a smaller place for your hand to grab hold, you waste a lot of energy holding onto the screwdriver rather than turning it. Try buying a screwdriver with a larger rounded hand grip. This will fill up your hand, and you can then apply your force to turning and not so much to gripping. When you turn it, instead of just using your wrist, try twisting with your forearm. If that isn't enough force, then walk around the screw with your entire body. This method is slower, but will get the job done.

*(continued)*

When using any type of wrench, try to push rather than pull, if possible. If you need a little more force, hold the wrench against your body and use your stomach and leg muscles to push and give you more leverage.

For those of you who have some physical limitations, there are some tools designed to help you maximize the strength that you have. There are screwdrivers that ratchet, much like an auto mechanic's tool, so the amount of turning or twisting of the tool is reduced. (The drawback is that this type will usually waste a small amount of the available force as a trade-off for the ratchet capability.) Some tools have a plastic cushioned hand grip that will make it less crushing to your hand to use.

These principles – using your body weight to your best advantage and spreading the work load around the different muscle groups – are used constantly by people in the trades. You can take advantage of these same ideas if you stop to think before you pick up a tool. After a while, using your body in this way will become second nature to you. But, for now, think before you work, and leave the linament in the bathroom.

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# 5.

# Hazards-

# Lead Paint / Pests

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## What You Need to Know about
# THE DANGERS OF LEAD-BASED PAINT

It seems as though every season brings us a new toxin to be aware of in our homes. We've been warned about asbestos, radon, PCB's, and radiation from televisions. But, the poison most frequently found in our homes is lead. Lead has been a popular and common additive to paint since long before Van Gogh's time. (Some historians have even attributed his insanity to lead poisoning.) There are probably very few houses in older communities like Cleveland Heights that don't have lead-based paint in them.

Lead is a heavy metal. It is known to be toxic to people and other animals. It doesn't break down or go away, so it remains in whatever it is used in. You can find lead in auto batteries, and in the solder holding copper pipes together. (In fact, prior to World War II, most water lines from the street to the house were made of lead.) It's found in old-style leaded gasoline, and in the exhaust vapors from cars and trucks that use it. And, lead is found in paint, of all types and brands, made before the late-1970's.

Most houses built before the late '70's have at least some lead-based paint in them – if not on the top layers, then in the older, buried layers of paint on the inside or outside of the home. When lead-based paint flakes or gradually rubs off (each time a window is opened or closed, for example,) or when painted plaster crumbles from a roof leak or other cause, this creates leaded dust. This dust is now considered the most common source of lead poisoning – NOT eating paint chips, as was previously believed. This is the reason why grit blasting is so dangerous for the homeowner and the community. The paint that is blasted off the house turns into dust, which not only is blown around for the surrounding homeowners to breathe, but also settles into the ground around the house and stays there, posing a long-lasting health risk.

Children – including a developing child in a pregnant woman – are at greatest risk from lead. Children typically retain about 50% of the lead they ingest, while adults usually retain 8%. The effects of lead poisoning are most easily seen in children under seven, but are often hard to relate to lead. Symptoms may include anxiety, tiredness, crabbiness, behavioral difficulties, sluggishness, and general flu-like symptoms. The eventual result of continued exposure is brain damage – reading difficulties, mental retardation, and, in extreme cases, death. Brain damage from lead poisoning is believed to be permanent. Ask your pediatrician to check the lead levels in the blood of your children on a regular basis. If the level is elevated, you'll know you need to take immediate action to reduce their exposure.

Lead in paint can be detected by several types of tests, ranging from inexpensive swab kits that can be used by homeowners (these may not detect the presence of lead in all cases, but a positive result would certainly indicate the need to take precautions) to X-rays or laboratory analyses that are much more accurate, but must be performed by trained professionals. In Cleveland Heights, contact the city's Housing Preservation Office (216-291-4877) or the Cuyahoga County Board of Health (216-443-5660) for information about having paint samples checked for lead. You can also get more current information from Environmental Health Watch (216-961-4646).

After you have confirmed that you are dealing with lead, what can you do about it? The most current recommendations for getting rid of lead-based paint reflect the increased concern

*(continued)*

of the medical community as to acceptable levels of lead in the blood. In 1960, the acceptable level was 60 mg. In 1985, it was lowered to 25 mg, and the current medical literature states that 10 mg is a level for concern. Because of this dramatic decrease in acceptable levels of lead in the blood, experts are suggesting more care be taken in removing lead-based paint from the home.

The current thinking about getting rid of lead is as follows: First, it is not recommended that lead paint abatement (removal) be undertaken by non-trained homeowners, but only by professionals. R. M. Santucci, in the May/June, 1991, issue of ***Cost Cuts*** (page 4), states, "...we now know that the historic method of abating lead in occupied units by scraping, sanding, or burning the accessible paint from chewable surfaces exposes the family to a 100-fold increase in available lead dust." In any decision about removing lead from the home, you need to consider whether you are creating more contamination by removing the leaded paint, or if a better choice is to encapsulate it (seal it in), at least for the time being. Most of the reports recommend throwing away all doors, windows, and molding that have lead paint, and replacing them with new. The only trim they suggest saving would be some unusual or ornate trim, one that would be difficult or quite expensive to replace. The recommended treatment for walls and ceilings covered with lead-based paint is to cover them with a state-approved liquid encapsulant or 1/2-inch drywall, although some wallpapers may work. Special cleaning with lead-specified detergents should follow all work that disturbs lead-painted surfaces. Clearance testing (by a licensed inspector) will ensure that the lead contamination was removed.

Removing all lead-based paint can involve very dramatic and costly measures, which are far beyond the average homeowner. In fact, the costs to abate the lead-paint hazard in some three-bedroom, two-story row houses in 1991 in Maryland averaged $17,500 per home (far higher in today's dollars), not including the walls (***Cost Cuts***, May/June, 1991, pg. 4.) What can you, the average homeowner, do to eliminate or reduce this hazard? Following the recommended precautions, you could replace doors and windows over several years, to spread the cost out. Chemical paint strippers are effective for removing paint from trim, but they must be used safely. Gradually upgrading your home with paneling or new drywall would help. Spreading these costs over several years, and including them with your remodeling/modernization plans seems to be a sensible approach. Although the experts believe total removal is the best policy, you can do it a little at a time. And certainly, doing something is better than ignoring the risk completely.

In addition, you need to consider the possibility that you can create lead dust during routine home maintenance and repair projects. Before you start any job on a house built before 1978, stop and think about whether you will be disturbing a painted surface. If so, you might wish to use a licensed lead-abatement contractor or lead-certified renovator to do the work. (There are strict lead control guidelines for any renovation work paid with federal funds.) If you decide to proceed with the project yourself or with a contractor who has not been trained in lead control, there are some relatively inexpensive and practical steps you can take to reduce the chances you will contaminate your home with lead dust. *(See separate handouts on "Controlling Lead-Based Paint during Inside/Outside Projects.")*

The danger of contamination is very real. Read more about it, and make good choices for yourself and your children. Before you undertake any work that disturbs lead-based paint, whether do-self or contracted, read the information available from the **EPA** (Environmental Protection Agency: www.epa.gov/lead/pubs/leadinfo.htm) regarding the removal process. The more you learn about lead paint, the better able you'll be to decide what you need to do to reduce or eliminate this risk from your life.

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# AVOID LEADED PAINT CONTAMINATION

Lead, found in all types and brands of paint made before the late-1970's, is known to be toxic to people and other animals. It can cause serious problems in children and in the developing child of a pregnant woman. Whenever you undertake a home repair project – whether you hire a contractor or do it yourself – think about whether the job might spread dust or chips from old lead-based paint around your house. **Because of their age, most houses in Cleveland Heights contain at least some lead-based paint, usually in the older, buried layers of paint on inside or outside surfaces.**

Many different kinds of routine home maintenance and repair projects can create lead dust. The most common sources of contamination are jobs that involve removing paint, sanding, patching, scraping or tearing down walls. However, if you are replacing windows, doors, or baseboards, or working with plumbing fixtures, electrical systems, or heating and ventilation duct work, you may be cutting into painted surfaces to do these jobs. In addition, when you are removing old carpeting or replacing or cleaning heating and air-conditioning ducts, it's important to take steps to prevent the spread of lead dust that may have accumulated over many years.

As of April 2010, the Environmental Protection Agency requires that paid contractors who perform renovation, repair, and painting projects that disturb lead-based paint in homes built before 1978 be certified and follow "lead-safe work practices" to prevent lead contamination. (This rule does not apply to minor maintenance or repair activities where less than 20 square feet of lead-based paint is disturbed on the exterior or less than six square feet of lead-based paint is disturbed in a room; however, the EPA specifies that window replacement is *not* minor maintenance or repair.)

Homeowners who are doing renovation, repair, or painting in their own home are not covered by the regulation, but **"lead-safe work practices" should be an important part of any do-self project.** The precautions involve relatively inexpensive and practical steps, like enclosing work areas with plastic to prevent dust from being spread around your house, and washing down surfaces with special detergent after doing the work.

Here are some sources of information that can help you prepare for your project:

From the EPA:

- **Steps to Lead Safe Renovation, Repair and Painting**, a new publication covering lead-safe work practices available at http://www.epa.gov/lead/pubs/brochure.htm

- **Reducing Lead Hazards When Remodeling Your Home,** an excellent resource available at http://www.epa.gov/lead/pubs/rrpamph.pdf (also available in HRRC's Resource Library)

- **Protect Your Family From Lead in Your Home,** a booklet available from http://www.epa.gov/lead/pubs/leadpdfe.pdf

From HRRC's Resource Library:

- "Lead-Safe Remodeling," article from the September 2004 Journal of Light Construction

*(continued next page)*

- “Controlling Lead-Based Paint during Your Paint Repair Project:  Inside Projects,” how-to information for do-self projects from Home Repair Resource Center
- “Controlling Lead-Based Paint during Your Paint Repair Project:  Outside Projects,” how-to information for do-self projects from Home Repair Resource Center

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# CONTROLLING LEAD-BASED PAINT DURING YOUR PAINT REPAIR PROJECT

## Working Inside: Setting Up

Dust, paint chips, and lead-contaminated trash are the main concerns of remodeling and renovation work. While all three are hazards, dust is the hardest to control. Dust contaminated with lead can cling to clothes and skin, to walls and floors, and to furniture and floor coverings. Forced-air heating and air conditioning systems will spread dust throughout the home.

All children and pregnant women should leave the house until work is completed for the day and an effective cleanup has taken place. If the job cannot be completed in one day, the work area should be cleaned up sufficiently each day *(see "Daily Site Cleanup")* to ensure that occupants have safe, uncontaminated access to sleeping areas, bathroom and kitchen facilities, and entryways after work hours.

To keep dust from spreading throughout the house, use the following precautions:

- Close off the work area with air lock flaps, created by covering each entryway with overlapping sheets of with 6 mil polyethylene plastic sheeting, taped in place with duct tape. Be sure to leave windows open for proper ventilation, if necessary. Allow only those doing the work to enter the work area.

- Remove furniture, area rugs, curtains, food, clothing, and other household items until cleanup is complete. Items that cannot be removed from the work area should be tightly wrapped in 6 mil polyethylene plastic and sealed with duct tape until all work and cleanup is complete.

- Turn off forced-air heating and air conditioning systems, or at least close off all ducts that serve the work area, during remodeling or renovation. Then, cover heating and air conditioning vents with a layer of 6 mil polyethylene plastic sheeting. Tape the sheeting in place with duct tape.

- Cover openings, such as gaps around pipes and between floorboards, with plastic or duct tape to prevent lead dust from sifting down to lower floors and rising to upper floors.

- Cover all exposed surfaces that cannot be removed, such as floors, carpeting, countertops, and shelves with 6 mil polyethylene plastic sheeting, and tape in place.

- If work is being done in or near the kitchen, tape around the doors of refrigerators, stoves and cabinets to prevent dust from contaminating food and inside surfaces of food storage areas.

- If working in the project area, wear a HEPA (**H**igh **E**fficiency **P**article **A**ccumulating) cartridge respirator and disposable overalls and shoe coverings. Remove these items before leaving the work area.

- Read and follow the safe work practices *(page 6)* and personal cleanup tips *(page 17)* in the EPA handbook, ***Reducing Lead Hazards When Remodeling Your Home.***

*(continued)*

## Sanding and Stripping Interior Surfaces

Preparing walls and other surfaces for painting, staining, or wallpapering can create lead exposure risks. With good work practices, the lead exposure is reduced.

- Avoid dry-sanding lead-based painted surfaces whenever possible. If you must sand, use a wet-sanding sponge.

- Wipe the area you are sanding often, and rinse the sponge in a bucket of water. Strain out any paint chips and dispose of them in heavy-duty 4 mil plastic bags. Dispose of the used wash water down the toilet. Wash the walls with TSP (trisodium phosphate), automatic dishwasher detergent, or a lead-specific cleaning agent; rinse and let dry before painting or wallpapering. *Be careful while wet sanding, because wet plastic can be very slippery.*

- Exercise caution when using paint strippers, since they contain volatile organic compounds (VOC's) and toxic chemicals. Ventilation is necessary, but it must be carefully arranged so as to not blow lead dust to other areas of the house. *(See "Working Inside: Setting Up," above.)*

## Daily Cleanup of Interior Work Sites

**(for projects that last beyond one day)**

- Dispose of construction trash in heavy-duty 4 mil plastic bags. Carefully remove dust and trash from the plastic sheeting to prevent contaminating other areas. (If possible, pass the trash out a window to avoid carrying it through the house.)

- Wet-wash floors and walls, plus the ceiling (if repaired) with TSP, dishwashing detergent, or other lead-specific cleaning products. When mopping, use a disposable mop, since the mop used for this cleaning could spread lead dust if it is later used for regular cleaning. Rinse with clean water; dispose of used water down a toilet. In areas where there is little dust, or wherever wall-to-wall carpeting has been covered with plastic sheeting, vacuum with a HEPA filter-equipped vacuum cleaner*. (A wet/dry model is most useful, since you can also use it to pick up water that contains dust.) Strain out any paint chips from the liquid waste and dispose of them in a heavy-duty plastic bag. Dispose of the remaining water down a toilet.

- Wet-sweep any outside areas that have lots of dust and trash by using a garden hose to spray these areas with water. Avoid dry sweeping, since it spreads lead dust. Shovel the trash into heavy-duty 4 mil plastic bags placed in cardboard boxes for support.

- Clean tools with detergent.

- Secure the work site whenever it is to be left unattended. If possible, seal off the entryways completely with 6 mil polyethylene plastic. If passage through the work area will be necessary, follow the above clean-up procedures to ensure that the occupants have safe, uncontaminated access to sleeping areas, bathroom and kitchen facilities, and entryways after work hours.

## Final Cleanup of Interior Work Sites

*Do not begin the final cleanup until at least one hour after the repair is finished.*

- Start your cleanup work from the dirtiest part of the work area, and work toward the clean area of the house. Dispose of any debris into a heavy-duty 4 mil plastic bag

- Work from the top of the room toward the bottom, cleaning ceilings first, then walls, counters and floors.

*(continued)*

- Carefully remove any disposable plastic sheeting used to protect surfaces by rolling or folding it inward and then disposing of it into a heavy-duty 4 mil plastic bag. Vacuum the plastic sheeting covering wall-to-wall carpeting with a HEPA filter-equipped vacuum cleaner* before removal. After removing the sheeting, vacuum the carpet with a HEPA filter-equipped vacuum cleaner with a beater bar attachment*.

- Vacuum any non-disposable tarps; then, roll or fold inward before removing them from the work area. If further cleaning is needed, carry the folded tarps outside and open them flat on the drive-way. Once the tarps have dried thoroughly, vacuum them with a HEPA filter-equipped vacuum cleaner.* Bag any paint chips in a heavy-duty 4 mil plastic bag for safe disposal. Then fold the tarps for re-use.

- Wet-wash all floors (within at least 10 feet of the repaired surface) and other hard interior uncarpeted surfaces (within at least 5 feet in all directions from the repaired surface) with TSP, powdered automatic dishwasher detergent, or other lead-specific cleaning product. Include walls and window sills; ceilings need not be washed unless they have been repaired. Wash all horizontal surfaces three times, changing wash water with each washing. Rinse with clean water; dispose of used water down a toilet. When mopping, use a disposable mop, since a mop used for this cleaning could spread the lead dust if it is later used for regular cleaning.

- Vacuum baseboards, chair rails, window sills, casings, shelves and countertops again, once they are dry, using a HEPA filter-equipped vacuum cleaner.

- If the repair was made near a door opening, extend these cleanup procedures into the adjacent room.

**** A HEPA filter-equipped vacuum cleaner with beater bar attachment is available at a modest fee to low-moderate income homeowners in Cleveland Heights through HRRC's tool loan program.***

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# CONTROLLING LEAD-BASED PAINT DURING YOUR PAINT REPAIR PROJECT

## Working Outside: Setting Up

Exterior work often produces dust, paint chips, larger pieces of material, and liquids that contain lead. It is easy to track dust containing lead inside the house, where it can pose a hazard. Lead can also be spread into the soil around the house if construction debris isn't handled properly. To avoid lead contamination of the areas surrounding your house, take the following precautions:

- Cover the ground and any flowers or plants with 6 mil polyethylene plastic sheeting to catch dust and trash. Extend the plastic sheeting beyond the work area far enough to catch all waste materials – at least 10 feet from the base of the house, plus an additional 3 feet for each story.
- Use bricks or rocks to hold the edges of the plastic sheeting in place. Place wooden studs under the edges of the sheeting to create a dam to prevent liquid from escaping.
- Avoid working in windy conditions. Strong winds can blow lead dust to areas that are not covered, and contaminate the soil. If the winds are more than 15 mph, or if the chips and dust are blowing off the plastic sheeting, set up vertical shrouds to block the wind or, preferably, do the work another day.
- Cover sandboxes with 6 mil polyethylene plastic sheeting. If possible, move play equipment at least 20 feet away from the work area.
- Close and seal all windows and doors.
- If working in the project area, wear a HEPA (**H**igh **E**fficiency **P**article **A**ccumulating) cartridge respirator and disposable overalls and shoe coverings. Remove these items before leaving the work area.
- Limit access to the area to only those doing the work. Limit the tracking of dust and debris to the house and surrounding soil.
- Read and follow the safe work practices *(page 6)* and personal cleanup tips *(page 17)* in the EPA handbook, ***Reducing Lead Hazards When Remodeling Your Home.***

## Sanding and Stripping Exterior Surfaces

Preparing exterior surfaces for painting, staining, repair can create lead exposure risks. With good work practices, the lead exposure is reduced.

- Avoid dry-sanding lead-based painted surfaces whenever possible. If you must sand, use a wet-sanding sponge.

*(Further information about paint preparation procedures can be found in HRRC's handout, "House Painting – Where Do I Start?")*

*(continued)*

## Daily Cleanup of Exterior Work Sites

**(for projects that last beyond one day)**

Implement a program of ongoing daily cleanup:

- Place smaller debris in 4 mil plastic refuse bags and seal shut. Larger debris should be placed in a covered container to prevent the wind from blowing the dust around.
- Wet-sweep outside areas with lots of dust and trash by using a garden hose to spray these areas with water. Avoid dry sweeping, since it spreads lead dust. Shovel the trash into heavy-duty plastic bags placed in cardboard boxes for support.
- Clean tools with detergent.
- Wash down the area with TSP (trisodium phosphate) and use a HEPA filter-equipped vacuum cleaner* to collect dirt and dust, as well as the wash water, from the ground sheeting. (A wet/dry model is most useful for this purpose.) Dispose of the wash water by flushing down the toilet.

## Final Cleanup of Exterior Work Sites

*Do not begin the final cleanup until at least one hour after the repair is finished.*

- Complete the procedures for daily cleanup listed above.
- Carefully remove any plastic sheeting and/or tarps used to protect surfaces by rolling or folding them inward. Dispose of plastic sheeting in a heavy-duty 4 mil plastic bag.
- Lay any non-disposable tarps on the driveway and allow them to dry fully. After they have dried, vacuum up all remaining chips with the HEPA vacuum.* Bag the chips in a heavy-duty 4 mil plastic bag for safe disposal. Then fold the tarps for re-use.

**** A HEPA filter-equipped vacuum cleaner is available at a modest fee to low-moderate income homeowners in Cleveland Heights through HRRC's tool loan program.***

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# DISCOURAGING ANIMAL VISITORS

Most urban areas in Northeastern Ohio, including Cleveland Heights, have experienced an increase in the populations of wild "critters" in recent years. The problems they cause can range from the merely annoying to the downright destructive – so, it's a good idea to look at ways to keep them from setting up housekeeping in your neighborhood.

Most unwanted pests come looking for food. If you eliminate the things they like to eat, you can go a long way toward improving the situation. Place your garbage in cans with lids (use a "bungee cord," if necessary, to lock down the top), or – if you use plastic garbage bags – keep the bags in a closed garage until the morning when they're to be picked up. Clean up after parties or barbeques. Don't feed animals outdoors, and keep birdseed off the ground. Elevate your wood pile at least twelve inches off the ground, and remove any decaying wood from your yard. Since skunks feed on grubs in the soil, you may want to treat your lawn to eliminate this food source. (If you're not comfortable applying pesticides, there are some "natural" alternatives that may be effective.)

The other attraction for animal pests is shelter. So, in addition to eliminating their food supply, you should also close off likely nesting sites. Skunks and other animals like to establish dens in the open areas beneath porches; fasten some wire mesh to the inside of the lattice panels around the porch foundation to keep the critters out. Seal all vents (such as the vent from your dryer) with 1/2" hardware cloth (a type of wire mesh,) and install caps on your chimneys. Eliminate nesting areas in garages and tool sheds, as well. Some animals like to burrow underneath steps, decks, slab additions, and air-conditioner platforms, so check for holes along your house, in the yard, or in the shrubbery and seal them up. Remove brush piles, and rotate compost piles regularly.

Squirrels and raccoons will chew through wood siding or roofing material to gain access to attics and wall cavities; check your roof and gutter area for holes, and repair them as soon as they appear. Again, wire mesh or hardware cloth can be used to prevent the critters from returning. Some bats can squeeze through an opening less than 3/4" in diameter; block the entry hole with sheet metal, foam insulation or metal screening. Birds that nest in your roof area may not pose an immediate problem, unless the nest blocks your gutter. Discourage pigeons from roosting by applying a product such as "Hot Foot" to areas where they congregate.

Finally, talk to your neighbors. Preventive measures are much more effective on a neighborhood level. Perhaps you could designate a weekend to share labor and hardware cloth to close up potential hideaways. Some communities provide a trapper who can capture skunks or other critters that have established dens in your neighborhood; others may have traps that you can borrow to capture the animals yourself. Check out the services available through your city, as well as any restrictions on disposing of animals you trap yourself.

Realistically, animals will continue to share our communities – but, with some common sense on our part, we can prevent some of the problems they can cause.

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# Exterior Painting

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## If you are contracting

# EXTERIOR HOUSE PAINTING

When obtaining bids to have your house painted, you should discuss with each contractor several important issues. Because preparation and painting are so labor-intensive, the price that a contractor quotes for a job will frequently depend on how you define the quality of workmanship you are seeking. For that reason, in addition to discussing the type and color of paint that will be used, it's important to clarify the work that the contractor will do BEFORE the paint is applied.

The preparation work that a painter does will not only affect how your house looks – it will also help determine how long the paint job will last. Because in most communities the painter does not need to obtain a permit for this job, you will not be protected by an inspection by the Building Department when the work is completed. That makes it all the more important to discuss with the contractor just what kind of a result you are looking for, and what it will cost. If you signal to the contractor that you are only concerned with getting the lowest price, the most likely place to reduce costs will be in the preparation. In a worst cast scenario, paint can simply be applied over the existing surface, with no cleaning or removal of the old paint. (A house painted in this way will usually start peeling in short order.) The other extreme is to have the old paint removed completely, down to the bare wood; while this will produce the most long-lasting result, the preparation costs can be higher than your budget will allow. Negotiating a "middle ground" in such cases might give you acceptable quality and longevity within a price you can afford.

What kinds of preparation might be involved? Before painting, the contractor should make all needed repairs to the siding and trim (replacing rotted, decayed, or badly cracked wood; securing loose siding or nails; removing any hooks and nails that are no longer in use; and covering over nail holes, rusty nail heads, and small cracks with vinyl spackling). This is also the time when caulk and glazing should be checked, and replaced as needed – especially around your doors and windows, and where siding butts up against a roof slope or masonry. Most painters can do these minor carpentry jobs as part of the preparation process, or you might decide to lower your cost by doing some of the work yourself.

The biggest problem will be dealing with the old paint that has built up on the surface of your house over the years. In most cases, that old paint will have cracked or "checkered," allowing moisture to get behind the paint layer. Before applying a new coat, the contractor must remove that damaged paint.

> *However, if your house was built before 1978, there is a good chance that one or more of those layers of old paint may contain lead. In dealing with any loose, blistering, or peeling areas, you should make sure that the painter will take care to protect your family and the environment from this lead-based paint.*

Some painters have pursued special training in how to deal with lead-painted surfaces. Even if you don't utilize one of these licensed or certified contractors, you should discuss how the painter proposes to remove deteriorated paint. Because of the danger when lead-laden dust is released into the atmosphere or contaminates the soil around your house, certain methods of paint removal are now prohibited in many communities with older homes, including Cleveland Heights. Dry sanding or dry scraping is no longer allowed, except in conjunction with heat guns or immediately

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around electrical outlets, or when treating small spots of defective paint on exterior surfaces totaling no more than 20 square feet. Paint removal with an open flame or burning torch is also prohibited, as is use of a heat gun that operates above 1100° Fahrenheit or that chars the paint. And, the contractor will not be able to remove paint by machine sanding or grinding, by abrasive blasting or sandblasting, or with volatile paint strippers. (There are a few paint strippers that claim to remove lead paint safely, but they tend to be rather expensive, especially for the whole exterior surface of a house.)

So, what *can* the contractor do to remove chipping or peeling paint? The best solution is for the painter to remove as much loose paint as possible by wet scraping, capturing all the paint chips with heavy-duty tarps and cleaning up daily. Then, if desired, the whole house can be washed down with a pressure washer and a detergent like TSP (applied at the lower-pressure "wash" setting that doesn't disturb the old paint), rinsed well, and allowed to dry completely before the paint is applied. This cleaning will remove dirt and chalking (from oxidized paint), giving a better surface for the new paint to adhere to.

After removing the loose paint, the painter can fill in any "craters" (areas where the bare wood is lower than the painted areas around them) with exterior vinyl spackling, so they come up level with the surrounding areas. (This method is 100% safer than sanding lead-based paint, and will give a neat finish when painted.) If you need to cut costs, you may want to skip this step, at least on the less visible areas of the house; the process does not increase the longevity of the job, but will result in a nicer "look." Priming, however, is essential. While an entire coat of primer is best, having the painter spot-prime any bare wood or spackling is an acceptable compromise.

Your cost will also be affected by any "problem areas" that require special treatment. If there are areas where paint fails repeatedly, for example, you'll want to talk with the contractor about how to solve the problem. Blistering paint can be caused by condensation in the outer walls of your house, particularly outside high-moisture areas like bathrooms and kitchens. You may wish to have small louvered vents installed in the siding to increase air flow and help keep these areas dry. If there are metal surfaces where rust has built up, the painter should scrape them and apply a rust-inhibiting primer, or use a rust-converter to stabilize the surface.

Find out what type of paint your contractor is recommending for the job—it can affect how long your paint job will last. Latex paint will let water evaporate through it without blistering and peeling, but it expands and contracts at a different rate than oil-based paint. Your choice will primarily depend on the paint that is already on your house, although there are primers that will allow you to switch from one type to the other. Regardless of whether you'll be using oil or latex, make sure the paint is medium grade or better. Also, if you are changing colors, ask whether one coat will be sufficient to hide the old color; with some combinations, you may need to use – and pay for – a second coat.

Don't forget weather concerns. Your contract should specify that painting be done only when the surfaces to be painted are thoroughly dry and when no rain is expected before the new paint can dry. The temperature – even at night – should remain above 50° F to allow the paint to cure properly. (If you MUST have the painting done in cold weather, make sure the painter will use one of the new paints designed for weather down to 35° F.)

Make sure you discuss how the contractor will protect your property and your house. The contractor should agree to repair or replace any gutters or other areas damaged during the course of the preparation or painting. Include in your contract the contractor's promise that all work will be done in a neat and workmanlike manner. Plants, sidewalks, and other areas around your house should be covered with protective tarps, to prevent damage to those surfaces, and the contractor should agree to clean up immediately all accidental drips, spills, or overspray – onto a driveway, off the dormers onto your roof, off the trim onto your brick house, etc. (And, you should plan to be home when the work is done – you don't need to be an expert to spot sloppy work!)

Finally, ask what warranty will be provided on the work (both from the manufacturer on the product and from the contractor on the workmanship), and what insurance protection the painter has in case of injury to his crew and/or damage to your property. If you decide to use a painter who does not provide these protections, you may trade a lower initial cost for long-term problems.

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# HOUSE PAINTING – WHERE DO I START?

House painting is one of these jobs that homeowners tend to put off as long as possible. When it's finally time to “bite the bullet” and put up the ladders, proper preparation of the paint surface will add years to your paint job. If you plan to do the painting yourself, allow adequate time for this preparation work before you open the paint cans. If you will be contracting, be sure to discuss with the painter how you want the finished surface to look, how much preparation work will be necessary to achieve that appearance, and how much that preparation will cost.

Before you start painting, check for any repairs needed to the siding and trim. Replace all rotted, decayed, or badly cracked wood, and re-nail any loose siding. Countersink any rusty nail heads 1/8” deep and putty over the top. Replace loose nails with slightly larger ones, and counter-sink and putty over them. Fill nail holes and small surface cracks with vinyl spackling.

While you're at it, check the condition of the caulk and glazing around your doors and windows. Check, too, for cracks or openings where moisture can enter the walls, especially where siding butts against a roof slope or masonry. Remove any caulk that has deteriorated, and replace it with fresh material, using a caulking gun. (You may have to press some of the caulk in place with a putty knife.) A **siliconized acrylic caulk** generally stays flexible and in place for the longest time, and it can be painted. Install new **glazing compound** when the old glazing has dried out and no longer makes an effective seal between the window frame and the glass pane. *(See separate handout on “Window Glazing & Glass Replacement” for how-to information.)*

The next problem is dealing with old paint that has built up on the surface of your house over the years. In most cases, that old paint will have cracked or “checkered,” allowing moisture to get behind the paint layer. Before applying new paint, you need to remove that damaged paint.

> *However, if your house was built before 1978, there is a good chance that one or more of those layers of old paint may contain lead. In dealing with any loose, blistering, or peeling areas, you must be careful to protect yourself and your environment from this lead-based paint.*

Because of the danger when lead-laden dust contaminates the soil around your house or is released into the atmosphere, certain methods of removing paint are now prohibited. **Many communities with older homes, including Cleveland Heights, do not allow dry sanding or dry scraping**, except dry scraping in conjunction with heat guns or immediately around electrical outlets, or when treating small spots of defective paint (totaling no more than 20 square feet on exterior surfaces.) Code also prohibits use of an open flame or burning torch, or a heat gun that operates above 1100° Fahrenheit or that chars the paint. And, code does not allow removal of paint by machine sanding or grinding, abrasive blasting or sand-blasting, or volatile paint strippers. (There are a few paint strippers that claim to remove lead paint safely, but they tend to be rather expensive, especially for the whole exterior surface of a house.)

So, what *do* you do to remove chipping or peeling paint? The best solution is to cover the ground below all work areas with tarps, and then remove as much loose paint as possible by

*(continued)*

**wet scraping**. You can use a garden hose or spray bottle to keep the surface damp; the moisture makes the paint chips heavier, so they will fall onto the tarp rather than floating through the air and contaminating surrounding areas. *(See separate handout on "Controlling Lead-Based Paint during Your Paint Repair Project"* for specific "how-to" advice on outdoor projects.) Place all paint chips in a 4 mil (contractor grade) plastic garbage bag and close it securely before disposal. Then, if desired, wash down the house with a pressure washer. (Make sure to use the lower-pressure "wash" setting that doesn't disturb the old paint.) Use a commercial-type cleaner such as **TSP** (Tri-Sodium Phosphate), available at hardware and building supply stores. Rinse well with clean water, and allow several days for the wood to dry completely – longer if it's rainy or very humid.

The next step is to fill in any "craters" (areas where the bare wood is lower than the painted areas around them) with **exterior vinyl spackling**, so they come up level with the surrounding areas. Not only will this give a neat finish when painted, but it isn't any more work than sanding. Moreover, this method is 100% safer than sanding lead-based paint.

If there are areas where your paint fails repeatedly, think about what's on the other side of the siding. Blistering paint can be caused by condensation in the outer walls of your house – particularly in high-moisture areas, such as outside bathrooms or under kitchen sinks. You can install **small louvered vents** in the siding to increase air flow and help keep these areas dry.

Finally, remove any rust that has build up on metal surfaces. After scraping, cover these surfaces with a **rust-inhibiting primer**. *(See separate handout on "Special Problems in Preparing Surfaces for Painting" for more details.)*

Now you're ready to paint. At a minimum, "spot prime" any bare wood and over any spackling you have applied. (Of course, a full coat of **primer** is best.) Then you can apply the final coat of paint. The paint you use can affect how long your paint job lasts. The priming coat must be able to bond to all types of existing paint on your house and also to the new paint you'll be using. Check with your paint supplier. **Latex paint** will let water evaporate through it without blistering and peeling, but it will expand and contract at a different rate than **oil-based paint**. *(See separate handout on "How to Measure Your House for Paint" for help in calculating how much paint to buy.)*

While you're painting, you'll want to protect the plants, sidewalks, and other surrounding areas around your house. You'll also have to check the weather. Make sure it's not too wet (wait for the morning dew to evaporate before starting) or too cold (the temperature should be above 50° F.) If you're painting in the sun, plan to *follow* the sun around the house. The heat of direct sunlight can cause the moisture in the paint or the surface underneath it to evaporate and form blisters.

Paint from the top down and from side to side, being generous with the paint. If you have to stop midway, try to complete the entire siding board, to avoid lap marks.

So remember – a bit more time spent in preparation will give you a longer-lasting paint job, and one that's more attractive, too.

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# How to
# MEASURE YOUR HOUSE FOR PAINT

Before painting your house, you'll need to determine how much paint to buy. There is a simple formula that will tell you how much paint you'll need. You must know only two things: the **area to be painted** and the **"paint coverage"** shown on the cans of paint you're planning to purchase.

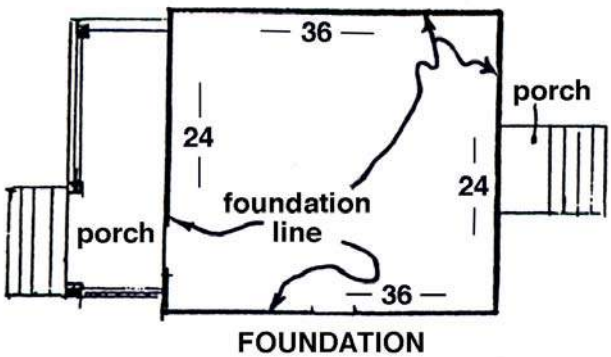
The first part is easy. Measure the perimeter of your house (the distance around it) – the main part, not including porches or other appendages. Then, multiply that number by the height, and you have the square footage (the area to be painted). Unless you have an exceptional house, use the average "paint height" of 9 feet per story, plus 1/2 the story height for gable ends.

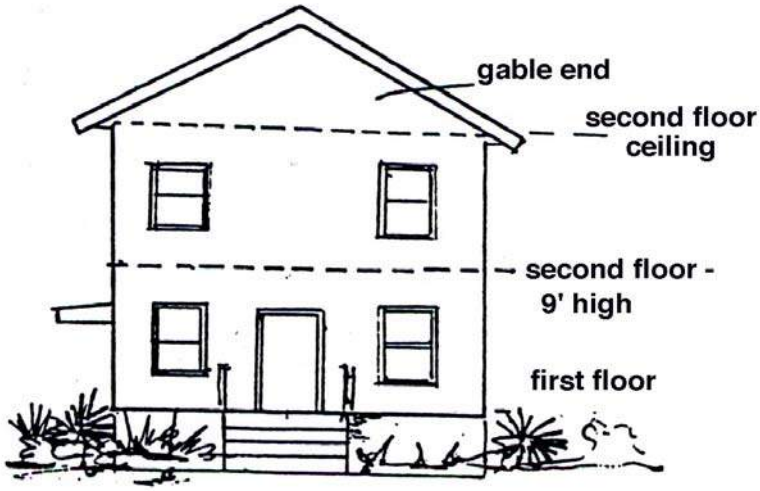
**EXAMPLE:** A house with a 24 ft. by 36 ft. foundation size would have a perimeter of 24' + 24' + 36' + 36', or 120 linear feet. If the house has two stories, then the height would be 9' + 9' + 4-1/2' (for gables), or 22-1/2 linear feet high. When you multiply the 120 ft. perimeter by the 22-1/2 ft. height, you get a 2700 sq. ft. area to be painted.

Don't worry about subtracting the area of the windows and doors you're not going to paint. Most houses have porches, steps, railings, etc., which will need to be painted. The paint for those elements will just about use up the paint you won't be using on the windows and doors. (Incidentally, if you plan to paint the windows and doors in an accent color, allow about 2 quarts.)

Once you have the square footage to be painted, divide that number by the coverage specified by the paint manufacturer. In the example, if the label says that one gallon of paint will cover 250 sq. ft., then you'd divide the 2700 sq. ft. area by 250 sq. ft. per can, to get 10.8 gallons per coat.

Remember that, with a good quality paint, you're more likely to need only one coat – although, to cover some colors completely, you'll simply have to use additional paint. Your paint dealer should be able to advise you.



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# SPECIAL PROBLEMS
## in preparing surfaces for painting

Getting ready to paint your house involves cleaning and repairing a variety of surfaces. This process can take longer than the actual painting, but it will play a major role in how the finished job will look and how long it will last. There are two purposes behind these preparation tasks: first, to remove dirt, oil, and grease and other materials that prevent the new paint from "gripping" the surface; and, second, to prevent moisture from getting under the new paint and destroying it.

**Preparing the body of the house:**

The first step is to remove any deteriorated paint and thoroughly clean the surface. Because houses built before 1978 may contain lead-based paint, you need to take precautions to prevent leaded paint dust from contaminating the surrounding area *(see separate handout on "Working Safely with Lead-Painted Surfaces.")* The best way to remove chipping or peeling paint is to tarp the area and wet scrape, using a garden hose or spray bottle to keep the surface damp. Place all chips in a "contractor grade" (4mil) plastic garbage bag and close it securely before disposal.

Once you have removed the loose paint, wash down the surface of the house with detergent, such as a commercial-type cleaner like **TSP** (tri-sodium phosphate). You can use a pressure washer on the lower-pressure "wash" setting, an automotive brush, or even a heavy-duty sponge. Pay special attention to protected areas, such as overhang eaves, gables, and porch ceilings. Rinse thoroughly and let the surface dry for several days.

Areas that are heavily soiled or stained by rust or mildew will require special attention. In many cases, detergent and a scrub brush will be sufficient. Remove rust stains with a solution of **oxalic acid**. (Follow up with a rust-inhibiting primer, or the stain will reappear.) A **bleach** solution will kill the mildew spores. Organic stains can be removed with a solution of **ammonium sulfamate** powder. Rinse off all these products with clear water, and remember to wear protective clothing and goggles.

Then, repair any deteriorated surfaces. Look for split or rotted pieces of wood siding or siding shingles and replace them before you paint. Re-nail any loose siding boards, and fill all nail holes and small cracks in the surface with vinyl spackling. Replace any loose nails with slightly larger ones, and countersink any rusty nails 1/8" deep; then, putty over the nail heads.

Repair any trim pieces, and replace any deteriorated glazing around windows. Check for cracks or openings where water might enter the wall, especially around door and window frames and where siding meets a roof slope or brick surface. Remove any old caulk and replace it with fresh (siliconized acrylic works best).

Finally, apply a coat of primer – at least to any areas of bare wood, and preferably to all areas that have been cleaned and repaired – before applying the final coat(s) of paint.

**Preparing porches and decks:**

High-traffic areas, such as porches, should be wet scraped and painted with an **exterior deck enamel.** Places where the old paint has chipped or peeled can be filled with **vinyl spackling**.

*(continued)*

Although this material does not hold up particularly well under foot traffic, it is still wiser to repair the surface and repaint more frequently than to spot sand and contaminate the area with lead dust.

**Preparing metal surfaces:**

Unpainted metal surfaces should be painted with a suitable primer. Older steel and iron metal surfaces need to be cleaned of grease, oil, and rust before painting. For oil or grease, use a solvent such as **mineral spirits** or **turpentine**. For rust, you can use the traditional method – scraping and sanding the fixture down to bare metal by hand or with a power tool, priming it with a **rust-inhibiting primer**, and then repainting it – or you can use a **rust converter** (like Duro's Extend®), found in the form of brush-on liquids or sprays. Before you apply the product, scrape away any loose rust or paint flakes, but you don't need to sand or grind the metal to a shine. The rust converter will cause the rusty areas to turn bluish-black as the surface is stabilized; where any old paint is left, the polymer vehicle dries clear. After the converter has dried, coat the entire surface with a **rust-inhibiting paint**, such as Rustoleum®, to protect the metal from further deterioration.

**Preparing exterior masonry surfaces:**

If your existing brickwork has been painted, you need to clean off any white, powdery deposits of crystallized salts ("**efflorescence**,") commonly found on masonry surfaces, before repainting. Paint will not adhere properly over these deposits. You can remove the built-up efflorescence with a 10% solution of **muriatic acid** applied with a wire brush, and then rinsed with clear water. (Be sure to wear protective clothing and goggles.)

Although some people look for ways to remove old paint from masonry surfaces like brick or structural clay tile, you may never be able to get all traces out of the nooks and crannies. Probably the best results can be achieved with a **paste remover** (like Peel Away®), but you still may have to deal with lead residue.

**Preparing concrete:**

New concrete should not be painted for at least 96 days, until it finishes curing.

Before painting a smooth concrete floor, etch the surface with a solution of one part **muriatic acid** to eight parts water, applied with a stiff fiber brush. Allow the solution to remain on the surface until it stops bubbling. Then, rinse thoroughly.

Clean all concrete with a good **detergent** before painting, to remove oils and grime that prevent the paint from adhering properly. You should also remove any efflorescence with muriatic acid, as described above.

**Power sanding and machine blasting:**

Although abrasive blasting for paint removal was popular in the past, it is now prohibited in many communities with older homes (including Cleveland Heights) – at least until technology is developed to contain all the lead dust created when old paint is removed. Dry sanding is also prohibited, as is use of volatile paint strippers, an open flame or burning torch, or a heat gun that operates above 1100° Fahrenheit or that chars the paint. You may dry scrape only in conjunction with a heat gun or immediately around electrical outlets or when treating small spots of defective paint (totaling no more than 20 square feet on exterior surfaces.)

Of course, each house is unique. Yours may have special circumstances that pose a challenge. If you have questions about preparing specific surfaces for painting, your local paint retailer will probably be able to guide you.

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# PAINTING ARCHITECTURAL IRONWORK

On many older homes you'll find architectural ironwork—scrolled wrought iron fences and railings on steps or porches, cast iron mailboxes and light fixtures—all features from an earlier time that add a great deal of charm. After all these years, however, most of this ironwork needs attention.

It's important that architectural iron be protected from the weather (usually with coatings such as paint and galvanizing), or it will eventually rust away. Maintaining ironwork has traditionally required a lot of time and elbow grease. The typical method has been to scrape and sand the fixture down to bare metal, prime it with a rust-inhibiting primer, and then repaint it. Power tools with wire wheels or sanding disks can reduce the time required to prep the surface, but a lot of detail work still must be done by hand. Otherwise, the only way to avoid this laborious procedure is to disassemble the item, take the parts to a sandblaster, and then prime the bare metal immediately to prevent "flash" rusting.

Rust converters in the form of brush-on liquids or sprays offer an attractive alternative to all that work. First introduced to industry in the 1950's, these products (like Duro's Extend®) are now found in stores selling building supplies, hardware, paint, and auto parts. They usually contain tannic (or nintannic) acid combined with a polymer solution (called the "vehicle.")

Before you apply the product, you should scrape away any loose rust or paint flakes, but you don't need to sand or grind the metal to a shine. The rust converter will cause the rusty areas to turn bluish-black as the surface is stabilized; where any old paint is left, the polymer vehicle dries clear. After the converter has dried, coat the entire surface with a rush-inhibiting paint, such as Rustoleum®, to protect the metal from further deterioration.

Following these simple steps whenever you see signs of rust will add years of beauty and usefulness to your ironwork. But, as Neil Young once sang, "Rust never sleeps...."

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## Preparation for exterior painting:

# REPAIRING WOODEN TRIM PIECES

When you're preparing exterior surfaces for painting, you may find that you need to repair some rotted wood. For example, one of your windowsills may have rotted through. If you spot the problem early, you may be able to avoid replacing the whole sill. By using a wood hardener to restore firmness to the rotted surface and then filling in with wood putty, you can have a paintable surface quickly. Some companies make a series of products intended to work together (for example, Minwax™ Wood Hardener and its companion wood putty,) that will create a better bond than unrelated products. Once the putty has cured, you can sand or file it to duplicate the profile of the existing wood.

When can you repair a piece of wood trim, rather than replace it? For thinner pieces, you can use wood hardener and putty on small areas, so long as the entire piece retains its integrity. On thicker pieces, like a windowsill, there's an old carpenter's trick that can help you assess the extent of the damage. If you can push a nail or screwdriver into the wood, by hand, no more than 1/4", the surface can be repaired; if you can insert it more than 1/4", the trim piece is too rotted to be repaired, and should be replaced.

After you clean up the sanding dust from the surface, use an oil-based primer to seal the repaired area. (You'll get the best results if the wood has been dry for several days, and if the humidity is low on the day you paint.) After the primer has dried (read the directions on the can), use latex or oil-based paint for the finish coat. Bob Moore, who used to demonstrate paint products for a major hardware wholesaler, said that – so long as the surface is "clean, dry, dull, and smooth" – you can get paint to stick to nearly anything.

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# Asphalt & Concrete

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# ASPHALT DRIVEWAY REPAIR

Those small cracks and depressions in your asphalt driveway can cause a whole lot of destruction. They provide places for water to work its way into and under the pavement; when that water freezes in the winter, it will expand – cracking apart the asphalt and even heaving up whole sections of the driveway, like icebergs. In most cases, the solution to this problem is fairly easy. A few hours of maintenance each fall will help avoid such destruction and extend the life of any asphalt drive.

Asphalt is basically made up of coal tars and fine gravel. When a driveway is installed, this compound is heated, spread out evenly, and compressed in place. After it cools, it becomes hard enough to retain its shape under the weight of your car. However, over the seasons, as the sun and the elements cook out the oils in the coal tar, the gravel is no longer held so tightly together. Cracks develop, and then chunks of asphalt fall out. The trick to ensuring a long life for your drive is keeping it sealed, to slow down the effects of the elements.

Before applying traditional sealers, you should fill any cracks and depressions in the existing asphalt. Ideally, this should be done several days before you seal the drive, to allow the materials to cure properly. To repair small cracks (up to about a finger width), use an old screwdriver or masonry chisel to clean all loose or broken materials out of the crack, remove any grass or weeds, and apply an herbicide; then fill the crevice with **crack filler**. (Crack filler is available in pour-bottles with spouts that let you pour the material right into the crack or in cartridges used with a caulk gun. It can be purchased at building supply or hardware stores.) The crack filler will harden, but remain pliable enough to stay in place despite temperature extremes.

For larger cracks or shallow craters, first clean them out as described above. Scrape away any build-up of grunge; then, remove oil or grease stains by scrubbing them with driveway cleaner or TSP or by coating them with a primer that covers oil spots. Next, fill the hole with **cold patch,** an asphalt repair material that is available in 80-pound bags at most lumber yards or hardware stores. (If you leave the bags of cold patch in the sun for several hours before installing the material, it will be easier to work with.) After you have filled each hole, use a rake to smooth out the cold patch, mounding it a bit higher than the surrounding surface. Then, compress the filler with a lawn roller, an asphalt tamper, or even your car driven over a board placed on top of the patch. When it has set, in a day or so, the patch will retain its shape.

Chuckholes or potholes are filled in much the same way. Make sure you dig out any dirt or loose materials to a solid base. The patch will hold best if you undercut the edges a bit, so the patch is wider at the bottom than at the top. If the hole is deeper than four inches, fill it with sand to a 4” depth. Then, add the cold patch in 2-inch layers, tamping after each layer. The final layer should start within an inch of the top; mound this last layer of cold patch slightly above the surrounding edges and tamp it down as described previously.

*(continued)*

After the crack filler and cold patch have cured, you'll be ready to seal your driveway. Ideally, **you should do this job each fall** while the weather's still nice (see the product label for the number of hours without rain that the sealer will need to cure, and for the minimum overnight temperature required.)

Until recently, your only choice for this job was traditional asphalt sealer. With this type of sealer, the material you buy definitely affects how long the repair will last. Better quality materials will have a higher ratio of "product" to liquid, while poorer quality materials are little more than black water. Generally, the more expensive the sealer, the better the quality. Your best bet is to **buy a good quality sealer with some grit or sand in it** to provide traction for wet days and to help fill any small cracks that remain.

Newer types of asphalt sealer, while more expensive, can make the job significantly easier. Combination sealer and filler products eliminate the need for filling cracks before sealing. (You'll still need to fill any depressions with cold patch.) Some sealers reduce or eliminate mixing, and gel-type products don't splash as much as traditional sealers.

With all sealers, the product label will tell you how many square feet each can will cover, but it's a good idea to buy some extra and return what you don't use. (Some driveways, especially those that haven't been coated recently, can absorb a lot more sealer than you might anticipate!)

In addition to the sealer, you'll also need to buy one or more **asphalt spreaders** for applying the sealer to your drive. The squeegee type will give you a smooth finish, while the bristles on the combination squeegee/brooms will leave visible brush strokes. While some types of asphalt spreaders are meant to be re-used, most are disposable.

For this job, **wear old clothes,** as you usually can't wash out sealer that splashes on your pants or shoes. (A petroleum-based waterless hand cleaner will remove sealer from your skin.) Before you start, clear the grass away from the edges and sweep the drive down well. If you didn't do so earlier, remove any oil or grease stains as described above, and rinse the area thoroughly. You're now ready to apply the sealer. Follow the manufacturer's instructions regarding whether the driveway surface should be wet or dry. With traditional sealers, you'll need to mix each bucket thoroughly for about five minutes, so any product that had settled on the bottom is suspended throughout the liquid; while you can stir by hand with a stick, using a power mixer will be easier.

Start near the garage and pour a line of sealer across the width of the driveway. Take care not to splash any sealer onto walls, foundations, or garage doors. Spread it evenly with an asphalt spreader to about an 1/8" thickness. When you have spread this first amount, pour another line of sealer and spread it out. Work your way in this manner to the street. (It will help if you have previously placed your buckets of sealer at intervals along the drive.) Place a barrier at the end of your drive to warn people to keep off the wet surface.

The product label will tell you how long you'll need to stay off the drive, to give it a chance to dry thoroughly. Avoid tracking the sealer into the house – it will be nearly impossible to clean off carpets and flooring.

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# RESURFACING OR REPLACING YOUR ASPHALT DRIVEWAY

Many people install a new asphalt drive over an existing driveway of some type. This is commonly called “resurfacing” – and is different from “sealing” the drive. Resurfacing is not usually as long-lasting as removing the old drive and installing new asphalt; however, since total replacement costs about a third more than resurfacing, many people will explore the resurfacing option for financial reasons. As in any repair, the amount of time and effort spent in preparation will determine how well the finished driveway looks and how long it will last.

In exploring your options for an asphalt drive, the following things should be considered:

**Tear-out/New Drive:**

The best method is to install the asphalt by itself and not over an old drive. In a complete tear-out, the contractor completely removes the old drive, and lays down a 4” layer of compacted gravel for drainage *(note: all code requirements are based on Building Code in Cleveland Heights)*. This is followed by a course of compacted asphalt as a base (a #301 binder course, 2” thick, is the minimum required by code, but 4” is better). Finally, a surface layer of 2”-thick compacted asphalt (#404 surface course) is installed. This type of installation will provide the longest lasting job. If you are considering total replacement, you might also price concrete, and compare the costs – and the advantages and disadvantages – of each.

**Asphalt Resurface (over Asphalt):**

A #404 surface course of asphalt can be installed on top of existing asphalt. Since the product used for both layers is the same, the layers should heave together in the winter. However, before choosing this option, you should consider why your present drive is failing. For example, is the base underneath the asphalt not giving it the proper support? Putting new asphalt on top of existing problems won't make them go away. The time to correct them is *before* you install the new asphalt.

**Asphalt over Concrete:**

Asphalt can be installed on top of concrete; however, you will be taking a risk that the concrete underneath will, after a period of years, heave and move under the asphalt, cracking or breaking the surface. Nevertheless, it is possible that your drive may last for a long time without this happening.

There are some things to look at in your existing concrete that can help you decide whether or not to try installing asphalt over concrete. Are the driveway blocks level? Are the joints or cracks pretty close, or are there large gaps between the pieces? Is one side raised up where it shouldn't be? Evaluate these problem areas in your drive. The more prominent they are, the more likely you are to have problems later on.

*(continued)*

In many communities (including Cleveland Heights), *this type of installation requires prior approval by the Building Department.* Consideration is given on a case-by-case basis, depending on the condition of the underlying concrete.

**Specifications:**

Regardless of how you have the asphalt installed, there are a few things to watch for. Make sure that the new asphalt will slope away from the house and carry the rain water to the street or to a catch basin in the drive – not onto a neighbor's property or into the garage; that the asphalt won't be installed any higher than the bottom of any basement window frame; that the edges will be firmly supported and tamped. These are all good specifications to get included in your contract.

Check out a potential contractor's past work by looking at a drive they did two or three years ago to see how well it has held up. Don't make final payment until you are sure the city has inspected and passed the job, and until you have checked the drainage (use a garden hose and water) and are fully satisfied.

You'll need to stay off your new drive for several days and be careful about tracking tar into the house. An asphalt drive will be "soft" the first year after installation – especially on hot summer days. Sharp things like bicycle kickstands tend to make holes.

**Sealing and Maintenance:**

Annual sealing of the drive, following the instructions given by the contractor and the manufacturer of the sealing compound, is the best way to give your new drive a long, happy life. *(See separate handout on "Asphalt Driveway Repair" for instructions on how to seal your drive.)*

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# CLEANING CONCRETE

It's incredible that something as hard as concrete can be so absorbent – but, let someone park an old oil-leaking car on your driveway, you'll be left with a large unsightly stain. While it's almost impossible to remove such stains to the point where you recapture that original white concrete appearance, there are steps you can take to remove most of the discoloration.

Attack a fresh oil spill immediately, sopping up as much of the oil as you can with dry rags or paper towels. Then, sprinkle a layer of kitty litter or sawdust over the area to soak up the remainder. Sweep up the sawdust or litter, and then mix a strong solution of **TriSodium Phosphate** and hot water (1/2 cup of TSP to one gallon of water). Scrub the area with an old broom or with a scrub brush mounted on a long handle, so you can stand upright while you work the cleaner into the concrete. Then, flush the surface with water. For a thick build-up of old grunge and grease, scrape up the thick stuff with a putty knife and apply a solvent cleaner like **SWAB™** concrete cleaner by GUNK (available at car parts stores) to get most of the stain out. Follow that by scrubbing with the TSP solution to remove the solvent residue, and finish by flushing with water.

To clean large areas of concrete, a number of things can be done. One is to scrub the concrete with a diluted solution of **muriatic acid** (one cup acid to three cups of water). This is not a job for an enclosed area, as the acid makes some nasty fumes, and you'll want to wear protective clothing. Let the acid set for a few minutes, and then flush the area well with water. The acid will "etch" or remove some of the surface of the concrete – along with any rust marks and tannic stains from leaves – leaving a whiter surface.

For a faster way to brighten the concrete, you can use a pressure washer, either with cleaners (used according to the manufacturer's instructions) or without cleaners for a no-chemical approach. Hold the spray nozzle about 8 to 12 inches above the block, so that the sharp water stream will not gouge the surface. Start by angling the spray nozzle to the left, making passes over the surface going left-to-right. Next, angle the spray nozzle to the right, and make overlapping passes going right-to-left. This technique will minimize streaking.

After removing dirt and stains, you can follow the cleaning with another technique that will whiten the surface and hide some minor pitting. Keeping the concrete wet, sprinkle a layer of **Portland cement** (or **type "N" masonry cement**) and use a push broom to work it into the surface. Be sure to make the coating as even as you can to eliminate light and dark blotches.

No matter what method you choose to clean your concrete, be sure to follow up by sealing the surface with a masonry sealer, such as **Thompson's™ Water Seal**. The sealer will minimize new oil stains and damage from road salt.

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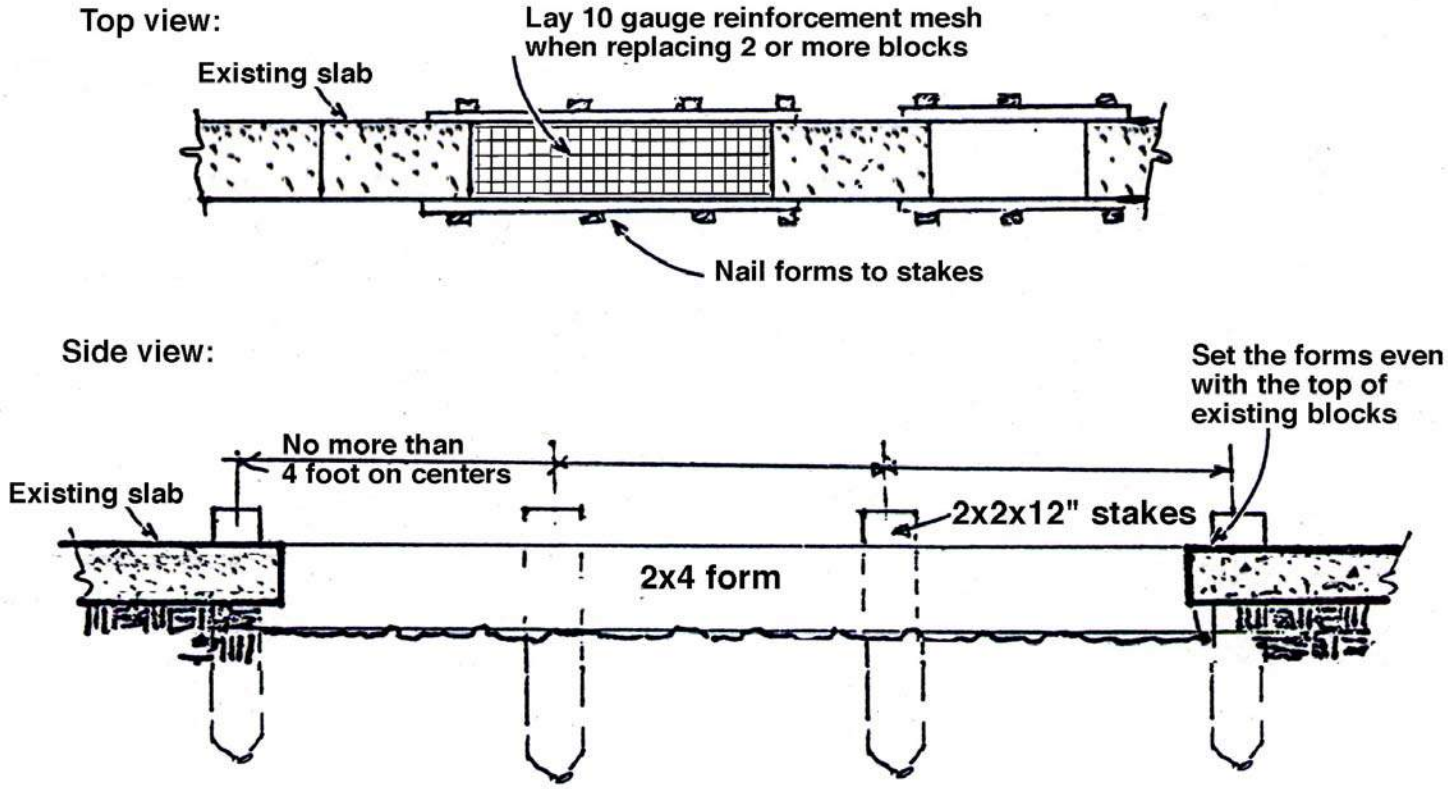
# CONCRETE FORMING

Building forms for replacement sidewalk blocks require a few wooden stakes and *straight* wood 2 x 4's to contain the wet concrete until it hardens. The wood does not have to be new, but should be strong enough to support side pressure. Attach the form boards to 2 x 2 stakes about 12" long. The form will be easier to disassemble if you connect the wood with screws; if you use nails, however, leave the head protruding from the surface so it will be easy to pull them out later.

After removing the damaged sidewalk blocks, dig out enough earth so that the new concrete will be the correct depth to meet code requirements. If the earth is not solid, dig out any loose soil and add a gravel bed 3 to 4 inches deep. (If the earth is solid and has a partial sand or gravel fill, you may not need to add more gravel.) Reinforcement mesh will be needed when more than one block is being replaced. The mesh will be laid onto the gravel bed before the pour.

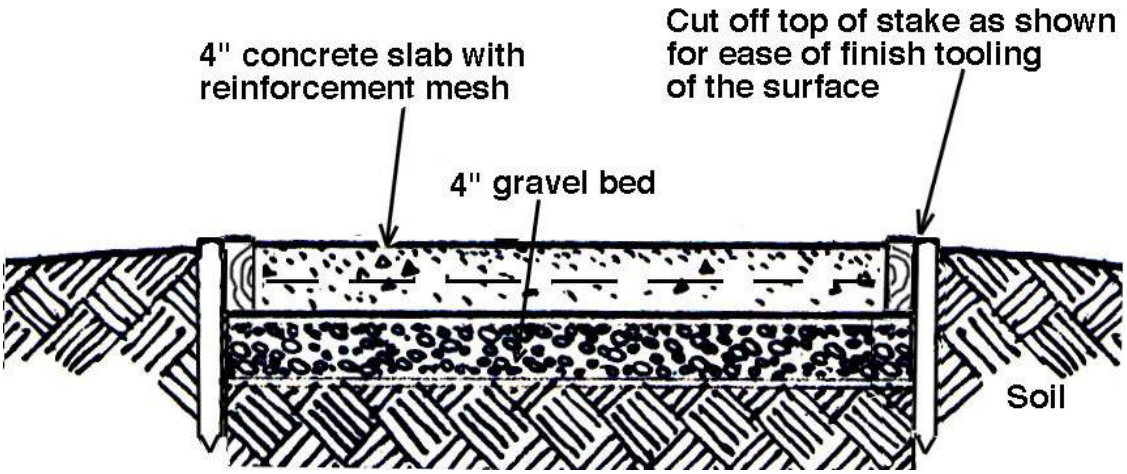
After preparing the site, set the forms as follows:




Cut off the stakes even with the top of the forms, for ease in finishing the wet concrete.

*(continued)*

Cross section view:




Forming for other types of concrete installation (driveway aprons, patios, etc.,) follows a similar process, but you should always check code requirements for the specific project. For example, in Cleveland Heights concrete apron blocks must be thicker than sidewalk blocks and require a curb footer to anchor the block at the street end. Check with your city's Building Department before you start.

Note that concrete replacement is a permit job. An inspector will have to approve the forms, so make sure you allow time for your preparation work to be checked *before* the concrete truck arrives for the pour.

After pouring, the concrete will need to cure for at least 24 hours before you can remove the forms, but you should leave them in place until after the final inspection.

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# CONCRETE REPAIR & REPLACEMENT

Concrete is one of the marvels of this modern world. We use it in so many ways that we don't always recognize it. The most common uses for concrete around the house, however, are for driveways and sidewalks. As tough as concrete is, it doesn't last forever, even with regular maintenance. The question that often arises is when to patch and when to replace. Let's start with that issue.

When concrete cracks, you have two or more chunks of concrete moving, independently of each other, through the freeze and thaw cycle that we have in our area. Anything that you put into the crack will be a temporary repair, at best. The longest-lasting materials will be ones that will remain flexible for a long time at various temperatures. Rubberized crack filler usually works best. This liquid filler is sold in a gallon container with a pour spout. There are two viscosities: use the thin solution for cracks up to 1/2", and the thicker solution for larger cracks. Another option for small to medium-size cracks is silicone caulk. Some caulks have cement mixed with silicone; these will stay flexible and blend in well with the existing concrete.

In larger cracks, it may be necessary to fill to 1/4" from the surface with either sand or a styrofoam rope (known as "caulk backer rod") before adding the crack filler or caulk. This will minimize the amount of filler you'll need to use.

If the concrete isn't cracked, but has round, bowl-like depressions – or if the surface that was once smooth now has a layer of pebbles on top – you have a different problem (called "spalling,") where the top layer of concrete has peeling off. This problem is not so easily solved. Latex patching cement (i.e., "Top 'n' Bond") is designed to be used as a patch, and will bond to existing concrete. You can use this material to fill in the holes and return the surface to a level condition. You can also apply a skim layer across an entire spalled block. Latex bonding additive can be painted on the old work to create a stronger bond with the new patch. This repair, however, may not last forever; after a couple of years, it may peel away.

So, as you can see, there is no quick fix for concrete problems. To prevent both cracks and spalling in the first place, seal your concrete annually with a masonry sealer (such as Thompson's®) to keep the water out. It is the action of water that usually causes the disintegration.

Once damage has occurred, however, it is often better to replace the concrete than to repair it. In a block of concrete the size of an average sidewalk section, you should generally replace the block if it has two or more cracks, or if more than 25% of the surface area is pitted or has depressions.

Having determined that your concrete does indeed need to be replaced, let's look at how to do that, step by step.

First, in most communities you'll need to get a permit for the work you are planning to do, and a copy of the specifications for that particular repair. (If the work is contracted, the contractor should obtain the permit and be responsible for meeting code requirements.) Then, you'll have to remove the bad concrete. A heavy sledge hammer is usually the best tool for this job. If you can get the concrete slightly off the ground with a pry bar, it will break much more easily.

After you have removed all the old concrete, you'll need some forms to hold the new concrete. Forms are basically a mold to hold the wet concrete until it hardens. Sidewalks and service walks will usually need to be 3-1/2 inches deep (the width of a 2 x 4), while driveways need to be thicker. The forms should be straight and level, and secured in place with stakes. (When the concrete is poured in, there is a lot of outward pressure, so your forms need to be braced against it.) When

*(continued)*

working with a large area of concrete, you need to include some expansion joints, which allow the concrete to move slightly (from temperature changes, for example,) instead of cracking. These joints are generally made of impregnated sheathing. They are generally required every 30 feet of length on a drive, and every 15 feet (approximately three blocks) of sidewalk and/or where a new section of concrete meets an existing wall or another section of concrete.

In areas where code requires, wire reinforcement mesh (at least 10-gauge, 6-inch squares) must be imbedded in the concrete. (Reinforcement fibers can be mixed with the concrete as an alternative to the mesh – see below.) The mesh is placed in the forms, and then, as the concrete is poured, it is pulled into the middle of the concrete. Wire mesh is usually required for drives, garage floors, and runs of sidewalk, but is not required for single sidewalk blocks. Check when you get your permit.

There are several ways to get concrete, each of which has advantages and disadvantages; the best source of concrete for a particular job will largely depend on its size. You can have a truck deliver the concrete (either pre-mixed from the plant or mixed from the dry materials on site), purchase concrete already mixed and poured into a special trailer that you haul home yourself, or buy bags of redi-mix concrete that you mix with water. Code may require that reinforcement fiber for larger jobs be added at the plant—*not* mixed in at the job site. (The load ticket should indicate which additives have been mixed into your load. For contracted jobs, make sure the contractor shows you the load ticket.)

To purchase the right amount of concrete, you'll need to measure the width and length of the area you are replacing, and then multiply these dimensions together to get your square footage. The square footage and thickness of the job will enable the supplier to give you the right amount of concrete. (If you are doing a small job with redi-mix concrete, the chart on the bag will use these same figures to let you figure out how many bags you'll need.)

Whether you are contracting the work or doing it yourself, be sure to check the sac mix (a measure of the amount of Portland cement in a cubic yard of concrete) your city requires for the specific job you are doing. Cleveland Heights requires a 6.5 sac mix for most concrete work.

Before pouring the wet concrete, the earth inside the forms should be soaked thoroughly with a hose. Once the concrete is poured into the forms, the first step is to “strike it off” with a level board that spans the form and rests on top of the sides. As the board is worked from one end to the other with a sawing motion, the concrete will be leveled off. Then, it is ready to be finished.

Use metal trowels to smooth and finish the concrete. Work the trowel in slightly overlapping half-circles around the entire surface. During this process, the rocks on the surface will become embedded deeper in the concrete, and a layer of pure cement will be drawn to the surface, along with the water that is being displaced by the rocks. After the concrete has set up some (an hour or so, depending on the temperature,) an edging tool can be used to finish the edge. If you have poured two sidewalk sections as one block, use a control joint trowel to install control joints (the lines that go across the width of the concrete to control cracking) between the sections. Finally, create a non-slip finish by using a wooden trowel (for a rough, sandy texture) or a broom drawn across the surface (for a “combed” look.)

Check the code in your community for other requirements that may affect your job. The City of Cleveland Heights, for example, does not allow concrete to be poured when the temperature is below 40°; if the overnight temperature will drop below 40°, the concrete must be covered with plastic and hay or straw to retain the heat created by the curing process. The addition of calcium chloride, a chemical sometimes used with cold weather pours, is not permitted in Cleveland Heights, because it shortens the life of the concrete.

Unless your contractor has coated the concrete with a curing agent that impedes the evaporation of water, concrete has to be kept moist for one week after pouring to allow it to cure properly. To do this, keep it covered and water it twice daily (more often when it's very hot.) Car traffic needs to be kept off during this time, as well. When the concrete has set long enough, you should seal it with a masonry sealer, following the directions of the sealer manufacturer.

Attention to the whole process – obtaining quality materials, constructing the necessary forms, finishing the concrete carefully, and allowing it to cure properly – can give you an attractive and long lasting job, one that you won't have to repeat any time soon.

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# CUTTING CONCRETE
## with a 7-1/4" Circular Saw

Homeowners who do their own repairs are often faced with cutting out an area of concrete (in preparation for sidewalk replacement, repair to basement drain lines, etc.) If you don't have access to a concrete saw, a circular saw can help you do this job, but serious injury can result if you do not use this tool properly. When cutting concrete, it's important to remember several safety tips:

**DO:** Purchase a masonry-type cut-off blade (available at hardware stores, lumberyards, building supply stores, etc.) These blades wear down rather quickly; if you're doing several cuts, you may wish to buy some extra blades. If you save your receipts, you can probably return any unused blades when you're done.

**DO:** Wear a protective face shield (preferably,) or at least safety glasses. The type of blade you'll be using is very brittle and disintegrates easily. Since the blade turns so fast, the pieces can fly off at high speed and be **very dangerous**. In addition, the small stones that make up the concrete can fly up and hit you as you cut.

**DO:** Use a chalk line to mark where you'll cut the concrete. You'll want to cut a straight line to lessen the stress on the blade.

**DO:** Make several shallow cuts, rather than one deep cut. This way, you'll prolong the life of the blade and lessen the chance of that blade breaking up.

**DO:** Use the saw in a position where you're comfortable and secure. If you're off balance, you'll be worrying about keeping your footing, and less aware of using the saw safely.

**DON'T:** Wear loose clothing that can get caught in the saw blade.

**DON'T:** Force the saw. Let the tool cut at its own rate, with only enough pressure to keep it on course.

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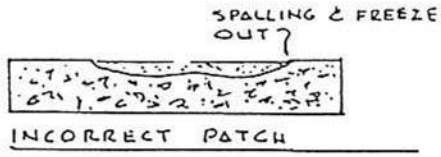
# PATCHING CONCRETE GARAGE FLOORS

Once again, that dreadful duty rolls around – cleaning out the garage. Well, after you have removed a couple of layers of junk and you begin to recall what the floor looks like, you may discover that you have a few more cracks than the last time you saw your floor. Don't panic – you can probably do some patching to save that floor and avoid an expensive replacement job.

First, clean out the area around where you are going to be working. Then, you are going to need a little time and a few simple tools: a **2-lb. heavy hammer**, a **steel concrete chisel**, a **rough cleaning brush**, a **concrete mixing tub**, a **concrete hoe**, and a **straight-edge** (a wooden 2” x 4" will do.) Plan on about two hours to repair the cracks in the average two-car garage. For crack patching, it's probably best to use a **ready-mix concrete** product, available from most area lumber yards, building supply, or local hardware stores. This mix will include everything that you need, except water.

Using your heavy hammer and chisel, undercut the area to be patched at an angle *(see diagram 1,)* so that the newly-poured concrete will be formed in the shape of a wedge to prevent it from heaving up. Clean the area to be patched thoroughly, and get it wet. Mix the concrete according to the directions on the bag, and install it in the area you've prepared. When you're finished, use your straight-edge to smooth the top of the wet concrete. Then, allow the new patch to rise about 1/8" above the existing concrete *(see diagram 2.)*

**Diagram 1:**

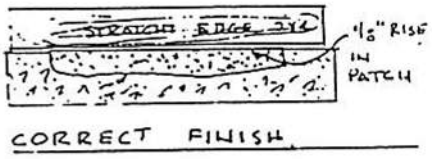



*This patch will fall out or wear out as a result of freezing.*


*This patch can be used in the center of large concrete areas.*

**Diagram 2:**


*The patch surface has shrunk due to over-working the surface, excess water, improper tools, or fast drying.*




*Use a good straightedge to screed off excess material. A little rise in the new material will allow for shrinkage.*

*(continued)*

After patching, why not try to clean and seal your floor? This won't take too much more of your time, and will probably keep you from having to patch your floor again next year. Here are a few ideas to make cleaning your concrete easier and more effective, especially if you need to remove oil or rust stains: first, scrub the stain with **paint thinner** or **grease solvent**. Then, mix a **cleaner** using one part sodium citrate to six parts water and six parts commercial glycerine. Mix this to a thick paste and put this paste on the stain. Keep the paste on the stain for a week; when the paste dries out, add some more. At the end of the week, take your hose and flush away the stain and the paste. You may need to repeat this process a couple of times to get out really stubborn stains. Trisodium phosphate (TSP) is another good cleaner to use. It is easy to find (try the hardware store) and works well with boiling water and a stiff scrub brush.

After you have gotten out those ugly stains, go ahead and seal your concrete. A **concrete sealer** will keep the water from entering the pores of your concrete and causing it to crack, and will keep any stains on the surface of the concrete so they won't set in. There are a number of brands of good quality concrete sealers available. Just follow the directions on whatever sealer you buy, and you'll go a long way towards extending the life of your concrete.

So, don't spend your time maneuvering the junk in your garage around those cracks (or strategically placing it to hide the worst offenders.) Patching, cleaning, and sealing that floor can simplify your life and extend the life of your garage. Most likely, you will still have to clean out your garage periodically, but you may be able to avoid any unpleasant surprises.

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# SIDEWALK LEVELING

Many people are interested in trying to level sidewalk slabs, but are afraid that the segment will be too heavy to handle without damaging the slab – or their backs! If you've been really struggling to get your sidewalks lifted and straightened out, there are some ways to get that project done even if you're not a body builder.

In many northeastern Ohio communities like Cleveland Heights, sidewalks are made of either **concrete** or **sandstone**. Although concrete is the heavier material, it's less likely to crack. It is usually poured 2-1/2" to 4" thick, and generally doesn't lie on a bed of sand. Sandstone, on the other hand, is usually installed over a bed of sand – and if it isn't, it should be. It's lighter, but the edges tend to chip, and it may crack while you're lifting the block to level it, if you don't handle it with care. Don't try to use a crowbar on sandstone, as you will almost assuredly crack or chip it.

Nine times out of ten, a section of sidewalk needs to be leveled because some uncooperative tree root grew where it wasn't supposed to and gradually lifted one section up until it is no longer at the same height as its neighbor. Code regulations in many communities require that there be no more than 3/4" difference between two adjacent sections of walkway, to avoid creating a trip hazard. To level a slab, you'll need to lift the section up, raise or lower the bed underneath it (so the slab ends up at the level of the section next to it), and lower it into place again. You won't usually need a permit if you're just leveling existing slabs (through you'll need one if you're replacing a slab with fresh concrete – check with the Building Department in your city.)

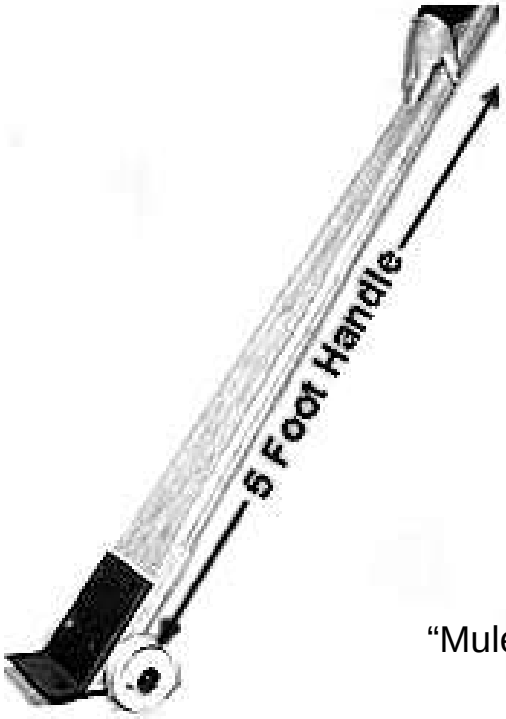
There are some tools that will make leveling a sidewalk section a little easier. First, if your sidewalk is concrete, check to see if the block was poured as one piece with its neighbor; if so, you can cut all the way through the control joint between them with a **concrete saw** to separate the segments. Next, use a **trenching shovel** to dig the dirt out along the edges of the slab. You don't need to dig too much; you just want to expose the edges and dig a trench under one side deep enough to pry up the slab.

Then, use a **mule** or a **slab lifter** to begin raising the slab *(see illustrations next page)*. A mule is a long piece of wood with a metal lip on one end. Slip the metal lip under the slab, and then push down on the handle to pry up the concrete. Slab lifters are basically two 2 x 4's nailed together for extra strength and leverage. Use the narrow width – not the wide edge – of the lifter, for greater strength. After you raise the slab up about 12", you can place a **hydraulic jack** under the slab. Then, raising it up further will be as easy as jacking up a car.

*Hydraulic Bottle Jack*

When you have the slab raised up enough to get at the tree root, place some type ofblocking under the slab to prevent it from coming down sooner than you planned (maybe with your hands underneath it!) Sometimes, you may find it easier to drag the slab completely out of the cavity, so you have easier access to the problem beneath it. With the slab safely blocked or removed, you can attack the tree root. *Don't use a chain saw;* it's not meant tobe used in the soil. You can cut out the root using a rough cutting blade in a **power reciprocating saw** (such as a "Sawzall"). An **ax** will also work, if there's enough room to swing it. Before replacing the slab, seal the cut ends of the root with some **roof tar**, to prevent insects from invading the tree.

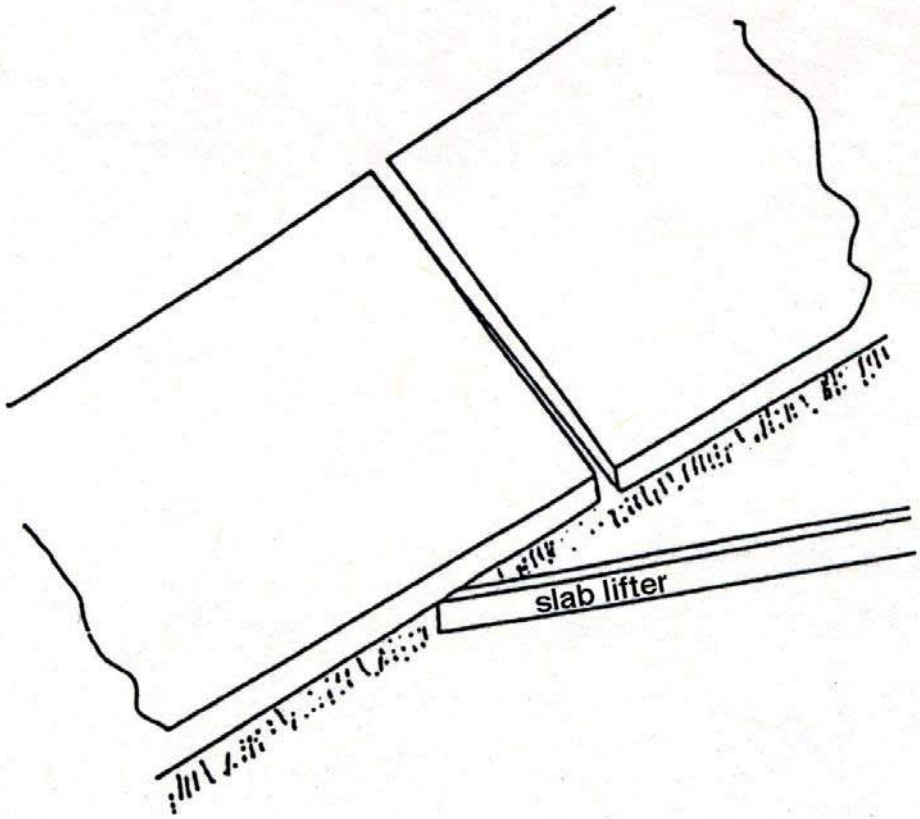
*(continued)*




"Mule"

If the slab is too low, and you need to raise it to the level of the one next to it, lift it up and add some **play sand** underneath it where it's low. Then, lower the slab into place again. If there are "humps" in the sand, water from a garden hose can be used to even them out.

So, if you let the tools do the hard work and take the time to get the root out, you should be able to get this job done without taking a weight-lifting class.



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# Masonry

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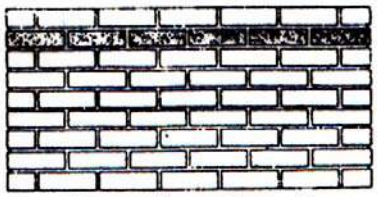
# BRICK PIERS

Many older homes have a rear porch supported, at least at one corner, by a brick post, or “pier.” This is where many homeowners first become acquainted with masonry work, because invariably these posts need repair. By their very nature, they suffer from the “ups and downs” of the weather – the changes in temperature and humidity that can cause the ground under them to heave with the seasons. In time, most brick piers tend to tilt one way or another and slowly self-destruct. Because they forge a critical link in the structure of the porch (and the home to which it connects), you can't afford just to ignore them.

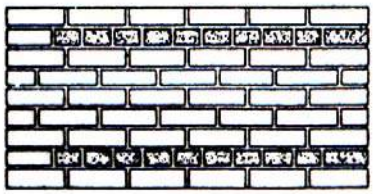
As with most other home repairs, the most common reason brick piers fail is lack of proper preparation – in this case, installation of a “footer,” the concrete foundation upon which the pier should be built. What you can't see below the ground directly impacts the longevity of what you can see above ground. A footer that is improperly constructed – or missing – will result in an unstable pier, one that is unlikely to remain straight.

Most homeowners, when attempting to correct this type of problem, try to “band-aid” it. They'll try to pull the pier straight or push it back into place. This type of repair will have a relatively short life. Unless the foundation is adequate, the pier will remain unstable and eventually tilt again.

To create an adequate footer for a pier, you must install it below the frost line (the average depth at which the ground typically freezes.) The frost line is about 33 inches in northeastern Ohio, so a footer 36 inches deep is generally considered safe. The basic rule of thumb is that footers should be twice as wide as the wall that will sit on them. For example, a 2-ft. square pier would need at least a 4-ft. square footer. The footer must support not only the weight of the pier itself, but also everything that will rest on that pier – the entire porch weight. So, most footers will need to be *at least* 10-12 inches thick; however, it is not unusual to need a footer 20 inches thick or so, depending on the combined weight it must support.



Running Bond



Common Bond

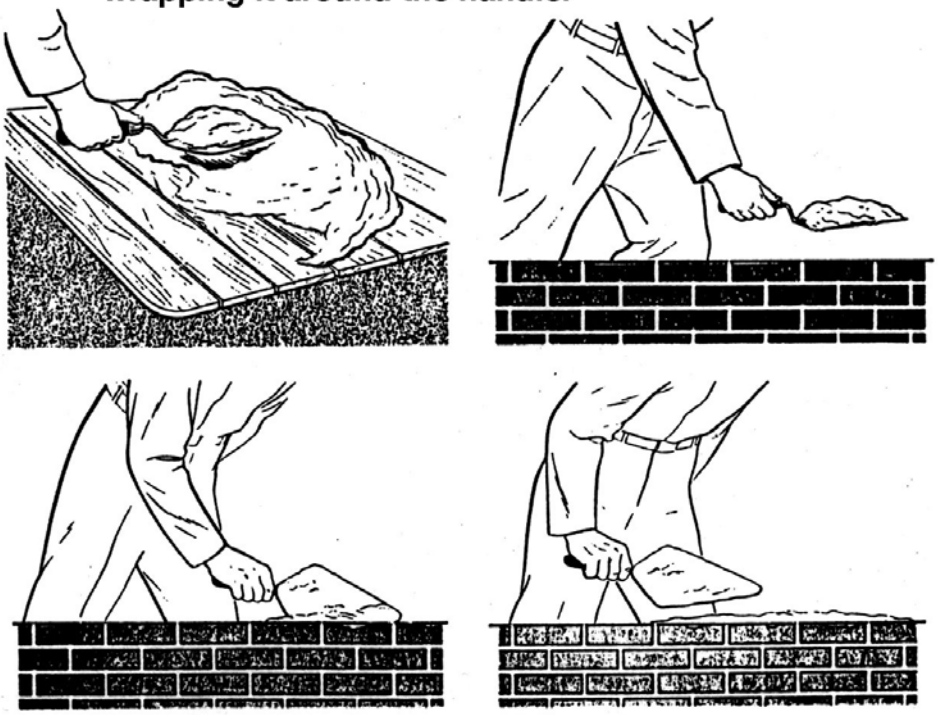
If you are installing a new pier and footer, you'll need a permit, and you should follow the required specifications for its construction. When the footer has set and you are ready to start the masonry part, you'll probably find either a “running bond” or a “common bond” the best pattern for building the pier. It's easiest to make your pier a size that takes advantage of full bricks, so you can avoid the slow process of cutting them to smaller dimensions. If you do need partial bricks, however, you can cut them with a hammer and brick chisel, or hit them with the pointed end of a mason's hammer, or cut them with a circular saw and a masonry cut-off blade, or rent a brick saw.

While mixing the mortar, soak the bricks thoroughly in water. Lay a bed of mortar on the footer to get started *(see illustrations on next page).* Then, “butter” (coat) each end of the brick with mortar, push it gently into the bed on the footer, and tap it lightly into place with the handle of your trowel. After getting the first row straight, and checking it with a level, you can continue on up with the pier. As you build, pay close attention to both the horizontal level and the vertical (called “plumb.”) Constantly check both directions with the level to ensure your pier is straight. After the pier is completed, allow it to set and properly harden for several days before putting any weight on it.

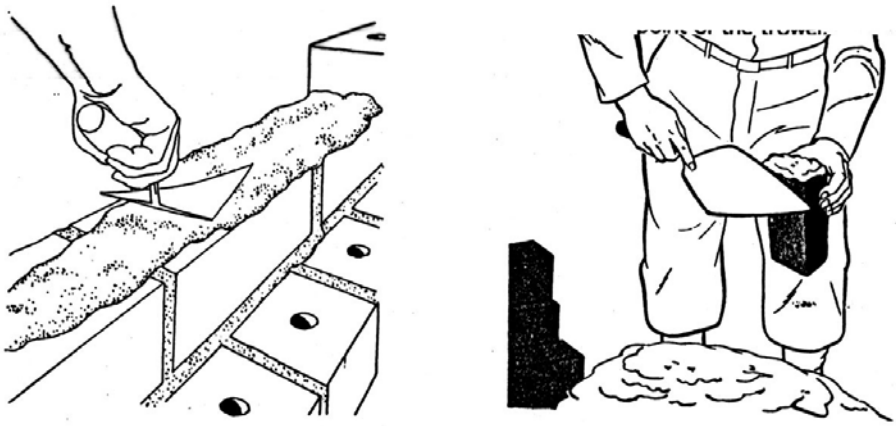
*(continued)*

These principles of basic masonry construction apply to whatever you are building, whether steps or piers. The quality of the work rests on its foundation.

**Get a good grip on the trowel by placing your thumb on the handle rather than wrapping it around the handle.**



**Pick up enough mortar to cover three to five bricks.**



**Spread the mortar, make a furrow with the trowel point. "Butter" the end of a brick before setting it into the course.**

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# MASONRY BASICS

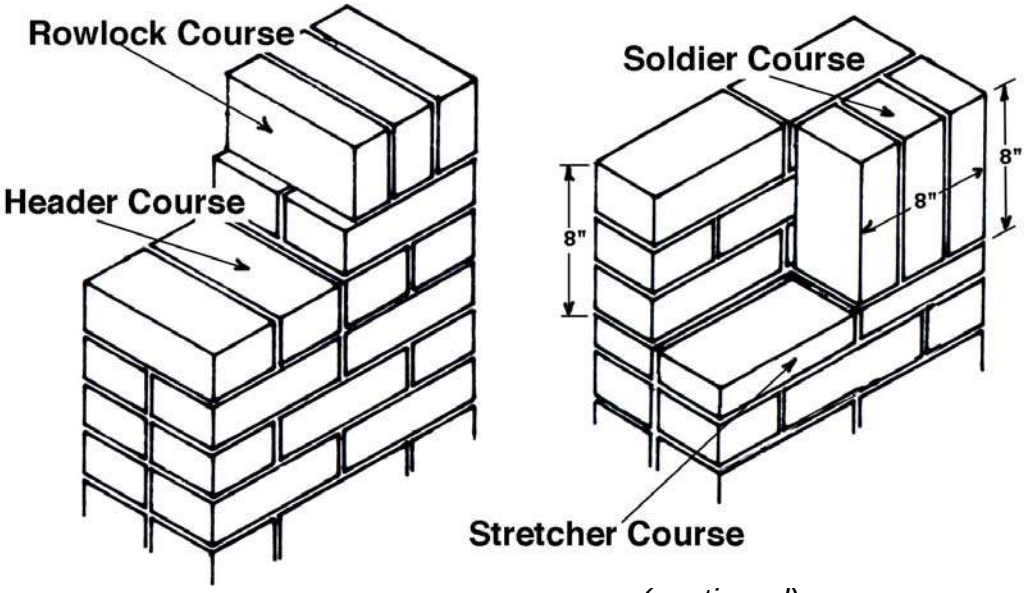
**Masonry** is a term used to indicate the part of construction that uses brick, concrete block, structural clay tile, and stone. These materials are held together with **mortar**. Mortar for masonry is *not* cement mix, the material used for sidewalks, patios, or driveways. Basically, mortar mix contains lime, sand, and gypsum, each in the proper proportions. Cement mix, on the other hand, has stones in the sand, and does not contain lime.

While some special mortar compounds may be needed to match the appearance of the existing mortar on your home – some brickwork, for example, has mortar made with lake sand, containing small shells – it is usually easier and more efficient for general use to get a "mason's mix," and then add the correct amount of water. The directions on the bag must be followed to get the right consistency. The resulting mortar will be gray but, if necessary, can be tinted to match the appearance of existing brickwork.

Large masonry projects are best done by a professional, but smaller projects are within the abilities of most do-it-yourselfers. **Bricks** and **blocks** are generally laid in the same manner, with horizontal and vertical courses that must be kept level and plumb. Bricks and blocks are manufactured to work with one another. The basic dimension used is the 8" *module*. (A *half-module* is, of course, 4".) The total horizontal dimension is divided into 8" modules to determine how many standard bricks will be needed in each row.

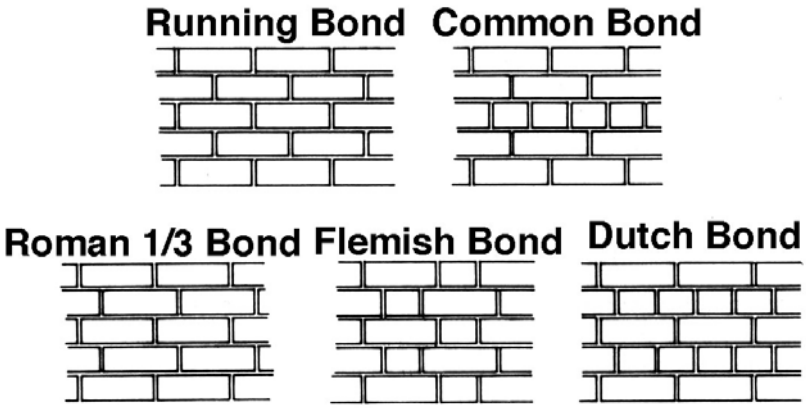
The height of a particular piece of masonry is also described according to the 8" module, but in a different way. Three horizontal brick courses are eight inches high. Thus, a wall 24" high would have three eight-inch modules with three rows of brick per module, and so would be 9 rows high.

Naturally, if you use bricks other than standard size, the modules will need to be computed differently. For this reason, it is imperative to know what size bricks will be used for your project.

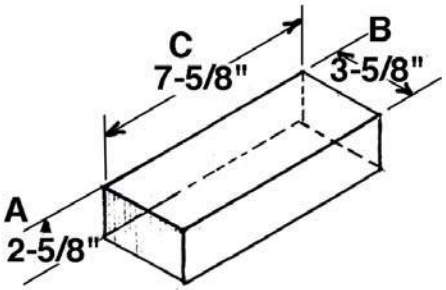



*(continued)*

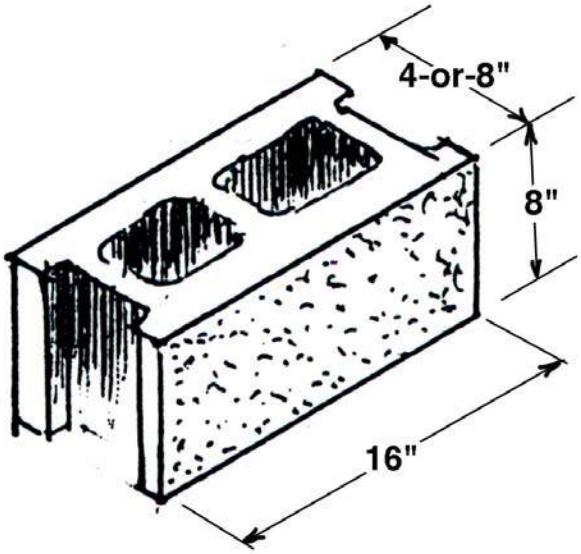
The pattern used when laying bricks is called the **bond.** There are many different types of bonds, but the most common use full bricks or half bricks *(see below.)* If you are constructing a masonry project on a do-self basis, it will be much easier if you employ a bond that uses only full bricks, to avoid the tedious process of cutting bricks to smaller dimensions. If you do need partial bricks, however, you can cut them with a hammer and brick chisel, or by hitting them with the pointed end of a mason's hammer, or by cutting them with a circular saw and a masonry cut-off blade, or by renting a brick saw.




While mixing the mortar, soak the bricks thoroughly in water. Lay a bed of mortar on the footer to get started. Then, “butter” (coat) each end of the brick with mortar, push it gently into the bed on the footer, and tap it lightly into place with the handle of your trowel. After getting the first row straight, and checking it with a level, you can continue on up. As you build, pay close attention to both the horizontal level and the vertical (called “plumb.”) Constantly check both directions with the level to ensure the bricks are straight. After the brickwork is completed, allow it to set and properly harden for several days before putting any weight on it.




| Brick Sizes | | | |
|---|---|---|---|
| Name | A | B | C |
| Standard | 2-5/8" | 3-5/8" | 7-5/8" |
| Roman | 1-1/4" | 3-5/8" | 11-5/8" |
| Norman | 2-5/8" | 3-5/8" | 11-5/8" |
| Brick BL | 3-5/8" | 3-5/8" | 11-5/8" |




Standard Concrete Block Dimensions

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# MASONRY FASTENERS

Many homeowners have questions about how to attach something to, or hang something from, a basement foundation wall. Much depends upon the type of foundation wall. The earliest homes in communities like Cleveland Heights had foundations of **fieldstone and mortar**. Prior to the turn of the 20th century, large and heavy **sandstone blocks** were used for foundation walls. There were many houses with **brick** foundations, too. Hollow **clay (tile) block** – lighter and much easier to work with than sandstone, and less expensive than brick – became the most common foundation wall during the WWI era. During the Depression, cement and ground-up coal cinders were mixed to create **cement (cinder) blocks**. From the mid-1940s to the present, these cement blocks have been the most common construction material for foundation walls, although in the past few decades, **poured concrete** foundations have also become popular in new construction.

Regardless of the foundation material, securing something to a masonry wall can be a bit of a challenge. Drilling into fire-hardened brick and then driving in a screw or an expansive anchor can cause the brick to crack. Clay blocks, on the other hand, are hollow, so they will be damaged by anything that is driven into the walls of the block. It's usually easier to drill and attach something into the mortar joints between the blocks than to drill into the block itself.

Clay block walls are found in many basements in older homes in northeastern Ohio. In addition to the blocks themselves being hollow, the vertical mortar joints are only 3/4" thick. So, when attaching something to this type of wall, it's best to **drill into the horizontal mortar joints**. Screws will be less likely to pull out if you choose screws long enough to pass through the item to be mounted and extend an extra 1-1/2" into the wall. Drill the hole at least 1/4" deeper than the screw length, so that any loose concrete particles will be forced into the back of the hole as you run the screw in.

The type of fastener to use will also depend on what you are trying to secure to the wall. To fasten lightweight items to masonry, a variety of nails, screws and anchors are available. Fluted (ribbed) hardened **masonry nails** are driven in by hand with a hammer. They can be difficult to get started and can bend as you drive them in. It helps to pre-drill a pilot hole (slightly smaller than the nail) with a masonry drill bit.

*masonry nails*

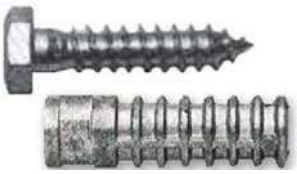
*powder-driven studs*

Another option is a powder-drive gun that shoots a **cement nail** (such as a powder-driven stud) into masonry walls. However, if you're not very experienced with the tool, you can easily overdrive the nail through the item you want to attach to the wall. Another problem is that the nails used with the gun are smooth, and can pull out.

*(continued)*

The most commonly used fastener is a **concrete screw**, a hardened blue-colored fastener probably better known by the trade name **Tapcon™ screw**. To install it, drill a pilot hole into the mortar with a masonry drill bit that is smaller than the screw size. (For example, if you are using a ¼" screw, use a 3/16" masonry bit.) Then, drive the screw into the pilot hole with a screw gun or drill, using either a nut driver bit of a Phillips screwdriver bit. The threads of the concrete screw will bite into the sides of the pilot hole. You can also drive this type of screw into a lead or plastic anchor that has been hammered into a pre-drilled hole. Concrete screws are the best choice when you're installing a piece of plywood to a foundation wall (to hang electrical boxes or clamp conduit).

*Tapcon™ screw*



*lag screw and shield*

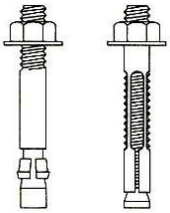
For medium-weight items, **use lag bolts and shields** that expand in the wall. They grab into the hole better than regular anchors (which tend to be smooth), but require that you drill a hole (at least 1/2" diameter) that will hold the shield snugly. Make sure the bolt is long enough to go through the item being mounted to the wall and extend slightly beyond the end of the shield to expand it fully. The shield should be about 2" to 2-1/2" long.

For heavyweight applications (such as a wall-mounted weight-lift machine, or a joist for a porch floor on the exterior surface), you may need to punch a hole in the block. Insert a L-shaped **foundation bolt** (anchor bolt) in the hole and fill the block cavity with anchoring cement. Let the cement cure for a couple of days before applying any pressure on the bolt.

*foundation bolt*

In addition to choosing the right fastener, you should also take care to prevent problems caused by basement moisture. Wall areas below "grade" (that is, below the soil line outside), are much cooler; in summer, water vapor in humid air will condense against the cool walls, leaving the surface damp. Moisture seeping through from the outside can also cause wall areas below grade to be wet. So, if steel or iron items are mounted below grade, they'll eventually rust and crumble away. There are some ways to minimize this problem. Consider mounting metal items, such as electrical workboxes, onto wood blocks that you have painted on all sides and positioned above grade. Paint the contact area of the metal with a rust-preventing coating (i.e., **Rustoleum®.**) Mount laundry tub faucets and the hose spigots for the washing machine onto painted wood blocks, as well, if they are below grade; while brass fixtures and copper piping don't rust, the clamps are often just copper-plated steel, and they will eventually rust if mounted directly to the wall. Outlets and switches should be mounted at least 48" up from the basement floor (as required by the electrical code).

You may find other projects where **wedge/sleeve** fastening "systems" will be helpful (for example, securing a garage wall stud to the concrete footer, or fastening a stud wall to a concrete floor.) If you're not certain which method will work best for your project, your local hardware store may be able to advise you.



*wedge and sleeve anchors*

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# REPAIRING EXTERIOR BRICK STEPS

Sometime today, you will probably walk up or down the steps outside your house without even noticing them. Seldom do we pay them any attention... until a loose brick falls into the cavity under your porch, or one of those beautiful sandstone treads breaks. If you could view your house through the eyes of a stranger, however, you'd see that steps in bad repair can ruin the first impression given by your home, and take away from its attractiveness.

There are many different types of steps, and one style is not necessarily better than another. The important thing is that the style of your steps relate to the type and style of your house. (Note that replacement of existing steps with a different style or material may require approval by your city's Building Department; check with them about the appropriate procedures.) The advantage to masonry (brick or stone) steps is that the materials don't deteriorate; however, the mortar holding the bricks together can fall apart in time, leaving them without normal support. Wooden steps, on the other hand, are subject to rot. So, there is no perfect material from which to make steps. The best approach is to learn to recognize the problems common to each type, so you can correct them before you have to replace the entire steps.

Problems with masonry steps usually start with the foundation. When a home is built, its foundation is dug deep into the ground. Unfortunately, steps are usually built on a much less substantial foundation. As the house settles over the years, the steps settle at a different rate. This situation usually produces a diagonal crack in the brickwork between the house and the steps. Unless you want to remove the steps, replace their foundation with a stronger one, and then rebuild the steps, there is little you can do except tuckpoint the crack when needed – digging out old mortar and replacing it with new. If the mortar deteriorates, then fairly quickly the bricks will loosen and fall out. Before you know it, your stone treads will crack and break, and they'll need much more substantial work to get them back into good shape.

A quick going-over once a year will help keep masonry steps in good repair. You may wish to tuckpoint in the fall, since the water and ice that get in between the brick joints in the winter does the most damage. If you go into the winter with the brickwork nice and solid, chances are you'll emerge in the spring in good shape.

Once the treads have broken, however, it becomes much more difficult to salvage the steps. Many steps have brick risers supported by the tread beneath them – so when a tread cracks, that support is lost, and the bricks start to shift out of alignment. In a few situations, you may be able to repair the broken areas without having to rebuild the entire unit. One common problem involves a sandstone tread or landing where a corner has broken off – often at the place where the handrail was anchored. If the broken portion is all in one piece, and if the piece can be supported by the riser underneath, then you can sometimes adhere the broken corner with vinyl patching cement or a two-part epoxy. (You won't be able to reattach the rail at that same spot; you'll need to readjust the railing to a new position.) If the broken corner can't be supported by the riser, however, you won't be able to reattach it permanently, and will need to have the entire tread or landing replaced.

*(continued)*

If the landing has cracked and started to collapse, but the rest of the unit is solid, you may be able to have a replacement landing cast in place from concrete. A form will have to be built to support the weight of the wet mix until it cures and hardens. Check with the your city's Building Department before undertaking this repair, to make sure their requirements will be met.

Masonry steps that are beyond preventive maintenance – with broken treads and/or many missing bricks – may need to be rebuilt. In most communities this is a permit job, and usually must be done by a professional. A new foundation will generally be needed, and you may have to add or change design elements (such as railings) to meet current code requirements.

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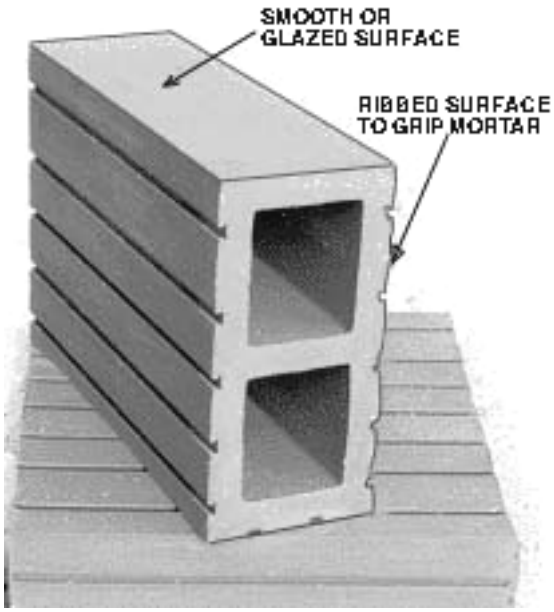
# STRUCTURAL CLAY BLOCKS

If you look at where the ground meets the foundation of the older houses in many northeastern Ohio communities, you may notice different types of building materials. On homes built prior to 1915, cut stone blocks or bricks were most often used for the foundation. From about 1915 to 1950, the foundation walls of many homes were built using structural clay (tile) blocks. These blocks are usually a reddish-brown color, and are quite a bit larger than bricks, usually 8” x 12” or 8” x 16”.

Clay blocks were less expensive than stone blocks and, being lighter weight, were easier to handle. Because their larger size provided a labor savings when constructing the foundation, they were usually found below the soil line (or “grade”) on the outside foundation wall; the more costly bricks were then used only on the exposed portion of the wall, for the few rows above grade that could be seen.




Clay blocks were not fired long enough to have a hardened surface like brick, so they are vulnerable to the destructive effects of weather exposure. If the outside foundation walls become open to the elements, clay blocks can become soft and porous. They will “spall” or deteriorate in a fairly short period of time, creating voids in the foundation that can allow water to seep into the basement. So, if your foundation is constructed with structural clay tile, it’s important that you fill any voids where the block face may have broken away, using some old bricks and mortar. Use the same method to fill any openings on the interior surface of the wall.

