HOME MAINTENANCE

Tips For [illegible] People

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Introduction

Seems like every time you turn around something else in you[r] is d[e]manding attention. But that's what home ownership is about. Go[od] maint[e]nance can extend the life of equipment in your home. Poor mainte[n]ance will [s]hor[t]en it. Good maintenance can enhance your daily life, while p[oo]r ma[i]nte[n]ance can cause headaches.

And when the time comes to sell your home, good maintenance c[an] make the difference between getting a quick sale, at your price, versus months of agonizing slow activity and "lowball" offers.

We've Seen A Lot Of Houses

We are professional home inspectors, and [we] have in[s]pected homes. We seethem in every condition imaginabl[e] [a]nd when [they] are on the active real estate market. That's when poor m[ain]tenance catches up [with] buyers steer clear of poorly maintained homes and [gra]vitate to [those] that are well-maintained. Don'tget caught in that trap. Enj[oy] your hom[e] to the fullest, maintain it well, and reap the benefits. Avoid pro[blems] that can come back to haunt you. Follow the recommendations in here, and y[ou] will be ahead of most homeowners.

This book was written b[y] [Ja]mes B. Ca[rey], a professional home inspector with HomeTech System[s], a home inspecti[on] company serving the Washington metropolitan area. [He has] inspected over 160,000 houses over the past 30 years, and maint[enance] lessons have been gleaned from those inspections.

This book is de[signed] to help you understand your home's systems better, because the more yo[u] understand th[em] the more you appreciate the need for periodic—and simpl[e] maintenance. As the systems are described, good maintenance practices ar[e] described. Also, there is straightforward advice on which m[ain]tenance tasks you can undertake yourself and those best left to hired p[ro]fessionals.

Enjoy yo[ur] home and [use] this book to help keep your house in mint condition.

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Water in the Basement...Unwelcome Guest

A wet basement is not fun, and emotion can get the best of yo[u] yo[ur] springs a leak. You'll want immediate action to correct the pro[blem] b[ut] if you understand where water in a basement can originate, you [can] take the most effective (and often least expensive) corrective steps.

Many people automatically assume that water coming into a basement can [only] come from underground: a high water table or a spring, f[or] ex[ample]. That's poss[ible], but generally not the case. Water in a basement can be t[raced] to sources: [plumbing] leaks, ground water, and rain or melting snow. If you have a [wet] [base]ment, s[tart] by examining your plumbing system to make sure that there [isn't] some [hidden] where that is allowing water to trickle its way through t[he] [foundation] ar[ea] [and] pop in your basement. Don't forget to check your outside [faucets] (hose bibs) to ma[ke] sure they are not leaking, and if it's winter, check for [exposed] pipe[s] [prone] to freezing. Then, if you have ruled out the plumbing, let's move [on] to [the] [most] source of water in a basement: ground water.

Built In Defenses A[gainst] Ground

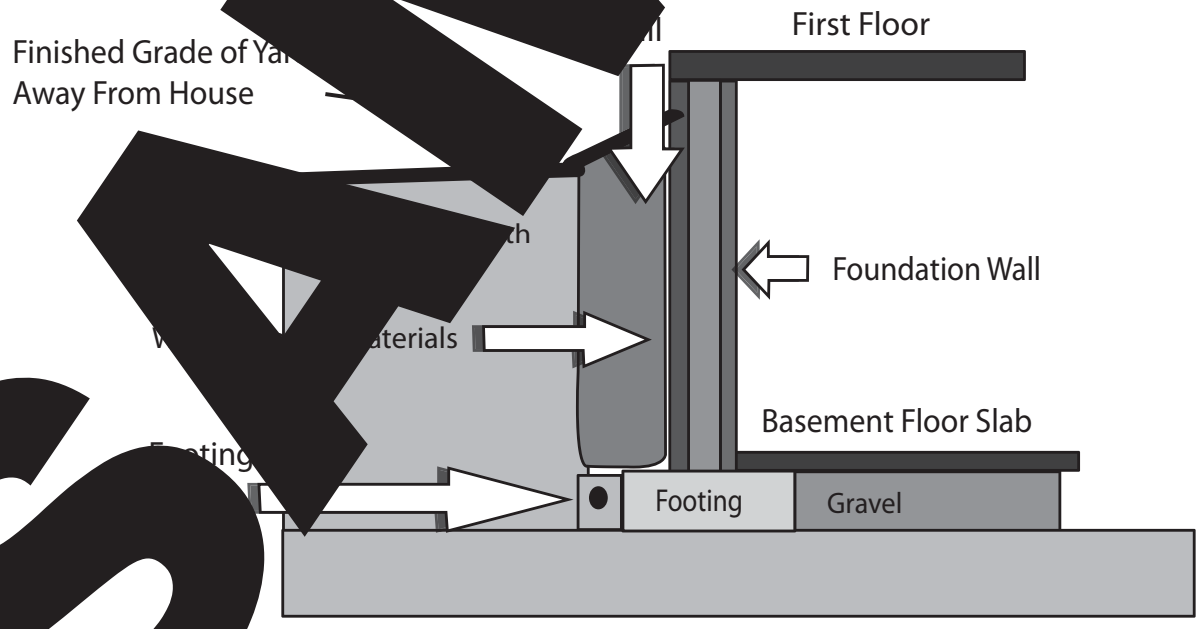
Most homes with basements [have] [two] lines [of] defense against ground water: footing drains, waterproofing compounds, and [an] [effective] slope away from the foundation wall out into the yard.

Footing D[rains]: [Most] [base]ment's foundation walls are special underpinnings called *foot[ings]* [that] are like [concrete] piers and provide a stable base for the foundation. Footings need [to stay] dry and secured, so a perimeterdrainage system is installed. This system, consist[ing] [of] perforated pipes, captures water and transports it to a new lo[cation] [that] may be the b[ack] of the yard, or a shallow well constructed for that purpos[e] [in a] [hole] in the basement called a sump, in which there may be a wate[r] [activated] p[ump] to evacuate the water. If there's a pump, there will be a pipe leading fro[m the] [sump] outside. (Go outside and make sure that pipe is long enough to get the wat[er] [away] from the house: 2 or 3 feet ought to do it.) It is unusual for the footing drain itself t[o fail] if it was properly installed, though they may become clogged with [silt] that has filtered [through] the protective gravel.

[Waterp]roofing Compounds On Foundation Wall: The next step is the application of [waterp]roofing compounds on the exterior of the foundation wall.

This may have been a one step or a two step process. In a one st[illegible]ess, a tar-like substance is applied to the foundation wall, or a silicone [illegible]und[illegible]sed. The purpose is to create a protective film that will repel wat[illegible] two[illegible]pro-cess, a thin cement-like mixture, called parging, is applied[illegible]fou[illegible]n wa[illegible] to seal the porous surface. Then waterproofing is applied.[illegible]erre[illegible] as water*proofing*, this is a relative term, and with extreme wat[illegible] soil adjoining the foundation wall, water can work its way around t[illegible]r through the smallest cracks in it.

Positive Grade in the Yard: When [illegible] was com[illegible]n your home, the finished grade of the yard sloped aw[illegible] ho[illegible]d tapered into the yard, directing water away. Any rai[illegible]er th[illegible]ome would then flow out into the yard to be absorb[illegible]tance[illegible]r foundation. Unfortunately, the critical part of you[illegible]e area ne[illegible]st your founda-tions—the first 4 to 6 feet. This ar[illegible]erred[illegible]backfill Backfill is dirt re-placed after excavation. Backfill d[illegible]ve t[illegible]mpaction or firmness that un-disturbed earth further out does. Th[illegible]at it typically settles, slumping into a little shallow ditch wh[illegible]water [illegible]late. This is the most frequent cause of wet basements bec[illegible]r ponds[illegible]fill area, percolates down into the soil adjoining yo[illegible]ll, and[illegible] finds little openings in the waterproofing coat.



If Water Problems Appear

The original waterproofing system should serve the home well for [illegible] years. However over time some part of this system may fail. Let's take a closer look at what can happen.

Usually The Problem Is Ponding Rainwater. Water in the basement usually stems from the fact that rainwater is ponding at your foundation wall. Rainwater should roll off the roof, flow into gutters and downspouts, and then continue on its way out into the yard. There it will slowly percolate into the soil. The gutters, downspouts and yard grade (slope) are major elements in this system. When one part of the system fails, water can pond at the foundation wall. Once the soil is saturated, it will take it inside the basement.

Settlement of the Backfill Around Your Foundation: Settlement can occur in this area, and a shallow depression may develop which can catch water. Take time to look at your yard. Does it slope toward the house in any way? Are there dips or indentations near the foundation wall? Can you see the waterproofing compound coated on your foundation walls? (Remember, all of the waterproofing compound was hidden by the original yard grade when the house was built. If you see it, the yard has settled.) Now look at nearby patio, walkway and sidewalk areas. If any are sloping toward the house, they too are directing water toward your foundation. Any of these could be the source of that water you're finding in the basement.

Clogged Gutters: Water rolls off your roof into gutters. When they are clean and properly aligned, they work well. But if they are clogged, the process can break down. Leaves and debris can cause the water to spill over the edge, and wind up next to your foundation wall. On the other hand, your gutters may be perfectly clean free of leaves or debris but they could be out of alignment. Gutters are supposed to slope downward, toward the downspout so that water can be easily directed by gravity. (The slope should be approximately one inch every 16 to 20 feet.) However, if the alignment is not correct, water can simply pool in the gutters, and then flow over the edge directly at your foundation wall. Next stop for the water is your basement.

Downspouts Dumping Water At Foundation Wall: Downspouts should be securely attached to the gutters, with an elbow at the bottom and a section of corrugated extending from it to transport water into the yard. The downspout's task is to receive the water from the gutter, direct it off the walls and then move it as far from the house as is practical. Typically there is a splash block at the bottom of

the downspout, made of concrete or heavy plastic. It is there to h[illegible]e force of water coming out of the downspout. Sometimes, simply dum[illegible]cted[illegible]terat the foundation. The pipe at the bottom may be too short [illegible] mis[illegible] The splash block may be tilted and directing the water again[illegible]oun[illegible]wal particularly if there has been settlement nearby in the bac[illegible]

Correcting The Problem

Correcting a wet basement problem is a step-by-step process. Start w[illegible]n-plest, and least expensive, actions. Work toward[illegible]e more complex and ex[illegible]sive if needed.

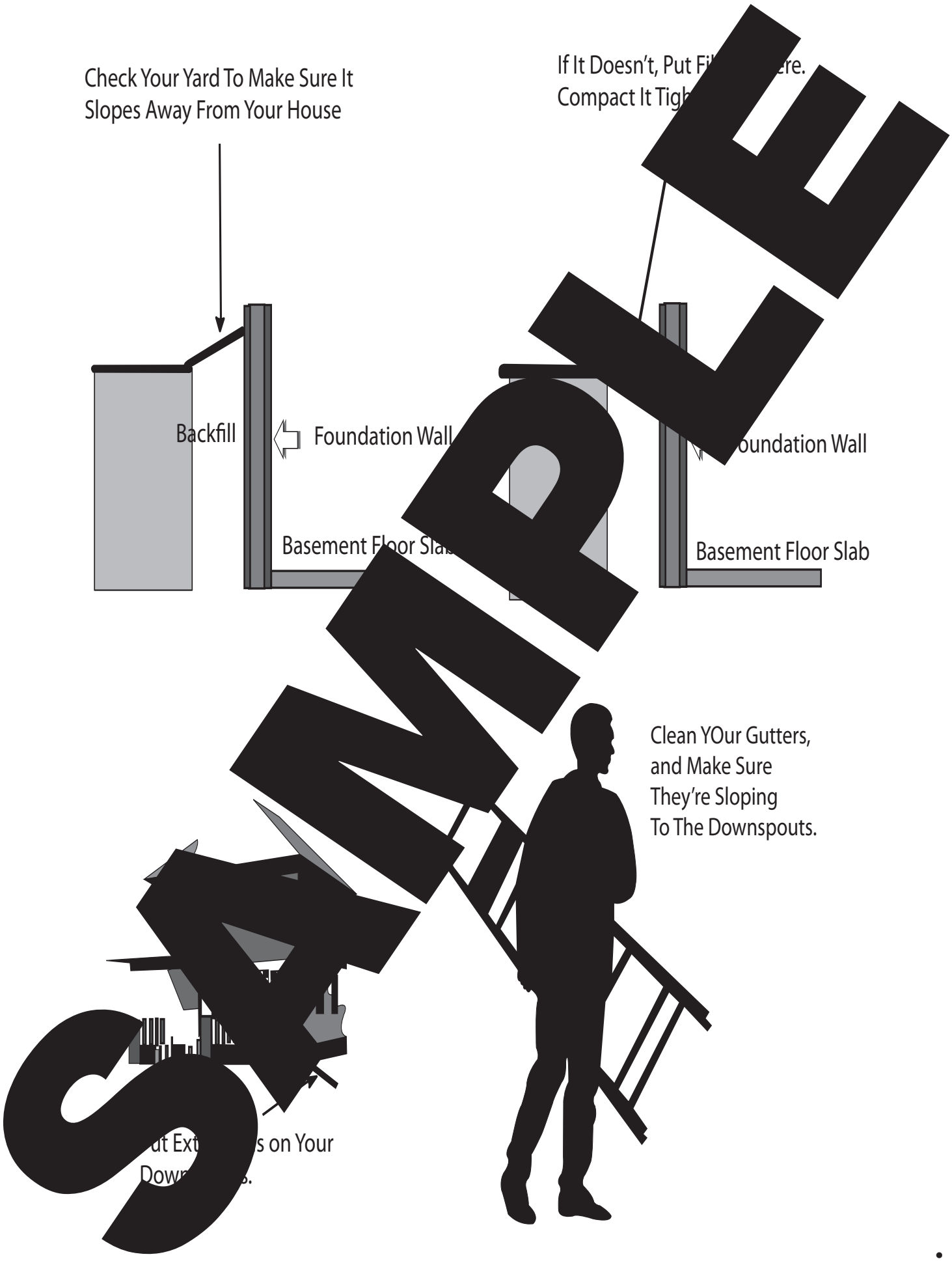
Do This Before You Try Anything Else.

Start by critically examining your yard n[illegible]foun[illegible]find any settled or sunken areas. If you can see exp[illegible]fing c[illegible]d on the exterior of your foundation (it's usually b[illegible]nce [illegible] asphalt-based compound), your yard has settled. Your original [illegible]rade c[illegible]d it completely. Even if you don't see the waterproofing, you[illegible]yo[illegible] has slumped into a shallow ditch near the house. That's where th[illegible]ecting to start its journey into the house.

Correct this problem wit[illegible]se top[illegible] Topsoil is a fine finish dirt used to encourage plant roo[illegible]ill wash away immediately after to put it down. Besides, it's expe[illegible]In[illegible]a high clay content fill dirt that you can compact w[illegible]foot [illegible]back[illegible] shovel.

Create a positiv[illegible]e the house. You want an angle that's about 1/2 to 1 inch p[illegible]the fi[illegible]o 6 feet. This will allow any water that lands next to the house[illegible]kly out into the yard before it has a chance to percolate down next to your[illegible]on. Then take the next step. Install extender pipes o[illegible]outs. Ther[illegible]e several types of extenders available. Some are the[illegible]spouts, and blend with them. Others are made of heavy pl[illegible]PVC)[illegible]bed and flexible. On top of the ground they are not the mo[illegible]ti[illegible]t they are designed to be buried and out of sight. A good hardware sto[illegible]you a selection of extender materials, as well as instruction instal[illegible]m. Next, clean your gutters thoroughly so that they really convey wate[illegible]downspouts rather than dumping it over the edge next to the fo[illegible]wa[illegible]low. Check to make sure that they are sloping toward the do[illegible]ey don't slope correctly, get someone to re-align them so they wo[illegible]rk.

[illegible] steps, and see if your basement dries out.

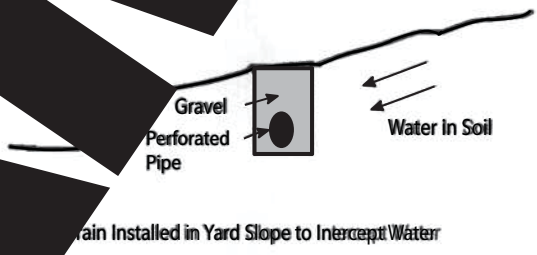

Check Your Yard To Make Sure It
Slopes Away From Your House
If It Doesn't, Put Fi re.
Compact It Tigh
Backfill
Foundation Wall
oundation Wall
Basement Floor Sla
Basement Floor Slab
SIMPLE
Clean YOur Gutters,
and Make Sure
They're Sloping
To The Downspouts.
ut Ext s on Your
Down s.

If It Doesn't, Your Lot May Have a Problem Slope or Problem

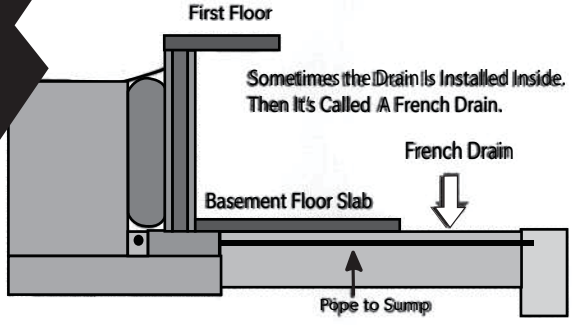
Your home may sit lower than your neighbors', or your lot m e do ward to your house, and rain runoff heads straight to your foundati you may have problem soils—typically heavy clay which retains w om rate and causes areas next to your foundation wall to becom Aft heavy rain, these soils can retain so much water that it overwh of your drainage system to remove the volume before it creeps into y .