If your lawn has settled over the years, exposing the clay blocks, it is to your advantage to get the blocks covered back up again as soon as possible. There are several ways to go about this. The easiest approach is to “ramp” soil around the house, piling some dirt high enough to cover the exposed blocks of your foundation and then sloping it away from the house to the level of the rest of the lawn. The ramped soil will also direct surface water away from the foundation, preventing water seepage into the wall. Another way would be to bring in a couple of loads of topsoil to raise the level of the lawn around the house to cover the clay tile. Then, you’ll need to plant new grass seed. This method involves a lot of labor – your own or paid help – and patience in tending the new grass. A third method would be to take some railroad ties or treated landscape timbers and enclose an area surrounding the foundation. The enclosed area, when filled with dirt high enough to cover the exposed blocks, will give you a raised bed perfect for planting shrubs or flowers. Keep any shrubs at least a couple of feet away from the house.

There are some other simple ways of doing all this – but, however you do it, the object is to keep the blocks covered and protected from the weather. Like many smaller repairs, this situation has a way of turning into a bigger problem, if care is not taken.

*(continued)*

On the inside of the foundation wall, problems can develop, too. Deteriorated mortar between clay blocks can be tuckpointed, just as you would exterior brick. *(See HRRC's "Tuckpointing" video and accompanying handout for "how-to" instructions.)* However, sometimes you may find it difficult to pack mortar into a vertical seam, where there is a large void between the hollow blocks. In that case, use low-expansion foam to fill most of the void, and then follow that with a layer of mortar along the face.

Holes in the block itself can also be repaired with mortar; however, it's a good idea to fill the opening first with brick or stones to fill most of the void, so you don't have to use as much mortar. If you must replace an entire block, you can get a single block from a brick supply yard. Chisel out the damaged one, butter the sides of the replacement block with mortar and insert it into the opening; then smooth the mortar with a tuckpointing trowel.

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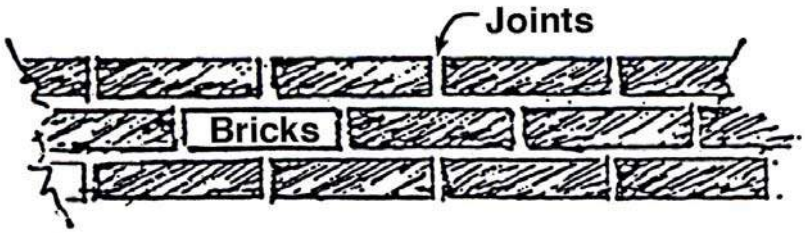
# ALL ABOUT TUCKPOINTING

Just about every violations list for an older home includes the need for **tuckpointing**. Yet, few people who are told to do this repair seem to know just what tuckpointing is, much less how to do it. Well, tuckpointing is just a fancy word for replacing the **mortar** that has fallen out from around your bricks – usually in the foundation, chimney, or porch steps. It's important to get this repair finished before winter, when ice conspires to tear your bricks further apart.

Mortar, the main ingredient in tuckpointing, is the cement-type product that is used between bricks to hold them together and keep the weather out. Over the years, it becomes soft or "rotten." It then starts to fall out, a little at a time.

The first step is to determine which areas need repair. Walk around your house and look for places where the mortar is missing, powdering, or not level with the rest of the mortar between the bricks. These are the areas that need work.




Next, take an old screwdriver or smaller chisel and scrape out the loose mortar. If the remaining mortar still seems to be crumbling, you can stabilize it by applying a solution of one part **concrete bonding additive** to one part warm water. Brush it on with a "cheapie" paintbrush the night before you start the work.

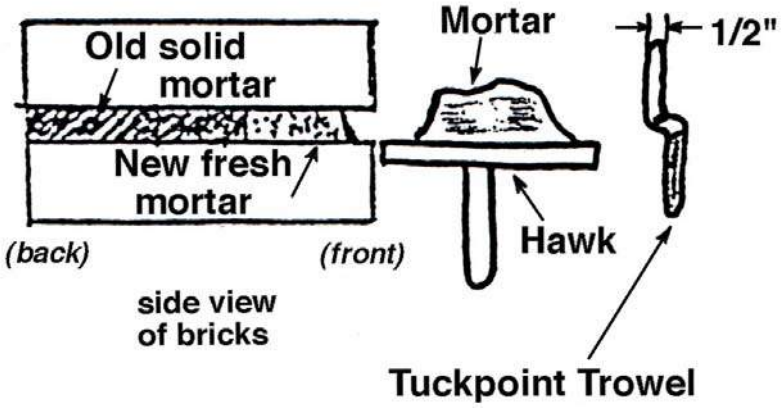
Before you begin tuckpointing, thoroughly soak the areas you are going to be repairing with a hose. (If you don't get the bricks really wet, the water in the new mortar you put in will be sucked into the surrounding brickwork, leaving the mortar without adequate moisture to set properly.)

A pre-mixed mortar mix is usually the easiest product to work with; just mix it according to the package directions. The mortar is grey, but can be dyed to match your existing mortar using **paint tints,** available at most hardware stores. You can mix it in any kind of container – a wheelbarrow, a pail, an old dishpan. (Just wash it out thoroughly when you're done to remove the leftover mortar.) Add water to the dry mortar and mix with a mason's trowel, hoe or shovel to an oatmeal-like consistency: creamy, but not drippy. Don't mix a lot at one time, especially when you're first learning to tuckpoint. *When the mortar starts getting too stiff to use, throw it out*. Don't add water to it to try making it thinner again – you'll create an improper mix, and the mortar will lose some of its strength.

The main tools you'll be using are a hawk and a tuckpointing trowel**.** A **hawk** is a flat board, about 12" square, with a handle attached to the bottom. It's used to carry some of the mortar right to the spot to be tuckpointed. (You can easily make your own hawk out of some spare wood pieces.) A **bricklayer's trowel** (with a triangular blade) can be helpful in transferring a small amount of mortar from the container in which you've mixed it to the hawk. A **tuckpointing trowel** (sometimes called a **joint trowel**) is a flat piece of metal, approximately 1/2" wide, bent to fit into the brick joints.

*(continued)*

If you place the hawk tightly against the wall you are working on, and right at the bottom of the joint, you can slide the mortar into the joint with the tuckpointing trowel for a nice, neat job. Pack the mortar in as much as you can. After it sets up for about ten minutes, you can then go over it again with the trowel to smooth it over. (This process is called **"tooling."**) Since the depth of the mortar between the bricks can vary from house to house, according to the bricklaying style used, you'll want to make sure that the replacement mortar matches the "look" of the original mortar around it.




Probably the most common question about tuckpointing is how to remove mortar that gets on the front of the bricks. No matter how careful you are, some is bound to get where it shouldn't. And, once it dries, it will be there forever. (You've probably seen a house with the foundation bricks slopped up with mortar – not attractive at all!) A simple cleaning with a medium-stiff brush and a **solution of one part muriatic acid to two parts water** will remove that slopped mortar before it hardens, and will help to blend the color of the new mortar with the original. Although this solution is an acid, you don't have to be afraid of it. Just use rubber gloves and take care to avoid breathing in the fumes. This is the <u>only</u> cleaning solution that will work to clean up the excess mortar.

With a little care and this follow-up cleaning, your tuckpointing job can look as good as a professional's. It's a job that almost anyone can do – it doesn't require much physical labor, and it doesn't all have to be done at one time – but it will go a long way in preserving the brickwork of your house.

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# Wet Basements

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# BASEMENT WALL COATINGS

If you're struggling with a damp basement, you may be tempted to "solve" the problem by painting your basement walls with a waterproof coating that promises to keep your walls dry. Don't do it! Not only do these waterproof coatings fail to deal with the underlying causes of basement moisture, they often cause problems of their own.

Before you try to eliminate basement moisture, you need to determine its source. The easiest way to do this is to tape a square of plastic (a piece cut from a garbage bag will work) securely to the inside of your basement wall. Wait a few days, and then check to see if moisture has collected on the surface. If the "room side" of the plastic is damp, the moisture has condensed out of the air onto the wall surface. (Since basement walls are underground, they are cooler than the other walls in your house.) Such condensation is a frequent occurrence in summer, when the humidity is higher. Painting the wall will not solve this problem; you'll need to run a dehumidifier or open more windows to increase air movement.

If you find moisture underneath the plastic, on the "wall side," you'll know that it's exterior moisture that has come through the wall or the floor. The most effective way to deal with this problem is by diverting the water *before* it collects alongside the wall and starts to move through it. Try snaking your storm sewers, re-grading any lawn area that slopes toward the foundation wall, caulking any joints between the driveway and the house, and correcting any sagging, loose, or leaking gutters. In most cases, these measures should eliminate your water problems.

But why not apply a waterproof coating to the inside of your basement? Because these coatings can create more damage by locking water into the wall, instead of letting it travel through the masonry and dry out in your basement. Sometimes, moisture trapped in the masonry will build up so much pressure that spalling occurs, where big chunks of the wall chip off. Or, the water will rise through the masonry until it reaches the wood sill plate above it, and start to rot the wood. If you already have a waterproof coating on your basement wall, you'll need to be vigilant about your outdoor drainage, so this type of damage doesn't occur.

Meanwhile the best material to use on your basement wall is a stain-blocking primer (i.e., Kilz™) or a good-quality, mildew-resistant latex house paint. Either of these paints will allow the walls to "breathe," so moisture can move through the wall and evaporate. A white powdery substance, called **efflorescence,** may collect on the wall. This is normal; the efflorescence is made up of salts, dissolved in the surface water, that are left behind when the water evaporates. It won't damage the wall and can be easily removed with a dilute solution of muriatic acid and a scrub brush.

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# FOOTER DRAINS

## and your storm sewer system

If you like to dig, replacing downspout or footer drains is the hobby for you. These drains form your **storm sewer**, the system of drainpipes buried around the perimeter of your house. They are designed to carry ground water away from your foundation and basement walls, so you can have a relatively dry basement.

Traditionally, a storm sewer system will consist of a series of 4-foot long clay pipes, 4" in diameter, laid end-to-end in a bed of gravel and slanting about 1/4" per foot. **Footer drains** encircle your home at the level of your basement floor or slightly below it. They slope from the high point at the back of your house toward the front, where the pipes running along either side of the house meet and extend out to the street. There, they eventually connect with the main storm sewer under the pavement. Along the way, your **downspout drains** (which also surround the house, but higher up along your basement wall), **driveway drain**, and any **yard drains** usually connect into this system.

It would be easier to list what goes right with this system than what goes wrong. When it is working right, you don't even know it is there; when it is malfunctioning, however, the water that seeps down to the storm sewer can't be carried away from the house. So, it seeks other places to go – most often through the foundation walls and into your basement. If your footer drain is not working properly, water will usually seep into the basement at the foot of the wall. On the other hand, if the problem is in a downspout drain, the seepage will usually appear higher on the wall, but below the outside grade level.

What can keep your storm drains from working properly? Pipes can break when ground heaves in the winter. (The pipes may even have been broken when the dirt was filled in, back at the time of original construction.) Tree roots can block the pipe; since the pipes simply lie end-to-end in the ground, roots can penetrate between them, or through any small cracks in the tile. Pipes can become blocked from leaves or other debris washing down from the gutters or driveway drains. Dirt may have sifted down over the years and packed the pipes.

Maintenance is cheaper than replacement. It usually consists of keeping gutters free of leaves; putting a root killer such as Root-X (a brand of copper sulfate) into your downspouts and/or drive-way drain four times a year to prevent roots from blocking the pipes; and using a sewer snake to open clogged drain lines or keep them clear.

Replacement is a last alternative, but one you'll need to undertake if the drain cannot be cleared with a snake. (This is usually a permit job, so be sure to check with your city's Building Department about their requirements.) Before digging begins, you or your contractor should locate the gas, water, and underground electric lines that come through the foundation; care must be taken to keep from cutting through them. Then, try to locate the portion of the sewer line that needs replacement – usually through the process of elimination. If, for example, a garden hose in the front downspouts can be run at full blast for ten minutes or so without water backing up, then the line is probably clear from that point to the street. But, if water backs up quickly from a hose inserted into a rear downspout, then the problem is probably in the downspout drain between the rear downspout and the front one that was clear.

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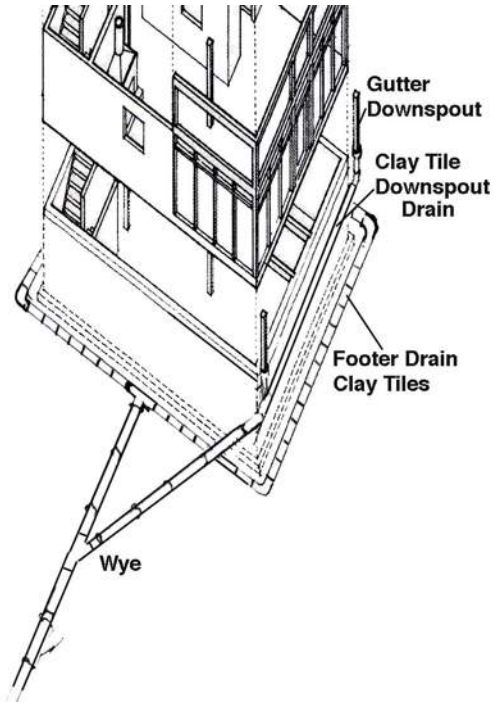
Once the problem area has been located, the next step is to dig down and expose that part of the drain. After the pipe has been exposed, you might try running a snake through it again. (Sometimes you can have better luck with the snake operating in a straight line.) Even if the snake doesn't clear the pipe, the snake cable can be used to determine the location of the blockage. Insert the cable until you reach the obstruction and mark that point on the exposed cable with tape. Then, pull the cable out, lay it on top of the ground, and use it to measure where you'll need to dig down to the clogged pipe.

When you have dug down far enough to expose the drainpipe, you can remove any broken or clogged pieces. It's usually easier to replace them with plastic pipe, using "no-hub" rubber adapters to connect the plastic to the clay pipe. It's a good idea to leave the hole open for one or two good rains, just to make sure the drain is working. When you are sure the system is operating properly, the pipe should be buried in gravel (to about two feet above the pipe) and then covered over with dirt on top.

When working below the ground, there's always a safety issue – the possibility that the trench may collapse on someone working in it. To minimize the risk, the dirt removed from the trench should be piled two feet or more away from the edge. If the trench is longer than four feet, there should be a ladder every 4 feet. If the ground is at all unstable, the trench should be shored up with upright 2 x 10's lining the walls and braced in between with 4 x 4 beams to hold back the sides.

Since exposing a footer drain is quite labor-intensive, hiring a professional to do this job can be costly. If you don't mind hard labor and take the proper precautions, you can save thousands by doing this job yourself.



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# WHY DO I HAVE A WET BASEMENT?

When was the last time your basement turned into a swimming pool? Living here in north-eastern Ohio, with its periods of heavy rainfall, you may have experienced a wet basement and wondered what to do. The first thing to consider is why water is getting inside your house and not staying outside where it belongs. Then we can look at how to get your house dry again – and keep it dry.

First, you need to understand how your house was built. In the Heights area, most basement walls were constructed from hollow structural clay tile, a reddish-brown block much larger than bricks (usually 5" x 12"). Because corner blocks had exposed hollow ends, builders generally stuffed a lump of mortar into the cavities to keep dirt and water out of the wall. Below the soil line, the exterior of the walls were "parged" (smeared with mortar and then coated with an asphalt liquid) for moisture-proofing. Walls built using clay tile were usually 18" thick and rested upon a concrete footer with drain tile laid alongside. The trench was filled with gravel, and then 14" to 36" of soil. A perforated clay footer drain installed around the foundation ran out to a sewer line in the yard. In most cases, this line went all around the base of your house and out to a larger sewer in the street; sometimes it was connected to the gutters, as well. This footer drain was designed to carry ground water away from your basement walls.

This footer drain forms your first line of defense against water coming into your basement. Your second line of defense is the waterproof compound that was spread around the outside of your basement walls. The third line is the gravel put around the sewer line; it lets any standing ground water flow away from your house and not toward it. Your last defense is a series of floor drains sunk into your basement floor. They are there to carry away any water brave enough to make it that far.

All these defenses are needed to protect your house. It's when one or more of them become ineffective that the problems usually start. There are few effective solutions that homeowners can do themselves. Re-waterproofing exterior walls or replacing buried sewer lines requires lots of digging – expensive, and too labor intensive to be practical for most people to do by hand. Trying to waterproof your basement walls from the inside is futile at best. **No paint or sealer has yet been proven effective in keeping water out for any length of time.**

But, you <u>can</u> keep your storm sewers clear. First, check that wter isn't backing up from the sewers in the street. Ask your immediate neighbors whether water is entering their basements. If so, talk to your city's sewer department about correcting that problem.

If the sewers from your house to the street have become clogged with tree roots, silt, or anything else, a sewer snake is fairly simple to operate. There are many types designed to clear pipe up to 4 inches in diameter, most powered by an electric motor and featuring a flexible cable, 50- to 100-foot long, with a cutting tip on its end. You can get access to the storm sewers through a driveway drain or at the base of a downspout (chip out the mortar holding the downspout in place, and lift the downspout out of the drain tile it feeds into.) To clear the footer drains, you'll have to go in through a cleanout in the front yard, usually located near the sidewalk.

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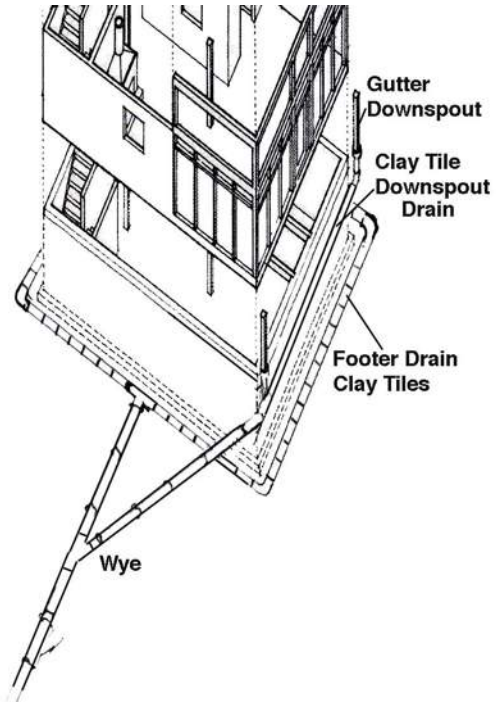
You can also divert surface water away from your foundation before it gets there (usually easier than keeping it from coming through once it's against the wall). If your yard slopes toward the foundation, add a few yards of fill dirt around your house, grade the surface to slope away from your foundation, and cover it with 6 to 8 inches of amended topsoil for plantings. Create another barrier by attaching a sheet of polystyrene (sheet plastic) to the foundation wall and extending it into the yard before adding the topsoil. In some cases, a modified French drain – a trench dug parallel to the wall some distance away from the foundation, containing a drain pipe set in gravel and feeding into your storm sewer or to daylight in the yard – can intercept water that runs toward the foundation wall.

If your driveway comes right up against your foundation, water can find its way into the gap between the asphalt or concrete surface and the house. Seal this gap with silicone caulk or a rubberized crack filler; these materials should stay flexible when our seasonal freeze-and-thaw cycle causes the driveways to heave.

Finally, check that your gutters aren't bent, sagging or pulled away from the house. A bare area in your lawn just beneath the roof line is a good sign that the gutter is dumping water along the foundation in heavy rains, where it can work its way through the basement wall. Securing the gutters in place will let them contain the water and direct it into the downspouts as they are designed to do.

Whether you do them yourself or contract the work these low-tech methods will cost far less than having your home "waterproofed" and will usually solve your basement water problems.



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# Plumbing

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# BATHTUB OPTIONS

In most older homes, you'll find an older bathtub – usually, one that has suffered problems from years of use and abuse. The most common source of porcelain damage is a long-running faucet leak that erodes the finish away and exposes the iron underneath. Another culprit is the use of high-abrasive cleansers, like Comet™, that literally wash the finish down the drain. If you have one of those scarred-up, rusty bathtubs, there are several ways to improve its appearance.

Your first option is to replace the tub outright. That may mean tearing open the walls in order to get the old one out, and then adapting the walls for a new bathtub. (Unlike older "expansive" models, newer tubs are only five feet long and 14 to 16 inches in depth.) This is a lot of work, and takes quite a bit of time. Moreover, the cost can be anywhere from $1,600 to $5,000, depending on whether you get porcelain-enameled steel (the least expensive material), fiberglass or plastic, or porcelain-enameled cast iron (the most expensive choice).

An alternative you might consider is to have the tub cleaned, acid-etched and recoated with urethane resin paint. It's generally advisable to hire a professional refinisher, who will fill in any pitted or chipped areas before applying the finish and power-buff the finish so that it shines like a new tub. The tub will be ready for use in 24 hours, and you'll pay far less than the cost of a new bathtub. If you don't clean the tub with an abrasive cleanser or with bleach, the finish will last 15 years or more.

A third option is to hire a company (i.e. ReBath™) that specializes in molding a vinyl liner to fit over your old tub. These companies usually have a variety of old tubs at their facility to use as mold forms. The job can be done in a day; the installers remove the drain covers, glue the liner in place, replace the drain covers, and caulk the joint where the liner meets the wall. Lining a tub costs more than recoating it, but less than the cost of a new fixture.

Regardless of whether you replace your tub or preserve the existing fixture with one of these alternative methods, the new surface will have a longer life if you treat it gently.

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# WHAT TO DO IF THE HEAT GOES OFF

If you are temporarily without heat in the winter, or if you will be leaving your home for an extended period of time, there are several things you can do to keep your tanks and pipes from freezing – and prevent expensive repair bills:

1. Turn off your water at the main valve (located at the water meter, which is usually at the front wall of the basement near the floor.)

2. Open all faucets (including any on the outside of your house.)

3. Flush all toilets till empty. Purchase nontoxic recreational vehicle antifreeze at an auto parts store or home center. Add 1/4 gallon RV antifreeze to the remaining water in the top tank of each toilet, and another 1/2 gallon to the bottom bowl.

4. Turn off the gas to your hot water tank and drain it. The drain valve is located near the bottom of the tank.

5. If you have a boiler, drain the system:

    a. First, take off the vents by each radiator – some are silver and cone-shaped – if you have a single-pipe steam system.

    b. Then, open all drains on the boiler (for either a hot water or steam system).

    c. If your boiler system has a condensation tank up in the rafters near the boiler, drain it, too.

6. Drain any water conditioning units you may have.

7. Put 1/4 gallon of RV antifreeze in each drain trap (all sinks, tubs, floor drains, etc.)

These procedures will remove 80-90% of the water from your system. There is still a slight possibility that some water may remain, but this will greatly reduce the risk of freeze damage.

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## Things to Consider when

# RE-PLUMBING A KITCHEN

Water Supply:

1. Depending on code requirements in your community, your new water lines can be ½" copper, or ½" cross-linked polyethylene (PEX), or ½" chlorinated polyvinyl chloride (CPVC). *(All are acceptable in Cleveland Heights, but if you use PEX or CPVC, you will need to have an electrician certify that your electrical grounding system is adequate.)*

2. To prevent water hammer, install an air trap on any new line where a supply line branches off to a fixture.

3. If your sink is located on an outside wall, bring the water pipes up through the floor of the base cabinet, to prevent the pipes from freezing.

4. Install a shut-off valve on each supply line underneath the sink.

5. Make sure the pipes are secured to the wall studs before they are enclosed in the wall or enter the base cabinet, so the pipes won't rattle later.

Drains:

1. Plastic drain pipe is accepted as standard in many communities, including Cleveland Heights. The standard drain size is 1-1/2". You will have to vent any 1-1/2" drain pipe where the distance from the sink to the sewer system is more than 15 feet; however, you can avoid venting the drain line by using 2" pipe instead of 1-1/2" pipe.

2. Connect dishwasher drains to the sink tailpiece.

3. If you install a new drain line, you must install a clean-out in it.

4. Drains must slope at least 1/4" per foot.

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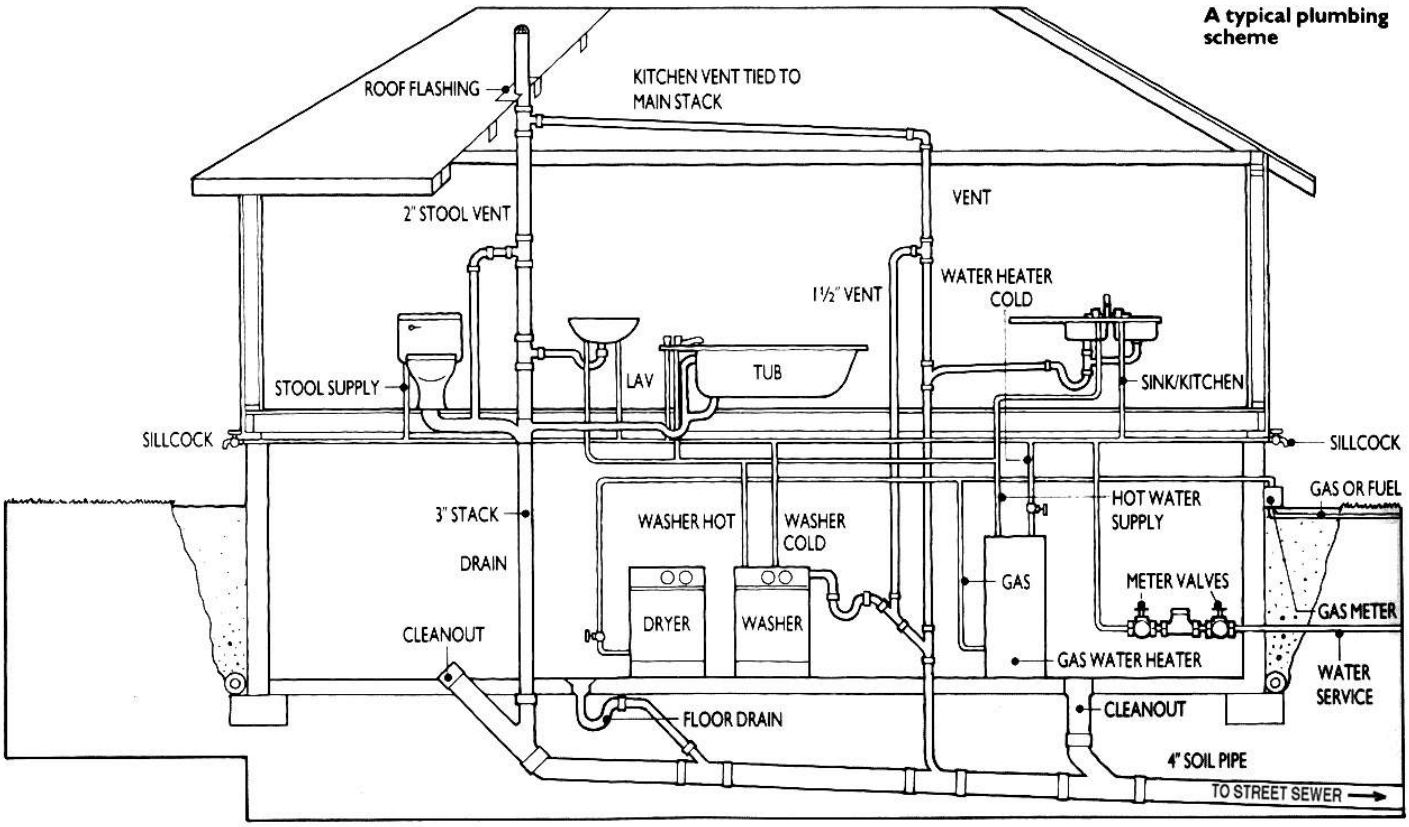
# WHEN TO UPDATE YOUR PLUMBING SYSTEM

People generally take their plumbing for granted. They expect that, when they turn on a faucet, water will appear, and when they open a drain, water will flow out. But, problems can occur in water supply and drain lines, problems that prevent the free movement of water through the pipes.




Most newer water lines are made of **copper**, and seldom become obstructed. The only time you will usually need to deal with copper pipe is when you are changing a valve or re-routing a water line. Lengths of copper pipe are soldered together, although you can use **compression fittings** – a more expensive option – to join them if you don't want to use a propane torch.

Even newer plastic materials (**PEX** or **CPVC**) can now be used for water supply lines in residential buildings in many communities, including Cleveland Heights. PEX stands for "cross-linked polyethylene," and CPVC stands for "chlorinated polyvinyl chloride." Since metal piping was often used to ground the electrical system in many older homes, an installer of plastic water lines will usually be required to have an electrician certify that there is an adequate ground connection to provide safety.

*(continued)*

Older water lines are usually made of **galvanized iron** or, in some homes, of **lead**. All kinds of problems can occur in galvanized pipes. First, these lines commonly become obstructed over the years, to a point where the space left for water to flow through may be only a small part of the original diameter of the pipe – significantly reducing the water pressure. Second, any time you physically disturb a galvanized pipe, unseen leaks may be created in other parts of the line, so you have to take extreme care when working on this kind of system. Third, if your water system is a combination of galvanized and copper lines, you need to make sure that, anywhere the two dissimilar metals meet, they have been separated with a **dielectric union** (to prevent a chemical reaction that will cause the pipes to deteriorate.)

Galvanized iron was also used for older drain lines. Obstructions in these lines can reduce the flow of wastewater. Galvanized drains can also deteriorate, creating leaks into the ceiling below. Some older bathtub drain lines contain a **"drum trap,"** a coffee-can-shaped reservoir commonly sunken into the bathroom floor. Not only do drum traps make clearing obstructed lines difficult, but they can also rust through and cause leaks.

Most people use **PVC**, a kind of plastic pipe, for new drain lines or to replace old galvanized ones. PVC is quite simple to cut (using a hacksaw or miter saw) and connect (using a primer, followed by an adhesive). You will need special fittings to connect new PVC pieces to old galvanized drain lines or to cast iron stack pipes.

So, if you have older water supply and drain lines, when should you replace them with newer materials? Certainly, any time you have a leak, you should deal with that right away – water intrusion can damage wood, plaster and other materials, causing a much more expensive repair. But, you might be wise to update your system *before* an emergency occurs. In addition to preventing water leaks, such an update can improve your daily life. Replacing galvanized water lines will usually increase water pressure (you'll have a better shower!) And PVC drains don't tend to clog as often as galvanized, so you won't need to be on a first name basis with Mr. Plumber.

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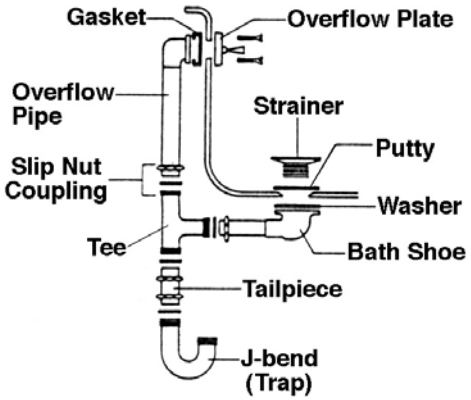
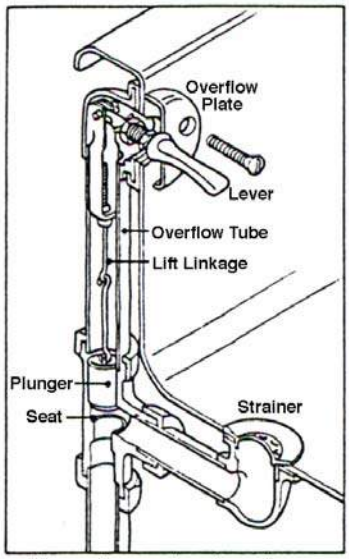
# BATHTUB DRAINS

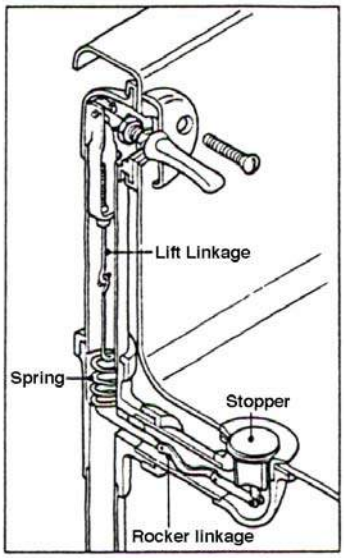
The drain from your bathtub may have one of a variety of configurations. When problems occur – clogged lines, leaks, etc. – the repair method may depend on the way the drain line is designed.

Nearly all tubs will have a waste and overflow drain assembly, comprised of three primary components: the overflow pipe from the upper tub wall, the waste pipe from the main drain opening, and the trip-waste mechanism that opens and shuts the drain opening *(not shown in illustration.)*



Plunger-type waste and overflow



Pop-up waste and overflow

There are two types of trip-waste designs *(see illustrations.)* The **plunger-type** has a strainer that sits in the drain opening, while the **pop-up** model has a plug that is moved up and down by a trip lever on the tub wall. To adjust a plunger-type drain, you'll need to unscrew the cover plate for the trip lever and pull the cover plate, lift linkage, and plunger out of the overflow drain opening. Clean the linkage and plunger. To adjust the drain flow, use needle-nose pliers to unscrew the locknut on the threaded lift rod; screw the rod down about 1/8" and tighten the locknut again. Then, reassemble the entire mechanism. The plunger cylinder should slide into place and close the drain opening when the trip lever is in the down position.

To adjust a pop-up tub drain, raise the trip lever to the full-open position and pull the stopper and rocker arm assembly out of the drain opening. Then, remove the screws from the cover plate and pull the cover plate, trip lever, and linkage out of the overflow drain opening. Clean off any hair and debris, especially from the spring on the end of the lift wire. To adjust the height of the drain plug, use needle-nose pliers to unscrew the locknut on the threaded lift rod; screw the rod up about 1/8" and tighten the locknut again. Then, reinstall the entire assembly. If necessary, turn the lift linkage inside the overflow tube until it catches the rocker arm assembly. When the trip lever is in the up position,

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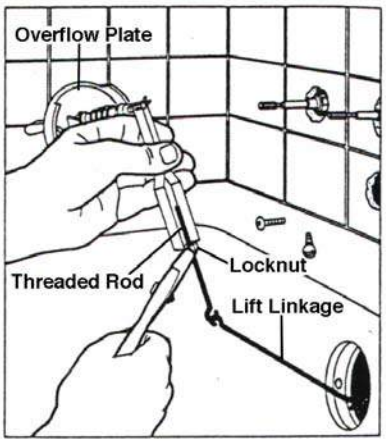
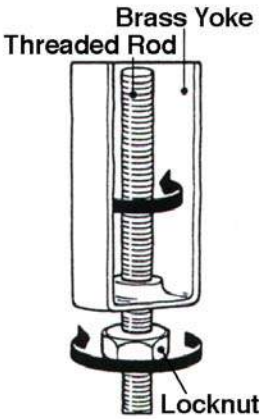


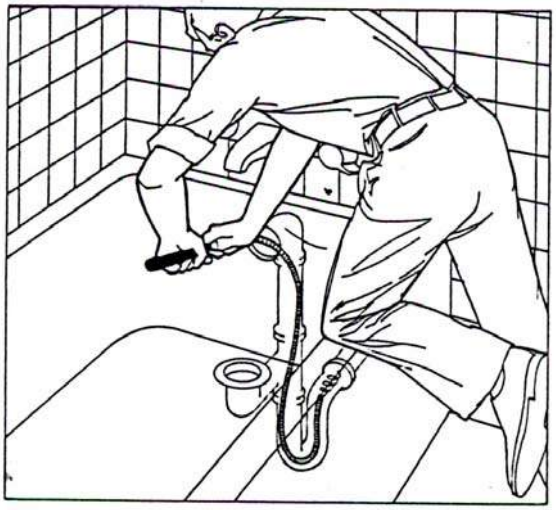




**Adjusting the tripwaste linkage**

Loosen the locknut on the liftwire and thread the wire up or down.

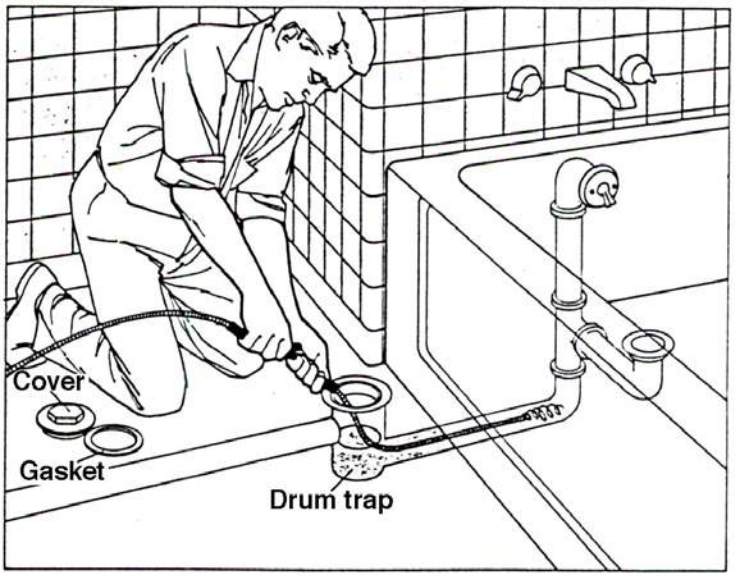
the pop-up should seat itself and plug the drain opening; when the trip lever is down, the plug should be pushed up so the tub will drain.

The drain line itself will generally have a trap that prevents the sewer gases from leaking into the bathroom. In modern tubs, a P trap is usually incorporated into the drain line below the tub, but you can seldom access it for snaking when the drain is clogged. Instead, unscrew the overflow plate and lift out the linkage as described above. Then, run a hand or electric snake into the over-flow tube and through the drain line beyond it.



*To snake a bathtub with a hand-powered auger or electric drain snake, run the cable through the tub overflow opening to reach the P trap.*

Older tubs may have a drum trap (located in the floor alongside the tub or mounted in a closet or behind an access panel) that will make snaking the drain line in this way difficult, if not impossible. To snake a line with a drum trap, you'll first need to remove the cover of the trap. There are several different designs; if you can't turn the cover, you may need to chisel through it—the covers are usually made from soft brass—and plan to buy a replacement cover from a plumbing supply store. From the drum trap, snake "upstream" toward the tub, and then "downstream" toward the main stack.




*Older-style drain systems may have a drum trap. To snake a drain with this configuration, remove the cover of the trap and snake both "upstream" toward the tub and "downstream" toward the main stack.*

Leaks in the drain line are rare, but not impossible. In most cases, getting access to the drain line will involve cutting into the ceiling of the room below. Before calling a plumber, however, check to see if the water might instead be coming through hairline cracks between the ceramic tiles in the tub area; re-grouting and sealing the tile may be necessary, instead of drain repair.

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# BROKEN SEWER LINES

Decisions about sewer line replacement are often made in an emergency situation. Sewer problems usually result from tree roots that intrude through joints in the underground pipe. Finding a source of water and nutrients, they continue to grow, until they eventually obstruct the sewer. When the problem becomes severe enough that snaking the lines or flushing them with a high-pressure water jet is not sufficient to clear the blockage, the traditional remedy has been a "dig down" (open cut trenching) with a back hoe or other large equipment. That process can leave significant surface damage to repair.

Many people aren't aware that there are alternatives. Homeowners might want to check out two types of trenchless sewer line replacement: "pipe lining" and "pipe bursting." **Pipe lining** involves inserting a flexible tube coated with epoxy resin into the damaged pipe, inflating it, and allowing it to harden for several hours. **Pipe bursting** involves fracturing the old pipe away from around a new jointless pipe being pulled through it. Both methods can preserve landscaping, patios, decks, sidewalks, and driveways. Experts claim pipe lining and pipe bursting are equally durable.

Costs will vary, depending on things like the configuration of the sewer line, their condition, and how deep the pipes are buried. You should also check to see which methods are permitted where you live; some communities allow one method, but not another.

Some people are opting to be pro-active. When they hire a professional to snake their sewer lines, they also arrange for the contractor to run a camera through the pipe. Knowing the condition of the sewer, they can plan for repair costs and explore alternatives before an emergency arises.

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# PLASTIC DRAIN LINES

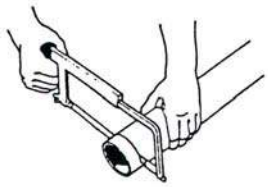
PVC (polyvinyl chloride) is almost always used for drain lines today. It is easy to work with, lightweight, and inexpensive, and comes in a variety of widths for fixture drains and sewer lines. Whether inside or out, drain lines need 1/4" of drop (downward slant) per foot to flow properly.

TO ASSEMBLE:

Tools: Tape measure, hacksaw, file, cleaner, and glue.

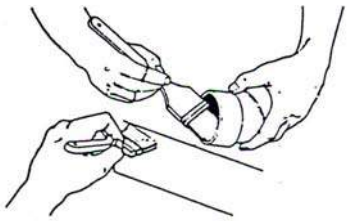
1. Measure the pipe and cut with a hacksaw.
2. Clean burrs off the cut ends with a file.
3. Coat both the outside of the pipe and the inside of the fitting with the cleaning solution.
4. Coat both the outside of the pipe and the inside of the fitting with glue; then, push together with a slight twisting motion.

Once assembled, the glue melts the two pieces together in about 30 seconds, so you have to be quick and assemble them right the first time. There is little or no time for adjustment. You can help assure accurate assembly by dry-fitting the pipes and fittings and marking where adjacent pieces should be lined up when gluing them together.

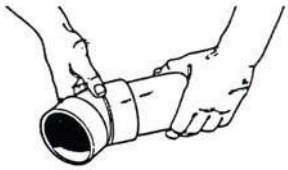


*1. Cut the pipe squarely with a hacksaw, power miter saw, or PVC tubing cutter.*

*2. Remove burrs along the cut end – both inside and outside – with a utility knife or sandpaper.*



*3. Apply primer to the inside of the pipe and the outside of the fitting, and allow to dry for a few minute. Then, brush on the PVC cement.*



*4. Insert the pipe into the fitting as far as it will go, making sure the pieces are aligned properly, and hold for a few moments. The cement will dry quickly, so you will have little room for error.*

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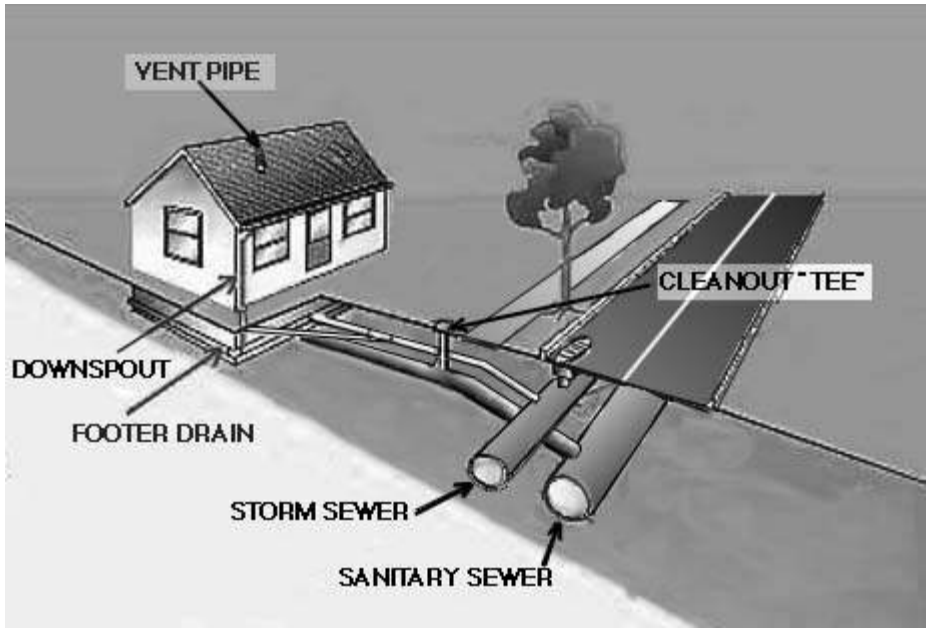
# UNDERSTANDING YOUR SEWER SYSTEM

Your sewer system has a big job – to carry wastewater away from your house. In most houses here in northeastern Ohio, there are actually two different sewer lines, both connected to larger pipes in the street *(see illustration below.)* The **sanitary sewer** carries wastewater generated inside your house – by activities like bathing, dishwashing, or laundry – to a waste treatment plant, where the impurities are removed before the water is sent back to Lake Erie. The **storm sewer** carries water from outside your house – rain and melted snow from your gutters and any drains in your yard and/or driveway – directly back to the lake, bypassing the water treatment plant (since the water presumably does not need to be purified). In some communities, older homes may have "conjoined systems," where the two lines join together and send all the water to the waste treatment plant.



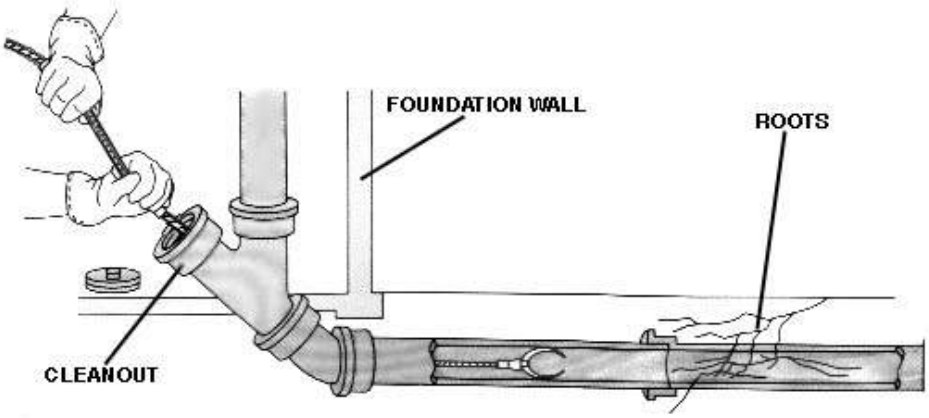

You probably never even think about this system, until there's a problem. But, when your laundry drain gets clogged with lint, or when roots invade either sewer line, water can no longer flow freely to the main sewers in the street. The result can be slow toilets, water backed up onto your basement floor, wet foundation walls, or soggy areas around your yard drain.

*There is no chemical that will dissolve these obstructions in your drain lines.* You have to snake them out, using a sewer snake with a thick enough cable and strong enough motor to chew through roots or other blockages.

The biggest problem can be getting access to the sewer line. If you're lucky, you'll have a **cleanout** where you can introduce the snake cable into your line *(see illustration next page.)* For your sanitary sewer, you may find a cleanout on the main stack or sticking up through the floor; for your storm sewer, a cleanout may have been installed at the bottom of one or more of the downspouts, where the downspout is connected to the underground system. If you don't

*(continued)*

have a cleanout, you can try gaining access in other ways. For a sanitary sewer, you can try snaking from a floor or laundry drain in your basement, although it may be difficult to get a thick snake cable through the trap beneath the floor. For a storm sewer, you can chip out the mortar around your downspout and lift it out of the clay crock, and then run the snake down the drain line from there. If none of these strategies are successful, your only other options may be to locate the **cleanout "Tee"** (usually in your front yard near the public sidewalk, where an access pipe comes up near the surface before your sewer line joins the main sewer in the street) and snake back toward the house, or to install a cleanout that you can use for snaking.




Although it's a lot of work, snaking your sewer line will clear most obstructions. If you find evidence that roots have grown into the line, you can add **copper sulfate** (a chemical sold in hardware and garden supply stores) to both storm sewers and sanitary sewers to slow down any new root growth; use it in the spring and fall when surges of root growth occur (and it won't hurt to use it in the summer and winter, as well.) If you have a small amount of dirt in the sewer line, a "mud head" can be used to remove it.

What snaking won't be able to remedy is a sewer line where the pipe has broken and collapsed. Until a few years ago, there was no sure way to know, without digging, if this was the cause of the problem. Now, however, many companies have **fiber-optic cameras** that can be sent on a cable down through the sewer line to visualize the situation below the surface of your yard. If you see a collapsed pipe, that portion of the line will need to be dug out and replaced.

Finally, some "slow" sanitary sewers may not be caused by a clogged drainpipe, but instead may be the result of a problem at the other end of the system. For wastewater to drain properly, there air must be able to enter the sanitary sewer through the **vent pipe** that extends through your roof. Bird nests, critter carcasses or other obstructions can block the vent, and – just like a finger held over the end of a soda straw – prevent the flow of water out the other end.

In Cleveland Heights, homeowners can ask the City's Streets and Sewers Department (691-7330) to try to snake their main sanitary sewer line. (This service is *not available* for storm sewer lines.) The cost is usually less than a private contractor, although there will be a higher charge if the work cannot be done during regular working hours. The City can't promise that their crew will be able to open the line, but they won't charge you if they're not successful.

The City's crew prefers to work from the outside of your house, so it helps if you know where the cleanout "Tee" is on your tree lawn. The City's records were destroyed by fire in the 1970's, but if your "Tee" isn't marked, they may be able to locate it – or sometimes they can work from the basement.

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# SNAKING DRAINS

The most common source of drain blockage inside a home is an accumulation of the soaps and shampoos that we Americans use so frequently. Most of these products have a base of animal fat. When they are rinsed down the drain, they tend to cool and cling to the inside of your drain lines where they act like "glue," causing other debris (hair, rust, mineral sediment in the water, toothpaste, coffee grounds, food particles, etc.) to attach themselves to the walls. The most vulnerable locations for this process to happen are the parts of the drain system furthest from the drain itself, or any places where the line is fairly horizontal and the speed of the running drain water slows down.

A drain line from a sink or tub usually consists of pipe with an inside diameter of 1-1/2 inches, part of the system designed to carry away your waste water. However, as a clog slowly develops in the line, the diameter of the pipe is narrowed, slowing the water flow in it. This reduced flow then allows even more debris to cling to the sides of the drain line, exaggerating the problem further. Soon you can have an opening the size of a straw, which will eventually close totally.

Once your sink or bathtub drain starts to slow, you have three options. The first is a chemical drain cleaner. **Use drain cleaners <u>only</u> if water is still moving through the drain** – once the line is blocked up, the drain cleaner just sits in one place, and is as likely to eat through the drain line itself as through the blockage. There are two types of liquid drain openers. One is caustic lye (like Liquid Plumber™ or Liquid Drano™.) The other is an acid solution (usually sulfuric acid), available in various strengths; the less diluted (and more effective) types go by the brand names of Assault™ or Release™. Whatever type you use, add the product cautiously, and follow all safety practices on the label.

Your second option is a drain snake. A drain snake has a semi-rigid flexible cable, usually 25 to 50 feet long, with interchangeable cutting tips on the end. Some are hand-powered, and others are powered by an electric drill-style motor. An electric "sink snake," slightly larger than an electric drill, is generally used to clear interior drains – sinks, bathtubs, basement floor drains, etc. However, some bathroom drains have pipes of a slightly smaller diameter (1-1/4"), where you may only be able to use a hand snake with a smaller diameter cable.

For outside sewers and driveway drains, use an electric "sewer snake." Blockages in sewer lines are usually caused by roots that have invaded the line. The only way to remove the roots is to use a snake with a cutter bit; **drain cleaners will not eat through root blockages.** (Use copper sulfate to prevent new root growth – *see chart below.)* Occasionally, a drain may be blocked by mud and sediment, which must be dragged out with a "mud head," a propeller-shaped bit at the end of the cable.

A sewer snake is powered by a larger motor and has a thicker cable that won't fit inside interior drain lines. The cables of sewer snakes vary in length and diameter; some cables are comprised of segments that attach to one another to make up the length required. Longer cables, or cables used to dig through mud in the sewer line, must be driven by a more powerful motor.

Electric sink snakes and electric sewer snakes work in basically the same manner. Both have a forward (clockwise) motion and a reverse (used only if the cable snags in the line.) Feed the cable into the pipe you are snaking, in as straight a line as practically possible. If you are snaking a sink drain, remove the trap and feed the snake into the drainpipe that runs into the wall. Bathtubs are almost impossible to snake from the drain; you'll usually need to remove the overflow for straighter access into the drain line. Some drains may have a clean out (an attachment to your drain line designed to give access for snaking); if not, you may need to take the trap apart under the tub and go in through there. If you have a **drum trap** on the line, it will probably be impossible to snake the whole drain line from the tub; you'll need to snake "upstream" and "downstream" from the drum.

*(continued)*

The main cutting tips on a snake are the arrowhead, the extractor, and the side cutters. The arrowhead tip is usually your first choice. Add the side cutters to the arrowhead when you have a particularly tough clog and need extra cutting action, and use the extractor to pull out debris after you are through the clog.

Some snakes have a power feed, which automatically advances the cable; with the rest, you'll need to advance and retract the cable manually. With these snakes, after you have fed the snake into the drain by hand as far as it will go, pull out about 12 to 18 more inches of cable and start using the motor with a forward motion. (When using the electric sink snake, push the orange collar forward to unlock the cable and pull the collar back to lock the cable in place.) The sink snake has a trigger mechanism, much like a drill, while the sewer snake has a foot pedal that you depress to start and stop the snake. As the motor turns the cable, physically push the cable into the drain and pull it back, repeatedly – much like rocking a car out of a snowdrift – as you work the cable into the drain line. Each time that length of cable goes in all the way, pull out another 18 inches of cable from the snake, and work the new length into the drain. Don't allow too much cable between the snake and the drain; if it snags, the excess cable can wrap around your arm.

You can usually feel when the snake cuts through the blockage, whatever it is. When you think you are through, pull the cable out and retract it into the snake by hand. (Hose down the cable on the bigger snake before returning it to the drum; on a smaller model, you can wipe the cable clean with a rag as you retract it.) Then, reassemble the drain and give it a try. On interior drains, follow up with drain cleaner once a week for a month or so, to help enlarge the hole you have bored through the debris with the snake.

You've probably been wondering about your third option – calling a plumber! Given the cost of professional drain cleaning, however, it makes sense to try this repair yourself first. (Plumbers don't approach the job any differently, but they've had more experience and will be persistent.) If you get stuck, try a different tip, try a different angle, try a different access to the drain line – those are the same things a plumber will try. It's usually by sticking with it that you can snake a drain successfully.

| *DRAIN* | *SNAKE TO USE* | *COMMON PROBLEMS* | *COMMENT* |
|---|---|---|---|
| Basement floor (mid-floor or under laundry tubs) | Electric sink or smaller sewer snake; probably extractor bit | Laundry drain usually clogged with fabric; can be tightly packed. | Drain can be too small for sewer snake. Cover drain with screen to keep out lint and floor dirt. |
| Kitchen or lavatory sink | Electric sink snake or hand snake; arrow-head bit | Clogs in kitchen sinks generally food and/or grease; usually not too tightly packed. Clogs in lavatory sink most often hair and soap fat. | Some lavatory drains too small for electric snake; use hand snake. Take trap off drain line before snaking. Use straightest access possible. |
| Toilet | Hand-powered closet auger | Seldom clogs; obstruction usually a large item. | Electric snake can crack porcelain toilet; use hand power only. As a last resort, take up toilet for access through bottom. |
| Bathtub | Electric sink snake; arrow-head bit | Clog generally hair and soap fat; usually not too tightly packed. | Can't snake through tub drain; snake through overflow, or take trap apart and snake there. Can be a recurring problem; regular use of drain cleaner can help as preventative. |
| Driveway drain | Electric sewer snake; arrow-head bit with side cutters, or mud head for dirt-clogged line | Tree roots or gravel are common problems; can be tough to get through. Can be blocked far from drain opening. | Copper sulfate, though it does not dissolve roots, can prevent new root growth into lines; use 2-4 times per year. The largest snake can be needed to power through tough clogs or to reach distant obstruction. |
| Downspout from gutters | *(same as above)* | *(same as above)* Watch for leaves. | *(same as above)* Take downspout out of drain before inserting snake. Adding clean out can give easy access for regular snaking. |

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# TRAPS

Traps are the J-shaped devices connected to the bottom of sinks. They retain about a cup of water in order to prevent sewer gas from moving from the drain system into the house via the sink drain. Whether made from plastic or metal, they assemble the same way.

When replacing a trap:

DO – check the old trap for weak spots replace it if there is a soft place or corrosion. Always use new washers even if re-using old pipe.

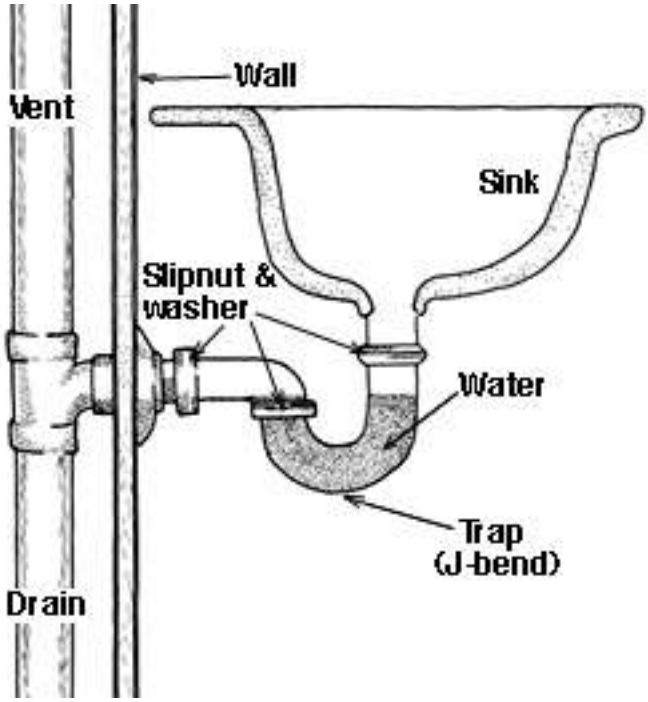
– buy a medium-quality-or-better trap to make your job of installing it easier.

– install the washers the way described by the manufacturer.

DON'T – tighten with a pipe wrench; hand tighten only. A pipe wrench can distort the fittings so they will never seal correctly.

– force pieces together; if they won't fit easily, they will leak, no matter what you do.

– glue pieces of plastic trap together to stop a drip. If it drips, it's not assembled properly – start over.



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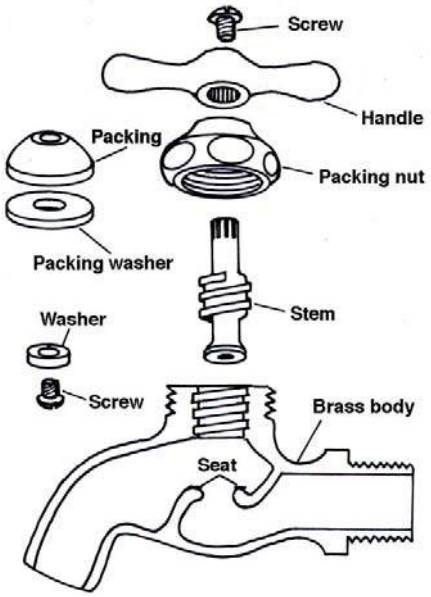
# FAUCET REPAIR

There is nothing more annoying than a dripping faucet. Not only does it waste water, but the repeated action of the water can also cause a spot in the sink surface below. Whether you have a single spout faucet or a mixing faucet (two separate units that share the same spout), fixing the problem is usually fairly simple. (The two units that form a mixing faucet are repaired separately.)

With both traditional **compression faucets** and the newer **"washerless" faucets**, leaks can originate in several areas, so it's a good idea to replace all the parts that can wear out while you have the faucet apart. The first step is to turn off the water to the faucet. If you don't have shut-off valves on the hot and cold water supply lines under the sink, you can usually find the zone valve in the basement that controls the water supply to that part of the house. In a pinch, you can use the main water shut-off near the meter that controls water for the entire house. When you have closed off the valves, turn on the faucet until the water stops flowing. Then close or cover the drain, to prevent losing small parts.

**Repairing a Compression Faucet:**

To disassemble the faucet, remove the screw that holds the handle in place. (Sometimes there will be a cap that you'll need to pop off to expose the screw beneath it.) If the handle has corroded in place and is difficult to budge, don't apply penetrating oil or other lubricant, as they will have little effect on the problem; instead, try using two screwdrivers, one on each side, to pry it off. Tapping the handle lightly with a hammer can also help to break the corrosion. If nothing else works, you can rent or buy a special handle-pulling tool.




Once the handle is off, you'll see a **valve stem** sticking up, connected to a **packing nut**. Before you separate these two pieces, check to see if there is any "play" in the valve stem when screwed into the packing nut; if so, the valve stem has worn down and needs to be replaced. (Take the one you have to the hardware store to find the correct replacement model.) Next, unscrew the packing nut and separate it from the valve stem, using a crescent wrench or an open-end wrench of the right size.

You will find a **washer** on the end of the valve stem, held in place by a screw at the tip. This washer fits into a metal depression or "cup" at the end of the valve stem itself; if the washer no longer makes a good seal against that cup, your faucet will drip even when the water has been turned off.

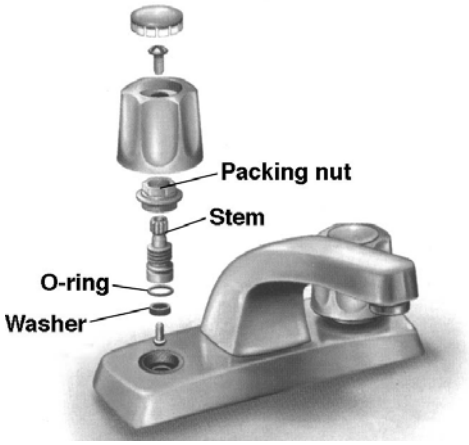
Put the valve stem back onto the handle to help you hold it, and remove the screw on the end. Remove the worn washer that was beneath the screw, and get a replacement of the same size; at most stores you can buy a single washer or an assortment of various size and types. There are three general styles of washers: one that is flat on both sides; one that is flat on one side and domed on the other; and one that is flat on one side and beveled on the other. You will generally get the best seal

*(continued)*

if you use a domed washer. Put the new washer in place, and tighten the screw down till it's snug (don't over-tighten). The washer should expand slightly as it is compressed to fill any gaps in the cup at the end of the valve stem.

Next, locate the packing nut that you removed earlier. Where it goes into the valve body there is space for another washer. You can use a **packing nut washer** here, or you can use **"packing,"** a type of string gasket that you make yourself. Wrap the packing around the spindle, and then reassemble the nut with the valve stem. (Put plumber's grease on the threads to make it easier to disassemble the unit next time.) When the nut is finger tight, cut off the excess packing string and finish tightening with a wrench.

On some faucets, instead of packing you will find an **O-ring** higher on the valve stem. When water comes out from underneath the handle when you turn on the faucet, it's an indication that the O-ring should be replaced. Cut off the old one and take it with you to the store to match; you can buy kits with assorted sizes, or the specific one you need. To install the replacement, soak it in a cup of hot water for a few minutes to make it more pliable, then take it out and put plumber's grease on it. Slide the O-ring over the valve stem and roll it down the shaft until it is in place.




Finally, look at the **seat**, the part of the faucet which mates up with the valve stem. Replacing a washer won't correct a leak if damage to the seat has left holes or cracks that prevent the washer from sealing completely against the surface. In such cases, you'll continue to have a small drip.

How you remedy this problem will depend on whether or not the seat in your faucet can be replaced. If you look into a faucet seat that is replaceable, you'll see squared edges (like a nut). You can use a steel **seat wrench** to grab these edges and unscrew the seat. Seats can be very hard to pull out. One approach is to insert the tapered end of the seat wrench and tap it with a hammer to drive it into the seat before you turn it to loosen the seat.

There are many configurations of faucet seats, so take the old one with you to the plumbing store to match it up. When you install the replacement, use the seat wrench to screw it into place. It just needs to be snug, so don't over-tighten.

On faucets where the seats are not replaceable, the seats will not have square sides, but only a smooth round edge with no surface to grab onto. Your only recourse will be to use a **seat dresser,** a cone-shaped tool that you insert into the seat and turn. As you twist the handle, the seat dresser will shave off the edges of the seat, smoothing out any chips or gouges. If the seat is too badly damaged for the seat dresser to be effective, you will have to replace the faucet completely.

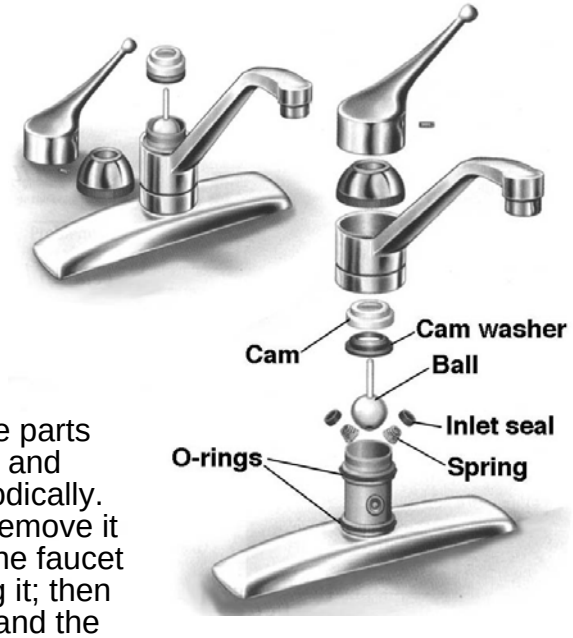
When you have replaced all the parts prone to wear and tear, reassemble the valve stem, packing nut and handle, turn the handle to the proper position, tighten the packing nut, and turn the water back on.

**Repairing a "Washerless" Faucet**:

There are several common types of "washerless" faucets: **ball faucets** (such as the ones made by Delta), **cartridge faucets** (such as the ones made by Moen), and **ceramic-disc faucets** (such as the ones made by American Standard and Kohler). Most have a single handle that controls both hot and cold water. Despite their name, these faucets do have some washers in them. The replacement parts are generally inexpensive and easily available; however, the specific items you will need and the way they are replaced will depend on the manufacturer. It's usually easiest to buy a replacement kit for the make and model of your faucet at the plumbing supply or hardware store. The kit will contain the all washers, springs, O-rings, etc. you'll need to replace.

*(continued)*

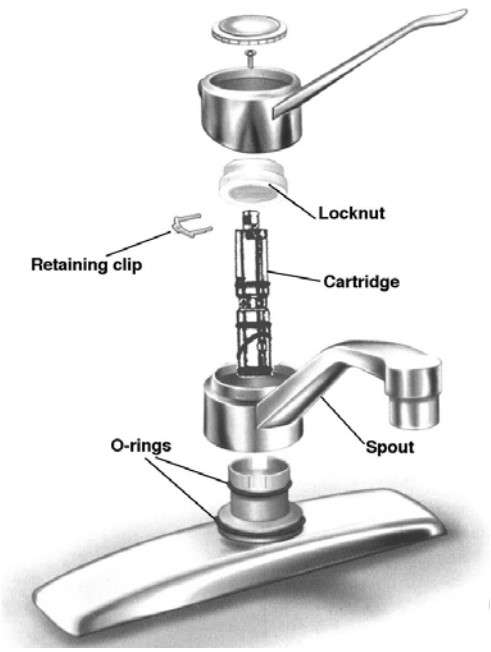
The first step is to remove the faucet handle. Before disassembling the faucet, shut off the water supply and close or cover the drain as described above. With a ball faucet, you loosen the screw in the base of the handle and lift the handle off the spout.




Water leaking from beneath the handle of a ball faucet is corrected by tightening the adjusting ring, a threaded washer that you see when you remove the handle. Place a putty knife in the slots on top of the washer and turn it clockwise. Replace the handle and test the faucet; if it still leaks, tighten the ring a bit more. Sometimes tightening the ring will make the handle too hard to move. If this happens, unscrew the ring and then the domed metal cap beneath it, and lift out the plastic and rubber cam assembly below the cap. These cam parts can be replaced.

If water leaks from the spout, you'll need to get to some parts that sit below the cam assembly. The ball, O-rings, seals and springs are subject to wear and need to be replaced periodically. Remove the old ball, and then twist the spout upward to remove it from the faucet's central tube. Once you have exposed the faucet body, use a screwdriver to pry off the O-rings surrounding it; then use needle-nose pliers to remove the small rubber seals and the tiny springs that fit into the faucet's inlet holes. The replacement parts must match the old ones exactly, although you can choose either a plastic replacement ball or one made from brass – a more expensive option, but one that will last longer.

Clean all the surfaces and scrape off any mineral deposits, then reassemble the faucet. Use plumber's grease to lubricate the O-rings before rolling them into their grooves on the faucet body. When you reinstall the spout, push down hard while twisting. Then install the springs and seals, and fit the slot of the ball over the pin in the side of the faucet body, so that the ball's ports will be aligned with the hot- and cold-water inlets in the faucet when you want the water to flow. Finish by reassembling the cam assembly and handle. If water still leaks from beneath the spout, tighten the cap; if you have a leak from beneath the handle, tighten the adjusting ring as described above.



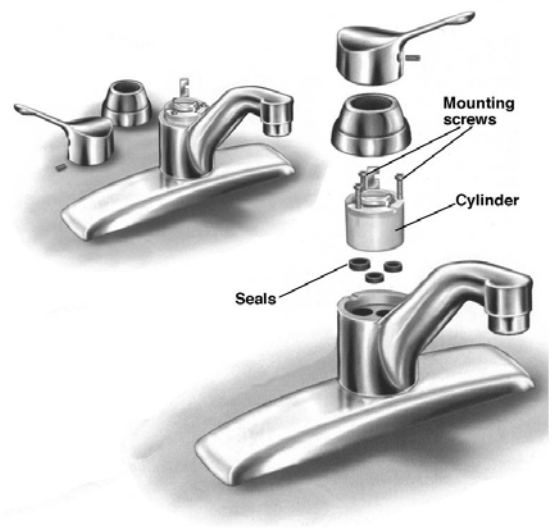

On a cartridge faucet, pry off the decorative cap and remove the screw underneath; then, lift off the handle and the handle body, a cylindrical slotted fitting. Before removing the spout, you'll need to unscrew the round retaining nut on top of it.

For leaks from the base of the faucet, remove and replace the O-rings around the faucet body. For other types of leaks, pry out the horizontal metal clip on top of the faucet body, and then pull out the sleeve cartridge from inside it. Buy replacements for the cartridge and the O-rings around it. (Cartridges with brass casings are more expensive, but will last longer.) To install the new cartridge, pull out the stem as far as possible, and press the cartridge into the faucet body. (It's normal for water to pool around the stem when you do this.) Rotate the cartridge until the protrusions at the top are aligned with the slots in the faucet body for the retainer clip; press down on the cartridge and slide the clip under the protrusions and into the slots.

*(continued)*

Position the stem so that its horizontal notch points toward the sink. Then, reassemble the spout and retainer nut. To replace the handle, the ringed end must slide into the handle body and the rear end must hook over the rear of the retaining nut. After you have reinstalled the screw, test the faucet. If the hot and cold water positions are reversed, remove the handle, rotate the stem 180°, and reassemble.

In a ceramic-disc faucet, the cylindrical valve typically contains two discs; when the handle is moved to the "on" position, one disc rotates over another in such a way that holes in both discs align and allow the water to flow. Start by removing the handle and the locking nut beneath it, and then pry out the cylinder. Because the valve is made from ceramic, a durable material that resists damage from grit and sediment in the water, you will seldom need to replace it. However, the inlet seals and/or O-rings are subject to wear. Replacement parts can sometimes be difficult to locate, but removing the old ones and inserting the new is reasonably simple.




Once you have replaced all the parts, reassemble the faucet and turn on the water.

**Conclusion:**

Repairing a leaking faucet is a common home maintenance task. Patience and a bit of manual dexterity can allow you to save the cost of a plumber by doing the job yourself.

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# INSTALLING A KITCHEN SINK AND FAUCET

Tools needed:

- Screwdrivers
- Adjustable wrench
- Pipe wrench
- Pliers

Materials needed:

- Plumber's putty
- Silicone caulk

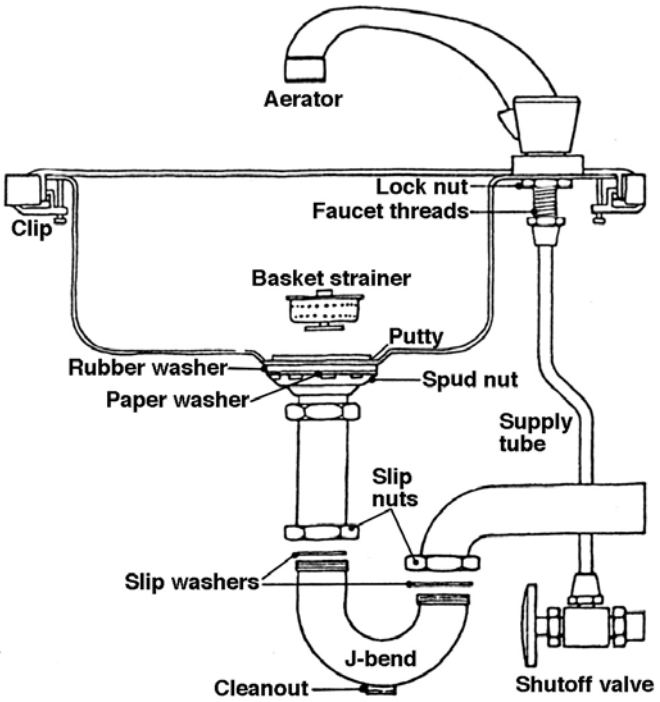
When you buy a new sink and faucet for your kitchen, think about both style and quality of material. Whether you choose porcelain or stainless steel, single-bowl or double, there are two basic styles of sinks commonly used in a kitchen. One is “self-rimming,” and the other has a separate trim ring. There is no real advantage to one style over the other; they just install a bit differently.

With faucets, however, material can have a big affect on durability. It pays in the long run to buy a quality faucet. Models that have plastic parts won't last very long. Generally, the heavier the faucet, the better. And, buying a “brand name” faucet means that you'll be able to get replacement parts in the future.

After the opening is ready in the countertop, the first thing you'll want to do is assemble as much of the sink as you can before installing it in the counter. First, mount the faucet on the sink. Faucets are held to the sink by two large locknuts, underneath the sink *(see illustration below.)* Before mounting the faucet to the sink surface, take plumber's putty, roll it into a “snake” about the size of a pencil, and apply it to the bottom of the faucet. This will keep water from getting under there later. Then, put the faucet in place and tighten the nuts underneath, keeping the faucet lined up and straight.

Next, install the basket strainer(s) on the sink drain(s). Apply plumber's putty to the underside of the strainer rim; then, assemble the washers as shown on the box. Stick the handles of a pair of pliers into the holes of the strainer from the top, to give you a “handle” to hold the strainer and keep it from slipping as you tighten the nut securely.

Finally, attach the supply lines to the bottom of the faucet. The flexible ones made from plastic tubing are worth the dollar or two more that they cost.

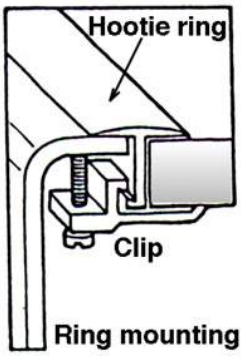


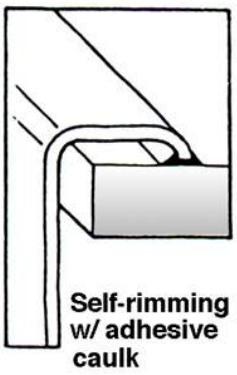

*Typical sink installation details*

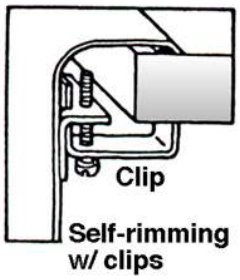
*(continued)*

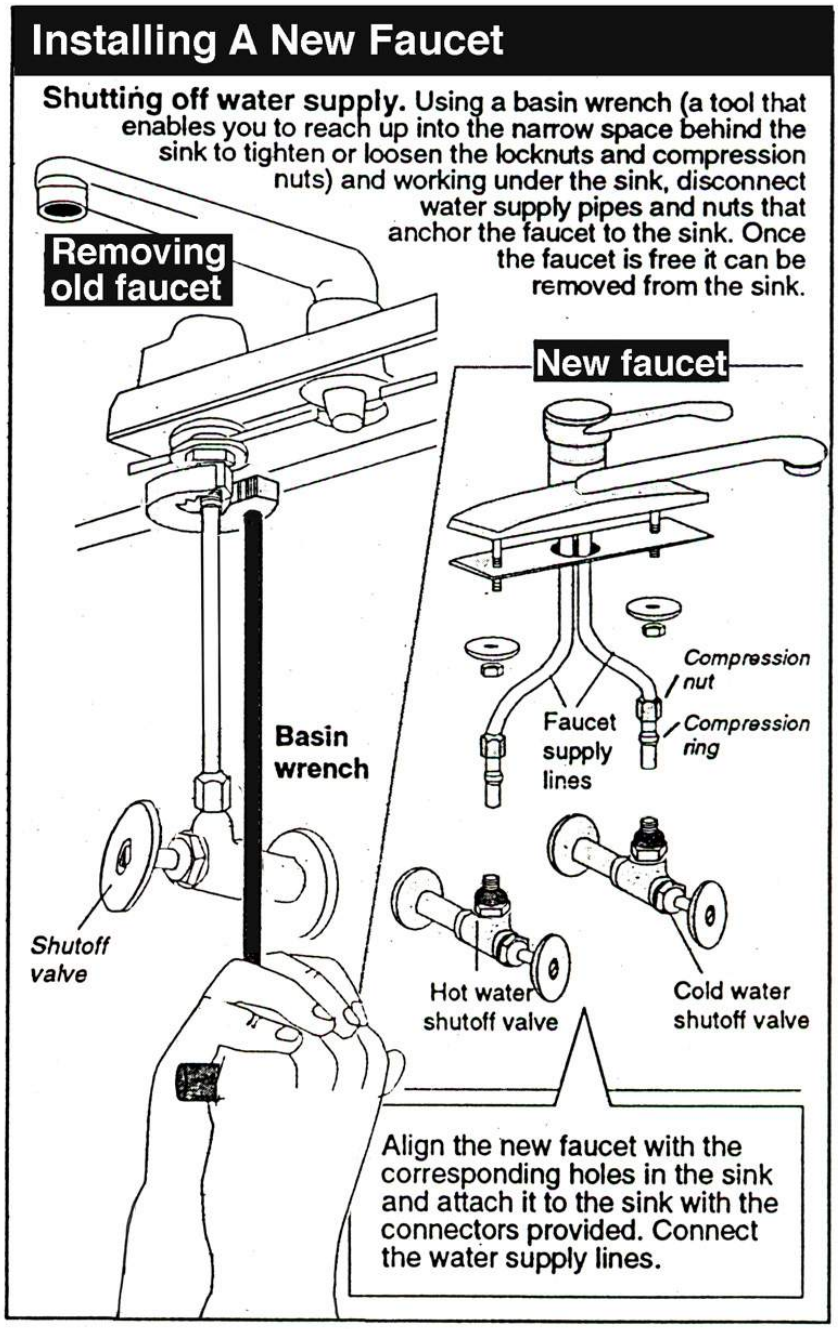
Now you can mount the sink. There are small clips that hold the sink in place. These clips attach to the trim ring, or – if you don't have a trim ring – to the sink itself *(see illustrations below.)* Before you mount it, apply a bead of silicone caulk to the bottom of the sink edges to seal out water. Then, position the sink and tighten it down as evenly as possible. (Note: There is one style of enameled cast iron sink that is so heavy that it doesn't use clips. It is simply set into a bead of adhesive/caulk that holds it in place.)

After you have mounted the sink in the counter, connect the supply lines to the water lines, and connect the trap to the sink drain. Clean up any excess caulk on the counter and any plumber's putty around the faucet or strainers to complete the job.



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# INSTALLING A PEDESTAL SINK

Whether your decision is based on style or space considerations, you may prefer a pedestal sink for your bathroom. This style of sink consists of two pieces – the sink basin itself and the stand ("pedestal") beneath it. The plumbing fits inside the pedestal, which rests on the floor. The sink rests on the pedestal and is mounted to the wall for added support.

Most of today's sinks are made from vitreous china, a glass-like porcelain, and are available in many sizes, styles, and colors. Be sure to open the box and inspect the parts when you first bring them home, so you can replace any damaged pieces before you're ready to put them in place. Since three different faucet hole placements are common in pedestal sinks, make sure that the sink and faucet you choose have the same hole arrangement.

Your first step will be to remove the old sink. Turn off the water supply, and run the faucet to make sure all water is drained from the lines. Remove the trap from the sink basin and empty it into a bucket. Then, disconnect the hot and cold water supply lines and the drain under the sink. Finally, remove the hardware attaching the sink, and lift it straight up off the bracket.

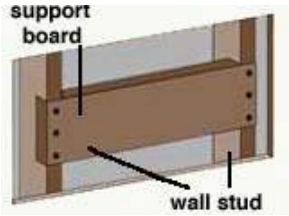
Before you install the new sink, look at the wall and floor area where the sink will be located. Depending on the style of sink you're replacing, problem areas may be exposed – missing floor tiles and/or baseboards, holes in the wall, etc. These should be repaired before you put the new sink in place.

You should also check to see whether any changes must be made to the water supply or drain lines to accommodate the new sink. Pedestal sinks will look best if these lines are centered and partially concealed by the pedestal base. (Manufacturers generally enclose information on the best locations for the plumbing lines.) Also, make sure the existing waste pipe will be high enough to add the trap. If you must move the pipes or make other changes, you'll need to open up the wall (and patch it afterwards). Usually, it's easiest to use PVC for the drain lines; you can connect it to old copper or iron pipe with transition couplings. Even if you don't need to relocate the pipes in the wall, you may need to shorten the drainpipe that extends out of the wall or replace shutoff valves if they're too long.

The sink basin will either mount directly to the wall or onto a bracket (usually provided by the manufacturer) that you attach to the wall. If your wall is covered with ceramic tile *on a mortar base*, it will probably be strong enough to support the sink. On the other hand, if the wall is plaster or drywall (even with tile or paneling covering it), the sink will need to be secured to the wood framing.

*(continued)*

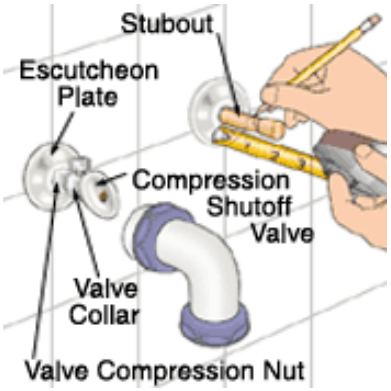
If you are very lucky, the mounting holes for the sink will align with the wall studs. In most cases, however, you will need to add a support board between the studs to hold the weight of the sink. Cut a hole in the wall between the studs and mount a wooden block (the size of the board will usually be specified in the manufacturer's instructions) between the studs at the height of the bracket. Notch the studs and nail or screw the support board in place, flush with the studs. Patch the wall with water-resistant drywall ("greenboard").




Once the wall support is prepared, set the pedestal in place on the floor and mark its location. It should be lined up with the waste pipe, with the center about the same distance from the wall as the center of the basin's drain. Carefully set the sink atop the pedestal and make sure it is level, both from side to side and from front to back. (If you don't have a helper to hold the sink securely, you can prop it up with 2x4's placed between the sink and the floor on either side of the pedestal.) If the parts move too much when you are positioning them, use plastic shims under the pedestal to keep it from rocking and foam pads under the sink bowl to level it, before marking the position of the mounting holes on the wall. After you have completed the installation, you can fill any gaps at the floor or between the sink basin and the pedestal with silicone caulk.

If the sink will be bolted directly to the wall, mark the location of the sink mounting holes, and drill pilot holes. If you are drilling into ceramic tile, use a masonry bit and put a piece of tape on the tile where you'll be drilling to keep the bit from slipping off center. For sinks that are installed using a wall bracket, draw a line along the top of the sink, remove the sink basin, and mark a second line for the bracket at the height specified by the manufacturer. (Make sure the line is level.) Hold the bracket in place and mark the holes for drilling. Attach the bracket to the wall with lag screws or other fastener specified in the installation directions.

Set the sink basin and pedestal aside and turn to the supply lines coming through the wall. You'll generally need to cut them with a tubing cutter and install new shutoff valves (compression fittings are a lot easier than soldering, but more expensive). Be sure that the stubouts that protrude from the wall are the right length; they must extend beyond the escutcheon plate far enough to attach the valve compression nut and the valve collar. Usually, cutting them about 2" from the wall will be right, but – since having them too short would be disastrous – you might even allow a little extra length. On the other hand, the supply stop handles should not extend more than 3" from the wall when open.




With the shutoff valves prepared, attach the faucet and pop-up drain assembly to the sink basin (follow the installation instructions that come with the faucet). One-piece faucets are much easier to install than models where you need to connect separate pieces with tubes. Mount the faucet to the sink; with some faucets, you use a gasket, and with others, plumber's putty. Connect the supply tubes to the faucet inlets (flexible braided stainless-steel will be easier to use than rigid metal); while an adjustable wrench will work to tighten the nuts, you will put much less stress on the piping if you use two wrenches working against each other – one to hold the valve and the other to tighten the nut.

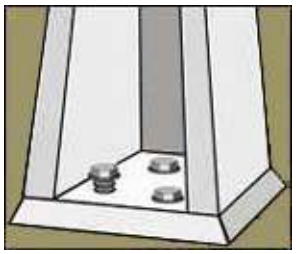
The last piece to add to the sink is the tailpiece, the piece that connects to the drain. Insert the flange through the drain hole in the basin from above, and seal it with a ring of plumber's putty. Tighten the lock ring on the bottom of the sink, secured to the wood framing.

*(continued)*

Now, it's time to make your final connections. This step is where an extra person can be particularly helpful, so one of you can lift and position the fixture while the other lines up and connects the pipes. As you work, remember two things: first, be sure to refer to the manufacturer's instructions for the order of the steps you should take, as they may be different from one sink model to another; second, take care when tightening bolts, nuts, and other hardware, as the sink or pedestal can crack if too much pressure is applied.

Generally speaking, if your sink attaches to a hanger bracket, pick up the basin and slide it onto the bracket. Check underneath to see if any adjustments are needed to the drain, trap, and water supply tubes; if so, remove the sink, make the alignment changes, and then replace the basin on the bracket. Put the pedestal in place under the sink (you can use a piece of cardboard to protect the floor as you slide it into position).

For basins that connect directly to the wall, reposition the pedestal and sink and attach the sink to the wall with the fasteners specified by the manufacturer (usually, bolts or lag screws). Mark the position of any bolts that will secure the pedestal to the floor (some pedestals are not bolted down, but only require caulking), remove the pedestal and drill pilot holes for the fasteners. If you have a tile floor, drill into the grout rather than the tile, if at all possible.



Install the P-trap assembly and connect it to the sink tailpiece and the PVC trap adapter. Also, hook up the water supply lines to the faucet. With some sinks, you do these steps before moving the pedestal back into position; with others, you must rest the bowl on the pedestal, close to the wall, and hook up these lines before securing the sink to the wall. When everything is connected, you can move the pedestal back into place and secure it to the floor with the fasteners specified. (You may want to test the water and drain lines for leaks before you make the final connections.) Your last step will be to run a bead of silicone caulk along the top of the sink where it meets the wall, and along the bottom of the pedestal where it meets the floor.

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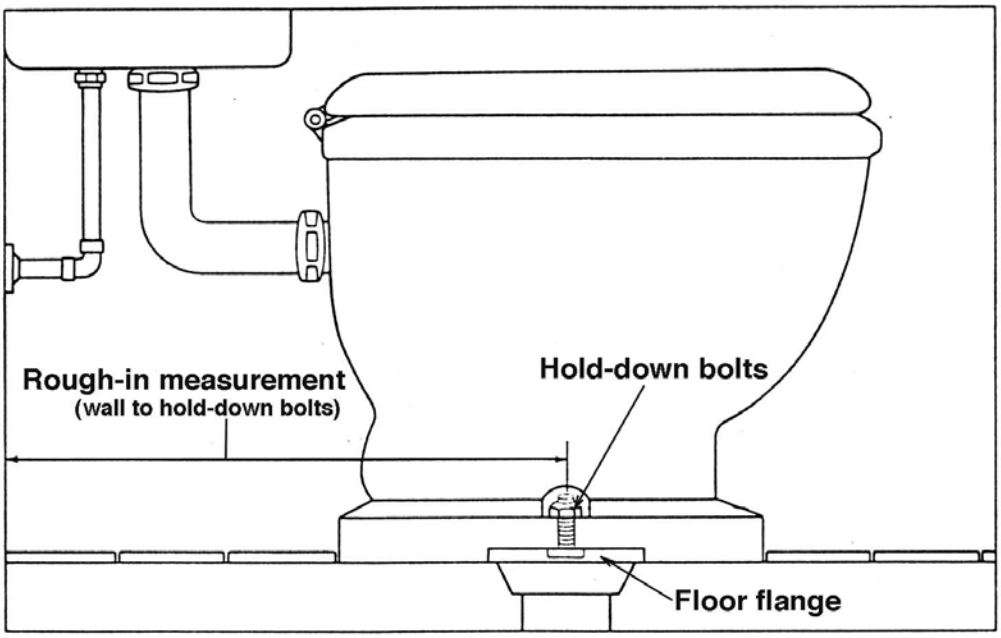
# CHOOSING A NEW TOILET

Toilets come in many styles, shapes, sizes – and prices. There are both two-piece models and costlier one-piece toilets. If you want something different, you can get a toilet that hangs on the wall, or even a corner toilet with a triangular tank. Some toilets have the standard round bowl, while other feature an elongated bowl with an oval-like shape.

Most of these options are more decorative than functional, unless you are dealing with limited space – although some may require more intricate plumbing configurations. However, there are a couple of choices that can be significant. A model with a lower bowl height might be difficult for people with back or leg problems (or for those of us getting up in years.) And, except in new construction, you'll need to match the existing "rough-in" measurement (the distance between the center of the flange around the drain opening and the wall behind it *(see diagram).* Toilets vary in how far they sit away from the wall. You can select a toilet designed for a shorter rough-in measurement (you'll just have to add some supportive blocking between the back of the tank and the wall), but you can't install a fixture designed for a longer rough-in measurement without some complicated alterations to the drain line.




There are various types of flushing mechanisms, but the two better-known types are the gravity flush and the pressure-assist flush. Tanks with the gravity system are usually less expensive; they have the common fill valve and flapper with an overflow assembly. The more costly pressure-assist units have a one-piece plastic chamber inside the porcelain tank. These units flush more efficiently, because each flush is pressure-assisted with compressed air; the solid wastes are *pushed out,* instead of being *pulled out* by the siphon action of a gravity unit.

*(continued)*

Parts for the gravity units can be replaced easily and inexpensively; however, because the trip lever is the only moving part on a pressure-assist unit, when this type of toilet fails, the flush unit inside the tank – and sometimes the entire tank – must be replaced.

With rising water and sewer prices, a new toilet can help reduce utility costs. Due to recent federally-mandated water conservation measures, the only new toilets you can buy are 1.6 gallon models. With these lower-capacity toilets, it's important to get a better-quality model that has a larger-diameter trap. Make sure the toilet is *glazed throughout*, including all surfaces of the trap. A siphon jet (included on nearly all current models) will produce better elimination of solid waste.

Whether you're installing a new toilet or replacing an old one, pay attention to the bolts you're using. For attaching the stool to the flange, **5/16" bolts** (instead of the 1/4" bolts generally provided) will give you a more secure hold. Both these bolts and the tank bolts (used to mount the tank to the stool on a two-piece model) should be **solid brass** – not brass-plated steel, where the heads can rust away.

Finally, check the flange itself. Make sure it is firmly attached to the floor to keep the toilet from rocking. If you have added a layer of flooring atop the original surface, you may need to buy an extension flange to accommodate the extra height.

Paying attention to these "material issues" will help ensure that you'll have fewer problems with the new toilet you select.

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# TOILET INSTALLATION

Installing a toilet – whether you are replacing an existing fixture or adding a new one – is not too difficult. However, there are a few “tricks” that are important to the success of the job.

If you will be purchasing a new toilet, you'll need to know the **"rough-in" measurement** (the distance between the center of the flange around the drain opening and the wall behind it – *see Illustration 1.)* Styles of toilets vary in how far they sit away from the wall. You can select a toilet designed for a shorter rough-in measurement (you'll just have to add some supportive blocking between the back of the tank and the wall), but you can't install a fixture designed for a longer rough-in measurement without some complicated alterations to the drain line.

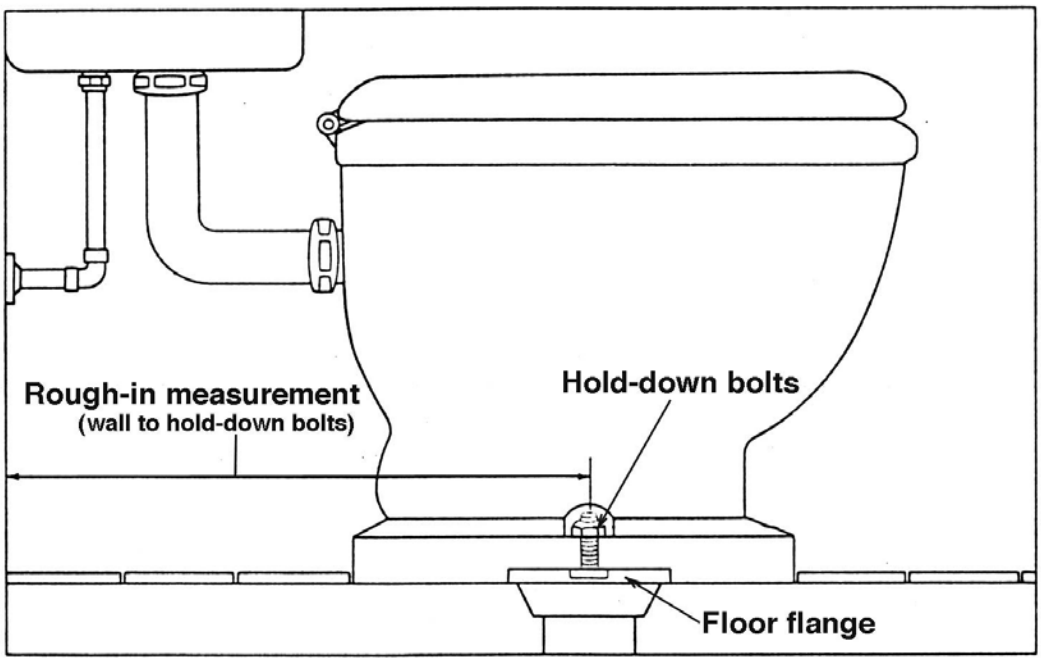



*Illustration 1: Determining the rough-in distance:*

To remove an existing toilet, first shut off the water supply. If you’re lucky, you can simply close the “shut-off valve” located in the narrow water supply line (usually found at the lower left rear of the toilet bowl.) If you don't have a shut-off valve for the toilet, look for a valve on the supply line to the entire bathroom, or turn off the water at the meter. Flush the toilet to drain the tank, disconnect the water supply line, and use a sponge to remove any remaining water. Loosen and remove the two bolts that hold the tank to the bowl *(see Illustration 2)*, and carefully lift the tank free. (If the bolts won't turn, try lubricating them with **WD-40™;** if that doesn't work, you'll probably need to cut through them with a hacksaw blade.)

Flush the water from the bowl by pouring a bucket of water into the bowl *quickly,* or mop out the water with rags. Next, loosen and remove the nuts and washers on the bolts holding the toilet stool to the floor. These bolts are located on either side of the base (some are hidden under decorative caps). Loosen the gasket that seals the toilet to the drain line with a slight twisting motion, and then carefully lift the stool straight up, approximately 8 inches. (*Hint:* If you'll be removing the toilet from the house,

*(continued)*

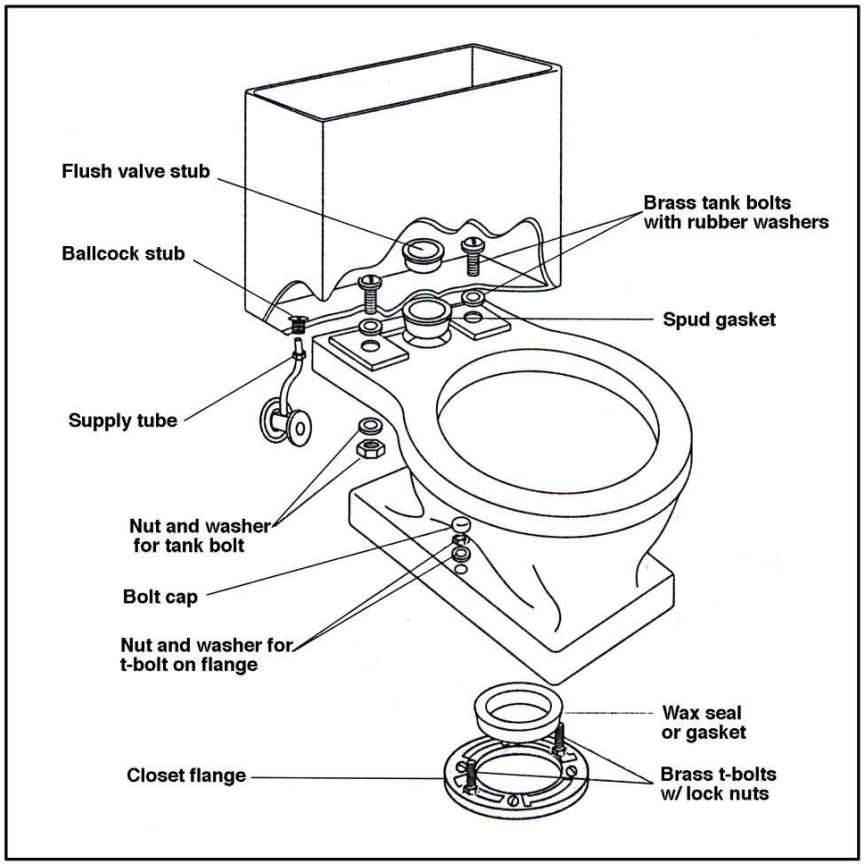
slip a large garbage bag up and around the stool from underneath, to keep from slopping water on the floor as you carry it out.) Stuff a rag into the drain opening to prevent sewer gas from entering the house.

Before installing a new toilet (or re-installing the old one), check the condition of the floor around the **flange** (the metal “collar” that inserts into the sewer drain). Repair any areas that have been damaged by water leaks. The flange must be secured tightly to the floor to keep the toilet from moving. If you are replacing your toilet after putting in new bathroom flooring, check whether the new floor is thicker than before. If so, you may need a flange extension.

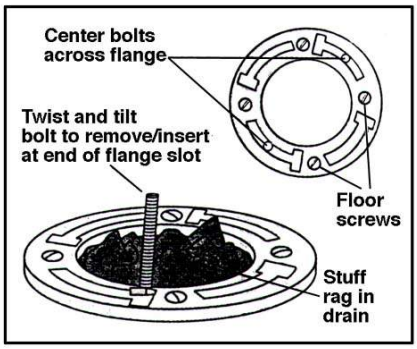
The toilet is sealed to the floor by a wax ring that circles the **horn** (the area on the bottom of the toilet that protrudes into the drain opening.) This wax ring should be replaced with a new one whenever a toilet is taken up from the floor. Scrape all the old wax off the horn and the flange, and then take a new wax gasket, at room temperature, and press it in place around the horn. Remove the rag blocking the drain, and set the bowl in place (making sure the bolts are inserted into the mounting holes.) Gently push down with a twisting motion, until the outer edge of the toilet base is evenly in contact with the surrounding floor.

Replace the washers and nuts on the bolts that extend through the flange and toilet mounting holes, and tighten them gradually, alternating from side to side. When they begin to feel snug, place your weight on the stool and tighten them again. (Don't overtighten, as the porcelain bowl may crack.) If the bolts are new, cut off the excess with a hacksaw blade, and then replace the bolt caps.

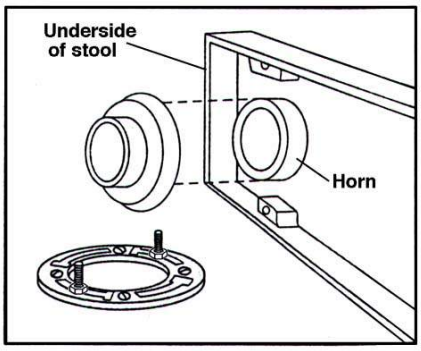
Replace the washers and bolts between the tank and bowl, and set the tank in place. (Use only **brass tank bolts**, as brass-plated steel bolts will eventually rust and crumble.) Tighten the nuts on the tank bolts carefully, just until they feel snug and the tank is level. Then, reconnect the water supply lines, open the valves, and check for any leaks at the base of the tank as it fills. Flush the toilet several times and check for leaks around the base of the stool.




**TOILET CONNECTIONS. These are the fasteners, washers and gaskets you must deal with when removing a toilet and installing a replacement.**




**Replace the closet bolts after scraping away the old wax seal. A rag in the drain blocks sewer gas.**




**Place a wax seal on the bowl horn, then set the bowl on the flange and make connections.**

*Illustration 2: Toilet connections:*

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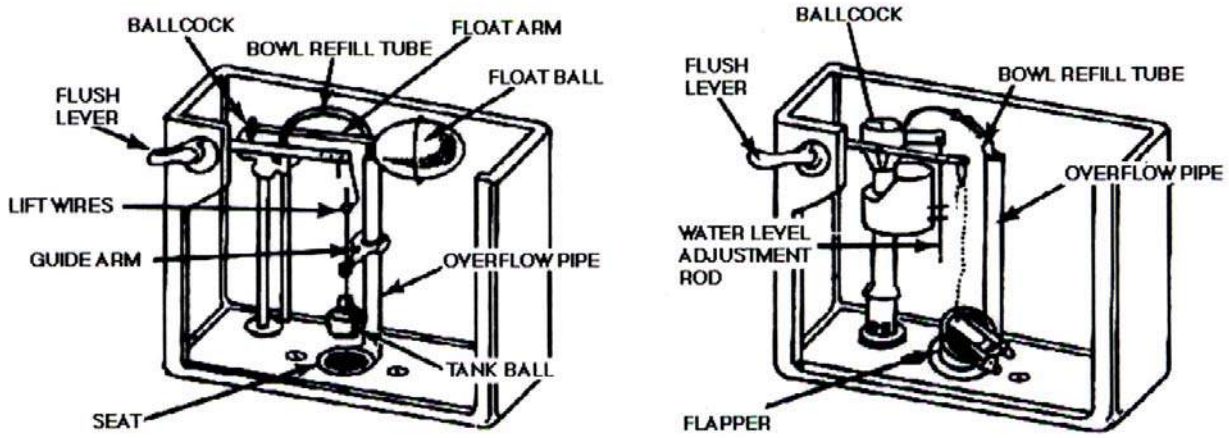
# TOILET REPAIR

Modern toilets consist of two parts. When you trip the handle, the water held in the **tank** is released into the **bowl**. Some of the water flows through port holes just beneath the rim of the bowl (to wash the sides), but most of the water is sent directly into the bowl itself, where the force of the inflow starts the flush. The way this process works has changed little for more than a century, because the design functions so well. And, most of the time, little goes wrong. However, everyday use does cause wear and tear on the parts, so most homeowners will eventually need to make minor repairs to their toilet.

There are two systems that can cause problems. The first involves the **flush valve** that opens to release water from the tank and then closes at the end of the flush. In some toilets, the flush valve is a rubber or plastic ball that sits over the outflow tube, while newer toilets will have a flapper valve instead of the tank ball *(see illustration below).* If this valve doesn't seat itself properly at the end of the flush, the water will continue to run until you jiggle the handle to reseat the valve. This problem usually occurs with tank balls; flush the toilet and check to see if you need to adjust the lift wires that align the ball in place to eliminate any obstructions. Or, you can replace the flush ball with a flapper valve that doesn't have guide wires to get hung up, but instead has a lift chain between the handle lever and the flapper valve.

If you have "ghost flushes" in the middle of the night, the problem may be a slower leak around the flush valve. Water seeps into the bowl, the level sinks in the tank, and the toilet refills. You can test to see if this is your problem by adding a bit of food coloring to the water in your tank; if the color shows up in the bowl without a flush, then there is a leak around the flush valve. This problem is usually caused by a breakdown in the rubber or plastic material in the flush ball or flapper valve, so replacing it will solve the problem. The parts are inexpensive, easy to find, and simple to install by following the directions on the package.




**Old Style vs. Newer Style Tank Parts**

*(continued)*

The other system that can cause problems is the mechanism that controls the water supply to the tank. After a flush, when the tank has been emptied, a valve opens to refill the reservoir with fresh water. This **water supply valve** (generally called a ballcock) is controlled by a float that stops the water from entering the tank when the level has reached a pre-set height. In older toilets, the float is a hollow metal ball, connected to a float arm. that rides on top of the water. Newer floats look like small plastic cups, and move up and down on the ballcock shaft. An overflow tube prevents the tank from overflowing if the ballcock fails to close off the water when the tank has been refilled.

If your toilet does not turn off after you flush, even after you jiggle the handle, the problem is most likely in this assembly. The first place to look is the float. If your toilet still has one of the older ball floats, check to see if is getting hung up on something that prevents it from rising as it should; if the ball or the float arm touches other parts of the tank, bend the arm so it moves freely. A leaking ball can also cause problems. Unscrew the ball from the arm rod and shake it to see if there's water inside; if so, replace it.

Repairing a float cup is a bit more complicated, because the cup is part of the larger ballcock assembly. As with the ball float, the cup's movement can be obstructed, usually by scale or corrosion on the ballcock shaft. If that is the problem, polish the shaft with fine steel wool. If the cup itself leaks, you'll need to replace the entire ballcock assembly, a relatively simple and inexpensive task *(see below).*

If the problem is not in the float, you'll have to look at the ballcock valve. After turning off the water supply and flushing to remove the water from the tank, take out the two screws from the ballcock lever mechanism, slip out the float arm and pull out the plunger inside the valve. Check for sediment or corrosion that could be affecting its function, and remove it with steel wool. At the same time, replace any worn parts (O-ring, packing washer, and plunger washer) before reassembling the ballcock.

Low-cost ballcock assemblies are readily available, if you need to replace the entire mechanism. Close the shut-off valve feeding water to the toilet, flush, and mop up any water that remains in the tank. Then, unscrew the nut at the bottom of the tank that holds the ballcock assembly in place. (If you can't loosen the nut, use a hacksaw blade to cut the shaft between the nut and the bottom of the tank.) If you have a float ball, slip its float arm from the ballcock assembly. Then, unclip the small bowl-refill tube from the overflow tube and lift the ballcock out of the tank. Reverse the process when installing the replacement mechanism, following package directions to set the water level.