Special Drains

You may need to install a special drain to inter oming tow house, called a curtain drain. It is built in the same way ting was built, and functions in much the same manner. Co ing o ith crushed stone, perforated piping is installed to i rans dwater away. As groundwater infiltrates the trench pipe, w n directs it to a distant part of the yard, a drywell, o p with eractivated pump. The materials for a curtain drain are not bu an extremely labor intensive effort. While some homeowners a dertake the work themselves, generally it is a project best l a wa ontractor. Sometimes it is not feasible to install a drain in espec ome has been landscaped over the years. In those can be lled in the basement itself. It involves digging up the nd the perimeter, then digging the trench below that. The pipe pl th rects the water to a sump with a pump installed. Thi d a Fr drain, d is a complex and costly solution, though sometime



rain Installed in Yard Slope to Intercept Water



Cracks In The Basement

Many homes have small cracks in basement floors and wa[illegible] in [illegible]ases they are not cause for concern. Over time houses settle ar[illegible]stres at joints in materials can cause small cracks to appear. In [illegible] this normal part of the home's settling in on its foundation. However, [illegible] where other factors are at work, and those cracks are causes for conc[illegible]ac-tion. The key is to be able to tell the differenc[illegible] Most times this determ[illegible]ation should be left to a trained professional, a quali[illegible]e inspector o[illegible]eded, a structural engineer. Nevertheless, here are som[illegible]umb th[illegible]help you if you experience cracks in your own basement.

Cracks In Basement Floors

Fine, hairline cracks often appear [illegible]rete b[illegible]nt floors. As a general rule, these are not cause for alarm. Mo[illegible]sements have a concrete floor which is not built as part of [illegible]e fou[illegible] is constructed separately.It is sometimes called a floating [illegible]use it [illegible]d of gravel or sand, and moves slightly with c[illegible] bed: [illegible]. The underlying gravel or sand allows water to pass t[illegible]cing its way up into the house. Very often that floating motion cre[illegible]fte[illegible]ses in the slab itself, and the result is a hairline cra[illegible]The crac[illegible] app[illegible]where an opening has been cut into the s[illegible]mp or steel columns are located. Hairline cracks in a base[illegible], and generally not serious.

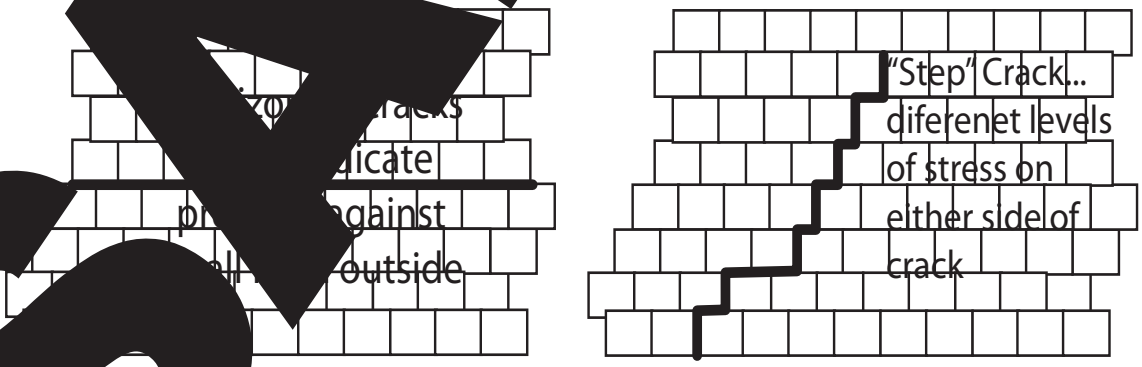
But there are exceptio[illegible]e cracks are more than 114" wide; (B) if they appear to be getting larger, [illegible]water is seeping through the cracks. If your home h[illegible]concentr[illegible]n, even the narrowest crack is enough to allow ra[illegible] experiencing any of these conditions, it's time for some[illegible]sional[illegible] If you are experiencing wide or moving cracks, it would be w[illegible]ro[illegible]with a structural engineer. If water is coming up through those cracks, [illegible] the first chapter on ***Water in the Basement*** and follow the [illegible]outlined t[illegible] you are concerned about radon, first have a radon concen-[illegible]on t[illegible]a c[illegible] testing lab; then you can have the cracks sealed. You can seal [illegible]lf [illegible]th a special caulk available at a nearby hardware store, or [illegible]ompany that installed the radon mitigation system.

If you are finishing your basement and you will put carpet, wood ing or tile on the concrete, here are some steps to take. First, monitor the for riod of weeks to make sure they're stable, not widening in size. is n ern- ible movement, you can proceed. As an added precaution e Aft that the carpet, flooring or tile can go down. Simple hair ld n no problem.

Cracks In Basement Walls

Cracks may appear in your basement walls, vi on the ins he out- side, or both. Pay special attention to them. Answ stio

Which direction does the crack run? Is i vertic r step" along joints between blocks in the wall? T ack ge ly is the more erious because it might indicate gr sure a the wall from the outside. Pressure can be caused by sever bu commonly it is hydrostatic pressure from water in particular so ly expansive clays. These lay formations can expand drama lly wh they shrink when dry. It can be a bit like a battering ram ur fou vertical crack, or one that is stair step, is likely caus stress g the base of the wall. It may result from simple settlemen ts foundation and footings. In other cases, water has gotten down ugh the soil at the foundation base in one location, ca sag the er part stays rigid. Upward stress movement—wat ndation and pushing up, for instance—can cause differ



How large is the crack at its smallest gap and at its largest? Hairline, about 1/8", or 1/4"? Or is it larger? Once the crack passes the hairline stage and measures between 1/8" and 1/4", it's time to start monitoring. (If the crack is much larger than that, don't wait. Call a qualified home inspector immediately for an initial assessment, and be alerted to the fact that the inspector may ultimately recommend the services of a structural engineer.)

Monitor the crack. Is it moving? Measure the width of the crack at several points, and mark points on both sides with an indelible pen at specific distances from each other. It doesn't really matter what distance you choose, say 1" or 2", what you want to determine is whether the distance between the points increases over time, indicating widening of the crack. Come back periodically, each week, and re-measure the distance between the points. Is the separation increasing? Once you have answers to these questions, you can formulate an action plan. If the cracks are vertical or stair step, hairline and showing no appreciable movement, then check outside for signs of water moving or funneling down the foundation wall.

Go *through the checklist outlined in the previous section on wet basements*. Check your gutters. Check downspouts. Do they have extenders on them? Check for settlement in the first 4 to 6 feet around the foundation wall to see if a shallow moat might be forming where water could pool. Check concrete patios, sidewalks, driveways and other impervious surfaces that might be causing water to run toward the house. If downspouts are attached to an underground drainage system, see if you can determine if there might be any holes or gaps which allow water to run out.

If you need some professional assistance in these tasks, call a home inspector who does this work. If the problem is water-related, taking the steps outlined in the previous section will usually provide a solution. On the other hand, if the cracks have a different cause, the inspector may recommend that you consult a structural engineer. It may be a week or two before you can get an appointment with the engineer. The recommended actions may be expensive, but it's better to address the problem sooner rather than later.

Your Roof: The First Line of Defense

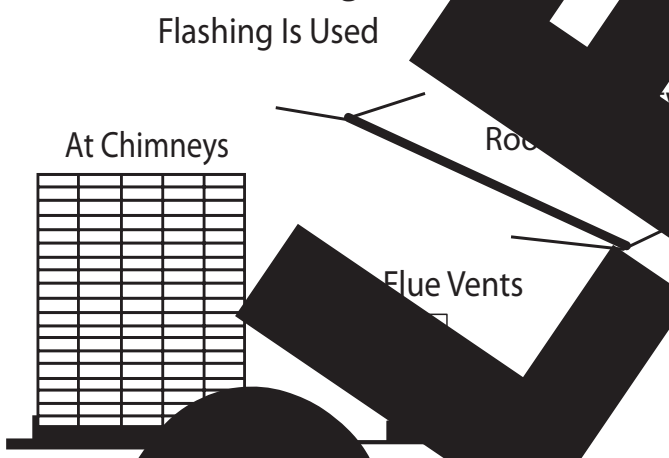
(We do not recommend that you try roofing repairs. Climbi[ng] roo[f] [haz]ardous, and proper repairs require training and experience. D[o] inj[ure] Call a roofer.)