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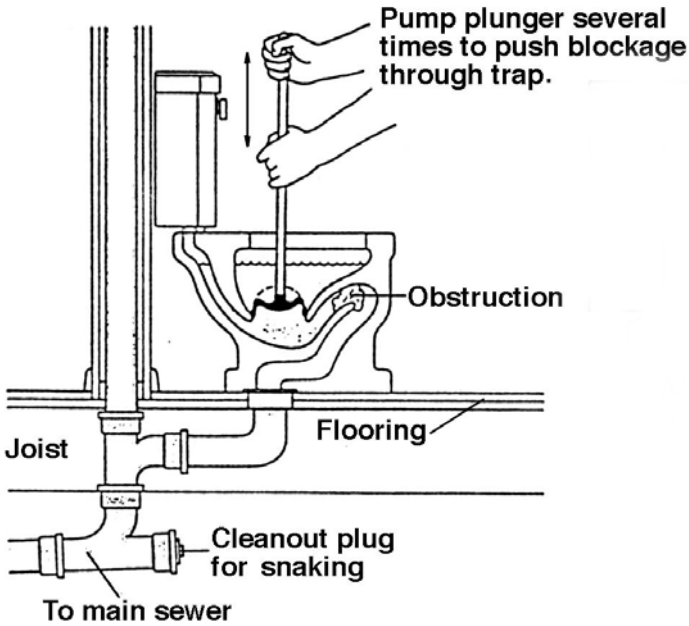
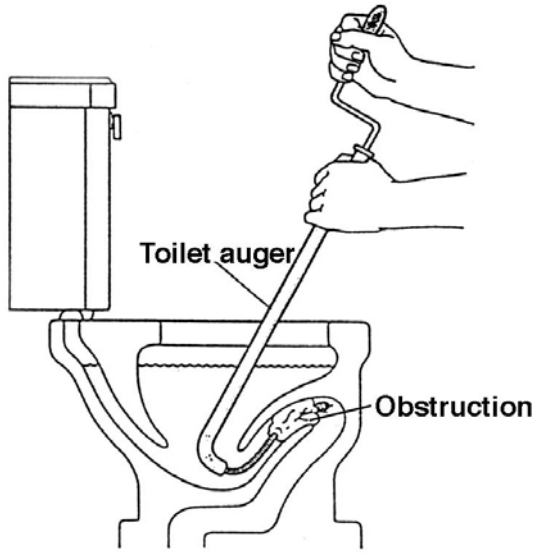
# UNCLOGGING YOUR TOILET

There is probably nothing more irritating than a clogged toilet. Usually, the problem is a clog in the trap that is built into the inside of the stool as part of the water outflow path. You clear the clog by using a toilet auger or a plunger to dislodge the obstruction and push it through the trap *(see illustrations.)* Never use an electric snake or chemical drain cleaners in a toilet, as they can scar – or even crack – the porcelain.

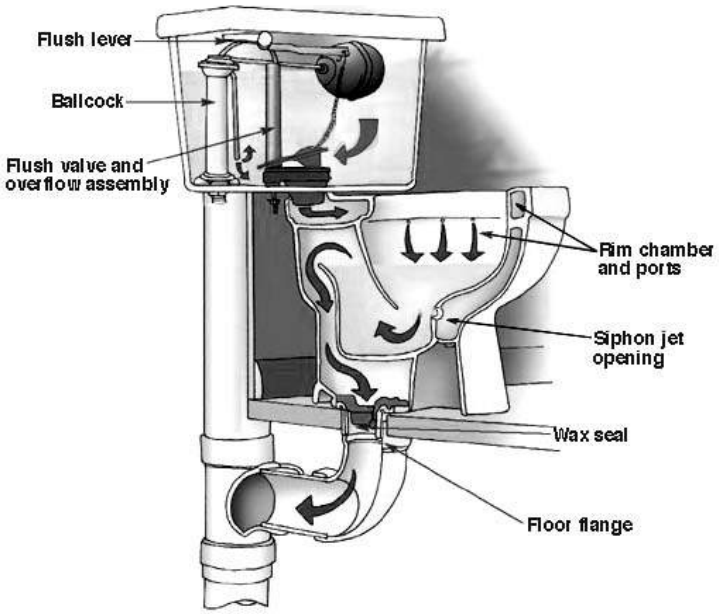



Use a toilet auger to dislodge a difficult clog.

If the trap is clear, but the waste and water don't seem to move through as they should, then there's another possibility to consider. Instead of a clog in the outflow path, water may not be able to flow into the stool rapidly enough to start the flush process. The most common symptom of this problem is that the water rises up in the bowl, and then slowly lowers without swirling.

Obstructions can occur at several points in the water inflow pathway. Many toilets have small passages built into the toilet stool, openings that can become clogged. Ordinarily, when the flush valve opens the passageway from the tank into the stool, water flows through the rim chamber, and then out these ports to wash the sides of the bowl *(see illustration.)* Some toilet designs also include a siphon jet that shoots water into the trap to start the swirling siphon effect that will empty the bowl quickly.




*(continued)*

If your toilet trap is clear, but the water still flows out slowly, check the flush valve (lift the flapper or tank ball) to ensure that the opening is free of obstructions. One of those drop-in-the-tank cleaners may have clogged the flush valve opening, or small kids may have put something in the tank.

Once you have ensured that the valve is clear, use a piece of stiff wire (like an old wire coat hanger that you have straightened out) to ream out each of the rim ports and the siphon jet opening. This will break up any scale or mineral build-up clogging the openings in the stool, and allow your toilet to empty once again as it should.

Rarely, blockages can occur in the large drain pipe leading from the toilet, so if none of these procedures have solved the problem, you may be forced to take the toilet up and use a sewer snake to clear the obstruction. *(See separate handouts on "Snaking Drains" and "Toilet Installation" for further information.*

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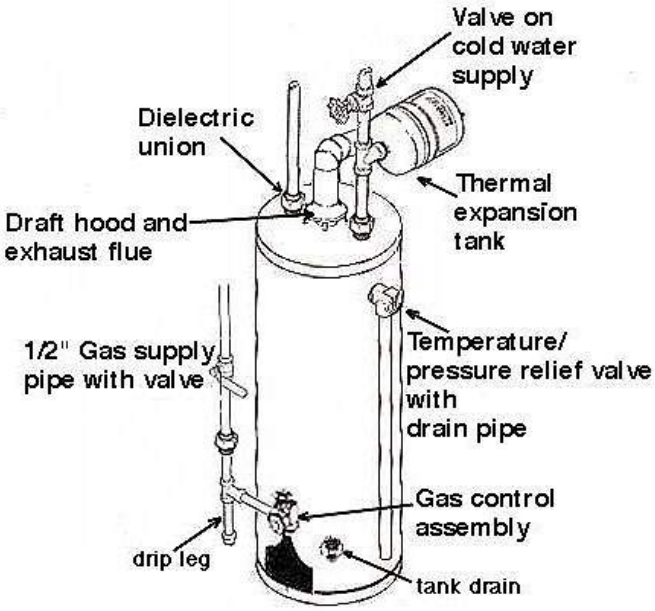
# INSTALLING A GAS WATER HEATER

While it appears to be a complex job, installing a water heater is really quite straightforward. Gas line connections are fairly simple, but great care has to be taken to ensure that the threaded joints are well sealed. The most difficult part for most people is soldering the copper pipe. (Note: Replacing a hot water heater requires a permit in most communities.)

When you purchase a replacement tank, you'll need to know whether your old one was "short" (about 48" in height) or "tall" (about 60" in height). There is no difference in capacity (all 40-gallon tanks hold the same amount of water), but the gas and water supply lines, as well as the flue pipe, will be at different heights, depending on which type or brand of tank you have. It's far easier to stay with the height you already have, so you won't have to change the piping.




In earlier models, the main differences in quality among various heaters were in the amount of insulation around the inner tank and in the recovery speed. With newer models, the difference in insulation is no longer an issue. New federal regulations in 2003 and 2004 mandated higher efficiencies in insulation and gas usage, as well as a new flammable vapor standard. (The standard now requires that if a flammable liquid is spilled the floor, that the vapors cannot be ignited outside of the combustion area of the water heater.) A temperature-pressure (T-P) relief valve must also be supplied with the tank.

When you bring the new heater home, be sure to transport it carefully, so you don't damage the carton and the tank inside. If you must move the heater up or down a staircase, use an appliance dolly. *NOTE: Inspect your new tank carefully – if the outer shell is dented, return the unit to the seller. The glass lining may be damaged on the inner tank, sharply reducing the lifespan of the unit.)*

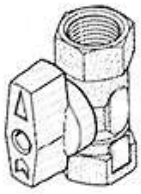
Start by shutting off the gas at the gas meter and the water to the heater. Open the bottom drain valve on the heater. A garden hose can be used to direct the water to the nearest drain and keep your work area somewhat drier. To speed up the water flow, open some of the faucets and lift the lever on the T-P relief valve to let air into the tank.

While the tank drains, begin to disconnect the pipes from the unit. If the water lines are soldered directly to fittings mounted in the tank, you'll need to cut the pipes as close to the fittings as possible. If the lines are connected to the tank with unions, it's a quick job of disassembly. With gas lines, it's a good idea to use two wrenches, so that you loosen only the parts that you need to take off. (If you do twist something loose, you will need to take it off and apply pipe joint compound – often called "pipe dope" – so there will be no new leaks.) When the water has drained out, slide the tank out of the way. Then move the new tank into position.

*(continued)*

For all gas and water lines, Ohio Plumbing Code requires that you use rigid pipe (not flexible connective lines.) If you have an old water-type (globe) valve on the gas supply line, remove it and replace it with a ball-type gas valve. Some city inspection departments insist on a new gas valve every time the water heater is replaced – which is not a bad idea. Be generous with the pipe joint compound on the male pipe threads, as this will keep the joints from leaking. After you have re-assembled the gas line, turn on the gas and test all the joints with soapy water for leaks.

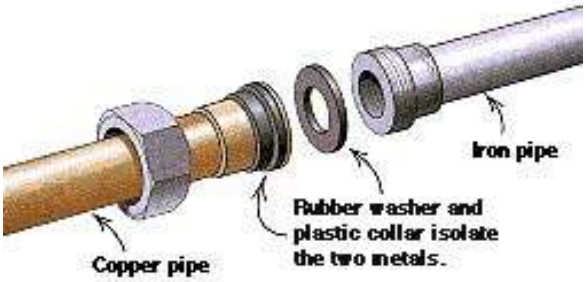
Water valve



Gas valve

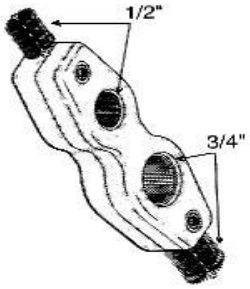
To attach the water lines, first install **dielectric unions** on the heater. (These unions isolate the steel tank from the copper in the water lines, to prevent the dissimilar metal from creating a weak electrical current that accelerates corrosion of the steel.) You can use either the pipe joint compound or Teflon thread tape to make the connection to the tank. Set the rubber washer aside and slip the nut and plastic collar onto the tubing. Hold the plastic collar out of the way before soldering the brass fitting to keep it from melting.

Dielectric Union




Dielectric Union

Polish the copper tube and the fitting with emery cloth, steel wool, or a wire brush. Apply flux (or a tinning flux) to both the tube and fitting before assembling. Heat the fitting with your propane torch, and then touch the solder to the joint. As the solder begins to melt and flow into the fitting, back the torch away. If there's too much heat, the solder will flow into the fitting beyond where you want it.




4-in-1 Wire Brush

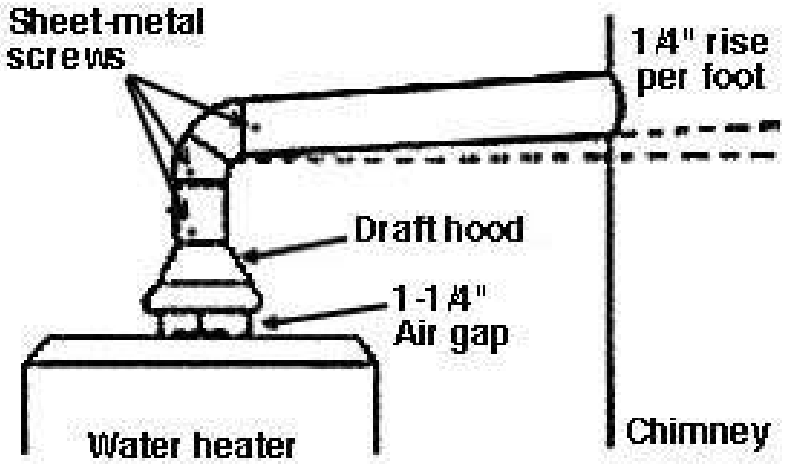
If you have water dripping in the existing tubing, the joint will not get hot enough for the solder to melt. An old plumber's trick is to stuff some bread into the pipe; the bread will temporarily dam up the dripping and let you heat the joint long enough for the solder to flow.

Install a 3/4" copper drainpipe on the T-P relief valve to within 6 inches of the floor *(see tank illustration).* If there is a water pressure regulator (usually found next to the water meter) on your system, you'll also be required by Ohio Plumbing Code to install a thermal expansion tank on the cold water supply just above the tank. When all of your soldering is done, it's time to assemble the draft hood and flue pipe.

Inspect the draft hood that came with the new water heater to see what size flue pipe is required. If the existing flue pipe is the correct size, check it for corroded areas. Replace it with galvanized steel pipe if there are any holes or thin spots.

The flue pipe must rise towards the chimney from the tank at least 1/4'' per foot, and all the crimped ends should point towards the chimney as you assemble it. Use self-drilling sheet metal screws (no more than 1/2'' long) to attach the draft hood to the tank, and put two screws in each joint of the flue. Use mortar to seal the joint where the flue enters the chimney *(see illustration on next page.)*

*(continued)*




Check to make sure the flue is drafting properly by lighting a small piece of paper and immediately extinguishing the flame, leaving a trail of smoke. Place the smoldering paper near the gap between the top of the water heater and the bottom of the draft hood. The smoke should be drawn upwards into the flue.

Read your owner's manual for the sequence of lighting the pilot flame or "light". Remove the outer panel that covers the burner area and set the control knob on top of the gas control assembly to the "pilot" position. Hold down the pilot button for several moments to purge the air from the gas line; then, press the igniter button to light the pilot. Continue to hold down the pilot button for another minute or so while the thermocouple gets hot. Once the pilot remains lit, replace the cover panel and set the temperature knob to "hot" for the burner to light.

It will take about 45-to-60 minutes for the water to become hot. You may hear dripping in the burner area during that initial heat-up. Don't panic! It's just condensation from the flue inside the cold tank – there shouldn't be any dripping once the water is hot. If, after that first hour, you still hear dripping, check for leaks in the piping before tearing out the tank and replacing it with a new one.

Water heaters are usually warranted for five or ten years, but most last longer than the warranty period. The only routine maintenance necessary is to drain about a gallon of water from the bottom of the tank (or until it runs clear) twice a year. This draining will remove accumulated mineral deposits that could damage the glass lining and help the burner operate more efficiently. Also, periodically check the two valves on the tank; if one develops a leak, it can be easily replaced. Once the tank itself starts to leak, however, it's time to buy a new one.

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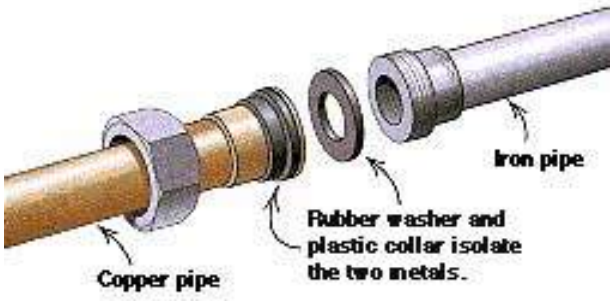
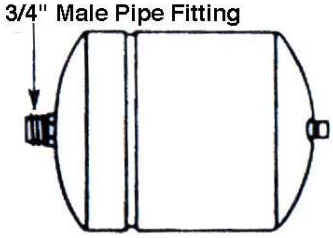
# WATER HEATER SAFETY ISSUES




Dielectric Union

When two dissimilar metals such as iron and copper are connected to each other, a weak electrical current is generated. Although you won't feel the current, it will accelerate the corrosion of iron pipe or the steel tank of a water heater. A **dielectric union** should be used to insulate iron from copper pipes, to minimize the corrosive effect of the electricity.


Thermal Expansion Tank


If there is a **pressure regulator** installed on the water line (usually near the water meter), a **thermal expansion tank** should be mounted on the cold water pipe above the water heater. This installation is an Ohio Plumbing Code requirement. Water expands as it is heated, raising the pressure in the pipes. That expansion causes faucets to "hammer" and pipes to bang in the walls. Sometimes the expansion will cause the **temperature/ pressure relief valve (**T-P valve) to leak. The expansion tank eliminates the hammering by giving the water a place to go as it expands.

The T-P valve is designed to open when pressure or water temperature rises above safe levels, minimizing the chance of an explosion. A pipe should be routed from the valve to within 6 inches of the floor. *Never block-off or plug the T-P valve to stop it from leaking.* Instead, replace a leaking T-P valve with a new valve of the same rating.

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# TANKLESS WATER HEATERS

If you're seeking to reduce energy costs, a logical place to look is your water heater. Unfortunately, there's not much we can do with tank-type units; adding tank blankets and pipe insulation may help conserve heat, but doesn't seem to save much money. Since 2004, storage tank-type water heaters have been mandated (by the U.S. Department of Energy) to be more energy-efficient, and there is a new combustible vapor requirement. Despite that (according to the DOE), operating costs for gas storage tank water heaters account for 20% or more of an average household's annual energy costs.

A tank-type water heater maintains the water temperature to the setting on the tank. It must operate even if no hot water is drawn from the tank, to compensate for "standby loss" (heat radiating from the walls of the tank and escaping out the flue pipe). Standby losses represent up to 20% of annual water heating costs. One way to reduce this expenditure is to use a tankless (also called "demand" or "instantaneous") water heater.

Common in Europe and around the world, tankless units heat water as it is used, or "on demand." When you open the spigot, a sensing device is activated, the heater fires up, and you get a constant supply of hot water for as long as you need it. When one person finishes a shower, there's no wait for more hot water before another person can take theirs.

Depending on the amount of hot water required, you might choose one of the larger gas units, designed to supply all the hot water needs of a household, and have it installed centrally in the basement. Another alternative is to install small units at the point of use. For example, you can use a small electric unit as a "booster" for a far-off bathroom, dishwasher, or laundry. These units are usually installed underneath a sink or in a nearby closet.

*Rinnai tankless water heater*

Although they will reduce energy use, tankless water heaters are not yet the perfect answer to a constant supply of hot water. If you choose a centrally-located tankless heaters, you'll have the best result if you look for one with the highest flow rate you can get. Also, you may need to modify your water-use behavior a bit. Despite manufacturers' claims, tankless units simply don't produce the same rate of water flow as do tank-type heaters. If you are showering with a 3-gallon-per-minute showerhead when a large water-using appliance cycles on, one or both may not get much hot water.

The cost of these units is still considerably more than conventional tank-type heaters, so you'll need to evaluate your cost savings over the long term. Neverthless, more and more people are finding that tankless units – whether used as the sole source of heated water or to boost an existing tank-type unit – can help them reduce energy usage and adopt a more sustainable life style.

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# PLASTIC WATER LINES

*CPVC water lines*

With the sharp rise in the cost of copper (as well as the reluctance many homeowners have to solder copper pipe), there has been growing interest in plastic pipe as an alternative for water and drain lines. Plastic pipe made from PVC (polyvinyl chloride) has been permitted for DWV (drain-waste-vent) pipe for many years, but only in recent years have communities allowed plastic (PEX or CPVC) water supply lines to be installed in residential buildings. **PEX** (cross-linked polyethylene) is sometimes colored red for hot and blue for cold. **CPVC** (chlorinated polyvinyl chloride) is usually beige-colored, to distinguish it from PVC. Neither of these materials should be confused with polybutylene (PB), a grey plastic tubing that came out in the early 1980's and then fell from usage because it frequently failed under moderate pressure with heat.

Changing the water line will generally require a plumbing permit. Since the original metal piping is part of the grounding circuit of the electrical system in many older homes, ***if you change to plastic water lines, many cities (including Cleveland Heights) require that the installer have an electrician certify in writing that there are adequate ground connections to provide safety.***

*brass pressure regulator*

Another consideration when installing plastic water lines is water pressure. Many homes have a **pressure regulator** mounted on the house side of the line, usually just above the water meter, to control water pressure from the street water line. High pressure can be damaging to plumbing fixtures and piping, so a regulator is needed to keep the pressure at a desirable level. In Cleveland Heights, the city water department owns the meter, but the homeowner owns the pressure regulator and is responsible for maintaining it. It is suggested that, with plastic piping, the pressure be set between 55 and 75 PSI (pounds-per-square-inch) so that the pressure will not blow out the pipe at the fittings. Ohio Plumbing Code also requires that a **thermal expansion tank** be installed on the cold water pipe just over the water heater whenever a regulator is present.

*tubing cutter*

When people think about the petrochemicals and solvents that are used for the manufacturing and installation of plastic pipe, they may worry about possible contamination of their drinking water. The National Sanitation Foundation (www.nsf.org), tests U.S.-manufactured pipe for any chemicals that could get into potable water; pipe printed with the NSF certification has no trace chemicals, will resist scaling and deposit build-up when used with both hard and soft water, and will not rust.

*Self-clamping brass fitting*

CPVC is frequently chosen to repair an existing galvanized iron water line because, unlike copper, plastic is inexpensive and will not corrode when in contact with old iron pipe *(dielectric effect).* However, CPVC does not work well with high-pressure water flow and doesn't handle cold well. In addition, repairs using CPVC can be challenging in an occupied house. Most connections are made by applying a solvent primer and then a plastic cement; a 24-hour curing period is required for the adhesive to set properly. All too often, people start using a repaired system long before the curing

*(continued)*

period is up, weakening the joints. Eventually the weakened joints let go and flood the house. Self-clamping brass fittings are faster – allowing you to turn on the water immediately – but you'll pay considerably more for that convenience.

*crimping tool*

PEX tubing can be used in radiant heating systems, as well as plumbing systems. It is gaining in popularity due to its relative ease of installation, flexibility and durability. There are several grades of PEX, and the "A" and "B" grades will not burst if the line freezes. Because the tubing bends readily, fewer elbows are needed in many situations, and it can be "fished" into existing walls almost as easily as Romex™ wiring. The connecting fittings are brass and require some specialty tools: one to "swage" or "chamfer" (open up) the end of the tubing, and another to "crimp" (clamp) a ring onto the tube once the fitting is slipped into it. While material costs for a PEX plumbing job are higher than a job with glued CPVC, no cement, chemicals or solvents are used in making the connections, and the lines can be used immediately after assembly is completed.

No matter which type of plastic tubing you choose, the lines should be secured to it to a wall stud or joist with a support clamps every 24 to 36 inches to minimize sagging and damage from movement. Install an air trap on any new line where a supply line branches off to a fixture (to prevent water hammer), and a shutoff valve on each supply line.


*air trap on CPVC water line*

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# SOLDERING COPPER PIPE

Tools:

Tape measure
Pipe Cutter or Hacksaw
Steel Wool or Fine Sandpaper
Propane Torch
Lead-Free Solder
Soldering Paste ("Flux") and Brush

Copper Pipe:

Comes in three weights:

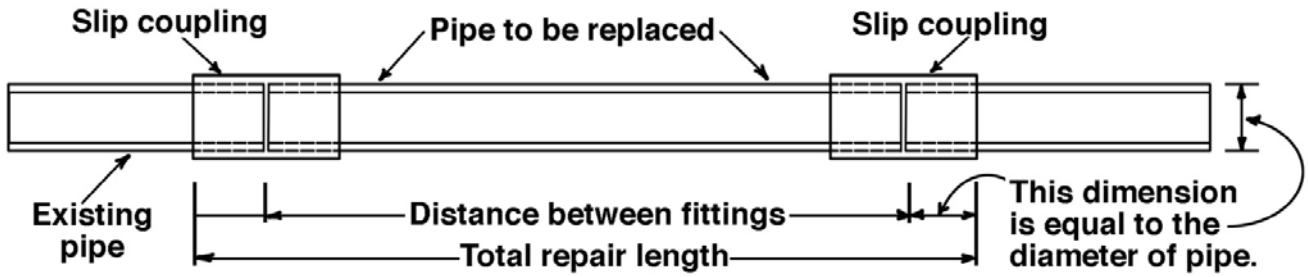
"K" — Thickest Wall
"L" — Medium Wall
"M" — Thinnest Wall

Procedure:

1. Cut pipe to length with pipe cutter.
2. Remove burrs on inside of pipe with scraper on pipe cutter.
3. Clean end of the pipe and inside surface of the fitting with steel wool or sandpaper.
4. Apply flux to both pieces to be joined (outside surface of the pipe and inside surface of the fitting)
5. Assemble the pieces and heat both pieces evenly with propane torch. Do not overheat; the most common mistake is overheating, not underheating.
6. Apply solder as soon as it will flow when touched to the pipe. (Solder melts at about 400°.) You'll only need a piece of solder as long as twice the diameter of the pipe.
7. Don't move the joint for at least a minute. If you have a leak after the water is on, drain the water from the line and reheat the joint to pull it apart; then, re-clean and start over. Don't just reheat and add more solder – that's how you can "overcook" the fitting, when it may never solder properly. You'd then need to replace the fitting.

How to Measure for Cutting Pipe:

1. Check diameter of pipe.
2. Measure the distance between ends of pipe fitting, and add twice the diameter of the pipe.



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# 11.

# Electrical Repairs

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# Questions for Your
# ELECTRICAL CONTRACTOR

These are some areas of discussion which may help you assess the skills of an electrical contractor, or determine the scope of what you want to have done:

**1. Ask about the permit.**

There are very few electrical repairs that will not require a permit in most communities, so you can assume that one will be needed. If the contractor tells you one isn't required – call your city's building department and check *yourself* to verify that fact. DON'T get the permit yourself. When the contractor gets it, he/she will then be responsible to the city for doing the work to code.

**2. Ask if he/she is licensed and bonded in your city.**

To obtain a permit in most communities, including Cleveland Heights, an electrician must be licensed and bonded (insured) to work in that city. Ask what name and address is used on the license, and make sure it matches the contractor who will be doing the work.

**3. Ask about the materials to be used.**

#12 wire is the smallest gauge that should be used in a home for general circuits; #10, the smallest for 240-volt circuits. Ground Fault Circuit Interruptors (GFCIs) are the type of outlet that must be used in exterior and water-prone areas. Grounded outlets are also required in most locations when new outlets are installed. In your project involves a new service panel, find out if the panel to be installed will accept interchangeable breakers (different brands) – a real advantage if the original manufacturer ever goes out of business.

**4. Ask if your electrical service should be upgraded.**

If you are remodeling your kitchen – or even if you just want to add some outlets – be sure to ask whether your electrical service (the total amount of electricity coming to your house, to be divided among all your circuits) is sufficient for your needs. Tell the contractor if you are experiencing brownouts, or if your lights flicker or the TV picture gets smaller when the refrigerator cycles on. Signs like these can indicate that there is not enough power available to meet demand.

**5. When upgrading electrical service, ask if it will be sufficient for future needs.**

When you upgrade your electrical service, think beyond immediate usage. For example, will the new service panel you are installing have room for additional circuits if you need them at a later date? Will the electrical service have the capacity to handle new large appliances, like central air conditioning? Might you need the capacity to charge an electrical vehicle? Any electrical work should take both present and future needs into account. Ask about it.

**6. Ask how the contractor plans to run new wires through your house.**

Determine who is going to be responsible for repairing any walls, ceilings, or floors that have to be cut open to run the wire, and for any repainting that is needed. (Such repairing and repainting can be a big job.) *Don't assume* that the electrician will restore the surfaces to their original condition; you may need to hire someone else for that work.

*(continued)*

***If your house was build prior to 1978****, the walls and ceiling may have one or more coats of lead-based paint on them; if so, cutting into these surfaces can produce lead-based paint dust, which is a health hazard that poses a special threat to young children. Make sure you discuss with the contractor how much cutting will need to be done and* ***what protections will be taken to minimize lead contamination****.*

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# Creating an
# ELECTRICAL MAP OF YOUR HOUSE

*(to be done during daylight hours)*

1. Draw a floor plan for each floor, showing all light fixtures, switches, and outlets.
2. Turn off all circuits at the service panel. Check your meter to make sure it is not turning. Then...
3. Turn on <u>only one circuit</u>.
4. Check all light fixtures, switches, and outlets to see which ones are powered by that circuit. Put a piece of tape over each one that works, and mark it on the floor plan with a number you assign to that circuit.
5. Turn off the circuit you just tested, and turn on another circuit. Repeat the process. Be sure to double-check each switch and outlet you have already identified, in case another circuit is back-feeding power to it.
6. Repeat process until all circuits have been checked, and all switches, outlets, and light fixtures have been identified and numbered on your map.
7. Make a list of your circuits. Then, list the wattage requirement of each light, appliance, etc., that is powered by each circuit. Add the figures to get a total load for the circuit. Check that load against the fuse or circuit breaker size and the wire size for the circuit to see if the load is within safe limits.

**Circuits:**

A: 21, 7, 6, 11, 18

B: 15, 16, 22, 24, 20

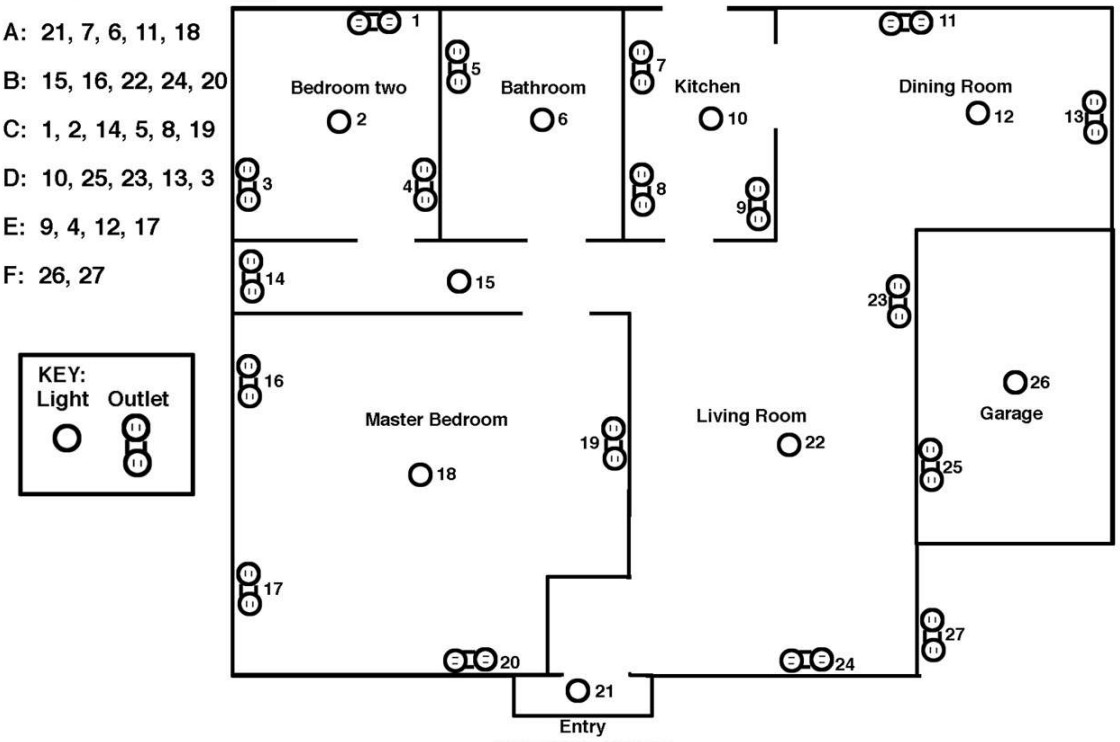
C: 1, 2, 14, 5, 8, 19

D: 10, 25, 23, 13, 3

E: 9, 4, 12, 17

F: 26, 27

**Sample Electrical Map**



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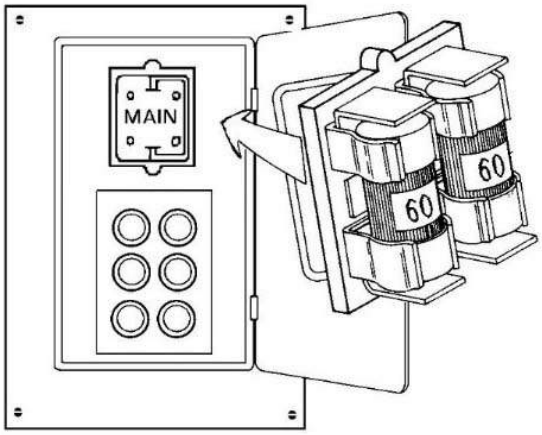
# SOME ELECTRICAL "BASICS"

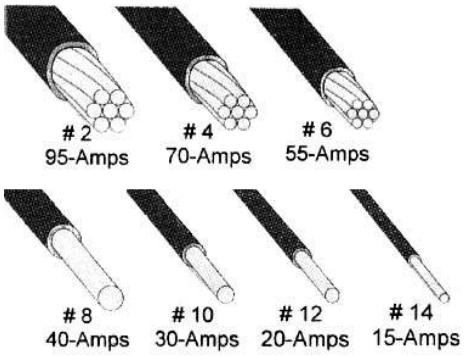



Every house should have an **ELECTRIC SERVICE PANEL with a MAIN SHUTOFF,** whether circuit breakers or fuses are used (cartridge main box with 6 circuits shown). The number of circuits will vary with the electrical loads in the house.

The National Electric Code (NEC) states that 240 volt -100 amp service is the minimum standard for residential usage. All new electrical work must be grounded to conform to the electric code. All outdoor outlets, bath outlets, most kitchen outlets and basement outlets are to be protected by Ground Fault Circuit Interrupters (GFCI). New work in other living areas of the house is to be protected by Arc Fault Circuit Interrupters (AFCI).

IDEALLY – black wires are “hot,” white wires are “neutral,” and green or bare wires are “ground.” But, with old knob-and-tube wiring (common in houses built prior to the 1950’s), all of the wires may be black. **ALWAYS CHECK – DON'T ASSUME!**

All fuses or circuit breakers used must be sized for the wire for which they are used – and the load on the circuit. Each wire size has a number (gauge) which corresponds to a RATED AMPERE LOAD that determines the "TOTAL WATTS" that can be used on that circuit (see wire chart).




## Formulas for Computing Electrical Loads

**Volts times Amperes = Wattage (120V x 15A = 1800W)**
**Watts divided by Volts = Amperage (1800W ÷ 120V = 15A)**
**Watts divided by Amperes = Voltage (1800W ÷ 15A = 120V)**

The maximum wattage permitted for 12-gauge wire is 2400 watts, with a 20-amp fuse or circuit breaker; for 14-gauge wire, 1800 watts, with a 15-amp fuse or circuit breaker. Unless you can determine the wire size, it's safest to assume any old knob-and-tube circuits to be 14-gauge, to prevent using too high a fuse.

*(continued)*

Many household appliances use so much current that they are required by the code to be to on “dedicated” circuits to prevent nuisance tripping of the circuit breakers. A dedicated circuit means that a single item is on the circuit. For example, a forced-air gas furnace should be on its own separate 20-amp circuit. Although the blower motor, when running, is rated at 1600 watts, a surge of 2200 watts is needed to get it to start spinning. If another appliance is drawing power from the same circuit as the furnace when it starts, the circuit breaker will trip.

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# PROPER FUSE RATING TO WIRE SIZE

| *Wire Gauge (copper)* | *Fuse Rating* | *Comment* |
|---|---|---|
| 22 gauge (ga.) | -- | 24 volt thermostat, 10-16 volt doorbell |
| 18 ga. | -- | Lamp cord, Low voltage equipment |
| 16 ga. | -- | Lamp cord, low volt sound system wiring (to speakers, etc.) |
| 14 ga. | 15 Ampere (amp) | Common old house wiring (knob and tube) |
| 12 ga. | 20 amp | Common residential circuit wiring |
| 10 ga. | 30 amp | Electric dryer (under 20 feet length) |
| 8 ga. | 30 to 45 amp | Electric dryer (over 20 feet length) |
| 6 ga. | 50 to 60 amp | Electric range, power feed to subpanel, heat pump or A/C unit |
| 4 ga. | 70 to 85 amp | Service entrance wire on old 60 amp main main service panel, also used for grounding . |
| 2 ga. | 95 to 115 amp | Service entrance wire for 100 amp main service panel |
| 1 ga. | 110 to 130 amp | Service entrance wire for 125 amp main service panel |
| 2/0 ga. | 145 to 170 amp | Service entrance wire for 150 amp main service panel |
| 3/0 ga. | 165 to 200 amp | Service entrance wire for 200 amp main service panel |

**How to figure the electrical load on your circuits.**
A couple of simple formulas (part of **Ohm's Law**) are used to calculate various electrical problems.

To find **amperage**, you divide wattage by voltage.
*Example: For a lighting circuit with twenty-four 100-watt incandescent bulbs (2400 watts), and a house voltage of 120 volts: 2400 watts ÷ 120 volts = 20 amps.*
*If this circuit is constructed with 14 gauge wire, the maximum allowed amperage rating of 15 amps would be exceeded, causing the fuse to blow.*

To find **wattage**, you multiply amperage by voltage.
*Example: To find the maximum wattage that a 14 gauge wire circuit can safely accommodate: 15 amps x 120 volts = 1800 watts.*

A correctly fused circuit will not overheat if an overload occurs; the fuse will "blow," or the circuit breaker will trip. If a circuit is over-fused, an overloaded wire can heat up enough to burn the insulation and start a fire in the walls.

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# NATIONAL ELECTRIC CODE STANDARDS

**for New Construction or Remodeling**

**Minimum Service Requirements:** 100-amp, 240-volt

## Circuits:

### Kitchen:

at least two 20-amp countertop appliance circuits *(No lighting on these circuits)*

| | |
|---|---|
| Dishwasher | Separate 20-amp circuit |
| Garbage Disposal | Separate 20-amp circuit |
| Electric Range | Separate 50-amp, 240-volt circuit |

### Laundry:

| | |
|---|---|
| Washer | Separate 20-amp circuit |
| Electric Dryer | Separate 30-amp, 240-volt circuit |

**Remainder of House:** 20-amp general-purpose circuits

## Receptacles (outlets):

1. Any wall space two feet or wider must have at least one outlet.
2. Outlets should not be spaced more than six feet apart, and no more than six feet from each door or window.
3. All counters in the kitchen or eating area that are wider than twelve inches must have at least one outlet.
4. At least one 20-amp outlet is required by the water basin in the bathroom.
5. All basements must have at least one outlet.
6. All garages must have at least one outlet.
7. The exterior of the house must have at least one outlet.

*All kitchen countertop outlets and all outlets in the bathroom, in the garage, or on the outside of the home must be protected by* ***ground fault circuit interrupters*** *(GFCIs). All new bedroom circuits must be protected by* ***arc fault circuit interrupters*** *(AFCIs).*

## Lighting:

Every room, hallway, stairway, attached garage, and outdoor entrance must have at least one lighting fixture (or receptacle outlet) controlled by a switch.

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# PLANNING YOUR ELECTRICAL UPDATE

Picture Model T's sputtering around on mud roadways, a paved surface only on main streets, no sidewalks and few streetlights. Imagine the ice man bringing ice to the back porch every other day for the ice box, the Roaring Twenties going full tilt. Against all this activity, most of the homes in older communities like Cleveland Heights were built. One convenience the buyers of these new homes wanted was electricity. They were tired of kerosene light at night, and they wanted to listen to the radio. But, there wasn't much else “electric” around – so, 120 volt/30 amp service was very common. There was no need for a higher capacity electrical system in these homes.

Look at us today – microwaves, VCR's, TV's, stereos, computers, laundry appliances...the list goes on and on. All these electricity-using conveniences of our modern times are being plugged into circuits designed for a few light bulbs and a radio. The problem comes when the current draw exceeds the fuse rating, causing the fuse to blow. Installing a larger fuse is *not* a solution – it can allow the wires to heat up and burn their insulation before the fuse blows and stops the current through the circuit. Overloaded wiring can cause a home electrical fire.

Many older houses have had their original wiring updated in a piecemeal fashion. In the 1950’s, for example, homeowners generally had their incoming service increased to 240 volt/50 or 60 amp, to accommodate new appliances. It was not uncommon to have added two new circuits to the kitchen at the same time, in order to use a new toaster, mixer, and electric skillet. That 1950’s homeowner, however, probably didn’t predict the need for a dishwasher or a microwave – so extra capacity wasn't included. In other parts of the house, it’s likely that the wiring today is still the original 1920-era layout, with one circuit serving several rooms. As a result many older homes are inadequately wired for today's lifestyles.

To get a handle on your own situation and what should be done, you first need to determine how you are using electricity in your home at present. Make an “electrical map” of your house, showing all the outlets, lights, and “hidden” electrical consumers (such as dishwashers, garbage disposals, or exhaust fans.) Then, determine on which circuits they are grouped (you can label the fuse box at the same time). After this, add up the wattage requirements of the things on each circuit, and compare that total to its capacity. The maximum wattage permitted for 12 gauge wire is 2400 watts, with a 20 amp fuse or circuit breaker; for 14 gauge wire, 1800 watts, with a 15 amp fuse or circuit breaker. (Unless you can determine the wire size, it's safest to assume any old circuits to be 14 gauge, to prevent using too high a fuse.) By completing this process, you can see which circuit(s) may be overloaded. *(See separate handout on “Creating an Electrical Map of Your House” for how-to information.)*

Armed with this information, plan for improvements. Planning is important – you’ll want to have a master plan, even if you carry it out in stages. You can start by calling the utility company to find out the present service to the house, or consult a licensed electrician. Your plan doesn't have to include complete replacement of all old wiring, simply because it is old; replace it only if the insulation is in bad shape.

Correcting overloaded circuits may involve updating your service panel (fuse box.) Fuses, in and of themselves, are not less safe than circuit breakers; but if you need to divide up overloaded circuits, your old fuse box may not have the additional capacity needed. If your fuse box can only handle 4, 6, or 8 circuits (or if your original fuse box has been augmented with several subpanels),

*(continued)*

you will probably want to replace it with a new circuit breaker panel – with plenty of room for future expansion.

Depending upon the additional appliance load, you may find that the electrical service supplied to the house may need to be increased, as well. (240 volt/100 amp is now considered to be the residential service minimum.) This will have to be coordinated with the utility company – they are responsible for the lines to your mast, but you are responsible for the wiring to the mast meter socket and your service panel.

Include in your plan some of the new requirements for grounding and safety devices (such as **Ground Fault Circuit Interrupters**) now required by **NEC** (National Electrical Code). The rules for what devices are needed and where they should be installed have changed in recent years.

Finally, in whatever plan you devise, try to anticipate future needs, allowing for expansion – because, before you know it, we'll probably have electric cars with rechargeable batteries or those “Star Trek” boxes on our counters that generate food.

## Who Owns the Electrical Service Equipment?

You are responsible for maintaining some parts of the system that provide electrical service to your home, and the electric company is responsible for other parts. There will be fees charges by the service provider for work done on equipment that belongs to you.

The electric service company is responsible for:

**Meter** – the device that records electrical service usage.

**Loop or Service Drop** – the wires from the utility pole to your house. (If the service is buried, you are responsible for the cable from the pedestal box to the house.)

The homeowner is responsible for:

**Mast or Conduit** – the pipe clamped to the side of the house.

**Meter Socket** – the box into which the meter is plugged.

**Exterior Wiring**—the wires that run from the loop to the meter, and then into the service panel inside the house.

**Main Breaker or Fuse Panel** (and any subpanels) – the box(es) where the main electrical service is divided among the individual circuits.

**All Internal Wiring** (and branches to out-buildings) – the wires that carry electricity to the appliances, fixtures, and outlets within your home.

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# PLANNING FOR ELECTRIC VEHICLES

With all the recent strides in automotive engineering, you may be considering buying an electric vehicle or a plug-in hybrid vehicle. (We'll refer to both types as "EVs.") EVs will help lessen reliance on imported fuels, but they do require another power source – electricity. They are powered by a large battery pack that needs a home-based charging system in order to "re-fuel." In some models, the charger is installed in the vehicle; in other brands, the charger might be located in a garage or in a weatherproof unit that stands outdoors, along the driveway. Regardless of placement, most garages and some older houses will need to be rewired to accommodate the charging equipment.

The EV charger should be on a '"dedicated" circuit, with no other fixture or appliance on that circuit (so the circuit breaker doesn't trip when someone uses the garage door opener or turns on the lights when the car is charging.) The National Electric Code® (NEC) details a number of safety requirements, including over-current trip, leakage current to ground protection (GFCI), and an automatic shut-off when – not if – someone drives off with the cable still plugged into the car.

Because the charger is operating for hours at a time, the 2011 NEC® specifies that *"Electric vehicle supply equipment shall have sufficient rating to supply the load served. For the purposes of this article, electric vehicle charging loads shall be considered to be continuous loads."* That means that the electric service to your home (from the pole to the house) must carry enough power to supply a constant charge to the vehicle. You should consult a licensed electrician to evaluate the capacity of your electric system to ensure that you are ready to install an EV charger. Heavier wiring to the garage, and possibly to the house, may be required.

Charging methods have been standardized by the Society of Automotive Engineers (SAE). Approved in 1996, SAE Standard J1772 specifies three levels of chargers. Recent updates describe the design of a standard connector (plug) for attaching power to the EV at Levels 1 and 2.

Approved plug for Level 1 and Level 2 charging
(© Society of Automotive Engineers)

**Level 1** – A Level 1 charger is rated at 120 VAC and 20 amperes (amps) and will plug into grounded electrical receptacle outlets. At this level, fully charging an EV could take 8 to 24 hours, depending upon battery size and its discharge level. This is not meant as the primary charging technique. SAE suggests that EVs carry a portable Level 1 unit that can be plugged into any available 120 VAC grounded receptacle for emergency or "top-off" charging.

**Level 2** – A Level 2 charger is to be used for everyday EV charging. It is rated to run from a single-phase branch circuit (similar to an electric dryer circuit) operating at 240 VAC and 30 amps. Charging time to fully charge the EV at this rate will generally range from 4 to 10 hours, depending on battery size and discharge level.

**Level 3** – The Level 3 standard is for "Fast Charging," similar to refueling at a service station. The charger is supplied by 480-VAC, three-phase equipment, designed to reach a 50% charge in 10 to 15 minutes. A separate connector would supply DC from the off-board charger directly to the battery.

*(continued)*

After many fits and false starts, it appears that the EV era is now with us. Several models of EVs are now being sold in the U.S., and other manufacturers have products that will soon come to market. As in the early days of gas engine vehicles, people are constructing homebuilt EVs from existing cars, motorcycles, and trucks.

This means that people who are considering electrical updates to their homes might wish to include sufficient capacity for charging EVs, even if the technology is still being developed. Your electrician should be able to advise you.

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# ARC FAULT CIRCUIT INTERRUPTERS

Electrical fires are often caused by loose connections (like worn-out outlets), broken wires, or shorted wires in the distribution system. Arcing at the point of faulty contact may cause sparks that can jump several inches to ignite combustible material. Heat generated by loose contacts can burn wire insulation and ignite combustible materials, as well.

Fires cause over $600 million in property damage and 370 lives to be lost annually. More than 40,000 fires a year are due to problems with electrical equipment, such as fixed wiring, plugs and cords, and lamp and light fixtures. Fires can start in any area of a house, but bedrooms are the most common site, followed by living rooms, kitchens, closet/storage areas, garages, bathrooms, laundries, hallways, and dining rooms (in descending order of occurrence).

**Protecting against Arc Faults**

According to a 1994 insurance industry survey, more than one-third of the electrical fires examined were due to arcing conditions. *These arcs may not be sensed by fuses or circuit breakers,* which normally protect against overload and short circuit conditions, because the current fluctuations that occur with arcing may not be high enough to exceed the fuse rating of the breaker and cause it to trip. **Arc Fault Circuit Interrupters** (AFCIs), on the other hand, are able to detect differences between normal current and intermittent arc current. When a hazardous condition is sensed, the AFCI interrupts the circuit, thus significantly increasing electrical safety.

**Arc Fault Circuit Interrupter (AFCI)**

Arc fault circuit interrupter technology was originally developed to protect areas near downed utility lines. As circuit boards were miniaturized, arc fault protection was applied to residential circuits. AFCIs are now commonly designed to protect 15- and 20-amp circuits in single and multi-family homes. The modern AFCI comes in a compact package that looks like a circuit breaker and will fit in most circuit breaker panels.

AFCIs recognize attributes unique to arcing and shut down the circuit in a fraction of a second when an arc fault is detected. There are three basic types of arc faults that can be detected by AFCIs *(see illustration.)* A **parallel arc fault** is a short between the line and neutral wires in parallel with the loads in the circuit, commonly caused by damaged or melted insulation on fixed wiring. A **series arc fault** is an arc fault in series with the load, usually resulting from loose connections, pierced or severed wires, damaged switches and similar situations. A **grounding arc fault** is an unintentional arcing of a “hot” wire to the ground wire; it can occur, for example, when a switch or wall outlet was not installed properly, and connections become loose and make contact with the grounded workbox.

**Arc Fault vs. Ground Fault**

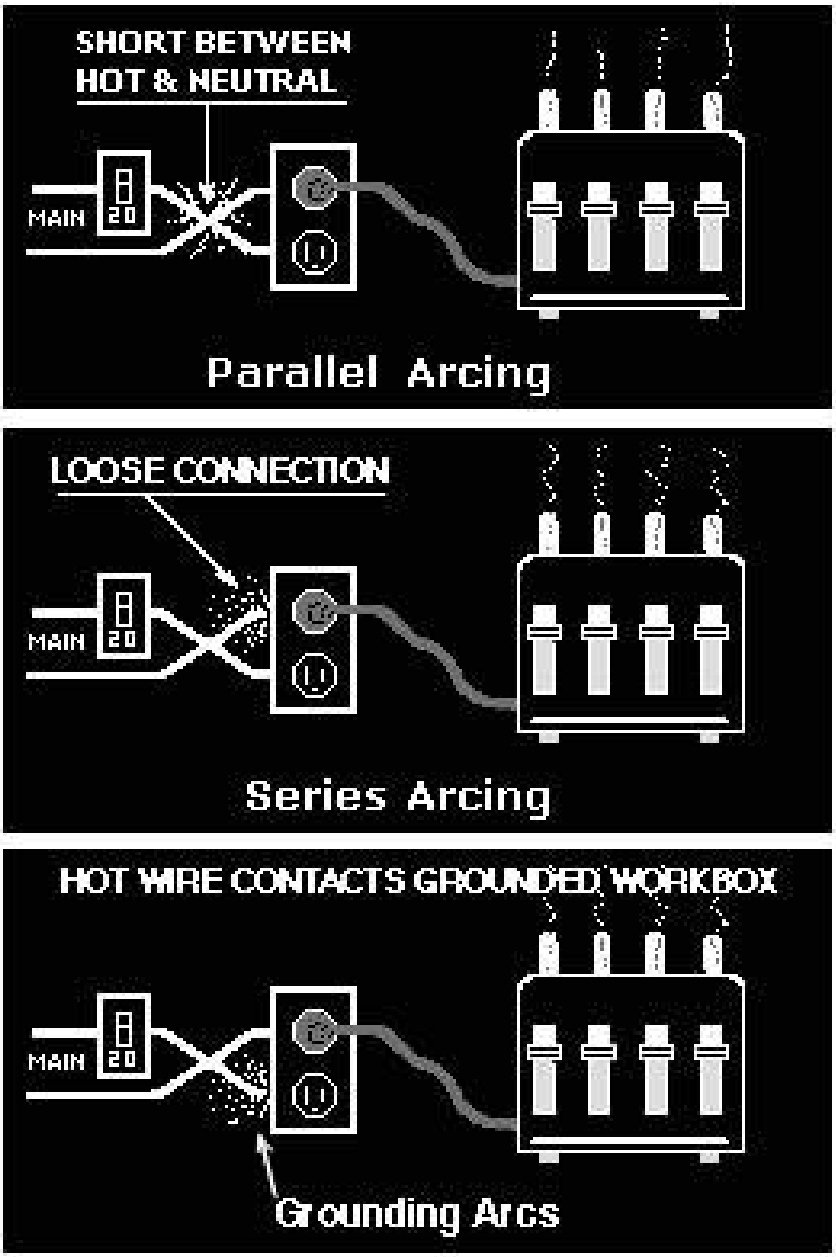
Ground Fault Circuit Interrupters (GFCIs) protect people from shock, by responding more quickly than a normal fuse or circuit breaker *(see separate handout on GFCIs.)* A GFCI interrupts the

*(continued)*

circuit when it detects a minute current leakage.  However, GFCIs don't protect against all types of arcing.  A GFCI can detect "hot" to ground arcs, but cannot detect series, parallel, or line to neutral arcs.  Since an AFCI detects these other arcs, it gives more protection to the circuit.  While an AFCI does not necessarily replace a GFCI, it will provide enhanced protection from arcing conditions that may cause a fire.

**Updating Your Electrical System with AFCIs**

AFCIs cannot be added to an existing circuit (although you can install one into an existing service panel), so you will only be installing AFCIs when you are doing new electrical work.  The 2002 **National Electric Code** requires AFCIs in all new bedroom circuit work, as the bedroom is the most likely spot for an arc fire to start.  In years to come, the AFCI will almost certainly be required in other areas of the home.




*Types of arc faults*

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# ELECTRICAL SYSTEM GROUNDING ISSUES

Grounding is an important part in all electrical construction projects. In a home, grounding provides a safe pathway for electricity that could cause a shock hazard to residents. There are two basic purposes for the grounding pathway: system grounding and equipment grounding.

**System Grounding**

The earth is part of the electrical generation system. Electricity flows from the generation plant to your home via power lines and returns to the plant through the earth. The overhead utility pole wires are “hot.” The “neutral” or return flow runs from the neutral buss bar in your service panel (through a connection to something buried in the earth – usually the water supply pipe) to a buried electrode at the utility pole where the step-down transformer is mounted. Practically speaking, this means that your water service pipe system (which travels in the soil to the house) is used to help carry away the residual electricity from your home after it has been used in light fixtures and appliances. Another function of system grounding is to route lightning and high voltages from the service entrance wires to the earth to minimize damage to the house.

Since the 1990's, the **National Electric Code** (NEC or Code) has required that two grounding paths be installed *whenever you replace or upgrade your main service panel.* In many communities (including Cleveland Heights), the electrical inspector wants to see a connection to the metal water supply line on the street side of the water meter, plus two exterior “made” grounding electrodes. The most common method specified by Code is to drive 8-foot long, 5/8-inch diameter copper-plated or galvanized iron rods into the soil. In areas where the bedrock is close to the surface, the rods can be driven in at no more than a 45-degree angle. An alternative approach is to excavate a trench 30 inches deep and lay the rods horizontally. The grounding rods are connected to the service panel by a continuous length of copper wire.

When the electrical system in older homes has not been updated, the cold water pipe system may still be the only ground. In order for it to serve this purpose, it must have a complete metal-to-metal connection throughout its entire length. If the metal path is interrupted, then the electricity will stop flowing at that point and become a possible shock hazard to you.

Often, water meters (water filter and conditioner housings, too,) are made of plastic or have **dielectric** or insulated unions to join to the water line. Without a **bonding jumper** *(see Illustration 1),* the electricity may stop at these units, rather than being safely carried back to the earth. A bonding jumper provides a bridge around the meter to allow electricity safe passage out of the house. Construction of a bonding jumper is simple; you’ll need a piece of 4-gauge copper wire about two feet long and two bronze grounding clamps. Fasten a clamp on the pipe about 6” or so on either side of the meter, and then attach the ground wire under the screw on each clamp. pipe is painted or heavily corroded, first scrape or sand off the corrosion to ensure a good metal-to-metal connection.

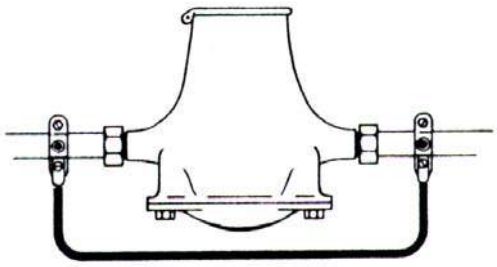

*Illustration 1: Bonding jumper*

Of course, many plumbing systems have been modernized since they were originally built, causing interruptions in the metal path designed to serve as a ground for the electrical system.

*(continued)*

If you have plastic pipe, fittings, or insulated unions (which separates two dissimilar metal pipes, such as copper and iron, to limit corrosion problems) anywhere else in your cold water pipe system, you should consider installing a new ground wire (must be continuous, with no splices) from the neutral buss bar in the service panel to the cold water pipe on the street side of the meter.

## Equipment Grounding

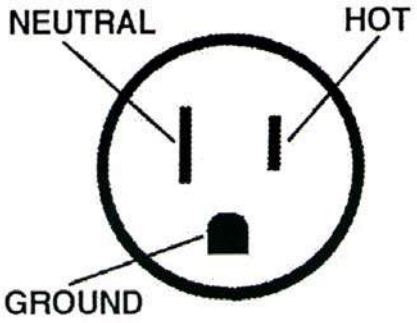

*Illustration 2: Polarized receptacle*

Equipment grounding provides the grounding path throughout the house. Electricity will seek the easiest path to the earth. Your body is an excellent electrical conductor; if you make contact with energized equipment, you'll become part of the circuit. Faulty equipment wiring is a major cause of electrocution at home.

Some of the outlets in your home have three openings: for a hot (black wire), a neutral (white wire) and a ground (green or bare wire, *see Illustration 2.)* Many appliances with metal housings have a three-prong plug. A green (or bare) wire is attached to the frame or housing to provide a grounding path to the round prong on the plug *(see Illustration 3).* If a hot wire shorts out against the grounded housing, the circuit breaker or fuse will disconnect the circuit to prevent the housing from becoming energized.

You should never install a three-prong outlet onto a two-wire circuit where there is no ground wire (unless it is a **Ground-Fault Circuit Interrupter** – *see separate handout.)* Ungrounded three-prong outlets are commonly cited as violations; you can replace them with a two-prong outlet, run a ground wire from the service panel to the outlet *(see below),* or replace it with a GFCI.

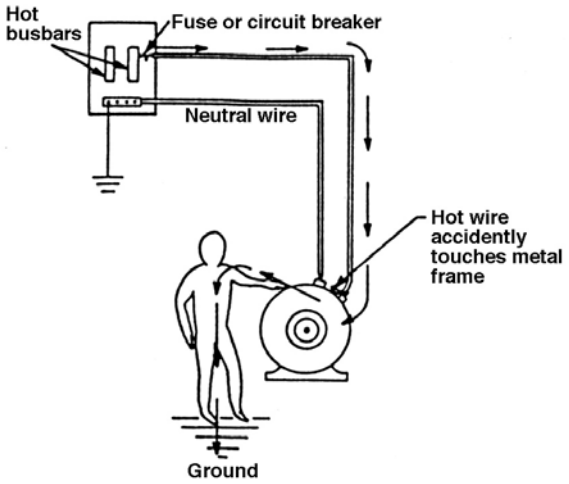

*Illustration 3-A: Ungrounded metal appliance housing poses a shock hazard.*

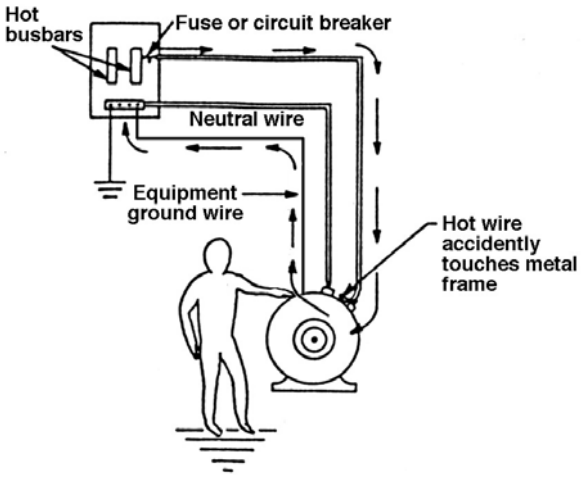

*Illustration 3-B: Equipment grounding wire offers a "least-resistance" path to ground.*

A common grounding issue in older homes concerns ground "taps" or connections from the ground prong opening on a wall outlet to the nearest cold water pipe (such as under the kitchen sink). At one time these connections were legal; however, because so many insulated or plastic devices are being installed in water lines – breaking the ground connection – the NEC now requires that all ground wires eventually connect to the grounded neutral buss bar in the main service panel.

## New Work

All new electrical circuits must be grounded – including all metal workboxes and exposed metal parts on fixtures, switches and appliances. All new receptacle circuits in living, dining rooms, hallways and bedrooms must be protected with **Arc Fault Circuit Interrupters** (AFCI). Even if old two-wire (knob-and-tube) circuits are being connected to new wires, the junction boxes must be grounded. If you have any questions about the rules, contact your city's electrical inspector prior to starting your job, as the rules change periodically (every three years). Since most electrical projects require a permit, you'll want to get it right the first time, rather than redoing work.

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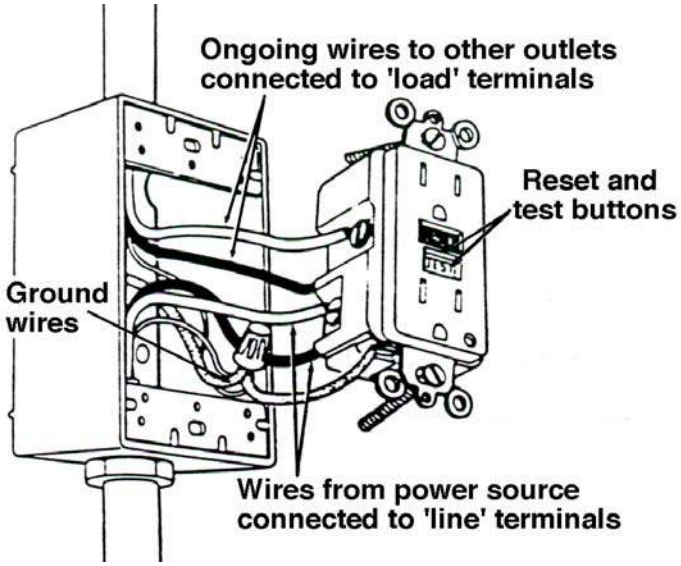
# GROUND-FAULT CIRCUIT INTERRUPTERS

Most people have a healthy respect for electricity—and for good reason. Electric shocks can cause severe injury, or even death. As we have become more dependent on electric-powered tools and appliances, however, a new form of protection has become part of the **National Electric Code**. Ground-Fault Circuit Interrupters (GFCIs) are now required in many locations where you might be using electrical devices in moist conditions: bathrooms, kitchens, basements, garages, and outside your home.

GFCIs protect you from electrocution by sensing minute leakages of current and shutting off the flow of electricity in 1/40th of a second. They go beyond the level of protection offered by the "ground wire" you may – or may not – have in your electric system. One kind of GFCI is a special outlet *(see illustration)* that you install in place of your existing receptacle, to protect that outlet and all other outlets "downstream" on the same circuit. Another kind of GFCI is a special circuit breaker that you can install in your service panel to protect all the outlets on a circuit.

GFCIs are now a routine part of updates to your electrical system (new construction or remodeling). But, because they provide such important protection, homeowners may be required to replace existing outlets with GFCIs in certain locations. Installing GFCI outlets is usually a simple procedure.

First, make sure that the power to the circuit is off. (Test with an electrical tester.) Remove the existing outlet, noting the "hot" wire (usually black) and the "neutral" wire (usually white). Connect the feed wires to the terminals marked LINE, black to black and white to white. If there are ongoing wires which continue to the next outlet on the circuit, connect them to the terminals marked LOAD, again black to black and white to white. (It's important to maintain the correct "polarity" to prevent the GFCI from cutting out, even when you are not using an electric appliance.) Splice together the ground wires (bare or green) and connect them with a pigtail to the screw at the back of the box.




When you have secured the GFCI to the receptacle box and restored power, check the device by pushing the "test" button, which simulates a leak in the current. The power should shut off. You can then push the "reset" button to restore power.

GFCIs are designed to work with grounded systems, but they will provide some level of protection even if you don't have a ground wire. (In fact, GFCIs are the *only* three-prong outlet that should be installed in a two-wire system.)

GFCI outlets and circuit breakers are more expensive than ordinary types, but the added cost is well worth their lifesaving potential.

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# PROTECTING YOUR EQUIPMENT FROM LIGHTNING STRIKES

Because electrical, cable, and phone services all come in on overhead wires, they can act as an antenna for lightning. So, it is important to have adequate grounding capacity to dissipate the surge into the earth. If you have had a new service panel installed in the past ten years, you should have two grounding rods installed outside. Older panels may only be grounded by one rod – or have no outside rod at all – so you may want to add additional rods for protection.

Inside the telephone interface box, there is a lightning arrestor on the company access side. To protect your phone lines, connect a 10-gauge or heavier wire from the arrestor to the ground rods for your electrical service panel. (You may have to contact your phone provider to get into that side of the box.)

And, while you're at it, install a coax grounding connector on the TV cable on the outside of the house and route a wire to the ground rods. The whole idea here is to divert any surges directly to the earth instead of allowing them to come into the house.

Finally, you might consider a whole-house surge suppression unit that mounts into the service panel. They are designed to protect all of your household appliances and electronics from all voltage spikes besides lightning. These units retail for $120 to $150. Not a bad idea, considering what it could cost to replace all your appliances.


*Surge suppression unit*

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# CEILING FANS

Whether you're looking to cool your house in summer or to create the look of a tropical plantation, a ceiling fan can add both style and function to your room. There are many different models available – four blades or five, a variety of finishes, and fans with or without light kits. Most offer several speeds and a reversing switch to change the direction of the airflow. More expensive models may include wireless remote controls, dimmer switches, and other features.

When selecting a fan, pay attention to the fine print on the carton. If you want a fan with a light, make sure the model you choose has a light kit included. (Trying to buy a compatible light kit may not be easy.) With ceiling fans, price usually indicates quality; cheaper models are likely to have a noisy motor, wobbly fan blades, and a shorter life span. Make sure, however, that you're not paying a premium for a designer "look" or features that aren't important to you.

The first step is to determine the size fan you will need. As a general rule, you should get a 36" fan if the longest wall in your room is 12 feet or less; a 42" fan if that wall is 12 to 15 feet; and a 52" fan if the longest wall is 15 to 18 feet. The fans blades should be at least seven feet off the floor, and the blades must be at least 12" from the ceiling (18" is better). You can choose a "ceiling-hugging" model without a down-rod for a room with lower ceilings.

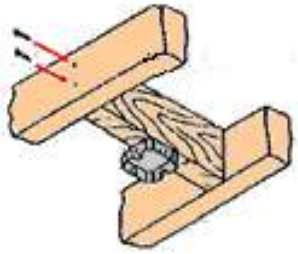
Manufacturers generally include assembly and installation instructions specific to the model you have purchased. Regardless of the fan you will be installing, however, you should think about how the fan will be secured to and supported in the ceiling, and how it will be connected to the electrical wiring – especially when installing it in an older home.

Before you begin, turn off all power to the circuit by pulling the fuse or tripping the circuit breaker. (Never assume that turning off the switch will guarantee that there is no current; sometimes, switches have been incorrectly installed on a neutral wire, leaving the other wire "hot" even when the switch has been turned off.) If you are not certain that you have shut off the correct circuit, be safe and turn off all power to the house at the service panel.

**Mounting the Fan**

If you are replacing an existing light fixture, especially in an older home, be aware that the ceiling-mount box for the light may not have been secured to the wood framing; in fact, the box for a lightweight light fixture may only have been attached to the ¼" lath behind the plaster. It's important that you replace the old box with a metal junction box able to support the weight of the motor and the vibration of the moving blades.

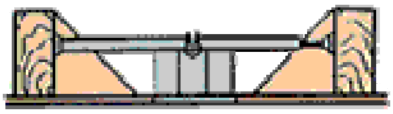
If your fan weighs 35 pounds or less, you can use a special electrical box approved for ceiling fans or ceiling suspended "paddle" fan installation, nailed to the side of a ceiling joist. For fans heavier than 35 pounds, you'll need to support the fan independently of the electrical box. If you have access to the attic above, you can add a 2" x 4" wooden header (brace) nailed between two joists, and nail the junction box to it.



*Fixture box attached to wooden brace*

*(continued)*

As an alternative, you can install an expandable metal ceiling fan hanger bar through the rough opening. (If your model will have a decorative ceiling cover against the plaster, you can usually enlarge the hole to insert the bar, since the opening will be hidden by the canopy. Metal teeth at either end of the bar secure the bracket in place between the floor joists. An electrical box, which generally comes with the hanger kit, is then attached to the bracket; with most bars, the box can be positioned at any point along its length, so your fan can be located at the desired spot in the ceiling.



*Ceiling fan hanger bar*

If you have a beamed ceiling, you'll need special mounting hardware to install the fan. There is one type for a horizontal beam, and another type for a sloping beam. You may need an extender to ensure that the fan has sufficient clearance.

**Connecting the Fan to the House Wiring**

With old knob-and-tube wiring, you won't be able to power the fan and the light separately; you will have to use the pull chains on the fixture to turn the light on or off and to change fan speeds. (Some people purchase a fan with remote control for that reason.) If you are not sure which of the existing wires coming into the function box is the "hot" wire and which is the "neutral," turn on the power to the circuit just long enough to use an electrical tester, and then turn the power off again. Attach the black "hot" wire that powers the fan and the "hot" wire that powers the light (usually blue, but sometimes another color) together in a wire nut with the "hot" wire in the junction box. Attach the white "neutral" wire from the fan to the "neutral" wire in the junction box. Because there is no ground wire on the knob-and-tube system, put a wire nut on the end of the ground wire from the fan and coil it up in the junction box.

If you wish to operate the fan independently of the light, you will need to run a 3-wire cable between the fixture and the junction box, and mount a double switch in the box. Similarly, if you are installing a fan where there is no existing light fixture, you'll need to run wires from the service panel or a nearby circuit to the junction box holding the fan and run a switch leg to a wall switch. (If you run a new circuit to the junction box with a ground wire, connect it to the grounding bracket on the fan and to the fan itself, joining all three wires in a wire nut.) Depending upon the way the joists are positioned, and whether the room is on the first or second floor, you may need to cut into your ceiling and/or walls to get the wires where they need to go. *The **Rewiring an Old House** handout from our Repair Library has tips on fishing wire through walls; our separate handout on wall switches may also be helpful*. And, be sure to consider how to protect your family from lead paint dust when old plaster is disturbed.

One additional note: If you are utilizing knob-and-tube wiring from an old lighting circuit, the insulation may have deteriorated around the conductors (wires). Wrap some electrical tape around the wire or purchase a length of knob-and-tube insulation fabric and run the wire through it. Be sure to use Romex clamps to secure the wires where they enter the junction box (through knock-out openings). Otherwise, the vibration of the fan can, over time, cut through the surrounding insulation, creating a shock and fire hazard or shorting out the circuit.

**Assembly**

Since fan assembly varies from brand to brand, it's important that you follow the manufacturer's instructions for putting the parts of your fan together. Once you have everything in place, turn the power back on and test the fan. If the fan wobbles when it runs, the blades may need to be balanced. This involves a bit of trial and error. You can interchange two of the blades to see if that solves the problem. If not, you may need to determine if one or more of the blades is lighter in weight than the others and attach a small object to the blade(s) to equalize their weight. Some fans include small weights that can be attached to the blade; if not, try taping a pencil eraser or small amount of modeling clay to the top center of the blade(s) until the fan runs smoothly.

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# BATHROOM EXHAUST FANS

If your house is like most, you're waging a constant battle against mildew, condensation, peeling paint and wallpaper, and other problems caused by excess moisture in your bathroom. The most effective remedy is to install an exhaust fan that will draw the water vapor produced by your shower to the outside. The vapor will be exhausted through a pipe made of rigid or flexible metal or plastic to an exhaust vent mounted on the roof or, occasionally, on an exterior wall. (*Never* exhaust water vapor into an attic or crawl space, as major structural damage and/or health issues can result.) If you don't already have a fan in place, you will need to purchase an exhaust duct kit, in addition to the new fan.

The first step is to determine the kind of fan that will meet your requirements. It's important that the fan be strong enough to exhaust all the water vapor in the size bathroom you have. According to the Home Ventilating Institute, you can compute how powerful a fan you'll need by calculating the cubic area of your bathroom (length x width x height), divide by 60 (the number of minutes in an hour) and multiply by 8 (the number of recommended air changes in an hour). For an average-size bathroom, the minimum requirement is 80 cfm, but if you have one of the larger bathrooms sometimes found in older houses, you'll need a more powerful model. Remember, though, that it doesn't hurt to get a stronger fan than the minimum required; a better quality fan will generally move more air than a model of lesser quality.

You should also consider how noisy the fan will be when it is running. Better quality fans will emit 2 to 3 "sones" (a measure of sound level), while less quiet models may emit more than five sones. Check the packaging of the fan you are considering to identify its noise level.

The exhaust fan is generally surrounded by a metal housing. You should install it in a central spot, near the shower area, at the high point of the ceiling. Unless you are replacing an existing fan, you'll need to cut a hole in the bathroom ceiling to mount the fan body. Try to install the fixture where you can fasten it directly to a ceiling joist. If this is not possible, attach a wooden brace between two joists as a support for the fan housing, or use the special hanger that comes in some kits. Remove any insulation from the area where you will be mounting the fan, and, if you are replacing a light or an old exhaust fan, turn off electrical power to the circuit and disconnect the old fixture. Hold the fan housing against the ceiling and trace around it to define the hole to be cut; drill pilot holes at the corners and use a drywall saw or jigsaw to cut between them. The fan housing will cover any small imperfections in your cut, but too loose a fit will lessen the insulation value around the duct pipe. Secure the fan body in place.

If you are replacing an existing light fixture with a light/fan combination fixture, you can just enlarge the hole in the ceiling to accommodate the fan body and then use the wiring already in place to operate the new fixture. The fan will operate whenever the light is turned on. If you wish to operate the fan independently of the light, you will need to run a 3-wire cable between the fixture and the junction box, and mount a double switch in the box. If your fan unit has a heater and/or timer, the wiring will be more sophisticated. In either case, follow the instructions from the manufacturer.

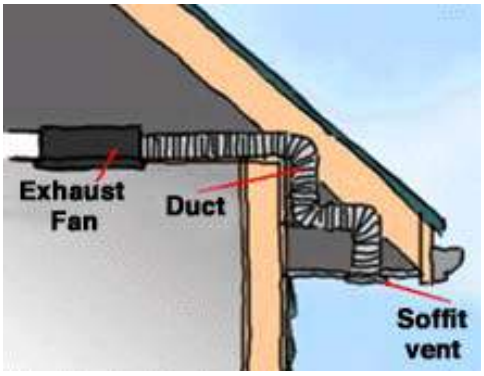
Depending upon the way the joists are positioned, and whether the room is on the first or second floor, you may need to cut into your ceiling and/or walls to get the wires where they

*(continued)*

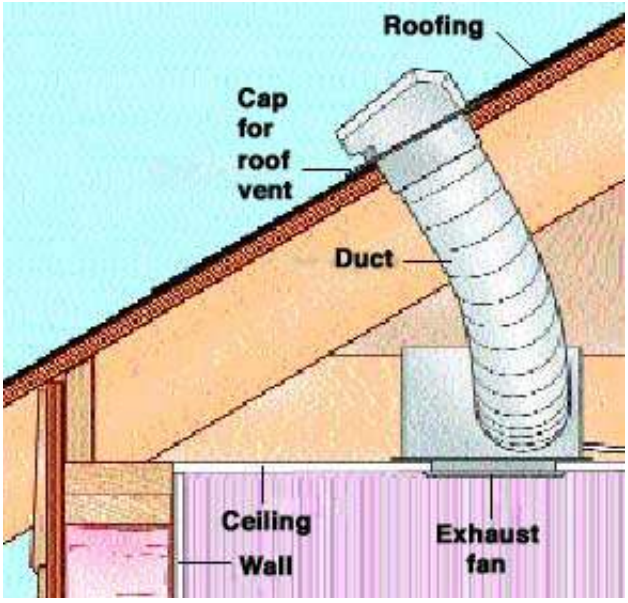
need to go. *The **Rewiring an Old House** handout from our Repair Library has tips on fishing wire through walls; our separate handout on wall switches may also be helpful*. And, be sure to consider how to protect your family from lead paint dust when old plaster is disturbed.

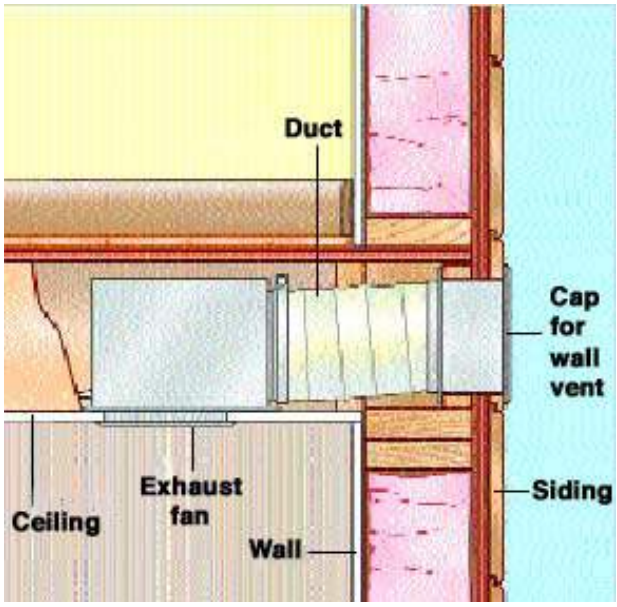
In addition to securing the fixture in the ceiling and completing the wiring, you'll need to connect the exhaust duct to the fan housing. Secure it around the vent shroud on the fan body with at least one screw or, if you are using flexible plastic, with dryer vent clamps. Replace the insulation, following the manufacturer's instructions about how far away it must be kept from the fixture; fans that have lights or heaters may require you to add dams to keep the insulation away from the heat source. Then, install the grill cover on the fan unit in the bathroom ceiling.

It's easiest to run the exhaust duct to the nearest soffit; by venting it under the overhang of the roof, you can prevent rain, snow, or debris from getting into the vent pipe. Cut a hole in the soffit according to the directions in your exhaust duct kit, and mount the vent in place. If you route as much of the duct as possible horizontally across the attic, you will reduce the chance that condensation might drip back down around the fan body. It can also help to cover the entire length of the duct with insulation wrap.




If you can't run the duct to a soffit, the project will be a bit more complicated. You can install a vent through the roof, with a special cap that includes a damper.




Another option is to vent the water vapor through the wall. There are even fans designed to mount on the bathroom wall, instead of the ceiling, and vent directly to the outside through hinged dampers similar to those used for clothes dryers.

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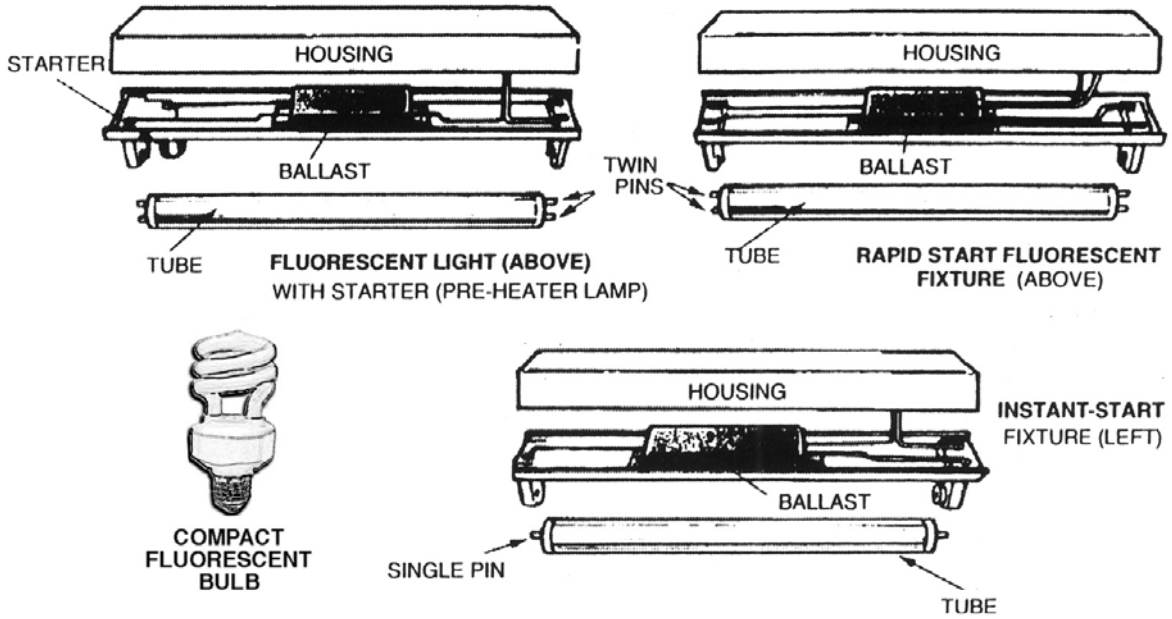
# FLUORESCENT LIGHTING

The use of fluorescent lighting has become very commonplace in do-it-yourself remodeling projects. Fluorescent lights have a longer service life, use much less electricity, and generate less heat than do incandescent bulbs. The light-to-wattage ratio is much greater, as well. This means a 22 watt fluorescent light bulb can deliver the same amount of **lumens** (a measure of light) as a 60 watt incandescent bulb.

Fluorescent lamps can be purchased with different chromaticity (perceived color temperature) values. Lamps with color temperatures of 3000 Kelvin (K) or less are considered “warm.” Those tubes with chromaticity values of 3000K to 4000K are called “moderate.” Tubes that have values above 4000K are called “cool.” Warm white tubes appear to enhance reds and yellows; cool white tubes enhance blues and greens.

There are many different types of fluorescent lighting, but all fluorescent fixtures fall into one of three categories: preheat, rapid start, and instant start *(see illustrations below).* Installation can be as simple as screwing a bulb into an existing fixture or lamp; on the other hand, a permanent fluorescent fixture will need to be hard-wired into a lighting circuit. In all cases, the fixture must be correctly wired for the light to function properly. (A fixture that is wired incorrectly often won't light up.)




A **hard-wired fluorescent fixture** must be polarized to the circuit. That means the black wire on the ballast must connect to the hot wire of the lighting circuit (usually a black wire), and the white wire on the ballast must connect to the neutral circuit (white) wire. The fixture housing should be grounded for the fixture to light reliably.

*(continued)*

A **compact fluorescent lamp** (CFL) is a bulb that contains a miniaturized fluorescent tube packaged into an integral ballast screw base. These bulbs can be installed into nearly any table lamp or lighting fixture. A common style has a spring-shaped tube, but other bulbs have a long u-shaped tube. Also, there are floodlight bulbs for exterior use or for recessed ceiling fixtures. Some u-shaped fluorescents are of the “modular” type, having separate bulbs and ballasts that can be replaced individually.

CFL’s are being promoted as energy-saving alternatives to incandescent bulbs, as CFL’s use about one-fourth as much electricity. For example, a 13-watt CFL produces the same amount of light as a 60-watt incandescent bulb (approximately 850 lumens**)** and remains much cooler. While more expensive than incandescent bulbs, CFL’s last far longer – some are guaranteed for 8,000 - 10,000 hours, while incandescent bulbs typically last 800 - 1000 hours.

Besides saving money on the electric bill, CFL’s also help to reduce pollution created by the generating plant. However, despite these benefits, there are some drawbacks to CFL’s. Compact fluorescent lamps usually do not produce full light output until they warm up for a minute or so; in an outdoor fixture in cold weather, a CFL may take even longer to warm up fully and, when first started, may produce as little as 25 percent of its light output for several minutes. Traditionally, the light produced has not been the same color quality as incandescent bulbs, distorting the perceived color of walls and furnishings (although the newest models have come close to eliminating this issue). To work well, compact fluorescent lamps need to be used in lamps with polarized plugs, where the large prong on the plug is the neutral and is wired to the threaded shell of the bulb socket, and the smaller prong on the plug is the hot and is wired to the brass tab in the bottom of the bulb socket. This design allows the bulb to light reliably during its entire service life. Most CFL’s won’t work with an ordinary dimmer switch. Lastly, CFL’s are often physically larger than incandescent bulbs they replace, so they simply may not fit a lamp or fixture at all.

Caution must be taken when handling fluorescent bulbs, as they contain a small amount of mercury in the tube. If a bulb breaks, do not vacuum the debris, as the vacuum can spray minute droplets of mercury into the air. Wearing disposable gloves, wipe up the debris with damp paper towels and place it in a plastic bag. Then, wash the area with soap-moistened paper towels and place those in the plastic bag. Finally rinse the area with clean wet paper towels and place them in the plastic bag. Seal the bag closed and dispose of it in the trash. (The Environmental Protection Agency currently (as of 2008) allows homeowners to send small amounts of hazardous waste like this, as well as intact fluorescent bulbs, to landfills. For alternative disposal methods in Cuyahoga County, call the Cuyahoga County Solid Waste District at 216-443-3749.)

Fluorescent lighting is one more way you can reduce the energy costs of operating your home or business. The reduced energy use means less fuel will be burned to generate electricity, and less pollution will result from using those fuels.

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# LIGHT BULB FAILURE

Why do some light bulbs burn out more quickly than others? When you purchase light bulbs, the package generally indicates an average life expectancy for the bulbs it contains. A typical 75-watt incandescent light bulb, for example, is rated for 850 to 1000 hours. If the light is on for 10 hours a day, that means the bulb should last about three months.

There are a number of reasons why bulbs can fail sooner than expected. Most of these reasons are related to heat – a bulb in a tightly enclosed fixture will burn out more quickly than one in an open fixture, where the heat can flow away from the bulb. Recessed lighting fixtures are often covered by insulation, which may block ventilation and cause heat to build up around the bulb, shortening its life. If the average life of your bulbs is clearly less than the manufacturer's rated life, then you may have a **heat problem**.

Bulbs can also fail if the light fixture socked is corroded. Again, the problem is heat; when corrosion prevents an effective connection to the bulb base, the base heats up, leading to bulb failure. If the metal parts of the socket are not clean and shiny, replace the socket or (if the socket cannot be removed/replaced) the entire fixture.

You might also consider switching to a cooler bulb. A 13-to-20 watt **compact fluorescent bulb** will generate a lot less heat than a 75-watt **incandescent bulb** does, and the fluorescent bulbs are rated for 7000 hours and more.

**Vibration** can also shorten the life expectancy of a bulb. A filament that bounces around – in an out-of-balance bathroom or ceiling fan, in a fixture near a door that is frequently slammed, or in a room where children often jump around – will break more quickly than filaments not subject to that kind of stress You can buy special shock resistant bulbs (also called "rough service" bulbs) for this situation.

**Flickering**, which looks like a light being turned on-and-off constantly, is caused by intermittent electrical contact. It will also reduce how long a bulb will last. The flickering can be caused by a bad light socket, or a poor electrical connection somewhere in the wires leading to the light (usually right at the fixture), or a bad switch. If you can't locate the cause of the flickering, and it affects all or many lights, you could have a bad neutral connection – a dangerous situation. If your lights get quite noticeably brighter or dimmer as larger appliances (such as washing machines or dishwashers) cycle, it can be another indication of a neutral problem (minor changes in intensity are normal). If you suspect this problem, have an electrician check it out.

Lastly, though it doesn't occur much in the Heights area, you may have an **over-voltage problem**. You can test the voltage with a cheapie multimeter from Harbor Freight or Radio Shack. If you find that your voltage is 125V or higher, you should talk to the power company about it. 7 or 8 extra volts on a 120V line will cut your bulb life in half. If you have a slight over-voltage, you can buy special 125V or 130V bulbs, though sometimes they're hard to find. (Some companies sell 130V bulbs as "long-life" bulbs.) These 125V or 130V bulbs will last longer even with normal voltage, but they're not a good deal unless your voltage is high – they cost more per unit of light overall. A compact fluorescent bulb is a better option in such cases; not only will it last longer – you'll save too.

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# THREE-WAY SWITCHES

It would be mighty inconvenient to have to cross a darkened room in order to turn on the wall switch at the opposite entrance. There is also the likelihood that you would walk into or trip over something and sustain an injury. Three-way switches allow you to control lights from two locations – from two doorways to a room, from the top and bottom of a stair, from house and garage, etc.

Despite the name, three-way switches are actually two-position switches. Each switch has three terminal screws: two terminals of the same color (silver or brass), and one terminal colored bronze or black. The black terminal screw is called the "common" terminal, and the other two terminals are called the "travelers." You will note that there is no ON-OFF marking on the toggle, nor indication of top or bottom on the switches.

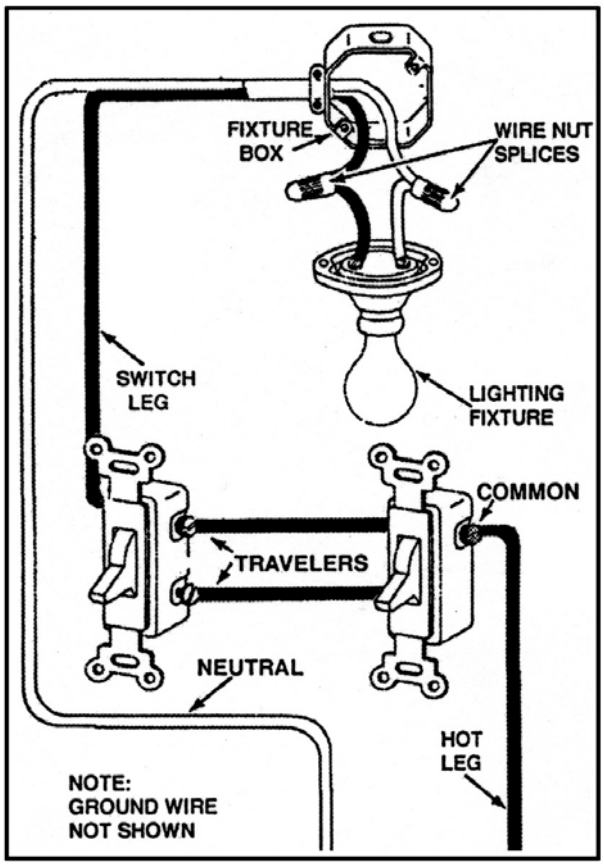



*Illustration 1*

**How They Work:**

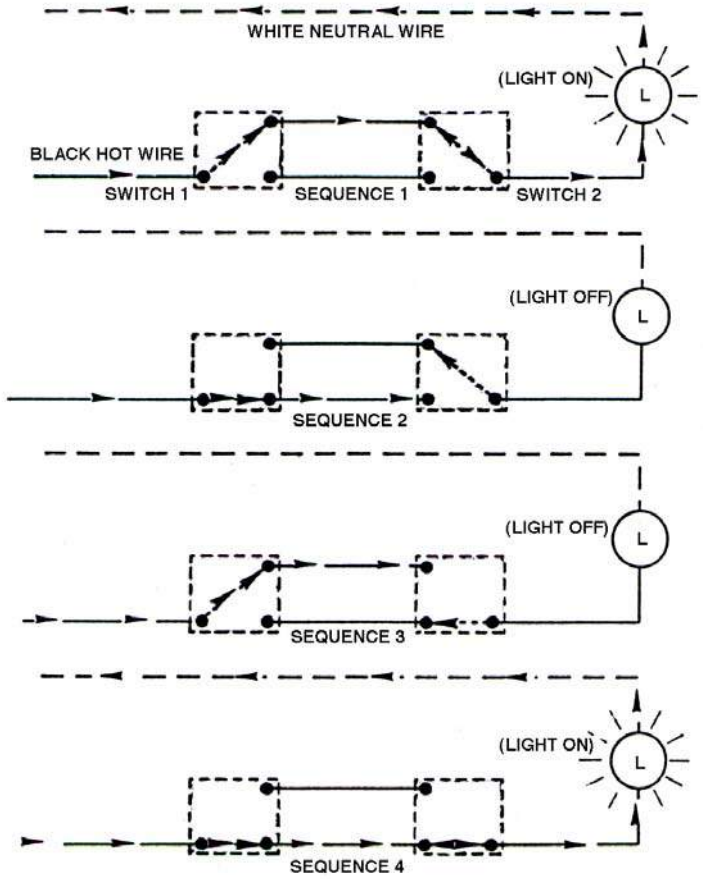
The hot (black) wire is connected to the common terminal on the first switch in the sequence. The continuation of the hot wire that runs to the light fixture is attached to the common terminal of the second switch. Two wires pass between the switches and connect to the traveler terminals *(see Illustration 1).* Changing the position of the toggle connects the common terminal to one or the other of the traveler terminals. It is the position of the connection in one switch in relation to the connection in the other switch that determines whether the fixture is on or not *(see the schematic in Illustration 2 on next page).*

Although it's possible that a problem with a three-way switch system is due to the switch having been installed incorrectly in the first place, a more common cause is a bad contact in one of the switches. As the switch is used, these contacts become pitted, dirty and corroded. So, it's a good idea to change both switches at the same time. While you are at the supply store purchasing the new switches, be sure to buy a neon tester if you do not own one already, plus a small roll of blue plastic tape.

**Troubleshooting:**

One big problem with most of the old switches is that the common terminal was not marked or indicated. In these switches, you will have to test the wiring to find which wires are hot and which are the travelers. Old knob-and-tube wiring is often all black, giving no visual clue as to which wire is hot. (The neutral wire usually isn't in the switch box).

*(continued)*




**Three-Way Switch Schematic**
*Illustration 2*

**Testing Sequence:**

Turn off the power to the circuit, disconnect the switches from the wires, and take the light bulbs out of the fixture (to minimize the chance of a “false positive” reading). Pull the wires out the switch wallboxes, making sure that they do not touch the box or contact the other wires. Hold the neon tester in your hand as shown in Illustration 3, with one probe contacting your skin. (Do not use any other type of tester than a neon one.)

Turn on the power, and touch the other probe against each wire until you get a dim glow on the tester. The glow indicates the hot wire, so you’ve found the first switch in the sequence. (Note that it may not be the switch that is physically closest to the service panel.) Use your blue tape to tag the other two wires in the box, to indicate that they are the travelers.

Shut off the power at the service panel; connect the hot wire to the common terminal of your replacement switch, and the blue-tagged wires to the traveler terminals. Turn on the power, and go to the second switch box. Test each wire until your tester glows, and tag that wire with blue tape, again indicating a traveler. Change the first switch toggle position, and then test the remaining wires in the second box until you get a glow (positive test); tag this wire blue, as well. Shut off the power, connect the blue-tagged wires to the traveler terminals of your second replacement switch, and the remaining wire to the common terminal.

Tagging the traveler wires will make it easier for you or someone else to locate them at a later date. Use better grade switches for a longer-lasting repair. You’ll enjoy the convenience of walking into a lighted room for years to come.

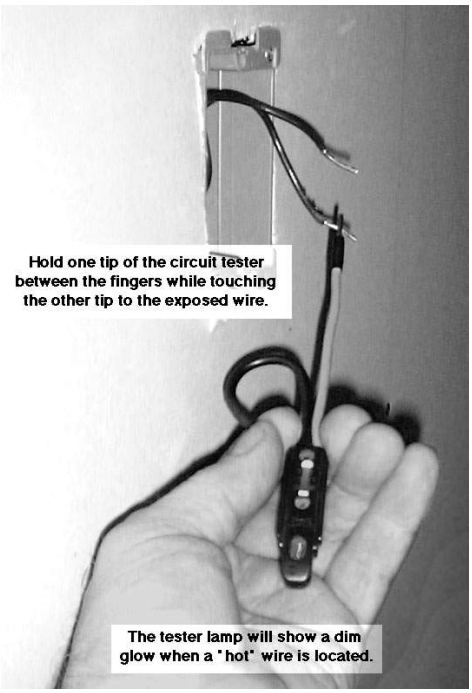



*Illustration 3*

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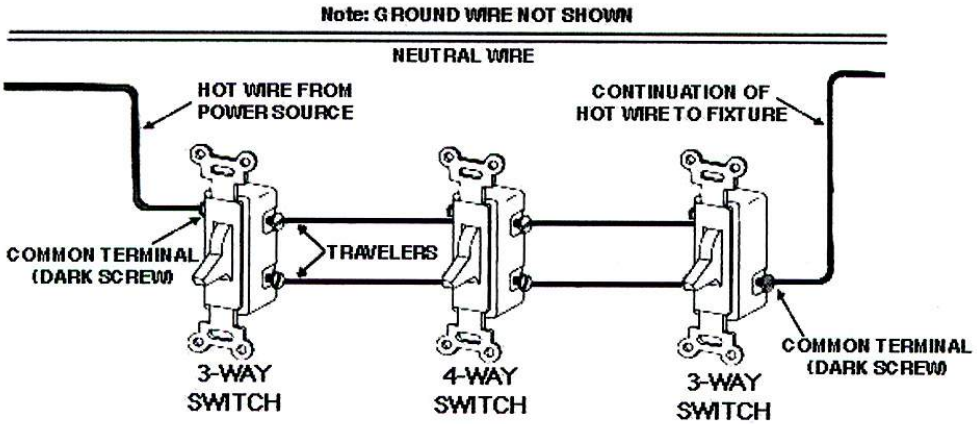
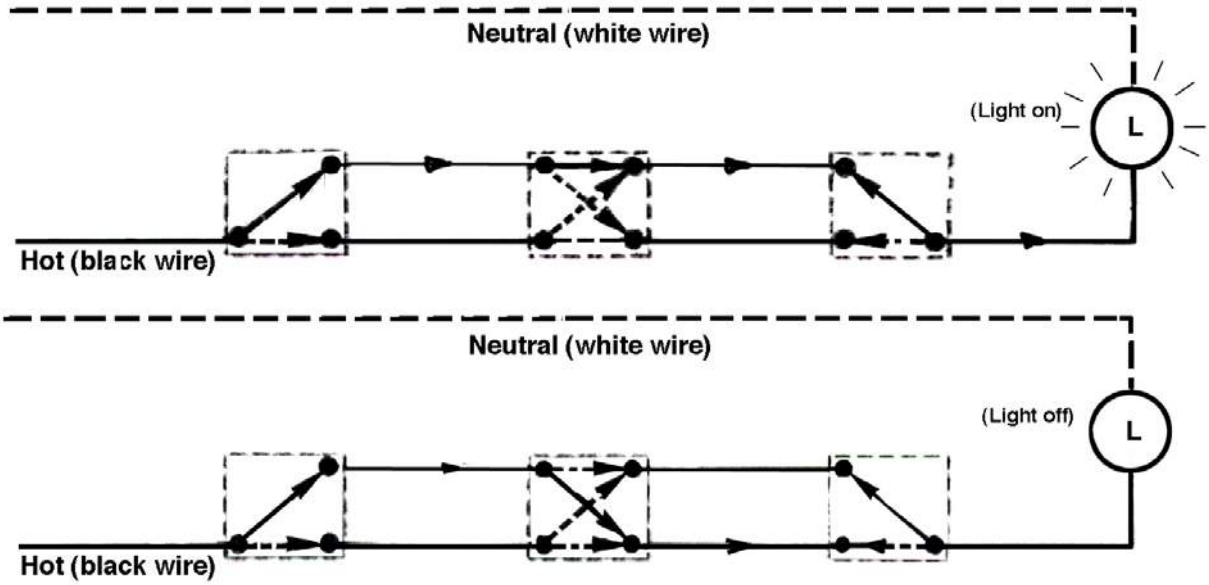
# FOUR-WAY SWITCH SYSTEM

A four-way switch system consists of three or more switches to control the same light. The system is often used in staircases to control the lighting at three different levels and in rooms with several entry points. The set-up consists of two 3-way switches and one or more 4-way switches *(see illustration below).* Notice that the switches do not control the neutral wire.




DIFFERENT MANUFACTURERS HAVE MAY OTHER COMBINATIONS OF CONNECTIONS THAN WHAT IS SHOWN ABOVE. BE SURE TO READ THE INSTRUCTION SHEETS THAT COME WITH THE SWITCHES.

The schematic drawing below illustrates how the contact points within the switches can route the electricity to the light fixture:



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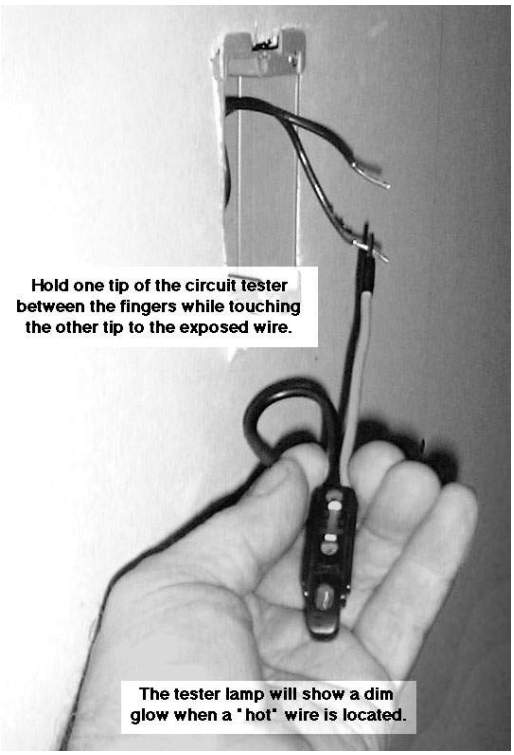
# SWITCHES AND OUTLETS

While you should have a healthy respect for electricity, you don't need an engineering degree to do some basic electrical repairs in your home. Installing or replacing a switch or outlet – whether it is part of an existing circuit or is connected to a new circuit you have run from your service panel—is a relatively simple project for most homeowners.

Outlets should be installed in a **receptacle box** in the wall. The boxes may be made of metal or plastic; they can vary in size and in how they are attached to the wall. If there is a lot of movement when you pull the plug out of an outlet, the problem may not be in the outlet itself, but rather in how it is secured to the receptacle box or how the box itself is secured to the wall. On the other hand, if the prongs of the plug are not held securely in the outlet holes, or if the outlet no longer carries electric current from the wiring to the plug, then it's time to replace the outlet.

To install an outlet, you first need to identify the wires coming to it. Whether you have the older "knob-and-tube" style or newer wiring – wire in conduit, armored cable, or wire in plastic sheathing (commonly known by the trade name *"ROMEX"*™) – you should have a **"hot" wire** that brings electrical current to the outlet and a **"neutral" wire** that continues the circuit back to the service panel. Newer wiring systems may also have a third **"ground" wire** that serves as a safety device to prevent electric shock. In old knob-and-tube wiring (which is usually ungrounded), the hot and neutral wires often look identical. In newer wiring systems, the wires are usually color-coded; hot wires are usually black, (although some may be red, blue, brown, etc.), and neutral wires are white or light gray. The ground wire will be green or bare copper.

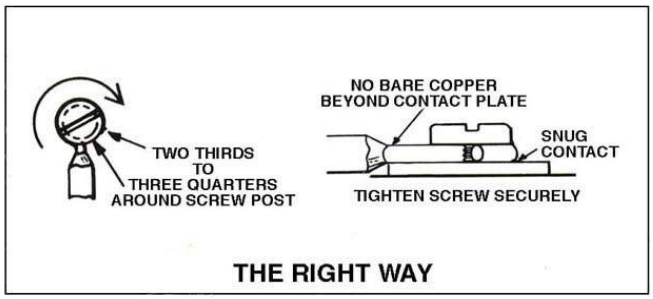
Even if you have a color-coded system, you should *always* make sure which is the "hot" wire and which is the neutral – it's possible that wiring mistakes were made previously. For testing, you can use an inexpensive **electrical circuit tester**, with two probes attached to a small neon bulb that lights up to identify the hot wire. (This test is done while power is coming to the outlet. A small resister in the tester protects you from injury from the electric current – just be careful not to touch any wires except with the tester.) Remove the outlet cover and, holding the tester as shown in the photo, touch a single probe to one of the wires, and then to the other, where each is attached to the outlet. The hot wire will produce a dull glow in the tester. Once you identify the hot wire, mark the neutral wire with a piece of white tape if it was not already color-coded.

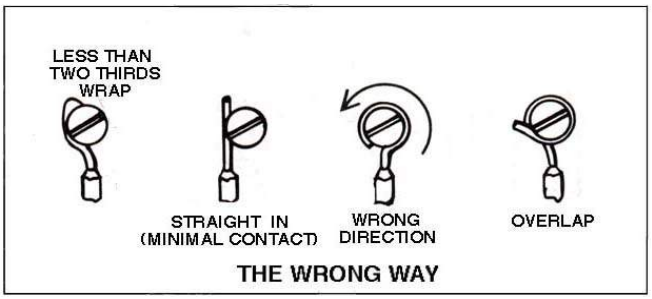



*(continued)*

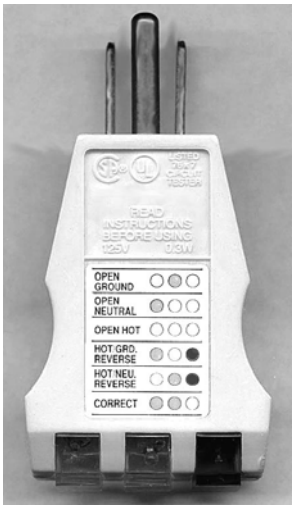
Now that you have identified the wires, turn off the power to the circuit that you're working on. Then, **test again,** to make sure that none of the wires is still carrying current. If you are replacing an existing outlet, you can now remove the mounting screws that hold the outlet in the receptacle box and pull it out. Unscrew the wires from the screws on either side of the existing outlet and discard it. (In some outlets, the wires may not be connected to screws, but may have been "back-wired" into push-in connectors on the back of the outlet; in such cases, cut the wire where it enters the outlet with wire cutters, removing as little wire as possible.)

To connect the hot wire to your new outlet, first make sure you have enough bare wire to wrap about 3/4 of the way around the terminal screw on the side of the outlet. (If necessary, use a wire stripper to remove about 5/8" of the plastic sheathing from the end of the wire.) Then, attach the *hot wire* to one of the *gold screws* on the outlet. Using needle-nose pliers, make a loop in the wire and wrap it around the screw as shown in the illustration below. (The loop should wrap clockwise, in the direction you'll be turning the screw, so that you don't unwrap the wire as you tighten the screw down to secure the wire loop.) Next, attach the white *neutral wire* to one of the *silver screws* of the outlet in the same manner. It is very important to match the right wire to the right color screw; reversing this **polarity** can damage some electronic equipment and create a shock hazard.




Occasionally, you may find two sets of wires attached to an existing outlet. Before you work on it, use a circuit tester to make sure *both halves* of the outlet are turned off – they may be connected to two different circuits (i.e., to create a "dedicated" circuit that powers just one appliance), and both circuits will need to be turned off. In these cases, the small tab connecting the two halves of the outlet will have been removed (you'll need to use your needle-nose pliers to snap off the tab on the replacement outlet); on each half, a hot wire is connected to the gold screw and a neutral wire from the same circuit to the silver screw. In other cases, the two halves of the outlet will be part of the same circuit, with the second pair of wires continuing on to the next outlet on the circuit. In this situation, there will be a black wire leading to one of the gold screws, and a continuation of the black wire leading from the other gold screw. In the same way, a neutral wire will lead to one of the silver screws, and a continuation of the neutral wire will lead from the other silver screw.




If you have a ground wire coming from your service panel, you can install a grounded outlet. The ground wire from the service panel enters the receptacle box and is then joined in a **wire nut** with additional "pigtails" of ground wire: one that connects to the green grounding screw on the outlet, and another that is secured by a grounding clip or screw to the box itself (this second pigtail is only used with metal junction boxes). If the ground wire is insulated with green plastic, the ends of the wire should be stripped before they are screwed together in the wire nut; the wire nut itself should be the appropriate size for the wire you're connecting. (Note: If you don't have a ground wire, a **ground-fault circuit interrupter** will provide some protection from electric shock – *see separate handout.* Do not install any other three-prong outlet where there is no ground wire.)

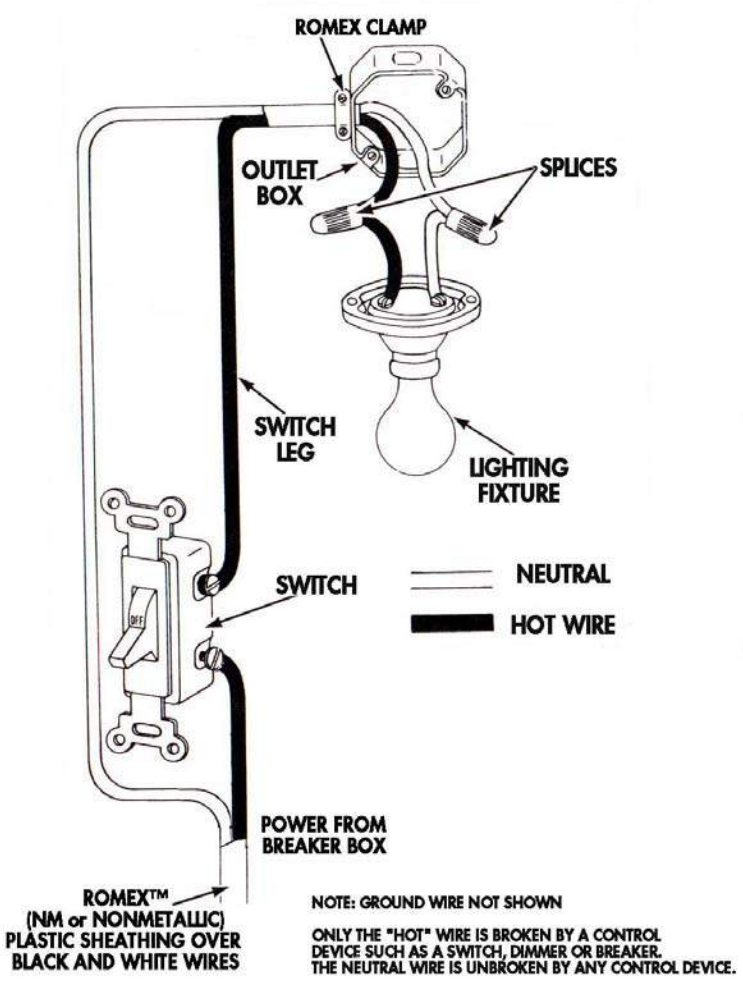
As an added measure to prevent shorts, you can finish by wrapping electrical tape around all four sides of the outlet, covering the terminal screws and bare wires. Then, neatly push the wires

*(continued)*

and the outlet into the box. Tighten the mounting screws, replace the cover plate, and turn the power back on. On a grounded outlet, you can confirm that the polarity and grounding are correct by inserting an inexpensive **three-prong circuit tester** into the outlet and checking the resulting light pattern.

Replacing a **single-pole switch**, where there is only one switch controlling a light or other fixture, is also a simple task. (It is not uncommon for switches to go bad.) Switches don't have a neutral wire – there will be a hot wire coming to the switch, and a continuation of the hot wire leading away from the switch *(see illustration);* when the switch is in the "off" position, it interrupts the flow of electricity through the hot wire to the light or outlet it controls. Some switches will also have a green ground terminal screw.

When you have removed the faceplate and identified and marked the hot wire, turn off the power to the circuit; use an electrical tester, as described above, to ensure that you have the power turned off before you continue. Then, take the old switch out of the junction box that holds it in the wall, unscrew the wires attached to it, and discard it. Attach the hot wire to one of the screws on the new switch, and the continuation of the hot wire to the other screw, making your connections as shown in the previous illustration. If there is a ground wire, attach it to the green grounding screw on the switch; if there is no grounding screw on the switch, attach it to a metal junction box with a grounding clip or screw, or, with a plastic box, to the metal switch bracket. Finally, insert the wires and the switch into the box, replace the mounting screws and faceplate, and restore power.




If you have a single-pole **dimmer switch**, the wiring is done in the same way as with traditional on/off switches. Dimmer switches should be grounded; attach the ground wire to the metal receptacle box or, with a plastic box, to the metal dimmer bracket.

Wiring **three-way switches** is a bit more complicated; you will want to see our *separate handouts* for these devices.

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# BURYING ELECTRICAL WIRING

## for garages, landscape lighting and other exterior uses

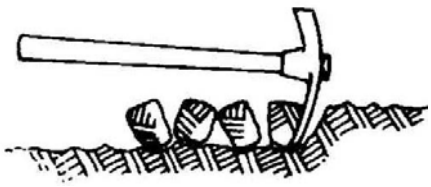
Buried wiring can be the answer to garage wires that hang too low across your back yard, as well as a way to add post lights, landscape lighting, and the convenience of exterior receptacles. Underground wiring will not be damaged by weather, wind, tree limbs or the occasional delivery truck, but – to protect children and pets from the wiring (and vice versa) – it should be buried properly.

Ohio law requires that, before beginning ANY digging project, you contact the Ohio Utilities Protection Service (www.oups.org), 1-800-362-2764. You must call at least 48 hours in advance, but no more than 10 working days (excluding weekends and legal holidays), so they can mark where the underground utilities lie on your property. Mark the path you where you plan to dig with white spray paint or white flag stakes prior to their visit. It is not unusual for natural gas pipes or other utilities to be near the surface.

By assessing current needs and future use, you can determine how many circuits to include, whether to use conduit or cable, and how heavy an amperage load to plan. Check with your community's electrical inspector for any recent changes in local rules, and obtain an **electrical permit** for this project.

Burying 120 volt electrical wiring is really not difficult; digging the trench is the hard part. Try to have as straight a path as possible from the house to the end of the trench. Be aware of the upcoming weather, as you want to dig in relatively dry soil on a fairly pleasant day. If the ground is wet, muddy, or frozen, it makes for a miserable time. A short trench (20 feet or less) can be dug in a day using hand tools, but longer trenches may call for a rented **trenching machine** to speed things up. The trench does not need to be any wider than the conduit you are burying. When digging by hand, a **mattock** is used to chop into the soil, a **digging bar** to hack roots and break rocks, and a **trenching shovel** to clear the trench. These hand tools will still be needed to clean out the trench even if you use a machine. If you place the excavated soil upon a plastic tarp that you've laid alongside the trench, you'll save the grass underneath.

If the path of your trench goes underneath a walk or driveway, you may be able to drive an iron pipe to create a passage underneath it, rather than cutting out the asphalt or concrete *(see illustrations that follow).* Large tree roots can be chopped out (although if too many roots are compromised, the tree may suffer), or it may be possible to route the wires under or through the root mass.



*(continued)*

The depth of the trench will be determined by the wiring method you use. In most cases, you'll probably use **conduit** (a hollow tube through which you run individual wires). However, if you only need a power supply (without wires to control lights from inside the house,) you can use a **direct burial cable**, placed in the soil without conduit. Known as **UF** for "underground feeder," the cable has a heavier plastic sheathing than the **Romex**™ used inside the house.

As with installing indoor wiring, there are some rules to follow. Most of the rules involve protection of the wiring from damage. The **NEC** (National Electrical Code) requires that UF cable be placed in a trench at least 24 inches deep. In most communities, you will have to leave the trench open until the inspector arrives to approve the depth. *If you are using UF wiring, lay 2"x6" treated lumber planks a couple of inches over the wire as the trench is being refilled* to prevent a shovel from piercing the wiring at a later date. Anywhere UF cable is exposed above the soil, it must be protected with conduit. All connections and splices should be done in weatherproof boxes above the soil, to keep water from getting into the connections and causing a short.

On the other hand, if you use conduit, the trench needs to be only 18 inches below the surface. Another advantage is that the conduit can carry several wires – wires to control garage lights from switches inside the house, as well as the power supply wires.

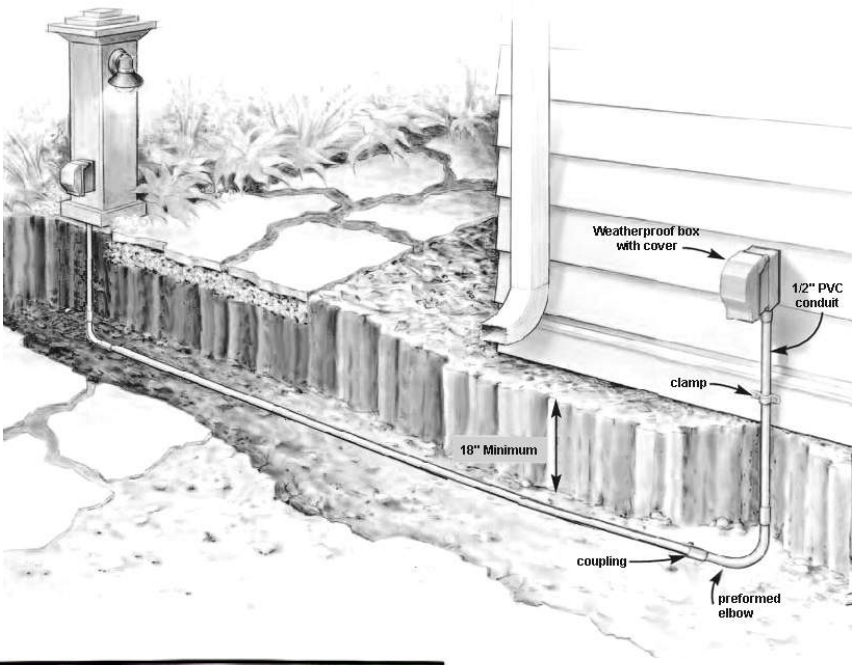
Not all types of conduit can be buried in the soil. **EMT** (Electrical Metallic Tubing) and flexible "**Raintite**" are not considered suitable for burial. Aluminum **Rigid** will corrode away in certain soils, such as clay, or in moist areas. Galvanized steel Rigid conduit requires special tools for making cuts and threading the pipe. That leaves **PVC** (PolyVinyl Chloride) conduit as the choice for most do-it-yourselfers. With PVC, you'll need only a hacksaw to cut and an utility knife to deburr it. As with other PVC projects, you simply glue pre-formed 90° or 45° ells (elbows) and fittings to the tubing using cleaner and PVC cement, as needed.

Code specified that Schedule **40 PVC** can be used underground, where the conduit passes through the house, or where it passes inside a lamppost. A thicker-walled PVC conduit (called **Schedule 80**) is required where the conduit is exposed *above grade* (above the soil) on the side of the house and/or garage. While most of the retail building supply companies sell Schedule 40 PVC, they usually do not carry Schedule 80. You will need to locate an electrical supply house to purchase Schedule 80.

Code also requires that **no** low-voltage wires be placed in conduit with 120/240-volt circuits. That means that low-voltage wires for garage door controls, intercoms, alarm systems, TV cables, low-volt landscape lighting, or telephone wires must be in their own conduit (or directly buried), although they can be laid in the same trench next to the higher-voltage conduit.

In addition to the basic code requirements, the wires and conduit you use will be determined by the distance between the service panel and the appliances to be powered. Long wire runs can result in a drop in voltage. Let's imagine that you want to build a wood project out in your yard or in a garage workshop, using a 12-amp circular saw. Even if you have a 20-amp circuit (which would normally use 12 gauge wire), because the wires are running 50 feet or more, the voltage can decrease – causing the garage lights to dim significantly *(a brown-out)* and your saw to run hot and erratically. To prevent voltage drops, use the next larger size cable (10 /2UF with ground, or 10/3 with ground for two circuits). If machines with higher current demands are to be used, consider running an even larger size cable. In addition, if you are running several circuits to your garage, you might also install a sub-panel to control them.

*(continued)*




Outdoor lighting and outlets should be on their own circuits, independent of any indoor wiring. That way, if the hedge trimmer trips the breaker, the ice cream in the freezer won't melt. In addition, **Ground Fault Circuit Interrupter** (GFCI) protection for all outdoor receptacles is required by the NEC – accomplished with an individual GFCI receptacle in each outlet box or with a GFCI breaker mounted in the service panel that protects the entire circuit. (Any electrical equipment operated outdoors should have GFCI protection to keep you from being accidentally electrocuted.)

As you progress with your project, take photos and draw a map to document where the wiring lies, to keep with your house records. When it comes time to do a new digging job, it will help to know where the hidden wiring should be.

*(continued)*

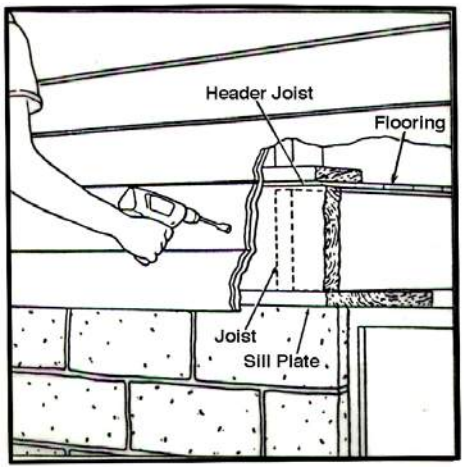



*Illustration 1: Locate* the point for the wiring to pass through the wall. Try to be 3-or-so inches away from a joist, in order to have room to mount a junction box inside the house. Use a 1/4" drill for the starter hole; it's much easier to fill with wood putty if you find it's not in the right spot. Then, use a 7/8" paddle bit to bore through the wall. If the wall is masonry, use a 7/8" masonry drill (available in a 12" length). You'll find it's usually easier to drill in at a mortar joint than into a brick

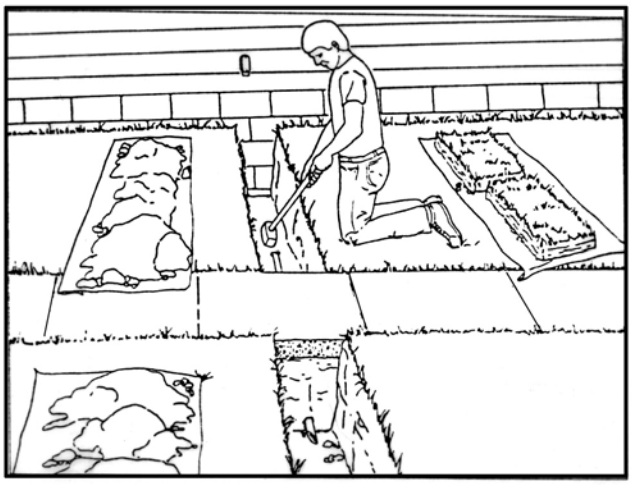


*Illustration 2:* To pass the wiring under a sidewalk block or a large tree root, drive a length of iron pipe through the soil with a sledge hammer. You will be able to pull the wiring or push the conduit through the hole after removing the pipe.

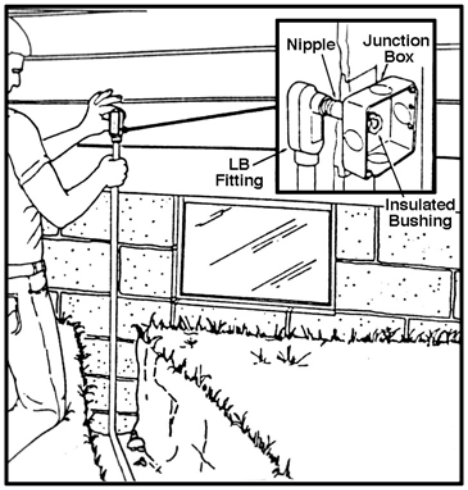



*Illustration 3:* A junction box is required wherever there is a change in types of wiring. Install one inside the house and one in the garage. Caulk around the LB fitting to prevent rain or insects from entering the siding

## Maximum Number of Conductors and Fixture Wires in Rigid PVC Conduit, Schedule 80

| Wire Type Letters | Wire Size *(gauge)* | Trade Sizes in Inches *½* | *¾* | *1* | *1¼* | *1½* |
|---|---|---|---|---|---|---|
| THHN. | 14 | 9 | 17 | 28 | 51 | 70 |
| THWN. | 12 | 6 | 12 | 20 | 37 | 51 |
| THWN-2 | 10 | 4 | 7 | 13 | 23 | 32 |
| | 8 | 2 | 4 | 7 | 13 | 18 |
| | 6 | 1 | 3 | 5 | 9 | 13 |
| | 4 | 1 | 1 | 3 | 6 | 8 |

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# IF YOUR DOORBELL DOESN'T RING...

It's annoying when a doorbell doesn't work! But you can do more than hang up a "Doorbell out of order" sign. In most cases, broken doorbells are pretty easy to diagnose and cure.

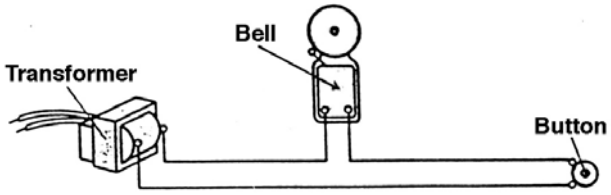
Most often the problem is in the doorbell **switch**. To check this possibility, you simply unscrew the doorbell button to get to the two wires that are fastened to the back. Touch those two wires together; if the switch is broken, the contact between the wires will make the bell ring. The current that flows through the wires is very low (10 or 16 volts AC), so you don't need to worry about getting an electrical shock.

If the switch isn't the problem, the next place to check is the **transformer**. The transformer supplies the power to the system. It is usually a small black box attached to a beam or an outlet box in the basement. This unit reduces the 120-volt current feeding the house to the 10 or 16 volts needed to run the doorbell.

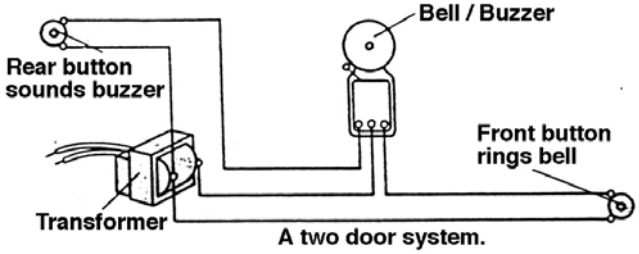
Unless you have access to a low-volt circuit tester or a multimeter, the only way to tell if the transformer is the problem is to replace it. To replace the transformer, shut off the electricity to it by removing the fuse or shutting off the breaker for that circuit. If you don't have a circuit tester to make certain the current to that line is off, shut off all the power in the house to be sure. Remove the old transformer and connect the new one the same way the old one was wired.

If your bell doesn't ring even after you've installed a new transformer, the next thing to check is the doorbell itself. You can buy a cheap **bel**l and connect it in place of your present doorbell. While the bell unit isn't the cause of most doorbell problems, it can fail on occasion – especially if it is hung over the stove, where grease can clog it up. Dust, smoke, and grease can collect on chimes and obstruct the hammer mechanism.

If you replace the bell but it still doesn't work, the only other place to look is in the **wires** that make up the doorbell circuit. Because these wires are very thin, they can break. But, if this is indeed the problem, it will take some tracking to find where the wire is broken. The wires are a little larger than fishing line, and you should be able to see them in your basement ceiling. However, breaks are usually found behind one of the door trim pieces. Once you've found the location of the break, you don't have to replace the whole length of wire – just the part that is broken. Twist the new portion together with the unbroken length and tape with electrical tape.



A single door system.



A two door system.

If you keep in mind that you are working with low voltage (except near the transformer), that you will pay a fairly low cost for any replacement parts, and that 95% of the work is inside the house, then making your doorbell work again is a job that can be done in any season. Of course, there's another option that some people prefer – a "wireless" doorbell. Whichever solution you choose, you'll no longer need that "Doorbell out of order" sign on your door!

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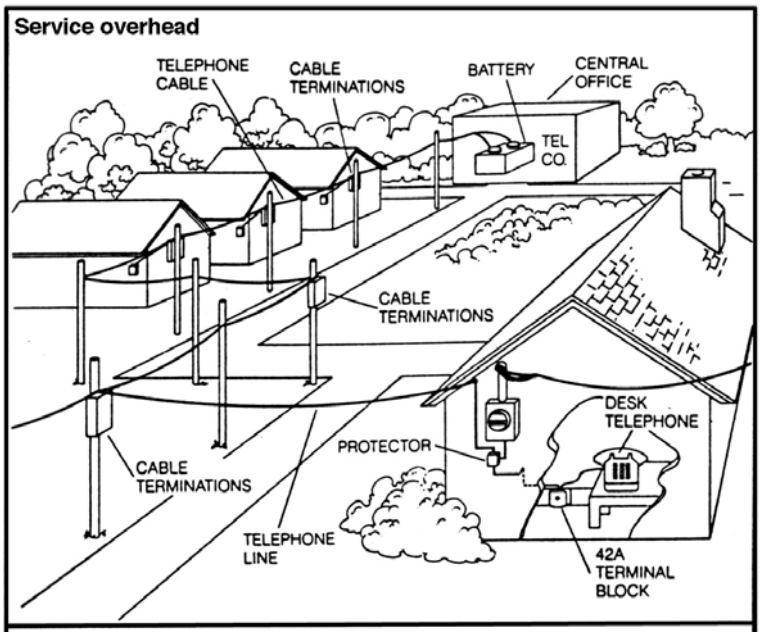
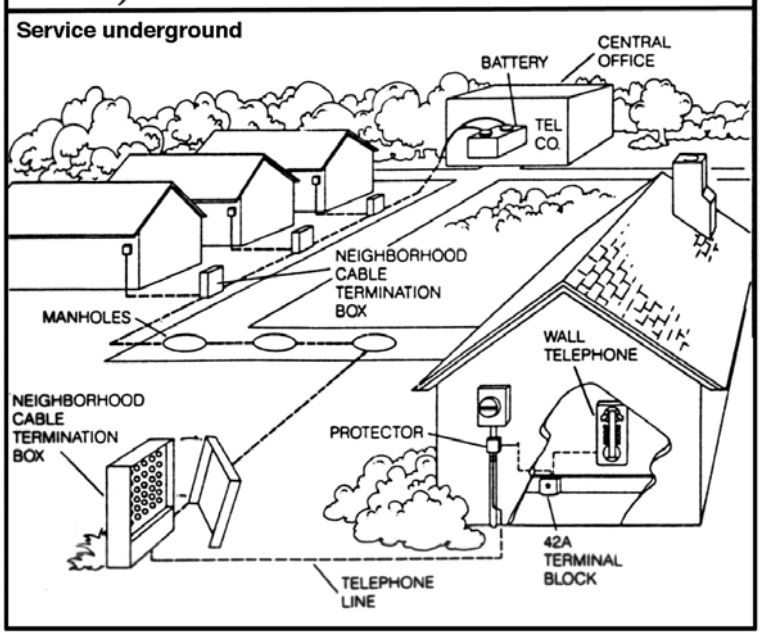
# UNDERSTANDING YOUR PHONE LINE

It's hard to believe that, before July 1977, it was illegal to work on the phone service in your home. All wiring and equipment was considered the property of the local phone company. You were not permitted to hook up specialty phones or any device that was not owned by the phone company. Service employees of the phone company were the only people allowed to do any of the installations of equipment and wiring.

Things are different now. Most people purchase and install their own phones rather than paying monthly for equipment rental. Any wiring and equipment from the service protector box is now considered the homeowner's responsibility. The cost of a service call to a residence (unless you pay a monthly fee for a maintenance plan) can be quite expensive. It makes sense to learn to do some simple line work yourself.



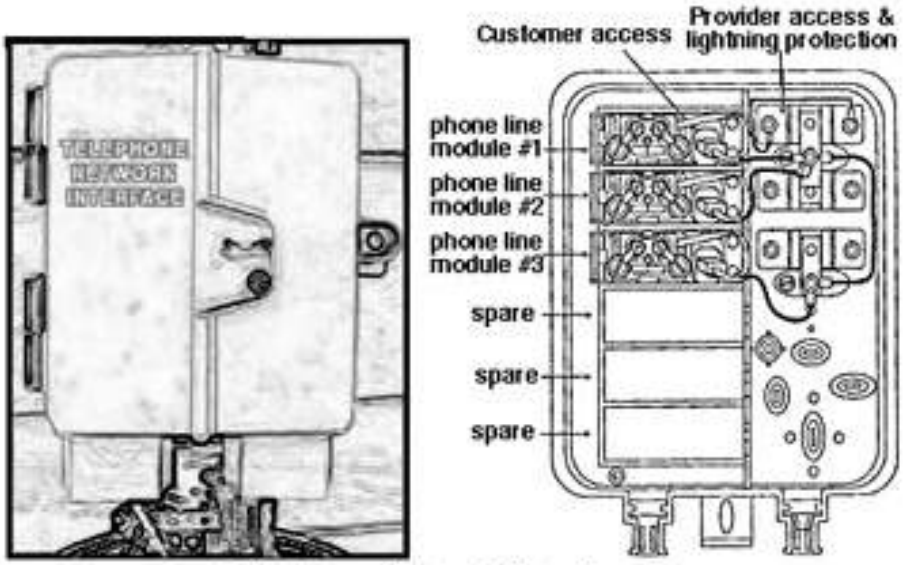




A single-line telephone system is pretty simple. Two wires, bundled with others in a cable, come from the local exchange building. These wires, whether strung on poles or buried underground, are usually attached to a grounded lightning protector before entering the house. Once inside, the wires are grouped in a thin cable with red, green, yellow and black conductors. The red wire is called the “ring” wire, and the green is called the “tip.” The yellow and black wires are not used in a single-line service, unless there is a need to power a dial light on an older phone; then, they are wired to a transformer.

The voltage on the line when you pick up the phone and hear the dial tone is 48VDC (direct current voltage). When the phone rings, a low-amperage 90 to 115VAC charge (alternating current voltage) is being sent across the wires. This ring charge can give you a stinging (but non-lethal) shock, so you need to be careful when working on your system. It's a good idea to take a handset off the hook while working on the line or equipment, and ignore the recorded warning message.

*(continued)*

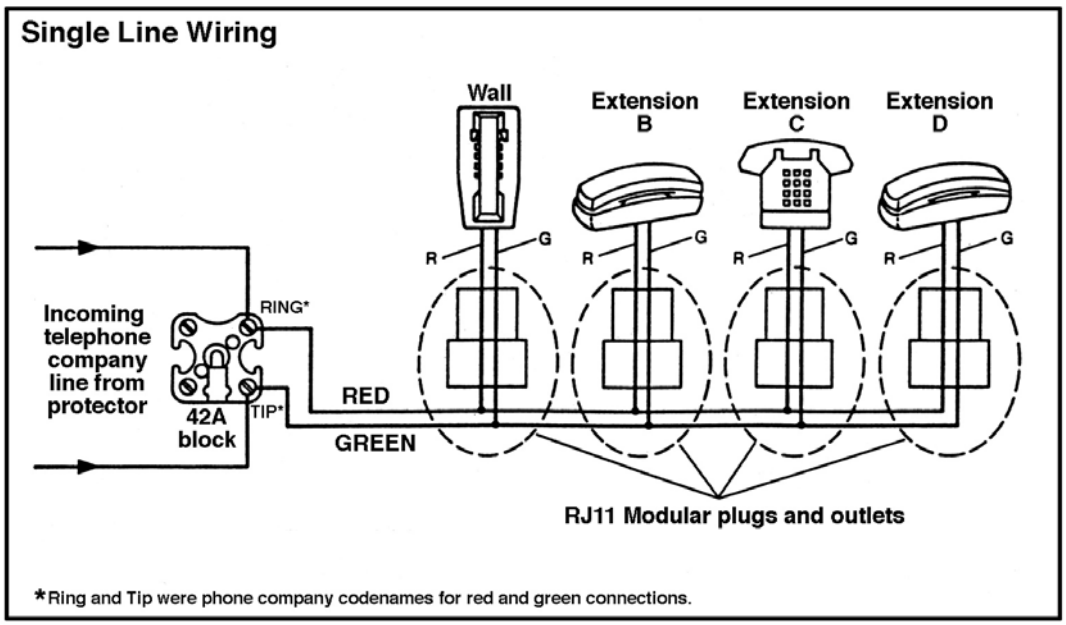
Extending the phone lines and adding wall jacks are the most common changes that homeowners want to make to their phone system. The easiest way to start is to extend the new wire from an existing wall jack. There is generally a cover over the terminal block (42A) that can be removed with a single screw. Connect the four wires in the new cable to the terminal screws on the block by looping the wire under the appropriate screw (the new red wire to the “R” terminal, the new green wire to the “G” terminal, and so forth.)




Telephone Network Interface Box

The new cable can be run along the top of the baseboard, under the baseboard, between the baseboard and carpet, or through the walls. Connect the new jack to the cable in the same way that you connected the cable to the terminal block. Jacks for desk phones are usually located along the baseboard; to install a wall phone, run the cable to the wall plate up through the stud cavity and bring it through the wall at the appropriate height (approximately four feet). Then, just plug in your new phone.

Wall jacks for computer modems are installed much the same way. Two-line phones are a bit more complicated, but are well within the ability of the average person to install. You can probably find additional information and wiring diagrams for home telephone systems in your local library.



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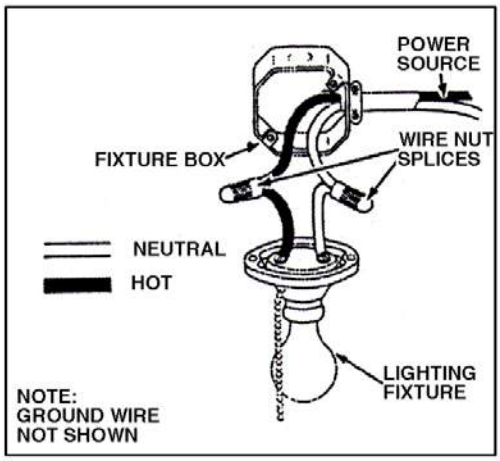
# REPLACING A PULLCHAIN
## with a Wall Switch

You walk into the dark bedroom trying to feel for the pullchain that will turn on the ceiling light; in the dark, you stub your toe against the footboard of the bed. Descending into the dark basement, you can't locate the pullchain; instead, you take a little trip on Junior's skateboard. You can end all that by installing a wall switch at each entrance to the room, to replace the pullchain on the light fixture.

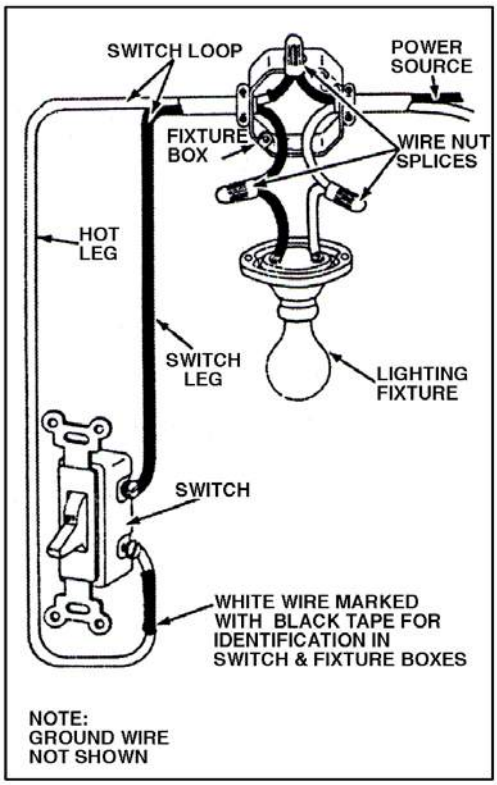
In new home construction, you'll see that even closets have wall switches for the overhead lighting. That was not the case for housing built in the dawn of the electric age. Bedrooms, bathrooms, basements and kitchens were often wired just to the ceiling fixture workbox (if there even was a box), to save labor and material costs. Almost immediately, this design became a health and safety issue. The **NEC** (National Electric Code) was eventually changed to require that wall switches be placed at the entryway of each room.




In many communities, including Cleveland Heights, it is required that wall switches be installed in all traffic and living areas (unfinished attics and closets are exempted) before you can sell your home.

**Tearing into walls**

Depending upon the way the joists are positioned, and whether the room is on the first or second floor, you may need to cut into your ceiling and/or walls to get the wires where they need to go. Read the **Rewiring an Old House** handout from our Repair Library for tips on fishing wire through walls. (If you are hiring a contractor to do this job, discuss whether wall repair will be done by the electrician, or if you will need to hire someone else for that part of the project.) And, be sure to consider how to protect your family from lead paint dust when old plaster is disturbed.




The wall switch should be positioned near the entrance door, about 48 inches from the floor. The switch must be contained in a metal or plastic box. (There are several types of boxes, which differ primarily in the way they are mounted in the wall. If possible, position your box next to a wall stud, so you can use one of the styles that is nailed or screwed to the stud. Depending on the type of wall material you have, you may find it helpful to use a box that adjusts in depth or one that has a "mud ring" on it to raise the switch to the level of the surrounding wall surface.)

*(continued)*

**New wiring**

The first thing you must always do is to shut off the power from the fuse box to the fixture. *Test the wires with a circuit tester* to ensure that the electricity is off before starting to work on the circuit. The black wire in the box holding the light brings power to the fixture. The purpose of the switch is to interrupt that power supply when you don't want the light on. To do that, you create a switch loop, which runs from the power supply down to the switch box and back up to the light fixture.

If you want to have multiple switches at different locations that control the same fixture (at the top and bottom of a stairway, for example, or at each entrance to a room with more than one door), the wiring will be more complex *(see separate handout on "Three-Way Switches.")*

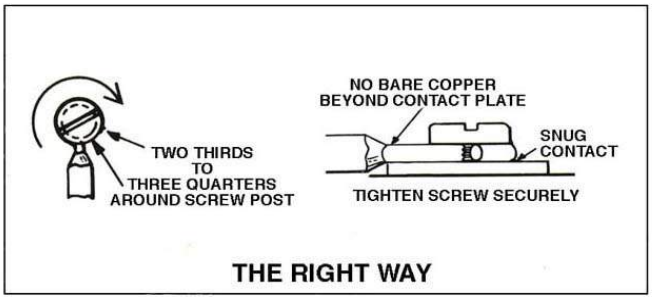
While most older houses were wired with 14 gauge knob and tube, for the switch loop use 12 gauge NM (nonmetallic sheathed cable), commonly referred to as Romex™. The cable contains a black wire, a white wire and a bare wire. Ordinarily the black wire is "hot," the white wire is "neutral," and the bare wire is "ground." For this job, the white wire in the switch loop will also serve as a hot wire, so it should be "tagged" (marked with black tape) in the fixture and switch boxes *(see lower illustration on previous page).*

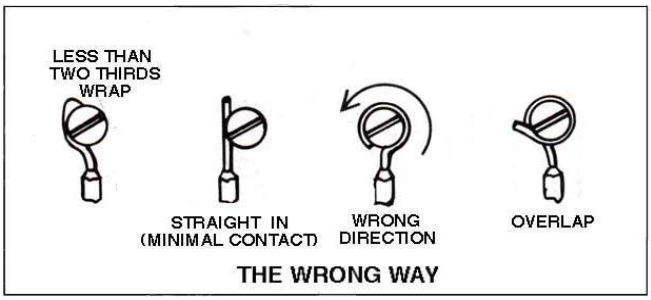
After you have run the Romex from the fixture to the box that will hold the wall switch, it is time to connect the wire to the fixture and the switch. Strip 5/8" of insulation from each wire. In the junction box holding the lighting fixture, attach the black "hot" wire from the power source to the white neutral wire of the switch loop (the one you "tagged" with black electrical tape in the fixture box and the switch box) with a correctly-sized wire nut. Next, attach the black wire of the fixture to the black wire of the switch loop with a wire nut. Then, attach the white "neutral" wire from the power supply to the white fixture wire. Finally, even if the fixture box is not grounded, attach the bare wire to the boxes. (Later on, the house may be rewired and there will be one less place to run a ground wire.)

At the switch, use your wire cutter to create a loop in the black wire. Place the loop under one of the screws on the switch, and tighten the screw down on the wire. (If you position the loop so that it goes in the same direction that the screw tightens *(see illustration below),* the wire is more likely to stay in position.) Connect the white "tagged" wire to the other screw in the same way.

Turn on the power to the circuit, and test to see if everything works. If so, compress the wires into each box and screw the switch and fixture in place.

The final part of the job is to repair the walls that you had to tear open. *(If you will be doing this job yourself, see separate handout on "Plaster and Drywall Repair.")*



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### Things to Consider when

# RE-WIRING A KITCHEN

1. Use 12-2 Romex wire with ground.

2. All Romex must be concealed in the wall. It cannot be run openly in the room.

3. Each piece of Romex must pass through its own hole in a stud; two or more pieces cannot share a hole.

4. When passing Romex wire through a wall stud, the wire must be at least 1-1/2" below the surface of the finished wall. If the wire is not that deep, you must cover it with a protective metal plate to prevent nails from accidentally being driven into it.

5. For ease in connecting wires, use large junction boxes whenever possible. Boxes with plaster rings will allow you to adjust the depth of the box in the wall.

6. All new electrical work must be grounded.

7 All outlets above the countertop must be protected by ground fault circuit interrupters. (One GFCI can protect multiple outlets, depending on how the circuit is run.)

8. An electric stove must have its own 240-volt circuit. The refrigerator, dishwasher, and garbage disposal must each have its own 120-volt circuit. It is recommended, but not mandatory, that a microwave also have its own 120-volt circuit.

9. Outlets must be placed within a 2-ft. reach all along the counter.

10. Lighting should be on a separate circuit from the outlets. The kitchen must contain at least two countertop appliance circuits. Where two outlets are installed next to each other, put each on a different circuit. If you install only one outlet, put the top plug on one circuit, and the bottom one on another circuit.

11. For safety, plan your lighting so that it shines directly down on the counter and illuminates your work areas. Light from behind you will cast shadows on your work.

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# 12.
# General Exterior Carpentry

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# INTRODUCTION TO CARPENTRY:
## All About Wood

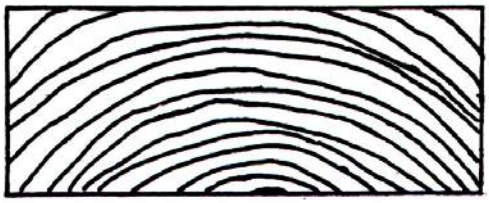
Wood is among the most versatile building materials in the world. Besides its inherent beauty, wood has a much higher ratio of strength to stiffness than iron, steel, or concrete. With your hands and some tools, you can form wood to create anything that your mind can conceive. But, before you can start down the road to calling yourself a carpenter, you need to know a few things about the material with which you'll be working. Understanding wood will make it easier for you to work with it, and will give you better results when finished.

Wood has several properties that you need to be aware of. First, there is a certain amount of moisture in all wood. Since wood is porous, it will absorb additional moisture, given a chance. As wood adds or sheds moisture, its dimensions will change. As a result, the wood will push towards or pull away from where it is attached.

Second, as the sun or other heat sources evaporate the moisture in wood, the wood has a tendency to warp, buckle, or cup – all terms for the uneven way in which wood can twist as the moisture is dried from it. To help keep this from happening, store wood out of the sun and away from other sources of heat, until it is used and fastened into place. You should also prevent it from absorbing as much moisture as is practical. It's as bad to lay wood directly on the ground or leave it out in the rain as it is to expose it to the direct sun. As little as one day under any one of these extremes can be enough to permanently affect the wood – and often make it unusable.

There are several ways to minimize the chances that a piece of wood will warp, split or chip:

1) As you look at the end of a board, you will notice a series of rings. These are the growth rings of the tree from which the board was cut *(see illustration).* If you nail the board in place with the rings pointing down, the board will be less likely to cup.



**Growth rings pointing down**

2) Nailing close to the end of a board tends to split it. You can usually avoid this by turning the nail over and blunting its end with a hammer.

3) When cutting a board, put the side that you intend to see down, and cut from the back of the board. That way, the board will not chip or splinter along its face as much.

4) Where it is important to maintain a tight joint without a gap between pieces of molding or other wood, use some white glue on the edges to be joined.

5) And finally, seal wood with paint, sealer, or varnish where applicable, to help stabilize its moisture content and maintain its dimensions, regardless of the environment.

*(continued)*

For some carpentry projects, you may use plywood – a versatile form of wood made by gluing several thinner layers (“plies”) of wood together. The direction of the wood grain alternates in each layer, resulting in a sheet of wood (usually 4’ by 8’ standard) that is resistant to splitting when nailed through. Plywood comes in varying thicknesses, from 1/8” to 1”. Although there are probably a hundred or more types, you will most likely use the three or four most common to a home. The basic differences are:

1) The number of layers that make up a sheet. 1/2”-thick plywood can be made of 3 to 5 layers, and still be 1/2” thick. The more layers used, the stronger the sheet produced, and the less likely it is to warp.

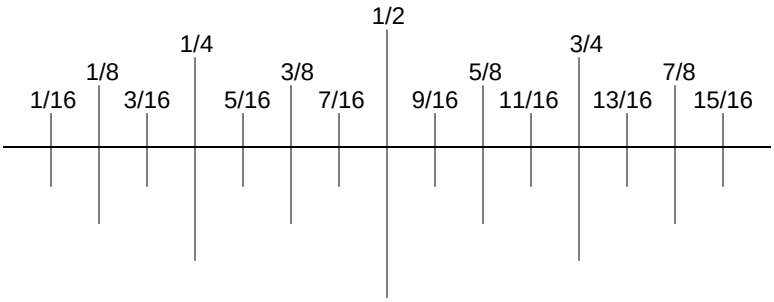
2) The glue used. Plywood is designated “exterior” or “interior,” depending on the glue that bonds the layers together. Use exterior plywood *inside* in high-moisture or water-prone areas, to prevent the layers from ungluing ("delaminating").

3) Rough or smooth finish. Each side of the plywood can be rough or smooth, so you can have any combination: two smooth sides, two rough sides, or a rough and a smooth. The price goes up with the number of layers and with the quality of smoothness.

Making wood work for you depends on your ability to cut it accurately. To do that, you have to be able to mark and measure it accurately. The basic unit for measurement in woodworking is one inch, usually divided into 16$^{th}$s. It is important that you feel comfortable using the divisions of your ruler *(see Illustration below),* because these relate directly to the finished quality of your job. Practice makes perfect here.

You will also need to understand which tools work best, for which projects. A radial saw, a table saw, a circular saw, a saber saw, and a hand saw will all cut wood – but each one is designed to be used at a certain time, and knowing which tool to use for your particular situation will give you the best results.

Most of this knowledge of tool use comes from experience. So, you need to practice, starting on small projects and working your way up. Soon you will be proud to call yourself a carpenter.




*Breakdown of an inch by 16$^{th}$s*

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# WOOD CONNECTIONS

Over generations, the Japanese have elevated the joining of wood to an art. Apprentices often spend several years cleaning, setting, and sharpening their master's tools before they are allowed to make joints themselves. These traditional craftsmen make incredibly intricate, tight-fitting, and visually pleasing joints that permanently connect two or more pieces of wood – without glue, nails, or screws.

Luckily, it is possible to learn how to make strong wood joints without a five-year apprenticeship. In fact, most people have probably joined wood at one time or another without realizing the range of joints and fasteners available to them. To make the best connection, you need to understand the basic properties of wood and how to select from the hundreds of different types of joints available. The method you choose to use will depend on your skill level, what you want to accomplish with your joint, how much strength the joint will need to have, and how visually pleasing the connection should be. Each of these factors can take on more or less importance in different situations.

Whether or not you need to use a fastener will depend on which joint you select. About half of all joints are designed to hold without fasteners. Regardless of whether or not you use a fastener, the use of some white glue (like Elmer's™) will greatly increase the strength of any joint. Take care to keep the wood clear of excess glue, as it can seal the pores of the wood and prevent stain from penetrating as deeply as in surrounding areas.

Choosing which joint to use in a given situation comes from experience. Until you have made the various types of joints, you can't fully appreciate how long it may take to construct one, or how strong it will be. The attached chart illustrates some of the more basic joints. We have rated them in regard to their strength and the skill required to construct them. As you can see, some require little skill, while others demand more from you. Start with the easier ones and work your way up the levels, until you can make the type of joints you want.

Now, let's talk about the easiest way to connect wood – nails. These fastening devices have played a major role in our development as a civilized race. The earliest nails were wooden plugs cut by hand. As you may guess, they were used very sparingly. (And, many alternative methods of joining wood were developed.)

There are now literally hundreds of nail types, each designed to work best at a certain job. Nail length varies, in most cases, from one inch to eighteen inches. The way nails are identified today refers back to how nails were purchased in centuries past. The length of the nail is indicated by a number followed by the letter “d” (from the roman coin “denarius”) or the word “penny” (indicating their price per hundred under the English system of weight.) The chart on the next page illustrates how the name of a nail indicates its size.

Another common fastener is the screw. The main advantage screws hold over nails is their greatly increased strength and durability. Screws can also be removed more easily to disassemble the pieces of wood, if the need arises.

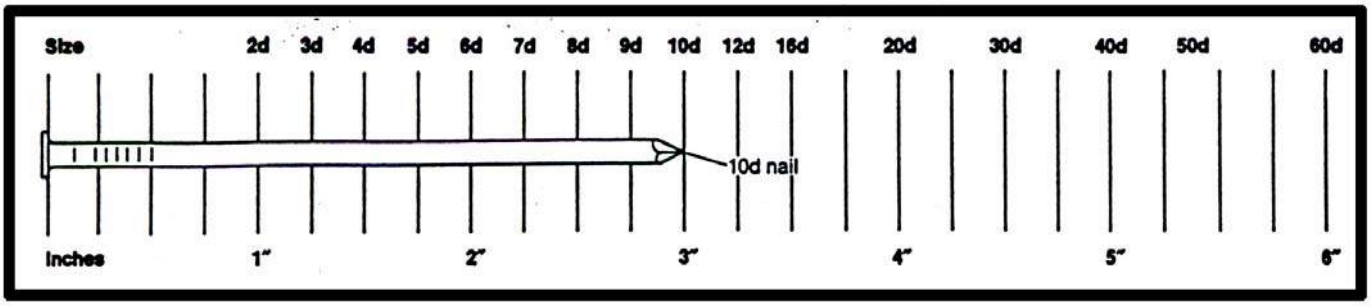
*(continued)*

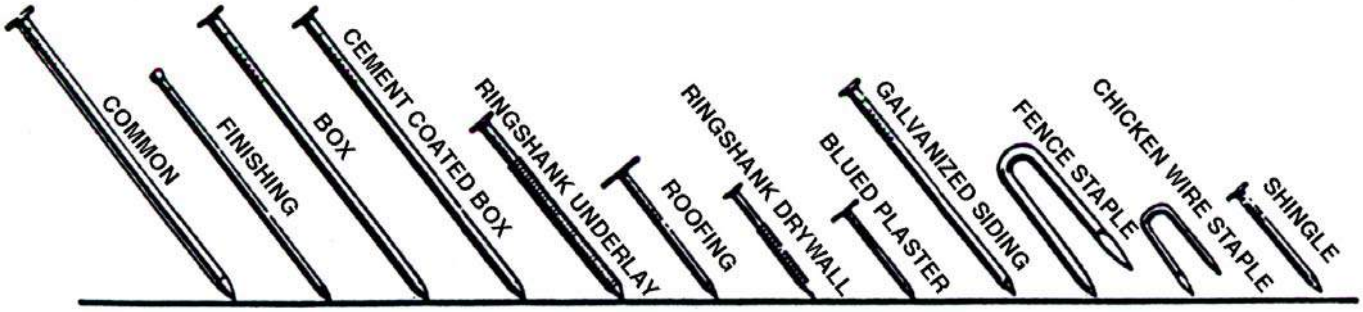
With screws, also, you have a large number of choices. Screws are numbered according to the diameter of the unthreaded shank beneath the screw head and the length. You can buy many different combinations of these two dimensions. Screws come in a range of head types designed for use with different styles of screwdrivers and made of different metals. These different types of heads have little to do with the strength of the screw; the head you select will usually depend on aesthetics more than anything else, although occasionally the screw's location or function will determine the type to be used.

A good rule of thumb for selecting the screw to use in connecting wood is that the screw should be long enough to pass through the top board and 2/3 of the way into the bottom piece you are joining to it. The use of hand soap on its threads will make a screw easier to turn in the wood.

There is not room here to list all the different joints or fasteners available to you in your home repairs. If you have questions about what joint or fastener might work best for your specific project, feel free to call us at Project Repair, and we'll be happy to discuss your options with you. However, experience and practice will be your best teachers in the long run.

**PENNY NAIL GAUGE**

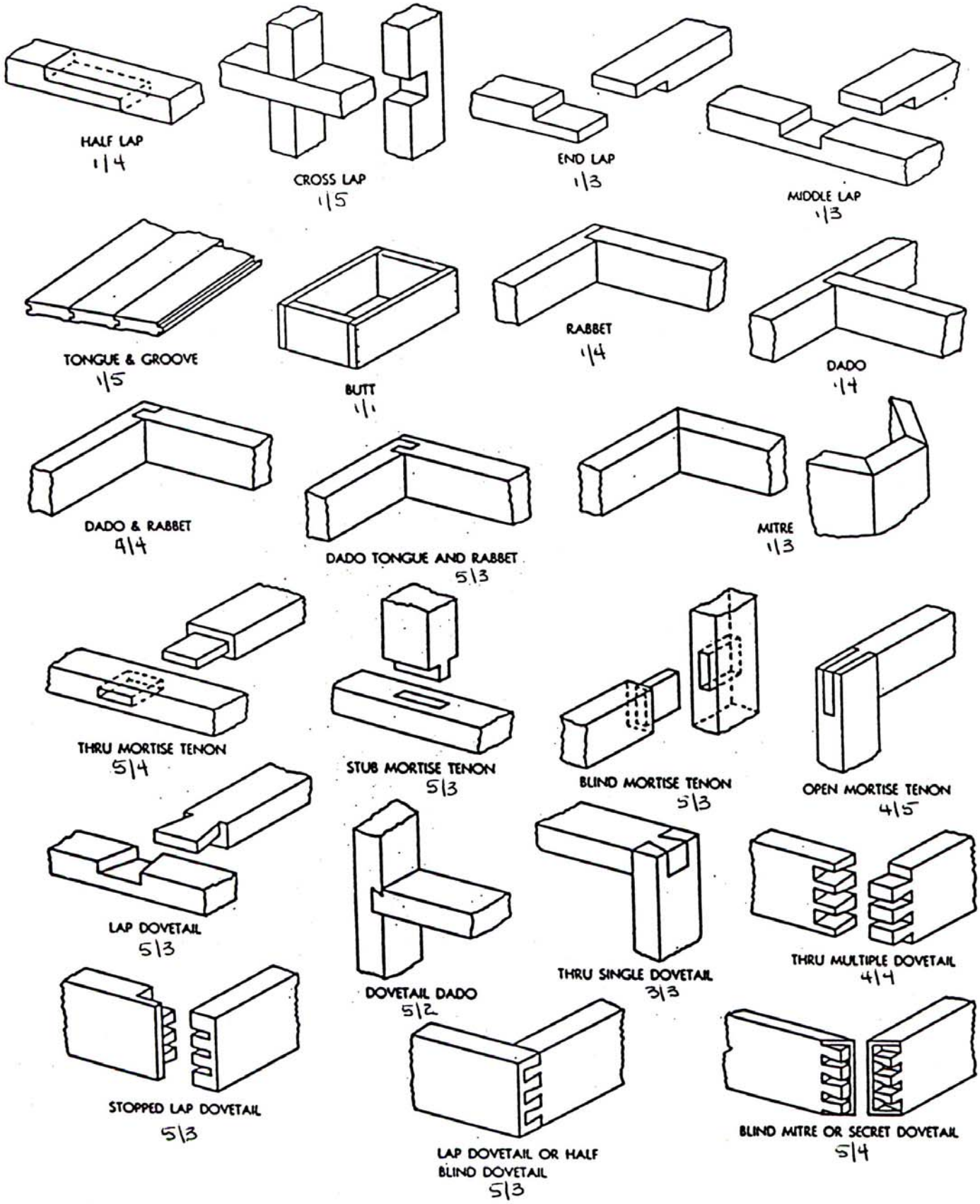


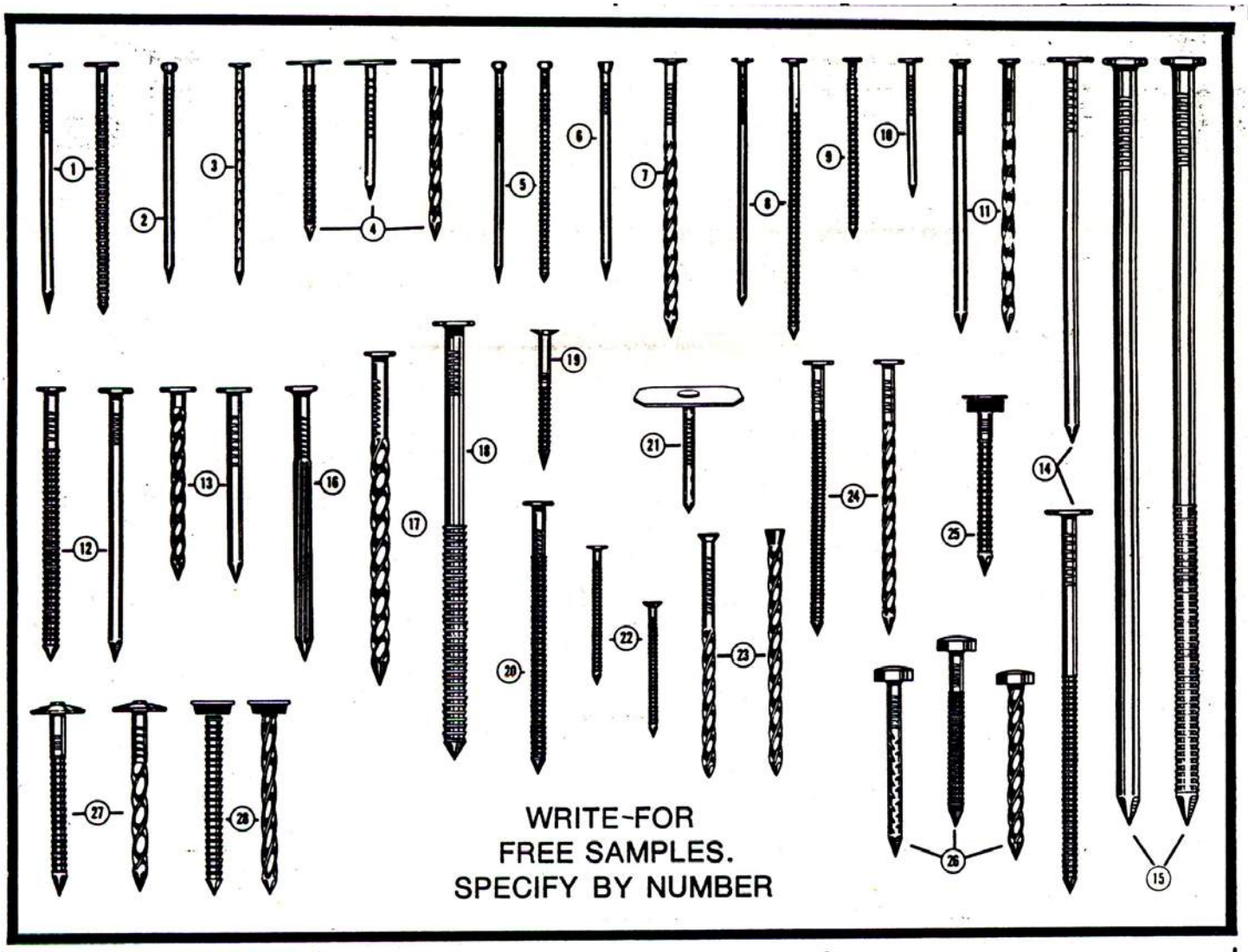




*(continued)*

## Key to rating system: Skill level required / Strength of joint

Skill level rated from 1 (easiest) to 5 (difficult) → **2/4** ← Strength of joint rated from 1 (weakest) to 5 (strongest)






## STORMGUARD® NAILS
### FOR EXTERIOR APPLICATIONS
**(Hot-dipped zinc-coated twice in molten zinc)**

1. Wood Siding, Box (Plain & Anchor)
2. Finishing
3. Insulating, Plastic Siding
4. Asphalt Shingle (Anchor, Plain & Screw)
5. Cedar Shake (Plain & Anchor)
6. Casing
7. Cribber
8. "Split-Less" Wood Siding (Plain & Anchor)
9. Asbestos
10. Cedar Shingle
11. Hardboard Siding (Plain & Screw)
12. Common (Anchor & Plain)
13. Aluminum, Steel & Vinyl Siding (Screw & Plain)
14. Insulation Roof Deck (Plain & Anchor)
15. Gutter Spike (Plain & Anchor)

## INTERIOR & OTHER NAILS

16. Masonry
17. Post-Barn/Truss Rafter (Screw)
18. Post-Barn (Anchor)
19. Drywall, GWB-54 Style
20. Underlayment, Plywood (Sub-floor, sheathing, etc.)
21. "Square-Cap" Roofing
22. Underlayment (Flat Head & Countersunk)
23. Spiral Flooring (Casing Head & Countersunk)
24. Pallet (Anchor & Screw)

# MAZE NAILS

Div. of W. H. Maze Company
Dept. 19, Peru, Illinois 61354

## METAL ROOFING NAILS

25. Rubber Washer (Stormguard, Anchor)
26. Compressed Lead Head (Barbed, Anchor & Screw)
27. Umbrella Head (Stormguard, Anchor & Screw)
28. Lead Washer (Stormguard, Anchor & Screw)

### Penny-Wise Nail Lengths

| | | | |
|---|---|---|---|
| 2d | 1″ | 12d | 3¼″ |
| 3d | 1¼″ | 16d | 3½″ |
| 4d | 1½″ | 20d | 4″ |
| 5d | 1¾″ | 30d | 4½″ |
| 6d | 2″ | 40d | 5″ |
| 7d | 2¼″ | 50d | 5½″ |
| 8d | 2½″ | 60d | 6″ |
| 9d | 2¾″ | 70d | 7″ |
| 10d | 3″ | 80d | 8″ |

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# Porches, Decks & Steps

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# MAINTAINING YOUR DECK

In 2003, a number of people in Chicago were killed when a third story deck broke loose where the deck framing met the building wall. Although there were a lot of people on the deck, the collapse was really caused by the failure of a plank (called a **"ledger board"**) that had partially rotted and split where the bolts attached it to the building.

This was not an isolated incident; deck collapses are more common than one might think. While there are decks that fail because they are not built to code specifications, the most common problem is lack of adequate maintenance. When a deck is refinished, the joists, ledger board, and posts are seldom coated with the waterproofing material. Joists – shaded by the planking above and unable to dry out – can remain wet for a long period of time and eventually rot. So, it's vital to conduct an annual inspection of a wood deck, especially an older deck on long posts. Homeowners can usually do most of the maintenance required, but if a deck is more than six years old (or if the age is not known), it's wise to turn over the inspection to a professional who specializes in wood-frame construction.

Start your inspection by checking the understructure to ensure the wood is solid *(see illustration next page)*. If you can push a screwdriver a quarter-inch into the wood, it's time to replace it. Do the same test with the deck planks, too. If you replace any rotted planks, use **galvanized or stainless steel screws** instead of nails, to prevent the plank from pulling up. On the other hand, if the deck planking has split, don't bother replacing it unless you feel the plank flexing under foot. (Since treated lumber is generally quite wet when it's installed, splitting will be a natural occurrence as the lumber dries.)

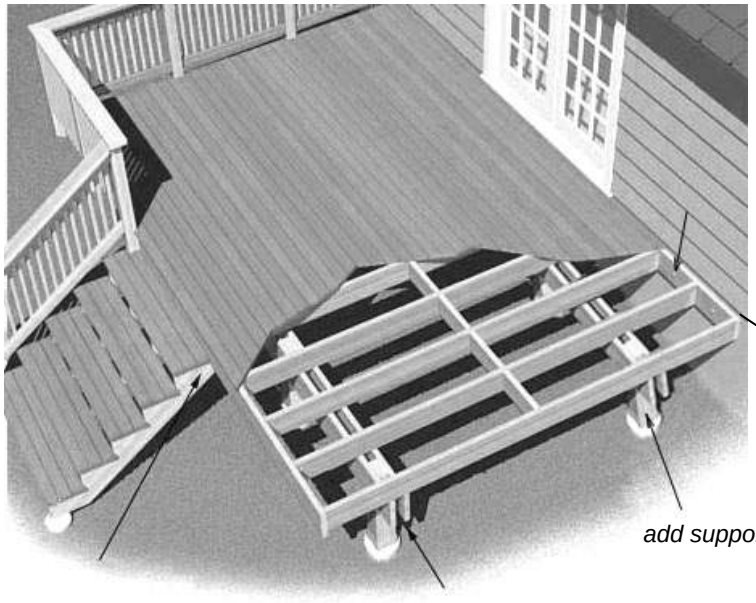
In addition to checking the condition of the wood, look carefully at how the deck was designed and constructed. The safest decks are those that are over-built. For example, even if the design load is for 40 pounds per square foot and the span chart calls for 2 x 8" joists, 2 x 10s will give more strength. Similarly, where a plan may have one support beam, a second beam, or more, can be added. To attach the ledger to the house, **lag screws with washers** are stronger than nails or drywall screws. (Here in the Snow Belt of northeast Ohio, it's not unusual for structures to collapse with a 3-to-5 foot wet snowfall, often breaking right at the ledger board). It's important that the railings are well secured and the spacing between balusters narrow enough to prevent small children from slipping through the railing – no more than four inches.

Once you have checked the condition of the wood, you can work to renew its appearance. Start by sweeping off dirt and leaves with a broom (a stiff palmyra push broom works well for this job.) Use an old hacksaw blade to scrape out any "crud" in the gaps between the planks.

You'll need to clean the surface of the deck before refinishing it. If you don't wish to use chemicals, pressure washing alone will clean the deck enough to prepare it for refinishing. But, if it's been a long time between refinishes, a commercial deck cleaning solution with **oxalic acid** (wood bleach) may be necessary to remove the dirt, gray coloring, mildew, and stains. Use a garden sprayer to apply the cleaning solution, and then work the solution into the wood surface with a scrub brush mounted on a broom handle. Let it sit for thirty minutes or so, and then wash off the deck. Grease stains (under an outdoor grill, for example,) are tough to get out; a paste of **TSP** (TriSodium Phosphate) scrubbed into the stain will break up a lot of it. Finish cleaning by washing the surface with a garden hose or, preferably, a pressure washer.

*(continued)*

Let the wood dry for a few days before applying the finish. There are many products available for the new finish. On the visible surfaces, you can use a **color stain water seal** that protects the wood from moisture and U-V rays, in addition to staining the wood. Be sure to coat the end grain of each plank. All the surfaces of the understructure should be treated with a **clear water seal** to prevent decay – especially the support beam and posts.




Even with proper maintenance, decks won't last forever. The life expectancy of an average deck, made with treated lumber, is 15 to 20 years. An annual inspection and periodic refinish is the best way to keep your deck attractive, protect your investment and prevent deck failure.

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# CHECK YOUR PORCH EACH YEAR

Each summer, it's a good idea to inspect the condition of your porch – a part of your house that is particularly vulnerable to attack from moisture and insects. Small problems, if not corrected, can soon lead to more expensive repairs.

The first part of your inspection is likely to be the least pleasant, as you'll need to crawl beneath the porch to check out the supporting structure. Look first at the **piers** that hold the weight of the porch. These piers can be made from wood, brick, stone, or concrete. Ideally, they should be supported by concrete **footers** that extend below the frost line, but in all too many older homes you'll find them resting directly on the ground. Especially in these cases, you may see signs of rot and water damage.

Wooden piers are in need of repair if you can push a nail by hand more than 1/4" into the wood. If the damage is not too extensive, you can reinforce the original piece by "sistering" two pieces of sturdy lumber alongside it, bolting them in place. If you are dealing with a severely deteriorated wooden pier, replace it with a new piece of pressure-treated lumber of the same size. Be sure to install a concrete footer beneath the new pier, to keep it from coming into contact with the ground.

With piers made from brick or stone, you'll need to check the masonry joints. If there are cracks or holes in the mortar, tuckpoint the joints and apply a masonry sealer, to prevent water from penetrating the mortar, freezing and expanding, and thus damaging the brick or stone.

Next, check to see if there are any gaps where the porch rests on the piers. If a small gap is present, you can fill it with a wooden wedge. A better alternative, however, is to jack up the porch to level it, and then build up any of the piers that may have settled.

While you're under the porch, check the **floor joists** and other support beams for rot or insect damage. Where the damage is minor, you can sister reinforcing pieces alongside the original beam, but replace any that are seriously deteriorated.

Look carefully at the **ledger board** (where the porch framework is attached to the house), because it is very important to the strength and stability of the entire porch structure. Check the condition of both the wood and the connecting hardware. Ideally, the ledger board should be attached to the house with lag screws and washers, instead of nails or drywall screws.

If you find evidence of insect damage or rot in any of the wood, it's important to correct the underlying cause – not just replace the damaged materials. An exterminator can help you control insect invasions. To prevent damage from water, there are several steps you can take: grade the soil away from the porch to keep water from collecting underneath it; install 4-mil polyethylene sheets under the porch to serve as a vapor barrier; and maximize air circulation by keeping all plants around the porch trimmed back.

Before you leave the crawl space, examine the **floorboards** from below (the first signs of rot are often most visible there), as well as the wood **apron** or **lattice** that surround the crawl space.

*(continued)*

You'll need to replace any rotted pieces.  You can also attach hardware cloth (a kind of screening material) to the back of any lattice pieces to discourage critters from taking up residence under your porch.

Finally, you can crawl out from under the porch and examine the top of the floorboards.  Pay particular attention to the edges of the floor, and to areas around the bases of railings and columns.  If just a few boards need replacement, you can get new tongue and groove flooring at most lumberyards – although you may need to go to bigger establishments to match the dimensions of old-style flooring.  Porch columns can also suffer from damage, especially around the base.  If you need to replace an area of flooring beneath a porch column, a base under the column, or the column itself, you can jack up the porch roof a couple of inches with a hydraulic jack and two 2 x 4's screwed together, and then support the roof with one or more longer piece of wood wedged between the ground and the ceiling, so the column can swing free *(see separate handout on "Porch Columns.")*

Make sure all railings are in good condition and well secured.  The spacing between the balusters should be narrow enough to keep a small child from slipping through – no more than four inches.

The last step in your annual inspection is to check the **expansion gap**, a narrow space between the porch floor and the house wall that allows the floor to expand during hot weather.  This gap should be caulked periodically.

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# PORCH COLUMNS

Many older homes are graced by columns supporting a porch roof. Most of these columns will eventually need repair or replacement, as they suffer the effects of age and weather. With a little know-how, this job can be done by the homeowner on a do-self basis.

The first task is to determine the extent of the repair. Sometimes, you will only need to replace the **plinth** (the bottom trim piece at the base of the column) or the **capital** (the top trim piece.) Small holes in the pillar or trim pieces can sometimes be filled with wood putty, or soft spots hardened up with wood hardener. Once the pillar shows signs of significant deterioration, however, it's usually necessary to replace the whole thing.

Locating a replacement column can be tricky. Some columns are made from aluminum, others from composite materials, and still others from wood. The round-style wood pillars are hollow, made from vertical strips of wood laminated together. Older columns tended to be larger than their modern counterparts – the wooden columns most readily available today are 8" in diameter, while older ones were often 9-1/2". You might be able to match your column at an architectural salvage place; otherwise, you'll probably have to replace all your columns to have them match one another.

If you need to replace all your columns, you may be able to construct hollow square or rectangular box posts *(see Illustration 1)* for far less than you'd pay for round ones. Be sure, however, that the new style is compatible with the architecture of your house. Look at similar houses to see, or talk to an expert in historic preservation if one is available in your city (Cleveland Heights residents can call the City's Planning Department,) or consult the preservation experts at the Cleveland Restoration Society, (216-426-1000). It's important that your new pillar have the right "look"; even though a 4" x 4" post may have adequate strength, it will be too insubstantial for the proportion of most porches.

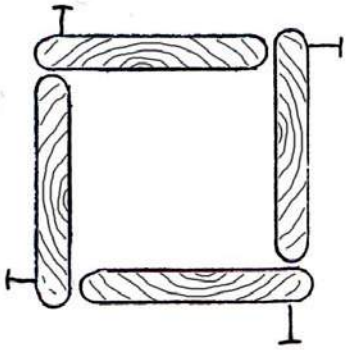

**Illustration 1: END VIEW OF POST**
*Nail or screw boards together along the outside edges to form a square.*

Once you have your replacement parts, the next problem is supporting the porch roof while you do the repair. You can use a **hydraulic jack** to lift the roof; you will only need to raise the roof 1/2" or so, just enough to remove the rotted post. Nail together some 2 x 4's to make two 4" x 4" posts – one to wedge between the floor and the ceiling (or support post) and the other between the jack and the ceiling. Hollow out the bottom of the shorter post with a **1-1/2" paddle bit**, so that the head of the hydraulic jack can be inserted into the wood to hold it securely. (If you have one, a metal jack post can be used in place of this shorter wooden support post.) Then, position the jack on the porch floor, or on the ground, if necessary; using that shorter post, lift up one side of the roof. When it is high enough that the porch column can be freed, wedge the longer post in place to support the roof at that height. Move the jack to the other side of the porch roof and raise the roof there to an equal height *(see Illustration 2).* Only when you have the roof supported in two places should you remove the damaged column. **(Never rely on the jack alone to hold the roof in place.)**

*(continued)*

While the roof is supported, make the necessary repairs to the column. If the pillar has a masonry base, you may need to fix the brickwork, in addition to the carpentry repairs. Then, lower the roof onto the columns once again. Finish up with a bead of caulk where the wooden column parts meet the porch floor or the masonry support, plus a coat of enamel trim paint on all wooden elements.

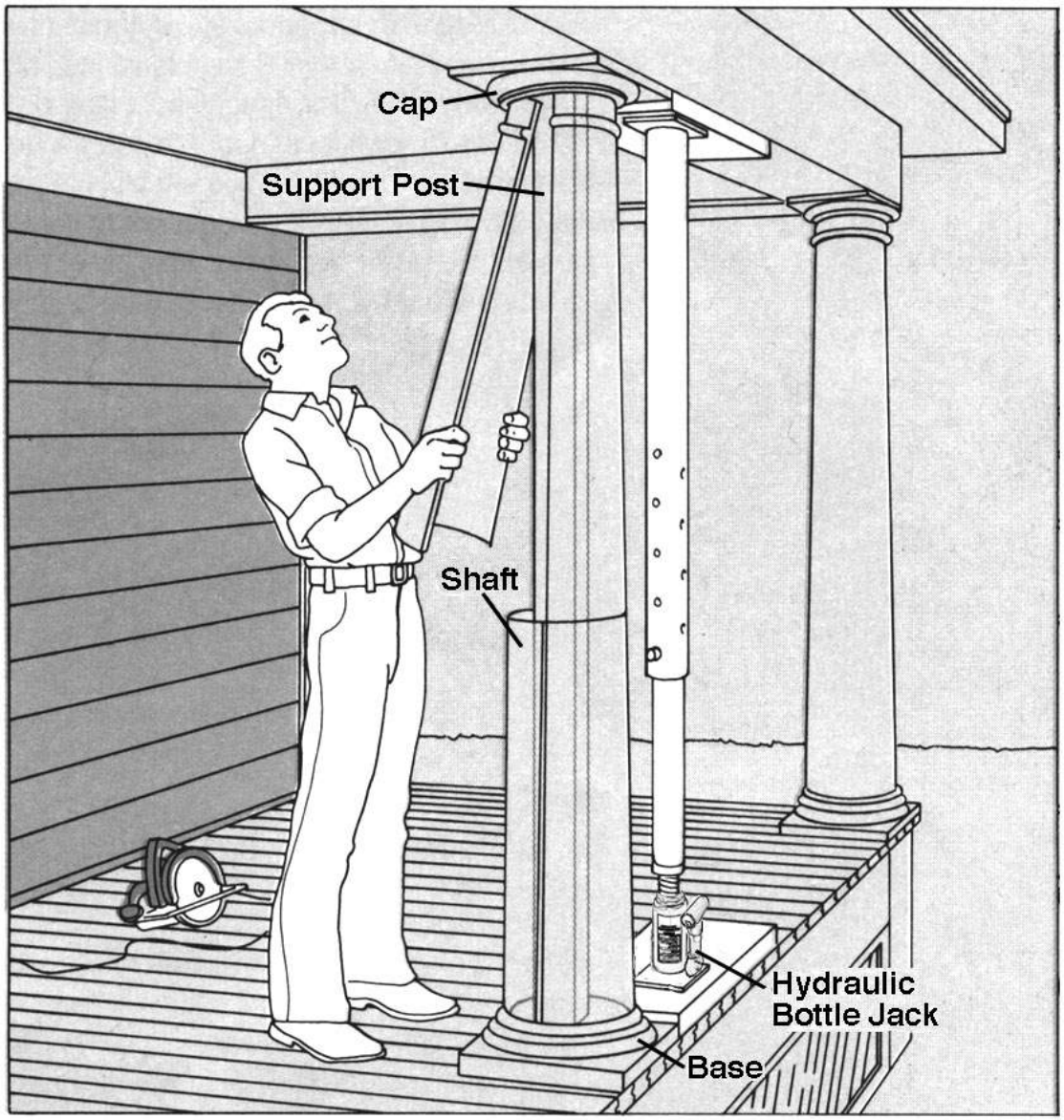


*Illustration 2*

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# PORCH FLOORING REPAIR

If the wood on your porch landing feels spongy, or if a few of the flooring boards have rotted and deteriorated, you are probably in need of some flooring repair.

It's not always necessary to replace the whole floor; you can often get away with replacing a few rotting boards here and there. Even if you have to replace a larger section, it doesn't have to be expensive. Most lumber yards carry 8-foot lengths of 4"-wide porch flooring – though if you have a less common size, the boards may be harder to find and more costly. The really important thing is to get to the repairs early, before moisture starts to damage the frame underneath. Once water gets under the floor, the flooring will start to buckle – and the cost and time required to fix the problem will increase.

Porch flooring is usually not too hard to remove and replace, if you understand how the pieces go together. The working edges of flooring are called "**tongue"** and "**groove**." These ends are made to work together to hold the flooring down, with the tongue of each flooring piece fitting into the groove of the neighboring piece.

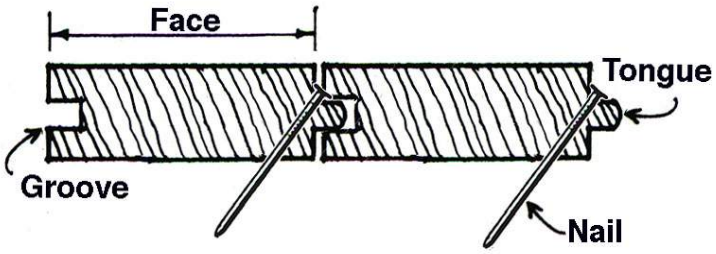
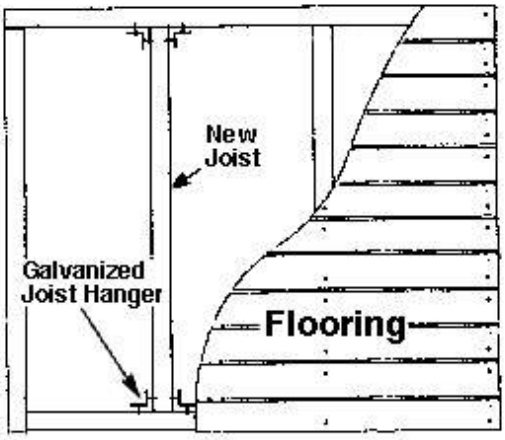
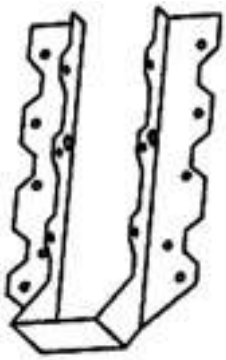



*Illustration 1*

Use a hammer and wood chisel to remove the first rotten board, being careful not to damage the tongue or groove of the sound board next to it. Once you have the first board out, use a cat's paw or pry bar to take out any other damaged pieces. Before putting down the replacement flooring, look carefully at the wood frame underneath. The flooring is nailed to boards called "**joists"** *(see illustration 3).* To have a firm floor, these joists must be solid, so check whether they have been damaged by moisture or dry rot. As a rule of thumb, if you can push a nail into a joist by hand to a depth of 1/2", then it is likely too far deteriorated to work as it should. You can usually repair or replace the joist yourself.



*joist bracket*

*Illustration 2*

To to strengthen a deteriorating joist, to cut a piece of new wood to length, nail that piece along one side of the weakened Joist, and then toe-nail it into the frame at each end. (This process is called "**sistering**.") If the original joist is totally rotten and must be replaced, attach the new joist to the supporting framework using a galvanized **joist hanger bracket** *(see illustration 2)*. In either case, use lumber the same size as the original joist (usually a 2 x 6 or 2 x 8.) Outdoor treated wood is a good choice, as it will withstand moisture.

*(continued)*

Once you're sure the joists are sound, you can install the new flooring. To protect the tongue edge and yet ensure that the floor boards fit tightly together, cut a small piece of flooring (about 6" long), and fit its groove along the tongue of the piece you're installing. Hammer against this small block as you move it along the board being installed, until the new piece fits snugly against its neighbor. Then, nail diagonally down through the tongue side of the new board *(see illustration 1);* the nail will be hidden by the groove of the next piece you install. You'll have no exposed nails, reducing the chance of the floor warping.

If you are patching a small area, you may not know what to do when the tongue of your last board sticks out beyond the adjacent piece. Just cut the tongue off, using a circular saw or a hammer and wood chisel, and fit the last piece in place. Then, either nail it down through the top or glue it down with construction adhesive.

Don't try to cut the pieces exactly to length before you install them. Cut them a few inches longer than you'll need. When you've nailed all the pieces in place, snap a chalk line across all the boards at once, and cut off the ends with a circular saw.

Unless your new flooring is outdoor treated wood, paint it right away with an oil-base primer and polyurethane deck enamel, to prevent the wood from warping. Then, pour a cool lemonade, settle in your porch chair, and enjoy the solid porch flooring under your feet.

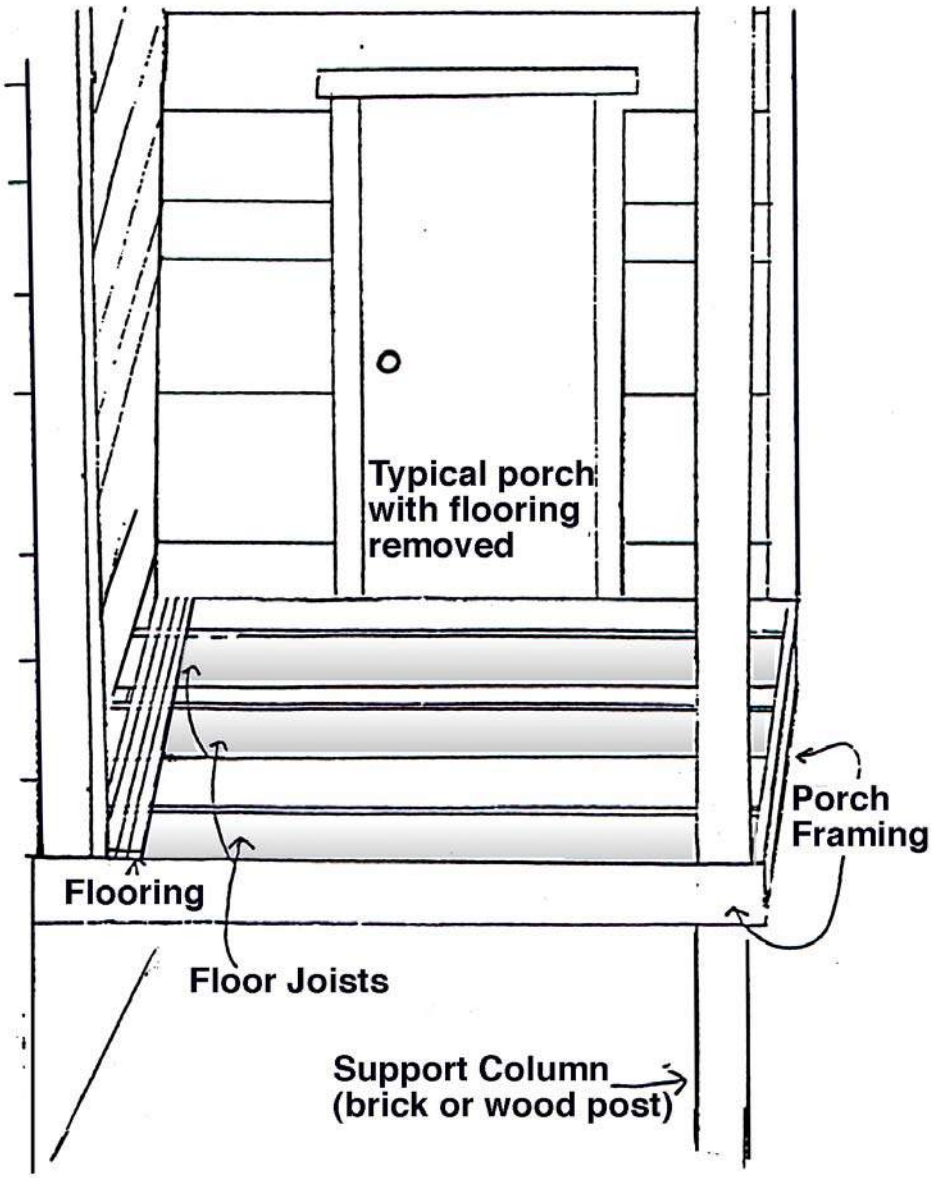



*Illustration 3*

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# One Method of Installing
# PORCH RAILING POSTS

There are almost as many railing styles for porches as there are houses. City code will generally specify such things as railing height and spindle spacing; but, within those parameters, rails can be constructed in any number of ways. Thus, they can define the style of a home, in addition to protecting against accidental falls. Railings are seldom a problem, unless they are used on a porch that also serves as a roof for the floor below. Then, they are the most frequent place for a leak to begin.

The most common way of attaching railing posts to the roof practically guarantees a leak. All too often, they are nailed or screwed right through the roofing, with the nail heads then covered with a little tar. This may work for a year or so, but eventually the tar dries out, cracks, and allows water into the room below. Even before that, people may walk out on the roof and lean on the railings, or hold onto them for security. As the rails are poked and prodded and leaned upon, they move – and the tar seal on the nail heads can crack and open up.

There is a method for making and attaching the railing posts that will reduce the chances of a leak. For each post, nail or screw four pieces of the same width lumber together to form a hollow square *(see Illustration 1).* Then, measure the inside dimensions of the post. Cut two blocks of "2 x" material to this size. Locate the place on the roof where the post is supposed to go, and mark the spot. Coat the bottom of one of your cut blocks with silicone caulk. Then, with that caulked side down, center the block over the spot you marked and screw it down. Screw the second block to the top of the first one.

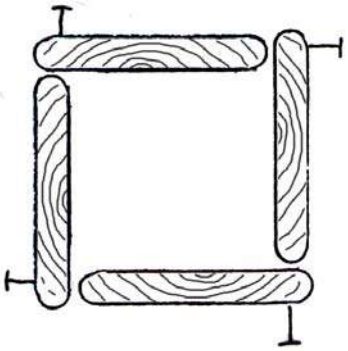


**ILLUSTRATION 1: END VIEW**

**Nail or screw boards together along the outside edges to form a square.**

Next, apply silicone caulk to the bottom edge of the post. Slip the post over the blocks you screwed to the porch deck. Now, after ensuring that the post is plumb, screw through the sides of the post into the blocks to secure it *(see Illustration 2).* When you put a cap on this post, there will be virtually no way for water to get into the roof.

If you feel savvy enough, you can even attach the railings to the sides of the post before you assemble the pieces together into a square. This assembly makes an attractive and strong rail design.

Whether you construct the railing yourself or hire a carpenter to do the work, this system will adapt to nearly every railing style. With this design, you will be insuring yourself against water leaks through the roof for quite a while.

*(continued)*

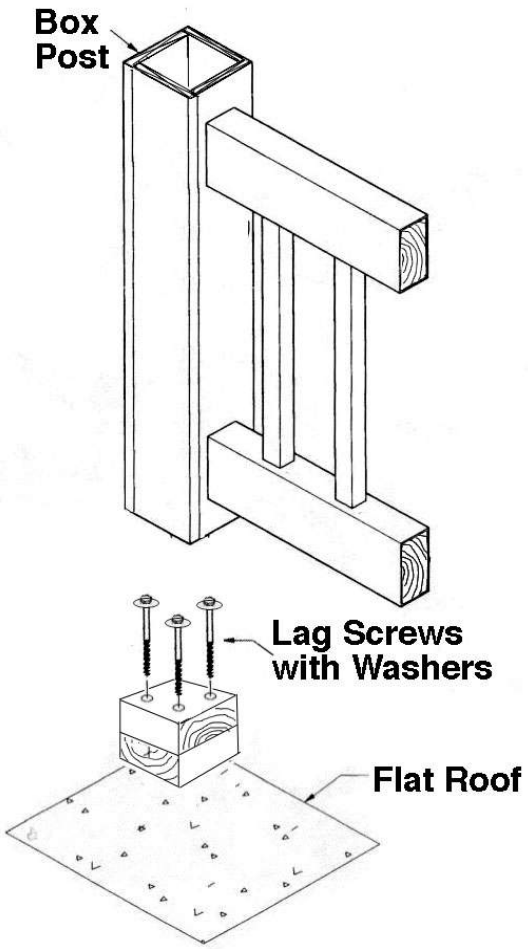


**ILLUSTRATION 2: ASSEMBLY**

**Slip pre-made post over blocks on roof.**
**Screw through the sides of post into blocks.**

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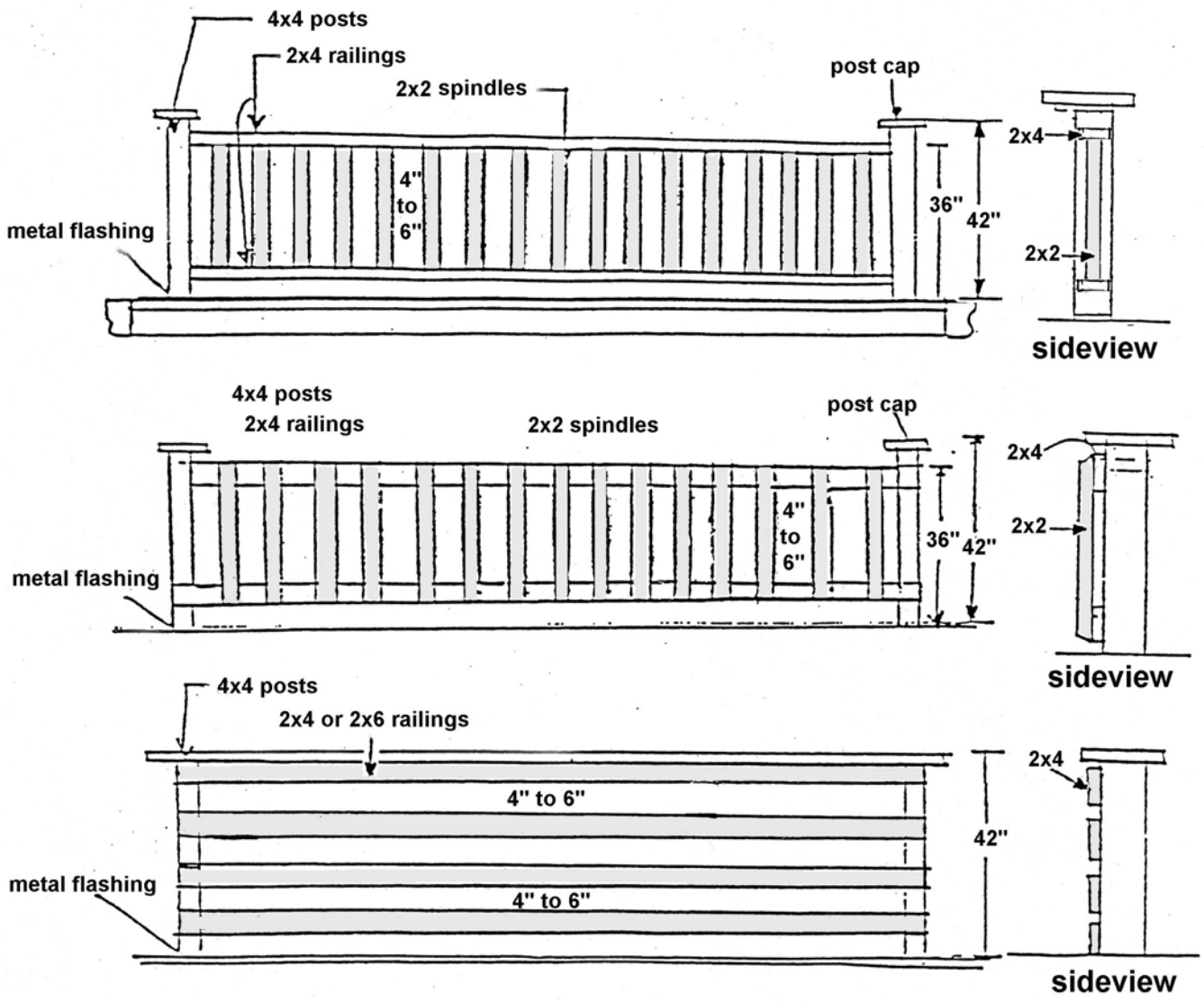
# SAMPLE RAILING STYLES

The following styles comply with basic safety standards for flat porch railings. It's a good idea to use outdoor treated wood, for added protection against rot and insects.

Note that code will generally specify such things as the minimum height for posts and railings. International Building Code also requires that all gaps – horizontal or vertical – be less than four inches wide, to prevent a child from falling through or getting stuck. *Always check with your city's Building Department for details.*



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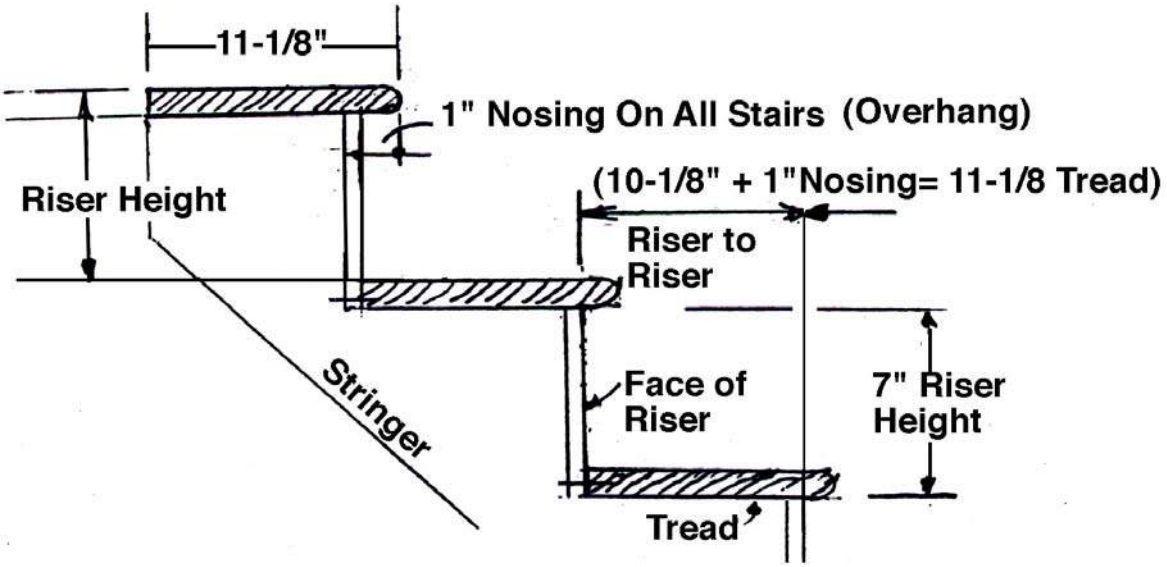
# BUILDING WOODEN STEPS

Building a set of wooden steps can seem intimidating, but it is a job most homeowners can do with a little skill – and a little patience. Before starting to measure and cut, however, it's important to understand some of the code issues in regard to steps. (This is a job that will generally require a permit; check with your city's Building Department for code requirements in your community.)

All steps must be supported by a foundation, or "**footer**." The purpose of this footer is to prevent the steps from being heaved up out of alignment when the ground freezes and thaws. If your steps do not rest on a sidewalk block or portion of the driveway, you'll need to dig out and pour either piers or a concrete pad, making sure the footer is at least 36" deep. Your footer will usually have to be approved by your Building Department before the steps are placed upon it.

A **landing** is usually required at the top of any steps that lead to a door. If your present steps do not meet this standard, you'll need to redesign their layout. This may mean that the steps will need to come off at a different angle or at a new distance from the house; in these cases, you'll have to install a new footer.

The design of your steps must meet code requirements. In Cleveland Heights, steps must be at least 36" wide; maximum **riser** height is 8"; **treads** must be at least 11" wide; a 1" **nosing** (overhang) is required for steps with closed risers; and, if the steps will be more than 36", there must be a middle **stringer** for support.

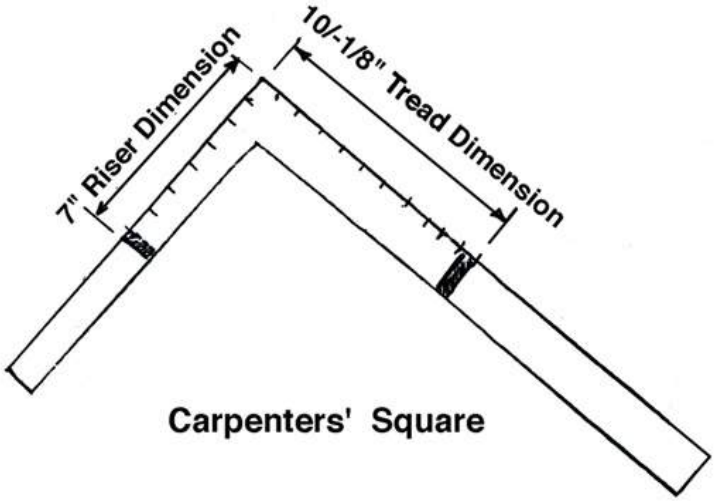



Your first step, then, is to measure the total height of your steps, from the footer up to the level of your landing deck. Divide that figure into equal increments, so that you end up with a step height between 7" and 8". Remember that the last "step" will be from the top tread up to the landing; for a 28" height, for example, you'd build three 7" steps.

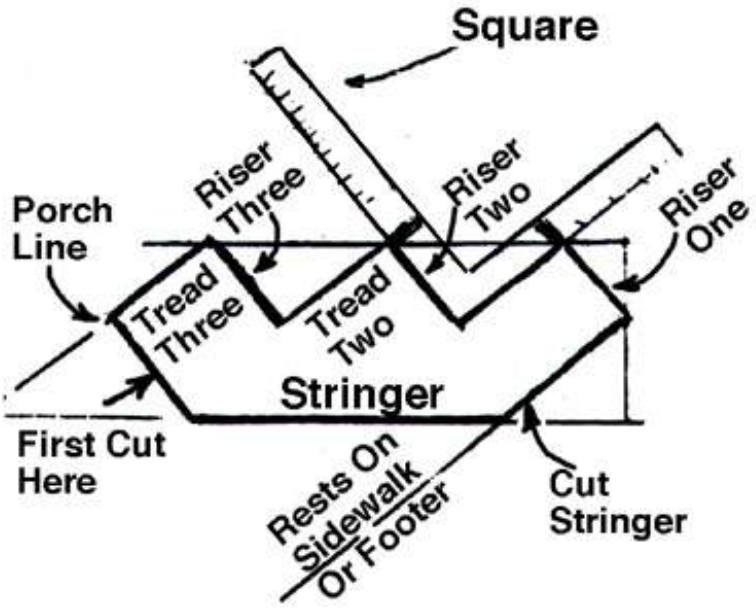
While outdoor treated wood is not generally required by code, it will give you a longer-lasting repair. For sturdiness and stability, use 2 x 12's for the stringers and treads – or, you can buy bull-nosed stair treads (where the front of the board has been rounded off). You'll also need wood for the risers (preferably 2 x 8's) and a 2 x 4 for a back brace to hold everything together.

*(continued)*

Once you have the lumber, you can start the most important part of constructing your steps – laying out and cutting the stringers. Take a framing square, and place a piece of tape around one leg at the dimension corresponding to the riser height. On the other leg, place a piece of tape at the dimension corresponding to the tread width, riser-to-riser (without the nosing). In our example, one leg would be marked at 7"; for the other, we'll assume that the stair tread we purchased was 11-1/8" wide, leaving us a 10-1/8" measurement when we subtract the 1" nosing.




Take the framing square and place it with the tape markers (at 7" and 10-1/8" in our example) against the edge of the board, as shown in the diagram. Trace along the edge of the framing square. Then, reposition the square so that the next tracing will begin where the first one ended. Repeat the process of positioning and tracing until you've marked the number of steps required. Finish off the stringer by marking the top and bottom as shown in the diagram. (Remember that, for the height of the riser going from the sidewalk to the first tread, you'll need to subtract the thickness of the tread board – since you won't have one sitting against the bottom of the riser like you do on the other steps. And, on the top tread, you'll need to subtract the thickness of the riser board, since the steps will be sitting directly against the porch.)




Now, before you cut, STOP, THINK, and CHECK YOUR MEASUREMENTS to make sure you have treads and risers of the right dimensions. Then, cut out the stringer. (You can use a circular saw for most of the cut, but you'll probably need to finish off the inside corners with a hand saw.) When you've cut your first stringer, use it as a pattern for the other(s) you'll need.

When your stringers are ready, you can cut and attach the treads and risers (optional) with nails or screws, making sure that you end up with steps that are plumb, square, and level. Attach pieces of 2 x 4's between the stringers on the back side of the steps, even with the bottom, for added support. Then, screw or toenail the steps to the porch landing, making sure the treads are level. (A very slight pitch away from the house for water drainage is also acceptable.)

Code usually requires **railings** on open side(s) of the landing and on stairs of more than three risers or more than 24" high. The railing on the landing must be at least 36" high, and on the side(s) of the steps, 30" to 34". The space between the spindles or other railing pieces must be less than 4", to prevent small children from getting stuck or falling through.

You may think that building your own steps is unnecessary, given the pre-made sets you can purchase at lumberyards and building supply stores. However, the above process will allow you to custom-fit the steps to your situation – designing the layout of steps and landing to fit your yard and ensuring that riser heights are the same between all the treads. With some thought –and attention to code requirements – you can end up with a set of steps you can be proud of.

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# REPAIRING EXTERIOR WOODEN STEPS

We seldom pay the steps outside our houses any attention... until someone falls through a rotting landing or trips on an uneven tread. If you could view your house through the eyes of a stranger, however, you'd see that steps in bad repair can ruin the first impression given by your home, and take away from its attractiveness.

There are many different types of steps, and one type is not necessarily better than another. The style of your steps should relate to the type and style of your house. (Note that replacing existing steps with a different style or material may require approval by your city's Building Department; check with them about the appropriate procedures.) The advantage to masonry (brick or stone) steps is that the materials don't deteriorate; however, the mortar holding the bricks together can fall apart in time, leaving them without normal support. Wooden steps, on the other hand, are subject to rot. So, there is no perfect material from which to make steps. The best approach is to learn to recognize the problems common to each type, so you can correct them before you have to replace the entire steps.

Wooden steps, even though they weigh much less than brick steps, nevertheless need a foundation to support them. They can be supported by a concrete sidewalk or a concrete foundation poured for that purpose. (Check with your Building Department about the size of foundation required.) Even with a foundation, however, seasonal changes may cause problems with wooden steps. As the ground shifts with the freeze-and-thaw cycle, wooden steps tend to stay attached to the house, but – because they are lighter and ride on the top of the ground – they may twist. As a result, they may not remain straight and level. The treads may begin to hold standing water, rather than allowing it to run off, causing the boards to rot.

There are a couple of things to do to remedy this situation. First, if your wooden steps aren't straight or level, and if your steps rest on a concrete sidewalk or other solid footing, you can usually do some shimming underneath the base. Just add small wedges of wood, a little at a time, and keep checking with a level. You want to end up with treads that are straight across, but have a <u>very</u> slight downward slant to the next tread.

If you need to replace any part of your wooden steps, consider using outdoor treated wood. This wood is guaranteed for about thirty years against rotting, and the tree from which it comes makes for a stronger-than-average board. Use the board you are replacing as a pattern to cut your new piece. If you replace the treads before the water has a chance to get underneath them and rot the supporting framework, you can probably avoid having to replace the entire set of steps.

If you must replace a set of wooden steps that has deteriorated too far for repair, there are some things to keep in mind to ensure a long-lasting replacement – whether the steps are built by you or by a contractor. First, replacing your steps will generally be a permit job, and you will have to meet current code requirements. A concrete foundation will usually be required, to give your steps a solid footing, and any steps leading to a door that swings out will likely have to have a landing, to prevent falls. (If you don't presently have a landing, you may need to redesign the layout of your steps to incorporate one.)

*(continued)*

Second, make sure that you use outdoor treated wood. This type of wood can be left unpainted permanently or, if you prefer, can be painted after it weathers for a year.

Third, make sure the steps are constructed for maximum strength and longevity. If the span of your steps is more than three feet, install a center riser to provide support, and place a small gap between the boards making up the stair tread to allow water to run off. *(For how-to instructions, see separate handout on "Building Wooden Steps.")*

Checking the condition of your steps each year will allow you to keep them in good shape, and will ensure that they remain an attractive feature of your home.

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# Roofs

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## If you are contracting a

# SHINGLED ROOF REPLACEMENT

When obtaining bids to replace your house roof, you should discuss with each contractor several important issues. It's important to clarify the composition and quality of materials that will be used – especially the roof felt, flashing, and shingles – as well as the way these materials will be installed. You'll want to make sure the roofer you use is familiar with the product to be installed, is experienced with the installation methods that will keep the warranty in force, and promises to use those methods in the written contract. A permit may be required; check with your city's Building Department for details. (In Cleveland Heights, you need a permit only if the job involves replacing any of the supporting structure of the roof – joists, beams, etc. – or if all the sheathing will be replaced. If the roofer will be applying a second layer of shingles over an existing layer or replacing only part of the roof sheathing, no permit will be needed, although the contractor must still be registered with the City of Cleveland Heights.) Note: If a permit is required, make sure that the job has passed inspection with your Building Department before you make your final payment.

MATERIALS:

Make sure the roofer will use 15# or 30# **roof felt**. The difference between the numbers is in the weight of the paper; 30# paper is thicker than 15# paper. A type of **waterproof roofing underlayment** (usually referred to as *Ice Guard* or *Ice Shield)* should be applied to specific areas that are prone to ice dam and/or water build-up, to prevent water from getting underneath the shingles and entering the house. (It is a little bit more expensive, so it's not generally used throughout the roof, but only in trouble areas – usually the bottom three to six feet along the roof line, and sometimes in the roof valleys.) **Drip edge** (a metal strip that prevents water from working its way back up under the shingles) is generally installed along the bottom edge of the roof, but in some cases may be recommended along the "rake edges" (the sides sloping down from the peaks), as well. Your contract should specify whether waterproof roofing underlayment and/or drip edge are included, and where they will be installed.

**Flashing** is the metal used to seal the roof where it joins other roof sections, house walls, or around obstructions such as chimneys. It's best to get all new flashing with a roof replacement, rather than allowing the roofer to re-use the existing flashing. The contract should specify use of coated aluminum flashing (a width of 24" is standard) with a gauge of .025 or heavier; if you desire a different flashing material (i.e., copper), make sure it is specified in your contract.

The contract should also specify the manufacturer, style, composition, and weight of the **shingles** to be installed. Shingles are generally described as asphalt or fiberglass. The difference can be confusing – even for roofers. Part of the confusion lies in the fact that fiberglass shingles are made from asphalt, and really should be called "fiberglass-asphalt shingles." Both types have a base mat that is surfaced with mineral aggregates. In organic asphalt shingles, that base mat consists of felt, made from rags, and paper wood pulp that is saturated and coated with asphalt. In fiberglass-asphalt shingles, the mat is made from glass fiber mat coated with asphalt. Although fiberglass shingles have a better fire rating than organic asphalt, both are considered acceptable.

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Both types of shingle are commonly used today. Your choice will generally depend on aesthetics, availability, and cost. Generally, the more expensive shingles, whether organic asphalt or fiberglass-asphalt, come with a longer warranty, some extending to 25 - 30 years.

The difference between asphalt and fiberglass-asphalt shingles will usually be of greater concern to the roofing contractor than to the homeowner. Fiberglass-based shingles are coated (not saturated) with asphalt, and don't get as soft during hot-weather installations – and thus aren't so easily damaged. On the other hand, fiberglass shingles are more difficult to work with in very cold weather because they can become brittle and can crack if flexed. For that reason, organic shingles may be a better choice if your roof will be installed during the late fall or winter months; fiberglass, for a summer installation.