Roofing materials add beauty to your home, but the primary function of a roof is to keep water from getting into your house. It is a key part of the home's waterproofing system, so it pays to keep it in good shape. If water gets into the wood in your home's structure, the result can major, and expensive, repairs.

To better understand a roof syste[m] a moment to study how it is built. roof actually starts in the at[tic] with a str[uctu]re system that holds it up, and holds it on when wind[s] The st[ruc]ture may be rafters and a ridge board (in older ho[mes] be pre-engineered trusses (in newer homes). A flat surface is plac[ed] op[on] this structure, called a roof deck or roof sheathi[ng] can be [made] from [indi]vidual boards, plywood, or if your home is new, it m[ay] [be] a composite material such as waferboard or oriented stra[nd] [b]oard. This provides the surface to which the exterior roof covering [is] [a]ttached. On the [out]side, the surface of the roof deck will be covered with a special [m]aterial—typically roofing felt—to seal out water. This material is [im]pregnated with asphalt to repel water. On top of this is the fi[nish] roofing ma[teri]als which distinguish your home. Some types of roof[ing] [re]quire more maintenance than others. As a general rule of thumb, t[he] [mo]st expe[nsive] coverings are those that are labor intensive—usually install[ed] [piece]-by-piece— and made of expensive materials, including wood, slate o[r] [tile]. If you have these on your roof, find a skilled, reliable roofer, [a] plan for an[nual] maintenance. Don't attempt to maintain these roofs yourself; [e]ven in a [pro]fessio[nal] with all roofing materials, your primary responsibility as a ho[meowner] is to know when your

A Word About Flashing

A technique called flashing is used in roofing systems to help se[illegible] wate[illegible] flash-ing is installed where two sections of roof come together—[illegible] a va[illegible]nce the roof sections usually join at an angle. Flashing is also used where something penetrates through the roof line, such as a chimney, vent Roof Sections pipe, attic fan or roof ventilator. Flashing is typically metal, such as copper, aluminum, galvanized steel or terne. In the valleys of the roof, metal may also be used. [illegible] compo[illegible]n shingles, the flashing may consist of shingles wo[illegible]gether [illegible] be another asphalt roofing material such as roll roofing



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Roofs commonly leak around[illegible]shing. [illegible]metal may corrode, form pin-hole openings, develop met[illegible]or pull[illegible]the chimney, vent or other adjoining surface. If roof[illegible]een us[illegible]seal the flashing, it can dry out and crack. Any of these [illegible]d to a leak. Good periodic maintenance of your roof includes a[illegible]l e[illegible]n of your flashing. You need not climb on the roof fo[illegible]f you h[illegible]noculs or a camera with a telephoto lens, use them. If any [illegible]dence of deterioration, call a roofer.

Asphalt Composi[illegible]gles

These are the most frequ[illegible]roof covering materials. Over 80% of homes have the[illegible]d for good reas[illegible]ey generally require little maintenance, and they ty[illegible]ely, ong[illegible]ives, 15 to 20 years. Let's look at how they are made. [illegible]e material coated with asphalt. The core may be a cellulos[illegible]rial c[illegible]be fiberglass. Once impregnated with asphalt, the core is cove[illegible]granules of mineral aggregate, for architectural beauty to h[illegible]ure, but m[illegible]revent the sun from attacking the underlying asphalt.

The thi[illegible]l he[illegible]r the shingle, the longer the life span. Lighter weight shingles are designed to last 15 to 20 years—heavier shingles, 25 to 30 years. Heat has a[illegible] impact on life span, especially heat from the attic. The

more ventilation your attic has, the cooler the attic, and the long[er] [r]oof life.) As an asphalt roof ages, shingles lose the coating of granule[s] [l]osing [t]he underlying asphalt base to the sun. In the sun's heat, and with [t]he [s]low[ly] [l]oss them, shingles can lift, or curl upward. Sometimes they ev[en] [t]ake a [c]url "fish mouth." These are signs that old age is catching up with t[he] [r]oof job is in your near future.

Shingles may blow off in high winds, even on newer roofs. This is [n]ot [d]irectly related to age, but rather to how well the shingl[es] [w]ere secured. Anytime you spot missing shingles, call a roofer to have them re[placed]. [Y]our roof has [l]ost part of its ability to resist rain, and water can find its wa[y] [i]nto the attic [a]nd from there, into your house.

Though little maintenance is typically [r]equired [f]or an averag[e] [a]sphalt shingle roof, here are some recommendation[s] [f]or ca[sual] maintenance, from the Residential Asphalt Roofing Manu[al] [f]rom the Asph[alt] Roofing Manufacturers Association:

1. Never paint or coat asphalt ro[ofs] [t]o change [t]heir color or give it a "new look".

2. Keep gutters and roof surf[aces] [f]ree of leaves, p[ine] needles, twigs and other litter so that water can dr[ain] [f]reely.

3. Never allow water fr[om] downspo[uts] [f]rom your u[pper] roof below. Connect upper story downspo[uts] [t]o lower [o]nes.

4. Keep trees trim[med] [s]o that [s]unlight can reach roof, and trim back vines, climbing roses a[nd] [o]ther plants from roof.

5. When removing snow or ice [f]rom a roof valley, be careful not to damage your roof. Use a bro[om] or extension pole [and] [d]o not climb on a wet or snowcovered roof.

6. Annu[ally] [i]nspect roof [e]specially after winter weather.

7. Inspect u[nder] [s]ide of [r]oof deck (in attic) for signs of leaks. Look for water stains, especia[lly] [a]round flashing areas.

8. [Li]mit walking [on] roof to avoid damaging surface.

9. Wh[enever] [a]ny equipment is added (roof top ventilating fan, for instance), be sure that p[roper] techniques are used to avoid leaks. Any metal objects installed should be non-corrosive met[al] to eliminate possibility of iron staining on roof surface.

10. Wh[en] [p]roblems are identified, call in a competent roofer.

Wood Shingles or Shakes

Wood shakes are hand split and thick, while wood shingles are wit[h] ower saws and are thinner and lighter. Usually cut from the hear[t] of w[hite] red cedar, both have a rich, natural beauty and are resistant t[o] th[e] the roofs had a long projected life span. The shakes were cut f[rom] n tim and were installed over spaced 1x4's or 1x6's which formed th[e] The spacing allowed air to circulate, drying the shakes or shingles w[hich] e wet after rain or snow. The result was a roof that would last 30 to 50 ye[ars]

But today the projected life is at best 20 ye[ars] eterioration sets in between years 10 and 15. Contemporary wood s[hin]hing[les] cut from second or third growth timber, without the [ad]vance[d] mber. Also, they are installed over solid plywood or [oth]er mater[ial] nger are there spaces to breathe. The result is often c[up]p[ing], be[cau]r rotted [shin]gles which will have to be removed by hand. Some[times] curle[d] gle can be split and forced to lie flat, but likely it will have t[o] ced[e] otted shingles have to be replaced.

A wood roof is difficult to [wa]nd the[y] kely to break or dislodge several other shingles or s[plit] pt to r[e]e damaged ones. The roofer will account for this fact in t[he] Select your roofer carefully, checking for competence, reliability [and] one[st]y. If you find good roofers who are skilled with wood [shin]ching[les] fs, ha[ve] them come by once a year for an annual check-up.

Periodic application [of] eal compound on your wood roof can extend its life, in the same way that [a] terseal will extend the life of a wooden deck or wood[en] irs. The differe[nce] that you can apply the waterseal to a deck yourse[lf] a wate[r]seal to a wood roof typically requires a trained roofer. [Wet] e roofs are both slippery and fragile, and you're likely to c[rack] num[erous] ngles while trying to work on them, and you could wind up wi[th] jury to yourself by slipping and falling.

[S]late and Til[e] [R]oofs

Slate [roofs] re [lon]g, beautiful, fireproof, and expensive. They are also very he[avy] s as heavy as asphalt composition shingles, and the roof structure [must] spe[cial]ly designed for them. Some slate roofs have very long projected [lives] 60-70 to [100] ears or more. However, not all slate is of thesame quality. Some varie[ties] hinner and more brittle, and can crack,

splinter or delaminate. So their projected life span may be only 30 years. Tile roofs have historically been built from kiln-fired clay. They often tra ional barrel, Spanish (S) and flat, inter-locking designs. In recent clay een replaced by concrete, which can be cast in almost any shap r d Con crete tiles are much lighter than clay tiles: 750 pounds per e is square feet) versus 1,000 pounds or more for tile.

If you have a slate or tile roof, your first goal is to locate a reliable roo set up a regular maintenance schedule. Your roof sh ld be checked annually f any tiles or slate pieces that may have broken, cra fallen off the Replace them immediately. If you have a slate roof, yo o repl e pieces that are delaminating, that is sluffing off layers. De nced dete rioration of the slate itself. Extensive de acro e roof's sur face is a signal that re-roofing is in or n enti roof is a very expensive proposition, so a program place of portions over a period of time is the preferred alternative.