Traditional three-tab shingles are most common, although some homeowners prefer the look of inter-locking shingles or the newer "dimensional" style that simulates the look of wooden shakes. In addition to appearance, your selection of a shingle style should take into consideration both current price differences and future costs. For example, dimensional shingles, because of their nature, should not be covered over with a second layer and should be removed before your next roof is installed (although HRRC *always* recommends stripping off to the roof deck – see below.) The choice of shingle style and color is usually left to the homeowner, but should be in the final contract (as should the color of the flashing, which should closely match that of the shingles.) The shingles should all be from the same manufacturer's lot number, to ensure consistent coloration.

**Venting** of roofs has become a virtual necessity in the last ten years, as a way of allowing hot, moisture-laden air to escape from beneath the roof and extend the life of the shingles. There are many types of vents to choose from, each with a "best application" and a different installation method *(see separate handouts on attic vents.)* Make sure you discuss the reasons for each contractor's recommendation for venting, and that your contract specifies the type and location of each vent to be installed.

The contract should specify that materials are to be delivered to the job site no more than three days before they are to be installed.

INSTALLATION:

It is always best that a new roof be installed directly on top of the roof sheathing (the wood deck that covers the rafters). Many contractors, however, will assume that you want a tear-off only when you already have two layers of roofing material and would be adding a third. If you have a single layer of roofing now, you might wish to ask about the cost of stripping off that layer, especially if your present roof has a lot of irregularities.

If your top layer of roofing covers an old slate or wooden shingle roof, there may not be any sheathing under it. Roofs of those types were often installed on "nailers," planking with four-inch gaps between them. In such cases, a base of plywood sheathing must first be installed over the entire roof surface after the old shingles are removed and before the new ones are installed. *Be aware that this will add to the cost of the job,* but it's important that the new shingles be nailed into wood – not air – so they will hold.

If your roof has had leaks, show those areas to the contractor. (A quick peak at water stains inside a closet or wet rafters up in the attic will give an idea of the problems involved.) Make sure you ask the contractor for a *best estimate* of the wood replacement that will be necessary, as well as a per-foot cost for any additional wood deck repair that may be discovered when the shingles are removed. It's important to know both figures, so you can plan for the extra cost.

Ask the contractor to specify how the shingles will be fastened. As a rule, hand nailing is preferred over power nailing. (Power stapling is *not* recommended.) If power nailing is used,

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it is important that the contractor control the amount of pressure being applied, so that the nail heads are not driven into or through the shingles. (Overdriving the nails can radically shorten the life of a new roof.) Regardless of the method to be used, the contract should specify that all installation requirements from the manufacturer will be followed, so as to keep the material warranty in full force.

If your work will be done during cooler weather, you may wish your contract to specify that the shingles will be installed only when the temperature is at least 50°.

Installation of the flashing is one of the most important parts of any roofing job. Be sure that your contract specifies that the contractor will install valley flashing *under* adjacent roofing shingles, and slip step flashing behind the wood siding or cedar shingles along house walls and dormers. In addition, the contract should call for the contractor to counter-flash all chimneys and imbed the flashing in mortar joints (grind and tuck method, using reglets). These installation methods will help prevent water from getting under the metal flashing and entering the house.

Finally, include in your contract that the contractor will be responsible for a thorough clean up, for damage if the roof is left uncovered and it rains, and for any damage to siding or gutters during the course of the roofing job.

**TIP**: If you are having the old roof torn off, it's almost guaranteed that debris will come through and make a mess in your attic. We strongly suggest that you take time to cover any items you have stored in an unfinished attic (or in the knee wall areas of a finished attic) so they are protected during the re-roofing – or include in your contract that the roofer will tarp and clean up in the attic.

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# INSTALLING EPDM ROOFING
## on Flat Roofs

Until the early 1990's, using a professional roofer was the only way to get a rubberized roof system installed. What was once a product used only on shopping centers or department stores is now being used for smaller residential jobs. Most do-selfers will find cold process modified bitumen roofing a more practical material for use on flat porch roofs, flat garage roofs, and any other location with too shallow a slope to apply shingles. However, single-ply rubberized roofing is another option in these locations. Since in many applications it has no seams and is usually installed without nailing, it may be a solution for leak-prone areas where other materials have not been successful in deterring water intrusion.

One of the disadvantages of this material is that it is currently available only in the large sheets used in commercial applications. As homeowners start to buy rubberized roofing, manufactures may begin to market it in more suitable sizes and quantities for residential use. Right now, though, your best choice is to buy jointly with one or two others and split the materials yourself, because the minimum size that you'll need to buy is often far more than you'll need for your own house. You'll find rubberized roofing products carried by many roofing suppliers; check the phone book.

There are several different manufacturers of rubberized roofing, and each one offers several different ways to install their product. Those differences in application mean that one method may be a better choice over another for a particular job. You'll want to get installation instructions for the product you choose from the roofing supplier–and, asking their advice for your individual application is a good idea.

This handout will describe installation of one particular brand of rubberized roofing, EPDM, using one particular method. EPDM roofing requires a flat, relatively smooth surface as a base. If you have an existing asphalt roof of some type (such as traditional roll roofing), you'll need to carefully and completely remove it. EPDM and asphalt-based products are not compatible–the asphalt will eat through the EPDM–so they can't come into contact with one another. If, after stripping the roof, there is residual tar left on the deck, you can cover the deck with a high-density fiber recover board (generally available where you bought your EPDM.)

With the deck prepared, unroll the roofing material and cut on the ground a piece that is two to four feet longer on each side than the actual roof. (The excess will be trimmed off later.) A pair of large scissors works well for cutting the roofing, and you can use a chalk line to mark where to cut.

Put your gluing supplies and the roofing on the roof. You'll also need a long handle and a roller with a good-quality roller cover for applying the glue. Position the roofing and make sure it is located where you want it. Then, fold half the roofing back over the other half. (You can fold it lengthwise or widthwise, whichever works best for your roof.) Then, spread the glue around on the roof deck and on the roofing portion that is folded over. The glue needs to dry

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before you mate the roof and the deck. Depending on the weather, the drying process takes from five to twenty minutes. When it's ready, you slowly and evenly unroll the roofing and press it against the roof deck. It helps to have several people working together at this point—because once the roofing touches the deck, it's stuck. There's virtually no way to move it or slide it around. Also, if two parts of the roofing happen to come in contact with each other, they will stick together where they touch.

When the first side has been glued down, fold back the remainder of the roofing, and repeat the gluing process.

If you have to cover an area that will require using two pieces of roofing, you'll need to allow for extra roofing to overlap one of the pieces at the seam (normally four to six inches.) The piece closer to the bottom of the roof always goes on first, with the top piece overlapping it. You'll also need to use a special cement at the seam to glue the overlapped portion to the piece below it.

Flashing around the edges of a rubberized roof requires special details described in the manufacturer's literature. Finish off the outer edges and the top of the flashing pieces with metal termination bars, trimming off any excess roofing material. These areas, along with seams or other areas that need it, should be sealed with the caulk specified by the roofing manufacturer.

Rubberized roofing systems, when installed properly, promise less maintenance and longer life than traditional roofing choices. When they are installed with glue, if you should develop a leak, the water doesn't travel under the roofing. Moreover, if you ever need to patch rubberized roofing, it's like repairing a bike tire–something most of us have done.

Rubberized roofs have been used commercially for decades. Now, as more and more people begin to see their advantages, they are starting to come home.

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# REPAIRING GARAGE ROOFS

When you stop to think about it, the real reason that there's a building stuck out in your back yard is to put a roof over your car. (Some of the older garages in northeast Ohio even date back to that simpler time when their purpose was to cover a horse!) Over the life span of a garage, the roof is usually the area that needs the most attention.

If you garage roof hasn't been replaced in a while, it will most likely be covered with **shingles** (on *gabled roofs* with a steeper pitch) or **roll roofing** (on *flat roofs* with a slighter pitch). If your flat roof was replaced more recently, it may have been covered with **modified bitumen roofing**, which looks like traditional roll roofing but has a rubberized base. While the life span of shingles and modified bitumen roofing is far longer than that of roll roofing, all these materials have an asphalt-type tar base, which means that – over time, as they are exposed to the elements – they slowly lose the oils, chemicals, and stones that make them work. Eventually, they dry up and start to crack. Things progress downhill fairly rapidly after that. Moisture, in the form of rain, dew, snow, and fog, gets into the cracks and starts to work; the cracks get larger; the roofing material becomes stiff; and then one morning, you find that you have a roof leak.

By the time you see water in your garage, there is a good chance it has been trapped for quite a while between the roofing material and the boards that make up your roof. In fact, the wood framing may have been absorbing water from small leaks for some time, never really drying out. In such cases, the wood can begin to rot, losing its structural strength. If the situation is not repaired, this rotting wood will eventually fall into your garage.

Preventative maintenance on a roof is very valuable in terms of stopping this domino effect and saving money on expensive repairs. Garage roofs are usually fairly close to the ground, so height usually isn't a problem. A twenty-minute inspection once a year should be all you'll need to make sure your roof is in good shape. This is what you'll want to look for:

1. Check for cracks in the roofing material. A smaller percentage of cracks to the area of the roof means you have caught the deterioration in its early stages. A larger percentage of cracks probably means replacement is in order *(see below.)*

2. Check for loose nails or nails that have popped up. Pull these out, and put in a longer nail of the same type; then, tar over the nail head.

3. On flat roofs, look at the outer edges to make sure the wind hasn't pulled the roofing material up. Re-nail as needed, spacing the nails about 4" apart along the edge.

4. Also with flat roofs, look for cracks along the seams. Re-nail and tar as needed.

If you catch the deterioration in its early stages, there are two roof care products that can help you preserve your existing materials: roof cement (for use with shingles, roll roofing, and modified bitumen roofing) and roof coating (to be used *only* with roll roofing or modified bitumen roofing.) Roof cement is thicker, and it must be applied with some type of putty knife. It can be

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used to go over seams, cracks, or nail heads, or to patch holes. Roof coating is fairly runny and is used to fill in the small cracks that appear as the roll roofing or modified bitumen roofing dries out. It is usually spread over the entire roof to replenish the oils and chemicals that have been bleached out by the weather. It can only be applied once, so if you have already put it on, it won't work again to stop a leak. However, if you haven't used it yet, roof coating can be applied as soon as you see more than a few isolated cracks. Dressing with roof coating will probably extend the life of your roof for a year or two.

When it's time to replace the roofing materials themselves, you'll find that installing new roofing can generally be done on a do-self basis. If your garage has only one layer of roofing material, you can add a second layer without stripping off the original roofing. However, be aware that installing roofing atop an existing layer may shorten the life of the new material somewhat, since creases and cracks in the old roofing can telegraph up through the new layer. Before you install new roofing material, make sure the wood deck under the roofing is sound *(see separate handout on "Roof Sheathing" if you need to replace all or part of the plywood deck)* and that the rafters that support the roof deck aren't deteriorated.

If your garage has a gabled roof, the new shingles will be installed the same way as they are on a house roof – except that you're not as far off the ground. *(See separate handout on shingled roofs for installation instructions.)* For a flat garage roof, modified bitumen roofing is a better choice than traditional roll roofing, since the roll roofing now being manufactured is simply not as thick as it used to be, and seldom provides much longevity. The **cold-process** type is easily installed on a do-self basis *(see separate handout);* installing the **hot-process** type is a contracted job.

A new shingled roof will generally last about 20-25 years, and cold-process modified bitumen roofing, about 20 years. As with most repairs, a quality installation will go hand-in-hand with longer life.

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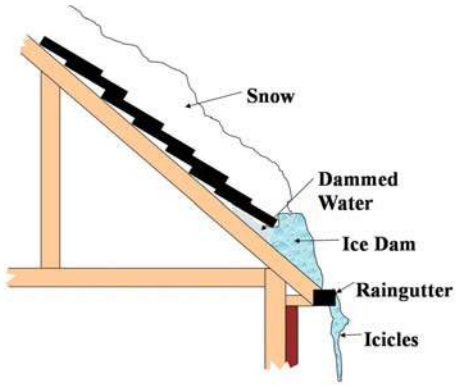
# PREVENTING ICE DAMS

With the freeze-and-thaw cycles that so frequently occur during Northeastern Ohio winters, most houses will occasionally be decorated with long icicles hanging from the gutters. Spectacular as they are, the ice can have a destructive side, when it builds up along roof overhangs – a problem commonly known as an ice dam.




Ice dams can damage soffits, rafters, sheathing, shingles, and fascia boards on the outside of the house. Melting ice can also back up under shingles, where the resulting leak can compact insulation and damage walls and ceilings on the inside of the house.

While it is unlikely that a roof will be completely ice-free, there are several ways to deal with ice dams. They range from simpler to more complex, vary widely in price – and none are foolproof. However, each can help reduce the chances that an ice dam will cause expensive damage to your house.

The first option is to add insulation to keep heat from rising through the roof and melting the snow, which then flows down to the cold gutter area and refreezes. This is particularly important on older homes, where insulation is inadequate or was never installed at all. However, you need to be realistic; even snow on well-insulated roofs can melt, run down to the gutter area, and freeze partway.

In addition to adding insulation, consider increasing the ventilation beneath the roof to allow any heat that does move up from the living area to escape to the outside. The easiest time to do this is when you re-roof your house; discuss the need for additional ventilation with each roofer when you are obtaining estimates on the project.

When you next replace your old shingled roof, make sure to have a waterproof membrane installed on the lower 3 to 6 feet of the plywood roof deck. This rubberized “Ice and Water Shield” will prevent melting ice from penetrating through the roof sheathing. Have your roofer install drip edge on the bottom edge of the roof, as well.

The most common way to prevent ice build-up to install low-wattage electric heating cables along the lower edge of the roof. The cables look like heavy-duty extension cords and plug into a standard outlet. They are usually installed in a zig-zag pattern along the lower edge of the roof, through the gutters and several feet into the downspouts. Some homeowners install them on a do-self basis, while others contract the job.

The cables are available in various lengths, ranging from 20 feet to 120 feet or more. The length of cable you’ll need depends on how deep into the overhang the cable will be run - 12”, 24” or 36” from the bottom roofline. Most manufacturers explain how to figure the length of cable you should buy for their product.

*continued*

Make sure the cable is installed safely. Don't use extension cords with the cable, as they can overheat. The cable should not be crisscrossed or overlapped, because that contact can create sufficient heat to melt the plastic insulation around the wire. Make sure the cable is plugged into a weatherproof outlet that is properly grounded, and that the cable itself is also grounded. While the cables operate on 120 volts, the longer the cable, the more wattage will be required to heat it.

Heating cable do not generally have thermostats, so you'll have to pay attention to the weather forecast to determine when you should turn them on and off. You don't want to pay for electricity to heat the cables on days when they are not needed.

Timing the installation is important, too. Make sure the heating cable is installed before the snowy weather hits. It's too dangerous to install them when there's a lot of snow and ice on your roof. You can remove snow accumulation with a roof rake (a large broom-like tool with an extension handle that you can use to drag loose snow off the roof deck), but – once an ice dam has formed – your options are limited. Don't try to hack at the ice (you can damage your shingles or gutters), or throw hot water or rock salt on the ice in an attempt to melt it. Just be patient and wait for warmer weather.

If the worst happens and you do notice a leak into your ceiling, drill a quarter-size hole through the plaster to let the water come through. It's easier to patch that hole later than to repair a whole ceiling that comes down.

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# MODIFIED BITUMEN ROLL ROOFING

## a longer-lasting roll roofing material for flat roofs

They just don't make stuff like they used to. For a flat roof on a home or garage, homeowners are learning that the traditional roofing material – asphalt roll roofing – is probably not the best choice any longer. Asphalt roll roofing was once rated at 90 lbs. per square (enough to cover a 100 square foot area), and you could expect at least 5 to 10 years of service before the aging asphalt dried out and cracked, allowing water to seep through. (Sometimes you could get another year or two before you had to replace the roof entirely by coating the roofing materials with liquid asphalt.) More recently, however, manufacturers have been making the material thinner, so the asphalt roll roofing now being installed will only last a few years.

Whenever you re-roof, you're probably looking for a long service life and low maintenance requirements. Currently, the material that best fills this niche is modified bitumen roll roofing. When modified bitumen is applied using a **"hot process,"** the installation is generally done by a roofing contractor. Even inexperienced homeowners**,** however, can complete a **"cold process"** application. This job involves nailing a base sheet to the roof deck, spreading a cold adhesive over the sheet, and then bedding a top membrane (the modified bitumen roll material) into the adhesive with a roller or by walking back and forth over the material. The membrane is made of a polyester mat impregnated with asphalt (bitumen) that is modified with a rubberized polymer. It resembles regular asphalt roll roofing, but is more durable and much more resistant to drying out. Modified bitumen costs more than asphalt roll roofing, but the increased longevity more than justifies the additional price.

Several companies make cold process modified bitumen products, but they are not available at all retail home centers. The manufacturer will usually offer a guarantee on the membrane – sometimes up to 20 years – if the application requirements are followed exactly. (There are specifications for the nailing, side and end laps, and the type or brand of adhesive.) If you contract the job, you'll want to make sure the roofer you use is familiar with the product to be installed, is experienced with the installation methods that will keep the warranty in force, and promises to use those methods in the written contract.

Whether you do the job yourself or contract it, there are a few guidelines to follow. First, a permit may be required; check with the Building Department in your community. (In Cleveland Heights, you'll need a permit for this job if it involves replacing any of the supporting structure of the roof – joists, beams, etc. – or if all the sheathing will be replaced. No permit is required for a job where you roof over an existing layer or replace only part of the roof sheathing.) Second, cold process application of modified bitumen roofing is best done in warm, dry weather; if the roofing is applied in cold weather, it may develop humps or ridges (due to expansion) when temperatures rise. Third, you'll get the best result if all the old asphalt material is stripped off before the new roofing is installed. The seams and old nails from a previous layer can cause bumps and ridges in the new layer, and – especially if the seams of the new roofing are directly over the old ones – you'll end up with dams that hold puddles of water.

*(continued)*

**If you plan to install the new roofing yourself.....**

The first step is to prepare the area. If you are re-roofing a walk-on porch roof, take down the handrails and posts to minimize protrusions through the new material. (If you try to wrap the roofing around posts, it just creates a potential leak problem.) On garages, remove the shingles that form the ridge cap. Then, strip the roof. A roof removal tool, flat edge shovel, or heavy ice scraper will clear the deck area in just a few minutes. (You'll spend much more time bagging up the debris!) Use a pry bar and hammer to get out any leftover nails. Be sure to clean up all the debris from the ground. Some tool rental stores have magnetic "brooms" to collect the roofing nails that have strayed into the driveway and yard. If you won't be able to install the new roofing immediately, place tarps over the exposed wood sheathing (especially if rain seems imminent).

Once the deck is clear, inspect the wood carefully. If some of the planks are rotted or missing, replace them. If the entire surface is poor, re-deck it with 3/4" CDX (exterior grade) plywood. If the roof is not a walk-on deck, you are permitted to use1/2" CDX or 1/2" OSB (oriented strand board). We suggest that you stay away from OSB for a walk-on deck, because it can weaken significantly if it becomes wet. (Plywood is much more forgiving.) Replace or "sister" any joists or rafters that no longer provide solid support to the deck, or that sag and allow water to puddle.

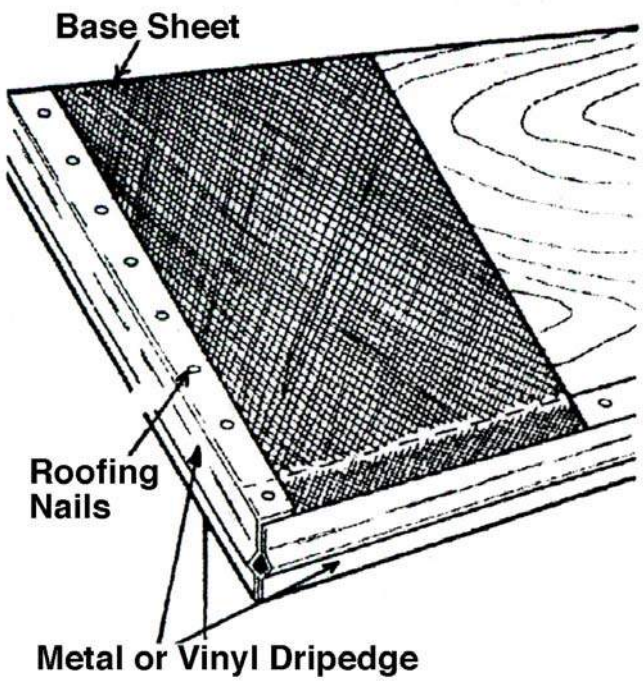


*Illustration 1: Drip edge nailed in place under the base sheet on the bottom edge, and on top of the base sheet on the rake edges.*

Start the installation of the new roofing by nailing down a metal drip edge to protect the exposed lower edge of the plywood and keep it from getting wet *(see Illustration 1.)* Meanwhile, roll out a couple lengths of the base sheet, 12 to 16 feet each, and let them "relax" in the sun to eliminate any tendency to curl. (Place the pieces on your driveway, as the material will kill grass if you lay it on your lawn.)

Fold the first row of base sheet in half lengthwise, and cut along the fold. This "staggers" the laps in the base sheet with the laps in the membrane on top of it, so the two seam joints are not directly over one another (to minimize puddles).

Nail this starter strip to the lower edge of the deck, covering the drip edge. Measure from the bottom of the roof and snap a chalk line to make sure the first row is straight. Space the nails according to the manufacturer's guidelines *(see Illustration 2, next page);* the most common nailing schedule calls for the use of 1" cap nails spaced 8" to 9" apart around the perimeter and along the lap-seams, and 16" to 18" apart in the field of the sheet. The nailing is very important, as it is the nailed base sheet that keeps the membrane secured to the roof in high winds.

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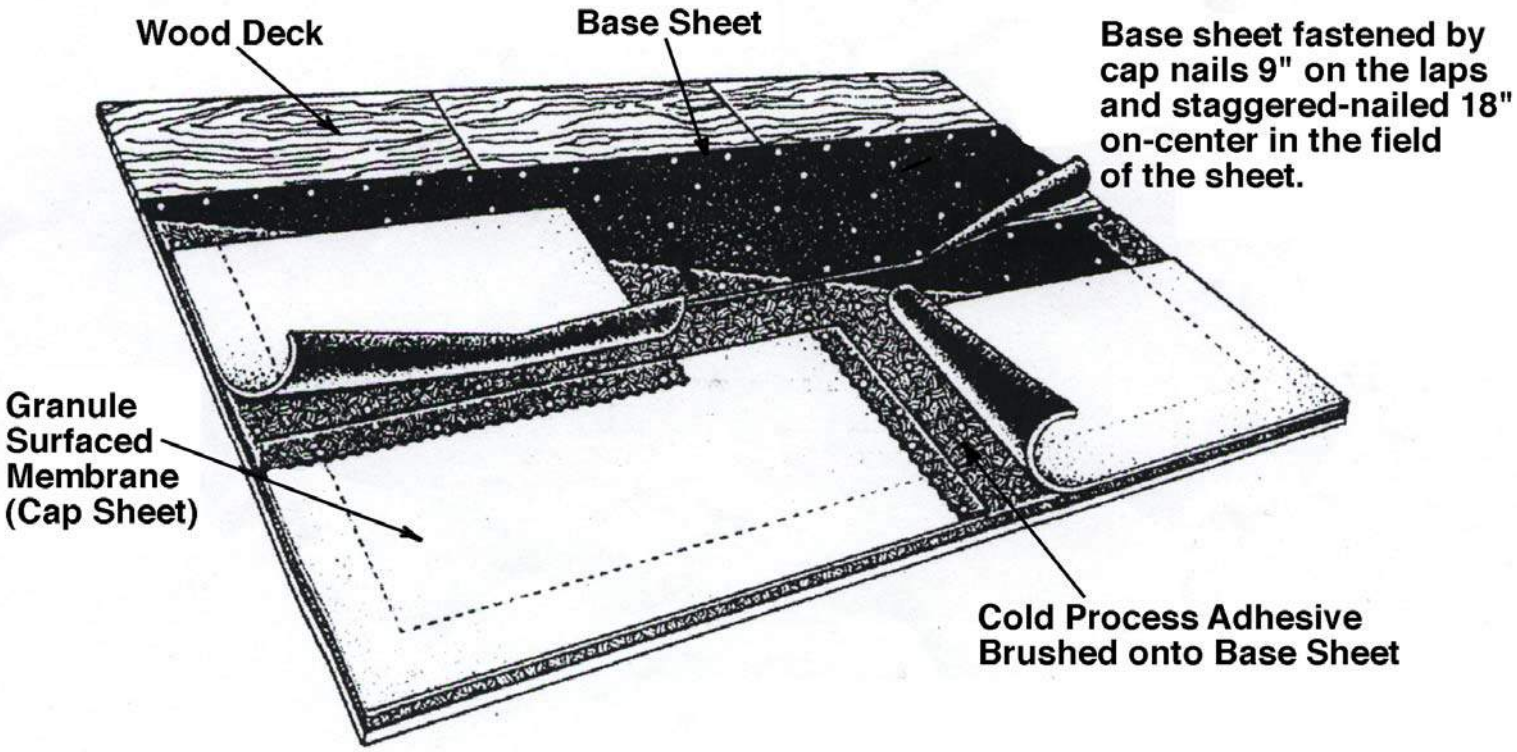


*Illustration 2: Typical nailing pattern for base sheet*

Lap the next row of base sheet over the starter strip by 2" or 3", and follow the manufacturer's nailing instructions for the lap seams and field nailing. Continue this process with the rest of the roof, using chalk lines to keep the rows straight and parallel. When all the rows are nailed down and excess material cut off along the top and sides, install metal drip edge over the base sheet along the rake edges (sides) of the roof *(see Illustration 1,)* except on garages with parapet sides. Besides protecting the exposed edge of the wood deck, the drip edge also helps keep the roofing material in place in high winds.

After the base sheet has been installed, roll out lengths of the top membrane to "relax." Make sure that the granule side is faced down, to keep dirt and grass off the side that makes contact with the adhesive. Before you bring up the first piece of the top membrane, pour adhesive on top of the base sheet along the bottom edge of the roof, spreading it out over the area that the first row of roofing will cover. Use only the adhesive specified by the manufacturer for the roofing material you are using, and apply it according to their directions. The directions will specify how much adhesive should be applied per square (i.e., one and a half gallons per 100 sq. foot area); the adhesive is designed to soften the top layer for a better bond to the base sheet, but too much adhesive might burn through the material. The most commonly used applicators are a notched squeegee or trowel or a three-knot roofers' brush.

We suggest you find a friend (or two) to give you a hand with the lengths of membrane. As you lay out the first row, leave enough material to extend beyond the drip edges at least one inch. Smooth out humps or bubbles in the material by pulling the material at the ends; then, use a roller (or walk over the membrane) to "bed" the material into the adhesive. To start the next row, spread adhesive on the "selvage," or lap area – the edge of the roofing material that has no granules – and on the area of the base sheet that will be covered by the next row of roofing membrane. Continue until the rest of the roof is covered, making sure to spread the

*(continued)*

adhesive only one row at a time. If you use two “remnant” pieces to complete a row, spread adhesive along the joint edge of the first piece and overlap it with the second piece by 6”. (Make sure to position the pieces so that the seams in adjacent rows are not at the same point of the roof.)

When you have the roof deck covered, use a straightedge and utility knife to cut the ends of the membrane, making sure that the membrane extends out over the drip edge by at least one inch. If your garage has parapets along the sides, follow the manufacturer’s instructions for how to install the membrane along the parapet; several installation methods are common, so you need to know the method that should be employed with the material you are using.

For a shed-type garage, all that’s left to do is to install the shingles that create the ridge cap along the peak of the roof. For a porch roof, you’ll need to flash (join) the roofing to any adjacent wall(s) of the house, again according to the manufacturer’s directions. Pay special attention to this process, as the joint between the house wall and the roof deck can be a prime area for leaks if the installation isn’t done correctly. Some manufacturers direct you to use the roofing material itself as the flashing, rather than metal. In this case, the material needs to be inserted behind the siding (at least 4 to 6 inches), and then lapped over the deck 6 to 8 inches and glued to the top membrane.

Walk-on decks are required by code to have posts and railings to prevent an accidental fall. Depending on the type of post, the method of fastening the railing to the deck will vary. *(For hollow-box wood posts, see our handout entitled “Porch Railing Posts.")* To attach solid wood posts, apply a liberal amount of silicone caulk to the bottom of the post, and then toenail (or toe-screw) it to the deck. Run a bead of the caulk around the post once it is fastened. Metal railing post brackets usually have exposed bolt heads. Be sure to use hot-galvanized lag screws (paint them with Rustoleum™ before installation), caulk the base bracket, and run a bead of caulk under the bolt heads to make a good seal.

Once the installation is complete, call your Building Department for a final inspection, if a permit was required for your job. Then, sit back and prepare to enjoy many years from this low-maintenance roof system.

**Long-term maintenance:**

On the rare occasion when you encounter problems with a modified bitumen roof, it will most likely involve bubbling or ponding. Bubbles (air pockets) occur where the roofing no longer adheres well to the surface below it; if you push on the bubble, you may hear a squishy sound where water has leaked under the membrane. You will have to cut out the bubbled section and replace it. Ponding (standing water) occurs where there are low spots in the roofing. If more than 10 – 15% of the roof remains water-covered 24 hours after a rain, you should build up the low spots to prevent water from working through the seams of the roof.

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# REPLACING A SHINGLED ROOF

The basic principle of all types of roofing is that they are designed to shed water. They do this by several means. First, they physically have a slope or pitch to them, so gravity will make the water roll off. Next, the surface is covered with a water resistant material. And finally, that material is installed in a manner that will not allow water to collect or be restricted in its flow off the roof.

When one or more of these basic design elements breaks down, the eventual result is a leak. The most common causes of leaks are when the roofing material loses its resistance to water, or when an object that protrudes through the roof material develops a leak around it.

## ROOF EVALUATION

You can usually assess the condition of your roof from the ground (with the aid of a pair of low-power binoculars). As shingles age and weather, the oils that keep them flexible dry out. The visible signs of this aging are curling shingles, missing granules, shingles that are raised up, or torn or missing shingles. All are indications, visible from the ground, that the general condition of the roof is not good. The larger the percentage of roof area having these conditions, the more urgent the need for a new roof. But, if these conditions exist at all, take it as your first warning sign that your roof needs replacement.

According to most experts, you should have no more than two layers of shingles on a roof at one time. So, if you already have two layers, they should be stripped off before replacement with new shingles. If you have only one layer, you can add another layer on top, but be aware that the life expectancy of a new roof installed on top of an existing one will usually be less. Also, if you have irregularities in your present roof, you can expect to see them work their way through your new one. For these reasons, it is best to install a new roof directly on top of the roof sheathing. That will provide the best job.

## MATERIALS

For your new roof, you have choices in the composition and quality of the materials to be used – especially the roof felt, flashing, and shingles. Roofing supplies are commonly sold in units called “squares.” Each square is the amount of material needed to cover a 100-square-foot area (10' x 10'). For example, three bundles of shingles will cover one square.

Use 15# or 30# **roof felt**. The numbers refer to the weight of the paper needed to cover a square; thus, 30# felt is thicker than 15# felt. There is a type of **waterproof roofing underlay-ment** that can be applied to specific areas that are prone to ice dam/water build-up that will help to prevent water entering the house from underneath the shingles. This product is called *Ice Guard* or *Ice Shield*. It is a little bit more expensive, so it is not generally used throughout the roof, but usually in the lower few feet of the roof where ice dams are a problem.

**Flashing** is the metal used to seal the roof where it joins other roof sections, house walls, or around obstructions such as chimneys. Don’t try to re-use the existing flashing – it’s best to use all new flashing with a roof replacement. Aluminum is the most popular metal now used, although copper and galvanized steel were used for many years. Flashing comes in many widths, but 24” is usually standard. You'll want a gauge of .025 or heavier.

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An asphalt **three-tab shingle**, made of either a fiberglass or organic base, is the most common type of shingle now used. Although shingles will usually be referred to as “asphalt” or “fiberglass,” the difference isn’t so clear-cut. Part of the confusion lies in the fact that fiberglass shingles are made from asphalt, and really should be called “fiberglass-asphalt shingles.” Both types of shingles have a base mat that is surfaced with mineral aggregates. In organic asphalt shingles, that base mat consists of felt made from rags, and paper wood pulp that is saturated and coated with asphalt. In fiberglass-asphalt shingles, the mat is made from glass fiber mat coated with asphalt.

Both type of shingle are commonly used today. (Although fiberglass shingles have a better fire rating than organic asphalt, both are considered acceptable.) Your choice will generally depend on aesthetics, availability, and cost – and maybe on the time of year you’ll be installing the shingles. Fiberglass-based shingles are coated (not saturated) with asphalt, so they don’t get as soft during hot-weather installations and aren’t so easily damaged. On the other hand, fiberglass shingles are more difficult to work with in very cold weather because they become brittle and can crack if flexed. For that reason, organic shingles may be a better choice if your roof will be installed during the late fall or winter months; fiberglass, for a summer installation.

Shingles usually come three bundles to a square. They are described by the number of years they are guaranteed (20-year, 25-year, 30-year...), which correlates to the quality and weight of the shingle. Generally, the more expensive shingles, whether organic asphalt or fiberglass-asphalt, will come with a longer warranty, some extending to 25 - 30 years.

Venting of roofs has become standard, as a way of allowing hot, moisture-laden air to escape from beneath the roof and extend the life of the shingles by keeping the attic cooler so that the shingles won’t dry out or curl. Vents also remove moisture that causes mold, wood rot and problems with the insulation. They should be installed at the same time as the roofing material. There are many types of vents to choose from, each with a “best application” and a different installation method: soffit vents, “mushroom cans,” ridge or gable vents and powered ventilators. The different types can be used singly or in combination, but there should be one square foot of venting for each three hundred cubic feet of attic space.

## INSTALLATION

A permit may be required for a new roof; check with your city’s Building Department before you start, to make sure you meet their requirements. (In Cleveland Heights, you need a permit only if the job involves replacing any of the supporting structure of the roof – joists, beams, etc. – or if all the sheathing will be replaced. If you will be applying a second layer of shingles over an existing layer or replacing only part of the roof sheathing, no permit is needed.)

It's best to install your new roof when the daytime temperature will be between 50° and 75°. Below 50°, shingles can develop hairline cracks that shorten their life; above 75°, walking on the roof during installation can remove the protective granules and shorten the life of the shingles.

If you're stripping off the old shingles, take this opportunity to check the condition of the roof deck for any deterioration or rotting, and replace any wood necessary. (This is also a good chance to blow insulation into your finished or semi-finished attic; use baffles for ventilation.)

The first item you should install after the wood sheathing is completed is rubberized roofing underlayment (i.e., Ice-Guard) along the bottom three feet of the roof. While Ice Guard is self-adhesive, you should make sure that you wrap it around the bottom edge of the deck and secure it to the fascia board with a few staples before the gutter is replaced. Also, center a piece of Ice Guard along each valley with the sides extended up the adjacent sections of the roof, to help protect these vulnerable areas from water leakage. (The valley flashing will be placed over the Ice Guard and nailed in place – see below.) After the Ice Guard has been installed, cover the remaining roof area with roofing felt. Install each piece of felt paper parallel to the bottom edge of the roof, overlapping the previous piece by 2 to 4 inches. The Roofing Materials

*(continued)*

Manufacturing Association suggests that the Ice-Guard also be positioned along dormers and chimneys before the metal flashing is installed.

Next, install a metal **drip edge** at the bottom edge of the roof. Nail the drip edge in place with roofing nails spaced 12” apart. It’s also a good idea to install drip edge along the rake edges of the roof (the sides sloping down from the peak), so the shingles can be extended on top of the drip edge and out from the roof a bit, allowing water to drip freely away from trim and siding; this drip edge installed along the rake edges is nailed *on top of* the roofing felt – *see below.*

Roofing felt is usually stapled down with a staple gun, making it secure enough to walk on without slipping or tearing. If you will be installing a vent that protrudes through the roof deck, first cut a hole in the sheathing for the vent; cover the hole with felt and then cut through the felt.)

After felting the roof, nail drip edge along the rake edges as described above. Then, install the flashing. In a valley (the area where two roof sections join,) first butter the area with plastic roof cement. Then, crease the flashing, center it over the valley and push it into the cement. Nail along the edges only, about 8” apart.

You also need to flash any places where the top of the roof meets a vertical house wall. Here, insert one side of the creased flashing up underneath the bottom row of wood siding or shingles about 8”; then, after the roofing shingles have been installed, use roof cement to butter the bottom of the other side of the flashing, lay it on top of the shingles and nail the edge, and cover it with cut shingle tabs cemented in place *(see Illustration 1.)*

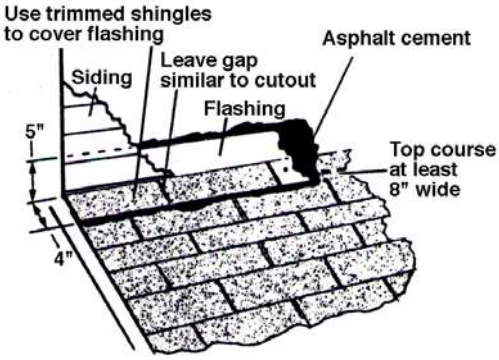


*Illustration 1: Flashing between the top of the roof and a vertical wall*

Use step flashing (smaller rectangles of metal flashing) against the side of a chimney. Weave the lower edge with the shingles as they are installed around the chimney *(see Illustration 2.)* Then, place cap flashing over the step flashing. The upper edge of the cap flashing should be bent about 3/8” and inserted into a groove cut into the side of the chimney and mortared in place *(see Illustrations 3 and 4.)*

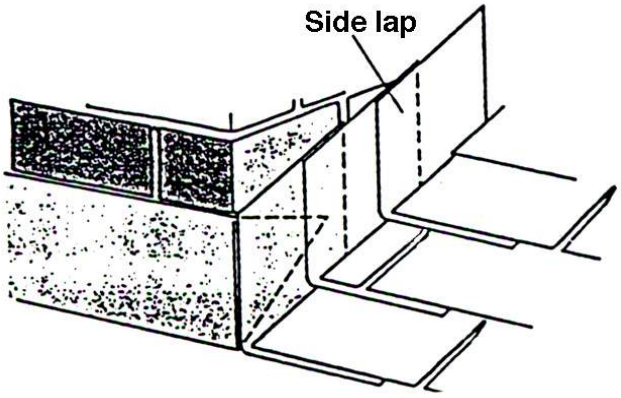


*Illustration 2: Step flashing against chimney*

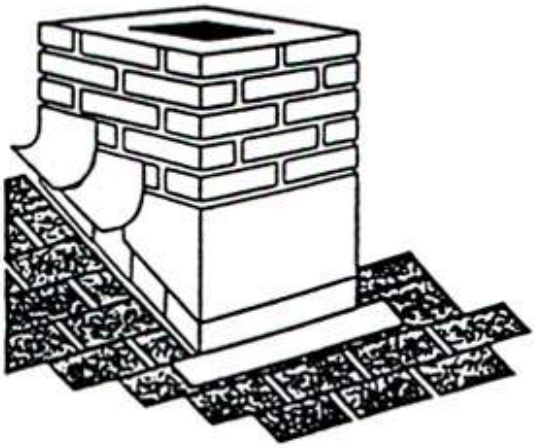

*Illustration 3: Front and side cap flashings set into chiseled mortar joints and mortared into place*

Step flashing is also used along dormers and other walls that extend up from the rake slope of the roof. Insert one side of the flashing piece under the wood siding or shingles, and then weave the lower edge with the shingles as they are installed, as you did along the chimney *(see Illustration 5 on next page.)* For soil pipes, use pre-made flashing collars that you simply slip over the pipe and interweave with the shingles.

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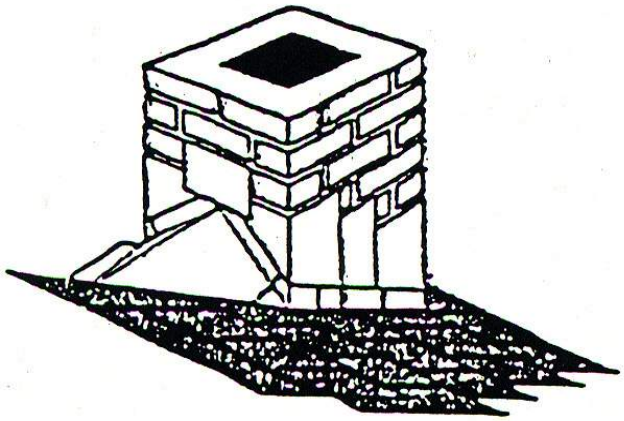

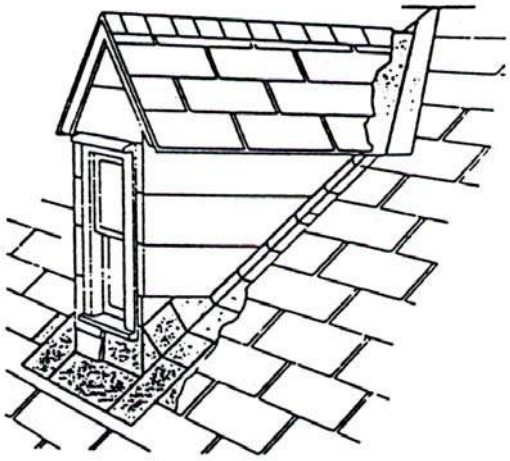

*Illustration 4: Rear corner cap flashings (install type suitable to situation)*

*Illustration 5: Step flashing against dormer wall, with one side inserted under wood siding and the other woven into the roof shingles*

Now, you are ready to shingle. Each shingle requires four roofing nails – a lot of hammer swinging by the time you install all your shingles. So, it pays to develop a rhythm for driving nails. You might also consider renting an air-powered nailer for the job. You'll need to follow safety precautions and take care to adjust the pressure properly to avoid driving the nails too deep into or through the shingles – but this tool can be well worth the cost if used properly.

Like the felt, you start installing shingles at the bottom. But, for the first row, cut the 5" tabs off and slide the shingles down, so that the sealer strip is next to the gutter. This places the sealing strip at the edge of the roof, to seal down the first row against wind tear-off. Then, nail another row of shingles right side up directly on top of this first row.

The next row of shingles should just cover the slits in the bottom row to ensure proper spacing. (Improper spacing can void the manufacturer's warranty.) You should also keep the lines between the tabs lined up; the line between each tab should fall in the middle of the tab on the shingle below it to get the maximum weather coverage *(see Illustrations 1 and 2.)* As you add rows of shingles, it's important to keep the rows straight. Use a chalk line to make straight lines you can follow. You work your way up to the peak this way. Usually, you let the rake edges go until the end, and then trim them all at once along the drip edge with a razor-blade knife. If you are installing vents, follow the manufacturer's directions for applying shingles around them.

On the top, nail a ridge cap to cover the peak. Cut the tabs into single widths, and nail them from one end, overlapping as you did on the roof *(see Illustration 1.)* Face the nailed end of the shingles in the direction from which the prevailing wind blows.

At this point, all that is left is clean up. You can rent a magnetic roller to roll through your yard to pick up any loose nails before they injure feet or damage tires.

It will take a couple of weeks of sunlight to soften and activate the self-sealing strip of asphalt on the underside of the shingle and give you a good seal. Then, you have only to wait for the rains to start to appreciate your new roof.

**TIP**: If you are tearing off the old roof, it's almost guaranteed that debris will come through and make a mess in your attic. We strongly suggest that you take time to cover any items with tarps that you have stored in an unfinished attic or in the knee wall area of a finished attic, so they are protected during the re-roofing.

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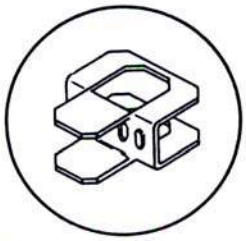
# ROOF SHEATHING

Water damage to a leaking roof can be so extensive that you must replace not only the roofing material, but also the entire wood deck or sheathing beneath the roofing. In older garages, the sheathing is usually made of “1-by” planking (1 x 6, 1 x 8, 1 x10, or 1 x12 #2 grade pine). The high price of wood planking will probably have you looking for a less expensive alternative for this job.

Particle board is not a good substitute; any exposure to water will cause it to swell and crumble in a fairly short period of time. Nor should you use oriented strand board (OSB), sometimes called “waferboard” or “flakeboard”; although it is more water-resistant than particle board, it will weaken quickly if it remains wet.

A rough (not sanded smooth) exterior grade plywood (CDX) makes an excellent replacement deck. It's a stronger material, and it’s much more forgiving of moisture than OSB or particle board. When the old sheathing is completely removed to the rafters, four-ply (4 layers of veneer) 1/2” CDX is permitted by code. If you are patching areas where there is still some “1-by” planking, you’ll probably have to use 3/4” CDX to match the thickness of the old deck. For any “walk-on” deck (like a flat porch roof with access via a window or door), you’ll need 3/4” CDX for adequate strength.

There are a few important rules for a strong plywood roof deck:



Plywood clip

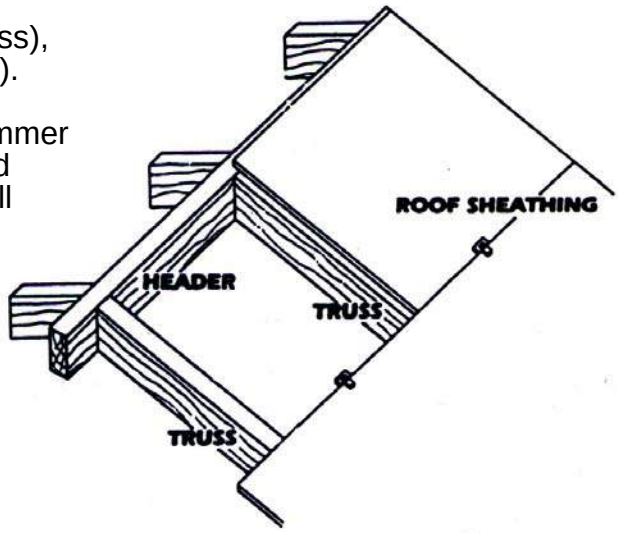
1. Any rotted or deteriorated rafters should be replaced or repaired (by “sistering” a new rafter alongside the old,) so the plywood can be securely nailed.

2. The long grain of the sheet should cross the rafters.

3. The sheets should be placed in a staggered pattern *(see illustrations),* with the short sides (cross-grain end) of the sheets meeting over a rafter.

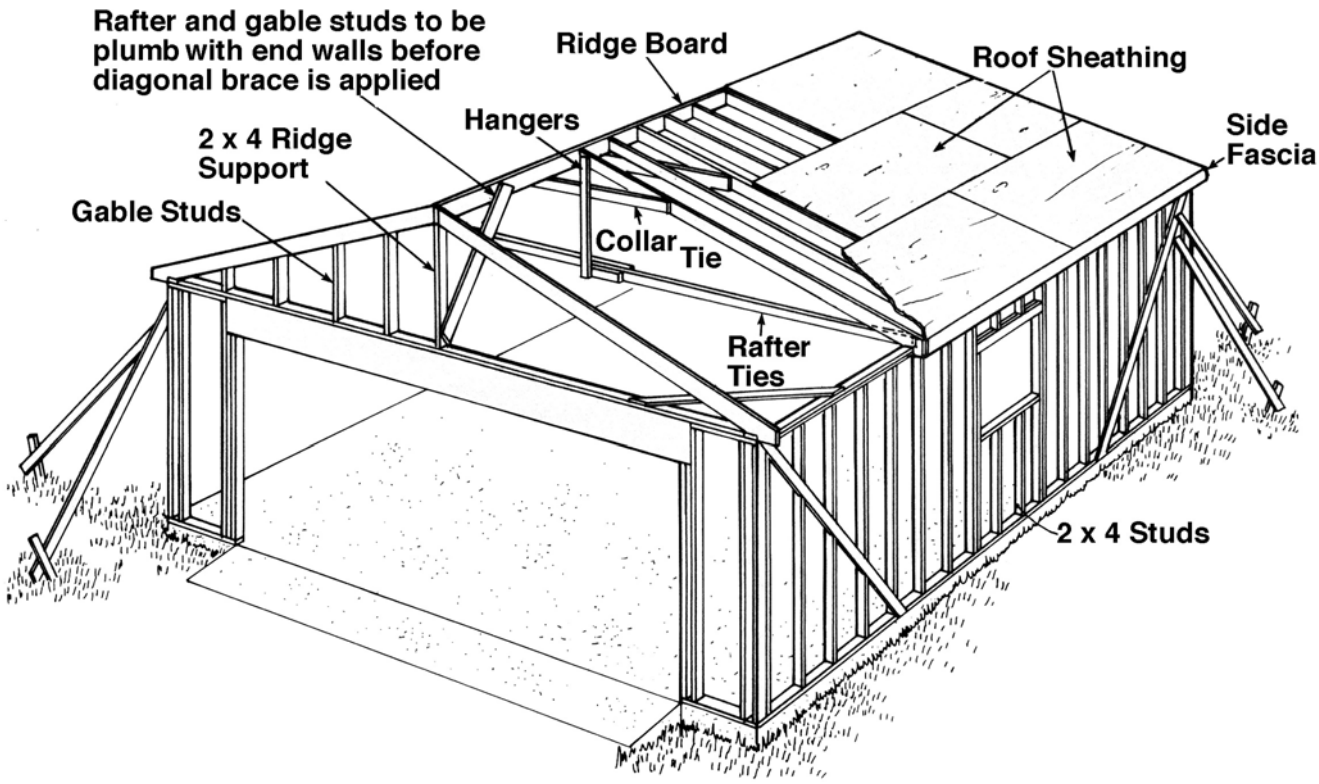
4. Metal plywood clips should be used along the long unsupported joints, midway between each rafter (truss), to keep the panels aligned (especially with 1/2” CDX).

Plywood sheathing can be nailed by hand with a hammer or with a pneumatic nailer. You can also use galvanized decking screws driven by a screw gun (or an electric drill with a Phillips-head bit.) The screws or nails should be about 6” apart along the length of each rafter.




The bare sheathing should not be left exposed. If you can’t complete the roofing job immediately, at least cover it with roofing felt or a tarp until you are able to install the remaining materials.

*(continued)*



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# CHOOSING ROOFING MATERIALS

If you are confused about the various roofing materials available, the following descriptions may help you make your choice.

A principal division among roofing materials has to do with the "pitch" of the roof. This term refers to the angle a roof slopes. It is expressed in two numbers, such as "4-12." In a roof with a 4-12 pitch, the roof drops 4 inches for every 12 inches it travels horizontally. Roof pitch can range from 0-12 to 12-12 and up. Roofs with a pitch of less than 3-12 are considered "flat" roofs.

**MATERIALS FOR GABLE ROOFS (with a pitch of 3-12 or more):**

Wooden Shingles, Slate Shingles, Cement Shingles, Clay Tile:

These roofing products were used on many older homes when originally built, but they are less commonly used today. Most of these products are designed to last 50 to 100 years. These are the most expensive residential roofs. They cannot be roofed over, but must be stripped off when a new roof is installed. They generally weigh a lot more than asphalt shingles, so the roof framing must be made stronger when the house is constructed to withstand the weight.

Organic or Fiberglass Asphalt Shingles:

These are the most common residential roofing materials used in this area. They are usually used on roofs with a 4-12 or greater pitch, but check the building code in your community. (Cleveland Heights, for example, requires that shingles also be installed on roofs between 3-12 and 4-12 pitch; the City recommends that in these cases an ice and water shield be installed beneath the shingles to prevent water from getting underneath the roofing material.) One additional layer may be applied over the first layer of shingles; however, on roofs that already have two layers of shingles, the roof will have to be stripped (torn-off) before the next layer is installed. If asphalt shingles are being installed on a roof that was originally covered with wood shingles (or, occasionally, slate or clay tiles), a base of plywood sheathing must first be installed over the entire roof surface after the old roof is removed – generally at an extra cost.

The difference between asphalt and fiberglass shingles can be confusing – even for roofers. Part of the confusion is due to the fact that fiberglass shingles are made from asphalt, and really should be called "fiberglass-asphalt shingles." Both types of shingles have a base mat that is surfaced with mineral aggregates. In organic asphalt shingles, that base mat consists of felt made from rags, and paper wood pulp that is saturated and coated with asphalt. In fiberglass-asphalt shingles, the mat is made from glass fiber mat coated with asphalt. Although fiberglass shingles have a better fire rating than organic asphalt, both are considered acceptable.

The choice of organic asphalt or fiberglass-asphalt shingles will usually matter more to the roofer than to the homeowner. Fiberglass-based shingles, which are coated (not saturated) with asphalt, don't get as soft during hot-weather installations – and thus aren't so easily damaged. On the other hand, fiberglass shingles are more difficult to work with in very cold weather because they become brittle and can crack if flexed. For that reason, your contractor may recommend using organic shingles if your roof will be installed during the late fall or winter months; fiberglass, for a summer installation.

*(continued)*

Asphalt shingles, like most roofing materials, are sold in “squares.” Each square of shingles covers 100 square feet, or a 10' x 10' area. They are available in many colors and several shapes, although rectangular shingles are the most common. Interlocking and dimensional shingles each offer an alternative “look” to traditional three-tab shingles; you might want to drive around your community and look at various roofs to determine what you like.

Your choice between organic asphalt and fiberglass-asphalt shingles will generally depend on aesthetics, availability, and cost. Both types of shingles are warranted for 20 to 30 years. In most situations, a longer warranty correlates to a heavier shingle. The shingles will have a longer life expectancy with proper ventilation. Vents can be installed at any time, but they are often included with a re-roofing job.

**MATERIALS FOR “FLAT” ROOFS (with a pitch less than 3-12):**

**RECOMMENDED CHOICES:**

Modified Bitumen:

Modified bitumen is a generic name used for several different types of roofs, but usually refers to a single-layer roofing product used on “flat” roofs. One type is installed with a torch, using heat to melt an adhesive/tar that bonds the roofing material to the deck; application of hot-process modified bitumen is usually best left to a professional roofer. A safer alternative is to use cold-process modified bitumen, which is installed without heat, using an adhesive to bond the roofing to a base sheet.

The base sheet used with cold-process modified bitumen is a polyester mat, superior to both fiberglass and organic, which remains flexible even in sub-freezing temperatures. This roofing material easily lasts 10-15 years, but needs to be maintained annually (checking for and repairing any loose seams or joints, or any cracks), particularly as it ages. Installation on a do-self basis is well within the ability of most homeowners.

Single Ply EPDM:

This roofing is basically a sheet of rubber sold in large rolls, from 10' x 50' to 50' x 100'. EPDM comes in two standard thicknesses, .045 and .060, and is available in white or black. It can be installed in several ways; the most common method is to glue the EPDM to a high-density fiber recover board nailed or screwed to the roof deck. Special techniques must be used if the flat roof abuts an asphalt-shingled roof, since direct contact with asphalt will chemically break down EPDM.

EPDM has a life expectancy of 20-25 years; however, the manufacturer may not honor the warranty unless the installer has received factory training in its use. Its advantages are its “stretch” and, often, the chance for a seamless application, resulting in minimal maintenance and few leaks. Its disadvantages are a more complicated installation method and, if the roof is not large, the difficulty of buying a small sheet of material.

B.U.R.:

This is the abbreviation for “Built-Up Roof,” which, as the name implies, is a roof made from several layers of roofing felt alternated with coats of hot roofing tar. It has been widely used on commercial roofs for some time, but on residential buildings would only be found on very large roof areas. (Modified bitumen or EPDM are more appropriate for typical house or garage roofs.) Most people will not be able to install a B.U. R. on a do-self basis.

The differences among B.U.R. installations come in the material the felt is made from, the number of layers of felt, and the composition of the roofing tar. Generally, more layers of roof felt mean a longer expected life; between 10 and 20 years is common. A B.U.R. roof will need increased maintenance (checking for and repairing loose seams, joints, or cracks) as it ages.

*(continued)*

**NOT RECOMMENDED:**

Roll Roofing:

This product is an asphalt-based strip of roofing material. It comes in rolls, generally 36” wide by 33' long; one roll covers one square (100 sq. ft.) 90 lb. roofing is the most common weight. Roll roofing is available in several colors.

Roll roofing has a life expectancy of three to five years, at best. For that reason, it’s no longer a good idea to use roll roofing. If you do decide to use this material, a half-lapped installation (with two layers of material over all parts of the roof) will offer the most longevity. The need for annual maintenance (checking for and repairing any loose seams, joints, nails, and cracks) increases with age.

Summary:

The pitch of the roof is always the first consideration when selecting roofing material. Budget constraints and the installer's familiarity with a certain product have traditionally been deciding factors after that. However, with the new materials available in the home repair field, the home-owner can now also consider longevity, maintenance requirements, and (if applicable) the ease of do-it-yourself installation. The chart below summarizes these variables:

| Material | Average Life | Cost of Materials | Roof Pitch | Maintenance Required | Ease of DIY Installation |
|---|---|---|---|---|---|
| Asphalt Shingles | 20 years and up | Inexpensive (about $50+ per square) | 3-12 or more* | Little | Moderate |
| Slate, Wood, Cement, or Clay Shingles | 50 - 100 years | Most expensive (about $800-3,200 per square) | 3-12 or more* | Little | Hard |
| Modified Bitumen | 10 - 15 years | Inexpensive (about $60 per square) | less than 3-12 | Moderate | Easy to Moderate |
| EPDM | 20 - 25 years | Moderate (about $90 per square) | less than 3-12 | Little to None | Moderate to Hard |
| B.U.R. (contracted) | 10 - 15 years | Expensive (about $145 per square) | less than 3-12 | Moderate | Hard |
| Roll Roofing | 3 years | Least expensive (about $40 per square) | less than 3-12 | Moderate to Heavy | Easy |

(2008 prices)

*Note: On roofs with a pitch between 3-12 and 4-12, an ice and water shield should also be installed.

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# Gutters

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# INSTALLING A CLEAN OUT
## between your downspout and storm sewer drain

Because tree roots can invade your storm sewer, periodic snaking is routine maintenance for many homeowners. To insert a snake cable into the storm sewer, most people chip out the mortar that seals the downspout into the clay tile hub below it and pull out the downspout. By adding a clean out at that junction, however, you can have easy access to the storm sewer without having to disconnect the downspout each time.

A clean out for the storm sewer system can be easily constructed from schedule 20 PVC parts. You'll need a 4" S&D ("storm and drain") wye, two pieces of 4" S&D pipe about 4" long, a regular 4" round cap, and a specialty adaptor to connect your 4" round storm sewer pipe to the size and shape of your downspout drain (in most cases, a 4" round to 2" x 3" rectangular fitting.) If you can't find the parts at your local home improvement retailer, check a plumbing supply store. Glue the wye, one of the short pieces of pipe, and the downspout adaptor together using primer and adhesive for PVC pipe. (Don't glue the cap to the wye.) Insert the downspout into the adaptor, and lock it in place with a sheet metal screw. Then, screw the cap onto the other fork of the wye, and mortar the assembled clean out into the clay tile crock *(see Illustration 1 below.)*

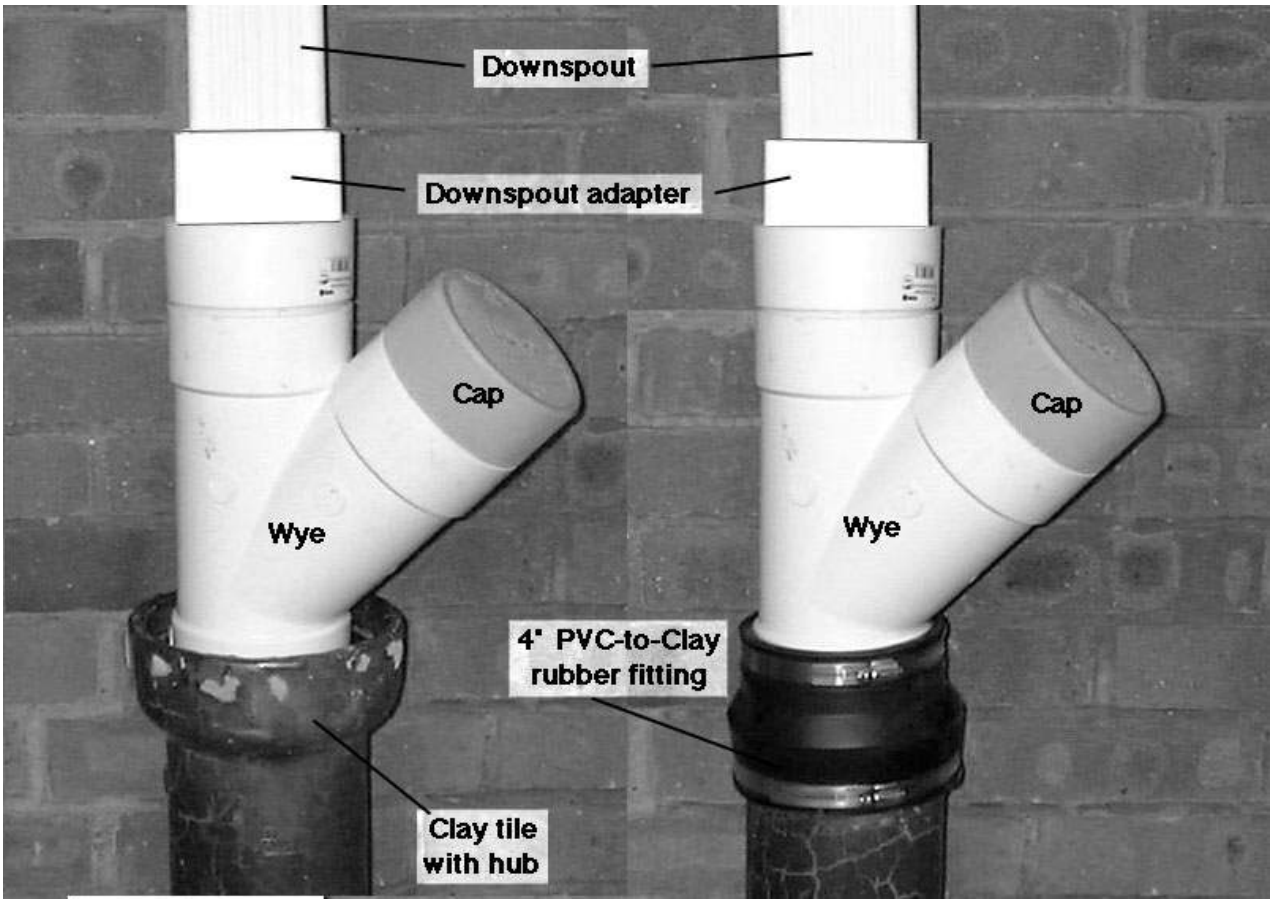


Illustration 1

(continued)

If the bell-shaped tile hub where you insert the clean out has broken away, you have a couple of options. The first is to dig down to the next hub joint, remove the broken piece, and purchase a replacement tile pipe at a building supply company. You can connect the new pipe to the next one with a rubber gasket (purchase it where you buy the replacement piece), or you can mortar it in place. Should the new piece of clay tile pipe be too long, cut it *outside* with a concrete saw or an angle grinder with a masonry cutter blade. Then you can mortar the PVC wye into the hub.

**4-1/2" angle grinder w/ diamond masonry blade**

*Illustration 2*

The other method is to use a PVC-to-Clay rubber coupling to join the PVC fittings to the tile pipe (*see Illustration 1*). Use an angle grinder to smooth and level any jagged edges on the clay pipe before slipping on the rubber fitting. Ultraviolet light (UV) rays can cause the rubber fitting to dry out and crack, so it's a good idea to arrange the connection in such a way that the coupling is buried in the soil to protect it from drying out.

You can install a clean out on all your downspouts, or just the one(s) used for snaking. The clean out will also give you an easy access to add copper sulfate to your drain lines. Be sure to read the directions on the package before diluting with water. Copper sulfate will kill the roots (but not the tree) in your storm sewer, so you don't need to snake as often. It will *not* dissolve existing roots, however – you'll need to snake to remove them.

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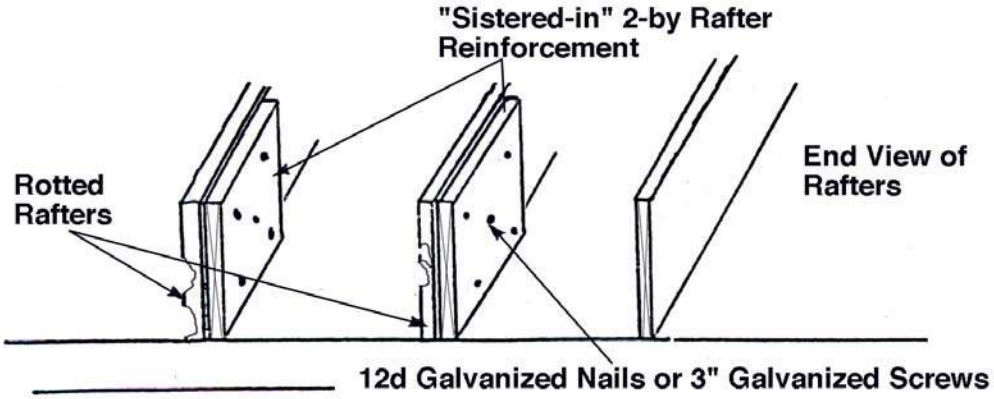
# FASCIA BOARD REPAIR

The board that rests behind your gutter is called a fascia board. It lives with some unique problems. First, since it's always covered by a gutter, it is never exposed to sunlight. Second, it is in an area that is constantly wet or damp. Third, it never gets any paint. (When you last painted your house, did you take your gutters down and paint behind them?) So, it's little wonder that fascia boards rot out as frequently as they do.

There are a couple of things that you can do to help prolong the life of your fascia boards. First, when you have to replace your gutters, check the fascia to make sure it is sound and securely nailed. If so, put two coats of paint on it. (Oil-base paint is best for this job.) After the paint dries, you can install the gutters.

If, when you remove the gutters, the fascia is loose, and longer replacement nails don't seem to secure it adequately, then the ends of the roof rafters have probably rotted. If this is the case, the fascia board must be removed completely to replace the rafter ends. When you get the fascia board off, your rafter ends will look much like the diagram below. You'll need to determine which one(s) are rotted. If you can't tell by looking, take a nail and try to push it into the rafter in several places. If you can push it into the wood by hand more than 1/2", then the rafter end should be reinforced.

Repairing the ends of your rafters is fairly simple. First, measure the size of your roof rafters. Then, cut a new piece of that size wood about three feet long, and nail it alongside the existing rafter, making sure that it is flush with the end (see diagrams.) After you have reinforced all the rafters that need it, re-nail the fascia board in place. Mark the location of each new rafter end on the top of the fascia board, so when you re-attach your gutter you'll know where to drive in your nails.



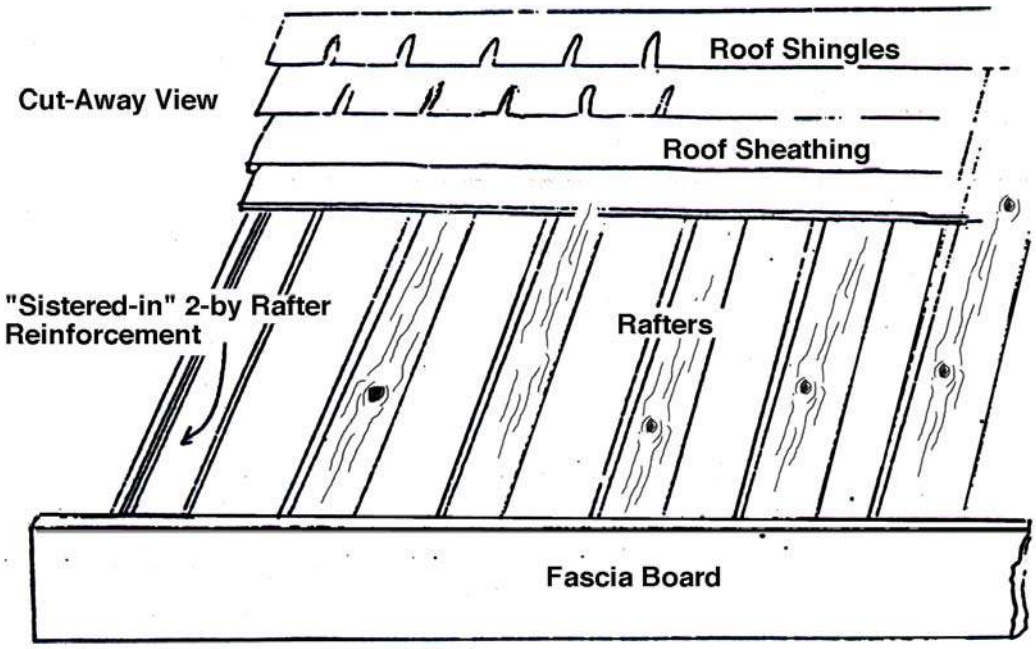

If the fascia board itself has rotted and must be replaced, outdoor treated wood is best to prevent recurrence of this problem in the future. (If you use untreated wood, you can slow down the damage from moisture by painting <u>all</u> surfaces of the fascia board with primer and two coats of exterior paint before installing it.) You can also use a vinyl or aluminum fascia wrap that fits over new or existing fascia boards and protects the wood from the elements.

*(continued)*

Measure the fascia board you are replacing to determine what size board you'll need. Nail the new one to the rafter ends, just like your gutters, using #10 galvanized box nails.

Bet you thought rafter repair was much more complicated! Most homeowners don't realize how simple this repair is, and how much it can extend the life of their home.

*Note: If your house was build prior to 1978, the fascia boards may have one or more coats of lead-based paint on them; if so, disturbing these surfaces can produce lead-based paint dust, which is a health hazard that poses a special threat to young children. Make sure you take the proper precautions to minimize lead contamination. (See separate handout on "Controlling Lead-Based Paint during Your Paint Repair Project – Outside Projects.")*



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# GUTTER SYSTEM MAINTENANCE

When April showers fall upon your roof, it's the job of your gutters to control and carry away all that water. You can pinpoint problems in your system if you take a few minutes to check the condition of your gutters and downspouts. Your annual spring inspection is a good place to start.

Put on your rain gear or grab an umbrella, and go outside during a heavy rain. Nothing else will give you such a graphic picture of how much water your gutters must handle – or how well they are doing their job. If you see water pouring out over the top of a downspout or flowing down your siding, you know you have some repairs to make to return your gutter system to working order.

Older galvanized gutters that have developed holes or are rusting out should probably be replaced. Aluminum gutters and downspouts, however, will last much longer with periodic maintenance, provided that they haven't been crushed by a ladder or car bumper, or deformed by excessive ice build-up.

Gutters that are otherwise sound can sag out of alignment, usually because they are no longer securely fastened in place. (A "washed-out" area in the lawn below can indicate this problem, as the cascading water destroys the ground cover.) When weather permits, climb a ladder to the gutter line and check the fascia board behind the gutter. This board can rot out, and you'll have to replace it. While you are removing the old fascia, check the condition of the rafter ends to which the gutter is nailed. If the ends have rotted, it's a simple job to nail a "sister" along side the rafter end, giving you sound wood to anchor the gutter.

Then, clean out any debris from the gutter, so you can check the caulking at the gutter seams and where the gutter meets the house. Remove any deteriorated caulk and re-caulk as needed.

Finally, while you're on your ladder, check the downspouts to make sure they are clear of obstructions and flowing smoothly. You can test your downspout drains by putting a garden hose into the top of each downspout (or into the tile crock at the bottom, if you break the mortar seal and pull the downspout out of the tile.) Let the water run for 10-15 minutes. If the water doesn't back up, the drain line is clear from that point onward. If, on the other hand, the water backs up, the drain should be snaked to remove the obstruction (usually caused by tree roots.) By testing each downspout, you can pinpoint the likely location of the clog; for example, if the rear downspout backs up, but the front one flows freely, the obstruction is probably in that portion of the drain between the two downspouts.

By checking your gutters periodically, you can prevent the major headaches that water damage can cause.

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# WHEN YOU'RE REPLACING YOUR GUTTERS

Installing new gutters is a common home repair. Most people choose replacement gutters made from aluminum, because they don't rust like the older-style galvanized gutters. White and brown are the standard colors available, although you can paint gutters to match your house trim, if you wish.

Homeowners generally consider two alternatives for new gutters. The first is "seamless" gutters, formed by a machine at your house. Seamless gutters are usually installed professionally. The second option is the more traditional pre-made gutter sections that you buy at a retail store and assemble to fit your house. These sections can be installed professionally or on a do-self basis. Both types of gutters have advantages and drawbacks.

Seamless gutters have fewer joints to develop leaks. On the other hand, the aluminum from which they are made must be a light enough weight to go through the forming machine. Most contractors use .027 gauge aluminum, which can deform if you lean a ladder against it or if you have some heavy icicles hanging from it. You can specify a heavier .032 gauge, but not all contractors have the equipment to produce seamless gutters of that weight, so you may have to pay a higher cost for them to obtain the materials elsewhere.

If there is a drawback to sectional gutters, it's that the joints may leak if the connections aren't made properly. Like seamless gutters, pre-made gutter sections can be purchased in different gauges. The gutter sections available in most retail stores are only .024 gauge (thinner than most seamless gutters), and are sold in standard ten-foot lengths. Heavier-gauge gutters, as well as longer lengths, are available in specialty shops. It's a good idea to use the heaviest gauge you can, one that will withstand some ice or ladders.

In choosing between seamless and sectional gutters, consider cost, durability, and the expertise of the installer. Then, select the option that makes the most sense for your situation.

Consider your downspouts, too. In most cases, a traditional 2 x 3-inch rectangular downspout will be sufficient to carry water from your gutter to the storm sewers. However, if one of the downspouts must transport a large amount of water – where several roof sections come together, for example – you may wish to install a 3 x 4-inch downspout. This larger-capacity downspout may not be available at retail stores, but is worth seeking out.

In addition to the type of gutter you'll be installing, you should also think about the condition of the fascia board that runs behind the gutter. This board can sometimes rot out. If any of your fascia boards have deteriorated, you'll need to replace them when you replace the gutter; otherwise, there will be nothing to nail the gutters into. Outdoor treated wood, pre-painted wood, or vinyl- or aluminum-wrapped fascia will all resist moisture. Any untreated wood used for the new fascia should be painted *both front and back* with two coats of oil-base paint before installation.

Rafter ends, to which the gutters are fastened, can also rot out. If that has happened, new pieces of wood will need to be "sistered" alongside the original rafter, so that a gutter hanger or fastener can be secured into sound wood at each and every rafter end. This ensures that the gutter will remain in place even when filled with ice or water. *(See separate handout on "Fascia Board Repair" for how-to information.)*

*(continued)*

Another “gutter issue” is how to keep your gutters clear of leaves, maple “helicopters,” and other debris. Don’t try covering your gutters with wire mesh (which will corrode) or flimsy plastic mesh (which will end up dropping into the gutter). If you are going to install gutter guards, it’s better to use something made for that purpose. There are many types of gutter coverings, all promising to end clogged gutters forever. They are generally made of aluminum or plastic; neither material will rust, but aluminum can corrode. Corrugated types, usually made of metal, can hold leaves on top of the guard, while plastic models tend to shed better.

Almost all gutter guards will keep leaves out of your gutters, but other types of debris can cause problems. For example, small granules from asphalt shingles are commonly washed into gutters when it rains, and certain styles of coverings can allow smaller bits of organic matter through the openings. Even with gutter guards, you’ll still need to check and clean your gutters – just not so frequently – and that can be difficult. Some styles of gutter coverings are screwed in place or otherwise permanently attached, making it nearly impossible to use a hose to wash out the gutter channel without removing the covers. On the other hand, guards that snap into place can be “unsnapped” when you need to do routine maintenance.

So, when you’re considering covering your gutter, don’t just consider the price – check out the style of gutter guard being proposed. Whether you are doing the work yourself or contracting the installation, ask what the covering will be made of, how it will be attached, and how you can get access to the gutter channel when necessary.

A final consideration is whether to add a clean out at the bottom of each downspout, where it enters the tile crock and connects to your storm sewer. Because tree roots frequently invade the storm sewer system, most people will need to snake their downspout drains periodically, and a clean out can provide easy access for the snake cable. **It’s a good idea to add clean outs when you replace your downspouts.** *(See separate handout on “Adding a Clean Out” for how-to information.)*

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# REPLACING GUTTERS AND DOWNSPOUTS

If you were to stand in the rain and watch the water roll down your roof into your gutters, you'd be very surprised at the amount. Watching your gutters work can help you appreciate what a big job they do, carrying rainwater safely into the sewer system. If all that water weren't controlled by the gutters, then much of it would end up in your basement and, in the process, push in some basement walls and heave up part of your driveway.

Installing replacement gutters is a fairly easy repair for most people and will generally be a lifetime repair, unless a falling tree limb or leaning ladder forces a section out of shape. However, you first need to know a few things about buying, assembling, and installing them.

**Buying Gutters:** Gutters come in various materials – copper, vinyl, galvanized steel, aluminum, and wood. Most people use aluminum replacement gutters for their lower cost and ease of installation. We'll be talking here about aluminum, but the general principles apply no matter which material you use. Aluminum gutters come in different thicknesses, or gauges. .027 is usually the lightest gauge allowed under the building code. A gutter with a gauge of .032 is a better choice, although it may not be readily available at retail stores; it will better withstand the weight of someone on a ladder, or the pressure of ice build-up in winter. The diameter of the gutter is standard for residential work. If you look at the chart, you will see the parts commonly used in assembling gutter systems.

**Assembling Your Gutters:** It helps to make a drawing of the gutter system you are replacing before you take it down. Then, you can use the old gutter pieces as a pattern for measuring the new ones. Tin snips work best when cutting the gutters to length. It's easiest to make a "rough cut" beyond your final cutting line, to get rid of the excess gutter length, and then carefully trim to your desired length, using a square to mark a straight line. You can cut the gutter with tin snips or a hacksaw; to make a hole in the gutter for the downspout “drop,” trace around the piece you’ll be inserting, drill holes near the corners, and then carefully cut along your line with tin snips.

The gutter parts are all designed to slip together. Remember – patience pays off here! If you try to force or beat the pieces together, you'll quickly end up with a dented, leaky, unattractive gutter. After assembling the section you are replacing on the ground, you’ll need to drill some holes and “pop-rivet” the pieces together. A pop rivet is a metal fastening device that holds the different pieces of aluminum together. You use them with a rivet gun, which lets you join the pieces without much effort on your part. 1/8” pop rivets are the best size for gutter work.

**Gutter Installation:** At this point, another set of hands is very helpful. The proper amount of slope or drop for a gutter is 1/8” to 1/4” per foot; so, a ten foot long gutter should be 1-1/4” to 2-1/2” lower at one end than the other. You can mark this slope with a chalk line.

There are several different ways to attach your gutters to the house *(see last page).* Most gutters in the Cleveland Heights area were installed using **spikes** (long nails) and **ferrules** (hollow tubes spanning the width of the gutter, through which the spikes pass.) The spikes are generally spaced approximately 3 to 4 feet apart and are nailed into a fascia board that is only ¾” thick. The problem with spikes is that they often back out of the fascia board, allowing the gutter to pull away from the house.

*(continued)*

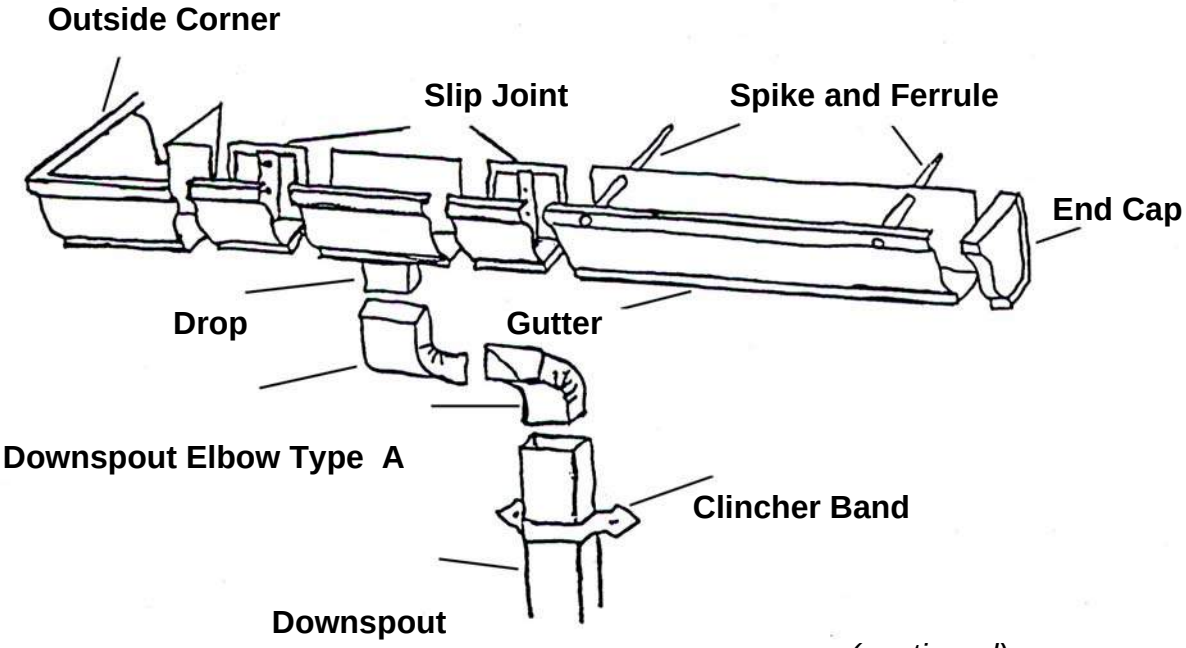
Using a **hidden hanger system** helps prevent this problem. The hangers hook under the front lip of the gutter and slip over the back gutter wall. They are installed using screws that go into the wood 1-1/2 inches. Because the screw is driven home using a ¼" nut driver on a cordless drill, the gutter is also spared the hammer damage that can occur from driving in a spike. Screwing a hidden hanger into each rafter tail (generally 16" on center) will ensure that the gutter can resist the weight of water, snow, and ice.

*Hidden hanger*

No matter which type you choose, nail each gutter hanger into the ends of the roof rafters for better support. Start at one end when nailing, and work towards the other. When you have finished nailing, caulk all the joints on the inside with a good quality silicone-based caulk.

Downspouts and elbows are made to slip together. When assembling downspouts, the piece on top slides *into* the next lowest piece, and right on down the line, so water won't leak out as it flows down the spout. When you get to the bottom of the downspout where it goes into the drain tile, seal the downspout to the crock with mortar to keep debris out of the drain.

Regular maintenance will involve seasonal removal of leaves and other debris, plus any needed snaking of footer drains and storm sewers. Because tree roots frequently invade the storm sewer system, most people will periodically need to snake their downspout drains. A **cleanout** at the bottom of each downspout, where it enters the tile crock and connects to your storm sewer, can provide easy access for the snake cable. **It's a good idea to add cleanouts when you replace your downspouts.** (See separate handout on *"Adding a Cleanout"* for how-to information.)

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## GUTTER PARTS:

Gutter
Comes in 10" to 32" lengths; different thicknesses (gauges) of aluminum

Drop
Used to connect downspout to gutter

End Caps
Right and left ends for the gutter

Outside Corner
Used to go around the outside of a corner

Inside Corner
Used to go around the inside of a corner

Slip Joint
Used to connect two pieces of gutter

## DOWNSPOUT PARTS:

Downspout
Used to carry the water from gutters to the drain

Clincher Band
Used to hold downspout to side of house

Downspout Elbow Type A
Used to move downspout in or out from wall

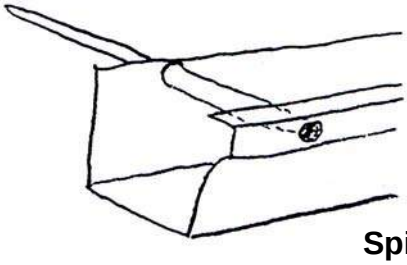
Downspout Elbow Type B
Used to move downspout to left or right

## MOUNTING BRACKETS:

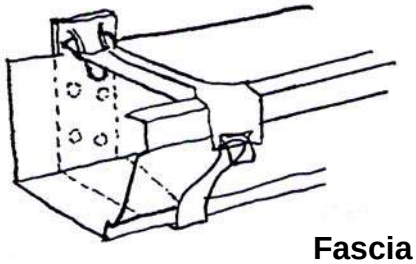
Fascia Bracket
Used to mount gutter to fascia board

Strap Hanger
Used to hang gutter from the roof

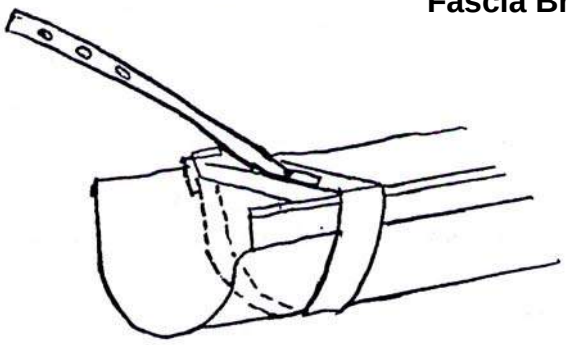
Spike and Ferrule
Used to hold gutter to fascia board



**Spike and Ferrule**



**Fascia Bracket**



**Strap Hanger**

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# 16.

# Siding

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# VINYL SIDING
## Issues to Discuss with Your Contractor

There are several points you should pay attention to, in order to get a nice looking, good quality vinyl siding installation on your house:

1. Selecting the right contractor is important. Look for one who has had a lot of experience installing vinyl siding. Ask for *and check* references. You'll want to look at houses that were done two or three years ago, to see how well the work has held up. Since siding jobs usually require a permit, check if the contractor is licensed and bonded in your city.

2. The material you select is also important to the quality of the job. The vinyl siding you choose should have an appearance that is historically correct and appropriate for the style of your house. You can find vinyl siding that simulates cedar shingles, as well as other decorative styles of siding (scallops, waves, etc.) Talk to an expert in historic preservation if one is available in your city (Cleveland Heights residents can call the City's Planning Department,) or consult the preservation experts at the Cleveland Restoration Society, (216-426-1000) regarding the style, size, and texture appropriate to the time your house was built. In addition to its appearance, check the quality of the siding to be used. Generally, the thicker the material used, the better. Siding is sold in gauges (thicknesses) of .030 and up. Older homes work better with about .040 gauge siding.

3. How the trim around the doors and windows is covered has a lot to do with the final look of the job. A contractor may suggest "jumping the casing," a process that brings the new siding on top of the existing trim, right to the edge of the window or door. The finished effect is that of a house without trim. This <u>never</u> looks appropriate. A better solution is to have the trim covered with flat aluminum, bent on site to closely match the existing style. When this aluminum trim is installed with corners that are mitered and properly caulked, the look is one that retains the architectural integrity of the house.

4. Color selection is much more important with vinyl siding than paint. Dark colors can fade in a few years, and the sun-exposed sides of the house may end up lighter than the shaded face. At this time, vinyl siding is almost impossible to paint, so you'll have to live with the color(s) you choose for 25 to 35 years – a long-term commitment to that color scheme. The Cleveland Restoration Society or local paint stores have people experienced with color selection to help you.

5. Before new vinyl siding is installed, the condition of the present siding should be assessed. Concentrated areas of peeling paint, siding boards that are severely warped or rotted, or sections of siding that have moss, fungus, or algae on them are indications of moisture problems – generally, the result of moisture coming through the walls of the house (usually near a kitchen or bath.) Water can also enter the walls from a leaking roof or gutters that overflow into the soffit. These conditions should be corrected first. Otherwise, the vinyl siding won't let the sun dry out the underlying wood, and you'll make matters worse – possibly leading to the wall studs rotting out over a 10-15 year period. For this reason, use of foam insulation/ backer board under vinyl siding is usually not a good idea. It can block

*(continued)*

the weep holes in the siding and prevent moisture from passing through it, and it doesn't provide much insulation for what it costs. It is no substitute for insulation in the sidewalls.

6. If you wish to insulate your house at the same time that you install vinyl siding, you can have the contractor blow insulation between the existing walls into the stud cavities. If the existing siding is badly rotted or deteriorated, you may need to remove it before the new vinyl is installed. In that case, a vapor-permeable housewrap can be applied over the sheathing before the new vinyl siding is installed; this material doesn't add insulation, but will stop much of the air movement through the walls.

7. An important detail of quality installation is allowing enough room for the natural expansion and contraction of the siding. If the siding is nailed too tightly or too loosely, then it can develop sagging or buckling problems. At spots where the siding meets other materials, there should be a tight enough fit so that a bead of caulk no wider than a finger will effectively seal the gap. Any gaps wider than that will eventually allow water to get underneath the siding. Places to check include trim edges, where the siding meets a chimney, and any other areas that aren't sealed by a molding strip.

8. A quality installation will include use of a good quality silicone caulk that is color-coordinated to the siding; a completed job that is entirely weatherproof; installation of all materials so that they are level and plumb; and a finished job that has a neat appearance. These are details to look for in previous jobs the contractor has done, and you might wish to include them in your contract.

You can attractively re-side your house with vinyl siding. When a job is done well, no one notices the siding. It is only when there is poor quality workmanship or an inattention to detail that the end result is less than pleasing.

## Maintenance

Most people believe that vinyl siding requires no annual maintenance. While it doesn't need much, there are some things you should do to protect your investment:

1. Once each year, wash the exterior with a mild soap and soft brush, rinsing thoroughly. Or, you can use a pressure washer. If you allow the natural accumulation of dirt to remain, the action of the wind blowing over it will create a scouring or sanding effect that will damage the finish of the siding.

2. While cleaning, check all caulked areas to make sure they haven't opened up and are allowing water to get behind the siding. Promptly repair any opened areas to make the siding weather-tight once again.

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# SIDING OPTIONS
## for houses and garages

There are an increasing number of options—both traditional materials and new products – that can be used to replace existing siding or to finish new construction (such as an addition or a new garage.) Some of these new products are easy to install, have minimal maintenance, and hold up well. Others are less durable. Let's look at the options currently available, and the advantages and disadvantages of each.

**RECOMMENDED CHOICES:**

**Ship Lap or Drop Lap Siding**:

This tongue-and-groove type of wood siding has been a longtime standby. Until recently, it was the type most commonly used on houses and garages. Each piece locks into the pieces above and below it. The siding comes in boards about 6” wide, sold by the foot, and is still available at lumberyards. It is one of the most expensive sidings, and, relatively speaking, takes the longest to install.

**Wood Shingles:**

Wooden siding shingles (rectangular pieces of wood) are most often found on the top half of older houses, but occasionally cover a whole house or garage. Siding shingles are most often made from cedar. They are naturally impervious to water, but are also prone to splitting or cracking and are relatively soft. The shingles are nailed in rows – sometimes even, but occasionally staggered – with each row overlapping the one below it. Shingles are sold in bundles that cover one-third of a square (33.3 square feet) and that contain pieces of wood of varying widths.

**Fiber-Cement Siding**:

Fiber-cement lapboard siding is a fairly recent development. This siding can be smooth, or it can have a rough-sawn wood grain appearance. While it is not very easy to work with for most do-it-yourselfers, and specialty tools are needed to cut the planks, this type of siding will endure more of the dings and bumps that can crack vinyl or dent aluminum. Moreover, it won’t crumble like hardboard or O.S.B. siding if the paint surface wears away, although such “raw” areas can absorb moisture and transfer it to the wood structure behind the siding, causing it to rot. Fiber-cement siding is manufactured with a wood grain appearance and will withstand the ravages of weather, rot, fungus, carpenter ants and termites. It is not completely maintenance-free, however; fiber-cement siding needs to be painted periodically – although a quality paint job will last many years.

**Vinyl Siding**:

Vinyl siding is frequently used on homes, as well as garages. It is inexpensive, installs quickly over existing sheathing, comes in many different colors, and, once up, needs only to be washed annually for maintenance. On the other hand, if it's hit soundly in the winter, it may crack; darker colors tend to fade in the summer sun; and, if you wish to change the

*(continued)*

color later, you won't be able to paint it. Damaged panels can be replaced with relative ease using just a couple of tools. Vinyl is the siding that will require the least maintenance.

**Polypropylene Siding:**

This plastic siding is usually made from recycled materials, and is available in patterns that resemble various styles of traditional wood siding and shingles. It is installed in much the same way as vinyl siding and has many of the same advantages and disadvantages, but polypropylene is heavier walled than vinyl. As a result, polypropylene siding is less susceptible than vinyl siding to strike damage, but it is also more expensive.

**NOT RECOMMENDED:**

**T1-11**:

Many people explore this product because it is an economical siding choice. T1-11 is a plywood product that comes in two thicknesses, 3/8" and 5/8". It holds paint well, but it takes longer to paint. T1-11 is readily available in 4' x 8' sheets, and can be ordered in sheets 4' x 10' or larger. Because of its size, it installs fairly quickly. When nailed in place, it has a rough-sawn appearance; the finished appearance looks like boards of a 4", 6", or 8" width hung vertically. It is somewhat difficult to join pieces end-to-end to make heights longer than the standard 8', when that is needed (such as on the gable ends of a garage.) The problem is that, if this joint is not protected, the siding can delaminate (peel apart.) *If you choose to use T1-11, it's important to ensure that all exposed edges are coated completely with paint to prevent delamination.*

**Hardboard Lap Siding**:

Several manufacturers sell this product. Hardboard lap siding is a composite of small chips of wood, compressed in a bath of adhesive to make a board. It is then coated with a paper-like covering. Since it is manufactured, it will come straight, and it will be primed. Its biggest disadvantage is that, if it isn't kept painted or if the covering gets scratched or torn (by a lawn mower, bicycle, etc.), moisture will enter it, swell up the wood, and destroy the siding very quickly. This type of siding is commonly used on economy-model garages – but it really isn't much of a bargain. In fact, some communities have banned hardboard siding altogether.

**O.S.B. Siding**:

O.S.B. ("Oriented Strand Board") siding, the next generation of hardboard siding, was introduced more recently. It is made using a process similar to the manufacture of hardboard lap siding, but the adhesive is better, and the way the wood chips are oriented makes for a stronger piece of siding. The covering is also supposed to be more durable. O.S.B. siding can come in several styles of siding (lap or vertical) or in 4' X 8' sheets. Like hardboard lap siding, it comes pre-primed. But, also like the hardboard siding, it is vulnerable to swelling and self-destruction if the covering material becomes torn or if the siding is not painted regularly. If a low-maintenance siding is your desire, stay away from hardboard and O.S.B. siding.

**Conclusion**:

If you will be constructing an addition or building a new garage – or even replacing some of your existing siding materials – weigh the advantages and disadvantages of the siding options available. Your house and garage are long-term investments, so it doesn't pay to be short-sighted about the material you choose. Cost, longevity, and maintenance requirements can vary widely. *If you are contracting the work – and particularly if you are purchasing a "kit" garage – look carefully at the type of siding specified; you may wish to upgrade the siding to be included (paying the cost difference involved).*

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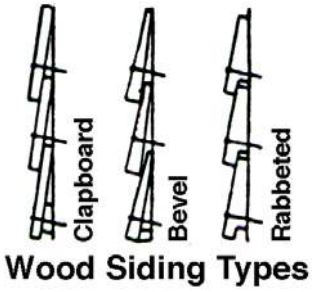
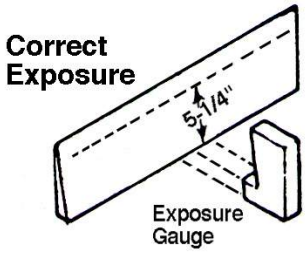
# REPLACING WOOD LAP SIDING

Common to most homes (and particularly to homes build more than 50 years ago) are two types of exterior wood coverings. The first one, often used on the whole house, but also commonly found on just the bottom half of a house, is called “lap siding.” Lap siding consists of straight horizontal boards, about six inches wide. The second type, most often found on the top half of a house, but occasionally covering a whole house, is “siding shingles.” These are rectangular pieces of wood attached in rows, resembling roofing shingles in appearance.

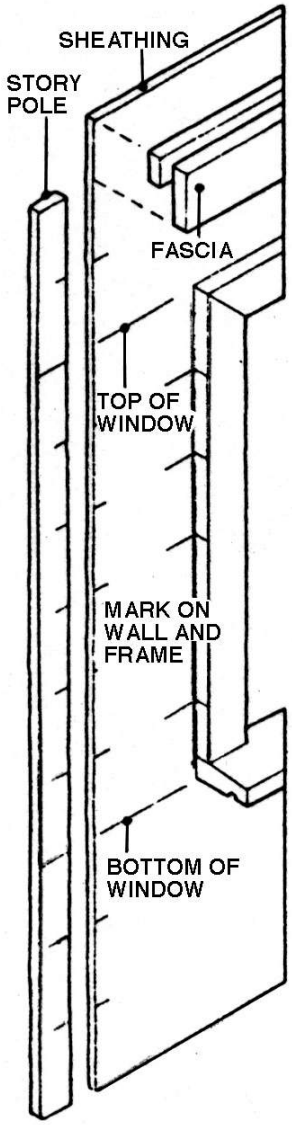
Lap siding comes in several different widths and thicknesses; the most common is 6” wide and 3/4” thick. If you need to replace any pieces because they are warped or split, however, take a piece with you to the lumberyard to match up the size used on your house.



**Wood Siding Types**



**Calculating Exposure**




If you understand how lap siding is installed, you will have a better idea of how to repair it. The bottom piece is put on first. Subsequent pieces are installed from the bottom up, with each piece put on top of – and “lapped over” – the preceding piece. Where the pieces meet going across a row, the ends are butted together, and that joint is caulked. Trim pieces are then installed around doors and windows, and on corners. *(see illustrations below.)*

You'll notice that a piece of siding is wider than the area it is to cover. For instance, a 6” wide piece of siding will cover only a 5-1/4” wide area. The extra 3/4” “laps over” the piece below it. This over-lapped area is where the siding is nailed, in such a way that the nail heads don't show.

To remove a piece in the middle of a wall, you first need to pry up slightly the piece above the one you are removing. Then, pry up or loosen the board that needs replacement. It's often easiest to split this piece with a hammer and a wood chisel to get it out. Then, use a hacksaw blade to cut off the nails that are under that top piece of siding (rather than trying to take them out.)

After you have cut your new piece of siding, slip it into place, line it up on either side with the existing siding, and nail through the new piece near the bottom. Finish the repair by sinking the nails about 1/8" below the surface of the wood and covering over the nail heads with wood putty.

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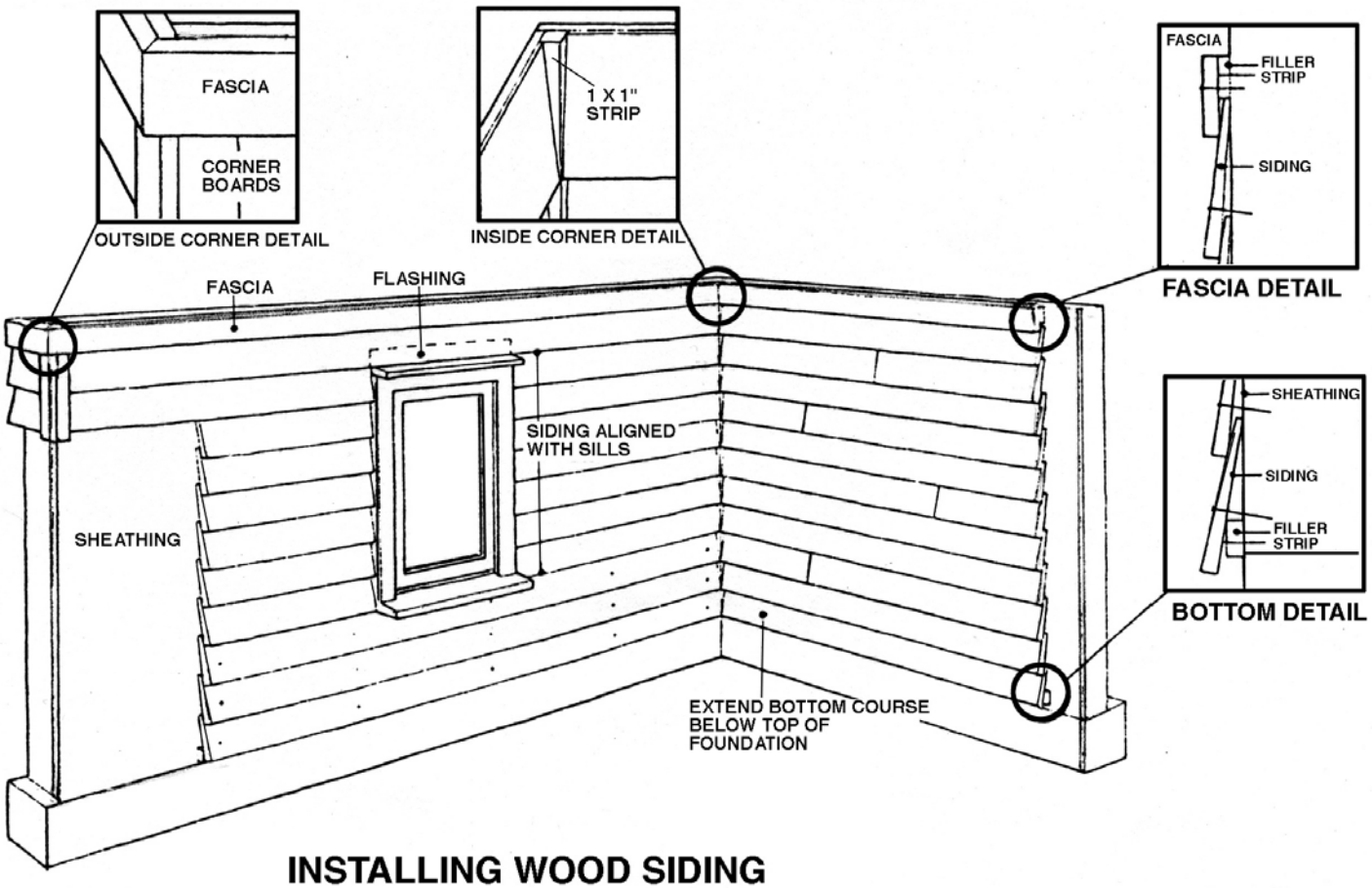


# INSTALLING WOOD SIDING

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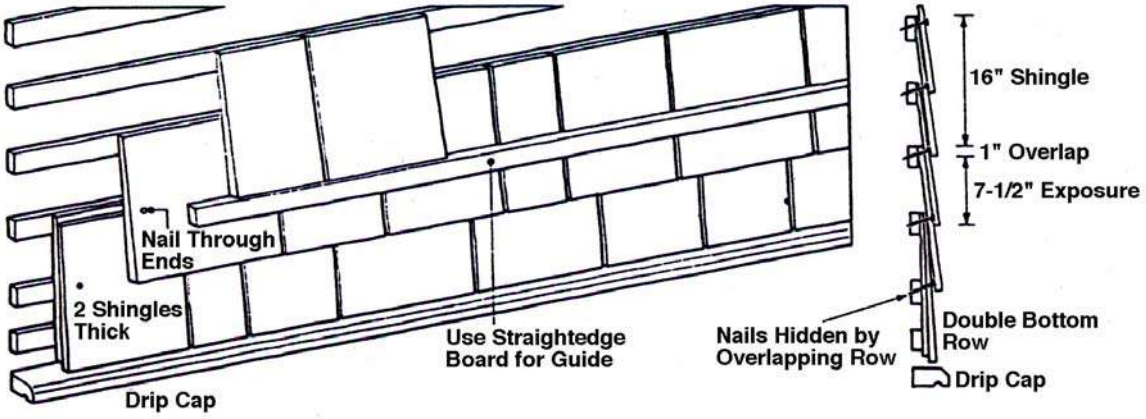
# REPLACING WOOD SIDING SHINGLES

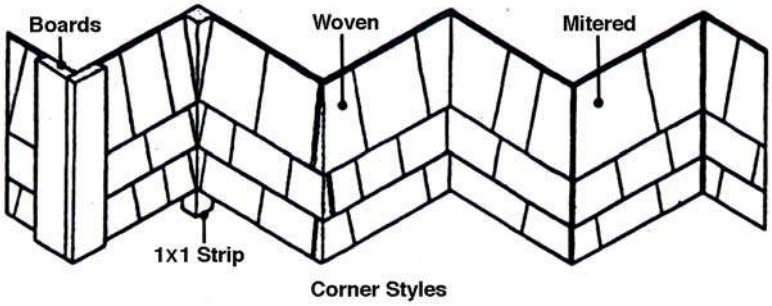
Common to most homes (and particularly to homes build more than 50 years ago) are two types of exterior wood coverings. The first one, often used on the whole house, but also commonly found on just the bottom half of a house, is called “lap siding.” Lap siding consists of straight horizontal boards, about six inches wide. The second type, most often found on the top half of a house, but occasionally covering a whole house, is “siding shingles.” These are rectangular pieces of wood attached in rows, resembling roofing shingles in appearance.

Wooden siding shingles are most often made from cedar. Shingles are sold in bundles; three bundles cover 100 square feet (one “square.”) Each bundle will contain shingles of various widths.

Shingles of this type are installed in rows. Usually the rows are even, but in some designs the bottoms are staggered. The bottom row is installed first, and each subsequent row is nailed on top of the row below it, overlapping it. When shingles are nailed in place, the nails are located within the area that will be covered by the shingle above it, so the nail heads don't show *(see illustrations.)*




Outside corners are usually formed by overlapping the shingles from one side over the other. The rows are alternated, with first one side overlapping, and then the other *(see illustration.)*

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While cedar is naturally impervious to water, it is also prone to splitting or cracking, and is relatively soft. So, the chances are good that, at some time over the life of your home, you'll need to replace some shingles. To remove a damaged shingle, use a hammer and wood chisel to split the shingle to be replaced and then pull out the pieces. Next, take a hacksaw blade and cut off the nails left under the upper shingle. Select a replacement shingle of the right width from the bundle. (If you need to trim one down, a razor blade knife and a straight edge work well.) Then, after slipping the new shingle in place, nail through it near the bottom. After nailing the shingle, sink the nail below the surface and cover over the nail head with wood putty to conceal it.

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# 17.

# Garage Repairs

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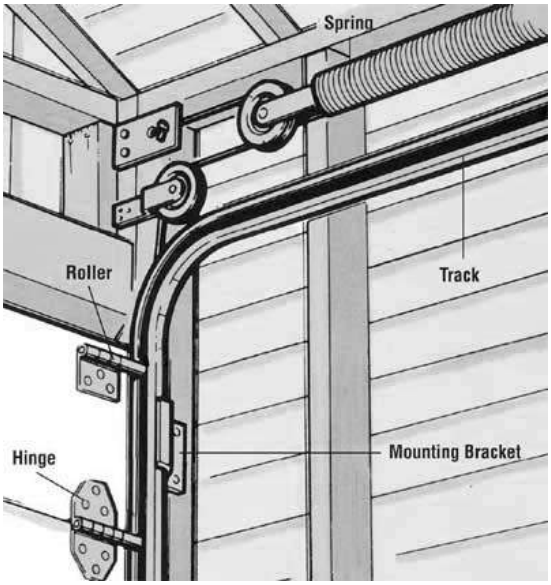
# GARAGE DOOR REPAIR & REPLACEMENT

Over the years, your garage door takes a beating. Not only can the cables and springs break under the repeated stress of moving that heavy weight, the door panels themselves can deteriorate from moisture or suffer impact damage. (We've all seen the effects of a "slight miscalculation," when a car has been backed into a closed garage door.)

Faced with fixing or replacing your garage door, the first thing to consider is the type of damage that has occurred. If the door itself is solid, problems in the hardware that raises and lowers the door can usually be repaired at a relatively low cost. It's not beyond the ability of most homeowners to lubricate balky rollers and track with white lithium spray grease and replace screws that have come out of position. However, replacing the lift cable or connecting the springs are jobs usually best left to professionals – accidental release of a spring under tension can cause serious injury!




If the door itself is damaged, it may not be necessary to replace the entire assembly. Some suppliers will sell single panels. You may not be able to match all the trim details, but you can usually get basic single- or double-car door panels in wood or metal.

On the other hand, if it's time for a whole new door, spend some time considering your options before you select the replacement. The price will be determined by such things as size (single- or double-car), material (usually wood, wood composite, steel or fiberglass), whether or not the door is insulated, and the type of hardware you choose. You will also pay more for certain style details and to have windows included. Most installers will haul away your old door for an additional fee.

In addition to aesthetic considerations, your choice of door material will also determine the amount of maintenance that will be required. **Wood** or **wood composite** doors will need to be painted when first installed and will need regular painting. You will need to protect the bottom edge with a rubber bottom seal to prevent water from damaging the wood. **Steel** or **fiberglass** doors will generally need less maintenance, but are more easily dented. Insulation is also a consideration if you have an attached garage or if you use the garage as a workspace in colder weather. A core of polystyrene foam in the door panels and weather-stripping will keep the space warmer.

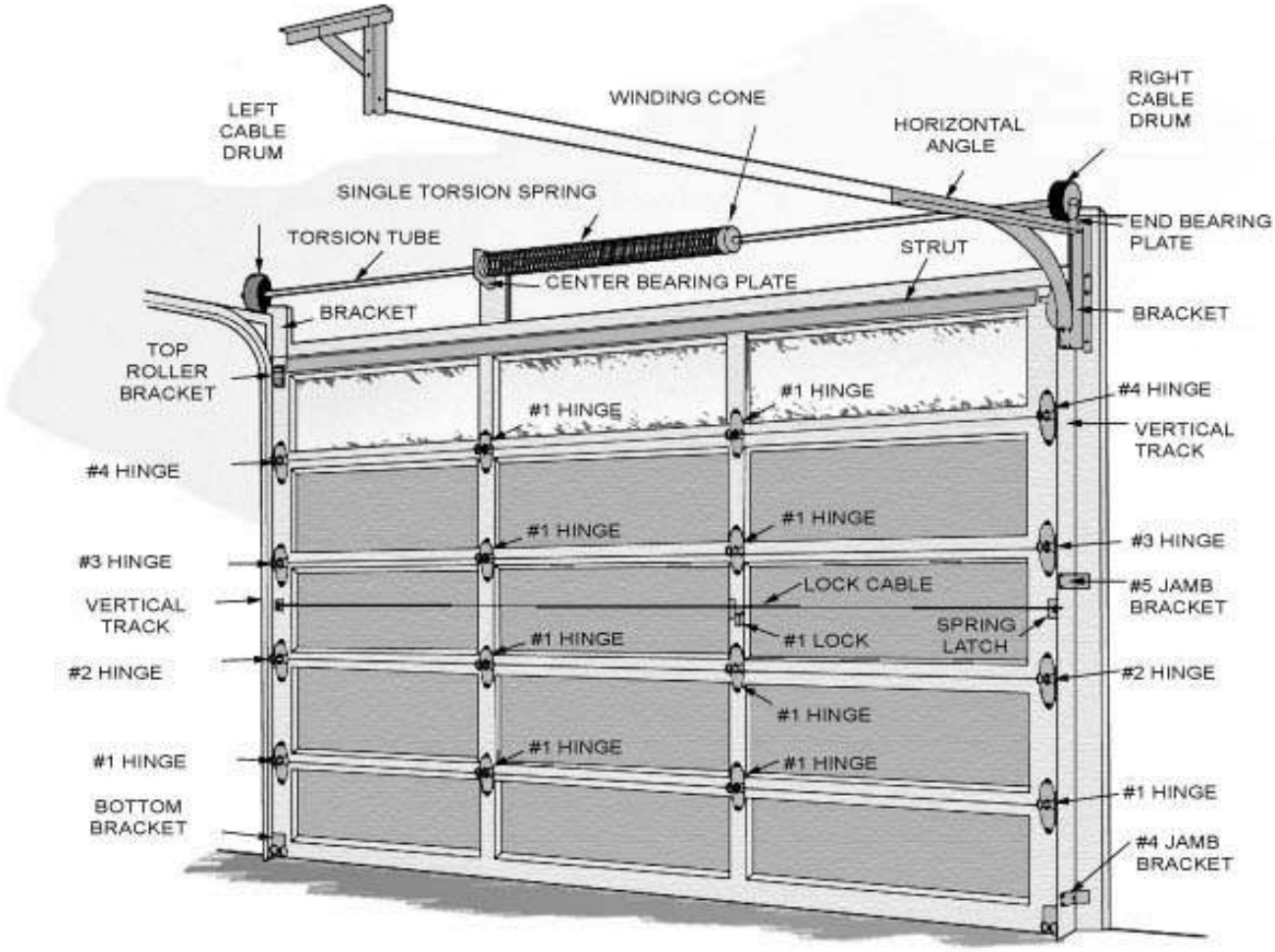
One of the most important choices will be the type of lifting spring you choose. Older doors will most likely have **extension springs** – springs attached on either side of the door, that stretch along the track next to each side of the door when the door is closed. The newer choice is to use **torsion springs**, which are usually placed just above the top section of the

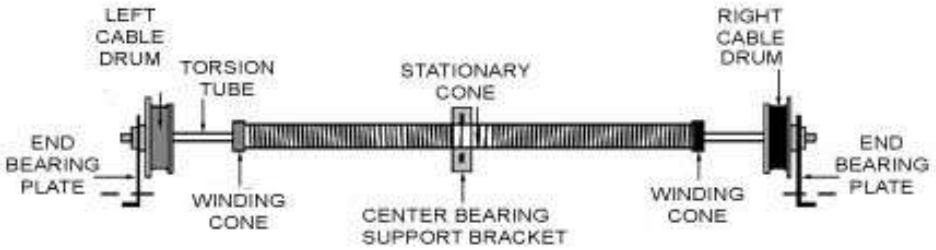
*(continued)*

door and mounted to the header. This type of spring does not expand and contract when the door is moved, but instead uses a wound spring that resembles a corkscrew. Advocates of the torsion spring point to increased safety for the homeowner and smoother operation because it better balances the door.

Finally, consider any locks you may desire. If you will be using an electric door opener, you probably won't need a lock on the door for security, but you may want a release mechanism on the front of the door in case of power failure – especially if there is no other access ("man-door") to the garage.

Garage doors have become increasingly important to the "look" of a property, so – whether you are repairing or replacing your door – you will want to make decisions that will give you the best appearance, function and safety.



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# FOUNDATIONS FOR NEW GARAGES

Most garages in older communities like Cleveland Heights were built much differently than were the homes – and certainly not with the same level of quality. Many were erected right on the ground, with no foundation at all to support them. Often the floor (concrete or asphalt) was added after the structure was completed. Over the years, many of these garages with no foundations (or with foundations that are inadequate) have seen the bottom third of their walls and structural framework rot out due to ground dampness and snow accumulation. Moreover, the action of the wind pushing against the structure and the repeated freezing and thawing of the ground may have caused the weakened garage to move, with the result that the garage can end up leaning this way or that.

If you are replacing your old garage with a new one, you can avoid such deterioration by installing a good foundation. There are two common types, either of which will satisfy code requirements in most communities. The first type is best, but it does cost more. In this method, a **footer** is poured first, and then a short wall is added above it, molded from concrete or built from concrete block. The wall, built around the perimeter of the structure, is 6” to 8” wide and extends from 8” above the ground to at least 36” below the soil, or “grade” (so that it goes below the frost line). After this **perimeter wall** has cured, a **separate concrete floor**, 4” thick, is poured inside it. After the floor has set, the garage walls are built upon and bolted to the foundation wall. This is the strongest design, similar to the way homes are built.

The other type of garage foundation is a **monolithic slab** (meaning “one piece”) of concrete, poured all at one time. The floor area is 4” deep before it thickens into a short wall formed around the perimeter, 6” wide and 8” above grade and 12” below. The garage framing is then bolted to this perimeter wall as it is erected. The disadvantage to this system is that all the stresses placed on the walls and roof – from soil heaving with the freeze-and-thaw cycle, tree roots. rain, wind, and heavy snow – are transferred to the floor, making it prone to cracking. Because the foundation is shallower, you are also more likely to have burrowing animals, such as skunks, make their home under your garage.

If you are considering a new garage, you should be aware that most contractors' bids are based on the second type of foundation, because it is less costly. Although the first method is more expensive, it can be well worth the additional cost. Not only will the frame last longer and stay straighter, but it is also far less likely that you’ll have to replace your garage floor due to cracking – a project which would cost much more than the additional money you'd spend for the first type of foundation.

It's never easy to spend more money, but a new garage is a long-term investment. When making your choice, look to the future and consider the benefits of a good foundation. The extra money you spend might turn out to be a bargain five or ten years from now.

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# STRAIGHTENING A LEANING GARAGE

Ever noticed how some garages seem to lean with the blowing wind – like a single-story Tower of Pisa? Many people are surprised to learn how simple it is to straighten their garage themselves.

First, let's look at why the garage is leaning. Many of the garages in older communities like Cleveland Heights were put up before there were building codes to control the construction process. To say they were poorly built would be putting it mildly. It was a common construction method to build directly on the ground, with a concrete floor poured as an afterthought. A lot of these buildings, therefore, have no foundation under the walls. The wall studs and rafters are often undersized by today's standards, and rarely are there diagonal corner braces *(see Illustration 2)* to support the structure properly and keep it from “racking” or twisting. Added to all this can be cobbled-up extensions tacked on later, so that the tail fins of larger cars could fit inside the garage. All these factors work together to weaken the structure.

Still, with some simple tools, these buildings can be pulled back to their original position. You'll need a pair of ratcheting cable hoists (also known as “come-alongs,”) several 1/2”-diameter screw eyes, some steel or wood stakes, an electric drill, a circular saw, a hammer, and a carpenter's level. You'll also need a short list of materials: six 1 x 4’s, 12-feet long, and a box of Phillips-head screws or 8d (eight penny) nails to serve as fasteners.

At each end of the wall opposite the lean angle, drill a pilot hole and thread a screw eye through the siding and into the corner stud. Hook each come-along so that it runs from one of the screw eyes to a stake driven into the soil, into a telephone pole or tree, or – if you're over the driveway – to the bumper of a truck or van *(Illustration 1).* Slowly start to ratchet in the come-alongs, first one side and then the other. As the cables are shortened, the wall will begin to straighten up. Take your time, so that the siding doesn't split. Use the carpenter's level to check when the wall is plumb (straight up-and-down).

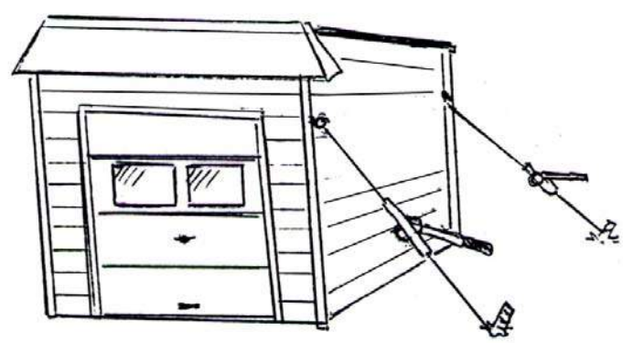

*Illustration1*

With the wall held straight with the come-alongs, go inside the garage and install some diagonal corner braces. Each brace should cross at least 4 studs *(Illustration 2).* Fasten it with two nails or screws driven into each stud or plate that the brace crosses. For the strongest support, notch each stud to a depth of 3/4” with a circular saw (also called “letting-in”), and then nail the brace where it lies in the notch *(Illustration 3).* When the corner braces are secured in place, release the come-alongs and remove the stakes and screw eyes. Your garage should be standing proudly erect once again.

*(continued)*

Note: If the walls to your garage are bowed-out, or if the bottoms of some of the wall studs are rotted, you should repair the walls before straightening the garage. *(See separate handout on "Garage Wall Repair" for how-to information.)*

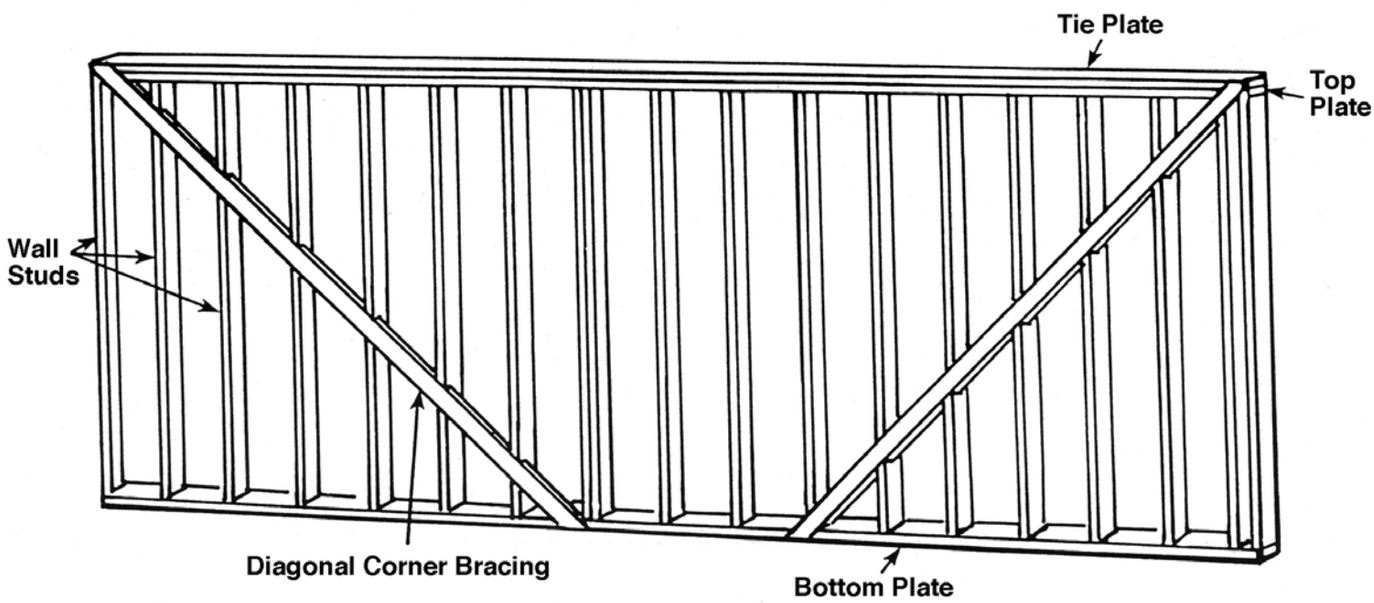


*Illustration 2*

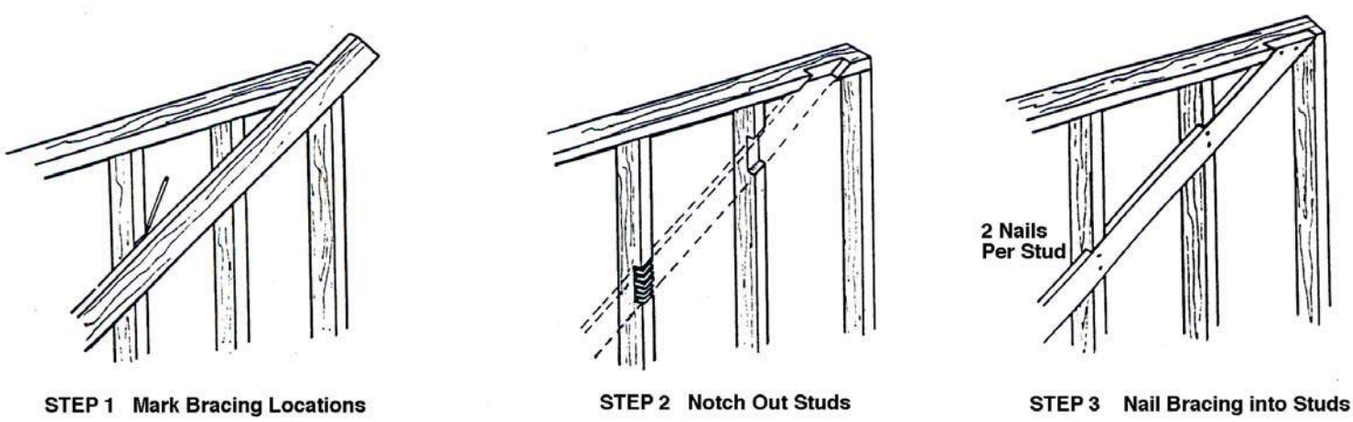


*Illustration 3*

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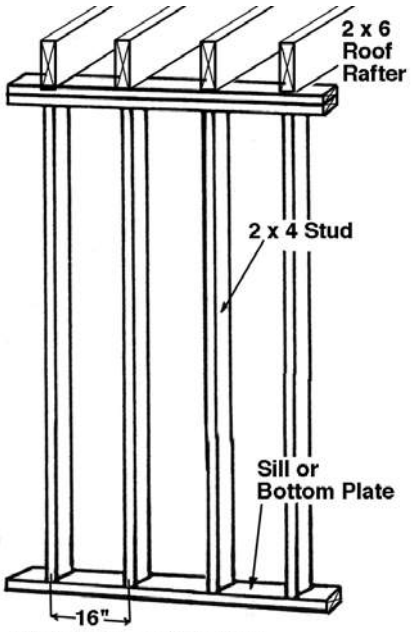
# Assessing and Repairing
# YOUR GARAGE STRUCTURE

Sooner or later, most homeowners must decide whether it's better to repair or replace an old garage. We suggest that you start by taking a good look at its overall structure.

In communities with older homes, many garages were built for smaller cars. They were certainly not built to the quality standards of the houses – in fact, they may not have been designed to be permanent structures at all. As a result, some areas that frequently fail are:

- the place the wall framing meets the foundation (if there even is a foundation!)
- the rigidity of the side walls
- the structural framework of the roof (which is often undersized or improperly supported)
- the framework around the doors and windows
- a rear wall that has either rotted out because there was never a gutter installed, or has had an extension for a longer car cut into it, destroying what little structural integrity it may have had originally.

The framing system of a garage *(see illustrations at right and on last page)* starts at the bottom with a **sill board**, the piece of wood that sits on the foundation and upon which the wall is built.) This board is attached to the **wall studs**. At the top of the studs is a **top plate**, usually two 2 x 4's nailed together. **Roof rafters**, the boards that support the wood and shingles on the roof, usually rest on top of the top plate.



Studs spaced 16" apart on-center

If any part of your framing system is damaged from water leaks or insects, it will weaken the whole structure. When enough damage accumulates, the garage becomes little more than a pile of giant pick-up-sticks. This seldom happens quickly, (although if your teenager runs your car through the back wall of the garage, the process may occur more rapidly!) Usually, the first sign of deterioration is a garage door that doesn't quite close. Then, your garage starts leaning to one side or the other. These problems don't go away by themselves; they will usually need some help and encouragement from you.

How do you assess your garage? You can begin by going inside your garage and taking a good look at your framing system:

1. Look at the base of the side and back walls, where the wall studs are fastened to the bottom sill. Is the wood solid or rotted? Ground dampness, snow, and standing water make this a good place for rot to start. (Dirt mounded against the outside of the garage keeps the dampness trapped in the wood, so keep the base of your garage – inside and out – clear of dirt and other debris.) If you can stick a nail more than 1/2" into the wood by hand, the wood needs to be replaced. Look carefully at the sill board, as these frequently rot out. Go around the entire garage like this with a piece of chalk and mark the pieces in need of replacement.

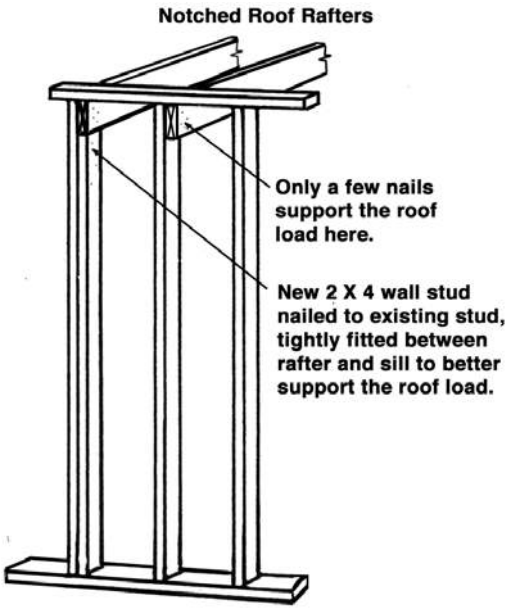
*(continued)*

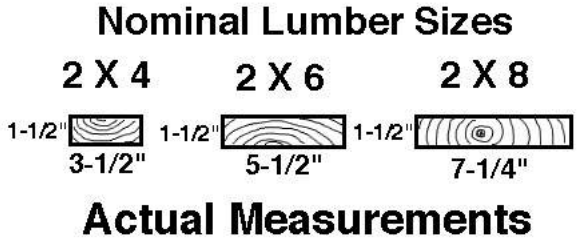
Wall studs are easily replaced. First, cut through the stud high enough away from the rotted end to where there is good solid wood, and remove the bad portion. Then, cut a new stud from 2 x 4 outdoor treated wood to fit in the opening and nail it in place. Next, take a full-length stud and nail it alongside the patched one, for strength. *(See separate handout on "Garage Wall Repair" for how-to information.)*

Replacing the sill requires that you jack up the side of the garage that you are working on. By taking two hydraulic bottle jacks, one at each end, and using a 2 x 4 placed from each jack to the top plate, you can raise the wall the couple of inches necessary for you to remove the rotted sill and replace it with outdoor treated wood of the same size (usually at least 2 x 6.)

If you need to replace any parts of the foundation, use this same method to support the garage off the foundation while you rebuild it. Dig out the old, and pour a new concrete footer and foundation. (You'll usually need a permit for this work, and your new footer and foundation must meet code requirements.) Repair one wall at a time until you are finished.

2. Then, assess the framework that supports the roof. First, look at how your roof rafters are supported. Ideally, they should be resting on a top plate; sometimes, however, they are attached to the sides of the wall studs instead. If they are, give them proper support by nailing another stud alongside the existing stud, directly beneath the rafter *(see illustration below.)* This reinforcement is required by code in Cleveland Heights and many other communities.




Before you support the existing rafters, however, check their size and condition. If they're 2 x 4's, they are too small; replace them with 2 x 6 rafters, nailed alongside the existing ones. Support each end of the new rafter where it meets the wall by nailing a full-length 2 x 4 wall stud beneath it, running down to the sill board.

If your rafters, regardless of size, span a two-car or larger garage without a center beam supporting them, you need to add a **center beam**. A center beam is made from two or three 2 x 12's nailed together, spanning the entire depth of the garage. Raise it with jacks at either end of the garage until it touches all the rafters and takes out any sag. Then, nail it into the wall studs at either end. (Most often, posts will also be necessary for support.) Once installed, the center beam will promote good roof drainage and prolong the life of the garage.

If your roof has puddles after a rain in areas where the rafters sag, then you need to remove that sag or you will constantly have roof leaks. To remove a sag, place a 2 x 4 on a hydraulic jack at the lowest point of the sagging rafter; then, slowly jack it up. When the rafter is bowed the other way, nail a new rafter along side it; after the jack is removed, the rafter should still have a slight upward bow.

Finally, look at what covers the rafters. If you have rotted **roof decking**, you'll need to replace at least the deteriorated area, or the damage caused to it by the rain will just multiply. Inside your garage, drive screwdrivers up from the underside of the decking to mark the corners of the area to be patched. Then, go up on the roof and cut away the roof covering

*(continued)*

to get to the decking. Make sure that the edges of the rotted area you cut out extend to the center of a rafter. (This will give you something to nail the new piece of decking into.) Replace the rotted piece with new wood of the same thickness, and patch the roof covering. *(See separate handout on "Roof Sheathing" for how-to information)*

3. The various openings in the sides of your garage are also important parts of the framework. The garage door provides a way for your car to get in, and most garages also have a window to let in light. In some garages you'll also have a service door ("man-door"), so you can get into the garage without opening the big door.

Each of these openings is really a hole in the side of your garage that weakens the whole wall. (You can imagine what that large opening for your garage door does for the front wall.) When garages – or houses – are built, special attention is paid to these openings to strengthen them and the rest of the wall.

Across the top of the garage door opening runs a beam, usually called a **header** (or **lintel**). Because this beam supports the weight of the roof, it must be especially sturdy. The header is commonly made by bolting two 2 x 12's together; in some cases, a piece of steel is sandwiched between them for added strength. If you have a sagging door opening, this is the piece that you must replace.

To hold it up, the header must be supported by studs on each side. These supports are usually two 2 x 4's, nailed together. The stud that is closest to the opening is called a **jack stud.** When your car bumper hits the side of the door frame and knocks the jack stud loose, you weaken the support for the weight of the entire roof. Before long, that nice, straight garage door opening isn't so nice and straight. So, if you have a garage door that won't close properly, you'll need to look at these important areas to see where the problems are. Most garages aren't enclosed on the inside, so these framing details are easy to see.

The frames for your windows and service door are constructed in the same manner but, because they are much smaller in size, the lumber used to frame them is smaller—usually two 2 x 4's, nailed together, are used to form all four sides. If you have a service door or window that won't open or close properly, look first at the frame for any deterioration or damage, to determine how to solve the problem.

4. Finally, older garages may be leaning one way or another, or the rear wall may have come off the foundation, so check the outside of the structure for these conditions, as well. Repairing these problems is more of an art than a science. You'll probably need to jack up some areas to pull the walls in. To correct leans, use a hoist-type device called a **"come-along"** to pull the garage straight. Once you have straightened it, a 2 x 6 nailed diagonally from top to bottom along the offending wall will keep it aligned properly. *(See separate handout on "Straightening a Leaning Garage" for how-to information.)*

These are the most common repairs needed for older garages. In light of current replacement costs, it generally pays to keep your old garage in shape. However, if the cost to repair an old garage reaches 50% of the cost of a new one, you should consider replacement.

**If you decide to replace your garage:**

Home Repair Resource Center strongly suggests that you select a design with a gable roof, rather than a flat "shed-type" structure. We also suggest that you focus on material choices and construction methods that will provide the most longevity. *Even if you are purchasing a garage "kit,"* talk to the supplier and/or contractor about how the foundation will be laid, what siding will be installed, and what roofing material will be used. (See separate handouts *"Foundations for New Garages," "Siding Options,"* and *"Choosing Roofing Materials"* for the advantages and disadvantages of the various options available.)

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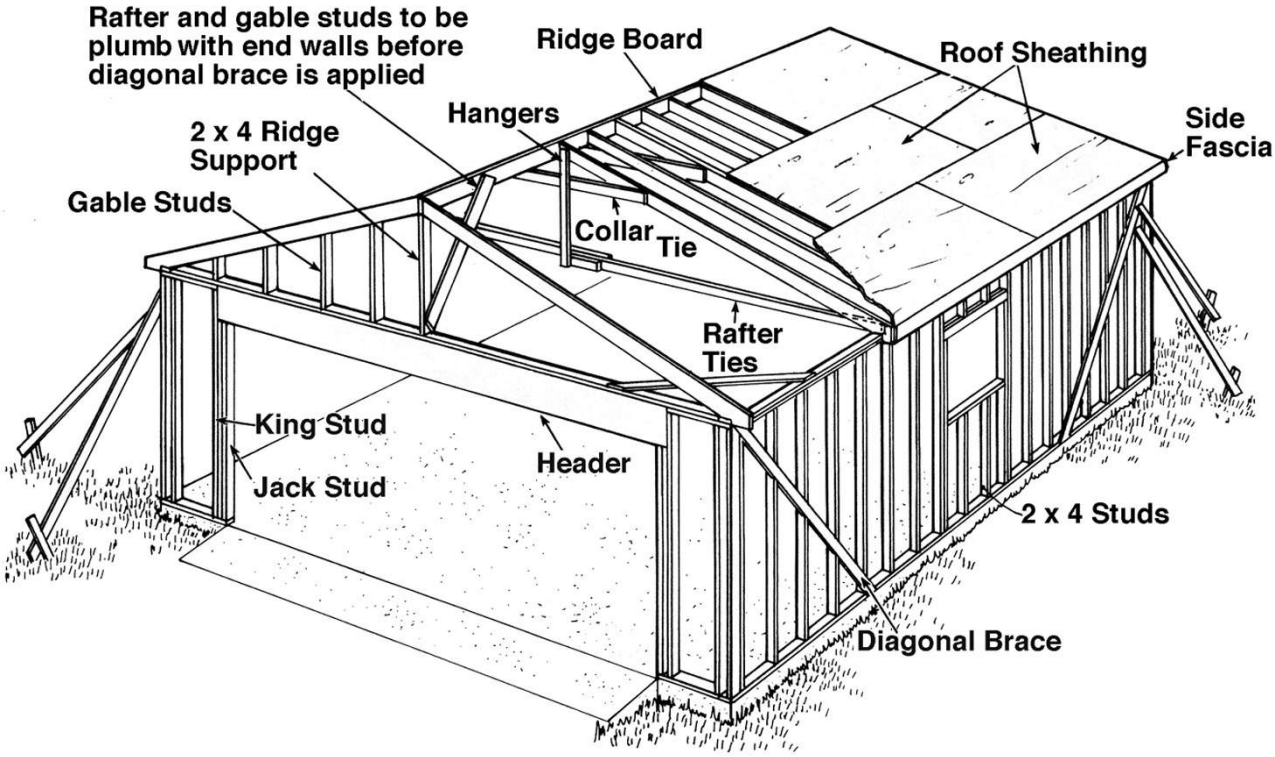

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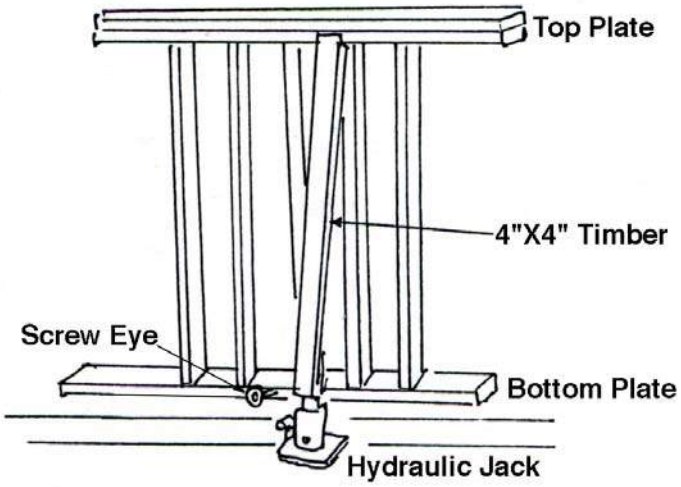
# GARAGE WALL REPAIR

Many older garages were built much like sheds and pole barns. The studs were set into the soil and siding was attached; if you were lucky, there was a bottom plate that sat directly on the dirt. Later, an asphalt or concrete floor may have been poured, covering the bottom plate (if there was one) and the lower portions of the studs. Over time, exposure to ground moisture may cause deterioration of the bottom plates (sill plates) and the bottom portions of the studs. Repairing this part of the framing isn't a complex project, but there are a few tricks that will make the job easier.

The first task is to cut out the lower portion of each stud, so that the new sill plate can be inserted between the bottom edge and the floor. The easiest way to do this is to jack up the roof an inch or so and support it while you're doing the job. You can use a hydraulic bottle jack along with some posts made by nailing two 2 x 4's together – one that will fit between the jack and the doubled header (top) plate of the wall, and two long enough to wedge between the floor and the top plate. Position the jack on the garage floor at one end of the wall; using that shorter post, slowly lift up the roof on that side. When it is up about an inch, wedge the longer post in place to support the roof at that height. Move the jack to the other side of the wall, raise the roof there to an equal height, and wedge the second post in place.




While the roof is supported, you can make the necessary repairs to the wall. Lay the new sill plate (a length of 2 x 4 Wolmanized lumber will do) on the floor beside the wall and mark its height along each stud. Then, using a reciprocating saw (Sawzall™), cut along the lines and remove the bottom portion of each stud. (If the stud is buried in concrete or asphalt, a bit of "persuasion" can be exerted with a small sledgehammer.) Once the bottom portions are out, you can insert the Wolmanized board below the remaining studs and lower the wall back into place, atop the new sill plate. Secure the sill plate to the concrete or asphalt floor with masonry anchors or Tapcon™ screws, and then toenail (nail diagonally) through the bottom of each stud into the sill plate.

If more than the bottom few inches of the old stud have rotted out, you can insert a small piece to support the rest of the stud; then, you'll need to "sister" a new full-length board along side the existing one, and nail the two boards together. (Code requires that studs be all one piece.) This sistering should be done before the wall is lowered back into place.

This same procedure can be utilized for other common garage repairs. If you have a bowed-out wall (usually caused by someone backing up just a little too far) that needs to be pulled back onto the foundation, jack it up as described above. Once the wall is swinging freely, thread a screw eye into the sill plate and use a come-along (cable hoist) to pull the wall back into position. Release the jack; the come-along will hold the wall in place while you drive concrete anchors through the bottom plate into the foundation to keep the wall from moving again.

You can also jack up a garage wall while you add or replace concrete footers beneath it, if you dig out and pour one side at a time.

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# PLANNING YOUR NEW GARAGE

It's never easy to decide to spend more money, but a new garage is a long-term investment. Unfortunately, many contractors believe that homeowners are looking only at cost, so they base their bid on coming in with the lowest price. However, it's smart to look not only at price, but also at the quality and longevity of the design, materials, and construction methods that will be used. The areas where choices are most important are:

- **Overall design** – we suggest that you select a design with a gabled roof, rather than a flat "shed-type" structure.

- **Foundation** – the strongest design has a footer poured first. Later, a short wall is added above it, molded from concrete or built from concrete block. After this perimeter wall has cured, a separate concrete floor is poured inside it. The garage walls are built upon and bolted to the foundation wall after it has set. Although more expensive, this design is less likely to crack than a monolithic slab, where the floor and a short perimeter wall are poured all at the same time. *(See separate handout on "Garage Foundations" for additional details.)*

- **Siding** - T1-11, O.S.B, and hardboard lap siding can quickly disintegrate if the surface is scuffed. Although the cost will be higher, you will be much better off if you choose wood siding or shingles, or fiber-cement, vinyl, or polypropylene siding – all of which will hold up better to the normal dings and dents that happen to garage walls. *(See separate handout on "Siding Options" for additional details.)*

- **Roofing** - With gabled-roof garages, generally covered with roofing shingles, your primary concern (other than matching the color and appearance of your house roof) will be how long a manufacturer's warrantee is given on the shingles. For shed-type garages, modified bitumen roofing (cold process or hot process) will look like traditional roll roofing, but will last MUCH longer. More rarely, you may want to consider single-ply EPDM (a pure-rubber product) or – on an extremely large surface – B.U.R. (built-up roof). *Don't* use asphalt roll roofing, as it will need to be replaced far sooner than the other materials. *(See separate handout on "Roofing Materials" for additional details.)*

When making your decisions, look to the future. Even if you are purchasing a garage "kit," talk to the supplier and see how much it would cost to upgrade their "standard" materials to ones that are longer-lasting. The extra money you spend might turn out to be a bargain five or ten years from now.

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# 18.

# Doors

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# CHOOSING A NEW EXTERIOR DOOR

Should you choose wood, fiberglass, or steel for your replacement door? Let's talk about the pros and cons of each, and then you can decide for yourself.

Wooden doors have been around since doors were invented. No doubt, the door you are replacing is wood. Think about why you need to replace it. Has it come unglued? Does it swell up and stick during certain seasons? Does cold air leak in around the edges, no matter how well you insulate it? All these common problems, along with a certain lack of strength/security, are the less desirable qualities of a wooden door. Nevertheless, people have made wood their primary choice for generations, not only because wood has a high weight-to-strength ratio, but also because wood, a natural product, brings a warmth to the entry of your home that no other material has yet matched. This psychological aspect should not be ignored.

Fiberglass doors are better insulated than wood doors, and have much the same kind of weatherstripping. They can be grained and stained to look like wood, but are lighter in weight. Fiberglass doors are less likely to absorb moisture, so they will not rot, swell, or bow.

With recent improvements in steel door technology, however, some people are choosing the practical advantages of metal. Steel doors eliminate all the sticking, ungluing, and vulnerability. Moreover, steel doors are much more energy efficient. Because a steel door is a hollow shell, it can be filled with insulation and thus made much more effective at keeping the cold out – so effective, in fact, that no exterior storm door is needed to retain heat in your house. While you do have to install a steel door carefully to prevent air from leaking around it, this type of door allows the use of a magnetic seal (like the one that seals your refrigerator door) – the best weatherstripping system now available. Added to all this, steel doors, when properly installed, are much stronger and resistant to intruders than wood or fiberglass.

When choosing a new exterior door, what should you look for? If you want to preserve the historical “look” of your house, you’ll want a door that matches the existing one you are replacing, one that fits the age and design of your home. There are numerous sources of wood doors with historically accurate features, and some steel and fiberglass doors that duplicate the styling of original wood doors of various styles and periods.

To get an energy-efficient door, look first at the weatherstripping. If you are buying a metal door, select one with a magnetic seal. This system is not usually available with fiberglass or wood, so you’ll have to get the most efficient weatherstripping system you can find. Next, look for a high R-value (indicating the degree to which the door is insulated.) Then, look for a spring-loaded threshold, which you can easily adjust later to give a good seal at the bottom of the door. Lastly, look at the manufacturer. Get a “better name” door – don't buy a cheap one.

Doors also vary according to how they are installed. One type, known as a **“replacement door,”** can be installed in about three hours. The door is slightly smaller than the one it is replacing, so both door and frame slip into the present opening. You simply remove the

*(continued)*

interior trim, fasten door and frame in place, and then replace the trim. Readily available in steel and fiberglass, these are good, reasonably priced options for door replacement. (Wood replacement doors can be specially ordered, which increases the cost, but are less expensive to install.)

With other types of pre-hung doors, you'll need to remove all the existing door jambs down to the framing before putting in the replacement. Expect to spend the day installing one of these doors, and you will probably pay more for it.

One additional note: many of the heavily-insulated steel and fiberglass entry doors have plastic moldings around the windows. Some experts warn against installing a storm door outside this type of entry door, because sunlight can generate heat build-up in the air space between the doors, and the heat can cause the plastic molding to soften and deform.

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# INSTALLING A “REPLACEMENT DOOR”

A “replacement door” is about the easiest kind of exterior door to install. This term refers to a door that is made just slightly smaller than the one it is replacing; you purchase the door and its surrounding framing as a unit, and then simply slip the unit into the opening from the old door and secure it in place. This system provides an allowance for out-of-square or out-of-plumb houses, and you won't need to take much of your house apart to install the new door.

Replacement doors made of steel or fiberglass are most readily available. There was some resistance at first to changing from traditional wood door to these newer materials, but many homeowners who tried them liked the extra security and insulation they provide. In addition, these doors are nearly indestructible, and don't “stick” like wood doors so commonly do during periods of high humidity. Steel replacement doors have another advantage – many come with a magnetic seal that provides the very best weatherstripping available for any door.

If you prefer a more traditional material, wood replacement doors can be specially ordered. This will increase the cost, but installation will be much easier and less expensive.

Before ordering your door, you'll need to measure the existing door and determine its “handing.” Stand outside the door and face it. If the hinges are on the right, the door is right-handed; if the hinges are on the left, the door is left-handed. Then, go to your building supply store and order a door that meets your size and handing requirements. (Make sure you get a “replacement door” – installing doors that don't come as a unit with their framing is more difficult.) Most replacement doors come with everything needed to install them – except for the locks, which you buy separately. You'll usually use a deadbolt and a knob lock, often packaged together by the manufacturer.

When you're ready to install your new door, remove the old door and all the hinges and lock plates. Then, carefully pry off the interior trim. (You will re-use it later.) Unpack the new door and see how it fits into the opening. If your threshold has been built up, you may need to chisel off some of it in order for the door to fit. If there is too much play on either side of the doorframe, fill the space with the shim strips included with the door. Once the door and frame fit the opening, take the unit out. Apply caulk to the back edge of the frame and replace it into the opening. Use a level to make sure the door is level and plumb. Then, tack it in place by driving some nails through the holes in the front face of the frame, and check again for level and plumb.

You can now unscrew the brackets holding the door to the frame. Open the door, and you'll see the holes for the 3” screws on the sides of the frame. Drive the screws through the holes into the sides of the frame, being careful not to overtighten. With the door securely in place, install the locks according to the package directions.

If you will be installing magnetic weatherstripping, first go outside and lock the door. Then, cut the top piece of weatherstripping to length, apply caulk to the back, and lightly nail it in place so that the magnet just catches the door. Don't drive the nails in all the way, in case you

*(continued)*

need to adjust the strip later. Install the two sidepieces in the same manner; making sure that the sidepiece with the magnet is installed on the side of the door with the lock. After you have tried the door a few times to make sure it works easily, drive the nails in all the way to secure the strips. Other types of weather-stripping are installed in a similar manner; just refer to the package directions.

The next step is to adjust the threshold strip. The threshold has three screws that control its height. Adjust them so that the door bottom seals, but the door opens easily. Finally, replace the inside trim – and then sit back and enjoy many years with a draft-free, easy-to-open door.

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# STICKING DOORS

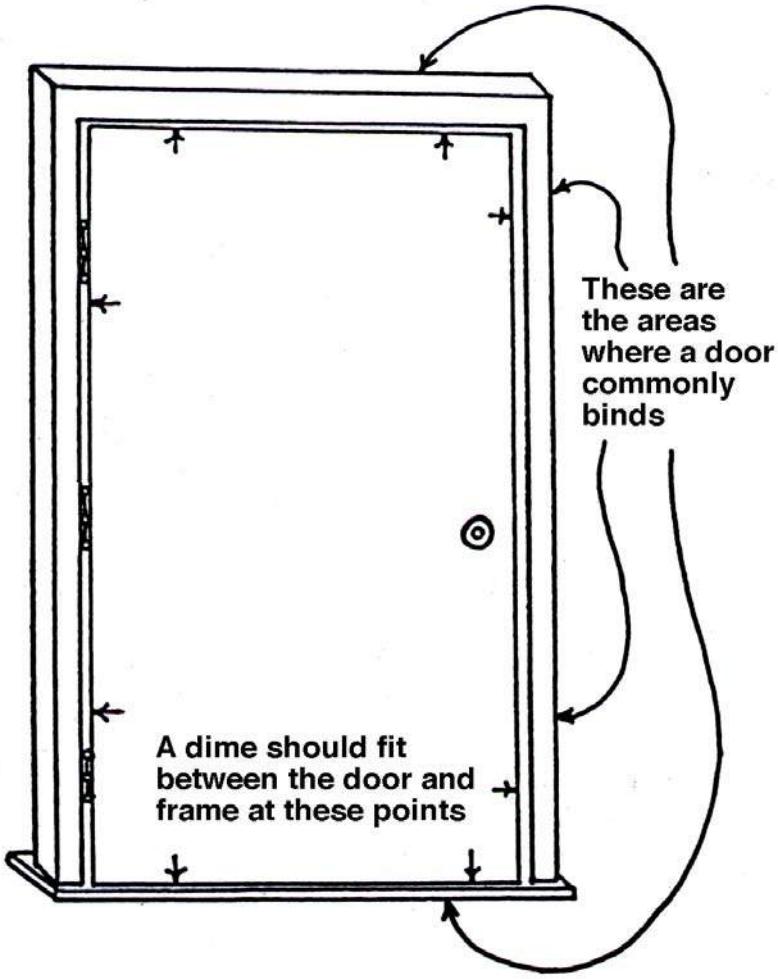
Wooden doors can be a real puzzle. Sometimes they open and close easily, and other times they can be really stubborn. Before you can do something about them, you need to understand why the doors are binding. There are several reasons this can happen.

To start with, as your house ages, door frames that were once straight-and-square can begin to sag (much like everything else.) When the door frame is no longer straight and evenly spaced around the door, parts of it will tend to catch on the door. Usually, by looking at the door, you'll be able to see these areas.

There are different ways to approach this problem. One is to remove both door and frame and reinstall them, making sure that the frame is put in place straight, level, and plumb – regardless of the condition of the wall around it. This process will usually take a few hours of work to accomplish.

A second and more practical approach is to shave the door down at the spot(s) where it is hitting the door frame. You can use a belt sander, a plane, or even hand-sand these areas until the door fits again.

A third method that will work in a few cases is to remove the top or bottom hinge (depending on where the door is binding,) and place some small shims, such as pieces of cardboard, behind it to make the door fit more evenly. If the door binds at the top, place the shims behind the bottom hinge (or *vice versa)*, and then reinstall the hinge.




However, the most probable cause for doors not fitting properly is not the settling of your house, but rather the much more inconspicuous problem of too much moisture. Moisture, in the form of water vapor, exists in every home. It enters the door through any area that isn't sealed – usually the bottom. (This is the least painted and cared-for part on most doors.) Moisture that is absorbed into the door causes the wood to swell up, until the door sticks and refuses to cooperate.

In the summer, there is a lot of moisture in the air. But, in winter, with our modern central heating, we often need to add moisture to our homes to make them livable, usually with a humidifier. Even

*(continued)*

with a humidifier, though, there is seldom enough moisture in the winter to cause doors to swell, so the wood "shrinks" to its normal size.  When that happens, you can make any needed door adjustments and seal the bottoms of your doors with some paint or varnish.

When a door is properly installed, you should be able to fit a dime around all four sides of the door.  If you use the winter months for some preventative maintenance – getting each door to fit correctly – they'll swing freely next summer.

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# REPLACING YOUR STORM DOOR

Not only does your storm door offer a first impression of your house, it is also used each time you come and go, day in and day out. If this door sticks or binds, or if it doesn't close properly, then it's not doing the job that it was intended to do. A storm door works by trapping air between itself and an inner door. This pocket of air acts as an insulator and helps reduce drafts that otherwise can creep into your house and make your feet cold in the winter. *(Note: Because sunlight can cause heat build-up in this air space, you may not wish to install a storm door outside of a heavily-insulated steel or fiberglass entry door that has plastic moldings around the windows. The plastic may melt or deform from the heat.)*

Replacing a storm door in a standard opening is a project that most homeowners can complete in about two hours. However, it's important to spend time making a careful selection of your new door. Storm doors can range widely in price, from inexpensive economy models to quite costly alternatives. There are a few features you should look for when selecting your new door. Only the most expensive doors will have all the best features, but you can seek a door with the most features for the money you have available.

Most doors need replacement because they sag, bind, twist, or stick. So, look at how the door is constructed. Pay particular attention to the corners, because when they start to pull apart, the door begins to bind. Some more expensive doors have a wooden core with a thin layer of aluminum or vinyl around it. Such doors have a solid corner without a joint – a good feature. Most medium-priced doors are assembled with corners that are mitered (at a 45° angle) and then screwed or riveted together. This type of corner can pull apart. On the other hand, mitered corner that are welded together form one of the strongest corners. (Welding also effectively seals the corners against air leakage.) The least expensive doors are assembled by butting the sides against the top and bottom, forming the weakest type of corner.

Next, look at how the window is installed. The best doors have corners that are welded, or at least caulked. If the door's main function is to keep out air, then openings at the corners of the window will defeat your purpose. You can caulk these corners yourself, but it's hard to do a neat, attractive job.

You'll also want to consider the bottom panel of the door. The size of this panel affects the door's rigidity. The larger and sturdier the panel, the less chance that the door will twist out of shape. Doors with a large piece of glass running nearly their full length are much more likely to twist; because there is no metal panel below the glass, the door is less rigid, and the frame can flex around the window.

The way the door seals to the frame is another important feature to consider. The best system is the magnetic weatherstripping (like the system on your refrigerator) that is found on some metal doors. More commonly, the weatherstripping is made from felt or nylon bristle; this type tends to wear quickly.

Finally, look at the material from which the door is made. Aluminum with no inner core of a different material will tend to conduct the cold from the outside in. Aluminum or vinyl doors with an inner core of wood or rigid insulation are the most efficient at preventing such heat loss.

*(continued)*

When you install your new door, caulk behind the frame before you install it, and at the corners of the frame after installation. This will help insure an airtight seal and increase the efficiency of your new door. Usually, a hacksaw (for adjusting the frame,) tape measure, hammer, screwdriver, and caulking gun are the only tools you'll need. There is no regular maintenance needed for most storm doors, beyond routine cleaning.

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# Windows

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# GLASS BLOCK WINDOWS

Glass block is currently enjoying a revival as a building material. It was commonly used during the '50s and still can be seen in a lot of “art deco” style applications. More recently, however, glass block has found a new usefulness in replacement basement windows, and it is starting to be used more extensively in other settings around the home.

Glass block has inherent qualities that make it a good material for certain locations. Because of how it is made, glass block is an insulator. It is secure, being difficult to break through, and it is waterproof. It lets light in, but obscures visibility from the outside. It can be back-lit for dramatic effect. Small vents can be installed in a glass block panel to allow air flow. It is durable, long-lasting, and virtually maintenance-free.

These features make glass block a good choice for basement window replacement. Glass blocks are also being used more frequently in bathrooms, both for shower stalls and to replace bathroom windows. In many communities, including Cleveland Heights, installing glass block windows requires a permit, and code requirements will usually specify the number of vents that must be included.

To install a glass block window in your home, first determine the size of the window opening. If you are replacing a basement window, you'll probably be removing the existing frame, whether metal or wood, and installing the glass block directly against the masonry wall. Other locations may require a wooden frame. Like any other type of window, a glass block panel won't itself support any weight, so the opening you put it into has to be self-supporting. Measure the entire window opening and subtract the thickness of the frame (if any), leaving you the dimensions to be filled by the glass block panel. Take these dimensions to your glass block supplier and choose the blocks you'll need to make the panel.

Glass block comes in many different looks and in two standard thicknesses. The blocks are sold in several heights and widths, so you can combine blocks of different sizes to make a panel of the required dimensions. Each row of blocks will have to be the same length as the other rows, but you can make small adjustments in the thickness of the mortar holding the blocks together to accommodate odd window sizes. Once you have determined the combination of block sizes you'll need and have selected their style and thickness, you are ready to start.

There are several ways to install a glass block window yourself, and each works well for different application and skill levels:

1. You can take your window dimensions to a glass block company and have them assemble the panel for you. You then take the panel home and install it yourself.

2. You can buy the supplies, make the panel yourself in your workshop, and then install it in your opening. If you have a window that will have a wooden frame surrounding the blocks (like a bathroom window), you can build the frame and assemble the panel inside it in your workshop, and then install the whole unit in the wall. For most basement windows, however, it works best to remove the existing framing, build the

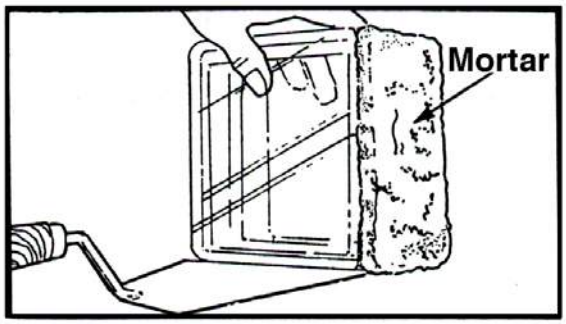
*(continued)*

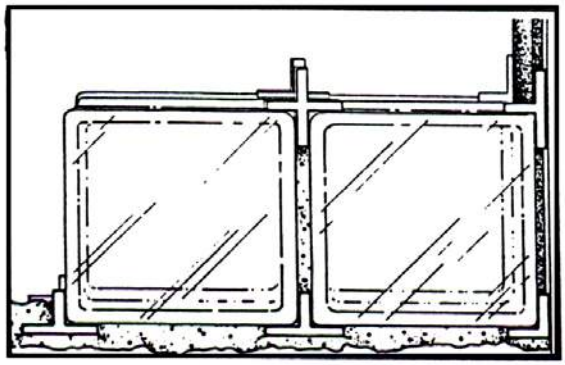
panel in your workshop, and then install it into the opening, mortaring the panel to the surrounding foundation wall. Even if your panel will be installed in such a frameless opening, you might find it easier to make a “temporary” wooden frame of the desired panel size and construct the panel inside it on your workbench. After the panel has set up, you can take apart the form and install the panel into the window opening. (Assembling the form with screws will make it easier to take apart later.)

3. You can assemble the panel from the individual blocks right in the wall opening. This method can be more difficult, but it may be the only way to install a larger window – glass block panels get heavy fast.

When assembling the individual blocks into a window panel, whether on your workbench or in the window opening, it’s important that the blocks are evenly spaced and that the panel is level and plumb. You can buy spacers designed for glass blocks, or you can space the joints by eye, using a straightedge or level to check each row of blocks. Take time assembling the first row because, if it isn't straight, all the other rows will suffer.

To join the blocks, you'll be using a special glass block mortar. This mortar is usually white, but it can be tinted to match the mortar in the surrounding foundation wall by using masonry tint (available at building supply outlets) or latex tint (available at paint stores.)



Glass block mortar is mixed stiffer than ordinary mortar. It's at the right consistency when it holds its shape when formed into a ball in your hand. Before you start each row, lay down a bed of mortar slightly wider and thicker than you want the finished joint to be. Before adding each block, apply a like amount of mortar to one side, to hold the neighboring block in place. Then, twisting slightly and applying pressure, embed the block in the mortar, pushing down until the block is level and plumb, and each mortar joint is at the right thickness. Scrape off any mortar that has been pushed out as you go along. You can use just about any type of trowel to install the mortar between the blocks, but a tuckpointing trowel is helpful for “tooling” (cleaning and smoothing) the joints after the mortar has set up for about ten minutes.

Once the panel has been assembled and the joints tooled, allow the mortar to set for another 15 - 30 minutes. Then, clean off any excess mortar from both sides of the panel and fill in any voids in the joints. If you used spacers, break off the projecting ends, leaving the body of each spacer imbedded in the mortar. After you have done all this, clean off any remaining mortar from the face of the bricks and let the panel set overnight for the mortar to harden.

If you made your panel on the workbench, you can then place it into the window opening and center it side-to-side and top-to-bottom, using shims if necessary. Check with a level to make sure the panel is plumb and level. Then, if the panel does not have a wooden frame, install mortar all around the panel between the blocks and the masonry walls, working from both sides. Let the mortar set up for a while, and then tool it as you did the panel. Pull out any shims that are sticking out, and complete the installation by cleaning off any excess mortar from the panel.

If you are doing this process for the first time, start with a small window and take your time. Before you know it, you'll be doing large curving shower stalls.

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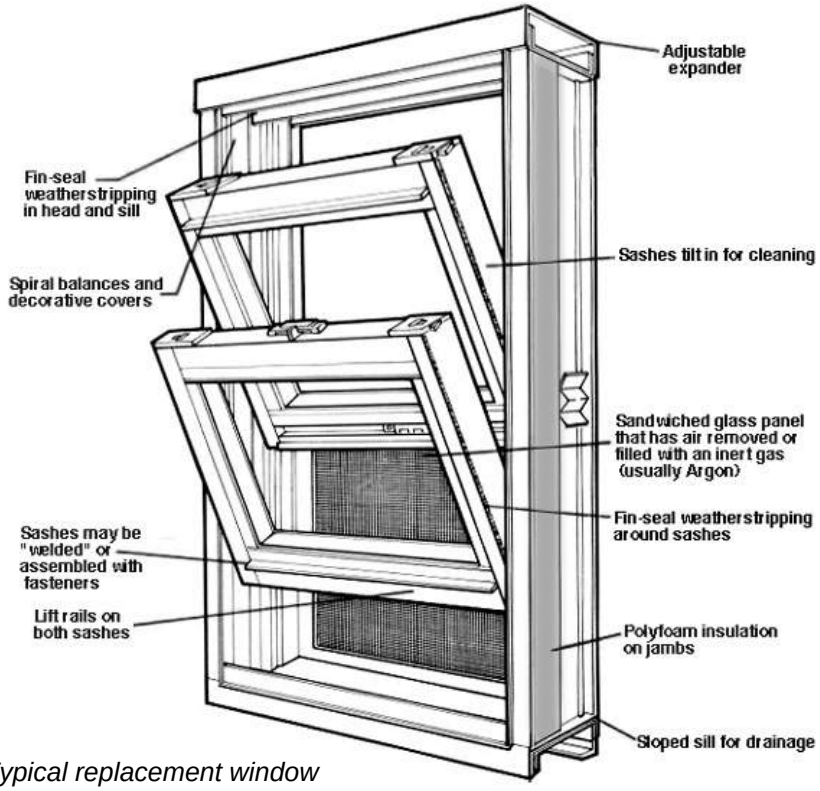
# Replacing Windows with
# "REPLACEMENT WINDOWS"

If you've been thinking about replacing your windows yourself, there are some things you should consider to make the job easier. In most cases, homeowners are looking to remove an old, drafty double-hung window and install a new, more energy-efficient window into the same opening.

A double-hung window consists of two "sashes" (window glass surrounded by the frame piece), one atop the other. The sashes ride in separate sash channels, so that they can be raised or lowered, the top sash behind the bottom sash *(see illustration of a typical "original window" on next page)*.

Whether the new window you select is wood, vinyl, vinyl-clad wood, or some other material, it will be one of two types. **"Replacement windows"** *(see graphic below)* are designed to go into the same opening from which you removed your old window. The advantage is that the entire unit – sashes and frame – will slip into the existing opening without the need to remove the original *jambs* (frame pieces) or trim moldings.




*Typical replacement window*

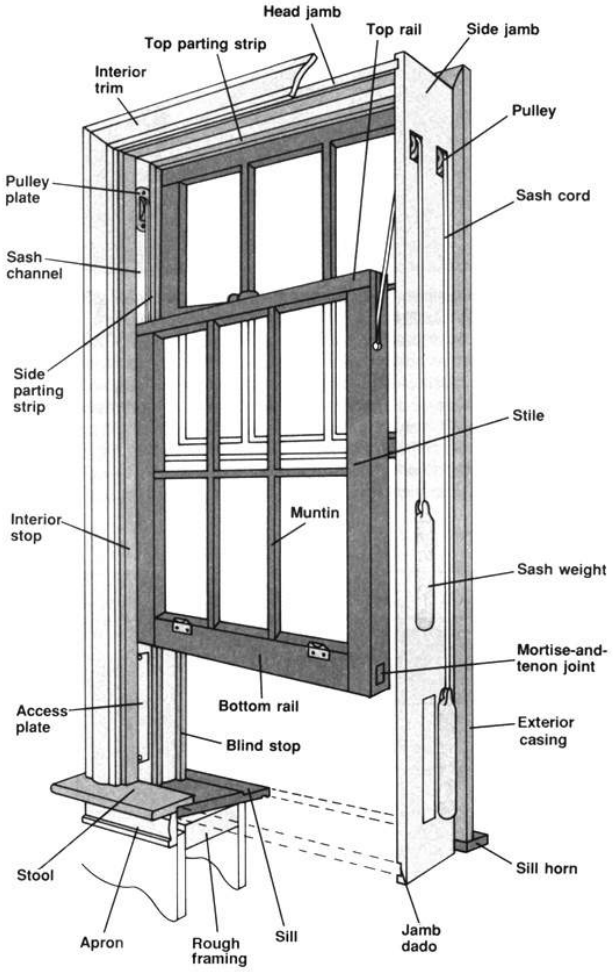
The main disadvantage of a replacement window is that there will be slightly less glass area than in the window being replaced, lessening the amount of natural light. Most people, however, will find that ease of installation far outweighs the small decrease in glass area.

With a replacement window, you'll be inserting the new window and its frame into the old window opening. If the original sill is still in good shape, it will be a fairly easy process. (If the sill is rotted or broken away, it should be repaired before installing the new window.)

Although you'll find that several common window sizes are readily available, you'll need to "special order" replacement windows of other sizes. For special order windows, it is critical that you measure accurately. *If a window that you order is made incorrectly due to your measurement, you may be stuck with it.* To find the horizontal dimension, measure across the space that the

*(continued)*

lower sash sits in – from one side to the other, sash channel to sash channel. To find the vertical dimension, locate the *stool* (the "inside sill" – the window ledge on the inside of the house); measure from the point where the stool meets the sill, up to the top of the channel. If possible, have someone re-measure these same dimensions, to make sure your numbers are correct. (Some of the "high-end" distributors will even send out a representative to do the measuring, because they want to have a satisfied customer.)




*Typical original window being replaced*

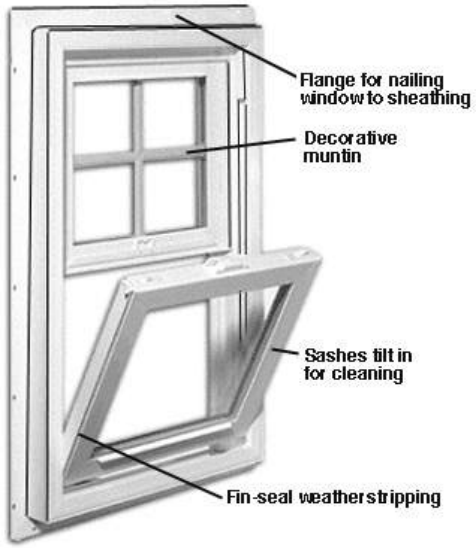
Installing your replacement window will involve removing the strips of molding that the sash slides against (called *interior stops)* and the side *parting strips* that separate the sashes. The sashes, cords, weights and pulleys are then removed. Pack fiber-glass insulation loosely into the cavity that the sash weight used to travel in, to minimize air movement. Apply a bead of good-quality caulk to the blind stop before slipping the new window into place. If you need to square up the window, use shims on the top, bottom, and/or sides before running the screws into place. Fill any voids between the old jamb and the new window with thin pieces of fiberglass batting or low expansion foam. Finally, re-install the interior stops with a bead of caulk to finish the assembly.

**"New construction windows,"** on the other hand, are installed into the rough-framed openings *before* the casing (trim molding) is added. ***If you choose to replace your old window with a new construction window, you'll need to remove all the interior and exterior molding from around the old window, and expose the rough framing.***

New construction windows have flanges *(see illustration below)* that are screwed or nailed through the wood sheathing (hidden beneath the outside trim) to the studs that surround the window opening. To determine the correct size of the window you need, you'll probably have to remove the interior trim and measure the dimensions of the rough opening.

When you are installing a new construction window in an old house, the walls may be thicker than in newer framing; in such cases, you may need to use extension jambs (pieces of wood that fill the gap). Any voids between the window jambs and the studs should be filled in with foam or fiberglass batting. Reinstall the trim after you have the new window mounted.

No matter what type of window you choose, **don't go cheap.** Be sure to buy a better grade unit from a reputable dealer. You'll want a sturdily constructed window, one that will withstand the abuse of daily usage. Make sure that you'll be able to get replacement parts 10 or 15 years from now, when Junior's foul ball meets up with your window. Use caulk rated for at least 35 years, and better quality paint for finish work on the trim. That way, you can enjoy looking out your new windows, instead of repairing them in the near future.




*Typical new construction window*

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# SASH CORD REPAIR

For several hundred years, double-hung windows have been the most popular windows used in homes. They have evolved little during that time. They basically consist of two separate pieces of glass, each enclosed in a wood frame. These two pieces are known as the lower and upper **sash**. The two sashes are then inserted into a wooden **frame** that has channels on each side to guide the sashes. A system of **weights and pulleys** allow the sashes to go up and down easily.

The part of this system that needs periodic maintenance is the rope that connects the sash to the weight, commonly known as the **sash cord.** (Other materials have been used instead of rope, such as chains and wires, but here we will focus on replacing rope.)

## Removing the Lower Sash

Remove the **window stops** – the strips of molding, one to two inches wide, on each side of the window frame *(see illustration next page.)* You don't need to remove the molding along the top of the window. Careful prying with a wide prybar or a stiff putty knife will help prevent these strips from breaking. (If, however, any of the parts do happen to break while you're working to remove or replace them, you can purchase replacements inexpensively at any lumberyard.)

At this point, the bottom sash can be taken out. Swing out one side at a time. If either of the ropes is still attached, you can pull it out of the **pocket** (the slot in the side of the window.) The cord is usually just sitting in there, but sometimes you may need to remove a small nail that holds the cord in place. Then, you can set the sash aside.

## Removing the Upper Sash

There are two rectangular pieces of wood, called **parting stops,** which hold the top sash in place (just like the window stops hold the bottom sash.) These parting stops sit in two grooves, and should pull out. They are usually not nailed, but they may be stuck in by old paint. Careful prying should remove them without breaking them. Again, you don't need to remove the top one. You can now remove the top sash as you did the bottom one.

## Replacing the Sash Cords

At each side of the window frame near the bottom, there is an **access door** cut into the wood. It’s usually held in with screws. After you have removed the doors, you will be able to get to the sash weights. There are two weights on each side of the window – one for the upper sash, and one for the lower.

The replacement sash cord should be the same size as the old cord that you'll find tied to the weight, or still attached to the sash. Run the new cord through the pulley at the top of the window frame down to the sash weight. (Sometimes a straightened-out clothes hanger is helpful in fishing the rope down to the weight.) Tie it securely to the weight; then, tie a large knot inside the window frame at the pulley. The knot is in the right place when the weight is

*(continued)*

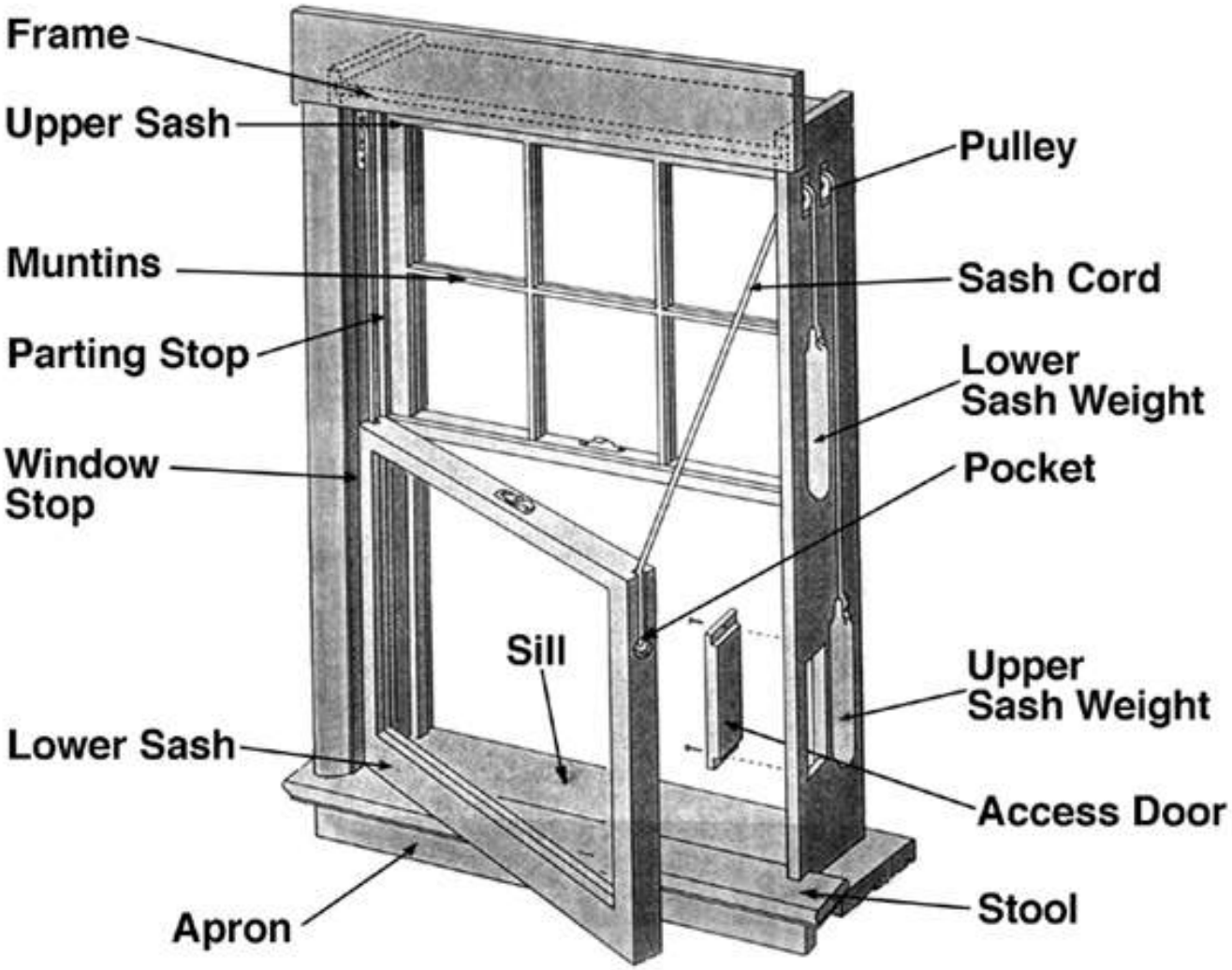
just suspended off the bottom and hanging in the air when the knot is tight against the pulley holding the weight up.  Cut off any extra cord with scissors or a utility knife.

Repeat this procedure with the other sash cords.  It is usually best to replace all the cords in a window at the same time, even if they're not all broken.

Reassembling the Windows

After replacing all the cords, replace the access doors and reassemble the window by reversing the steps you used to take it apart:  first, slip the sash cords into the pockets on the upper sash; work in one side, and then the other.  Insert the upper sash into the frame, and replace the parting stops.  Then, do the same for the lower sash.

Finish by rubbing a bar of soap into the inside of the channels that the sashes ride up and down in, so they will move more freely.



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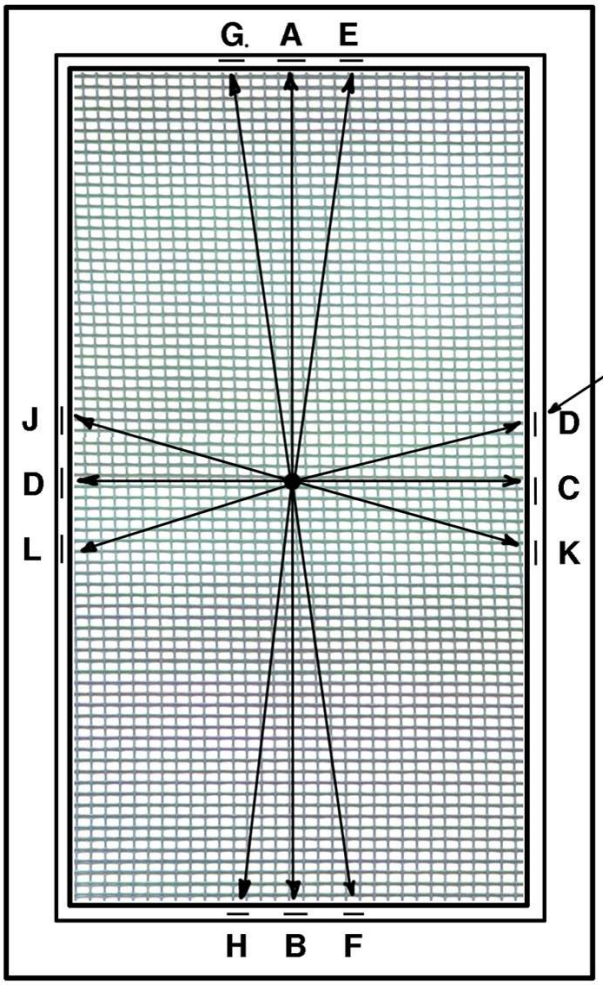
# SCREEN REPLACEMENT

Replacing screen (using screen fabric) is a simple repair, but requires some care. Screen is attached to a wood frame in a different fashion than with a metal frame, so the technique for replacing damaged screening will depend on the frame type.

Before replacing screen in a wood frame, examine the condition of the frame itself. The wood should be strong, solid, and not rotted. Porch screens, especially, are vulnerable to damage from weather exposure, lack of paint, improper porch drainage at the bottom of the screens, and storage of material stored against them. If you determine the frames are in good shape, remove the old screening and the **screen bead** running around the edges.

Cut the piece of replacement screen 6 to 8 inches larger than the “opening” dimension. Start by attaching the screening fabric with staples or tacks at the center of the top and bottom. Stretch the fabric in opposite directions and staple at the center of each side. Then, continue stretching the fabric in opposite directions, back and forth, toward the corners *(see Illustration 1),* tacking it to the frame as you go. (Position the staples or tacks about 1/2” from the inner edge of the frame, about 1 to 1-1/2” apart.) The final stretch will be at the corners.




**Tack or staple screen to frame at "A," then at "B," "C," "D," etc.**

**Keep screen straight with the frame**

**Staples should be placed about 1/2" from inner edge of frame and 1" gap between staples**

**Apply screenbead molding over staples**

***Illustration 1***

*(continued)*

Once the screen is attached all around, apply new screen bead to the joint between the screen and the frame. (It's unlikely you'll be able to re-use old screen bead, unless extreme care is used in its removal.) The screen bead should be painted on all sides before it is applied to the screen. Trim the excess screening with a sharp utility knife. Make sure the screen bead is solid and tight into the corners.

If you have metal-framed screens, you'll need a "splining tool" to attach the screen to the frame. The screen and the **splining** (a flexible rubber or plastic strip) need to be wedged into a narrow channel around the perimeter of the frame. The splining tool helps you insert the screen and splining into that channel.

Using an old screwdriver, dig up one corner of the old splining out of the channel, and gently remove it without tearing or stretching. (If it is damaged or stiff, buy a roll of splining at the hardware store, and cut a piece of new spline a bit longer than the told one.) If the window is long and narrow, cut the spline so you can install the two short sides first; for square windows, the spline can be installed in one piece.

Cut a piece of new screening about two inches larger than the opening, and center it over the frame. Cut diagonally across the corners of the screening so they will fit neatly into the channel. If the replacement screen is metal, crease the screen and push it into the channel on all four sides *(see Illustration 2),* using the convex wheel of the splining tool (the one with the edge that bulges out). (For fiberglass screen, you can skip this step.) Then, using the concave wheel of the splining tool (the one with the edge that curves inward), force the spline into the channel along with the screening *(see Illustration 3).* Make sure the screening is pulled taut as you go. Cut off excess spline and screening with a utility knife *(Illustration 4).*

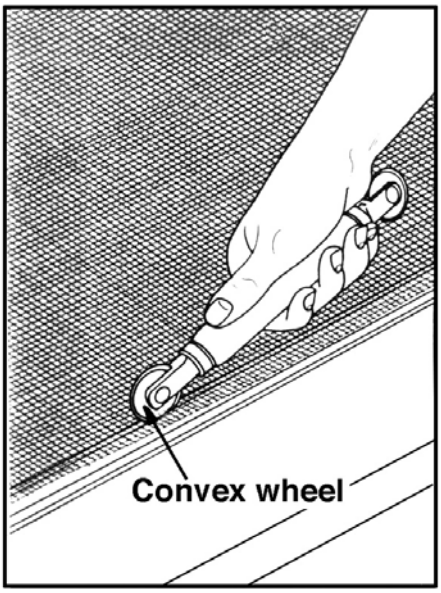



***Illustration 2***

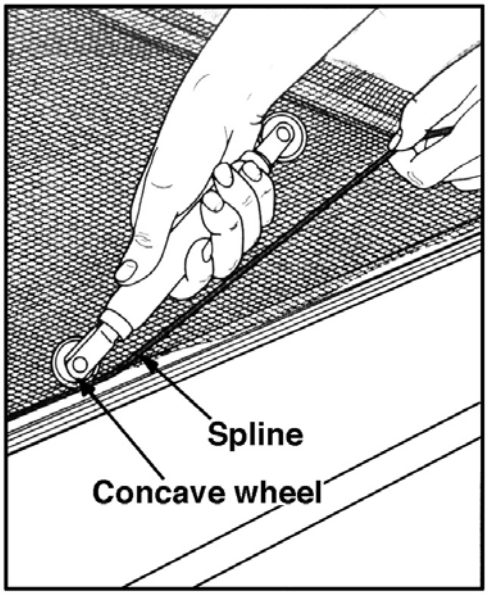



***Illustration 3***

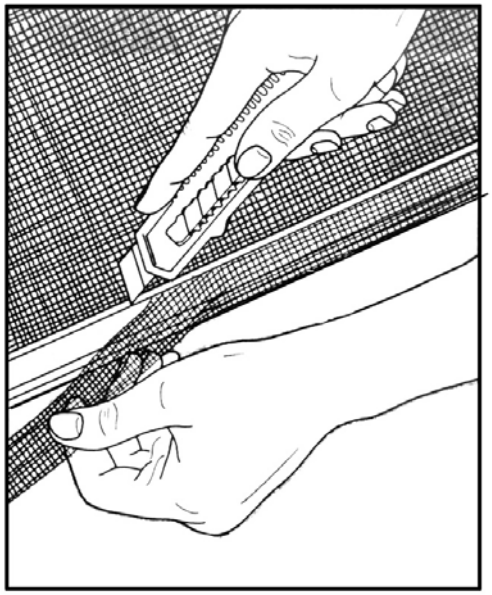


***Illustration 4***

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# WINDOW GLAZING and GLASS REPLACEMENT

When autumn winds start whistling in around your windows, and you get that “rattling bones” sound – it’s time to do some **glazing**. Glazing is the term used for the putty around the outside of your windows where the glass meets the wooden frame, as well as for the act of replacing that putty. Although glazing is pliable when it is installed (to seal the glass,) over the years it has a tendency to dry, crack, and fall out. Replacing loose or missing glazing is a fairly simple chore that almost anyone can do.

First, remove any loose pieces of glazing that are still partly stuck to the glass. A stiff putty knife works well for this. Then, clean the glass, so the putty will stick to it. (You only need to clean a strip as wide as you'll be glazing.)

Now, you're ready for the glazing. Glazing compound has a relatively short shelf life – so, if you have a can that’s more than a year old, get some fresh glazing, no more than you'll need this season. Glazing is easier to use if it's warm, so on cold days leave the can inside to keep the glazing flexible. A heat gun can be used to warm up a can, as well.

Take a lump about the size of an average tomato, and knead it in your hand for a couple of minutes to mix it well and make it more pliable. Then, roll this glazing into a long rope about the diameter of your thumb. Gently press it in place where the glass and the wood frame meet. Next, starting from the top down, run a glazing tool or a putty knife held at a 45° angle down the glazing to seat it into the corner. You may need several passes with the tool to get the surface smooth enough. You can wet your finger and lightly rub it up and down the glazing after using the tool, to give the surface an extra-smooth texture. With a little practice, you'll move more quickly, and your results will be neater.

If you need to replace the glass in a window, the procedure is a bit different. Remember that glazing compound does not hold the glass in place – it only seals out water and air. The glass is really secured by **glazing points**, small pieces of metal inserted into the wood frame along the edge of the glass *(see illustration.)*

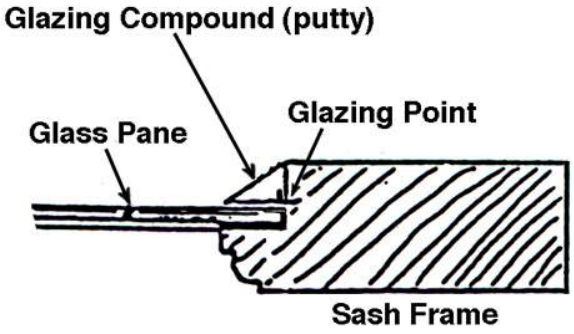
**Glazing Point Actual Size**

To remove broken glass from the sash, you must first remove the old glazing material. With a heat gun or propane torch, soften the old glazing compound and scrape it out, using an old sharp wood chisel or putty knife. Remove the glazing points, using a putty knife or screwdriver to force them out of the wood. Once you have removed the old glass, continue to scrape the frame until the wood is completely cleaned. This will help the new glazing compound bond to the wood.

When ordering replacement glass, measure the inside of the sash to get the glass width and length. Deduct 1/8 inch from each measurement.

*(continued)*

When you're ready to install the new glass, take a small amount of glazing compound from the can, knead it into a ball as described above, and roll it between your palms to form a narrow snake. Push it with your fingers into the wood to form a bed for the glass (see illustration). Lay the piece of glass on the bed of glazing compound and **secure it by using a putty knife to push the glazing points into the wood**. Place the points about 2 inches from each corner, and about 12 inches apart along the sides, top, and bottom of the frame.




Once the glass is secure, form another snake of glazing compound as before. Push this snake into the area where the glass meets the frame on the outside. Run a glazing tool or putty knife held at a 45° angle along the edge, as described above, so that you end up with a smooth wedge of glazing compound that is not visible from inside the window.

Many people make window glazing part of each house painting project. (You can paint glazing right away, although it will take a week or two before it sets up completely.) It's best, however, not to wait until your house needs painting, but instead to check your house annually; once you have caught up – unless you get a baseball through a window – it should take you only about half an hour once a year to maintain your window glazing and end those rattling windows once and for all.

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# General Interior Carpentry

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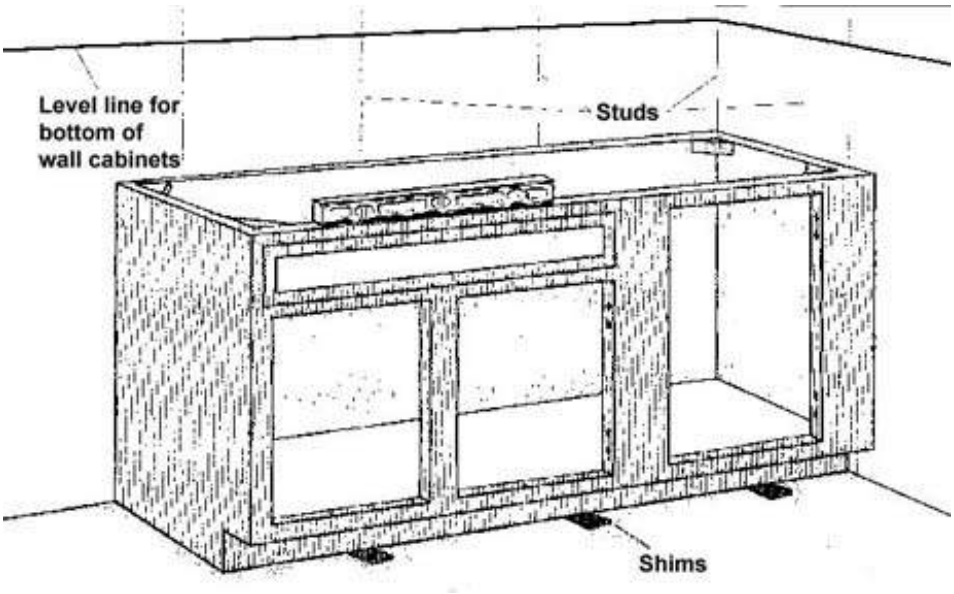
# INSTALLING KITCHEN CABINETS

Cabinetry is generally considered finish carpentry work. There is little room for error, especially since many cabinets are at eye level, where mistakes are particularly noticeable.

Nevertheless, cabinet installation is well within the abilities of most careful people with some skill. In addition to knowing some of the how-to, anyone trying to install cabinets must be able to exercise patience. (This is not a job to do at 7:30 p.m. while the kids run through the kitchen.) It also helps to have a partner for this project, as the upper cabinets can be heavy to lift into place. You don't need a lot of tools; a couple of good levels, a hammer, some clamps, an electric drill with a Phillips screw bit, and a straight length of 2 x 4 should be sufficient. You will probably need some shim material, as well, to compensate for floors and walls that aren't level and plumb.

First, you'll need to draw vertical lines to indicate the location of the wall studs to which you will be attaching your cabinets. (If you are replacing old cabinets, the holes where they were mounted may show you where some of those studs are.) Set your base cabinets in position, and level them with shims underneath, front to back and side to side. Measure up 19-1/2" from the top of the base cabinet, and draw a line to indicate the bottom of the wall cabinets. Remove the base cabinet, and then take your 2 x 4 and screw it to the wall along the line you have drawn, checking to make sure it is level; in addition to helping you position the upper cabinets, the board will provide temporary support until the cabinets are secured to the wall.




It usually works best to assemble all the cabinets for one wall on the ground, attaching the cabinets to each other before mounting them on the wall as a single unit. Remove the doors and any loose shelves; then, align the frames and use C-clamps to hold them together while you screw each cabinet to its neighbor at the front, at both top and bottom, using 2-1/2 inch panhead screws

*(continued)*

driven from both sides. If the frames are hardwood, drill small starter holes before inserting the screws. If you have room, you can leave the clamps on for better support while you lift up the assembled cabinets and set them on the 2 x 4.

Check with a level held against the face of the frame to make sure the units are plumb; if they are not, insert shims behind the frame until they are. (The part of the shim that protrudes beyond the frame can be cut off with a hacksaw later.) Occasionally, you'll run into a corner of a wall that is so far from plumb that you'll need to cut into the wall and partially recess the back corner of the cabinet to get it to fit properly. When the units are in place and you have made sure they are plumb and level, you're ready to screw the cabinets to the wall studs. Drill pilot holes and drive 2-1/2 inch panhead screws through the ledgers (the horizontal pieces of wood on the rear wall of the cabinet). If you have a double-door cabinet, add a second set of screws near the middle, at both top and bottom.

As you move to the next set of upper cabinets, reposition the 2 x 4 to support them; then, assemble the cabinet unit and set it in place as before. Clamp and screw these new cabinets to those already in place before attaching them to the wall. Continue around the room in this manner, until you have finished the upper units. Fill any gaps between cabinets and wall with caulk or spackling; if the gap is very large, you can cover it with molding (filler strip). You should also use a filler strip where cabinets come together at right angles, to prevent the doors from banging against each other. When you are done installing the upper cabinets, rehang the doors and shelves, remove the support board, and spackle over any screw holes in the wall.

The lower cabinets are installed in much the same way, except that you have to deal with differences in floor levels. Most floors slope up or down; if you don't compensate for that slope, then the counter won't be level on top of the cabinets. The easiest way to do this is to find the highest part of the floor with a level and measure up the wall at that point to the height of the top of the base cabinets. Using your level, extend a line from that mark all the way around the room where the cabinets will be installed. If you use this line as your guide when screwing the base units to the wall, the cabinets will all end up level and at the same height.

Clamp and screw the base cabinets together first, just like the upper cabinets, and then screw them to the wall along the line you marked. Fill any gap between the bottom and the floor with shims, and cover it with molding later on. Make sure the cabinets are both plumb and level – if they aren't, problems are likely to develop later on, with doors failing to close as the frames rack themselves out of square. Cut openings in the sink base for water and drain pipes, using a drill and hole saw, jigsaw or keyhole saw.

Patience and attention to getting the cabinets plumb and level will produce an installation that you can be proud of for many years to come.

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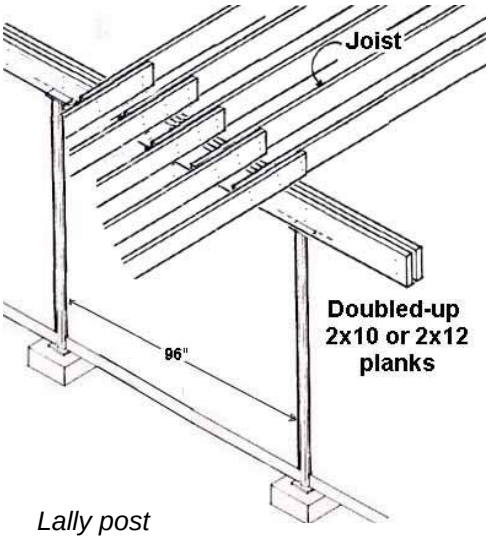
# REPLACING A LALLY POST

Let's say that you see your child's ball rolling across the living room floor towards the wall – seemingly on its own. Most likely, it's not the action of a poltergeist, but simply the result of a floor that sags towards the interior wall. It's not unusual for some sagging of the floor to occur in older houses as they settle over the years. However, a very pronounced sag may mean that you have a problem with the center support beam in the basement, or with the columns holding up that beam.

Depending on the age of your house, the support beam may be a solid piece of wood, a laminated beam made from 2"x12" planks, or a steel I-beam. You will usually find it near the middle of the basement, supporting the floor joists. Since it was nearly impossible to find 2x10 planks long enough to span the entire house, most builders used two lengths of floor joists, overlapping them on top of the support beam *(see illustration below).* For a 26-foot-wide house, for example, you will usually find two 14-foot-long floor joists resting on the beam, overlapped 24 inches. The stability of the entire house depends on that center beam.




*Lally post*

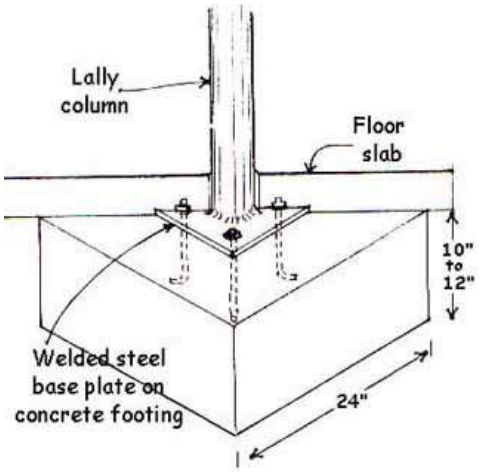
The beam is itself supported by hollow iron pipe columns (also known as "Lally posts") every eight feet. Each post rests on a concrete footer, 10 to 12" thick, hidden under the basement floor *(see illustration on next page)*. Lally posts often rust away where they meet a damp concrete floor; with insufficient support, the center beam will then start to sag. To remedy the problem, many people buy a floor-jack post, place it near the original Lally post, and jack up the beam. While this technique will bring the floor back up into position, it does not meet the Building Code in most communities. The correct repair is to install a new Lally post that rests on a footer and is secured both to the footer and to the beam, so that the post cannot be bumped out of place.

Sometimes you can accomplish the job by raising the beam just a bit with a hydraulic bottle jack and temporarily supporting it with a wood post. Then, use a reciprocating saw (Sawzall™) to cut the old iron post at the top and at the bottom flush with the floor and remove it. Since the newer steel posts have a smaller diameter than the old iron posts, the new steel post can sit inside the remaining section of the old one below the floor level and be mortared into place. However, if the problem area is not above an existing old footer, you will need to cut into the floor and pour a new footer to support the column you're installing. (Be sure to let the concrete cure for about two weeks before applying any pressure on the column.)

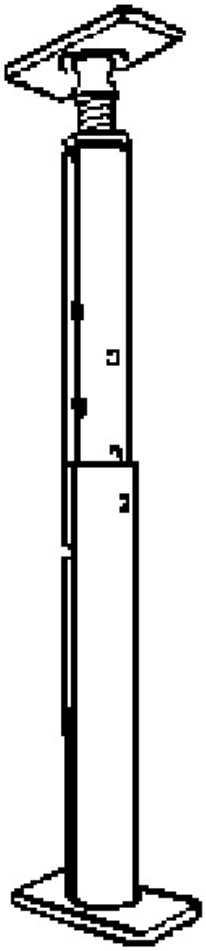
This is a process that should not be done too quickly, or the wall plaster or wood trim will crack as you take the sag out of the floor. To minimize the development of cracks, lift the

*(continued)*

beam in quarter-inch increments over a few days.  Lift the support post with the hydraulic jack, and then adjust the threaded rod at the top of the lally post until it is snug up against the beam. Repeat this process until the floor is approximately level.




*Lally post footer*



*Replacement Lally post*

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# Floors

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# FLOOR UNDERLAYMENT
## beneath your new flooring

If your kitchen floor looks like someone stabled horses on it all summer, if your bathroom floor tile is broken and chipped, or if the pattern went out of style before man walked on the moon, you may wish to replace your flooring material. To do the job right, however, you need to consider more than the color, pattern, and composition of your new flooring.

Before installing any new flooring material, make sure that the surface below it is intact and solid. If you try to put tile or linoleum directly on top of an existing tile floor, or over a floor that is flexing, the new flooring will quickly crack and break up. (This is particularly true when installing ceramic tile; if the floor beneath ceramic tile is not rigid and solid, the tile will crack.)

The usual way to remedy this situation is to install new floor underlayment. The underlayment will provide a clean, solid surface on which to install the new flooring. In most areas, your underlayment will consist of one or more sheets of plywood. As an alternative, especially in a bathroom or other water-prone area, you may wish to use concrete backer board, a kind of "drywall" impregnated with cement that provides a rigid, waterproof base.

If your kitchen floor is covered by carpeting, scrape off as much of the carpet or pad as practical, but you don't have to overdo it – small amounts of residue won't have too much effect when you put down the underlayment. For tile floors, remove any loose tiles and fill in the spaces they leave with underlayment crack filler (a powder which you mix with water to a plaster-like consistency). Spread it into the spaces where the tiles were, and smooth it with a large putty knife. It will harden quickly.

**Underlayment nail**

After the crack filler has hardened, you can start installing the underlayment. First, if you have baseboard molding around the room, remove the bottom piece (usually called "quarter-round molding"). Then, nail 1/4" mahogany plywood right on top of your existing floor. (This material will work well as underlayment, unless you have a particularly weak or "spongy" floor, or if you intend to install ceramic floor tile, which needs a stronger base – *see next page.)* Mahogany plywood is smooth on both sides. You'll find it readily available and fairly inexpensive.

To nail down the plywood, use underlayment nails, which have a smaller head and rings on the nail shank that prevent them from working loose. Drive nails throughout the entire sheet of plywood, every 6 to 8 inches *(see illustration on next page),* to ensure the floor is down solidly. If you have a very flexible floor, you can use some construction adhesive to help glue down the underlayment. You'll still need to use nails, but the glue will help stop the wood from flexing.

After you are done nailing, take some more underlayment crack filler and fill in all the joints where the plywood sheets meet and at the edges of the room. Any other gaps should also be filled (such as around door jambs), so you have a good solid base. The crack filler can be sanded after it is dry, to create a really smooth surface. After a good sweeping up, you will be ready to start laying your new floor.

*(continued)*

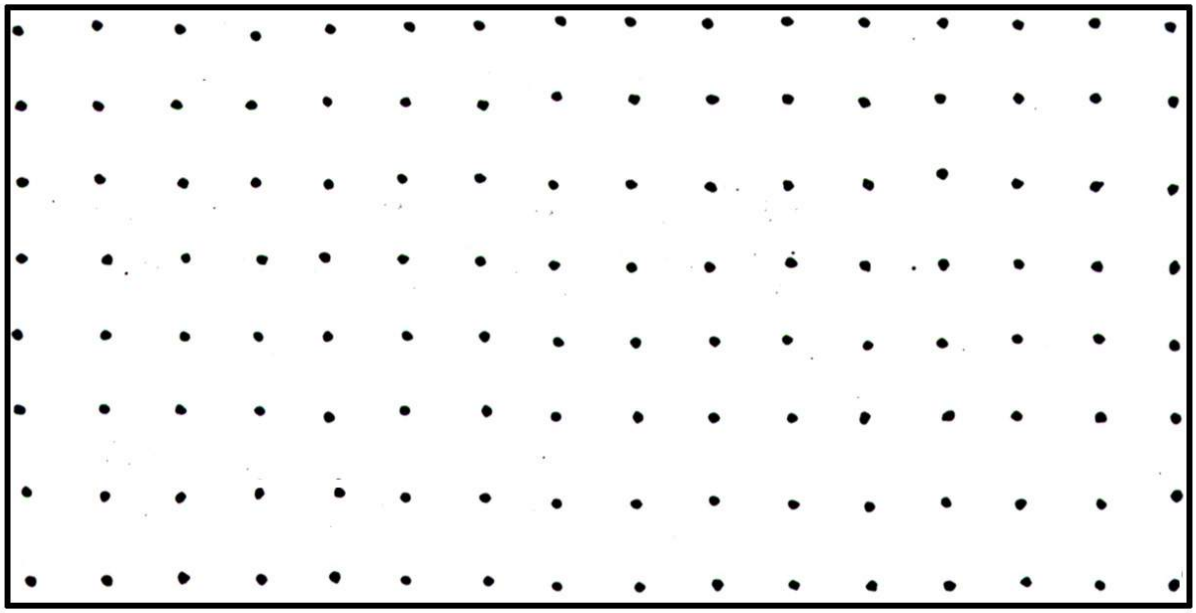
If you will be installing ceramic tile, you'll need a firmer base. Your best approach is to use concrete backer board as your underlayment material, cutting the sheets to size with a carbide scoring tool or a circular saw with a masonry blade. Nail the pieces in place or glue them with construction adhesive or thinset mortar. Cover the joints with mesh tape – the kind found in the tile department (not the drywall department.) If you use wood under ceramic tile, start with a ½" sheet of plywood and top it with a ¼" sheet, laid at right angles to the first. (Don't use Lauan plywood, as it can be damaged by the moisture in the adhesive you'll be using to imbed the tile.) Secure each sheet with nails and construction adhesive as described above.

Remember that adding the underlayment will raise the height of your new floor. You may need to shave off the bottoms of doors, add an extension flange on your toilet, and/or install a special threshold molding (i.e., "carpet bar" or "tile strip") at each edge of the floor to bridge the differing heights in adjacent rooms.

An alternative is to remove the old flooring and underlayment down to the subfloor and "start over." For ceramic tile, begin by nailing a layer of plywood directly into the floor joists. Cover it with a thin layer of inexpensive thinset mortar to fill any voids between the plywood and the next layer, and then install concrete backer board on top of the thinset. Finish by spreading another layer of thinset on top of the backer board when you're ready to imbed the tile.

The time you spend getting the floor ready will help ensure that your floor covering will be more attractive and long-lasting.

**Approximate nail spacing for plywood underlayment**



**One 4 X 8 sheet = 32 square feet**

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# REFINISHING A HARDWOOD FLOOR

with a Flat Plate Floor Sander – using Lead-Safe Work Practices*

Are you contemplating sanding and varnishing your hardwood floors yourself? Till now, the tools most commonly used for this job have been a drum sander and a smaller edge sander – tools that, if not used properly, can produce deep gouges and waves in the floor. A different type of floor sanding machine is now available, one that makes sanding safer and easier for the do-it-yourselfer. This **flat-plate floor sander** (a larger version of the hand-held orbital palm sander) has a large, flat, rectangular pad that uses self-adhesive sandpaper to remove the old floor finish.

If your floor is badly stained or if the floorboards are cupped and must be evened out, you must still use a drum sander. Because a drum sander is more difficult to handle and control, take care when operating it – you can gouge, cup and burn the floor. For less complicated floor refinishing jobs, however, a flat-plate floor sander can give you professional results, even without experience. While it will not sand your floor as quickly as a drum sander, a flat-plate floor sander is quieter, does not produce as much dust, and needs no special tools to load the sandpaper. You can sand closer to the wall, so you probably won't need an edge sander.

Regardless of the machine you use, you'll need to decide on the degree of refinishing you want to do. A **REDO** completely removes the old finish and possibly a light stain, sanding down to bare wood. A **RENEW** does a light sanding before you apply a floor finish, to return luster to a tired-looking floor. (You'd also follow this procedure when sanding a new bare floor.) *If you want to change the stain color on the floor, a redo is in order.*

**SETTING UP THE PROJECT/LEAD-SAFE* PRACTICES:**

If you have an older home, the finish on your floor may contain lead. If your floor was painted before 1978, the paint may be lead-based. While shellacs and varnishes did not usually contain lead, lead may have been used as a coloring pigment in the stain underneath it.

Hazardous lead-containing dust, leaded paint chips, and lead-contaminated trash can all be produced during remodeling and renovation, but dust is the most dangerous and hardest to control. If there is lead in the floor finish, using a floor sander will produce a great deal of lead-contaminated dust that can cling to clothes and skin, to walls and floors, and to furniture and floor coverings. Forced-air heating and air conditioning systems can spread that dust throughout the home.

For that reason, you should presume that the surface might contain lead and make sure that appropriate precautions are taken by anyone refinishing the floors in your home. All children and pregnant women should leave the house until work is completed for the day and an effective cleanup has taken place. If the job cannot be completed in one day, the work area should be cleaned up sufficiently each day *(see "DAILY CLEANUP" section)* to ensure that occupants have safe, uncontaminated access to sleeping areas, bathroom and kitchen facilities, and entryways after work hours.

*(continued)*

***The safest course is to have the work done by a licensed lead abatement contractor or a certified lead renovator,** trained to minimize the chance of lead contamination. If you decide to do the work yourself, or to use a contractor who is not lead-licensed, at a minimum you should make sure that "lead-safe work practices" are used, as precautions to keep dust from spreading throughout the house. Lead-safe work practices generally include washing the area down with detergent and lots of water; however, since water should not be dripped on an unfinished floor, Home Repair Resource Center has made our best attempt to adapt lead-safe work practices to this job. The techniques suggested will reduce lead dust, but may not completely eliminate risk.

Before starting your floor refinishing project, take at least the following precautions:

- Close off the work area with air lock flaps, created by covering each entryway with overlapping sheets of 6 mil polyethylene plastic sheeting, taped in place with duct tape. Be sure to leave windows open for proper ventilation, if necessary. Allow only those doing the work to enter the work area.
- Remove furniture, curtains, food, clothing, and other household items until cleanup is complete. Items that cannot be removed from the work area should be tightly wrapped in 6 mil polyethylene plastic and sealed with duct tape until all work and cleanup is complete.
- Turn off forced-air heating and air conditioning systems, or at least close off all ducts that serve the work area, during remodeling or renovation. Then, cover heating and air conditioning vents with a layer of 6 mil polyethylene plastic sheeting. Tape the sheeting in place with duct tape.
- Cover openings, such as gaps around pipes and between floorboards, with plastic or duct tape to prevent lead dust from sifting down to lower floors and rising to upper floors.
- Cover all exposed surfaces that cannot be removed, such as countertops and shelves, with 6 mil polyethylene plastic sheeting, and tape in place.
- If work is being done in or near the kitchen, tape around the doors of refrigerators, stoves and cabinets to prevent dust from contaminating food and inside surfaces of food storage areas.
- When working in the project area, wear a HEPA (**H**igh **E**fficiency **P**article **A**ccumulating) cartridge respirator *(see "Safety Equipment and Clothing" in the yellow pages)* and disposable overalls and shoe coverings. Remove these items before leaving the work area.
- Read and follow the safe work practices *(page 6)* and personal cleanup tips *(page 17)* in the EPA handbook, ***Reducing Lead Hazards When Remodeling Your Home.***

**PREPARATION OF THE FLOOR:**

Before starting, you need to remove the quarter-round or shoe molding around the room, to allow the sander to get close to the edges. Then, double check to make sure there are no nails sticking up in the floor – they can rip the sandpaper.

**REDO OR RENEW:**

Depending on how much of the finish you want to remove, you'll use one of two sequences of sandpapers:

**REDO:**

A "redo" begins with 36 grit (coarse), goes to 20 grit (very coarse), goes back to 36 grit, then 60 grit (medium), and finally 80 grit (fine). Starting with 36 and then going to 20 gives a better

*(continued)*

bite for the coarser paper and is more effective. All grits are important, as each one serves an individual and progressive purpose.

**RENEW**:

A “renew” involves a light sanding with 80 grit sandpaper. The old finish is hard and probably quite smooth. Sanding will give a good mechanical bond for the new varnish coating. For NEW floors, a “renew” starts with 60 grit, and then finishes with 80 grit sandpaper.

**LOADING THE SANDER:**

Ensure that the sander switch is in the “off” position. Peel the back paper off the first piece of self-adhesive sandpaper and adhere it to the Scotch-Brite pad (which acts as a buffer between the floor and the sander, so that no gouging occurs.) Put the pad on the floor with sandpaper side down, position and place the sander squarely over the pad, and you are ready to sand. Press down on the release lever with your foot to lower the sander’s arm and start the machine.

**SANDING:**

Go slowly, letting the sander do the work. The sander will pull to the right, so sand from left to right. The coarser grits (36 and 20) work slower; they do the big job of cutting through the old finish. The medium and fine papers are faster; they do the smoothing. Keep an eye on the sanding dust you create; whenever the dust lessens considerably, it’s time to replace the sandpaper sheet.

**DUST COLLECTION AND SAFETY:**

Have an assistant vacuum the sanding dust as you go. This leaves less clean up later and lets you see your work area. Use a HEPA-vac (preferable) or at least a wet/dry type vacuum **with a HEPA-filter and collecting bag,** as sanding dust can harm the vacuum’s delicate motor. Purchase several bags to have on hand. Empty the vacuum of dust often and in a safe manner *(see “DAILY CLEANUP,” below).* Turn off the pilot lights on gas appliances, and don’t smoke during the sanding operation. (The fine dust can ignite.)

Once you have progressed through each successive grit of sandpaper – 36, 20, 36 (again), 60 and 80 – the floor will look ready for finishing. You may need a cabinet scraper (a thin rectangle of tool steel) to get the old finish in the corners, and a palm sander to reach the edges along the baseboard and the few low spots the sander could not reach. Cut the used floor sandpaper to fit the palm sander, and sand the edges using the same progression of grits. There shouldn’t be much to sand, because the floor sander gets close to the edge. Now you are finished sanding.

**DAILY CLEANUP** (if project is not completed in one day)**:**

- Vacuum the floor several times, and clean the window casings and sills, door frames, and anywhere else the dust might settle. Carefully remove dust and construction trash from the filter bag (to prevent contaminating other areas) and dispose of it in heavy-duty 4 mil plastic bags. (If possible, pass the bags out a window to avoid carrying it through the house.)