Metal Roofs

Metal roofs are becoming p again. aintained, they are durable and long lasting. Metal ro shione copper, galvanized steel or tin (actually terne, a steel nd tin). Because the cost of anentire roof made of copper would b ib nsive, copper roof coverings are typically found only limited ati n as over a bay window or positioned elsewhere a e At the other end of the scale, a terne roof is not as durable nd is highly susceptible to rust. It must be painted as soo t on, st be kept well-painted to prevent rust. Rusting is basically in

The mos material for roofs is galvanized steel, often installed with standi ividual strips of the metal join. A galvanized steel roof ca ere y, pre-formed into sections and prefinished with paint. Or e i iece by piece by a skilled roofer, just as it was in years past. oof work is truly an art form, and few roofers today have aining o undertake an on-site assembly and finishing job. As with a roof, galva eel has to be protected from rust with special paints which are av a y of colors and specifically designed to protect galvanized ste the instructions of the manufacturer in using these paints. Some ed roofs, for instance, need to weather for a period prior to painting, e other re-finished. Have the roof painted regularly. For awhile asphalt (tar) w metal roofs as a protective coating, but this is no longer the case. Exp as shown

that acids in the tar deteriorate the metal, and the asphalt can tr[illegible]sture, promoting rust. Paint is the answer to the threat of rust.

Flat Roofs: Roll Roofing, Built-Up (BUR) and M[illegible]an[illegible]

Flat roofs are challenging because rainwater and melted s[illegible]n th[illegible] gradually working its way through to the house below. Three [illegible] are commonly used. The least expensive is roll roofing, called se[illegible]e shortest life span, 5 to 10 years. Individual roofing strips are placed si[illegible]nde with a proper overlap, then sealed with roofing [illegible]nt. If not prope[illegible]y installed, water can seep between the strips. A second [illegible]ilt-up, or B[illegible]ften referred to as tar and gravel roofing. BUR is built u[illegible]layer[illegible]ing roofing felt strips and then coating them with ta[illegible]everal[illegible] 3 to 5) are put down and finished in this manner. Th[illegible]ping [illegible]s put on. The gravel provides the underlying tar wi[illegible]n the su[illegible]ind and rain. It also serves as an anchor to protect t[illegible] in hig[illegible]ds.

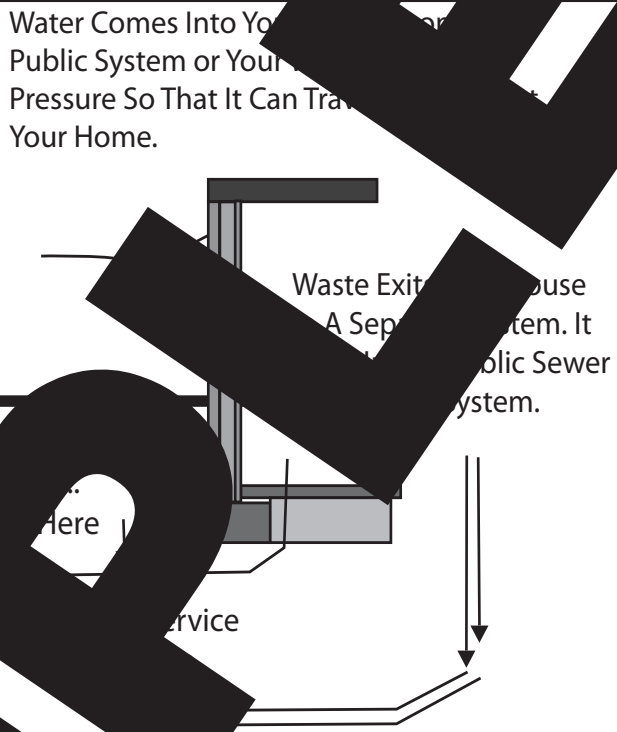
Built-up roofs lose their gravel co[illegible]rain and wind work on them. Loss of gravel creates bald sp[illegible]which[illegible]ar to the hot sun, which dries the tar, and the tar and felt [illegible]to cra[illegible]when leaks start. Built up roofs are also susceptible[illegible]ater w[illegible]the gravel contours change or when the drainage syste[illegible]ded water can accelerate the deterioration of the tar and felt ba[illegible]d ca[illegible]s way into your house. Another problem is moss. M[illegible]living[illegible]nism[illegible]d puts down tiny roots which can penetrate the und[illegible]y avenues for water. While a well built tar and gravel ro[illegible]s, this type of roof requires an annual check-up to determin[illegible]ion.

A rubber[illegible]brane roof is a[illegible]tive to the built-up roof. It is somewhat like a rubb[illegible]ver the roof structure. Membrane roofs are relatively new, a[illegible], manufacturers claim a projected life span of 10 to 20 yea[illegible]ever[illegible]nstallation is key since they are susceptible to being punctur[illegible]eteriorate rapidly if water is allowed to stand on them for [illegible]nded peri[illegible]e.

If you[illegible]ling[illegible]er on your flat roof the day after a rain, regardless of what typ[illegible]rial was used, it is a strong indication that your roof is experiencor dr[illegible]e problems. Call a roofer.

Water In, Waste Out, Fixtures In Between That's Your Plumbing System

Your home's plumbing has three major parts. The first is the water supply and distribution. Water is provided either by a public system or a private well, and enters the house through a foundation wall or up through the floor slab. From there, water goes into distribution piping, which runs throughout the house. Next we have waste collection. At each lavatory, sink, tub, shower and toilet there will be a connection to waste collection piping. Waste water is channeled down and out of the house. If you have public waste treatment, a pipe from the house will join the public sewer line. If you have a private treatment, the pipe will lead to the treatment system.



Waste collection pi also ha to g wer gas into the atmosphere, and provide air into th rk. Those vents should go through your attic and out the e vented into the atmosphere.

In between the water the waste collection systems, there are fixtures. A fixture may be an appli s a water heater, washing machine or dishwasher. be a lavato ower, tub or toilet. The fixture is where the water aste collection systems join.

Typicall mbi ems Are Leaks

Fortunately, th plumbing systems do not happen often, but when they do generally ems are leaks. You should deal with them promptly. Damage to your hom e just as severe as by water from ground sources, or rain; in fact ng can be a bigger problem. The water system is under pressure e in the water system—even a pinhole leak—will cause water to sp into the house. Most of your plumbing is out of sight, and your s, so typically you cannot see the leaks when they occur. You have to wa t to manifest itself somewhere else, and in the interim, the hidden leak major damage to the home's wooden structure.

Control Your Water System With Shut-Off Valves

Rule number 1 is, "Know How To Turn The Water Off." If a w[illegible]pe r[illegible]res, pressure will force the water out, often arching like a geyser. [illegible] are [illegible]d shut-offs that you should be familiar with.

Main Shut-Off Valve: Where water service pipe enters th[illegible] will be a main shut-off valve. It may be a round wheel (often red or [illegible] may be a rectangular handle with a vinyl covering. If you should have a p[illegible] break anywhere inside the house, that main valv[illegible] stop water flow[illegible]g to all points. Become familiar with the location bec[illegible] have to fi[illegible]ickly in case of an emergency.

Prevent Frozen Pipes With Hos[illegible]Off V[illegible]ow where to shut off your outside hose faucets, [illegible]os[illegible]. The w[illegible] pipes to hose bibbs can freeze and rupture during [illegible] winte[illegible]ther if they are full of water. To prevent this, locate the shu[illegible]s i[illegible]he house. Track the interior water lines to find small valve hand[illegible] blue) on pipes leading to an exterior wall. In the fall, as co[illegible]weather[illegible], turn off the water at this interior valve. Then go outs[illegible]en the [illegible]e bibb valve, draining the pipe. Leave the outsid[illegible]en.

Some homes have a bleeder va[illegible]the[illegible]f the inside shut-off. That is there to drain wate[illegible]be [illegible]ine b[illegible]een the interior shut-off and the outside faucet. If [illegible]cket under it, open it and drain the remaining wate[illegible]

Fixture Shut-Offs: [illegible]bing fixtures have shut-off valves mounted on them [illegible]can be used to [illegible]the fixture from the water system in case of leak[illegible]. Typically they are below the fixture, except those on clothes [illegible]s.

Water Se[illegible]oblems

[illegible]f the big[illegible]oblems for a homeowner is a break in the water service [illegible] pipe. It ma[illegible]itself as a slow, dribbling leak, or it can be dramatic—it can bl[illegible]ge[illegible]and remove a portion of your front yard, or flood your do[illegible]roblem usually starts either at the connection with the source [illegible] poi[illegible]ere the pipe comes through the foundation. What causes these [illegible]blems? [illegible]ause is settlement or some other type of movement, especially if your [illegible]arine clays or soils that have a high shale content. These can

slip and allow the trench to move—but the pipe won't move sin[illegible] anchored at both ends; a high sheer stress is created and the pipe gives v[illegible]

Polyethylene and Polybutylene Pipe. Breaks i[illegible]se e[illegible]nes have been experienced with plastic pipes, including those [illegible]nyle or polybutylene. Polyethylene is a black plastic pipe used throu[illegible]o and 1970's. Polybutylene has been used since the late 1970's, and t[illegible]e over 10 million homes that have it. Two types of polybutylene water pip[illegible]e used: service entry pipe and internal distributio[illegible]tems. Polybutyle[illegible]e service entry pipe is usually blue, in fact, it was nickn[illegible]Blue. Poly[illegible]e water distribution pipe—the pipe that carries water [illegible]ho[illegible]gray .

Leaks in plastic service entry pipe often[illegible]arly [illegible]ns, either at the entry to the house or at the connec[illegible]supply [illegible]em. In many cases, the strength of the pipe (mea[illegible]pour[illegible]square inch of pressure) was insufficient for the actual pre[illegible]g d[illegible]d to the house. Water pipe rated @ 100 psi was used on the as[illegible]coming water pressure would be less than 100 psi. But ofte[illegible]was m[illegible]plastic pipe would split or puncture with the additiona[illegible]. A swi[illegible]si rated pipe in later installations solved that pro[illegible]

Very often problems arise bec[illegible]ere[illegible]patible materials thrown into the trench that hous[illegible]ipe: i[illegible]lass, [illegible] drink or beer cans, which can puncture the pipe[illegible]. Other times, the trench itself would experience settlem[illegible]ar[illegible]re problem soils such as some clays or shale. The pipe co[illegible]ff, creating an underground fountain.

Whether[illegible] leak or a dra[illegible]ow off, this type of problem requires that the plu[illegible]trench in which the service entry pipe is located, either just a p[illegible]. When the problem is found, the pipe may be repaired, [illegible]r ce[illegible]nstances, it may have to be replaced for its entire length from[illegible]your foundation wall. These repairs are [illegible]nsive, ra[illegible]n a few hundred dollars to several thousand:

Most o[illegible]ro[illegible]s were traced to faulty installation. By 1987 a new set of i[illegible]tru[illegible]tions for polybutylene water pipe was developed, and the [illegible]s us[illegible]connections were changed. Copper inserts at joints and copper rin[illegible]ound the connection began to be used. Insthllers were trained to be mo[illegible]in pulling the plastic pipes through wood joists and studs as the plu[illegible]s installed, and in fact, special plastic rings were to be used

wherever a hole was drilled in the wood for the plastic pipe [illegible] splinters wouldn't puncture the plastic.

The revised installation procedures and the renewed cauti[illegible]stall[illegible]olyb[illegible] tylene pipe greatly reduced the problems experienced with [illegible], but not eliminate them entirely. Most problems seem to have occur[illegible] years after installation. At the first sign of a problem, call a plumb[illegible] problem rectified. If you continue to have problems, there are remedies [illegible]le, which involve re-plumbing. Your plumber will [illegible]e details on these as well as sources of money to help defray the cost. Just [illegible] that if you [illegible] to have your polybutylene pipe replaced, it is a major re[illegible]n pr[illegible]nd many walls in your home will have to be torn out [illegible]in ac[illegible]

Galvanized Steel Pipe. Some [illegible]e histor[illegible]omes in which galvanized steel pipes were install[illegible] water [illegible]bution. You can recognize these because the pipes are a son[illegible]hiny [illegible]metal. You may note that on the exterior they look perfectly sa[illegible]no rust showing at all. That's because galvanized steel wate[illegible]ipes bu[illegible]sits inside the pipe. Over time it may choke of your water[illegible] the o[illegible]is to have these pipes replaced. The horizontal pi[illegible]placed [illegible]nce they are the ones most likely to have the major dep[illegible] generally exposed in the basement and are easy to reach). Replac[illegible]se [illegible]pproximately $2000 to $3000.

Lead Pipe[illegible] [illegible]ve service entry pipes made from lead, which raises co[illegible] po[illegible]oisoning. As a general rule, lead content in the water sta[illegible]evels so[illegible]ong as the water is running, and builds up when the water stand[illegible]ged periods, so it's a good idea to run water through f[illegible]s for a few mi[illegible]fore drawing water for drinking or cooking. An alt[illegible] good [illegible]uality bottled water for cooking and personal consum[illegible]ce entry pipe with another material is the best solution, [illegible]exper[illegible]

Knock, Kno[illegible]o's There?

[illegible]her proble[illegible]imes encountered is a knocking or spitting sound as your water i[illegible]on. [illegible] can occur if an excessive amount of air gets trapped in the pip[illegible]g to find a way out. If you have had any plumbing work done, [illegible] wat[illegible]ply to the house has been shut off for a period, you may have a [illegible]ounced[illegible]ng at the faucets when you first turn them back on; this is trapped air. L[illegible]r run to clear the pipes. Sometimes if the water has

been shut off for a period, without any plumbing repairs, you will hear a knocking sound. Typically, that's air and can be bled out by running the

A different type of sound is an audible banging when the water is shut off. This too is related to air in the pipes and is referred to as air hammer. Pipes actually vibrate when water is shut off due to trapped air in the water lines, causing a banging sound. If the problem is severe, the pipe joints can be jarred over time and a leak can start. The air hammer problem can be solved by a plumber, however, who can install an air chamber (trap) in the lines.

Waste Collection System

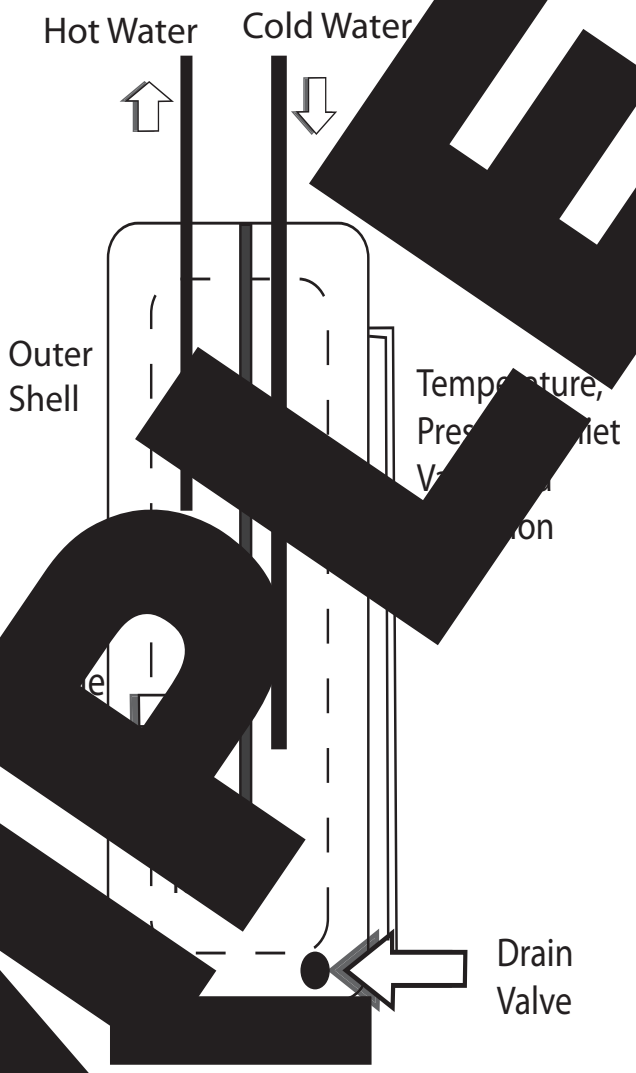
The waste collection system in your home consists of a network of pipes that gather the used water from all fixtures and carry it out of the house to a treatment system. The pipes may be copper, cast iron in older homes, or PVC plastic (white) or ABS plastic (black) in newer homes. It may be a mixture if the home is older and pipes have been replaced over time. The waste pipes are large because, unlike the water supply, the waste collection system operates by gravity flow.

You may experience a leak in the waste system but it will be different from a leak in the water supply piping. Usually it will be from a bathroom, originating at a fixture connection, such as a lavatory or a tub. It may start under a kitchen sink. Because the system depends on gravity, the waste water will slowly run down the outside of the pipe and into the wood structure of your house.Over time it can cause rot. Leaks may not be noticed for some time, so preventive maintenance requires that you periodically look under lavatories and sinks to see if there is any water. Use a flashlight. Go into your basement and use the flashlight to trace the waste pipes as they run through the subfloor areas. Look for darker areas that indicate water.