- Wipe down walls, ceiling, and other surfaces with a damp rag rinsed in a solution of TSP, dishwashing detergent, or other lead-specific cleaning products. (Be careful not to drip water onto the sanded floor, as water spots will be difficult to remove.)

- Wipe down hand tools and the casing of the sander with the detergent. Dispose of used water down a toilet.

- Secure the work site whenever it is to be left unattended. If possible, completely seal off the entryways with 6 mil polyethylene plastic. If passage through the work area will be

*(continued)*

necessary, follow the above clean-up procedures so that the occupants will have safe, uncontaminated access to sleeping areas, bathroom and kitchen facilities, and entryways after work hours.

**FINAL CLEANUP** (Wait at least one hour after the repair is finished)**:**

- Vacuum the floor thoroughly to remove **ALL** the sanding dust from the room. Vacuum the floor several times, and clean the window casings and sills, door frames, and anywhere else the dust might settle. Carefully remove dust and trash from the filter bag to prevent contaminating other areas. Dispose of dust and construction trash in heavy-duty 4 mil plastic bags. (If possible, pass the bags out a window to avoid carrying it through the house.)

- Wipe down walls, ceiling, and other hard surfaces within the room with a damp rag rinsed in a solution of TSP, powdered automatic dishwasher detergent, or other lead-specific cleaning products. (Again, be careful not to splash or drip the water on the sanded floor.) Wash all horizontal surfaces three times, changing wash water with each washing. Rinse with clean water; dispose of used water down a toilet. Work from the top of the room toward the bottom, cleaning ceilings first, then walls, counters and floors.

- Carefully remove any disposable plastic sheeting used to protect surfaces by rolling or folding it inward and then disposing of it into a heavy-duty 4 mil plastic bag.

- Vacuum any non-disposable tarps; then, roll or fold inward before removing them from the work area. If further cleaning is needed, carry the folded tarps outside and open them flat on the driveway. Once the tarps have dried thoroughly, vacuum them with a HEPA filter-equipped vacuum cleaner. Then fold the tarps for re-use.

- Outside the airlocks at the doorways, wet-wash adjacent floors (within at least 10 feet) and other hard interior uncarpeted surfaces (within at least 5 feet in all directions) with TSP, powdered automatic dishwasher detergent, or other lead-specific cleaning product. Include walls and window sills. Wash all horizontal surfaces three times, changing wash water with each washing. Rinse with clean water; dispose of used water down a toilet. When mopping, use a disposable mop, since a mop used for this cleaning could spread the lead dust if it is later used for regular cleaning.

- Vacuum baseboards, chair rails, window sills, casings, shelves and countertops again, once they are dry, using a HEPA filter-equipped vacuum cleaner. Then, to remove the last dust particles off the floor, “tack” the floor using tack clothes (available at paint stores) or lint-free cloths just slightly dampened with water. Wipe across the floor, rinsing the cloths regularly to remove the dust. Let the floor dry, and you are ready to stain and/or finish.

**STAINING:**

If you choose to stain your floor in order to change the color of the wood, think carefully about the products you will use. For example, *a water-based polyurethane varnish may not be compatible with a sanding sealer (used to close the grain of the wood so that the stain appears more even on the surface) or an oil-base stain;* in some cases, the water-based varnish may curdle like cottage cheese. **Read and follow the directions on the product labels.** If you want just the natural wood color, an oil-base polyurethane varnish will give an amber-honey cast to the wood, while a water-base varnish will be clear.

**FINISHING:**

When the floor is ready to be varnished, you can use a good quality varnish brush and an applicator pad on a stick to apply the polyurethane. (A roller can leave a lot of fuzz and stipple marks on the floor surface.) If you are using an oil-based finish, clean the applicator pad with

*(continued)*

mineral spirits prior to use. Rinse the pad with water if you're using a water-based finish. This rinsing will clear away any fuzz, loose fibers, or debris that would mar the finish. Then, stir the varnish slowly with a paint paddle, to mix it without creating bubbles in it. Pour the varnish gently into a paint tray, and dip in the applicator. Use the pad like a squeegee, pulling the finish gently down the floor. At the end of each room-length pass, turn around and return the other way, to keep a wet edge. Use a brush to get into tight areas and for edge work.

Let the finish dry, per label directions, before recoating. Sanding is NOT necessary between coats, but a light hand-sanding before the final coat will give a better appearance to the finish. Four coats are recommended on refinished or new floors; two or three coats to renew. Let the coating dry completely before touch-ups. Coverage for each finish is on the label. Don't skimp – put on what is needed. The secret is not to get impatient, and to take your time.

Maintain your refinished floor by dust mopping and damp mopping, to keep off the dirt and grit that can act as sandpaper and grind off all your hard work.

*Note: A Squar Buff flat-plate floor sander, HEPA-vac, and respirators with HEPA cartridge filters are available to low- and moderate-income Cleveland Heights residents through Home Repair Resource Center's Tool Loan.*

# Materials for the Squar Buff™ sander system

| Material List by Room Size & Square Footage | 8' X 10' (80 sq. ft.) | 10' x 12' (120 sq. ft.) | 12' x 14' (168 sq. ft.) | 14' x 16' (224 sq. ft.) |
|---|---|---|---|---|
| ScotchBrite Pad* *(see note below)* | 1 | 1 | 1 | 1 |
| 20 grit sandpaper | 1 | 2 | 3 | 3 |
| 36 grit sandpaper | 1 | 2 | 3 | 3 |
| 60 grit sandpaper | 1 | 1 | 1 | 2 |
| 80 grit sandpaper | 1 | 1 | 1 | 2 |
| Quarts of wood stain *(optional)* | 1 | 1 | 2 | 2 |
| Gallons(s) of polyurethane floor finish (oil- or water-based) | 1 | 1 | 2 | 2 |
| Pad applicator & good-quality varnish brush | 1 each | 1 each | 1 each | 1 each |
| Refill applicator pad for staining *(optional)* | 1 | 1 | 1 | 1 |
| Tack cloths (sticky cheesecloth) | 3 | 3 | 3 | 4 |

*(*Note: You can purchase an extra ScotchBrite pad to buff smooth the polyurethane finish before applying the final coating. This eliminates the need to hand-sand between the coatings.)*

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# LAMINATE FLOORING

Laminate may be the “new kid on the block” when it comes to flooring options, but it has quickly become one of the most popular. It resists scratching, staining, fading, and denting, and is reasonably easy to install on a do-self basis. Laminate flooring is sometimes called a “floating” floor, because it is all connected to itself, but not to the house. It can be installed over most hard surfaces – concrete, sheet vinyl, vinyl floor tile, and ceramic tile – so long as that surface is flat.

**Choosing Laminate Flooring:**

Laminate flooring has three layers, which are fused together to form boards 6” to 10” wide, 36” or 48” long, and about 5/16” to 1/2” thick. The top layer is cellulose paper finished with a design, usually a high-resolution photographic image of natural wood flooring, but sometimes a print or photograph of other materials (like ceramic tile); it is this design layer that determines the appearance of the flooring. It is covered by a low-sheen finish, made up of thin layers of clear melamine plastic resins, that protects the surface from scratches and general wear. Below this top layer is a moisture-resistant core of high-density fiberboard, a man-made material composed of small pieces of wood compressed and bonded together. Pay attention to this middle layer; how it is made can affect durability. A thicker core is more stable and less vulnerable – and will sound more like a real hardwood floor when you walk on it – and a quality core is treated with water-repellent chemicals. The bottom layer is a thin ply of balancing material that helps the flooring conform to the surface it is being placed upon; in some higher-priced laminates, it may have some noise-deadening properties.

It’s also important that you choose flooring that is designed to hold up under the use it will be getting. Like many materials, laminate flooring comes in various grades, called AC hardness ratings. For an area without much traffic, like a bedroom, you can probably use AC1 flooring, where a high-traffic area in a home would require AC3 material. (The highest grade, AC5 flooring, is designed for heavy-traffic commercial areas.) Consider, too, how much water the flooring will be exposed to. Check out the locking system on the flooring you are considering, as that is key to preventing water from getting underneath your floor and ruining it. Many professionals do not recommend using laminate flooring in a bathroom or other water-prone area; if you decide to install it in such a setting, you’ll have to utilize special installation techniques to prevent the core of the laminate from swelling and warping. In kitchens and other rooms where water may occasionally fall on the floor, choose a laminate material with joints and edges that have been factory-treated to help prevent water from penetrating to the core.

Finally, check the warranty provided by the manufacturer. They can range from ten years to a lifetime, but some warranties can be affected by putting the flooring in a wet area or installing the flooring yourself. Be sure to ask your retailer.

**Preparation:**

Laminate flooring is sold by the square foot, so the first step is to measure the area you want to cover. Then, multiply the overall length by the overall width, to get your approximate square footage. Measure stairs, landings, closets, and other areas separately, and add to the total. Add at least 10% for waste, wrong cuts, etc. – 20% is safer. Each box of flooring is labeled with

*(continued)*

the number of square feet it will cover. If the floor will be in a room where the length or width is greater than 66 feet, you'll also need to buy a T molding to provide added expansion space.

Bring your flooring into the house two to three days before you install it, to allow it to adjust to the temperature and humidity levels (Note: the room temperature should be at least 65°). That way, the boards won't move after they are installed. Take time to check each piece for defects.

Unless the flooring you buy has an attached foam underlayment, you will also need to purchase rolls of rubber or foam underlayment, a backing material that provide cushioning for the flooring boards and helps reduce noise. If you will be installing your flooring over concrete, or over an unfinished basement or crawl space, you must also have a moisture barrier to keep moisture from entering the underside of the new flooring and damaging it. You can purchase a foam underlayment that's also labeled as a vapor barrier, or put regular foam underlayment on top of six-mil plastic sheeting.

For a modest cost, you can also purchase an installation kit for laminate floors, with some specialized tools you will probably find helpful and some spacers to keep the laminate the proper distance from the wall.

Next, take a look at the surface you'll be installing the laminate flooring on. The important thing is that, whatever the surface, it is solid and flat. Get rid of old carpeting, scrape off any residue left on the surface, and pull out all the nails or tacks. Fasten down any lose or squeaking floorboards, and fill in any depressions with floor leveling compound. If you are covering over vinyl or ceramic tile, you don't have to worry about an embossed pattern on the old flooring, but fill in any dips or gaps (i.e., missing tiles, areas where the old flooring has chipped off) with floor leveling compound, and sand it smooth.

If you are covering over concrete, it's especially important that the concrete be flat. If there are dips and bumps in the slab, your laminate flooring will "creak." Use a long level or straight edge to check for depressions greater than 1/8" and fill them with floor leveling compound. (Make sure the floor leveler has dried completely before installing the new flooring, to prevent moisture from being absorbed by the laminate.) Grind off any high spots.

Carefully remove and set aside all baseboards. Lay a piece of the new underlayment and flooring next to each doorjamb. Draw a line at that height, and undercut the jamb with a coping saw or flush-cut saw to let the new flooring slide underneath. If the doors also come down too far to clear the new flooring, remove them and use a circular saw or belt sander to trim them to size. (Don't forget to seal the wood on the raw edge with paint or varnish.)

Finally, sweep the floor carefully before you start your installation.

**Installation:**

Before you start, read the instructions supplied by the manufacturer of the flooring you have chosen. There are subtle differences between the way different products are installed, and it is important to follow the appropriate procedures so you don't void the warranty. Some types simply snap together, while others involve use of a tapping block and mallet. The most common design has tongues running along two sides of each piece, and grooves along the other two sides. Use glue in the joints only if specified by the manufacturer.

Before you start installing the flooring, you'll need to decide how you want to orient the boards. Laminate is usually installed running the length of the room, but some people like to run it parallel to the light entering the room.

Start your installation by putting down the underlayment. It you are installing over concrete and using an underlayment with a vapor barrier, make sure the vapor barrier side is up. If you are using plastic sheeting as your vapor barrier, put down the sheeting first, butting the ends

*(continued)*

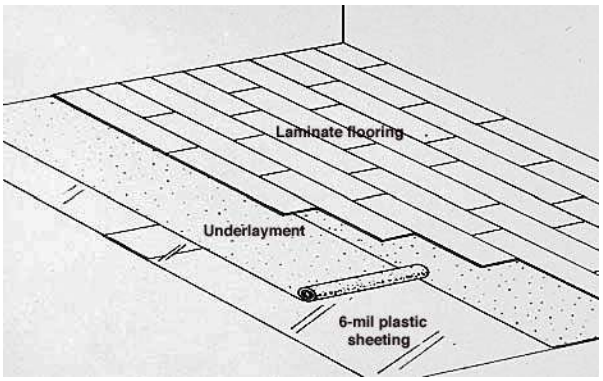
together and sealing the seams with duct tape. Next, roll out the foam underlayment in the same direction as the flooring will go, again butting the ends together and joining the pieces with wide clear plastic tape. Over a concrete floor, run the underlayment 2” up the wall; over other surfaces, you don’t have to extend the underlayment up the wall. To avoid damaging the underlayment, put down only as much underlayment at a time as will be needed for you to install a few rows of the laminate flooring.

Measure the length of the room (in inches), and then divide that dimension by the length of the floorboards (usually 36” or 48”). See how much of a remainder you’ll have once the full boards are installed. To look visually pleasing, the first and last boards in a row should be at least 8” long, so if your remainder is shorter than that, trim the amount of your remainder from the first board.

Similarly, measure the width of the room and divide by the width of the floorboards to be installed. If you don’t end up with an even number, you’ll have to trim the first and last row, to keep the pattern centered; divide the remainder by 2 to determine how wide the first and last plank should be. If you need to rip the first row of boards to width, cut off the groove side.

Cut laminate flooring with a circular saw or a jig saw, using a fine tooth “hollow ground” or “laminate” blade. Make sure to cut the laminate with the good side down, to reduce damage along the cut.

Lay out your first piece, groove side toward the wall, keeping a 1/4" space between the laminate and all vertical surfaces (walls, pipes, toilets, cabinets, etc.) You can use 1/4" spacers (included in the installation kit) to keep the space uniform. Join the next piece by inserting the tongue into the groove at a slight angle (about 45°), and then lower the boards gently, keeping them engaged until they are in place. On long runs, it can be helpful to have enough people so that the whole row can be lowered and snapped in place at once. If instructed by the manufacturer, use the tapping block (one of the specialty tools you get in the installation kit) and mallet to tap the new board into the previous one for tight fit, or use a pull bar (also in the installation kit) to snug up the pieces. Never use a hammer directly on the laminate; it can damage the edge so badly that you will never get it to fit! You don’t need to nail through the planks or glue them down, as this is a floating floor.




As you continue, alternate boards from several boxes to make any color variation less noticeable. Be sure to stagger the seams in adjacent rows. One way is to use the excess from a row you just completed to start the next row. Another way is to cut the first piece in the second row 2/3 the length of a board, and the first piece in the third row 1/3 of a board. Regardless of the method you use for the first piece, fill the row with full boards and cut the last piece to fit the remaining space.

Move across the floor, adding underlayment as needed and continuing to stagger the joints in the floorboards (keep them at least 8” from each other). If you find it difficult to fit the boards together as you install your flooring through a doorway, the best solution may be to cut off the snapping connections in the adjoining planks with a utility knife, slide the boards together, and use a few drops of wood glue to keep them joined.

Should you need to drill a hole for a pipe or other round obtrusion, make the hole about 3/8” wider than the pipe. Cover the pipes with sleeves, and use expansive joint sealant to fill the space around the penetration.

*(continued)*

When you get to the last row, you'll probably have to rip the floorboard so it will be the right width. Be sure to measure each piece, as rooms in old houses are seldom square. Remember to allow for the 1/4" expansion gap at the edge of the room. You'll need to use the pull bar to ensure that the last plank fits tightly.

**Finishing Up:**

When you have completed the installation, you can remove the spacers and reinstall the baseboards. Don't nail them to the flooring; fasten them to the walls with glue, construction adhesive, or finish nails. If there is still a gap between the baseboard and the edge of the floor, add quarter-round molding at the floor line. Also, install any transition pieces or thresholds – between rooms where the type of floor covering changes, between floors at different heights, or between rooms with laminate flooring oriented in different directions. There are numerous styles designed to handle various situations, so talk to your supplier.

Be sure to find out about post-installation instructions – either check the manufacturer's instructions or ask the retailer. Depending on the brand, you may not be able to mop the floor for 48 hours. In most cases, you should allow the floor to settle for at least 24 hours before you walk on it, especially if you used glue. Then, sweep up any debris and check all the joints to make sure they are even.

Don't throw away the leftover flooring pieced – save them in case you need to repair the floor at a later date.

**Caring for your laminate floor:**

One of the most important things you can do to protect your laminate floor is to prevent people from bringing in debris on their shoes that can scratch the floor's finish. Large pieces of sand or small pebbles can cause visible marks, so put floor mats at all doorways that lead outside or to an attached garage. However, dirt may get by the mats and cause invisible scratches, dulling the finish, so be sure to vacuum and mop frequently to keep grit off the floor. Use a damp towel or microfiber pad for spot cleaning.

You can damp clean laminate flooring using a solution of vinegar or ammonia with water (i.e., 1/4 cup vinegar with 4 cups of water in a spray bottle). Spray it on the floor as you go and mop up immediately with a damp terry mop or Swiffer. For stubborn stains, use only the products suggested by the manufacturer (typically, acetone for nail polish or cigarette burns; mineral spirits for grease and tar; warm water for blood, fruit juice, wine, beer, soda pop, and pasta sauce; and a neutral cleaner on a clean, light-colored cloth for oil, paint, permanent marker, rubber heel marks, etc.)

Now, the "don'ts." Don't let water sit on your floor – clean up spills immediately. Never clean with steel wood, abrasives, or scouring powder. Don't wet mop laminate floors, lest water seep behind the baseboards and under the floorboards, causing the core to swell and warp. Don't apply wax or acrylic floor finishes.

Don't walk on the floor with stiletto heels, and put felt pads or easy-glide buttons on the feet of furniture to avoid scratches or dents in the surface. If you have to move heavy furniture or appliances, put down a piece of plywood and/or use a dolly (and check the tires for any small pebbles that could scratch the flooring).

To avoid damaging the floor if you accidentally drop a sharp or heavy object, take some preventive measures when doing projects like using power tools or installing a ceiling fan. A carpet scrap or heavy tarp in the work area can cushion the impact in case of a mishap.

And, if the worse happens, touch-up sticks to repair scratches can be purchased from some manufacturers. If you have to replace a plank, the new plank (hopefully, one of the scraps you saved from the original installation) should be virtually indistinguishable from the others.

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# VINYL FLOOR TILE

Installing vinyl floor tile is a home repair just about anyone can do. It's manageable because you're only working with one 12"-square piece of flooring at a time – so, if you make a mistake, you only lose a dollar or two.

Vinyl floor tile comes in two basic types. In the first type, the surface coating or design is bonded to another layer to form the tile. In the second type, the design and colors go all the way through the thickness of the tile. This second type is more durable and long-lasting, especially under kitchen chair legs.

Both types of tile can be purchased in either residential grade (usually 1/16" thick) or commercial grade (usually 1/8" thick). Although commercial tile is more expensive (but less than twice the price of residential), the extra cost is well worth it. Commercial grade tile looks smoother and more even when installed, and it will last much longer.

To determine the amount of tile you'll need, measure your room. Then, multiply the overall length by the overall width, to get your approximate square footage. Measure stairs, landings, closets, and other areas separately, and add to the total. Tile is usually sold in boxes; check the label for the square footage each box will cover.

After you choose your tile, you'll need to prepare the floor upon which you'll be installing it. Make sure the underlayment is solid, and that you have filled any cracks or depressions with crack filler and sanded them smooth. *(See our "Floor Underlayment" handout for how-to instructions.)*

Start your installation by locating the center point of the room. (If your room is irregularly shaped, you'll have to decide how to roughly square it off to locate a center point.) Along each of the four sides, measure to find the center, and make a mark there. Snap a chalk line between the center points of opposite walls. The two lines will cross at the center of the room.

From this center point, lay out a row of tiles in each direction, placing the pieces down with their edges touching but without sticking them to the floor. Extend the rows all the way out to the walls. You want to end up with the last piece of tile at each wall being the same size as the piece at the opposite wall. If your rows don't end up that way, adjust your starting point one way or the other until the edge tiles (or "border tiles") will be of approximately even size at all the walls. Snap a second set of lines from your new starting point; these are the lines you will work from *(see diagram on next page).*

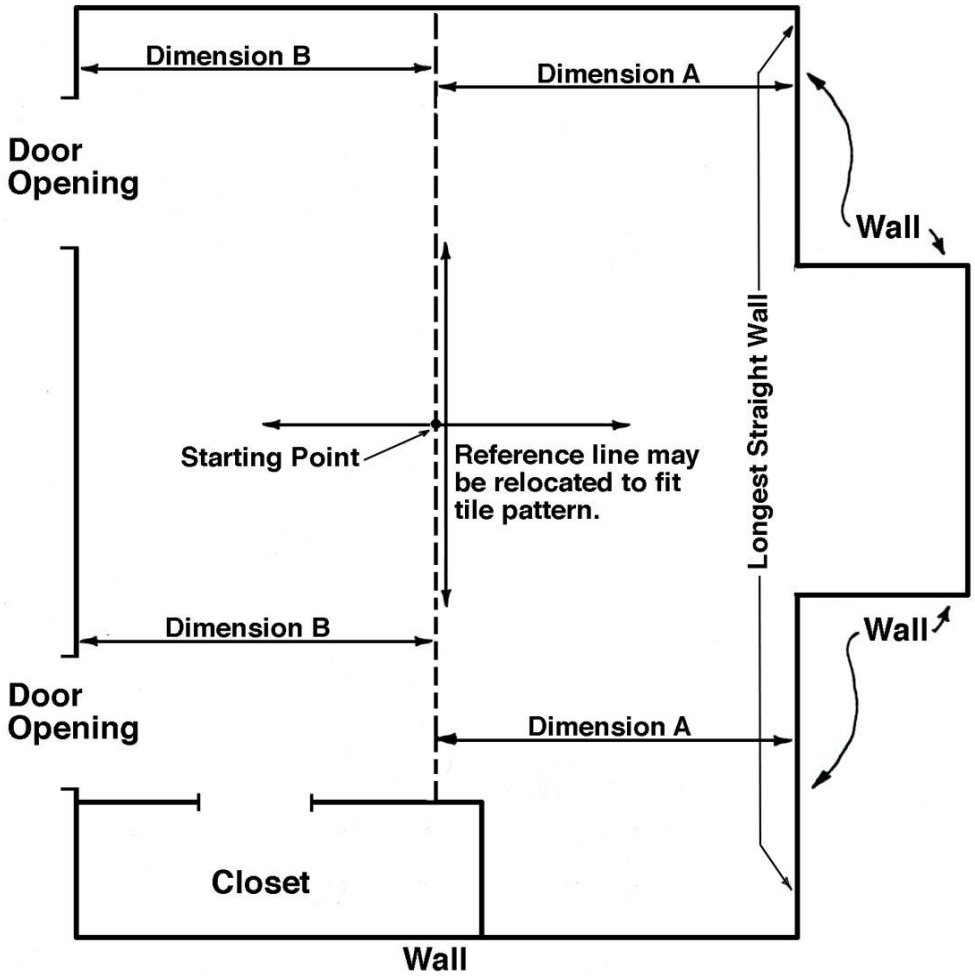
With the new lines established, you can start installing the tile. Lay the pieces right along the lines you have marked. If you are using self-adhesive tile, simply peel the paper from the back of each piece and press it into place along the line, pushing it tightly against the tiles next to it. Radiate out from the center in all four directions, rather than installing one row at a time. Tile that is not self-adhesive is installed in much the same way, except that you first apply adhesive to the area you are working. (Follow the application procedures described on the adhesive can.) Some tile will have an arrow printed on the back of each piece to indicate the direction the tile should face. You can orient this arrow any direction you wish, so long as you are consistent after you start.

*(continued)*

When you've finished all the uncut tiles, you're ready to install the border tiles. Measure the space between the last full tile and the wall, and cut a piece of tile to fit. (Since rooms are seldom perfectly square, measure for each tile—don't assume all tiles will be the same size.) A sharp utility knife or a paper cutter works well to cut the tiles. To allow for easier cutting, make sure the tiles are at room temperature. If you have to cut a tile to an unusual shape, you can make a paper pattern and cut around it.

At doorways, undercut the door frame by laying a hand saw flat on top of a tile and sawing out a portion of the frame at the floor. This opening will allow you to slip the tile slightly underneath the frame, giving you a neater finished look.

Once all the tile has been installed, run a linoleum roller over the flooring to bond it well to the underlayment. (You can rent a roller for about $15 to $20.) This finishing step is frequently skipped, but it does make the job look better and last longer. With the floor rolled, replace any baseboard trim. Then, after the floor has set overnight, you can move back in.



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# INSTALLING SHEET VINYL FLOORING

Sheet vinyl floor covering (linoleum) can be installed by just about anyone with a little knowledge – and a lot of patience. Trying to work too quickly can lead to errors that, because of the nature of the material, cannot be corrected. So, before you start to install this type of flooring, it's essential to plan ahead, prepare the area to be covered, and get things organized. These are the most important "tricks" for a successful installation.

To plan ahead, first look at the room to be covered. Measure it. It's very hard to get sheet goods any wider than twelve feet. (The length is unlimited, but the bigger the piece, the harder it is to work with.) If *both* the length and width are longer than twelve feet, you are going to have a seam. Seams are usually a source of trouble later on and are more difficult to get right when you install the flooring, so you should avoid them if at all possible. If, however, you must have a seam, plan its location wisely. Try to put it in the least noticeable spot in the room, as far as possible from the main traffic patterns.

Once you have measured the room and planned for any seams, you can select the type and pattern of flooring material you want. The more expensive floorings are easier to install, since they are generally thicker and more pliable. (Because the most common difficulty in installing this kind of flooring is having the sheet tear when you are positioning it, a bit more money spent on quality goods may prevent this problem.) A more expensive material will also be more durable; it has a greater resistance to cuts, and the pattern will not generally rub off by the repeated sliding of a chair or by people walking on the same path through the room.

In addition to the quality of the flooring, consider the design. A pattern can make your room look larger or smaller, brighter or darker. A light, plain pattern will take more work to keep clean, while a medium-tone "busy" pattern will need less frequent cleaning.

In addition to the flooring material, you'll need to purchase adhesive. *Be sure to use the adhesive specified by the flooring manufacturer.* The wrong adhesive can discolor the flooring.

After purchasing your flooring material, make the necessary preparations for installation. The first part of your preparation is to set aside enough time. You won't be able to work in the room for 24 hours after installation, so plan accordingly. You'll also need to get the floor ready for the new covering. Remove any quarter-round or shoe molding (the small molding between the baseboard and the floor.) If you can remove it without breaking, you can re-use it. (Pulling the nails from the back side will make it less likely that the molding will splinter.) Then, install the proper floor underlayment. *(See separate handout on "Floor Underlayment" for how-to instructions.)* This job will probably take four or five hours, so allow yourself enough time. Trying to install sheet flooring at 9:00 at night after working all day preparing the floor is asking for trouble.

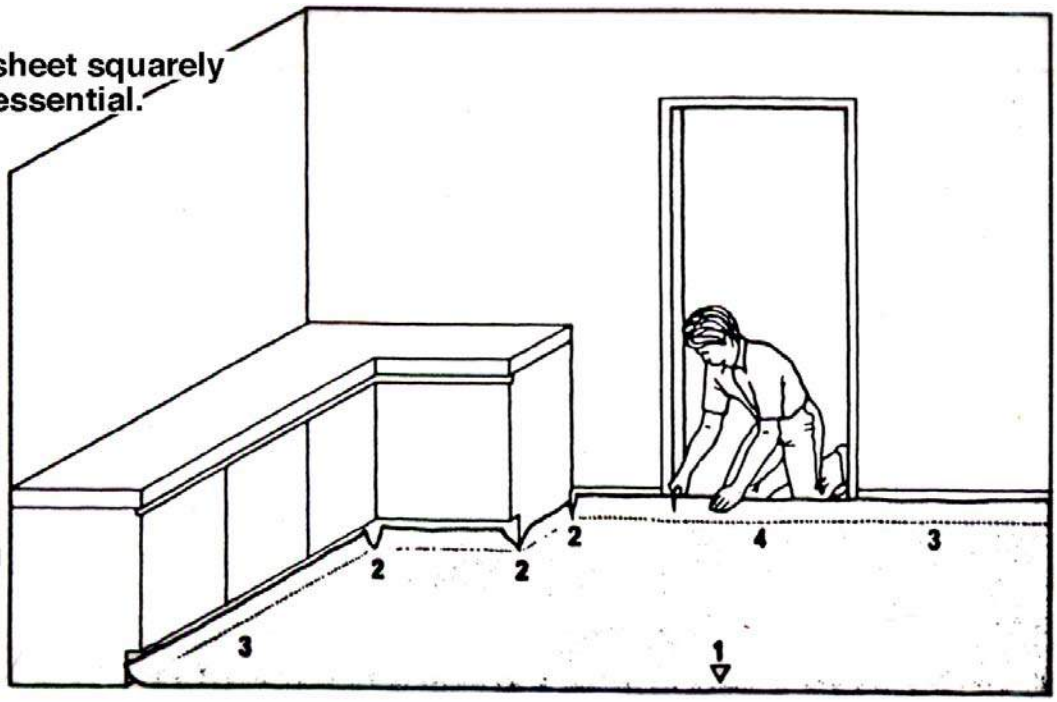
Unroll the flooring a day ahead, if possible, to let it relax. *Never* bring it in from outside and try to install it while it is cold – it will crack. Sheet vinyl flooring needs to be warm, relaxed, and pliable.

Now you're ready to install. Organize your tools, along with your materials, before you start. (You don't want to walk through the glue to get a knife blade.) You'll need a razor blade knife with several new blades; a framing square; a straight edge, like that used with wallpaper, for trimming; a trowel for spreading the glue, with the proper size notches (according to the directions on the glue can); and a linoleum roller (usually rented) to tightly bond the sheet goods to the floor and remove any bubbles.

*(continued)*

To start, bring the sheet of flooring material into the room, and carefully unroll and position it. (You can let the excess curl up the walls.) Position the pattern so that it is straight and runs at a 90° angle to the walls. The framing square can help you do this.

Once the goods are straight, make some rough preliminary cuts to allow the flooring to lie down better. Always leave several inches to trim later; never cut all the way down to the finished line. At any right angle cut, put some tape on top of the flooring to reinforce it and help prevent tearing. Handle the flooring very carefully so it doesn't tear.




Now, pull half the sheet back and fold it loosely over the other side, face to face. Then, apply the glue to the underlayment you've uncovered, according the directions on the can. Glue to a straight line at the fold. Next, carefully roll the flooring back, embedding it in the glue as you go. Carefully press it into place, taking care not to twist or move the sheet as you lay it down. Then, finish that side by rolling it with the roller and using the knife and straight edge to trim the edges. When the first side is rolled and trimmed, repeat this procedure on the other. After completing both sides, thoroughly roll the entire floor again, and clean off any excess glue.

If your floor has a seam, install the first piece as described; then, butt the next piece edge-to-edge like wallpaper, lining up the patterns perfectly. Install the second piece like the first.

An **alternative installation method** that some people find easier is to make a paper pattern of the floor (using brown Kraft paper, like that used for paper bags), position it on the sheet flooring, tape it in place, and cut around the pattern. You need to be *very* certain that the pattern is accurate and that it doesn't move when you are cutting around the edges. Once the flooring is cut to size, position it and glue it down as described above.

To install sheet goods on a set of steps, cut pieces of flooring slightly larger than the risers and treads, so the pattern will be lined up after trimming. (You'll also want to line up the pattern at the floor and landing.) Glue each piece in place, butting against the adjacent pieces at the outer and inner edge of each step and trimming to size. Then, protect the edge of the step by installing wood or metal stair nosing (molding) over the outer corner joint between each tread and the riser below it. In addition, install quarter round molding between each tread and riser above it to keep the vinyl tightly in place at the inner corners.

After finishing, stay off the floor for 24 hours. Then, move back in and enjoy your new floor.

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# Drywall & Plaster

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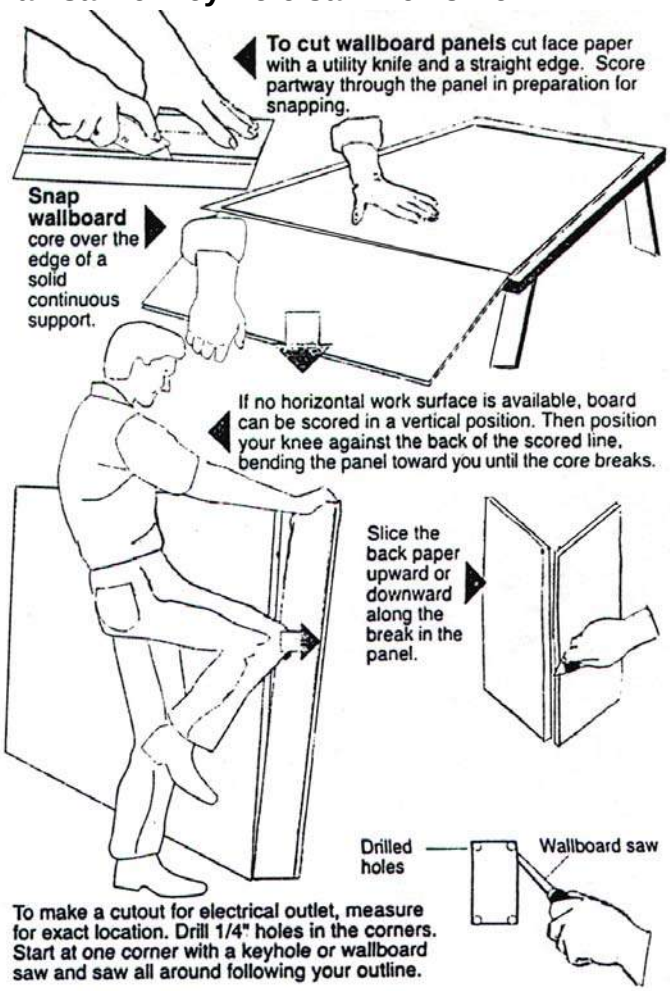
# DRYWALL INSTALLATION

Drywall is the ceiling and wall material used for about 90% of all new home interiors. It is also used frequently for repair or remodeling of plaster walls. Drywall is made from gypsum, and comes in sheets from 4' x 8' to 4' x 16', with a paper coating on both sides. It is a fairly simple, inexpensive material to use, and with a few pointers you can get some very good results with little or no experience.

The first thing to remember about using drywall is that accurate measuring is very important. To cut drywall to the size you need, use a **utility knife**, with a **straight edge** as a guide. Since drywall cuts easily, very little physical strength is required. The drywall doesn't need to be cut all the way through; you cut through the paper and into the drywall on one side, snap the drywall along your cut, and then cut through the paper on the other side with your knife *(see illustration).* Use a **surform plane** (rasp) to smooth a rough-cut edge. To make a small hole or cut-out in the center of a sheet (i.e., for a switch or outlet), a **drywall saw** or **key-hole saw** works well.

After cutting the drywall to the size and shape you need, it's time to attach it to the wall. You can use three different methods: nails, glue, or screws. Some people still utilize drywall nails, but most find that drywall screws are quicker, easier and less likely to back out or vibrate loose. Although glue can be used by itself, it's a slow method, so glue is more frequently used in combination with nails or screws to attach the drywall more securely.

Both screws and nails need to be sunk slightly below the surface, so they can be covered later with plaster to conceal them. With nails, you'll have a small dimple or crater around the head from the hammer strike; and with screws, you'll have a small hole where the head has been driven into the drywall. (Screws are best installed with a specially designed **drywall screw gun** or a **drill with a drywall bit** that sinks the head to the appropriate depth.) Space your nails or screws about 8" on center throughout the sheet of drywall, driving them into the wood studs or framing and keeping them about 1/2" away from the edges of the sheet. Finish by lightly run the edge of a putty knife across the surface to check that none of the nail or screw heads extend above the drywall; if you get the "chattering" noise of metal on metal, drive the head deeper into the drywall.

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After you fasten the sheets to the walls, you'll need to hide the seams and nail heads. The joints between sheets of drywall should be covered with a layer of tape and several coats of a plaster-like material known as "**joint compound**," often referred to in the trades as "mud." (When purchasing joint compound, you'll probably find the pre-mixed type easiest to use. Look for a type marked as "EZ Sand" and "Dust Control" on the label.)

You won't need to use tape to hide the nail or screw heads, but each one should be covered with several thin coats of joint compound. It will take three thin layers of regular joint compound to achieve the correct finish; if you use a "light" version, two coats may be sufficient. ***You can't cover the joints properly in one coat, nor can you rush the process.*** Each coat must dry completely (about 24 hours) before the next one is applied.

Apply **drywall tape** over each seam – either paper tape embedded in a layer of joint compound, or self-adhesive fiberglass mesh tape. To protect corners and give you a straight edge, you can use **corner bead**; there are several types, some flexible self-adhesive mesh and other more rigid versions that need to be imbedded in joint compound and/or nailed in place. An alternative for inside corners is to fold drywall tape along the center spine and imbed it in the corner the same way that you do over joints, placing half the tape on each wall of the corner and pressing it in place with a **corner taping blade**. Regardless of the type of corner protection used, cover the material with joint compound and spread it with the corner taping blade to make the edges blend in. If your corner bead is nailed or screwed in place, you don't need to tape over the heads, but cover each one with the three coats of joint compound.

After taping, apply the first layer of joint compound over all the joints and over each nail or screw head, using a 10-inch or wider putty knife (better known as a "**taping blade**") to apply a thin coat of compound – just enough to cover the tape. After this coat is dry, apply another thin coat, a bit wider than the first. When this second coat is dry, sand it to remove any irregularities, using a damp **drywall sponge** or drywall screen on a **hand-held drywall sander**. You can also use an **electric drywall sander** made especially for this purpose; a shroud attached to a power vacuum will reduce the amount of dust you'll need to clean up later. *(Don't use a regular electric sander for this job, because plaster dust will ruin its motor in short order!)* You'll save a lot of work if you take care to make the joints as smooth as possible while the compound is wet. Don't count on heavy sanding later – that's the hard way.

After sanding the second coat, apply the third coat as before, a bit wider yet. You may need to sand lightly after this final coat, also. Then, wipe all dust off the walls with a damp rag. Cover the wall with one coat of **PVA primer**, followed by a coat of a **high-pigment water-base primer** (like Kilz™) before painting or installing wallpaper.

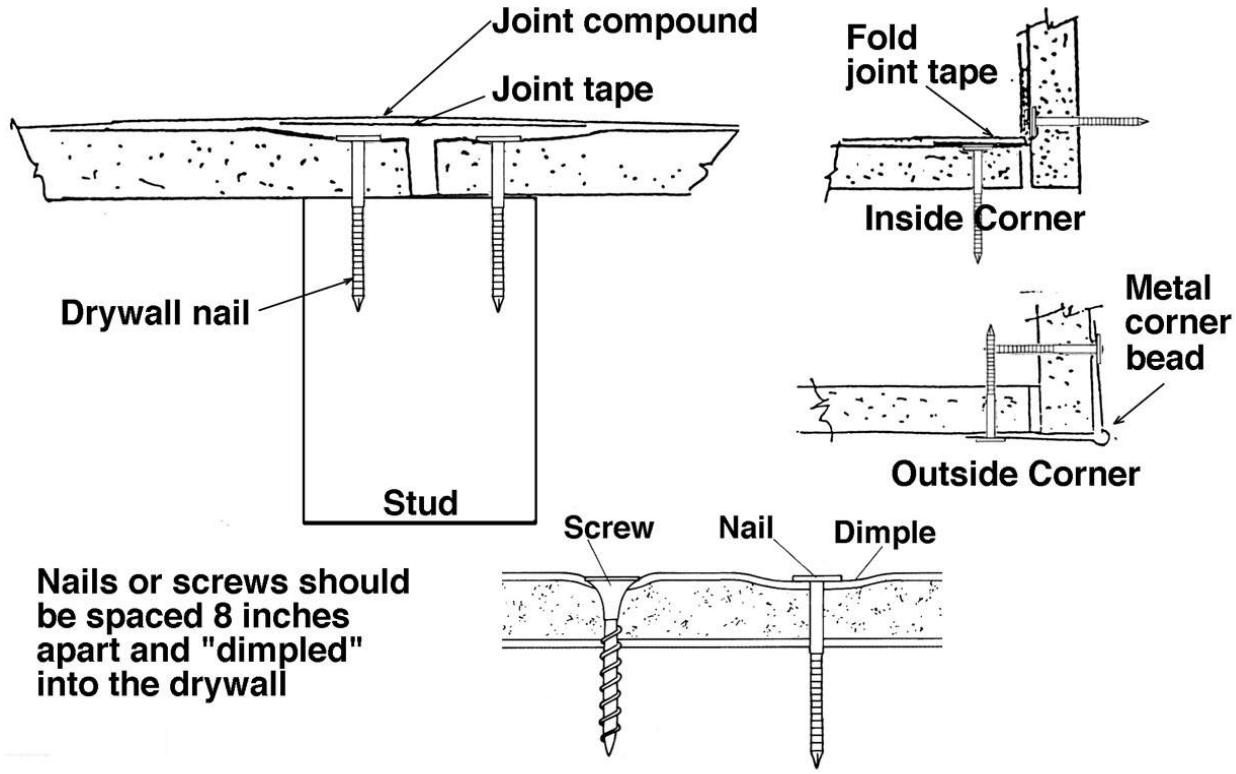
Drywalling a ceiling can be challenging. There are several ways to make the jog easier. First, plan to have at least one helper; it's quite difficult to for one person to nail or screw a drywall sheet above their head. (Some drywall installers put a sponge inside a stocking cap, so they can hold the sheet in place with their head and have both hands free.) You may also consider using ¼" drywall for the ceiling; the materials is considerably lighter, and you don't need as much strength and rigidity as you do for a wall.

You will note that this process is likely to generate a lot of dust, which tends to spread quickly to other parts of the house. In addition to the techniques described above, you can attach plastic at the doorways of the room, to keep the dust contained. You can buy the sheeting pre-cut as a kit, or purchase rolls of plastic and cut it yourself. (You don't need to buy the heavy-weight plastic; the lighter-weight rolls are less expensive and are sufficient for the job.)

There's another way to set up the space that will make the job go easier. Set up two fans – one in the doorway blowing in, and the other in a window blowing out. This will increase air circulation and help the joint compound dry more quickly. Just make sure that you don't have any air blowing directly on the wall – you don't want the "mud" to dry too fast and crack.

*(continued)*

Finally, remember – patience is the key to making the job turn out nicely. You can't rush the taping process, and you need to let each layer of joint compound dry fully before applying the next. If you take your time, you'll develop your skills as you go and have a finished project that you will be proud of.



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# WHAT TYPE OF DRYWALL
## Will Best Fit Your Situation?

Whether you're using it in new construction or to repair existing plaster and lath, drywall is the wall material most commonly used by today's homeowner. Drywall is made from gypsum, with a paper coating on both sides. Since there are various sizes, thicknesses, and types available, you'll need to think about how the material will be used in order to select the option that will work best for your project.

For a new wall, the most important consideration is how much water the drywall will be exposed to. In a dry area – such as a new bedroom closet or a finished attic – you can use the standard 1/2" drywall that is usually the least expensive. However, in moist areas, such as a bathroom, "regular" drywall is not your best choice. In the shower area, where direct contact with water can occur if your grout develops hairline cracks or your caulk doesn't make a complete seal, use **cement-impregnated drywall** – like Durock or Wonderboard – as the substrate for your ceramic tile or tub surround. This cement backerboard is not damaged by moisture; but, if your tub is on an outside wall, the material does allow moisture to pass through it and condense on the sheathing under the exterior siding, so you'll want to attach a layer of plastic sheeting over the insulation between the studs and the backerboard to prevent peeling paint or damaged siding.

In other parts of your bathroom, or in other areas prone to humidity, you'll want to use a **water-resistant drywal**l (usually called "greenboard" because of its color). One side of this drywall has a treated paper surface that resists moisture. Cover this surface with a mildew-resistant primer and paint, and you'll decrease the likelihood of mold growth and mildew odor.

It's usually not a good idea to install drywall on the exterior walls of a basement, because it will prevent you from seeing signs of water intrusion – usually caused by clogged sewer lines, sagging gutters, or other problems that are easily remedied – that can cause expensive damage if the problem goes undetected. If you nevertheless want to finish your basement, you can use regular drywall; however, on exterior walls you should first apply a layer of plastic sheeting as a moisture barrier, and then install pieces of 1"-thick Styrofoam board behind the studs and drywall as an insulating material. This combination will decrease condensation on the cold walls on warm and humid summer days *(see handout on "Basement Remodeling").*

Finally, even if you're using "regular" drywall, you may need to seek a size or thickness other than the standard 4' by 8', 1/2"-thick sheets. For example, you may find drywalling a large area is easier, with less taping required, if you use 4' x 16' drywall – *provided that* you can handle the extra weight during installation and have the means to transport the larger sheets. If you're using drywall to repair part of your plaster and lath wall, you may need to use 1/4" or 3/8" drywall to have the surface of the patch at the level of the surrounding plaster. Some of these "alternate" forms of drywall are more expensive than the standard, but are usually worth the extra cost in situations like these. If the alternate size you need cannot be found at your neighborhood hardware, seek out a larger building supply store.

Even if you are doing a simple repair, taking the time to select the most appropriate type of drywall for your project can save you a lot of time now – and headaches later.

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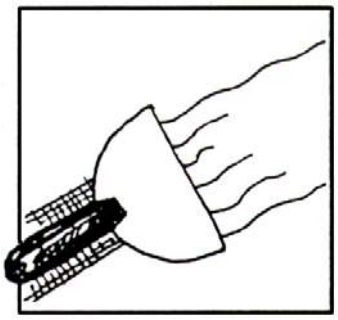
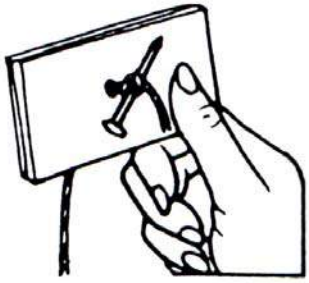
# PLASTER AND DRYWALL REPAIR

In most homes built before 1945, the interior walls were finished with plaster and lath. After WWII, drywall replaced plaster and lath, allowing for quicker and more uniform construction. Although the two products are different, repairs to plaster and drywall can be made in much the same manner.

One important caution – you should *never* use an electric sander to sand drywall or plaster unless it is made specifically for this purpose, as the fine plaster dust will be sucked into the motor and ruin the ball bearings. To limit the spread of dust during large-scale sanding of plaster and drywall, you can use a **power drywall sander** specially made for this purpose, with a sanding head surrounded by a shroud and attached to a vacuum. For smaller sanding jobs, use a **hand-held pole sander**, with clamps on the head that hold a piece of drywall screen. The head is attached to the pole in such a way that sanding can be done from any angle without gouging the plaster or drywall. Drywall screen, readily available at most hardware stores, will work longer than traditional sandpaper, because you can knock the plaster dust from it to prevent the surface from becoming clogged.

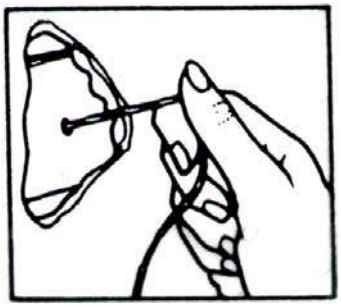


Materials and techniques to repair plaster and drywall depend on the size of the problem. For small hairline cracks, use **interior vinyl spackling**. This product has some elasticity and is thus more likely to remain intact than plain patching plaster. Using a flexible putty knife, push the material into the crack as firmly and thoroughly as you can, smoothing it as you go.



Another way to repair hairline cracks is to enlarge the crack into a "V" shape with a stiff blade, so it narrows from top to bottom. Then, fill the crack with joint compound and smooth it out. Add another layer of the joint compound after the first has dried for 24 hours. Use a wider putty knife and spread the second layer a bit further, feathering the edge to the level of the surrounding wall. If a third layer is needed, apply it in the same way. Lightly sand between layers and after the last layer is applied.

As the cracks get larger than the hairline variety, you might want to give the patching material more support. Apply **drywall tape** over the crack – either paper tape embedded in a layer of **drywall joint compound** (a form of spreadable plaster), or self-adhesive fiberglass mesh, and cover it with a layer of joint compound. Then, apply two or three additional layers of the joint compound as described above – 24 hours apart and with each layer spread further out than the last, sanding lightly between layers and at the end.



Holes can be treated in several different ways, depending on their nature. The easiest way to fill small holes is to purchase a "drywall patch kit" that contains a piece of self adhesive metal mesh (usually 6" square, but 12" square patches are available). Clean the edges of the hole back to firm material and then press on the mesh patch to cover the

*(continued)*

hole. Apply drywall tape around the edges, and then apply three layers of joint compound (24-hours apart), tapering wider around the hole with each layer.

You can also fill in small holes with one or more coats of joint compound. (Allow each coat to dry before adding the next.) Especially with larger holes, you'll be better off installing some wall material in the hole before you add the joint compound. First, shape the hole into a square or rectangle for easier repair. Then, cut a piece of drywall to fit as a patch. (You may need to use 1/4” or 3/8” drywall to have the surface of the patch at the level of the surrounding plaster.) Install the patch with screws, nails, or construction adhesive; then, cover the seams with drywall tape and joint compound.

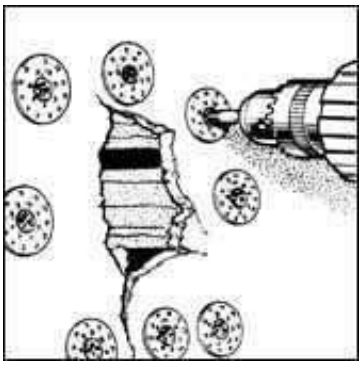
For a hole with no lath or other support to which you can attach a patch, you'll need to make your own backing piece before patching. One way is to cut a few shims a bit longer than your hole, insert them behind the surrounding drywall, and screw the top and bottom edges in place. (You can drive a screw part-way into the wood to use as a “handle,” and then remove it once the shim is secured in place.) Another way to add support is to cut a piece of drywall or scrap wood slightly narrower than your squared-off opening, and a few inches longer. Drill a hole in the center of this piece, and tie a piece of string through it *(see illustration on previous page).* On the ends that you cut to be longer than your hole, apply some construction adhesive along the front edges of the piece. Insert the backing piece through the opening, and use the string to pull it tight against the wall around it; the construction adhesive will glue the support piece to the back side of your hole. Tie the string to something that will hold the backing piece in place until it dries.

Once you have your backing in place, you can fill the cavity with joint compound (apply several thin layers, 24 hours apart) or with a drywall patch cut to fit in the hole and glued to the backing piece you previously installed. Use drywall tape and joint compound around the edges of the patch.

When patching a larger area with drywall, it's usually best to cut the damaged material back on each side to the center of the next wall stud, and square up the hole. Then, nail your patch to the studs, finishing with drywall tape and joint compound as described earlier.

Whatever size the hole, if you repair plaster and lath with drywall, you'll generally find the drywall patch is not as thick as the plaster around it. Use a thin layer of joint compound to build up the patched area to the level of the surrounding plaster.

If you don’t want to use drywall for your repair, there are several products that can help you repair the plaster itself. If you have a smaller area of plaster that moves rather easily when you push on it, you can try stabilizing the plaster with **plaster washers** *(illustration right).* These devices are used with drywall screws to secure loose plaster to the lath behind it. (Plaster washers can also be used to stabilize any loose plaster around a hole, before you fill it in.) Cover with several thin layers of joint compound.



For a larger area of loose plaster, or an area that is extensively cracked, one option is to remove the plaster completely down to the lath, and replace it with new materials. Use a layer of **greycoat** (rough plaster) or **Structo-lite™,** let it dry overnight, and then dampen it with a sponge or spray bottle before applying a layer of **patching plaster**.

*(continued)*

Another approach is to cover the entire wall with 1/4” drywall. Sometimes, this option can be easier than trying to patch the plaster, and will give you a smooth, stable surface. Before you start, remove any crown molding at the top of the wall. You should also take off the baseboards; if your baseboards are made of several pieces of wood, you can just remove the top molding strip. Don’t worry that you won’t be able to see the studs to which you’ll be screwing the drywall; when you’re removing the baseboard molding pieces, take a grease pencil and mark the location on the floor below of the nails fastening the baseboards to the studs. Install and finish the drywall as you normally would *(see separate handout on drywall installation).* If desired, you can also spread construction adhesive over the existing plaster before hanging the drywall, to help hold it in place.

Light sanding of all these repairs will blend them in. To avoid a “too smooth” patch and approximate the eggshell stipple of the original surface, use a **high-pigment water-base primer** (like Kilz™), applied with a semi-smooth (1/2” nap) paint roller. If you are painting over new drywall, cover the wall with one coat of **PVA primer**, then a coat of the high-pigment water-base primer, before the finish coat is applied.

Then, when you've painted, you'll wonder where the damage went!

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# Walls & Ceilings

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# INTERIOR PAINTING

**Types of paint:**

**Oil-based (alkyd) paint** forms a surface coating that doesn't allow water or moisture to pass through. Its advantage is that it is durable and can withstand repeated scrubbings. On the other hand, it is slower to apply, tends to make imperfections more visible, and is harder to clean up. It is also more expensive. Oil-based paint is being phased out by manufacturers because of health concerns caused by the volatile organic compounds in this type of paint. You will need to clean up oil-based paint with paint thinner.

**Latex-based paint** attaches to the surface in a way that allows the surface to breathe, and moisture and water to pass through. It is easy to apply and clean up, and dries faster with less odor; however, it is not as durable as oil-based paint. Latex paint comes in several different degrees of shine – flat, eggshell, semi-gloss, and gloss. The duller the paint, the better it will hide surface imperfections, but the less it will stand up to regular cleaning. Latex can be purchased in an enamel-type mixture, which combines the ease of use of Latex paint with the durability of oil-based paint. All Latex paints can be cleaned up with warm soapy water.

**Where each type of paint should be used:**

Oil-based paint is generally used only for woodwork or trim, although it is occasionally used for walls and ceilings in baths, kitchens, or other high-moisture areas. Latex paint is used for ceilings and walls anywhere. Semi-gloss latex enamel is frequently used as an alternative to oil-based paint for woodwork and trim.

You can apply latex on top of oil, with some preparation, but don't try to apply oil over latex.

**Preparation:**

| | | | |
|---|---|---|---|
| Tools needed: | 2" or 3" stiff putty knife | Vinyl spackling | Sandpaper |
| | Hammer | Painter's tape | Sanding block |
| | Screwdriver | Tarps | |

First, a word of caution. If there is any chipping or peeling paint, or if you are thinking about stripping the old paint off the surface before repainting, inform yourself about the **dangers of lead-based paint** before you proceed. If your house was built before 1978, there is a good chance that lead-based paint was used on the exterior *or interior* of your house. **Using the wrong preparation methods can pose a serious health hazard to your family.** *(See separate handouts on "Controlling Lead-Based Paint during Your Paint Repair Project.")*

Taking these precautions into account, the most important thing you can do to ensure a good finished paint job it to prepare the surfaces properly. Start by removing all switch plates and outlet covers. Then, pull out any nails from the walls. Fill all cracks and nail holes with vinyl spackling and, when dry, sand them smooth.

Take time to protect all the surfaces (like floors and countertops) that you don't want to get paint on. A canvas drop cloth is best (paint can't seep through); mover's blankets are a less expensive alternative. You can use old sheets to protect furniture, but they're not heavy

*(continued)*

enough to stay put on the floor. Don't use plastic drop cloths on the floor – they will only cause problems – but painter's plastic is good for covering windows, furniture, etc.

As part of your preparation, unscrew and lower – or tape around the edge of – all light fixtures. (Garbage bags work well for covering hanging fixtures.) Give the walls one final check for any bumps or valleys; scrape or sand them off or fill them in, as needed. *(Note: Don't use an electric sander on uneven plaster, unless it is specially designed to sand drywall. Plaster dust can ruin the motors of other sanders.)*

Washing the walls and woodwork with TSP, some mild dish soap, or a household cleaner at this point will help the new paint adhere better. If you are painting over latex gloss or semi gloss paint, or oil-based paint of any sort, wash the surface with Krud Kutter's Gloss-Off™ instead of TSP (apply it with a wash rag with light pressure); the Gloss-Off™ will etch the glossy surface so the new paint can adhere better.

**Painting procedures:**

| | | | |
|---|---|---|---|
| Tools needed: | 1-1/2" or 2" angled sash brush | ladder | 9" roller frame and cover |
| | single-edge razor blades & holder | roller pan | extension pole |

After you have finished preparing the surfaces, follow these steps:

1. ***Prime everything, every time.*** No matter how thoroughly you wash your walls, there will always be some residue. Priming is the *only* way to ensure that the new paint will adhere properly.

   In most cases, you can use a regular all-purpose primer (such as Gripper™), but check with the sales staff where you purchase your paint about any situations where a specialty product might be helpful. There's a drywall primer/sealer that prepares newly-installed drywall properly, a primer for walls where you have removed wallpaper, a primer that prevents water stains from bleeding through your new paint, etc. Sometimes using a more expensive primer can prevent real problems later on.

   If fumes bother you, a relatively inexpensive mask will help with the odor while you're working. For paints or cleaning products with very strong fumes, you can purchase a more expensive respirator with disposable charcoal cartridges. Expect the new paint smell to be noticeable for a day or two after the paint dries.

   Follow directions on the can for how long your primer must dry before you apply the paint.

2. **Caulk** all cracks between walls and painted woodwork. Use a paintable white latex caulk; this product is easy to apply, and you can smooth it out and remove any excess with a wet rag (or your finger). Run a bead of caulk just wide enough to seal the crack between the molding and the wall. If your woodwork is unpainted, caulk only if there's a noticeable gap; in that case, protect the wood with painter's tape and run a very narrow bead of colored caulk, close to the color of the wood.

3. **Paint the ceiling.** One coat of paint will usually cover sufficiently. Mix your paint really well, as the pigment can separate out. (If your store-mixed paint has been sitting for more than three days, mix it again.)

   Paint around the edges first (this is called "cutting in"), using the sash brush. It doesn't pay to buy a cheap brush; it won't cover with one coat and will leave streaks. You'll pay more for a quality brush, but it will last a long time if properly cleaned.

   Dip only the first third of the brush in the paint. Then, gently wipe the excess off on the side of the can. Cover the entire joint where the ceiling and the wall meet. It doesn't matter if you get a little paint on the wall, as you will be covering it later.

*(continued)*

After you have cut in, then you're ready to roll the rest of the ceiling. Since latex paint dries in about an hour, you'll need to work steadily – or you'll have a visible ridge where the "wet edge" of the paint you applied first dries before you roll the rest of the wall.

Roller covers can be purchased with several different naps (material thickness) on the surface of the roller cover. The shortest nap is for very smooth walls; the longest naps are for brick or stucco surfaces. Choose the shortest one that will do the job. A 3/8" "smooth" or "semi-smooth" cover will generally work for walls and ceilings.

Pour some paint into the roller pan, roll the roller through it, and then roll the excess off at the top of the pan. Start applying the paint to the ceiling, using an even, gentle pressure and a random pattern (a "V" or "W" pattern that overlaps itself often works well.) Using an extension pole with the roller will not only save your back, it will help ensure you're using the right amount of pressure. Even pressure will prevent roller tracks, which will be visible after the paint dries. Let the roller do the work. If you roll slowly, you will be less likely to splatter paint from the roller.

4. **Paint the woodwork.** Once the ceiling is finished, you can use the sash brush to paint the door and window trim and the baseboards. You can also use the brush to paint any doors. Hold the brush like you hold a pen. The angle of the brush will aid you in getting into corners and other tight spots. You can use painter's tape to mask around window panes, but don't worry if you slop a little paint on the glass; it's not difficult to scrape the glass with a razor blade after the paint has dried.

   Again, one coat will generally be sufficient, although darker colors may take more coats. You'll also use more paint to cover a dark color with a lighter one.

5. **Tape the woodwork.** Don't use masking tape; other products will give you a neater result. Blue painter's tape is designed to prevent pulling paint off of woodwork, but "Green" Frog™ tape is even better; it has a chemical in the adhesive that causes any latex paint that gets beneath it to gel (so you always end up with a clean edge). For delicate surfaces, such as woodwork that's been newly painted, you might consider "Yellow" Frog™ tape. It's a bit more expensive, but won't ruin paint that hasn't yet cured.

   Position your tape as close to the wall as possible, while staying on the wood. Run a "5-in-1" tool along the surface of the tape to smooth it out and press it securely in place.

6. **Paint the walls.** After finishing the ceiling, start on the walls. Plan on at least two coats, regardless of what it says on the can. (With less expensive paints, you'll need additional coats.) If you are using a different color of latex paint on the walls than you used on the ceiling, you can wash out the roller sleeve and then re-use it for the walls. You can also wash out the roller pans, or you can use inexpensive roller pan liners, which you change with each new paint color.

   Before you paint, tape along the joint at the top of the wall to prevent slopping paint on the ceiling. Start by cutting in all the corners and where the walls meet the ceiling, around all window and door trim, and at the baseboards. Then, roll the paint on the wall like you did on the ceiling. (If you are using flat paint, you can cut in around the whole room before painting the main body of the walls; however, with gloss or semi-gloss paint, do one wall at a time to make sure the edges of the paint are wet where they meet.) Start at the top and work your way down. Let each coat dry for the time specified on the can before applying your next coat.

   Remove any tape you put on as soon as you finish painting – don't wait until the paint dries.

If you follow this "order of painting," you can expect pretty good results, even the first time. And, each time you paint after that, you'll get better and better.

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# WALLPAPER INSTALLATION

Wallpaper is a home decorating option which can be installed by people of all skill levels. The success of your wallpapering job, though, will depend on understanding the process, taking your time, and exercising patience.

First, measure the room you'll be wallpapering. Multiply the height of each wall by its width, and then add together the figures for all the walls to find the total square footage of the room. For example, for a 9 ft. x 12 ft. room with 8 ft. high ceilings:

| | | | |
|---|---|---|---|
| Wall 1: | 8' x 9' | = | 72 sq. ft. |
| Wall 2: | 8' x 12' | = | 96 sq. ft. |
| Wall 3: | 8' x 9' | = | 72 sq. ft. |
| Wall 4: | 8' x 12' | = | 96 sq. ft. |
| | TOTAL | = | 336 sq. ft. |

Some wallpaper guides recommend that you subtract from this total any space you won't be papering, such as doors or windows. However, unless most of a wall is made up of windows, where very little paper will be used, it's probably wiser not to subtract those areas, but instead to have a little extra for mistakes or problems.

With your square footage figured, you can shop for wallpaper. The number of rolls you'll need will depend on the type and style of paper you choose. The salesperson can help you determine how much to order.

## Selecting Wallpaper

Just as there are numerous flavors of ice cream, there are many types of wallpaper. How do you select the right type for your home and for the skill level of the person installing it?

Let's start with skill level. If you're just learning and don't yet have much experience hanging wallpaper, you'll want to select a type of paper that's easier to install. Lightweight vinyl papers (Sanitas™ is one brand) are about the easiest type to start with. Avoid flocked paper, foils, or mylars until you have some experience. Paper wallpaper, grasscloth, or heavier-weight vinyls are also a little tricky to handle when you are first learning.

Another choice is between paper you have to paste or pre-pasted paper. Both go on the wall about the same way, but pasting usually is messier and requires a couple of additional steps. So, you may want to choose a pre-pasted paper, especially when first getting started.

Finally, select the pattern of your paper carefully. Basing the pattern you choose on the condition of the wall it is to cover will make installation – and the results of that installation – much more satisfying. Just about any kind of paper will work on walls that are perfectly smooth and straight, but few houses – especially older homes – have smooth or straight walls. On rough and irregular walls, medium size random patterns will tend to conceal wall imperfections. Also, papers that are physically thicker will conceal more effectively.

If you keep these guidelines in mind when selecting your wallpaper, you will make your work that much easier and your finished project more attractive.

*(continued)*

## Preparing the Walls

Once you have your paper, you're ready to get started. Preparation of the walls is very important for good wallpaper installation. Remove all switch plates, outlet covers, and nails. Then, patch and sand all cracks or holes. Next, paint the walls with **sizing** (a clear product that will allow for better adhesion of the wallpaper now and easier removal later.) The sizing will dry in about half an hour. Finally, if you are going to repaint ceilings and/or woodwork, do so before you put up the wallpaper.

## Tools You'll Need

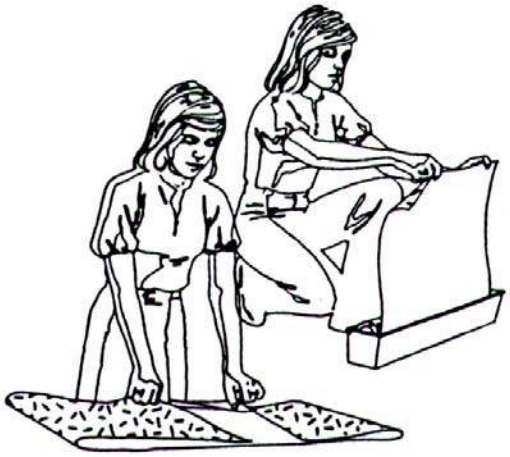
Before starting to hang your paper, get together the tools you'll need: a **tarp** to protect the floor; a **razor blade knife** and a large supply of new, **single-edge razor blades** (a 9' x 12' room can easily take 20 or more razor blades); a **smoothing brush**; a **straight edge**; a 2' or 4' **level**; a **seam roller**; and a **sponge**. In addition, if you are using pre-pasted paper, you'll need a **water tray**. If, on the other hand, you'll be pasting the paper yourself, you'll need a **paste brush** or a **short-napped roller and roller pan**. You'll also need a **stepladder**, and a **table** to work on will be helpful.

## Installing the Wallpaper

Paper hanging starts in the least noticeable corner of the room. Your last piece of paper will meet your first one here, and you can't always control the match. The corner behind the entry door to the room is often a good starting place.

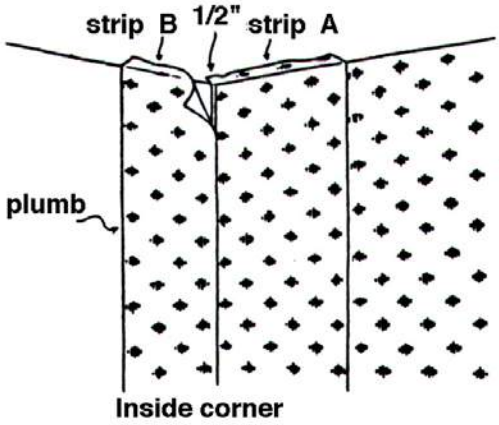
Cut your first piece about six inches longer than the height of the wall. Allow enough paper that you can place a full row or pattern element just below the ceiling line, so the pattern is not cut in half.

Then, if the paper is pre-pasted, follow the directions that come with it. The directions will tell you whether to use cold or warm water in the water tray and how long the paper needs to soak in the tray. They will also tell you the length of time the paper should be "**booked.**" (To book the paper, remove it from the water tray and gently fold it, paste side to paste side, without creasing it. This allows the paper to expand and adjust to the reconstituted glue and achieve its final dimensions.) Booking time can range from 30 seconds to 5 minutes, depending on the paper and glue.



If you are applying paste, brush or roll it on to a thin, even consistency. *(Different types or weights of paper require different glues. Be sure to get the right type when you buy your paper.)* Directions on the paste may advise booking the paper; if so, follow those instructions.

Now you are ready to hang your first piece. Put it up in the corner, allowing about a 3" overlap on the ceiling and 3" over the baseboard. About 1/2" of the paper should extend around the corner onto the adjoining wall, so that when you're completing the room, your last piece will go on top of this small overlap of the starting strip. If the corner is not plumb or square, any defects will be covered by the paper. (Paper all your inside corners this way.)




Check with your level to make sure the edge of this strip is perfectly plumb. It's very important to get this first piece hanging plumb, because it will affect all the rest.

*(continued)*

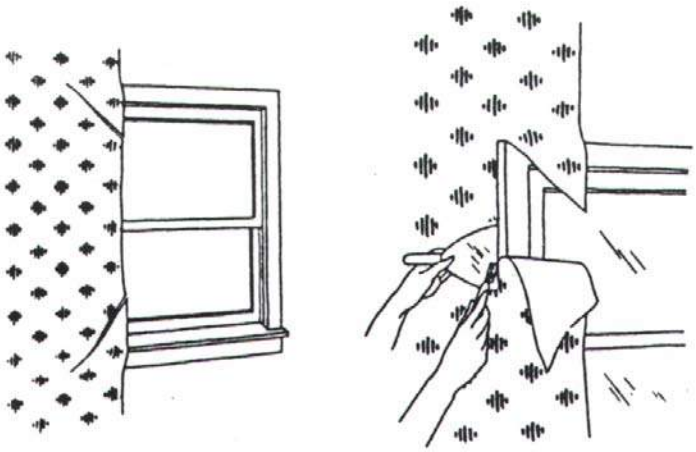
With your smoothing brush, gently work out any wrinkles in the paper, being careful not to crease it. You can usually lift off the top or bottom half of the strip several times, if necessary, to get out wrinkles – the paste will still work. After the paper is straight and the wrinkles are out, use the brush to remove any remaining air bubbles and ensure a good bond between the paper and the wall. Work from side to side in sweeping arcs across the entire sheet.

Your next piece will butt up against your first piece. If you've chosen a pattern with a match, the two adjacent strips must line up correctly to form the pattern printed on the paper. Be sure to cut each piece long enough to allow the paper to match and still have several inches to extend over at the ceiling and the baseboard. With some matches you may have a foot or more scrap at either end. Don't worry – this is normal.

When you put this second piece on the wall, you can gently slide it some – but don't stretch it too much. Paper is somewhat elastic when wet, but, as it dries, it will shrink up and show a gap between pieces if it has been stretched to “fit.” You’ll also need to watch for stretching of the paper from its own weight as it hangs wet, as such stretching can cause the pattern to be misaligned. If you have this kind of mismatch, start your piece a bit high at the ceiling; the match will be aligned where it is most noticeable, at eye level, though it may be off again at the floor.

After the second strip is up for a few minutes, use a seam roller to roll over the seams. Then, trim the excess paper at top and bottom, using a wallpaper straight edge held against the ceiling or baseboard. Cut between this guide and the wall with a single-edge razor blade, held either by itself or in a holder. Since you only cut with the corner of the blade, it will dull quickly. If you don't change blades frequently, the dull edge will tear and rip the paper, instead of cutting. Using a dull blade is one of the most common mistakes made by beginners.

To install wallpaper around a door or window, apply a full piece as described previously, lightly pressing the strip over the opening to be trimmed. Then, make a diagonal cut from the corner into the center of the opening. Being careful not to tear the paper, gently fit it around the frame until it sits flat against the wall. After smoothing any wrinkles out, trim the paper around the molding, using a straight edge as described earlier.



When you are done trimming each piece, wash down the strip with a dripping wet sponge to remove any paste that has smeared on the paper. You'll also want to wash adjacent wall, ceiling, and woodwork areas. Use warm water, and change it often. The paste can be difficult to see, but – if you don't remove it thoroughly – it will show up when it dries, and the residue is very difficult to remove it then. For this reason, it's a good idea to go over the entire room with clean water when you're finished installing all the paper.

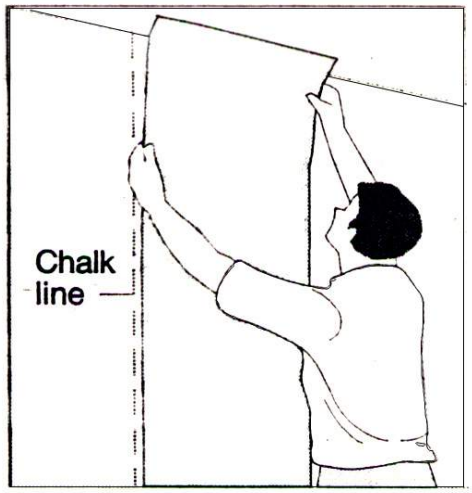
The paper will shrink slightly as it dries, so small wrinkles will stretch out. Wallpaper usually dries overnight. For particularly stubborn areas that won't stay pasted down, try **seam adhesive** (a “super glue” for wallpaper. It usually comes in a tube.)

As you gain experience and more confidence, you can move on to tougher rooms, more temperamental papers, and more unusual areas, like ceilings and arches. But, start simple and easy, and you'll soon get the “hang” of it.

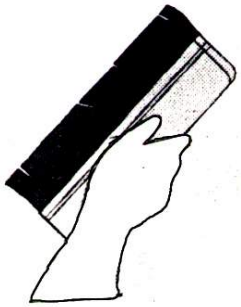
*(continued)*

# Hanging wallpaper

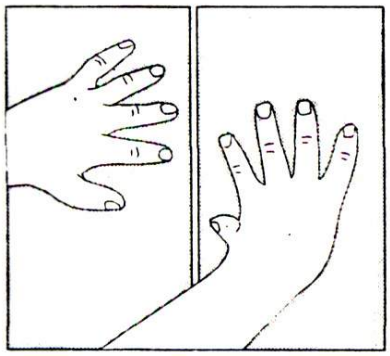

**Snap a chalkline** at the starting point. The first strip must be perfectly plumb.




**Align the first strip** by the plumb line. Leave 2 inches of excess paper at the top and bottom.

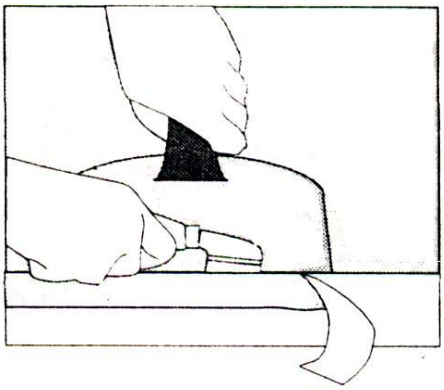


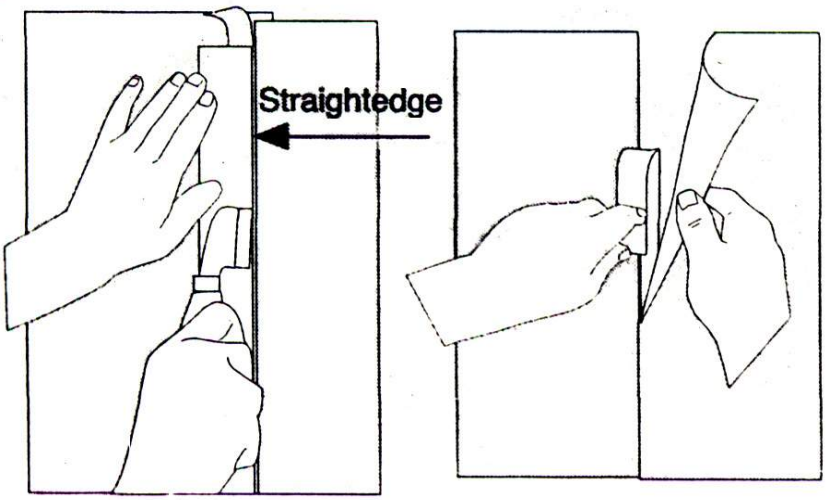
Use a smoothing brush to get rid of air bubbles and to ensure a good bond.



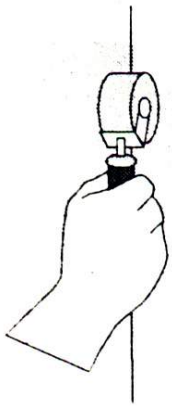
**Join strips** so that the pattern lines up. Butt together tightly.

**Trim to fit.** Use a broad taping knife as a guide. Cut away excess paper with a sharp razor knife.






**Double-cut seam** starts with an overlap. Use a straightedge as a guide to slice through both layers of paper. Remove the cut top strip, then open the seam to remove the strip below. Press the edges together.



Roll seams gently with a seam roller.

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# WALL FASTENERS

Lath-and-plaster walls are common in older houses (those constructed from the late 18th Century until the early 1950's, when drywall became the common building technique.) Whether it's an oil portrait of an early ancestor or wall-hung kitchen cabinets, securing things onto older lath-and-plaster walls can present a bit of a dilemma.

First, let's talk about how lath-and-plaster walls were constructed. Once the house was framed (generally with studs spaced 16" on-center), the exterior sheathing and siding completed, and the doors, windows and mechanicals (plumbing, heating, electrical) installed, the plasterers would start covering the walls with wood strips called "**lath**." The pieces of lath were generally 3/8" thick, about 1-1/2" wide and 48" long, with a gap of 3/8" between them. A thick layer of gypsum-based coarse plaster (gray or brown colored) was troweled onto the lath until it oozed through, forming "**keys**" that held the plaster to the lath. A thin layer of white finish plaster was applied after the coarse layer had cured.

*Plaster and lath wall*

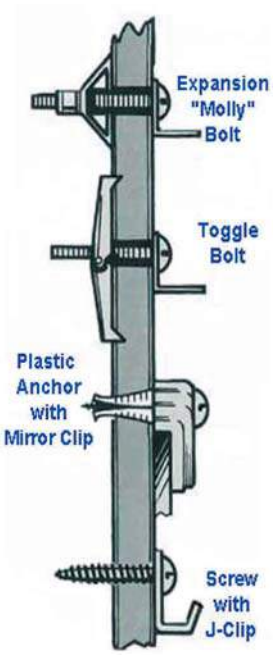
To attach lightweight items to this type of wall, it's usually enough to drive a nail or screw into the plaster surface and catch a piece of the lath beneath it. If the nail goes through easily, it didn't get into the lath; pull the nail out and and try again, 1/2" higher or lower. But, if you are hanging anything on a plaster wall that weighs more than a couple of pounds, the hard and fast rule is to find a **stud**, and screw or nail your item to that. Switch and outlet workboxes should also be attached directly to studs, so they won't become loose and move about as you use them.

So, how do you find the studs? Some old-timers used powerful magnets to locate the lath nails. There are modern versions that use the same principle. Tool manufacturers have come up with a swiveling magnetic stud finder in a clear plastic vial. Another option, in this semiconductor era, is an electronic stud finder, which measures the density of the wall to locate the stud. These tools have been on the market for quite a long time, and can work fairly well, although they sometimes are less successful locating studs in traditional lath-and-plaster walls. So, in older houses, you may find that a magnetic model can work better to find the nails in the studs.

You'll have more options for hanging items from drywall. There are many types of hardware available; the most common designs utilize screws that are driven into plastic anchors or

*(continued)*

"wings" that spread out on the back side of the drywall *(see illustration below).* Most of these devices will handle lightweight items, but you will still want to anchor heavier things directly to the stud. Luckily, stud finders usually work well on drywall, probably because there is a row of nails or screws along each stud securing the drywall in place.




*Types of drywall anchors*

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# Miscellaneous Interior Repairs

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# BASEMENT REMODELING

In most older homes, the basement was never designed to provide living space. Today's homeowner, however, may want to use this area for family recreation, entertainment, or additional office space. The challenge is to "finish" the basement with materials that will not be destroyed when – not if – water comes in through the walls or backs up from a sewer.

"Defensive remodeling" begins with choosing materials that can withstand exposure to water, or which are inexpensive enough that you can replace them when necessary. **"Waterproof paint" is not a good choice**; when water is blocked from moving through the wall, it can either wick up into the wood above the foundation, or build up enough pressure behind it that bits of masonry will "explode" off the wall surface. If you want to coat your walls, use a stain-killing, mildew-resistant primer and paint (an exterior latex works well) to reduce the likelihood of mold growth and mildew odor, with the expectation that you'll have to repaint periodically.

It's really **best to have no drywall along the exterior walls of a basement**, because drywall will prevent you from seeing signs of water intrusion (usually caused by clogged sewer lines, sagging gutters, or other problems that are easily remedied) that can cause expensive damage if the problem goes undetected. However, if you really want to finish your basement with drywall, there are some techniques you can use to protect the drywall from water *(see illustration on reverse side)*. You won't need to use water-resistant drywall or concrete backer board – regular drywall will do. On each exterior wall, staple a layer of 6 mil plastic sheeting to the existing top plate as a moisture barrier, extending it the length of the wall and several feet onto the floor. Then, install sheets of 1"-thick Styrofoam board on the wall surface as an insulating material (to decrease condensation on the cold walls on warm and muggy summer days – though you may still wish to use a dehumidifier during periods of high humidity.)

The next step is to attach the drywall. You don't want to nail anything into the masonry walls, since the holes can provide a route for water to enter. Instead, construct a "free-standing" stud wall, attached only at the top and bottom. Start by securing a 2 x 4 to the floor along the bottom of the wall with Tapcon® screws. Then, nail 2 x 4's between the top plate and this new bottom plate, every 16" on-center. Your drywall can then be nailed or screwed to the studs, just as you would do in any other room. After you've taped, mudded, and sanded the drywall, bring the plastic sheeting up from the floor and secure it in place behind some *plastic* baseboard molding (less likely to be damaged by water than wood trim), and trim off the excess. The sheeting will direct to the floor any water that moves through the wall, protecting the bottom of the Styrofoam, studs, and drywall. (Whether or not you install drywall along your *exterior* walls, you can use plastic sheeting and plastic baseboards to protect the bottom of any drywall you install on *interior* walls.)

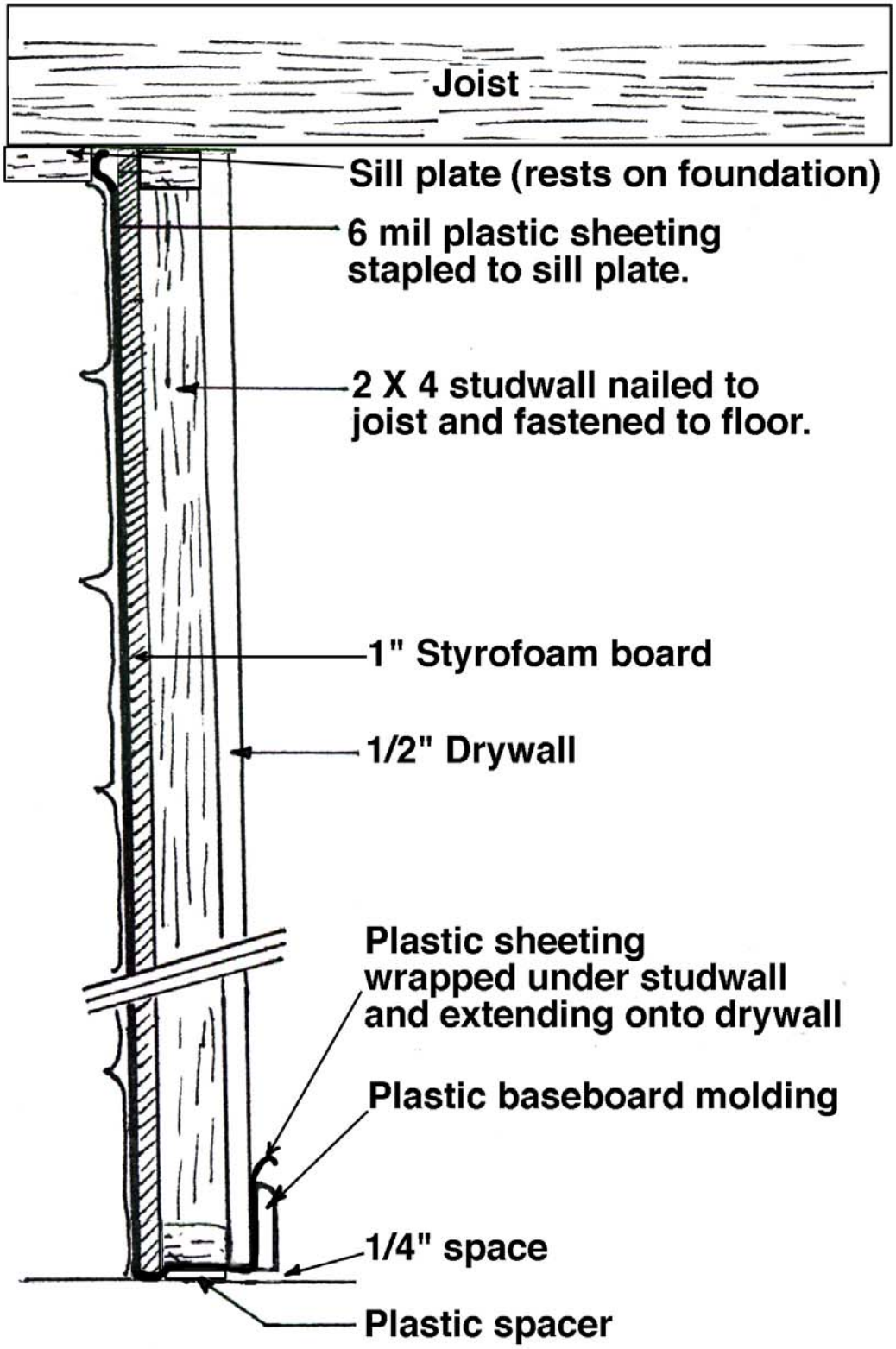
If you are adding outlets along your basement walls, position them higher off the floor than you otherwise would (about 4 ft.), to prevent problems during water backup. Using GFCI outlets or GFCI circuit breakers to protect against shock hazard is also a good idea.

Basement floors are best painted with floor enamel or covered with ceramic floor tile glued to the concrete floor. If you plan to install any type of rug or carpeting, make sure the material can be easily taken up and cleaned after sewer back-ups.

**Remember – remodeling defensively won't guarantee that you'll never experience a wet basement. You'll simply have a better chance that all those materials you've installed will remain in good condition when water does intrude.**

*(continued)*

***Basement drywall installation – exterior walls:***



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# CERAMIC TILE FOR FLOORS & WALLS

**PRODUCT CHOICES:**

Ceramic tile is a term that encompasses many diverse products, from wall tiles to floor tiles to tiles used on countertops. They come with a variety of finishes, from smooth to rough, and from flat to irregular. They are made from a number of different products, from clay to porcelain to ceramics to glass. They have either a sealed non-porous surface or a water-absorbing, porous surface. Whatever type you choose, all ceramic tiles are basically installed in the same manner.

In recent years, manufacturers have introduced new adhesives designed to work with the expanded array of tile now available to homeowners. As a rule, it doesn't pay to get a cheap adhesive; the more expensive products have technologically advanced formulas that give better adhesion, especially with porcelain tile. Talk with your tile supplier about which adhesive will work best with the tile you select.

There are also new products you might consider for particular circumstances. Red Gard™ is especially helpful in stall showers. When painted over the concrete beneath the tile, it creates a waterproof membrane that prevents mold and accepts up to 3/16" lateral movement, making it less likely that the tile above it will crack. (You can also use this product over cracks in concrete floors.) Tec's 3N1™ thinset mortar, in addition to giving excellent adhesion to the small porcelain tiles commonly used in older homes, will also accommodate some vertical movement in situations where that might be a problem. While neither product is inexpensive, using them when installing your tile might prevent pricey repairs in the future.

**PREPARATION OF THE UNDERLAYMENT:**

The surface that floor tiles are attached to must be smooth and solid. Any movement of the wood underneath them will cause the tiles to crack. To provide the essential strength and rigidity, it is usually necessary to install **underlayment** first.

Tile is usually installed atop **backer board**, a concrete-type underlayment product that is impervious to water. It is particularly appropriate for use on bathroom floors, where water spills are common. You cut the sheets to size with a carbide scoring tool or a circular saw with a masonry blade, and then glue the pieces in place with construction adhesive or thinset mortar.

You can also use a layer of plywood at least 1/2" to 3/4" thick. For added stiffness, use two pieces of plywood, each half the total thickness of the underlayment you desire. Install them one at a time, at 90° angles to each other. Once the underlayment has been glued down with construction adhesive for added rigidity and then properly nailed in place, fill any cracks or gaps with floor leveler. *(See separate handout on "Floor Underlayment" for how-to instructions.)*

**INSTALLING FLOOR TILE:**

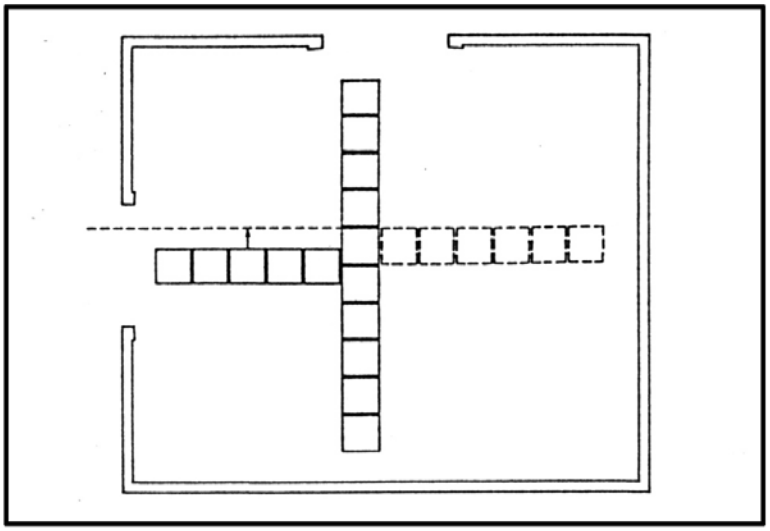
In most rooms, floor tile should be laid from the center of the room outward. To locate the center, measure from the longest straight wall across to the other wall at either end, and find the midpoint of each line. Then, strike a chalk line joining these two midpoints. Repeat this

*(continued)*

process in the other direction.  You should end up with two lines that cross each other in the center of your main floor area.  That point is the center of your room.

Before installing your tile, however, you need to check your layout to make sure your tile is balanced around the walls.  Starting at the center point, lay out one straight line of tiles in all four directions to the walls.  Some tiles have small ridges on their edges that won't allow them to touch each other; these are designed to provide a uniform space into which you'll later install **grout** (the material that seals the gap between tiles.)  If the tiles you have selected don't have these ridges, then you'll need to buy plastic **tile spacers** (small plastic “crosses” that you insert between adjacent tiles to maintain even spacing.)  If you'll need to use spacers, put them in during this initial layout to get an accurate idea of how the tile will end up at the wall.

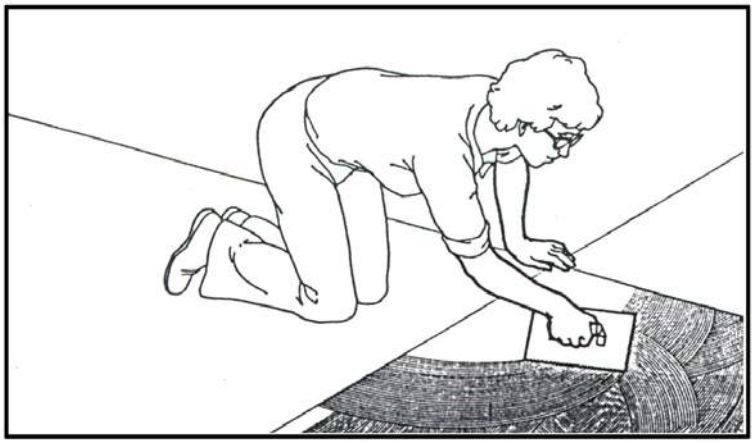
Ideally, the tile piece at each wall should be equal in size to the piece on the opposite wall.  If your layout doesn't result in this even sizing, shift your center line one way or the other *(see illustration at right)* to balance the tiles.  Do this until all your edges are as evenly spaced and balanced as possible.



Mark any adjustments you have made to your intersecting lines and the center point, and pick up the tiles and spacers.  The next step is to mark some **chalk lines** as guides to keep the tiles straight as you install them.  It's probably sufficient to mark every other row.  (Remember to include the spacers when marking the widths of the tiles.)  When finished, your floor will look like a giant checkerboard.

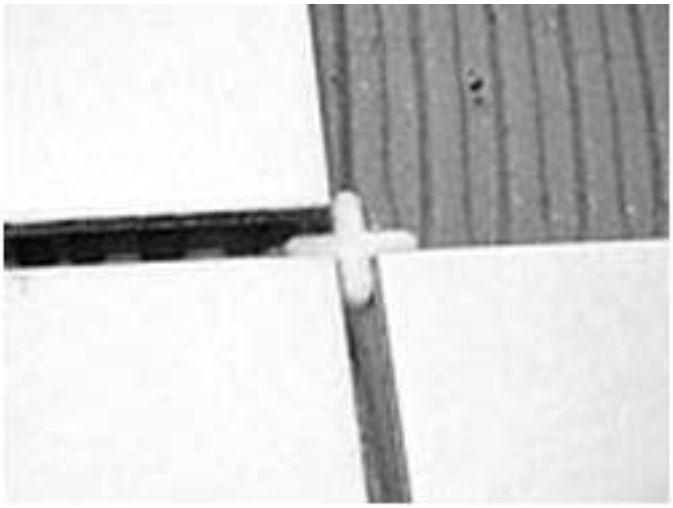
In a bathroom, however, it will be most visually pleasing if the tiles run parallel to the bathtub, even if the tub is not perfectly square to the walls.  Adjust your chalk lines as described above to create equal cuts on opposite walls, and make sure your guide lines are at exact right angles.

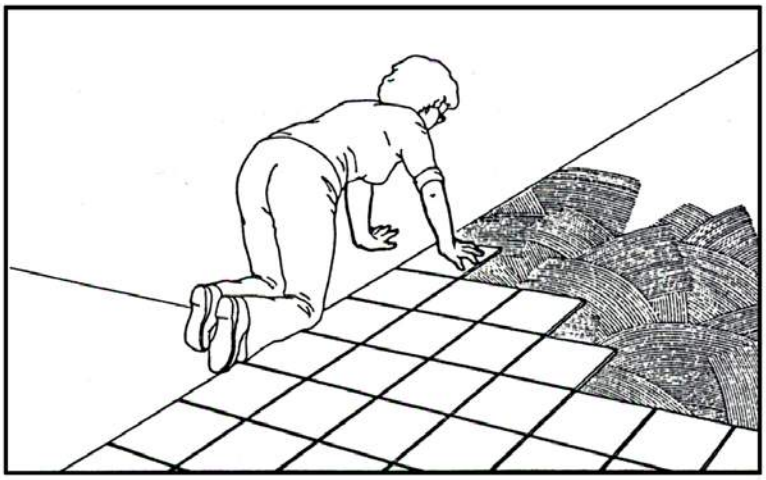
Now you are ready to install your tile.  If you will be imbedding your tile in adhesive or a “mud bed” of thinset mortar, the manufacturer’s instructions will tell you what notch-size **trowel** you'll need.  (The notches create grooves in the adhesive as you apply it, allowing room for it to spread as the tile is pushed into it and settles down flat.)  Start in one quadrant of the floor, as determined by the center crossing lines, and spread the adhesive over about a three-foot square area at a time *(see illustration below).*



*(continued)*

Start laying the tiles *(see illustration below),* following your lines and using spacers (two on each side of the tile.) As you install subsequent tiles, be careful not to move the previous ones.





*Spacers keep grout width consistent*

When you have this area installed, go back over the tiles with a **rubber hammer**, gently setting each tile firmly in the adhesive and driving out any air bubbles. (This will greatly reduce the chance that the tiles will crack later.) After using the hammer, move a 2' to 3'-long **wooden straight-edge** or **level** along the top of the tiles, to see if you have any tiles that are sitting higher than the others. Tap them down until the tiles are all uniformly level.

When you finish one section, move on to the next, until you have installed all the full-size tiles (called *"field tiles")*. Don't remove the spacers until the adhesive is set, at least overnight.

If you have a particularly uneven substrate , you may want to install your tile using the "lath and coat" method, instead of the method described above. With this approach, you staple metal lath tightly to an underlayment of concrete backer board. (If you are using this method to cover a hardwood floor, use 1" or 1-1/4" staples, long enough to go through the flooring into the joists.) The lath is then covered with a layer of latex mortar mix, ½ to 1" thick, into which you imbed the tile.

When all the field tiles have been installed, it's time to cut the edge pieces (*"border tiles.")* You can use various cutting tools, depending on the type of cut needed. **Tile nippers** will allow you to break off small chunks to make minor adjustments to the tile. You can also remove small areas of a tile using a **hack saw with a carbide blade**. In most cases, however, you'll be cutting one side of the tile along a straight line, to adjust the width to fit against the wall. For this job, you can use a **hand-powered cutter** that will let you score the tile along the cutting line and then apply pressure to break the tile along the line you have scored. (Special attachments to this tool can let you make holes in the tile for water pipes, etc.) If, however, you need to make an "L-shaped" cut, (changing directions, for example, to tile around a corner), then you'll be better off using a power saw. While you can equip a table saw with a tile cutting blade, most people find it easier to use a **"wet saw"** that sprays water over the tile as you cut to allow more accurate results. Rub a **smoothing stone** along the cut edges after using any of these tools.

After cutting the border tiles to fit, install them the same way you did the field tiles, using the spacers. After all the tile is installed and has had a day to set up, remove the spacers and clean off any adhesive on the tile surface.

*(continued)*

## GROUTING:

Grout fills the gaps between the tiles. It comes in many colors to complement or contrast with your tile, depending on the “look” you desire. (Be aware that the darker the grout, the harder it will be to work with and the faster it will discolor.) Grout with sand is generally used on floors; smooth grout without sand on walls. If you mix the grout (which is in a powder form) with a **latex bonding additive** instead of water, it will provide a stronger, more waterproof seal between the tiles. Mix the grout to a plaster-like consistency (much like peanut butter), and spread it with a **rubber-bottom grout trowel**. By moving the trowel at a 45° angle across the surface, you can fill in the gaps between the tile. After the gaps are filled in and the grout has just begun to set up, take a wet **sponge** and lightly remove the residue from the surface, changing sponge water often. You'll need to repeat this procedure several times, to remove the excess grout; mop the floor the next day to remove any cloudiness that remains.

## WALL INSTALLATION:

You use much the same technique to install tile on a wall as you do on a floor. Locate and center the tile in the same way, and use the same method to install and grout it in place. Wall tile usually has more of a tendency to slip or slide down, so you'll need to pay particular attention to keeping the rows straight.

The best wall surface for tile is concrete backer board *(see “Preparation of the Underlayment,” on page 1.)* Plaster and drywall are not good wall surfaces for attaching tile in a tub or shower surround or other areas frequently exposed to water.

On vertical surfaces, ProLite® thinset mortar will keep the tile aligned better than most glues. OmniGrip® glue, however, will also work well The advantage to OmniGrip is that you can move the tile around for a while (in case you find your row is “drooping”); its disadvantage is that it takes several days to dry, so you can’t grout the next day.

## REPAIR AND MAINTENANCE:

The two areas most likely to need attention later are cracked/broken tiles or damaged grout. If you have a cracked or broken tile, you need to keep the neighboring tiles from being damaged as you remove the bad piece and install a replacement. Start by carefully scraping out the grout surrounding the damaged tile using a **grout saw** or old screwdriver. Then, wearing eye protection, chisel out the bad piece with a **cold chisel**, being careful not to break the surrounding tiles. Use the cold chisel to clean as much adhesive as possible from the wall or floor area you exposed; then, apply glue or thinset mortar to the back of the replacement tile and set it in place. With your rubber hammer and a block of wood, tap the replacement tile down to the level of the surrounding pieces and wipe off any adhesive that oozes out around it. After the adhesive has set, you can grout around the new tile as described above.

Grout can be renewed by scraping out the bad areas, or even the entire area if you so choose. A **grout saw** works best for this job; it will remove the top 1/4-inch or so of grout. After scraping, you can re-grout the area as described above. It's important to replace grout as soon as it appears defective or has hairline cracks, to keep the wall or floor watertight. Once water is able to penetrate under the tile, it will destroy the floor or wall beneath it and cause the tile to literally fall off – requiring total replacement.

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# MAINTAINING CERAMIC TILE WALLS

## around Your Tub and Shower Area

Ceramic tile walls surrounding a tub or shower need periodic maintenance. Cracks in the grout can absorb water, allowing the moisture to penetrate behind the tile and destroy the underlying plaster or drywall. Many of the leaks that appear on the ceiling below a bathroom aren't the fault of a leaking water supply or drain pipe; rather, they are caused by water coming through grout that is in poor condition. To stop these leaks and prevent damage to the walls and ceiling below, you need to repair and seal the grout and then re-caulk the seam between the tile and the tub or shower floor pan.

Start by cleaning the entire area, removing soap scum and mold. Inspect the grout between the tiles for cracks and loose or missing sections. Remove any loose pieces (you can use a hammer and narrow chisel, grout saw, or rotary tool if you have one, but an old flat-head screwdriver will often work), until you get to solid grout. Make sure you have scraped out the joints and brushed out all the chips and dust, so you have a good surface for the new grout to bond to. Then, fill the seams with new grout as needed. (For a small jog like this, it's probably easiest to use p**re-mixed grout**, available in squeeze tubes or in small tubs; install it with a sponge or grout squeege.) Wipe off any excess with a damp sponge after it has set.


Don't use grout to fill the seam between the tile and the tub or the shower floor pan. The sealant you use here needs to be flexible, to allow the tub to expand and contract. **Silicone caulk** is your best choice. Scrape the old caulk out of the seam, and then fill it in with fresh caulk.

Faucet escutcheons and tub spouts should meet the wall snugly, so that water cannot flow in behind the tiles. Many plumbers use **clear silicone caulk** around the fixtures to make a better seal to the wall.

Let the new grout and caulk cure completely, usually for three days. Then, liberally apply a **grout sealer** (available at all tile stores and most building materials centers) over the entire tile area, and let it set for about an hour. Wipe off the excess sealer, and your shower will be ready for use once again.

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# INSTALLING NEW CERAMIC TILE OVER OLD

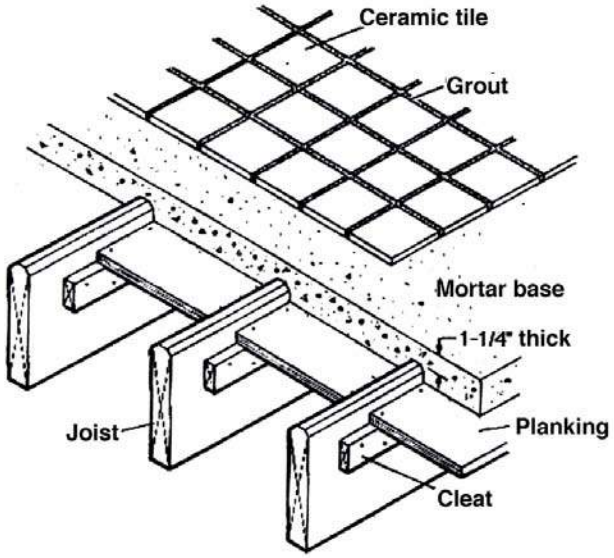
The ceramic tile on the bathroom floors of many older homes can be pretty worn out, with cracks and/or missing tiles. Replacing that tile can often be complicated by the original construction of the floor *(see illustration).* Many tile floors in Cleveland Heights and nearby communities (from 1900 through the 1960's) have a **mortar-bed subfloor**. These floors are usually solid and rigid, but sometimes settling or water seepage has caused a joist to bow, creating a long crack in the floor on top of it.

If your floor shifts or moves when you walk on it, the only real solution is to demolish the entire floor and install a new one. If the floor is sturdy (with no movement when walked upon), and the existing tile is firmly attached, it is possible to install a new layer of tile on top of the original flooring, so long as you prepare the surface properly.

Remove the toilet and any floor-mounted items like vanity cabinets and radiators, so that new tile can be installed under those items. The existing tile and grout has to be clean and relatively smooth. Fill any cracks in the floor with **thinset mortar**. Imbed **mesh tape** (like that used for drywall joints, but the kind you buy in the tile department) into the mortar over the crack; the tape will stabilize the filling, so the crack doesn't reappear in the new layer later on. Thinset mortar can also be used to fill any areas where tiles are missing. Let these repairs dry before starting the tile layout.

Lay out the new tile just as you would over any other surface, finding your center point and working out from there *(see separate handout on "Ceramic Tile" for how-to procedures).* You can snap chalk lines over the old floor, as needed, to serve as guides for your new tiles. When you install the tile, however, you won't use adhesive. Instead, you'll be bedding the tile in a new layer of mortar. To get a better bond to the old flooring, combine **powdered thinset mortar mix** with **latex bonding additive** as the liquid, instead of water. Then, apply the wet mortar with a **notched trowel** to a thickness of about 1/4", and imbed the new tile in it. Clean any excess off the tiles with a wet cloth, and let the mortar dry for 24 hours before adding **grout** around the tile. Seal the joint along the base of the bathtub with **silicone caulk**. When the grout is cured (in about three days), coat it with **silicone grout sealer**.

Because the new floor will be higher than your old one, you may need to raise the **threshold** or replace it with a new piece where you terminate the floor at the doorway. (Thresholds are available at the place you purchased your ceramic supplies.) You may also need to trim the bottom of the door itself.




**Mortar-Bed Floor**
(cut-away view)

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# INSTALLING LAMINATE COUNTERTOPS

The most popular choice for new kitchen countertops is plastic laminate (Formica™ is the brand name of the most common type). This material offers numerous styling options to fit your decor. The front and side edges can have rounded corners, or you can create a counter with two or three different colors on the edge. The **backsplash** (the piece, about 4" to 6" high, that covers the wall area immediately above the counter) can either be purchased separately or bought as part of a "one-piece" unit that has the counter molded together with a backsplash, with no seam or joint between the two. If your walls are "wavy," as in most older homes, then a separate backsplash usually works better; this separate piece can flex and bend to meet the wall, whereas the one-piece type can't. You can also buy matching **sidesplashes**, to protect the walls along the sides of the counter.

Most people buy the laminate already adhered to the wood form, virtually ready to install. (The advantage to such ready-made counters is that commercial shops have power clamps that can exert great pressure on the laminate as it is glued to the wood, as well as the tools and experience to do the job right.) You can buy a pre-made counter section from stock and then cut it to fit where you will install it, or you can accurately measure where the counter will be going and have it made to your exact size. Custom sizing costs about one-third more, but sometimes cutting laminate at home can be tricky.

However, you may not be able to get a ready-made counter in the style and color you desire; in such cases, you can buy the laminate in sheets, which you then glue onto a "blank" to form your counter. To construct the blank, glue two 3/4" sheets of plywood or particle board together and cut it to the desired size and shape for your counter. Then, cut a piece of the laminate to fit each exposed surface of the blank – including any edges. Glue the laminate to the blank with contact adhesive, and then run a **laminate roller** firmly over the entire surface to press it down. Remove any excess adhesive with mineral spirits, and let it set up overnight. If you desire separate backsplash and sidesplash sections, construct them in the same way as you did the countertop.