If you find water traces in any of these locations, call a plumber. The usual problem experienced in waste lines, though, is not leaks but blockage. Paper or other objects can become stuck in the waste line, totally block the flow of water, and cause water will back up into the fixtures served by that section of piping, and may even overflow. Should this happen to you, call a plumber, who will use a special auger—also called a snake—to clear the obstruction.

Fixtures

Fixtures include a variety of laborsaving or therwise desirable devices, including the water heater, sinks, lavatories, tubs, showers, toilets and dishwashers. We won't discuss all of these, but we will give you some tips on maintaining some of the most important ones.



The Water Heater.

Water heaters supply hot water for bathing, cooking and cleaning. They are classifled by fuel, size and recovery rate. The recovery rate is how fast the water heater can bring Cold water to the desired temperature. distinctions are interrelat fired water heaters are the to recover, and usually have smallest tanks-20 llons Gas-fired water h ond in recovery ypic 0 gallon tanks. Electric water heaters have much slower r es and e typically installed in 50 or 60 gallon capacities to compensate f their differences, all water heaters are essentially tal tanks full with heating elements inserted (electric) or with b (gas or il-fired.)

Water heate y rusting: the bottoms rust through. To delay the ting, manu insert anode rods—typically made of magnesium. An e rod is a sa l element, put there to attract the rust and corrosion that mi rw fect the tank itself. Over time the anode rod will eff away and become useless. Depending on the mineral content ater can occur between years 6 and 10 in a heater's life. However, node r be replaced, giving a new lease on life to your water heater.

You can take steps to slow the rusting process. At the bottom of your water heater there is a *drain valve*; it looks like a hose faucet. (If you have a gas water heater, it may be tucked inside a metal shield which covers the burner compartment.) Use it to flush out rust and sediment from the bottom of the tank. Attach a bucket under it, or attach a garden hose. Open the valve carefully, and only part way. Let 1 or 2 gallons of water drain out. It will look rusty at first coming from the bottom of the tank, and it won't significantly diminish your water supply. This procedure will help to remove sediment that may be building up in the water heater. When the water is clear, close the valve. Repeat often, every 2 or 3 months.

Pay attention to the temperature/pressure relief valve. This is a valve that is mounted on a separate pipe coming out of the side of your water heater. It is a safety device. If your water heater ever overheats the water inside, hot water can be converted to steam, which creates dangerous pressure inside your tank. If that occurs, the relief valve is triggered, springs open, and releases the steam down the extension pipe attached to it. The extension pipe should extend almost to the floor and is attached to a sink or plumbing line in order to keep the escaping steam from burning anyone. Periodically check to see if there is any corrosion around the end of the extension pipe. If there is, it may signify that your water heater is leaking and some of the controls may need repair or replacement. Caution: ***Never plug up the pipe connected to the temperature pressure relief valve. If you do, youhave created a huge bomb which can take out the entire home's inhabitants with it!***

Toilets

Toilets often continue to run after the tank after they are filled. The flow should stop when the tank has reached a predetermined fill level if the ball float inside the tank is properly adjusted (the ball float closes the water supplyvalve), and if the rubber bottom has closed off the opening where the water flows from the tank into the bowl. If water still runs, the situation can usually be corrected by adjusting one or the other. If a simple adjustment doesnot work, you may have to replace the inner mechanisms in your tank. Your local hardware store has replacement kits.

Sometimes the toilet itself may rock. Either the mounting bolts have loosened or the seal beneath the toilet has dried and broken. If the toilet is new, then you probably need the bolts, mounted under the little porcelain caps on the sides. You can tighten them, *but don't over-tighten!* The porcelain can crack. If your home is old, there's a good chance that the seal under the toilet underneath

has dried out and cracked. The seal is there to prevent water le[illegible]er the toilet and to prevent leakage of sewer gas. Cracked seals have t[illegible]eplac[illegible]. The toilet will have to be removed in order to do this, so don't tr[illegible]ours[illegible]all a plumber.

Tubs and Showers: Grout & Caulk

Tubs and showers are surrounded by special materials that keep wa[illegible]- trating walls and the floor. Joints between ceramic tiles are filled with *gr*[illegible]out hardens when it dries, sealing the joint, but like [illegible]asonry products, it is still porous. Water can still penetrate it, in minute am[illegible]over time[illegible]ut will fall out, leaving the joint open. Water can then ge[illegible]iles,[illegible]ng them, and potentially rotting the backerboard on [illegible] open wall joints with more grout when you find th[illegible]pur[illegible]t at any good hardware store. Another product, a si[illegible]er, can[illegible]sed to coat the grout and slow the deterioration pr[illegible]Apply[illegible]aler, and repeat the sealing according to the manufacturer's instructions.

Another type of sealer used[illegible]e rim [illegible]here it joins the wall, and at the joint between the tu[illegible]called[illegible]. Caulk seals out water too, but unlike grout, it stays pl[illegible]tep into your tub, it will flex down to a degree, and the caulk ha[illegible]ex[illegible]aulking will eventually dry out and split. When thi[illegible]s re-[illegible]. Mos[illegible]ople find either acrylic or silicone caulk best to wor[illegible]*h caulk over the old; it won't work.* Take a screwdriver o[illegible]and[illegible]old caulking. Then you may want to use rubbing alcohol[illegible]old cleaner to remove built up soap scum.

Now you[illegible]eady to apply t[illegible]ing, but first fill the tub with water. This will flex th[illegible]n the joint. Fill the joint, then smooth it with your finger or the b[illegible]. Clean off the excess. Let the water stand in the tub for 24[illegible]givi[illegible]lking time to dry. Then let the water out. You will have a good[illegible]*d don't forget to caulk outside the tub as well, at the joint where your tu[illegible]e bathroom floor. This is where leaks can rot your bathroom floor.*

Cl[illegible]rs

[illegible]g ma[illegible]s have hoses that connect the washer to the hot and cold water [illegible]y, and[illegible] can rupture. The result is a destructive mess. You can avoid this by tu[illegible]e water at the supply faucets to the washing machine

whenever you leave home for any period of time. Or you can repl[illegible]nventional rubber hoses with hoses made of flexible metal. These replace[illegible]re a[illegible]lable at most hardware stores and are not difficult to install.

Dishwashers

Dishwashers can leak. Sometimes a water line connection conn[illegible] er inside a connection wears out, and you'll have water dripping o[illegible]r beneath the unit. The problem is that you might not see it unless it run[illegible]nto the kitchen floor. Periodically you should chec[illegible]der the dishwasher to see if there is any evidence of water. Simply remo[illegible]om piece o[illegible]front of the unit (a couple of screws hold it in place) an[illegible]vide[illegible]water underneath. Try to catch these early because a[illegible]tting of the subfloor underneath.

Dishwashers can also flood your kit[illegible]oor if [illegible]nnection between the dishwasher drain line and the sink d[illegible]ose.[illegible]he dishwasher drain line is severely clogged and the water ha[illegible]. One of the best ways to prevent this from happening is t[illegible]ve an [illegible]lled on the sink. An air gap is a small metal dome with ho[illegible]lots tha[illegible]the back edge of the sink. It builds in a column of ai[illegible]sher d[illegible]e so that dirty water won't flow back onto the clean di[illegible]vides an overflow outlet in case the line gets stopped up. If it's a [illegible]blo[illegible]line may cleanse itself. On the other hand, if it co[illegible]ove[illegible]whe[illegible]the dishwasher runs, you'll need to have the drain [illegible].

Food Disposers

As your food disposer ag[illegible]its ability to thoroughly grind waste food, and bits of fo[illegible]ay begin to acc[illegible]in the drain pipe below the sink. Over time, the pip[illegible]stricted. Then when the dishwasher runs, waste water from th[illegible]an back up into the sink. If this is happening to you, it's t[illegible]repla[illegible]poser.

Use Th[illegible]e Trick: Ice cubes can be your disposer's best friend. Use [illegible] to clean t[illegible]s of any food scraps which may be stuck there. Simply put 10[illegible]c[illegible]n the disposal unit and turn it on. They will grind into ice sha[illegible]do the cleaning for you.

Refrigerators

Refrigerators operate much like an air conditioning system, [illegible] compressor and condenser that remove heat from the inside of the unit [illegible] one cleaning chore important to your refrigerator is cleaning [illegible] and [illegible] off the condensing coils. These are usually at the rear of the unit [illegible] your refrigerator away from the wall, and look for a metal apparatus on [illegible] probably see dust and dirt clinging to it. Vacuum this off thoroughly [illegible] low the unit to breathe properly as it operates, improving the efficiency [illegible] tion and prolonging the life of your unit.