If your counter wasn't custom sized, you'll need to cut it to length. You'll need a **circular saw with a fine-toothed blade** – the finer the better. (The blade should be labeled *"for cutting plastic laminate.")* Turn the counter upside down, and put it on something stable. (Cutting with the counter upside down will reduce the chances of chipping the surface. Be sure to protect the surface of the counter with old rugs, so it won't get scratched.) Then, determine the desired length; if the counter will run between two walls, measure the distance between the walls at both front and back, and mark the counter with these measurements. (Remember, the counter is upside down, so be sure the get the measurements in the right places.) Draw a line that connects these points, and then use the saw to slowly cut the counter along the line.

To make the sink cutout, turn the counter back over, so its upper surface is on top. Locate the center of the cutout area – widthwise from the front of the counter to the backsplash, and lengthwise from one side of the sink base to the other. Draw a large cross, marking that intersection point. Then, if you are installing a new sink, center the template that comes with it

*(continued)*

over the intersection point and mark your cutting line as the as the template indicates. If you're re-installing your old sink, remove the faucet(s), turn the sink upside down and center it over the cross; trace around it, and mark your cutting line about 5/8" inside that tracing all the way around. **(Before you cut out the opening, double check that your sink will have enough clearance inside the sink base.)**

Begin your cut by drilling about a 3/4" hole at each corner. Then, again with the counter positioned upside down, cut out the rest of the opening using **a jigsaw with a fine-toothed plastic laminate blade**. Alternatively, you can use a **router** to cut out the opening, though you may need to make several passes at increasing depth. The countertop will be stronger if you round the corners of the opening slightly.

The sink should be mounted before you put the counter in place. *(See separate handout on "Installing a Kitchen Sink and Faucet.")*

When you are ready to install the counter, first put it into place to check the fit and make any adjustments needed. Then, there are a couple of ways to attach the counter to the base. If you want to glue the counter down, take the counter out, turn it over, and apply silicone caulk to all the edges where it touches the walls. In addition, apply construction adhesive on the bottom, where it contacts the cabinets. Flip the counter right-side-up and set it in. After you are sure that it is in its proper position, take a hammer and a block of scrap wood and tap fairly hard over the adhesive you applied, to drive out any air. Let it set for 24 hours before you use it.

On the other hand, if you want to be able to replace the counter before you buy new cabinet bases, you may choose to attach the counter with screws. Drive the screws from inside the cabinet base up through the wooden corner blocks on the underside of the counter. **Be very sure that the screws are long enough to extend into the wooden blocks, but *not* so long that they pierce the top of the counter.**

Install the backsplash using construction adhesive on the back and bottom surfaces. If possible, brace lengths of 2 x 4 against the opposite wall to apply pressure at several points along the backsplash, until the glue dries. Install sidesplashes in the same way.

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# PLANNING FOR KITCHEN REMODELING

Remodeling a kitchen can be one of the most stressful projects you can undertake. Before you start, here are some things to consider.

**Cost**

First things first – your budget! Whether you will be doing it yourself or hiring a contractor, you have to determine what you have available to spend on the project. Everything else will be secondary to your budget.

This handout will not address specific costs, because that subject could take several pages alone. However, there are some general perspectives on project costs that you may find helpful. Moving the locations of windows and doors is usually very expensive. Even moving water or electric lines can add more to your cost than you can afford, so you will have to decide if relocating that sink is worth it! Working within a very tight budget may mean that your kitchen remodeling job is limited to cosmetic changes. But, even such changes – such as replacing the countertop, installing new lighting, and adding a fresh coat of paint – can rejuvenate the room. You can complete the new look with new faucets and hardware, like cabinet handles.

While this “low-bucks” approach won’t gain you a built-in refrigerator or a restaurant-style stove, you can still be resourceful when faced with a problem. For example, you can have the dishwasher painted to match the other appliances instead of replacing it, and then put the cost savings into another part of the job. Recycle what you can; for example, you can choose to clean up and re-use cabinets, rather than buy new ones.

A tight budget usually requires some sweat equity. Patching plaster and painting can be handled by just about anyone, and it’s not that hard to replace a faucet. However, when there are structural changes to be done, calling in a professional tradesperson is the thing to do. Moving or replacing plumbing lines and upgrading electrical work will usually require permits, and the work will have to be inspected by your city’s Building Department.

Expect to find extra things that will need repair as the job progresses, such as crumbling plaster walls or corroded iron piping, and allow for that work in your budget (call it your “contingency fund”). Getting a minimum of three bids is another smart idea. An estimators’ guide will give you a clue as to average prices for the work you need to have done.

Especially if money is tight, stay away from extreme or custom designs in cabinets, light fixtures and hardware. Standard items – though not as glamorous – are less costly, and it will be easier to find replacement parts when needed.

Comparison pricing is work, but your preliminary research can pay off in considerable savings. Let a store know you’re working on a remodeling project and, armed with your complete shopping list, inquire if it can offer any discounts if you make all your purchases there. Many retailers have a meet-or-beat pricing policy that may save you some more money.

*(continued)*

Check online sources, also. Look at different brands and collect model numbers at a home center or plumbing-supply house, then investigate Web outlets.

**Design**

You'll find graph paper very helpful in your kitchen planning. By mapping out the floor plan of your kitchen, you can work through new ideas. You'll want to have accurate measurements of the walls and the locations of all doors and windows. There are some inexpensive computer design programs for homeowners, so you can print out various options.

Every year several do-it-yourself magazines have a kitchen-remodeling issue; check at your local library for back copies to scour for ideas. Now is the time to develop that "wish list" of things you would like to have – roll-out pots and pans drawers, recycling bins, and the like – and see which of them might fit your budget.

An architect is indicated if you want to change the structural design of the house, such as moving walls or building an addition. In some communities, exterior changes may have to be approved by an Architectural Review Board and/or the Ohio Historical Society. If you intend to stay within the existing kitchen floor plan, you will not need to do these steps.

Many "home center" retail stores and kitchen-and-bath specialty shops will do kitchen cabinet design plans for you. Most of the stores charge for the design plan, but will drop the charge if you purchase the cabinets from them.

**Preparation**

When it comes time to start the work, be prepared to be inconvenienced for a long period. Even with a "bare bones" project, the work is likely to take longer than you anticipate. Don't believe a contractor that promises that a whole new kitchen can be done in two weeks; you'll want to insist on a realistic timetable that will allow for a few unexpected delays.

Plan to set up a "temporary kitchen" while yours is getting its makeover. Perhaps you can move appliances into a nearby room. (Be sure you have enough electric capacity to handle the load, and that you use the right size extension cords; check your plans with an electrician or your city's Building Department.) A backyard grill can be a serviceable alternative to your stove, as can a microwave oven. Unless you're planning to use only paper plates and cups, you'll probably need to set up an area to wash dishes in your bathtub or laundry sink.

Before the job starts, you'll need to pack up the contents of your kitchen, so they're out of the way while the work is done. Keep out any items you use frequently, and store the rest elsewhere in the house. Heavy boxes from liquor stores are usually sturdy enough to handle pots and pans, silverware, and small appliances. Before you pack up your pantry staples, use this opportunity to check them and get rid of anything that is no longer in good condition.

Install a barrier of plastic sheeting at each doorway to the kitchen. It will help contain dust and debris (especially important if you will be disturbing old lead-based paint *(see separate handout on "Controlling Lead-Based Paint during Your Paint Control Project.")*

If you are getting new cabinets, be sure to open the cartons and inspect the cabinets as soon as they are delivered. That way, you can deal with any broken or damaged pieces before it's time for them to be installed.

Even a low-cost kitchen remodeling project is going to disrupt your life, but approaching that disruption with humor – and an occasional restaurant meal – will help make it more bearable.

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## OFF WITH THE OLD...

# Removing Old Wall and Floor Coverings

Over the years, most homeowners seek to improve the look of their house by installing new wall coverings and flooring materials. Before you put on the new material, however, you may have a hard time getting the old, deteriorated covering off the wall or floor surface first. Here are a few hints to make such jobs easier.

You can take up old **floor tile** or **sheet flooring** with a chisel-edged scraper. The most difficult part is usually getting the old adhesive off the floor surface. A floor scraper made for this purpose works best for this job, or you can use an ice chipper (a tool that looks like a straightened-out garden hoe) – but, in either case, you'll need a fair amount of elbow grease. For particularly stubborn adhesives, use a heat gun to soften the material before removing it with the scraper. *(Note: don't try to remove, sand, or level asbestos flooring or its backing; Instead, install new floor covering over it.)*

For **carpeting and its foam padding**, use a utility knife to cut the materials into smaller strips that you can handle more easily. To remove the staples used to tack the padding into the hardwood flooring, a brad puller – a v-shaped "mini crowbar" with a screwdriver handle – works best. Sometimes, the foam padding will have become imbedded into the varnish. The best way to remove it is to scrape it off with a floor scraper, ice chipper or a straight-bladed paint scraper, being careful not to scar the hardwood floor beneath. In some cases, paint thinner will remove part of the residue, but it is highly flammable – and, you'll definitely need to refinish the hardwood flooring afterwards.

**Wallpaper** can be particularly difficult to get off your walls, especially if there are multiple layers or if the old paper has been painted over. A steamer will sometimes work wonders, but with some papers or adhesives, it may not accomplish much of anything. Chemical removers are another option, but with foil, vinyl, or vinyl-covered wall coverings, you'll need to perforate the material to allow the chemicals or steam to get behind it and work on the adhesive. Use a perforating tool, such as Zinsser's PaperTiger™ *(pictured right),* to puncture the paper without scarring the plaster wall beneath it.

Residue from old, poorly-done **plaster repairs** can be smoothed out with a pole sander, which has a swivel-head that holds a piece of sanding screen. You'll need to exert some physical effort and clean up all the plaster dust that is produced. For this reason, you may choose to use an electric sander made especially for this purpose; a shroud surrounds the sanding head and controls the plaster dust so it is sucked into an attached power vacuum, reducing the amount of clean up needed later. (Don't use a regular electric sander for this job, because plaster dust will ruin its motor.) If the plaster is covered with layers of old paint, make sure you take precautions to prevent contamination from leaded paint dust *(see separate handout on "Controlling Lead-Based Paint during Your Paint Control Project.")*

If you need to **cut into existing walls or floors**, a reciprocating saw (such as Milwaukee Tool's "Sawzall"™) can be equipped with a blade that will cut through nail-imbedded wood or plaster. This tool makes removing old built-in cabinets easier, as well.

*(continued)*

**Cleaning-up debris** as you go along will make your job site safer and less likely to damage any new material you apply. Wash down walls and floors with warm water and TSP (trisodium phosphate), a detergent that you can purchase at most hardware and building supply stores. Pick up chunks of plaster or other large debris with a stiff push broom and a snow shovel. Heavy plastic refuse bags (3 mils or better) that will withstand sharp pieces and a lot of weight are available at builders' supply stores and well worth the extra cost.

Even if you are using a contractor to install your new wall or floor covering, removing the old materials yourself may allow you to negotiate a lower price. Just give yourself enough time to do the job properly.

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# 25.

# Heating & Coooling

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# BUYING A NEW FURNACE OR BOILER

Forced-air furnaces and boilers usually have a life expectancy of twenty years. If yours is reaching the end of its useful life – or if a cracked heat exchanger or other equipment failure has made replacement necessary – there are a number of issues you should discuss with your contractor before deciding on a new heating unit:

1. The efficiency of your weatherization – The heating contractor should give you a written analysis of the heat loss in your home, based on its size, structure, and how well your house is (or will be) weatherized. This calculation will help determine the right size heating unit for you, one that will operate more efficiently and save your energy. In many cases, it will be important to add weatherization materials to get the most efficiency for your heating dollar.

2. The effectiveness of your heating delivery system – It's important to consider not only the heating unit, but also the duct work or water lines, dampers, valves, and other parts of the system that moves the heat throughout your house. Your contractor should help you evaluate your delivery system and adjust it to its maximum performance. (It's likely, however, that you will have to make further adjustments during the first year or two, as you live with your new heating unit.)

3. The effectiveness of the heating units available – Given your needs and the fuel costs in your area, your contractor should discuss with you what heating units he/she would recommend for your situation. Some high-efficiency units are 95% efficient or more, but they are usually more expensive and may involve costly modifications to your chimney or your delivery system. You may find it makes more sense to buy a unit that is slightly less efficient and put the savings into added insulation or toward the extra fuel cost.

   *If you would find it helpful for a heating engineer to help you evaluate your system – particularly before undertaking major modifications – you can hire an outside consultant. Look in the yellow pages under Engineers (Heating, Ventilation, and Cooling) or Engineering Consultants.*

Considering these factors, you can discuss with your contractor each alternative – including how many years in savings it will take for the new equipment to pay for its installation cost (the "payback period.") You should also ask each contractor the following questions (and compare their answers):

1. What size furnace or boiler do I need, given my planned or present weatherization measures?

2. Does this unit achieve its efficiency by design, or did the manufacturer take an old design and add features to increase its efficiency?

3. What is the life expectancy of the heating unit being discussed? What does the warranty cover?

4. Are there any unusual operating characteristics to this heating unit? (Some models may need special drain set-ups, may be noisier than usual, etc.)

*(continued)*

5. Are any changes needed to my delivery system (ducts, radiators, etc.)?

6. Does this furnace or boiler require installation of a chimney liner? What is its cost?

7. Which of these features is recommended for my situation, and what is the added cost for each?

    a. Flue dampers

    b. Set-back thermostat

    c. Fresh-air inlet (for furnaces)

    d. Zone controls (for boilers)

    e. Automatic water feed (for boilers)

    f. Higher-efficiency air filter (for forced-air furnaces – helpful to people with allergies or who are sensitive to dust)

    g. Water heater (included as part of the system with some high-efficiency units)

    (NOTE: If you have reason to want either whole-house air conditioning or a humidifier as part of your heating system, now or in the future, you'll want to make sure the heating unit you choose will be compatible with these options.)

8. Is there asbestos to be removed as part of this installation? If so, who will be removing it? What precautions will be taken? (For further information on the dangers of asbestos, you may wish to contact Environmental Health Watch at 216-961-4646.)

9. How often should this unit be serviced? What maintenance is it recommended that you do yourself? (How often should you change the air filter or lubricate the blowers on your new furnace? How often should you check the sight glass or drain off your new boiler?)

In addition, if you are concerned about lead-based paint dust in your home (i.e., if you have a child with elevated blood lead levels, or have severely deteriorated paint surfaces), you may also wish to discuss with your contractor the precautions that will be taken when cleaning or replacing your heating ducts. The EPA pamphlet, *Reducing Lead Hazards When Remodeling Your Home,* has helpful suggestions.

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# CHECK OUT YOUR HEATING SYSTEM

Each year, as the weather turns colder, it's a good idea to have your heating system checked out by a professional. There are some things, however, that you can do yourself once a year to make sure your furnace or boiler is operating at maximum efficiency (most will be part of a professional inspection):

1. Check the flame on your furnace or boiler (and your hot water heater, too). The flame should be blue, with very little orange or yellow color. An orange flame can indicate that the air/fuel mixture is incorrect, and can result in soot filling up the heat exchanger. (Call a professional to adjust the air/fuel mixture.)

2. Turn off the system and let it cool down. Then, use a stiff brush to scrape clean the blade on the blower fan. Vacuum the blower and burner compartments to remove any dust or other debris.

3. Check all belts for wear and tension. Replace any belt that is cracked or glazed. If the belt on the furnace motor has more than about a half-inch of play, tighten it using the adjusting bolt. If you have an older system without sealed bearings, add some lightweight non-detergent oil to the oil port(s) on the furnace motor and/or blower motor. (Do not oil the belt itself.) Some hot water boilers have a pump that should be oiled periodically.

4. Check the draft system. Open the clean-out door at the bottom of your chimney and remove any ashes that have accumulated there. Hold a mirror inside the cavity and make sure you can see daylight. If your chimney is blocked by a bird's nest or other obstruction, it should be removed. Check the chimney itself, inside and out, to make sure the bricks and the mortar between them are solid and intact.

5. Check the heat delivery system. On forced-air furnaces, make sure all joints in the ductwork are tight and do not allow hot air to escape. (Loose joints can be corrected with sheet metal screws and duct tape.) Insulate any ductwork that travels through unheated areas. If a steam radiator is not heating, you may need to replace a vent. Most hot water radiators should be bled of air at the start of each heating season.

Some maintenance needs to be done more frequently. If you have a boiler with a sight glass, check it every couple of days. (If the water supply to the boiler is not adequate, the boiler can over-heat and explode.) For furnaces, change the filter monthly during the heating system.

Don't forget to check your owner's manual. It will specify the maintenance needs of your particular system.

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# SPECIAL CONCERNS OF HIGH-EFFICIENCY FURNACES

Homeowners are often surprised when their fairly new high-efficiency furnace shuts down unexpectedly in the middle of winter. In many cases, the problem is due to ice build-up in the vent pipe, blocking the exhaust flow. In high-efficiency models, the lower temperature of the exhaust can allow moisture (a by-product of combustion) to condense in the flue, especially when outdoor temperatures drop into the 20's or below.

High-efficiency (or "condensing") furnaces exhaust the combustion gases and bring in fresh air through PVC pipes to the outside, usually routed through the sidewall of the house. If not installed correctly or checked regularly, problems in these pipes can affect the operation of the furnace itself.

If your newer furnace shuts down, check these common venting problems:

- Incorrect size of the exhaust pipe. Manufacturers specify the maximum length and number of elbows that pipe of a given diameter can handle.
- Not enough hangers to support the exhaust pipe. If sags develop in the exhaust piping, condensate can pool in the low spots, blocking the vent enough to trigger a furnace shut-down.
- Incorrect slope of the exhaust pipe – down toward the outdoors, rather than back towards the furnace. The exhaust piping should be pitched at least 1/4-inch per foot, to allow condensate to drain freely back into the furnace.
- Vents positioned too close to the ground, where they can be blocked by snow drifts or critters.
- Running exhaust and intake pipes out different sides of the house. The pipes must be next to each other so that the wind pressure is the same on both.

During wintry weather, it's a good idea to check regularly the exits for the exhaust and intake pipes on the outer wall of the house, to make sure they aren't covered by snow or ice. In addition to shutting down the furnace, a blocked exhaust pipe can allow carbon monoxide to build up inside the house.

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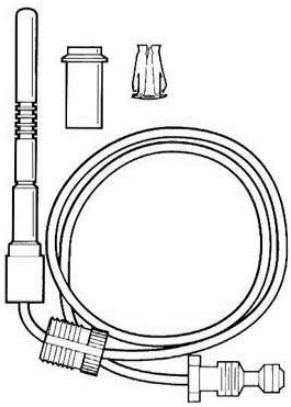
# REPLACING A THERMOCOUPLE:
## a furnace repair anyone can do

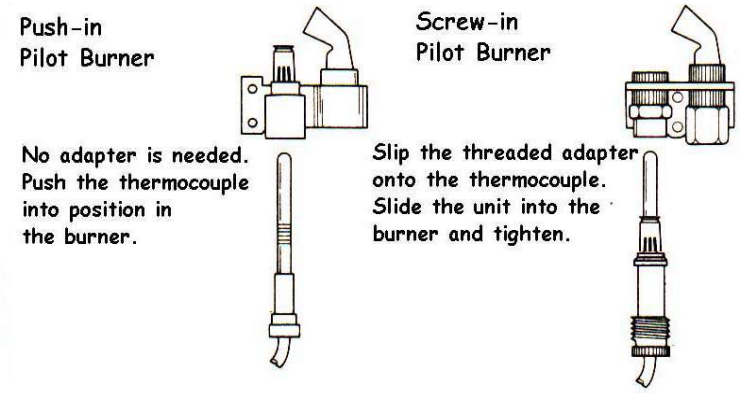
During the winter months, we all depend on our heating systems to keep us warm. When they stop working, we can't ignore them, but must act quickly.



30 Millivolt Thermocouple

One common cause of furnace breakdown that can be easily diagnosed and repaired is failure of the **thermocouple**. The thermocouple is a safety device on most furnaces and boilers *(*see note next page)* that tells the gas control valve whether or not your pilot light is burning. (It prevents gas from being released into an unlit furnace.) When the thermocouple is defective, even though the pilot light is burning, the main burner won't light – no matter how cold it gets.

The thermocouple looks like a piece of metal tubing smaller than a soda straw. To find it, first locate the gas control box. This is the box that the main gas line enters, where you turn the gas on in the furnace. (On most furnaces, it also houses the button that you hold open or push to relight the pilot.) Once you have located the gas control box, follow the three pipes leaving the bottom of the box. The largest pipe leads to the main burner; the medium one leads to the pilot (this pipe will not be present in some furnaces with electronic ignition); and the smallest is the thermocouple. The other end of the thermocouple sits in the flame of the pilot light.




After you locate the thermocouple, turn off the gas to the furnace. Then, unscrew the thermocouple from the control box and from where it is attached near the pilot light.

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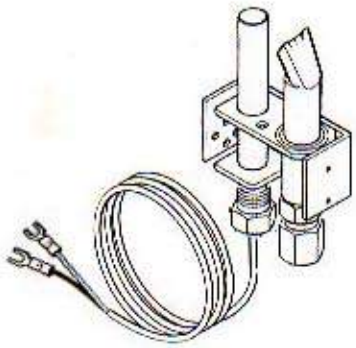
Replacement thermocouples are readily available, and come in four standard lengths (18”, 24”, 30”, and 36”). Simply take the thermocouple you’ve removed to any home supply store, hardware store, or heating/plumbing supply store to get an identical model. (You might take the furnace model and serial number with you, in case there’s a question.) Reverse the process to install the new thermocouple.

This is the same process you use to replace the thermocouple on your hot water heater. Expect to pay a minimal cost for the thermocouple; you'll save a lot of money by replacing it yourself. You might even consider buying an “extra” thermocouple to have on hand, before you actually need a new one.

**Note: While most furnaces and boilers have a thermocouple, in some boilers and gravity furnaces a **thermopile** (pilot generator) will generate electricity to operate the gas control valve. You can distinguish this device from the metal tube of a thermocouple by the two wires in sheathing that lead to it. It is not difficult to replace a thermopile; simple remove the two wires connecting it to the gas control valve and remove the nut holding the thermopile in place. However, replacement thermopiles are less readily available than thermocouples, so you will probably need to go to a heating supply store.*



750 Millivolt Pilot Generator
(also called a "Thermopile")

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# 26.

# Energy Conservation

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# HEAT SAVING TIPS

With rising energy costs, it is more important than ever to conserve wherever possible. Generally, cut heating costs by looking for places where cold air can enter, and sealing up those gaps and holes. If you feel a draft, fix it! Here are some specific things to check each fall:

- ❑ Make sure you have adequate insulation in your attic. If it is unfinished or used only for storage, insulate between the floor joists. In finished attics, insulate between the roof rafters (using baffles for air flow.)
- ❑ Seal gaps around heating ducts, pipes, soil stacks, chimneys, and wiring that run from heated rooms into unheated areas or to the outside.
- ❑ Shove fiberglass roll insulation into the rim joist (band joist) cavity – the place in the basement where the floor joists meet the foundation wall.
- ❑ Seal up any holes in the walls of your house (inside or outside) or gaps where the house framing meets the chimney.
- ❑ Use caulk to eliminate any gaps where the baseboards meet the floor.
- ❑ Check each window to make sure it fits tightly (keep it locked to make the sashes fit as tight as possible). Make sure that the caulking around the outside frame is in good condition, that any gap between the interior molding and wall has been caulked, and that weatherstripping has been installed.
- ❑ Replace any cracked or missing window panes, and make sure that the glazing (the putty that holds the glass in the wood frame) is in good condition.
- ❑ Make sure you have a storm window on any single-pane window.
- ❑ Make sure each entry door fits tightly in its frame (both inside and out), that the caulking around the outside frame is in good condition, and that it has a sweep or weatherstripping along the bottom.
- ❑ Make sure you have a tight-fitting storm door outside each entry door (unless it is an insulated steel door).
- ❑ Close all doors leading from living areas into unheated basements, garages, attics or crawl spaces.
- ❑ Close off all rooms not being used, and shut off heating outlets (registers or radiators).
- ❑ Insulate heating ducts running through unheated spaces, and eliminate air leaks by taping the joints.
- ❑ Have your heating system checked at least every two years to make sure it is operating efficiently.
- ❑ If you have a gas forced-air furnace, clean or replace the filter monthly.
- ❑ Close the damper when the fireplace isn't in use, or block the opening with a removable cover.
- ❑ Set your thermostat no higher than 65° during the day, and 5 to 10° less at night. If you will be away, lower the setting to 60° for a weekend, 55° for a longer period.
- ❑ Keep draperies and shades open in sunny windows; close them at night.
- ❑ Move furniture, curtains or anything that blocks air circulation from heating outlets and air-return grilles.
- ❑ Wear warm clothing – using layers — rather than turning up the heat.

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# HOME ENERGY AUDITS

Homeowners with high heating costs may wish to consider a professional energy audit. A professional auditor uses various techniques and equipment to determine the energy efficiency of a structure.

Before the audit, write down any problems (such as drafty rooms or condensation) and gather your energy bills from the last year. The auditor will measure the house and note doors, windows and other openings. You will also be asked about your lifestyle – the temperature at which the thermostat is set, the number of people in the house during day and evening, which rooms you use, etc.

Most professional auditors will use a **blower door test** to determine how airtight your home is. A blower door is a powerful fan mounted into the frame of an exterior door. When the fan exhausts air out of the house, it lowers the air pressure inside, allowing outside air to flow in through unsealed cracks and openings. The auditor may use a smoke pencil to locate these drafts.

The best blower door tests will use a *calibrated* door with instruments to measure the amount of the air pulled out of the house. This equipment will not only identify the air leaks, but also quantify the overall tightness of any air-sealing job.

A second type of test offered by professional energy auditors is **thermography** – infrared scanning. This test measures variations in temperature to identify heat leaks and areas where insulation is needed. It can also determine if existing insulation has been installed incorrectly or if it has settled. Interior scans are usually more accurate than exterior surveys, because there is less air movement to deal with.

The auditor will use special video or still cameras that make images of heat variations in the building's "skin." Various infrared sensing devices may also be used to measure the tempera-ture of a given spot, but these instruments alone will not provide the necessary detail for a complete home energy audit.

Don't contract with a professional energy auditor, the U.S. Department of Energy suggests, until you have obtained and checked several references; checked with the Better Business Bureau; made sure the auditor uses a calibrated blower door; and made sure they do thermographic inspections (or contract with another company to conduct one).

For more information, visit *www.eere.energy.gov/consumer/your_home/energy_audits/index.cfm/mytopic=11160.*

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# 27.

# Insulation Techniques

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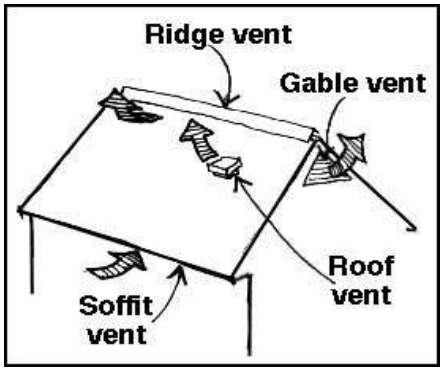
# INSULATING AN ATTIC FLOOR

Why is it so important that your attic be adequately insulated? The answer is that, because heat rises, an attic without insulation will allow the warmth from the living space below it to escape – causing heating costs to go "through the roof," as well.

**WHERE TO INSULATE:**

Your first decision will be where to install the insulation. In an **unfinished** attic, the most effective method is to add insulation between the joists of the attic floor. You can lay fiberglass (sold in pre-cut batts or rolls that you cut to size) into the joist cavities or pour in loose-fill insulation (cellulose is the most common type, although you can occasionally find glass fiber and rock wool). If your attic is finished but only used for storage, you may choose to pull up several pieces of the floor and blow in loose cellulose there. In both these situations, insulating the attic floor will retain the heat in the house below it and leave the attic cold. On the other hand, if your attic is **finished** and currently used as living space, you will need to add insulation behind the ceiling and ceiling walls. Insulating in this way will allow the heat from the other floors to pass through to warm the attic, but keep it from being lost through the roof. (*Note: If you plan to have insulation blown into the ceiling of your finished attic, Home Repair Resource Center recommends that this work be done by a professional, to ensure uniform coverage.)*

Insulation is described in terms of its **R-value**. The higher the R-value, the more effective the insulation. In Northeastern Ohio, it is recommended that attic insulation have an R-value of 49. However. if your attic has a floor, you may not be able to install enough insulation beneath it to attain an R-49 rating; you will be limited to the depth of the cavities between the floor joists. Say, for example, your joists are 2" x 8" boards; the cavity will be about 7.25 inches deep. If you install fiberglass, which has an R-value of roughly 3.0 per inch of thickness, into those cavities, the maximum rating you will be able to achieve is 7.25 x 3, or R-22. If you install cellulose, which has an R-value of almost 4.0 per inch, your maximum R-value will be 7.25 x 4 or about R-29 – better than fiberglass, but still short of the recommended rating. (Forcing more material into the space will *not* increase the R-value; if the insulation is too tightly compressed, it looses its effectiveness.) Nevertheless, some insulation is better than none at all.




After you have determined the kind of insulation you want to install, your next step will be to figure out how much to buy. Measure the square footage of the floor and the depth of the joist cavity before going to purchase the materials, so that you'll have an idea of the quantity you will need. The packaging labels on each product will tell you how much material you'll need to fill the space.

When insulating an attic, you may be tempted to close up every little nook and cranny you can find, but you should also consider how well your attic is ventilated. In our Northeast Ohio climate, the goal should be to insulate the living space of the house, while allowing the roof to remain the same temperature as the outside. Not only does poor ventilation keep heat trapped in your attic in the summer, reducing your ability to keep the house cool, but it can also cause problems in the winter. Warm roofs are the main cause of ice

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dams, because the melting snow refreezes over the colder **soffit** area (also known as eaves or overhang) and in the gutters, causing wetness to back into overhangs and between the roofing shingles. It's important that there be a free flow of outside air from the soffit of your roof all the way to the peak; air should flow in through soffit vents and out through gable vents, ridge vents or other types of roof vents *(see illustration on preceding page)*. To prevent the insulation from blocking airflow on the underside of the roof, **baffles** should be used in areas where insulation butts against rafters or roof sheathing.

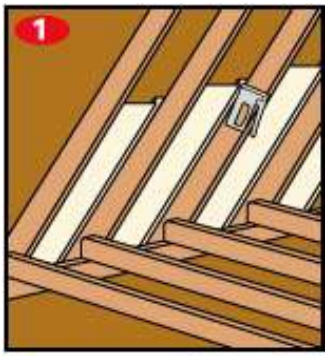
*Baffles allow air movement beneath rafters*

If you insulate the attic floor, it is also important to have a vapor barrier in place, to prevent warm, moist air from rising into the chilled attic from the living space below. The moisture will condense on the wood and insulation, reducing the insulation R-value and encouraging the growth of mold and mildew. You'll need to plug up and seal any openings from the heated area to prevent such humid infiltration. Look for anything that penetrates from the rooms below, and seal any gaps around them. Seal around chimneys, soil stacks, exhaust fan housings and recessed light fixtures. Check for holes that may have been drilled for wiring, and use caulk or spray foam to close them. Chimneys should not have any combustibles against them and may require metal flashing and high heat caulk to seal air leaks. It is especially important to duct exhaust fans and clothes dryers to the outside to reduce humidity in the attic.

The stairwell to the attic should also be insulated by drilling into the sidewalls and stair risers and blowing-in loose-fill product. If there is a landing floor between two flights of stairs, you may need to drill into it with a hole-saw and, when finished, use tapered wood plugs (and glue) to fill the holes after the insulation is blown in.

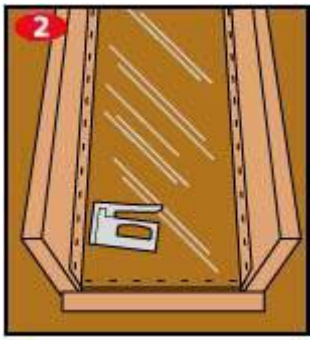
**DO-SELF INSTALLATION OF ATTIC FLOOR INSULATION:**

Most insulation products can be rather irritating to your breathing, as well as to your eyes and skin. Dress for work with a long-sleeved shirt, gloves, hat, and long pants. Wear goggles and, at a minimum, a dust mask (a HEPA-filtered respirator will filter the dust more efficiently). Consider earplugs too, if using a blower to install loose-fill product. If there is no flooring, it's a good idea to stand on a sturdy plank or piece of plywood temporarily screwed to the joists while you work. Don't smoke while working with insulation, and shower thoroughly afterwards.




Start your job by installing baffles in areas where you need to hold back insulation. Where joists intersect with roof rafters, insert a plastic or polystyrene baffle in each rafter bay. Staple the baffles into position *(Figure 1).*

You need to make sure you have a vapor barrier in place, to prevent the movement of most air from the living area. If the insulation you are installing has a vapor barrier, make sure it faces the **interior** of your house.




You can also create a vapor barrier by cutting sheets of 6 mil polyethylene plastic about six inches wider than the space between the floor joists and laying them in place with a few inches extra on each side. Use a staple gun to tack each sheet to the sides of the joists *(Figure 2).* If you cannot get a vapor barrier under a floor in the attic, you can use vapor barrier paint on the ceilings below.

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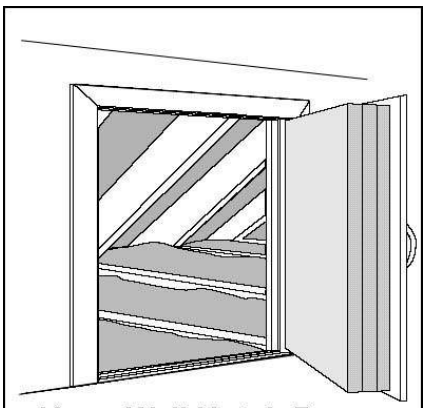
There may be electrical fixtures (recessed lights, etc.,) that protrude through your ceiling. These fixtures can become quite hot when in use. The best thing to do is to replace the old fixture with an IC-rated *("Insulation Contact")* fixture that can be covered directly with insulation. Otherwise, you will need to install baffles to hold back the insulation. Use a piece of 1" x 6" or 1" x 8" lumber to create a dam on either side of the fixture. Keep the baffle about 3" away from the fixture *(Figure 3).*


To install **fiberglass insulation**, start by measuring out each section. Cut a piece to the proper length and press it in place. Make sure the fiberglass batting is tucked snugly into the space, with no gaps next to the ceiling joists or baffles, but don't pack it in too tightly. This will defeat its insulating effect.

If you are not planning to put in an attic floor, you can add another layer of insulation perpendicular to the ceiling joists *(Figure 4).* Don't place a vapor barrier between the layers, because moisture would be trapped between the two vapor barriers. Adding this second layer will bring you closer to the recommended R-value for our climate.


**Cellulose** (and other loose-fill) insulation can also be installed in an attic without flooring. While it's easy to just pour the insulation into the spaces between the joists, you may wish to rent a blower, as it will "fluff-up" the material uniformly, leaving no dense lumps. Install the insulation into each and every joist cavity, making sure you have filled the space completely. Contractors will often "shoot" in material to a depth of more than twelve inches, to allow for some settling.

If your attic has flooring atop the joists, you may need to remove some of the flooring planks before you can blow insulation into the joist cavities. Select pieces that will allow you to access most of the spaces in between the joists. Blow insulation between the ceiling joists *(Figure 5).* (Take special care near any electrical fixture; as discussed above, make sure to blow the insulation in such a way that the baffles will hold it away from the fixture.) Replace the flooring pieces you removed.



Knee Wall Hatch Door

Two final areas – and ones that many people do not consider – are the attic door and access hatches. *An attic door should be treated as though it were an opening to the exterior of the house.* Install weather-stripping and a door sweep, and insulate the attic side of the door with fiberglass batts or foam board. The knee wall hatch shown in the illustration to the right has 3 inches of rigid foam board (an R-15 value) glued to the back of the door and weather-stripping around the perimeter of the opening to seal off drafts. If your attic uses a folding ladder with a hatch, there are kits to insulate the cover of the assembly to minimize air infiltration.

**Tools You May Need:**

Staple Gun
Tape measure
Utility knife
Goggles and dust mask or respirator
Straight edge
Insulation blower (rental)
Pry bar
Electric drill and hole-saw
Caulk gun
Tin snips

**Materials to Price:**

Fiberglass insulation or Cellulose insulation
Baffles
Plastic sheets
5/16" staples
Foam board (optional)
Silicone caulk
Low-expansion foam
Aluminum flashing
Door weatherstripping

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# INSULATING A FINISHED ATTIC

Insulating a “finished” attic can be a tricky project. Your decision about how to do it – or if you should do it at all – should take into consideration whether you will really save money. For example, if you install $200 worth of insulation, but have to remove drywall and replace it at an additional cost of $600, how long will it take to save that $800 materials cost in your gas bill – not even including your time? Ideally, to be worthwhile, this payback factor should take no more than 3 to 5 years – and your calculations need to take into account the likelihood of rising energy prices. Of course, there are other factors to think about beyond dollars and cents, both societal and personal; in addition to broader sustainability issues, the increased comfort and long-term value that attic insulation can give your home is often harder to put a price on, and such considerations may offset a longer payback period in your situation.

Finished attics will generally fall into two types: one type is used as a bedroom or other living space, and the second type is one to which you have no access. The “room” type can be insulated in several different ways. One method is to remove whatever material is covering the ceiling and walls (drywall, paneling, or plaster and lath.) After installing fiberglass blanket insulation as you normally would, you'll need to put up new drywall or paneling on the walls and ceiling.

Another approach is to drill holes between the studs and rafters and blow in insulation from the inside of the room. The drawback to this method is that there are often wood members nailed between studs or rafters for structural support. These pieces will stop the flow of blown-in insulation without your realizing it, leaving you with uneven coverage.

Probably the best method of insulating a finished attic “room” is to blow the insulation in from the outside at the time you remove the old roof to replace it. You can usually see any crossbraces through the roof sheathing, since it doesn't fit tightly together, and you'll be able to see if you're covering all areas evenly. In addition, you won't need to patch any holes in the interior walls and ceiling, as you must do if the insulation is installed from inside the room.

In attics with no access, you need to choose an inconspicuous place (such as a closet ceiling) to cut a hole in the ceiling to make an access door. Once you have done that, you can install the type of insulation that best meets your needs.

If your attic is finished but only used for storage, then you may choose to pull up several pieces of the flooring and blow in insulation there. However, if you later wish to use the attic as living space, this approach may backfire. Insulating the roof allows the heat from the other floors to pass through to warm the attic. Insulating the attic floor, on the other hand, keeps the heat in the house below it, and leaves the attic cold. To turn an attic insulated in this way into living space, you'll need to provide another source of heat – new heating ducts, a space heater, etc. For this reason, think carefully before you decide to insulate an attic floor.

Whichever method you choose, install the insulation properly, and you'll enjoy increased comfort and energy savings for years to come.

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# INSULATION STRATEGIES
## to reduce heating costs

There are many products that can be used to weatherize and insulate your house. The main objective when insulating is to create a heat-retaining envelope, one that will contain and put to best use the heat produced by the home's heating unit. To achieve this, you'll need to use different materials, each in an appropriate location. Let's talk about some different approaches and look at where they work best.

Let's start with air control. Air is constantly moving around us. In winter, the colder outside air enters the home, and the heated inside air naturally rises. These are the two forms of air movement that you need to pay the most attention to controlling – leakage of cold air from the outside into the house, and loss of heated air from the house to the outside.

External colder air enters the house any way it can. It moves through cracks around doors or windows, through gaps where the wood walls of the house connect to the masonry foundation, and through other spaces, such as around outside water faucets. It will also radiate from cold window glass. To correct air leakage, you need to close or seal the gaps. Around doors or windows, use one of the many available types of weatherstripping. For gaps between wood and masonry, or around door or window frames, caulking is the solution. *(See separate handout on "Caulking and Weatherization" for hints on how to choose and install the right materials for each situation.)* To block cold radiating from glass, add storm windows, insulating glass, or even plastic "shrink wrap" barriers to create a pocket of trapped air to act as insulation.

The warmer air that you've paid to heat is also moving inside the house. It rises up to and through the roof. To a lesser extent, it also moves out through the side walls and windows. The first step in controlling this movement is to make sure the heated air gets to where you want to use it. If you have a furnace, the warm air moves through a system of pipes, called "ducts." They can and do leak, allowing warm air to escape where you won't use it, such as in the basement. Prevent this air loss by sealing all joints in the ducts with duct tape, and by insulating ducts that pass through unheated spaces. If you have a register on your furnace for the basement, close it. (Most often, the heat that radiates from the furnace and ducts is more than enough to warm a basement.) If the heat source in your home is a boiler, it is relatively easy to insulate the water pipes that carry heat from it to the rest of your house.

Once you've made sure the heat is getting to where you want it, keep that warm air where it belongs by following the caulking procedures already outlined. In addition, close doors and turn off the heat in unused rooms. Seal around anything that passes from the heated floors into the attic (such as the chimney, water or soil pipes, or wires.) All these holes allow the rising warm air to move out of the house. **Only when you've done all these steps are you ready to look at house insulation.**

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There are several types of insulation, but all are designed to contain heat within your house. **If your attic is finished**, your best strategy is to add insulation behind the ceiling and ceiling walls. Insulating in this way will allow the heat from the other floors to pass through to warm the attic, but keep it from being lost through the roof. **If your attic is unfinished** and used primarily for storage, your most effective strategy will be to insulate the attic floor. This will retain the heat in the house below it and leave the attic cold. In either case, the goal should be to insulate the living space of the house, while allowing the roof to remain the same temperature as the outside.

In determining how to insulate your attic, it's important to consider both present and future use of the space. If you insulate the floor of an attic presently used only for storage, but later want to turn it into living space, you'll need to provide another source of heat – new heating ducts, a space heater, etc. For this reason, think carefully before you decide to insulate your attic floor.

Insulation works on the same principles that a storm window does. It traps air, and the trapped air provides an insulating barrier. That is why thicker insulation has more resistance (or "**R value**," a measurement of the ability of a material to resist the flow of heat through it.) When you stuff or compress insulation, you reduce its R-value, because you reduce the amount of air it can trap. *(For help in choosing the best form of insulation to use or where to install it, see the separate insulation handouts in our Resource Library.)*

The same thing happens if the insulation gets damp or wet from moisture in the house. As it mats down, its R-value decreases. This is the reason that adequate ventilation in an attic is so important. Attic vents allow air movement, which carries away moisture and thus maintains the insulation at its peak effectiveness.

Just as trees, bushes, walkways, and exterior lighting all add to the total effectiveness of your landscaping plan, the various forms of insulation and weatherization work together in your house to keep the cold air out and the warm air in. When you add to these energy conservation methods some lifestyle changes, such as setting your daytime thermostat lower and lowering it even further at night, moving beds to inside walls, hanging heavier curtains, and closing off unused rooms, the savings will translate into money in your pocket, and comfort in your home.

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# Caulking & Weatherization

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# CAULKING AND WEATHERIZATION

Autumn may be a confusing time of year if you need to seal up your house for the coming winter. Where do you use caulking? Weatherstripping? Glazing? How are they different?

Don't feel alone in your confusion. There are a lot of products available, and the differences among them, where you use them, and how you use them would likely confuse many home builders as well. Let's see if we can make some sense of them. Refer to the chart on page 3 for a guide to the different products and some tips regarding their use.

First, you need to keep in mind just what you are trying to achieve – that is, to seal the exterior of your house to keep out water and cold air. The main thing to remember when you are sealing two different types of materials together is that each material will expand and contract at its own rate. So, you need a sealant that will flex with the seasons and bond to the specific surface(s) you are sealing.

**Glazing putty** is used to seal glass to the wood sash frame. If the putty is cracked or missing, cold air will bleed around the glass panel. It's easier to work with glazing putty during warm weather, but you can work indoors if it's cold outside. *(See separate handout on "Window Glazing" for how-to instructions.)*

**Spray foam** is the best product for filling a hole or crack larger than 5/8th of an inch. Modern spray foam sealants not only expand to fill up the hole, but also have insulating value. They will bond very well to just about any surface – including your hands (so wear gloves when you use them!) The foam can be trimmed easily when hardened, but will need to be painted if exposed to daylight. Plan to use the spray foam all at one time, as unused foam will harden in the can.

**Caulking** (which usually comes in a cartridge-type container, but is occasionally found in squeeze tubes,) is used to fill long, narrow gaps between similar or dissimilar materials. It comes in a variety of colors and is rated by the number of years it will stay flexible. You shouldn't cut costs and get a less expensive caulk, because you'll end up doing the job again in a year or two. Caulks with a polyurethane or acrylic-silicone base are the best all-around caulks available. Many now have a rated life expectancy (the period of time they will bond and stay flexible) of 20-30 years.

## Where to Seal Your House: Exterior

Sealing exterior gaps and seams is important home maintenance. It will reduce drafts, dirt, and moisture infiltration into the house walls and contribute to lower heating and cooling costs. You can use **caulk backer rod**, a kind of Styrofoam rope *(right)* to fill gaps, so that you won't need to use as much caulk to close the opening.


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You may need to use a combination of products to seal your house for the winter. Check the following areas on the outside of your house for places where cold air can enter:

- Where the chimney and siding meet
- Joints between eaves and gable molding
- Where the window trim (casings) and siding (or masonry) meet
- Inside corners formed by siding
- Door frames and threshold
- Where the siding meets the foundation
- Joints between masonry or concrete elements (steps, porches, etc.) and the main part of the house
- Where wires, cables, conduit, and garden hose spigots pass through the siding.

## Where to Seal Your House: Interior

Sealing each room on the inside is the only way to prevent blasts of air from entering. Even with sidewall insulation, a lot of air will leak into a house. A good caulking job will increase the comfort of your home considerably. You may find gaps so wide that caulk backer rod will be required. You can tape a piece of tissue or plastic wrap to a pencil and check the following places for air leaks:

- Where window trim meets the plaster
- Where pipes pass through walls
- Where dryer or exhaust vents exit
- Door trim (casings) and threshold
- Where baseboards meet the floor
- Outlet and switchboxes on exterior walls: **Gaskets** for outlet and switch cover plates can help prevent air leakage through the walls. If there is a gap between the box and the wall, fill the gap with caulk (It's a good idea to turn off electricity to the box to prevent a shock hazard.)

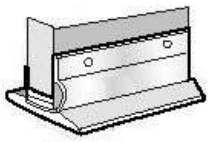
## How to Caulk:

The best time to caulk an exterior joint is in the spring or fall, since extreme heat or cold may affect curing. A standard 10.5-oz. cartridge will usually produce enough caulk to seal two or three windows or doors, if the gap is not too large.

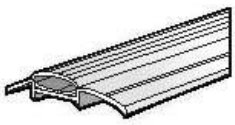
Before applying the caulk, make sure the surface is completely dry. Use a putty knife or old screwdriver to remove any dirt or loose debris, paint build-up, or old caulk from the area; you may need to use a solvent. If you are using a caulking gun, cut off the tip of the cartridge, pierce the foil seal, pull the handle back to its furthest extent and insert the cartridge. As you press the trigger repeatedly to apply the bead, pressure is applied to the end of the cartridge to expel the caulk. When you want to stop applying the caulk, turn the handle 180° to relieve the pressure.

Drawing a good bead of caulk will take some practice. Make sure the caulk overlaps both sides of the gap for a tight seal. You can smooth the bead with a wet finger, with a damp sponge or lint-free rag, or with a special tool made for that purpose.

## Weatherstripping Doors:



Door sweep with vinyl flap



Threshold with vinyl gasket

A quarter-inch gap under a door is equivalent to a four-inch diameter hole in a wall. So, you should always make the door as airtight as possible – not only at the bottom, but all the way around. There are a variety of systems you can use to seal around your door. The old-

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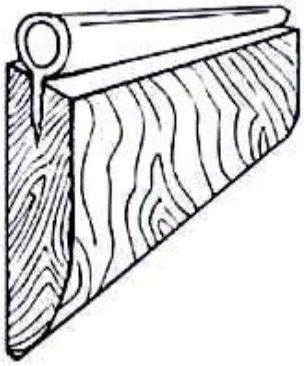
fashioned method of **door weatherstripping**, with a metal channel and metal strip that fits into it, is still the most effective. (A full-service lumber-yard or store specializing in doors and accessories are your best bets for locating this type of weatherstripping.) While some of the new plastic systems may not work as well, they will nevertheless reduce air intrusion.

Replacement doorstops with a spongy rubber-bulb weatherstripping will help seal a wood exterior door. They are nailed to the doorjamb and will work on a door that is slightly warped. Pre-hung steel doors have a thermal break and magnetic weatherstripping (much like the door seal of a refrigerator) that work well to seal out the cold. Remember that, with use, the strip along the door bottom in many systems can wear away, so you will need to check it periodically and replace it when necessary. You may also want to look for a system that will allow you to adjust the bottom weatherstripping to keep it snug as seasons change.

There are literally hundreds of ways to seal up your home. The chart below explains some of the products available and where they should be used. *(See also our separate handout on "Weatherizing Windows.")*

| PRODUCT NAME | APPLICATION & USE | COMMENTS |
|---|---|---|
| Glazing Compound | Comes in can. Apply with putty knife. Seals glass to window sash frame. | Doesn't store for too long. Replace after one year on shelf. |
| Latex Caulk | Comes in caulking tube. Bonds wood to wood (to seal around door frame, fill cracks in wood siding, etc.) | Inexpensive. Won't seal two different materials. Works best on wood. Easy to clean up. Paintable. Has a tendency to shrink. Does not remain flexible. |
| Silicone and Siliconized Acrylic Caulk | Comes in caulking tube. Best all-around caulk. Bonds to almost all dry surfaces. Long-lived; remains flexible. | Fairly long shelf life. Use paint thinner or similar product to clean up tools. Pure silicone is not paintable, and will remain sticky. Paintable silicone caulk will be less sticky after it cures. |
| Vinyl Spackling | Comes in can. Apply with putty knife. Use for patching holes or cracks in wood. | Easy clean-up. Not a sealer, but a hole-filler. |

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| | | |
|---|---|---|
| Spray Foam | Comes in spray can. Use to fill larger cracks, holes or cavities. Bonds easily to almost all surfaces. Use “low expansion” around window or door frames where swelling could move the jambs out of position; use “regular expansion” where the foam needs to swell to fill the space. | Stiffens as it cures. Once it has hardened, can be trimmed easily Must be painted if exposed to daylight. |
| Water Putty | Comes in can as a dry powder. Mix with water to plaster-like consistency. Dries very hard. Works well for patching or filling larger holes. | Strong, long-lasting product. Not a sealer, but a hole-filler. |
| Wood Hardener | Liquid used to reinforce soft wood fibers (i.e., rotted window sills) to form solid base for filling. | Dries clear. Paintable after it cures. |
| Wood Filler | Comes in can. Paste used to fill holes in wood trim. | Dries light brown. Paintable after it cures. |
| "V" Plastic Weatherstrip | A self-adhesive plastic weatherstrip adhesive to seal around doors. May also be used on most windows. | Easy to install. Fairly inexpen-sive. Seems to last 2-3 years. |
| Metal Channel Weatherstrip | A two-piece metal system used to seal doors. One piece goes on the door; the other, on the door frame. The two pieces interlock. | Long-lasting. Takes 1 to 2 hours per door to install. Positive seal to keep out cold air. |
| Door Stop with Rubber Weatherstrip Nailed to Door Jamb. | A wood trim piece with rubber weather-strip attached, used to seal doors. | Easy to install. Lasts about 5 years. Can be used if door is warped. |

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# WEATHERIZING WINDOWS

One of the most common complaints regarding older homes is windows that don't seal out cold air. Before you choose a weatherproofing method, try to determine how the air is getting in. Outside air can seep in around the window frame, around the glass panes in the sash, or around and between the sashes themselves. Depending on the source of the air intrusion, barriers can be installed to block the draft.

For air that enters the house around the outside of the window frame, a good quality **silicone caulk** is your best defense. Make sure that any old caulk has been removed, and that the area is clean and dry. Caulk all joints between the window frame and the surrounding structure. If the gap is wide or deep, you can fill much of the space with a piece of Styrofoam **backer rod** (a sort of "foam rope"), to minimize the amount of caulk that must be used. Caulk can also be applied inside, where the wood molding joins the plaster wall. You may want to consider a clear caulk in these areas.

If the source of the draft is air coming around the glass panes of your window, it's time to replace the **glazing compound** that holds the glass in place. Over time, the glazing can harden and become brittle, creating gaps between the glass and the frame. Remove the old glazing with a putty knife and replace it with fresh, smoothing the new compound with a glazing tool or putty knife so that it creates a neat and attractive seal. (Note: glazing compound has a brief shelf life; don't try to use material from a can that has been sitting in your basement for the last six months.)

One of the most common sources of drafts is around and between the sashes in the window itself. Unfortunately, the remedies for this problem are not as effective and long-lived as the barriers provided by caulk and glazing compound. You can use inexpensive **weatherstripping** (such as "V-strips") that adhere to the frame throughout the year. **"Rope Caulk,"** a temporary barrier, can be installed between the upper and lower sashes and around the frame each winter and removed in the spring. Similarly, you can cover the entire window with one of the **plastic "shrink wraps"** that you heat with a hair dryer until you have an air seal; again, this barrier must be removed in the spring to gain access to the window.

Drafts often have their source in the cavity designed to hold the sash cords in double-hung windows. Homeowners who seek to end cold drafts by replacing their windows are often disappointed with the results, unless the contractor fills the sash cord cavity with insulation before installing the new window. **Low-expansion spray foam insulation** can sometimes be added after the window has been installed, although this measure often requires removing the woodwork around the window.

These are just some of the strategies you can use to reduce drafts from your windows. They will vary in cost and complexity, but all will help you save on energy costs and increase your comfort level.

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# 29.

# Contracting Repairs

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# WHAT YOU CAN DO TO
# GET A QUALITY REPAIR

If you are planning a repair, whether do-self or contracted, there are a number of things you can do to help ensure a quality job:

**1. Do your "homework" first:**

Before you start getting estimates, learn as much as you can about the repair to be done – how the job should be done correctly, what choices you'll have regarding materials and installation methods, what your City's building code requires (for permit jobs), etc. The more you know what the "issues" are, the better prepared you'll be to discuss the repair with the professionals.

*In a few situations, even after your research, you may not be sure exactly how a repair should be made. In that case, you'll need to rely on the bidding process itself to get information. Meet personally at least three contractors and interview them. Be sure you understand how each thinks the repair should be done (ask lots of "why" questions), and then get the proposals in writing. Compare the three written bids – and, if you don't see a common thread, get another.*

**2. Ask questions:**

In most cases, your research will probably have given you a pretty clear idea of the issues you'll want to talk to the contractor or supplier about. (You may want to jot a few things down, so your questions are consistent from one person to the next.) Now, let each professional tell you what he/she is proposing. *Tip: Make it clear that you are looking at cost – that you expect a fair and reasonable price – but never give the impression that all you're looking for is a cheap job.* Ask about the **quality of materials** to be installed; if one material estimate is higher than another, ask about the difference (a higher price may be the result of a "designer look," rather than a more durable material.) Particularly for an interior job, find out if the material is easy to care for. Ask about the **construction methods** to be used – and whether, in the opinion of the professional, what is being proposed is all that will be needed for a long-lasting repair. (It won't help to replace the roofing material on a garage if the rafters and sheathing beneath it are rotted and can't provide good support.) Ask **who will do the job** – is the person who is giving you the bid a salesperson who doesn't do actual hands-on repair work, or has he/she had real experience? Who will be overseeing the work – how much will that person actually be at the job site? Will any work be left unfinished for someone else to complete (i.e., holes left in walls after plumbing or electrical work?) Ask about the **guarantees** on materials (and, if you will be contracting the work, on the labor) to be given. Ask the professional to provide a **written bid** detailing all these issues.

**3. Evaluate the information:**

Next, look at the bids and see whether you're getting a reasonable price for good workmanship. You want to end up with a repair that is structurally sound, long-lasting, and done in a workman-like manner to the current standards of the trade. **Cheaper is not necessarily better!**

*(continued)*

4. **Check references:**

   Ask for *and check* one or two households who have used the contractor for similar work, or who have had the same material installed. Find out if there were any problems with the repair, and, if so, whether they were resolved promptly.

   Also check the contractor's qualifications. If the work will require a permit, confirm with the Building Department that the contractor is licensed and bonded in your city.

5. **Think ahead:**

   Finally, spend a few minutes thinking about what *could* go wrong – paint splattered on your shingled roof, mortar smeared on a brick foundation, etc. – and see if you have something in the contract agreement to protect you. Remember – you can't necessarily rely on permit requirements to protect you. In most cases, permits will cover code issues (how deep the concrete for your driveway needs to be, for example), but don't define the qualities of workmanship that determine how the job will “look.” It's up to you to discuss those issues with the contractor and make sure everything important to you is in writing!

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Prevent Contracting Problems—

# Establish a Payment Schedule

before Work Begins

One of the most frustrating parts of dealing with a contractor can come at the end of a project, when – even though most of the work has been completed and paid for – there are a few small details that the contractor has promised to fix "in the next few days." Weeks later, they are still unfinished, and the contractor has not responded to your calls. Mild irritation has turned to total dissatisfaction with the contractor, destroying all your pleasure in the work that has been done.

What can you do to keep this all too common problem from happening? In most cases, the answer lies in establishing and managing a payment schedule in such a way that the contractor has a real incentive to finish up the detail work.

Talking over expectations – both yours and the contractor's – and negotiating the payment schedule before work starts can help prevent a myriad of problems. In developing the payment plan, Home Repair Resource Center suggests that you do not agree to a large down payment, but instead seek reasonable alternatives based on the principal of **"money paid for value received."** For most small jobs, no payment should be necessary until work is completed. On larger projects, you might offer to make a check to the store for materials that must be specially ordered; offer to pay for materials delivered to your home; or offer to make progress payments as agreed-upon portions of the work are completed.

If you and your contractor come to agreement on a series of progress payments (a common arrangement is 1/3, 1/3, and the final 1/3 after all work is done), it's best to tie those payments to completion of readily identifiable stages of the work, which have been defined in advance. For example, on a contract for a new garage, you might agree to pay a certain amount when the concrete foundation has been installed, another amount when the rough framing has been completed, and the final payment when the whole job is done.

Once you agree to a plan, stick to your guns. Remember – retaining funds until all work is done is the best way to make sure that those nagging details at the end get finished! Whether it's the last progress payment on a big repair or "payment in full" for a small job, don't give up that final check until you are ***fully and completely satisfied*** with the work. (And, if yours was a big job where subcontractors were used, don't make the final payment without proof from the contractor that all subcontractors were paid.)

A final tip – ***Before you make <u>any</u> payment (even a progress payment) on jobs for which a permit is required, make sure that the work has been approved by your city's Building Department.***

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## When Does My Repair
# NEED A PERMIT?

Homeowners often have questions about permits for repairs. Since requirements can vary from community to community, we always suggest calling your city's Building Department if you are unsure about permit requirements. The information below is based on permit requirements in Cleveland Heights:

### 1. When is a permit needed?

According to the Cleveland Heights Building Department, a permit is required:

- to demolish, alter, or make major repairs to any existing building structure, or any portion of that structure, or to build any new structure/addition
- to do <u>any</u> electrical (other than minor corrections), plumbing, heating or air conditioning work
- to do <u>any</u> concrete or asphalt work involving replacement or asphalt resurfacing, or any paving work (brick walks, etc.)

Permits are not needed for painting, gutters/downspouts, tuckpointing, sidewalk leveling, asphalt sealing, and <u>minor</u> repairs (such as replacing missing shingles or a rotted stair tread.) **Always call the Building Department if you are uncertain whether your repair requires a permit, as it may depend on the scope of the work.** *For example, no permit is needed if only roofing material and part of the sheathing are being replaced; if <u>all</u> the sheathing or any part of the roof structure is being replaced, a permit is required. (Even if no permit is required, the roofing contractor must be registered in Cleveland Heights – see below). No permit is required to replace kitchen cabinets if the new ones are the same size and in the same location; just obtain electrical and plumbing permits, as required.*

> Note, however, that if you want to build a new structure or change the design of an exterior element (from brick steps to wood, for example), you'll need to submit a plan to the Architectural Board of Review and get their approval before a permit can be issued.

### 2. Can a homeowner get a permit?

Yes. Homeowners who own and occupy a 1-, 2-, or 3-family home can obtain a permit for most repairs, *but only if they will be doing the work themselves.* **(Do <u>not</u> agree to get a permit for a contractor** – you'll lose all the protections the permit process can give you.)

### 3. What if I'll be using a contractor?

To obtain a permit for work that requires one, the contractor must be licensed and bonded in Cleveland Heights. (It's safest to call the Building Department yourself and ask if the contractor has met the necessary requirements.) Check that your contractor is licensed under the same company name as appears on your estimate – no contractor is

*(continued)*

allowed to do work under someone else's license. Home Repair Resource Center also suggests that you make sure the contractor is familiar with Cleveland Heights code before you accept their bid, to avoid unpleasant surprises ("I didn't know the City requires that sac mix for the concrete. I'll need to charge you more for it....")

Remember – *it's the homeowner's responsibility to make sure the contractor has obtained the appropriate permits for the work.* Failure to do so can result in a Stop-Work Order.

## 4. After getting the permit—what then?

The permit should be posted on a front door or window (visible from the street) work is going on. Whether the work is do-self or contracted, it must pass inspection to make sure it meets Building Code. Depending on the type of repair, the Building Department may need to inspect for code compliance at various stages during the process, as well as upon completion.

The inspections are <u>not</u> automatic – you or your contractor must call and make arrangements to get them done. (If you will be doing the work yourself, ask how to arrange the necessary inspections when you obtain the permit.) Home Repair Resource Center strongly recommends that, if you are not present at the final inspection, you *call the Building Department and confirm that any contracted work has passed the final inspection before making your last payment.*

## 5. What if the repair is a violation?

In Cleveland Heights, the inspectors for the Building Department are not the same as the inspectors who do Point-of-Sale or Systematic Exterior Inspections of your property. If you have questions about a repair on your violations list, call the Inspections Department, and ask for clarification. (An inspector from that department can come out to your home, if necessary, and show you exactly what you're being asked to do.) Usually, your violation list will indicate when a permit is required for a cited repair – but it's best to check with the Building Department to be safe, if you have any question at all. Once a cited repair has been corrected, it will be up to the Housing Inspections Department to remove the violation from your list.

## 6. Will the permit inspection ensure good work?

The permit process protects both the homeowner and the community by ensuring work is done to the current Building Code. But, the code specifies only a minimum standard, and may not cover everything that is important to you – especially details involving "quality of workmanship." It's best to make sure that those issues are addressed in your written contract. In addition, Home Repair Resource Center always suggests that the bid contain the phrase, "all work will be done to meet or exceed current standards of the trade and in a neat and workmanlike manner." *(Note: Home Repair Resource Center has developed specifications that can help you include important details for a number of common repairs.)*

One final suggestion – some contractors, believing that homeowners look only for the cheapest estimate, will submit their bid based on the least expensive way to meet code requirements. You may wish to have the contractor use more durable types of materials or repair techniques, despite their higher cost. Make sure you tell each contractor to base the estimate on those choices, and check the final contract to make sure it specifies exactly what you want to be done.

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# SUGGESTIONS FOR CONTRACTING HOME REPAIRS

## SELECTING A CONTRACTOR:

**1. GET RECOMMENDATIONS**. Ask friends, neighbors, and associates for contractors they have used and found satisfactory. Some communities provide names of contractors to residents; in Cleveland Heights, for example, a list of registered contractors can be found on the City's web site *(www.clevelandheights.com/citydept_safety_building.asp)*. Home Repair Resource Center has compiled evaluations of contractors' work by Cleveland Heights residents that you can review for ideas. These may be of help, but remember that **neither HRRC nor the City of Cleveland Heights can recommend or endorse contractors.**

**2. DO YOUR OWN CHECKING**. Ask the contractors for the names of several people in the area for whom they have done *similar* work. Call them and ask questions about the quality of the work and the response of the contractor to requests for corrections. Go see the work, if possible. You can also call the Better Business Bureau to see how long the contractor has been on file and if there have been complaints.

**3. MAKE SURE THE CONTRACTOR IS LICENSED** in your city if the work to be performed requires a permit. Check with your Building Department if there is any question about this.

## OBTAINING BIDS — Get 2 to 3 written estimates

1. Always get written estimates. Ask for an itemized cost for each major portion of the job, and *then compare the estimates,* looking at what is to be done, quality of materials and cost. (Cheaper isn't necessarily better.) A detailed, well-written estimate can be used as a contract later.

2. Find out if the person giving the bid will be doing your work (or at least overseeing it.)

## THE CONTRACT

A written contract is essential, because verbal agreements are sometime misunderstood. A well-written contract is your protection – it is your way of being sure that all items have been discussed and the work to be done is clearly described. Be sure that a responsible official of the company signs the contract and that you receive a complete readable copy. Read *all* the fine print.

*(See next page for items that should, at a minimum, be spelled out in a contract.)*

## THE REPAIR WORK ITSELF

If at all possible, be home while the work is being performed, so you can be sure that it is done as specified in the contract and that the quality of workmanship is to your standards. Then:

1. When a contractor requests payment, check the work carefully yourself to be sure it has been fully and properly done. Call your city's Building Department if a permit inspection is needed, and try to be present to talk with the inspector. **Do not sign an acceptance of work or make final payment until you are fully satisfied and all work requiring a permit has been inspected and approved.**

2. Ask the contractor for affidavits, generally called "waivers of lien," from all subcontractors used, stating that they have been paid in full for all materials and labor. Final payment should not be made until you have the affidavits.

*(continued)*

**AT A MINIMUM, BE SURE YOUR CONTRACT INCLUDES:**

1. The name, street address (not a post office box), and phone number of both parties.

2. A clear and detailed statement of the **work to be done** (i.e., scraping to be done before painting), the **quality of materials** to be used (brand/grade, weight, color, size – as appropriate) and the **cost of materials and labor** to be used in performing the work.

3. Guarantees on materials and on the contractor's labor. Quality of workmanship should be addressed. A good general phrase for all contracts is: *"All work will be done in a neat and workmanlike manner and to the current standards of the trade."*

4. Agreement by the contractor to obtain all necessary permits from your city's Building Department and to "*do all work to the code of your city."* (If drawings are required, it should state that the contractor will provide them.) Remember, Building Code generally sets only a minimum repair standard. You may wish to exceed that standard in quality of materials or method of repair.

> Home Repair Resource Center has developed many handouts to help you better understand your repairs. Also available are specifications for several common repairs – lists of specific items that should, at a minimum, be included in your contract.

5. An understanding that the contractor is responsible for any work subcontracted. If the job is large, it should state which portions will be subcontracted – and the names, business addresses, and phone numbers of subcontractors to be used.

6. Certification of contractor's workers' compensation and insurance coverage and an understanding as to responsibility for personal injury and property damage during the work.

7. Estimated start and completion dates, how long the job will take once begun and arrangements for clean-up, scrap, and waste disposal.

8. Payment schedule. The contractor may ask for an initial deposit (and this may be reasonable for materials that involve a special order), but we recommend that payment only be made for value received – for materials delivered to the site or for portions of work completed. **Payment upon completion is preferable** and should be the rule for small or quickly completed work, but progress payments are acceptable for larger jobs. A good rule is one third, another third, with the final third held until completion. Another method is to pay for definite portions of work, on a job-by-job basis (roof completed, then paid). It is not wise to pay for one third of a job if you cannot tell that one third is done. **No payment should be made for any portion of work until it has been completed to your satisfaction and any permit work has been inspected and approved by your city's Building Department.**

9. A statement that all contract changes must be in writing and agreed to by both parties.

NOTE: If you have an attorney, it would be wise to have the attorney look at the contract before you sign. DO NOT SIGN A CONTRACT UNTIL YOU ARE SURE YOU HAVE FINANCING – **and if the contractor promises to find you financing, be sure that the contract spells out the specific terms of the financing before you sign it.**

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# 30.

# Contract Specifications

(as written, for work in Cleveland Heights, OH; if used for work in other communities, modifications would be necessary)

**Addendum to Bid:**

# ASPHALT DRIVEWAY

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

> *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.
2. The driveway will be *(check one):* ❑ totally replaced ❑ resurfaced.
   Approximate square footage of asphalt to be installed: _____
3. If the drive will be totally replaced, the old drive will be *(check one):*
   ❑ removed to the dirt ❑ removed to the old base.
4. The contractor will remove all present vegetation, as well as seeds, acorns, and any other potential plants, and will spray the area with weed killer before any asphalt is applied, so as to prevent vegetation from growing through the drive during the first year after installation of the driveway.
5. *Specifically for a new driveway:* the contractor will provide a compacted base of gravel at least 4" thick; a #301 binder course of compacted asphalt at least 2" thick; and a #404 surface course of compacted asphalt at least 2" thick, all throughout the entire drive.
6. *Specifically for a driveway resurface:* the contractor will provide a new #404 surface course of compacted asphalt at least 2" thick throughout the entire drive, and will give special attention to the following area(s):
   ❑ _____ sq. ft. of low areas to be brought to grade before resurface;
   ❑ _____ sq. ft. of badly broken areas to be dug out and replaced (as specified under "new driveway" above);
   ❑ no areas need special attention.
7. The contractor will ensure that the drive has positive drainage away from the house and garage, but not in a manner that will affect any surrounding homes.
8. The contractor will ensure that the height of the drive does not exceed city requirements where the driveway meets the house (i.e., basement windows, doorway thresholds, etc.)
9. The contractor will ensure that the driveway surface will be free of craters or other depressions that will retain water to a depth of 1/4".
10. The contractor will ensure that all edges and other hand-tamped areas have a neat, straight, and uniform appearance. (The use of rough-in forms is recommended.)
11. A drain *(check one):* ❑ is required ❑ is not required by the city. If a drain is required, the cost is included in the contract price.
12. If a drain is not required by the city, in the contractor's opinion, a drain *(check one):*
    ❑ should be installed ❑ is not indicated.

*(continued)*

13. If a driveway drain connected to the storm sewer is not required by the city but is recommended by the contractor, the cost would be $_____ in addition to the contract price.
14. If a driveway drain is installed, the contractor will ensure that it is installed in a manner and location to satisfy all city code requirements.
15. The contractor will instruct the homeowner in the care and maintenance of the asphalt drive.
16. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# BOILER REPLACEMENT

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

> *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. Boiler to be installed *(please specify):*

   Brand name: _____

   Model number: _____ Efficiency rating: _____%

2. After evaluation of the house, the contractor has determined that the heating unit should be _____(BTU's) to be properly sized for maximum heat efficiency, and the boiler to be installed will meet this criteria.
3. The contractor will obtain the proper permits from the city and will ensure that all work Passes all inspections required by the Building Department.
4. Will asbestos be removed during the boiler installation? *(check one):* ❑ yes ❑ no
5. If yes, asbestos will be removed by:

   θ Licensed asbestos removal company *(specify name, address, phone):*

   _____

   _____

   Cost of asbestos removal ❑ is ❑ is not included in the bid. Amount: $_____

   θ Contractor installing boiler *(specify precautions contractor will take):*

   _____

   _____

   _____

6. The contractor will install *(check one):*
   ❑ all new piping
   ❑ some new piping
   ❑ no new piping
7. A separate flue liner *(check one):* ❑ is needed ❑ is not needed for this boiler.
8. If a flue liner is needed, its cost is included in the bid, and the contractor will ensure that the liner is installed according to the manufacturer's guidelines and city code.
9. An automatic flue damper *(check one):* ❑ will ❑ will not be installed.
10. If an automatic flue damper is to be installed, its cost is included in the bid, and the contractor will ensure that it is installed according to the manufacturer's guidelines.

*(continued)*

11. An automatic water feed *(check one):* ❑ will ❑ will not be installed.
12. A dual check backflow preventer will be installed.
13. New radiator(s) *(check one):* ❑ will ❑ will not be installed. If so, specify number to be installed and their location(s):

    _____

    _____

14. Number of radiator valves to be installed/replaced on existing radiators: _____
    Number of vents to be installed/replaced on existing radiators: _____
    New vents ❑ will ❑ will not be adjustable.
15. New zone control valves *(check one):* ❑ will ❑ will not be installed.
16. New thermostat(s) ❑ will ❑ will not be installed. Specify type and location for each new thermostat: _____

    _____

17. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, except as specified for asbestos removal, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# CONCRETE WORK

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

> *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.

2. The contractor will ensure that all concrete is installed in strict accordance with the standards established by city codes, and will conform to or exceed these standards.

3. As one measure of quality, the sack content of the concrete to be used will be _____ sacks.

4. Additives to be included in the mix, if any *(specify):* _____
   _____

   The contractor will ensure that such additives (i.e., reinforcement fiber) are mixed in at the concrete plant. The contractor will provide the load ticket as verification that the additives are in the concrete.

5. The contractor will ensure that the finished condition of the concrete is straight, level, and without depressions, and that the surface of the concrete is appropriate to its location, according to city code.

6. The contractor will ensure that control joints are installed at appropriate intervals, to conform, at a minimum, with city code requirements and current standard building practices.

7. If the concrete is to be installed as a garage floor or drive, the contractor will ensure the proper drainage of water. The contractor will contact the Building Department to determine if a drain is required. If a drain is required, the cost is included in the contract price.

8. If a drain is not required by the city, in the contractors opinion a drain *(check one):*
   ❑ should be installed ❑ is not indicated.

9. If a drain connected to the storm sewer is not required by the city but is recommended by the contractor, the cost would be $_____ in addition to the contract price.

10. If a drain is installed, the contractor will ensure that it is installed in a manner and location to satisfy all city code requirements.

11. The contractor will ensure that the concrete is poured only when the temperature is above 40°. *(Note: City Code does not allow calcium chloride to be added to the concrete for "cold weather pours.")* If the overnight temperature will drop below 40°, the contractor will cover the concrete with appropriate materials to retain heat during the curing period.

*(continued)*

12. The contractor will ensure that wet or curing concrete is protected from rain.

13. The contractor will ensure proper curing of the concrete and will instruct the homeowner in the further care and maintenance of the installed concrete.

14. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# ELECTRICAL WORK

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

> *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.
2. Electrical work to be completed will be *(select one):*

   ❑ new installation *(specify):* _____

   _____

   _____

   ❑ replacement of existing electrical work *(specify):* _____

   _____

   _____

   _____
3. The contractor will ensure that all new electrical work or replacement of existing electrical work is completed in accordance with the current adopted edition of the National Electrical Code.
4. No interior wiring will be surface-mounted (run in conduit on top of the wall surface), except as specified: _____

   _____

   _____
5. Repair of any damage to existing plaster, drywall, ceramic tile, or other wall surfaces that results from the electrical work *(select one):*

   ❑ will be completed by the electrical contractor signing this contract, except as specified:

   _____

   ❑ will be completed by a subcontractor under the supervision of the contractor signing this contract *(also complete information on back of page),* except as specified: _____

   _____

   _____

   ❑ will not be the responsibility of the contractor signing this contract

   ❑ no damage to wall surfaces will result from the repair(s) being done.

*(continued)*

6. If the work to be done requires coordination with the electric service provider, the contractor agrees to schedule the work so that interruption of service to the home is minimized.
7. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

If subcontractor(s) and/or assignee(s) are to be used:
The contractor agrees to be responsible for any part of the work that is subcontracted or assigned, and understands that the subcontractor and/or assignee must be licensed and bonded in Cleveland Heights if performing permit work.

Work to be subcontracted or assigned: ❑ all ❑ part (specify below):

_____
_____
_____

*Attach list with company name, street address, phone number, and list of specific work to be performed for each subcontractor or assignee to be used.*

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# EXTERIOR PREPARATION & PAINTING

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

> *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will prepare and paint *(check all that apply):*
   ❑ body of house ❑ garage ❑ other outbuildings
   ❑ all previously painted surfaces of house (including porches, window frames, and other trim) unless specifically excluded as follows:_____

   _____

   _____

2. Permits may be required for certain preparation methods. If applicable, the contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.

3. The contractor will not use the following methods to remove paint that is, or may be, lead-based paint:
   - open flame or burning torch;
   - machine sanding or grinding without a high-efficiency particulate air (HEPA) local exhaust control;
   - abrasive blasting or sandblasting without HEPA local exhaust control;
   - heat guns operating above 1100 degrees Fahrenheit or charring the paint;
   - dry sanding or dry scraping, except dry scraping in conjunction with heat guns or within 1.0 ft. (0.30m.) of electrical outlets, or when treating defective paint spots totaling no more than 2 sq. ft. (0.2 sq. m.) in any one interior room or space, or totaling no more than 20 sq. ft. (2.0 sq. m.) on exterior surfaces;
   - paint stripping in a poorly ventilated space using a volatile stripper that is a hazardous substance in accordance with regulations of the Consumer Product Safety Commission at 16 CFR 1500.3, and/or a hazardous chemical in accordance with the Occupational Safety and Health Administration regulations at 29 CRF 1910.1200 or 1926.59, as applicable to the work.

4. The contractor will ensure that all loose, checked or flaking paint is removed from all surfaces to be painted. All chips and flakes will be captured by a tarp made of heavy-duty polyethylene plastic sheeting (6 mils. thick) or its equivalent, and cleaned up daily.

5. The contractor will ensure that all cracks, open joints, splits, etc., are properly filled or caulked, using the appropriate material or caulk.

6. The contractor will remove any hooks, nails, or other protuberances that are no longer in use, and will fill the resulting holes properly before painting.

7. The contractor will ensure that all window glazing is repaired or replaced in all areas to be painted.

*(continued)*

8. The contractor will ensure that any unpainted surface or surface requiring priming is properly primed before painting, using a primer suited to both the material being primed and the type of paint to be used. If the surface is to be stained, the contractor will touch up any bare wood with the new stain, to act as a primer, before coating the entire surface.

9. The brand and type of paint to be used *(please specify):*
_____

10. The contractor will ensure that all painting is done only when the surfaces to be painted are thoroughly dry, when no rain is anticipated before the applied paint will dry, and when the temperature is at least 50°F (unless special low-temperature paint is specified above).

11. The contractor will follow all manufacturer's requirements in the installation of these materials, so as to keep the manufacturer's warranty of _____ years in full force.

12. The contractor will ensure that the finish coat of paint is applied to an even finish, completely covering all areas to be painted, and that all drips, spills, splatters, or overspray are cleaned immediately from areas not intended to be painted.

13. The contractor will ensure that reasonable care is used to protect all trees, shrubs, yards, drives, walks, roofs, and adjacent property from damage while painting or preparing the house.

14. The contractor shall repair/replace any gutters damaged during the course of the painting and/or preparation work.

15. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that all work will be performed by the above named company/individual *(check one)* ❑ yes ❑ no

Will subcontractor(s) and/or assignee(s) be used? *(check one)* ❑ yes ❑ no
The contractor agrees to be responsible for any part of the work that is subcontracted or assigned, and understands that the subcontractor and/or assignee must be licensed and bonded in Cleveland Heights if performing permit work.

Work to be subcontracted or assigned: ❑ all ❑ part (specify below):

_____

_____

*Attach list with company name, street address, phone number, and list of specific work to be performed for each subcontractor or assignee to be used.*

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# FURNACE REPLACEMENT

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

> *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. Furnace to be installed *(please specify):*

   Brand name: _____

   Model number: _____ AFUE rating (efficiency %): _____

2. After evaluation of the house, the contractor has determined that the heating unit should be _____(BTU's) to be properly sized for maximum heat efficiency, and the furnace to be installed will meet this criteria.

3. The contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.

4. Will asbestos be removed during the furnace installation? *(check one):* ❑ yes ❑ no

5. If yes, asbestos will be removed by:

   ❑ Licensed asbestos removal company *(specify name, address, phone):*

   _____

   _____

   Cost of asbestos removal ❑ is ❑ is not included in the bid. Amount: $_____

   ❑ Contractor installing furnace *(specify precautions contractor will take):*

   _____

   _____

   _____

6. The contractor will install *(check one):*

   ❑ all new ductwork ❑ some new duct work ❑ no new duct work

7. If new sheet metal work is to be installed, the contractor will ensure that all work will be tightly sealed and neatly done. No duct tape or other sealing compounds will be used to close gaps created by inadequate metal work.

8. A cold air return and filter will be connected to furnace. Easy access to change or clean filters will be made. The type of filtering will be *(check one):*

   ❑ replacement ❑ permanent ❑ electronic or electrostatic

*(continued)*

9. A fresh air inlet to the cold air return *(check one):* ❑ will ❑ will not be installed.
10. A separate flue liner *(check one):* ❑ is needed ❑ is not needed for this furnace.
11. If a flue liner is needed, the cost is included in the bid, and the contractor will ensure that the liner is installed according to the manufacturer's guidelines and city code.
12. If an automatic flue damper is to be installed, the cost is included in the bid, and the contractor will ensure that it is installed according to the manufacturer's guidelines.
13. New thermostat(s) ❑ will ❑ will not be installed. Specify type and location for each new thermostat: _____

    _____

14. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, except as specified for asbestos removal, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# GENERAL CARPENTRY

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*
*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

| |
|---|
| *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.* |

1. The contractor has checked with the city's Building Department and determined that a permit ❑ is ❑ is not required for this work. If required, the contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department. *(If job requires a permit, complete information on back of this form.)*

2. The contractor will ensure that all wood is fastened securely, using the proper size and type of fastener in each location. The fasteners used will be as unobtrusive as possible, without sacrificing their holding capability.

3. The contractor will ensure that all wood joints and connections are neatly and evenly cut and assembled, designed for tight fits without unreasonable gaps.

4. The contractor will ensure that all wood members are level, plumb, and evenly spaced.

5. The contractor will ensure that all work is solid and substantial, designed and built for safety and longevity, and completed in such a way that it meets or exceeds all city code specifications.

6. The contractor will ensure that all work is structurally sound and matches as closely as possible the existing style and workmanship of the home. All materials will match that already existing on the house, except as specified: _____

   _____

   _____

7. The contractor will complete the entire project, with no portions of the project left to be restored or reinstalled by the homeowner or another professional (i.e., plaster walls, moldings, electrical fixtures, railings, etc.), except as specified: _____

   _____

   _____

8. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

*(continued)*

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**To be completed if work requires a permit:**

The contractor warrants that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor warrants that all work will be performed by the above named company/individual *(check one)* ❑ yes ❑ no

Will subcontractor(s) and/or assignee(s) be used? *(check one)* ❑ yes ❑ no
The contractor agrees to be responsible for any part of the work that is subcontracted or assigned, and understands that the subcontractor and/or assignee must be licensed and bonded in Cleveland Heights if performing permit work.

Work to be subcontracted or assigned: ❑ all ❑ part (specify below):

_____

_____

*Attach list with company name, street address, phone number, and list of specific work to be performed for each subcontractor or assignee to be used.*

Contactor's Signature: _____

Date: _____

# ADDENDUM TO CONTRACT
# FOR GENERAL PERMIT WORK

**Re: work to be done for:**

**Homeowner's Name:** _____

**Address:** _____

Licensing:

1. The contractor warrants that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

   Company name: _____

   Street address: _____

   City, state, ZIP: _____

   Phone: _____

2. The contractor warrants that all work will be performed by the above named company/individual *(check one)* ❑ yes ❑ no

3. Will subcontractor(s) and/or assignee(s) be used? *(check one)* ❑ yes ❑ no
   The contractor agrees to be responsible for any part of the work that is subcontracted or assigned, and understands that the subcontractor and/or assignee must also be licensed and bonded in Cleveland Heights if performing permit work.

   Work to be subcontracted or assigned: ❑ all ❑ part (specify below):

   _____

   _____

   *Attach list with company name, street address, phone number, and list of specific work to be performed for each subcontractor or assignee to be used.*

4. Contractor's Insurance Protection:

   | | | | |
   |---|---|---|---|
   | Workman's Compensation | ❑ yes | ❑ no | ❑ n/a |
   | Business liability coverage | ❑ yes | ❑ no | |

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# GUTTERS & DOWNSPOUTS

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*
*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

| |
|---|
| *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.* |

1. Replacement gutters to be installed will be *(check one):* ❑ seamless ❑ sectional.

2. The contractor will replace *(check one):* ❑ section(s) of existing gutters
   ❑ all existing gutters.

   Approximate linear feet of gutter to be installed: _____.
   Approximate linear feet of downspout to be installed: _____.

3. The contractor will install replacement gutters of all one color *(specify):* _____.
   If only section(s) of gutter will be replaced, the new gutter section(s) will match the color of the existing gutter.

4. The gauge of the gutters to be installed will be *(specify):* _____.

5. The contractor will make all connections within the gutter system using appropriate fittings (i.e., preformed corners, elbows, end caps, and connectors.)

6. It is the contractor's best estimate that replacement of _____ linear feet of fascia board will be required, and the $_____ cost of that replacement is included in the bid. Additional fascia board, if any is needed, will be replaced at a cost of _____ per linear foot. Material to be used for any new fascia *(check one):*
   ❑ outdoor-treated wood ❑ vinyl or aluminum-wrapped fascia
   ❑ pre-painted wood ❑ untreated wood that has been primed and painted, front back, with two coats of exterior paint before installation.

7. The contractor will mortar seal all downspouts into the existing sewer lines.

8. The contractor will install cleanouts at the bottom of downspouts *(check one):*
   ❑ at all locations where a downspout joins an existing sewer line
   ❑ only at the following locations *(specify):* _____

   _____

   ❑ no cleanouts will be installed.

9. The contractor will properly caulk all joints.

10. The contractor will ensure that all gutters are secured properly to the house and are aligned at the correct slope to carry away water. If gutter hangers are used, the straps will be installed <u>under</u> the roofing shingles.

*(continued)*

11. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that all work will be performed by the above named company/individual *(check one)* ❑ yes ❑ no

Will subcontractor(s) and/or assignee(s) be used? *(check one)* ❑ yes ❑ no
The contractor agrees to be responsible for any part of the work that is subcontracted or assigned, and understands that the subcontractor and/or assignee must be licensed and bonded in Cleveland Heights if performing permit work.

Work to be subcontracted or assigned: ❑ all ❑ part (specify below):

_____

_____

*Attach list with company name, street address, phone number, and list of specific work to be performed for each subcontractor or assignee to be used.*

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# PAINT REPAIR OF PRESUMED LEAD-BASED PAINT SURFACES

## on houses built prior to 1978

*The following items and responses are to be incorporated into the bid*

*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

*These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will not use the following methods to remove paint that is, or may be, lead-based paint:
   a. open flame or burning torch;
   b. machine sanding or grinding without a high-efficiency particulate air (HEPA) local exhaust control;
   c. abrasive blasting or sandblasting without HEPA local exhaust control;
   d. heat guns operating above 1100 degrees Fahrenheit or charring the paint:
   e. dry sanding or dry scraping, except dry scraping in conjunction with heat guns or within 1.0 ft. (0.30m.) of electrical outlets, or when treating defective paint spots totaling no more than 2 sq. ft. (0.2 sq. m.) in any one interior room or space, or totaling no more than 20 sq. ft. (2.0 sq. m.) on exterior surfaces;
   f. paint stripping in a poorly ventilated space using a volatile stripper that is a hazardous substance in accordance with regulations of the Consumer Product Safety Commission at 16 CFR 1500.3, and/or a hazardous chemical in accordance with the Occupational Safety and Health Administration regulations at 29 CRF 1910.1200 or 1926.59, as applicable to the work.

2. The contractor will use protective coverings (a durable material such as polyethylene or its equivalent) on the floor, horizontal surfaces or ground, extending a minimum of 5 feet out in all directions from the surfaces being worked on.

3. The contractor will protect the occupants by:
   a. ensuring that occupants do not enter the worksite until after all paint repair and cleanup have been completed. (For projects that extend beyond one day, the contractor will clean up sufficiently each day to ensure that occupants have safe, uncontaminated access to sleeping areas, bathroom and kitchen facilities, and entryways after work hours);
   b. relocating or protecting the occupants' personal belongings in the work area; and
   c. containing dust to the work area by installing an airlock flap or comparable device.

4. The contractor will remove all loose paint and other material from deteriorated paint surfaces by wet scraping or wet sanding before repainting, except where wet scraping/sanding cannot be performed safely, such as around electrical outlets.

5. The contractor shall complete the repair of the surface by applying new paint according to manufacturer's recommendations.

*(continued)*

6. The contractor shall complete a final cleanup of the work area. This final cleanup may not begin earlier than one hour after paint repair has been completed. The cleanup is to include, at a minimum:
   a. carefully removing all protective coverings to control the spread of dust;

   *and, for interior repairs:*
   b. washing with a lead specific detergent or equivalent all hard, interior uncarpeted surfaces in the area of the repair, including floors within at least 10 feet of the repaired surface and all other surfaces within 5 feet in all directions of the repaired surface (i.e., walls, window sills, and other horizontal surfaces, excluding ceilings unless they have been repaired);
   c. if the paint repair has occurred at or near door openings, extending the cleanup procedures specified above into the adjacent rooms; and
   d. cleaning carpeted floors in the work area with a HEPA vacuum equipped with a beater-bar *(available at a modest fee to low-moderate income residents through HRRC's tool loan program).*

7. The contractor will dispose of waste from paint repair by enclosing it in such a way as to prevent recontamination of the interior or exterior of the residential property.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

*Responsibility for some of the above procedures might be assumed by the client; if so, the procedures to be completed by the client are circled and initialed by the client, and the client will sign below indicating acceptance:*

Client's Signature: _____

*Note: The above requirements are methods for paint repair in houses built before 1978, where some or all of the paint is presumed to contain lead. These requirements for controlling lead-based paint dust must be followed as a condition of participation in CDBG-funded programs. They are, however, only minimum requirements. Home Repair Resource Center encourages both client and contractor to discuss other procedures that might be used during this project and to adopt those that provide the desired level of protection. For a checklist of suggested procedures to carry out the above requirements, see HRRC's handout, "Controlling Lead-Based Paint during Your Paint Repair Project."*

**Addendum to Bid:**

# NEW MASONRY AND MASONRY REPAIRS
## (including Tuckpointing)

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*
*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

*These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor has checked with the city's Building Department and determined that a permit ❑ is ❑ is not required for this work. If required, the contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department. *(If job requires a permit, complete back of this form.)*

2. The contractor will ensure that all work is structurally correct and is performed in strict accordance with the standards established by city codes, and will conform to or exceed these standards.

3. The contractor will ensure that any new masonry units and mortar installed match as closely as possible any existing units of masonry and mortar in quality of materials, workmanship, and appearance.

4. The contractor will ensure that all work is finished in a neat manner, with no mortar slopped on the face of the masonry, and that all joints are properly filled, have a uniform width, and are tooled and raked to conform with existing masonry.

5. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

*(continued)*

**To be completed if work requires a permit:**

The contractor warrants that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor warrants that all work will be performed by the above named company/individual *(check one)* ❑ yes ❑ no

Will subcontractor(s) and/or assignee(s) be used? *(check one)* ❑ yes ❑ no
The contractor agrees to be responsible for any part of the work that is subcontracted or assigned, and understands that the subcontractor and/or assignee must be licensed and bonded in Cleveland Heights if performing permit work.

Work to be subcontracted or assigned: ❑ all ❑ part (specify below):

_____

_____

*Attach list with company name, street address, phone number, and list of specific work to be performed for each subcontractor or assignee to be used.*

Contactor's Signature: _____

Date: _____

**Addendum to Bid:**

# INSTALLATION OF EPDM RUBBERIZED ROOFING

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

> *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain any permits required by the city and will ensure that all work passes all inspections required by the Building Department.
2. *(Check one:)* ❑ The existing roof will be torn off to the wood deck and the deck primed
   ❑ the exposed wood deck will covered with underlayment
   ❑ the existing roof will be completely covered with new decking *(specify type and thickness):*_____

   _____
3. The manufacturer, type, composition, and weight of EPDM to be installed *(specify):*

   _____

   _____
4. The contractor will follow all manufacturer's requirements in the installation of these materials, so as to keep the manufacturer's warranty of _____ years in full force.
5. The contractor will provide adequate weather protection for the house or garage in the event that the existing roof is stripped off before the new roofing materials are installed.
6. If the existing roof is being torn off to the wood deck, it is the contractor's best estimate that replacement of _____ square feet of roof sheathing will be required, and the $_____ cost is included in the bid. Additional roof sheathing, if any, will be replaced at a cost of $_____ per linear foot or $_____ per plywood sheet.
7. The contractor will properly flash with new materials all protrusions through the roof, such as railing posts, vents, and all places where the roof abuts adjacent walls or other roof sections.
8. The contractor will properly and neatly terminate the roofing on all edges, according to the manufacturer's instructions. (Unless it is inconsistent with the manufacturer's recommendations, a termination bar will be used.)
9. The contractor shall repair/replace any gutters damaged during the course of the roofing job.
10. The contractor will be responsible for properly maintaining the work site, for storing Materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

*(continued)*

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# COLD PROCESS MODIFIED BITUMEN ROOFING

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*
*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

*These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain any permits required by the city and will ensure that all work passes all inspections required by the Building Department.

2. The old roofing materials will be torn off to the bare wood before the new materials are installed.

3. The manufacturer, type, and weight of the modified bitumen roofing material to be installed *(please specify):* _____

   _____

   _____

4. The contractor will follow all manufacturer's requirements in the installation of these materials, so as to keep the manufacturer's warranty of _____ years in full force.

5. The contractor will provide adequate weather protection for the house and/or garage being roofed in the event that the existing roof is stripped off before the new roofing materials are installed.

6. It is the contractor's best estimate that replacement of _____ square feet of roof sheathing will be required, and the $_____ cost is included in the bid. Additional roof sheathing, if any, will be replaced at a cost of $_____ per linear foot or $_____ per plywood sheet.

7. The contractor will install one ply of base sheet as underlayment for the roofing material. The base sheet will be of the type specified by the manufacturer of the modified bitumen roofing material. The base sheet will be seam-lapped 2” and end- lapped 4”. The contractor will fasten the base sheet with cinch-type nails (cap-nails) driven along the lap seams no more than 9” apart and down the center of the sheet in a staggered pattern 18” on-center.

8. The contractor will fully adhere the roofing membrane to the base sheet according to the method specified by the manufacturer of the modified bitumen roofing material, using the specified adhesive. The membrane layers will have 4” seam laps and end laps of 6”. If the roof pitch is steeper than 1-12, the contractor will use roofing nails (spaced 9” apart) in the factory selvage to prevent the material from slipping. The contractor will remove all excess adhesive along the seam lines.

9. The contractor will install drip edge along all lower edges of the roof.

*(continued)*

10. The contractor ❑ will ❑ will not install drip edge along all rake edges of the roof.

11. The contractor will properly flash with new materials all protrusions through the roof, such as railing posts, vents and all places where the roof abuts adjacent walls or other roof sections. The flashing material and installation method will be consistent with those specified by the manufacturer of the roofing material.

12. The contractor will not install any roofing materials when the temperature is below 50°, without the homeowner's permission.

13. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# SHINGLED ROOFS

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*
*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

*These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain any permits required by the city and will ensure that all work passes all inspections required by the Building Department.
2. *(Check one):* ❑ the new roofing materials will be installed over the existing roof, or
   ❑ the old roofing materials will be torn off to the bare wood before the new materials are installed, and the removal of all layers is included in the contract price.
3. The manufacturer, style, composition, and weight of shingle to be installed *(specify):*

   _____

   _____

   _____

   *(Color is to be customer's choice.)*
4. The contractor will ensure that all shingles are from the same manufacturer's lot number, to assure consistent coloration.
5. The contractor will follow all manufacturer's requirements in the installation of these materials, so as to keep the manufacturer's warranty of _____ years in full force. Installation method will be: ❑ hand nailing ❑ power nailing with pressure adjusted properly to avoid overdriving the nail into or through the shingle.
6. The contractor will provide adequate weather protection for the house in the event that the existing roof is stripped off before the new roofing materials are installed.
7. It is the contractor's best estimate that replacement of _____ square feet of roof sheathing will be required, and the $_____ cost is included in the bid. Additional roof sheathing, if any, will be replaced at a cost of $_____ per linear foot or $_____ per plywood sheet.
8. The contractor will install _____ lb. roofing felt as underlayment for the shingles.
9. Rubberized roof underlayment, such as Ice-Guard, will be installed along the lower edge of the roof (3 feet minimum) and wrapped around the roof deck to the fascia board; the same material *(check one):* ❑ will ❑ will not be installed in all roof valleys.
10. The contractor will install new aluminum valleys, apron, step flashing, stack boots, and chimney flashing to replace existing flashings. (No existing flashing will be re-used.) No unfinished aluminum flashing will be installed; all flashing will match as closely as possible the color of the roof shingles *(color to be customer's choice).*

*(continued)*

11. The contractor will counter-flash all chimneys and imbed the flashing in mortar joints (grind and tuck method, using reglets).
12. The contractor will install drip edge along all lower edges of the roof.
13. The contractor ❑ will ❑ will not install drip edge along all rake edges of the roof.
14. The contractor will install roof venting *(specify number and type):* _____

    _____
15. The contractor will not install any roofing materials when the temperature is below 50°, without the homeowner's permission.
16. The contractor will ensure that materials are delivered to the site no more than three days before they are to be installed.
17. The contractor shall repair/replace any gutters damaged during the course of the roofing job.
18. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# VINYL SIDING INSTALLATION

*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*
*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

| |
|---|
| *These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.* |

1. The contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.
2. The contractor ❑ will ❑ will not remove the existing house siding before installing the new vinyl siding.
3. If the existing siding will not be removed, the contractor will evaluate the existing siding for signs of rot, replace any rotten wood and secure any loose boards before installing the vinyl siding. (Cost of wood replacement is included in the bid.)
4. If the existing siding will be removed, the contractor will repair or replace any sheathing and/or other structural members under the siding that show signs of deterioration or rot before the new siding is installed. If replacement is needed, the additional cost will be $_____ per square foot.
5. If the existing siding is to be removed, the contractor will install a house-wrap material beneath the vinyl siding *(specify type:* _____*)*
6. Insulation ❑ will ❑ will not be installed before or during the siding installation. *If so, specify the material to be used, R-value, and application method:* _____
   _____
   _____
7. The manufacturer, style, and gauge of siding to be installed *(specify):* _____
   _____
   _____
   *(Color is to be customer's choice.)*
8. The contractor will ensure that all siding panels are from the same manufacturer's lot number to assure consistent coloration of the finished work.
9. The contractor will install all siding so that it is straight, level, plumb, and even, without any appreciable dips or deviations.
10. The contractor will ensure that all joints between courses of siding are randomly placed, not lined up above one another in a symmetrical manner.
11. The contractor will ensure that existing venting under soffits and/or on gable ends of the roof is not covered or reduced by the new siding. If the existing venting is insufficient, the contractor will install proper new venting as part of this contract.

*(continued)*

12. The manufacturer, type, and gauge of trim material to be installed *(specify):* _____

_____

_____

*(Color is to be customer's choice.)*

13. The contractor will install trim molding around all doors and windows.

14. The contractor will cover all trim pieces (facia, soffits, porch details, etc.), except as specified: _____

_____

15. The contractor will ensure that all trim work matches the architectural appearance of the wood members being covered, except as specified: _____

_____

16. The contractor will ensure that all aluminum or vinyl trim work is neat, that it fully encloses the wood member(s) it covers, and that it is properly caulked.

17. The contractor will ensure that all trim molding is cut to the proper length and is installed in a consistent manner around the house.

18. The contractor will ensure that the exterior of the house has a contiguous, weatherproof enclosure by properly installing and sealing the siding and related trim products.

19. The contractor will use no visible nails or screws on the siding or soffit materials. If necessary, aluminum trim nails colored to match the trim may be used on aluminum or vinyl trim pieces.

20. The contractor will follow all manufacturer's requirements in the installation of these materials, so as to keep the manufacturer's warranty of _____ years in full force.

21. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# WOODEN RAILINGS

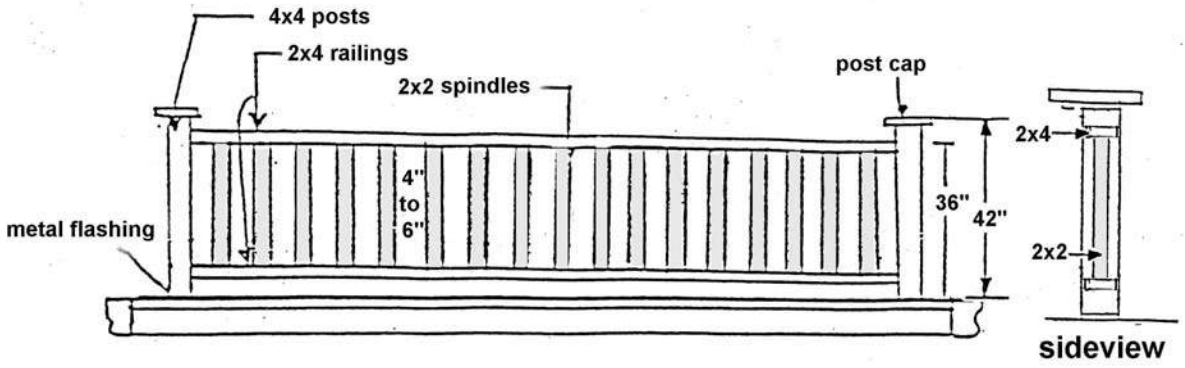
*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

*These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.
2. The contractor will construct the railings in such a manner that all wood joints and connections are neatly and evenly cut and assembled, and the proper size and type of fasteners are used.
3. The contractor will ensure that all posts, spindles, and rails are level, plumb, and evenly spaced.
4. The contractor will construct the railings so that they are solid and substantial, built and designed for safety and longevity.
5. The contractor will install new rails and spindles. If an existing porch railing is being replaced, the replacement rails and spindles will match the existing rails and spindles in size, shape, and spacing, unless doing so would conflict with city code requirements. If no porch railings presently exist, the style below will be utilized *(required to meet Ohio Historical Preservation Society rules, if applicable):*




Note: This diagram depicts railing style only. For appropriate measurements, see city policy bulletin on Exterior Steps.

*(continued)*

6. If the railing is installed on a roof, all places where the railing is attached to the roof, such as posts, will be properly flashed in the method appropriate to the roofing material.

7. If the wood used is not Wolmanized outdoor-treated wood, the contractor will prime and paint the railings in a timely manner to prevent warping or other damage.

8. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____

**Addendum to Bid:**

# WOODEN STEPS

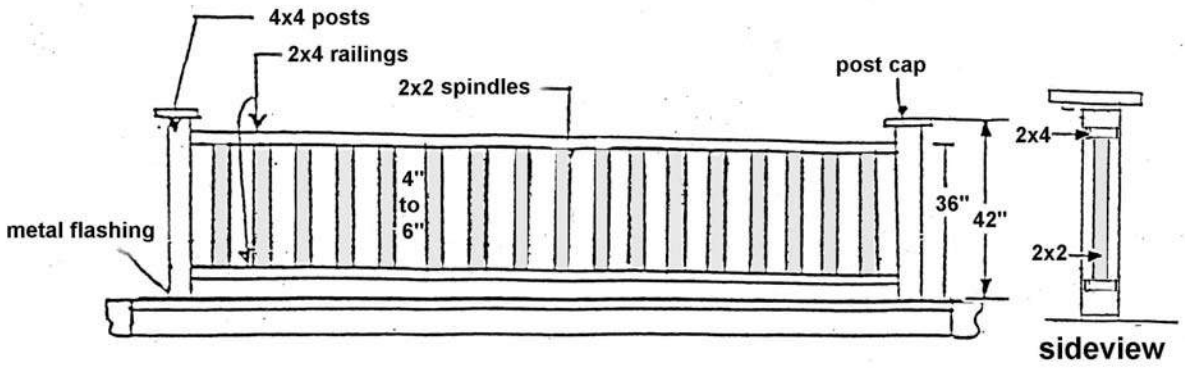
*The following items and responses are to be incorporated into the bid*
*for* _____ *(customer)*

*at* _____ *(address)*

*If the bid is accepted, then this addendum will be incorporated as part of the contractual understandings.*

*These additions are NOT INTENDED to be, or to substitute for, a complete written description of the scope of the work or materials.*

1. The contractor will obtain the proper permits from the city and will ensure that all work passes all inspections required by the Building Department.
2. The contractor shall determine if a proper base for the steps, one that meets or exceeds the standards established by city code, is present. If such a base is not present, the contractor will provide one, with the price for providing the base included in the price for the steps.
3. The contractor will construct the steps so that they are solid and substantial, built and designed for safety and longevity, and so that they will meet or exceed all city specifications pertaining to step construction.
4. The contractor will ensure that all wood used is Wolmanized outdoor-treated wood. Exception: If a painted deck on the porch or landing is desired, then non-Wolmanized tongue and groove flooring will be acceptable.
5. The contractor will construct the steps in such a manner that all wood joints and connections are neatly and evenly cut and assembled, and the proper size and type of fasteners are used.
6. The contractor will ensure that all posts, spindles, and rails are level, plumb, and evenly spaced.
7. The contractor will install new step rails and spindles. If a railing is present on porch or steps, the new step rails and spindles will match the existing rails and spindles in size, shape, and spacing, unless doing so would conflict with city code requirements. If no railings presently exist, the style below will be utilized *(required to meet Ohio Historical Preservation Society rules, if applicable):*




Note: This diagram depicts railing style only. For appropriate measurements, see city policy bulletin on Exterior Steps.

*(continued)*

8. The contractor will be responsible for properly maintaining the work site, for storing materials in a safe and secure manner, for removal and disposal of any and all debris generated by the work performed within 24 hours, and, upon completion, for cleaning the site to a pre-work condition.

The contractor warrants that all work will be done in a workmanlike manner, to conform to current standard building practices and to meet or exceed any city code requirements. Work will be guaranteed against defects of materials for _____ years and against defects in workmanship for _____ years after date of completion.

The contractor warrants that he/she will perform the work described above, and that he/she is licensed and bonded to do this repair in the City of Cleveland Heights as follows:

Company name: _____
Street address: _____
City, state, ZIP: _____
Phone: _____

The contractor agrees that there will be no assignment or subcontracting without the express written permission of the client.

*The contractor, by his/her signature, agrees to all the terms and conditions of this Addendum, unless otherwise noted above.*

Contactor's Signature: _____

Contractor's Name *(please print):* _____

Date: _____