Modern refrigerators are typically frost free. [illegible] they remove moisture from the interior before it can freeze into an [illegible] rust. [illegible] to go somewhere, so it is directed to a pan underneath [illegible] of the unit. Look behind the kickplate at the bottom, and you'll usually find a [illegible] that slides out. Over time, the pan can fill with a variety of debris and deposits [illegible] in it regularly. Remove the kickplate, slide the pan out, rinse [illegible] and [illegible] it back into position.

Gas and Oil Heating Systems

Gas and oil heating systems use combustion—i.e., they bur[illegible]—t[illegible]uce heat. The heat can then be transferred to air, as is the case [illegible]urn[illegible]d th heated air is then circulated through the house in a syste[illegible]clos[illegible] called ducts. Or the heat can be transferred to water; in this [illegible]st[illegible] referred to as a boiler. The heated water is then circulated throug[illegible] pipes, which feed into a device in each heated room that spreads the hea[illegible]ily radiators or baseboard convectors, or circulates [illegible]neath the floor or ceiling as a radiant heat system.

Combustion Can Produce Carbon Monoxide

Exhaust gases from combustion can con[illegible]mono[illegible]orless, colorless and poisonous gas. When inhaled [illegible]oxygen[illegible]our blood, and with enough exposure, can kill you[illegible]hreat [illegible]bon monoxide is increased when the system is not operating[illegible]tly, [illegible]s when it needs cleaning or adjustment, or when there is any bl[illegible]haust system. Your best protection is an annual servicing of t[illegible]system[illegible]ed heating and cooling system technician.

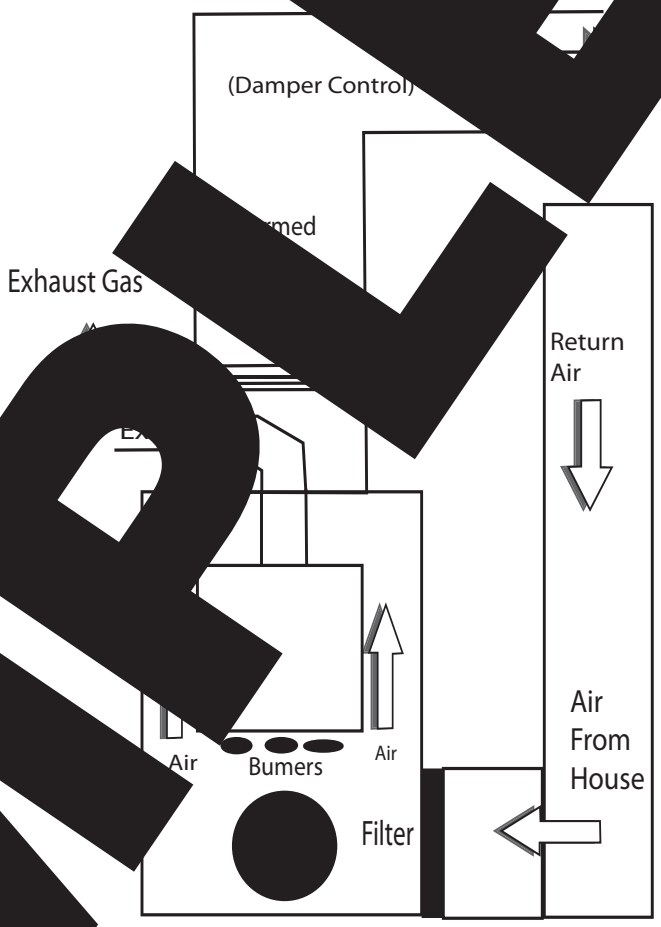
Exhaust gases are vented [illegible]hrough a special pipe called a flue, which can run through a chim[illegible]parate metal vent pipe. This exhaust gas system is[illegible]te fro[illegible]syste[illegible]hat conveys warm air throughout your house. Com[illegible]nces and exhaust flues deteriorate with age. If your gas[illegible]ears old or more, there could be cracks or pinhole leaks wh[illegible]llow ex[illegible]st gases to escape. If they do, it is possible for them to mix wi[illegible]eam going throughout the house. This is how carbon m[illegible]oxide spreads. A[illegible]your best safeguard is to have your system checke[illegible]ualified t[illegible]nician. If there are any problems, have them repaire[illegible]g system concerns you, replace it with a modern, high[illegible]ncy m[illegible]

Your flue nee[illegible]n as well. Sometimes exhaust gases re-enter the house due [illegible]ockage in t[illegible]It can be blocked by a bird nest, or part of the flue lining itself. C[illegible]ch[illegible]y flue cleaned regularly by a chimney sweep so that blockage[illegible]ov[illegible]ed before any harm occur. For added protection, you can [illegible]ar[illegible]onoxide detector. These are similar to smoke detectors, emitting [illegible]arm if [illegible]n monoxide is detected. Prices range from $30 to $80 depending [illegible]upon [illegible]that you purchase. Use them just as you would smoke detectors: put [illegible]he furnace or boiler, such as at the top of

the basement stairs, and another one outside your bedroom. Th[illegible] for these devices is small compared to the consequences of a major l[illegible]p of[illegible]rbon monoxide in your home.

Gas and Oil Hot Air Furnaces

Furnaces use either gas or oil to heat air, and then blow the heated air throughout your house. When you turn up the thermostat, burners ignite in a metal enclosure called a heat exchanger (sometimes called a combustion chamber in an oil furnace). The heat exchanger's job is to absorb the heat from the burner flames and then transfer that heat to the a[illegible] stream which will enter your roo[illegible] The air stream will not start as so[illegible] as you turn the thermostat up. [illegible]ause the heat exchanger isn't ho[illegible] There is a built-in delay[illegible] won't have cold air blowi[illegible] your house.



When the heat [illegible] starts.. The blow[illegible] the heat exchanger [illegible]ir is w[illegible]med. It is then blown through box-like passageways called duct[illegible] heated air is introduced to individual rooms by small [illegible]ings in the floo[illegible]s, called registers. These typically have adjustme[illegible] so that you can open and close the air flow in specific locatio[illegible] controls on the large ducts leading from the air supply si[illegible]our f[illegible]etal levers, which move in a limited arc, marked "closed" at [illegible]e arc and "open" at the other. The lever controls a metal plate inside t[illegible]rk, mounted in the air stream. When the control is in the [illegible]n" positio[illegible]te is parallel to the air stream, allowing it to flow freely. When "[illegible] th[illegible]te moves perpendicular to the air stream, blocking the flow. Th[illegible]ntrols help you to direct and control the air flow in different sec[illegible]the [illegible].

Most furnaces recycle air from the house for combustion and for the supply that provides heat to your rooms. There are air returns located at strategic points in your home, typically on each floor. Generally they are large wall grilles placed in walls, though in older homes they may be small, the same as floor supply registers. Some new gas furnaces do bring outside air directly to the furnace for combustion: the 90+ units, (indicating an efficiency level of 90+%). These furnaces use plastic pipe for drawing outside air for combustion and for exhausting waste gases from combustion. Even though they draw outside air for combustion, house air is still re-circulated through them to be warmed and sent to the rooms again.

Burners. Gas furnaces typically have multiple burners, usually 3 to 6 of them. Heating capability is measured in thousands of BTU per hour, or BTU/H, and as a rule-of-thumb, each burner has a heating capacity of about 20,000 BTU/H. Oil furnaces, on the other hand, have a single burner, generally mounted at the bottom of the unit. It is often referred to as a gun burner because it "shoots" the flame into the combustion chamber. Some advanced burners on oil furnaces incorporate an air intake and mixing system with fins much like the blades of a jet turbine. This boosts the efficiency and the efficiency of the system, and puts contemporary oil furnaces on par with high efficiency gas furnaces.

Furnace Filters. Return air picks up dust and dirt in your home—regardless of how well you keep your home clean—and needs to be cleaned before it recycles through the heat exchanger of the filter. The filter not only keeps the operating parts of the furnace clean, but it also cleans the air you breathe. The most commonly used filter is the slide-in, disposable filters which you can get at your local hardware store. Usually they are inexpensive, particularly on sale. Some disposable filters contain activated filtering material, or they have had a special process to impregnate them with an electrostatic charge, and will cost more. Other filters are washable. They are made of plastic or metal mesh, and can be cleaned with a hose or put in the sink under a faucet.

The top-of-the-line filter is an electronic or electrostatic filter. These use an electrical charge to ionize particles of dust, dirt and pollen, which then stick to a special screen. This type of filter is a special installation, and expensive ($600-$800), but very efficient at removing pollutants from the air; most will remove 95%. They too should be cleaned regularly, so they are designed with sections that slide out for cleaning. Whatever type of filter you may choose, remember that *a clean filter is key to proper furnace operation*, and

it is *key to maintaining your health as well, so change or wash yo[illegible] every 30 to 60 days, regardless of the type.*

Maintaining Your Furnace

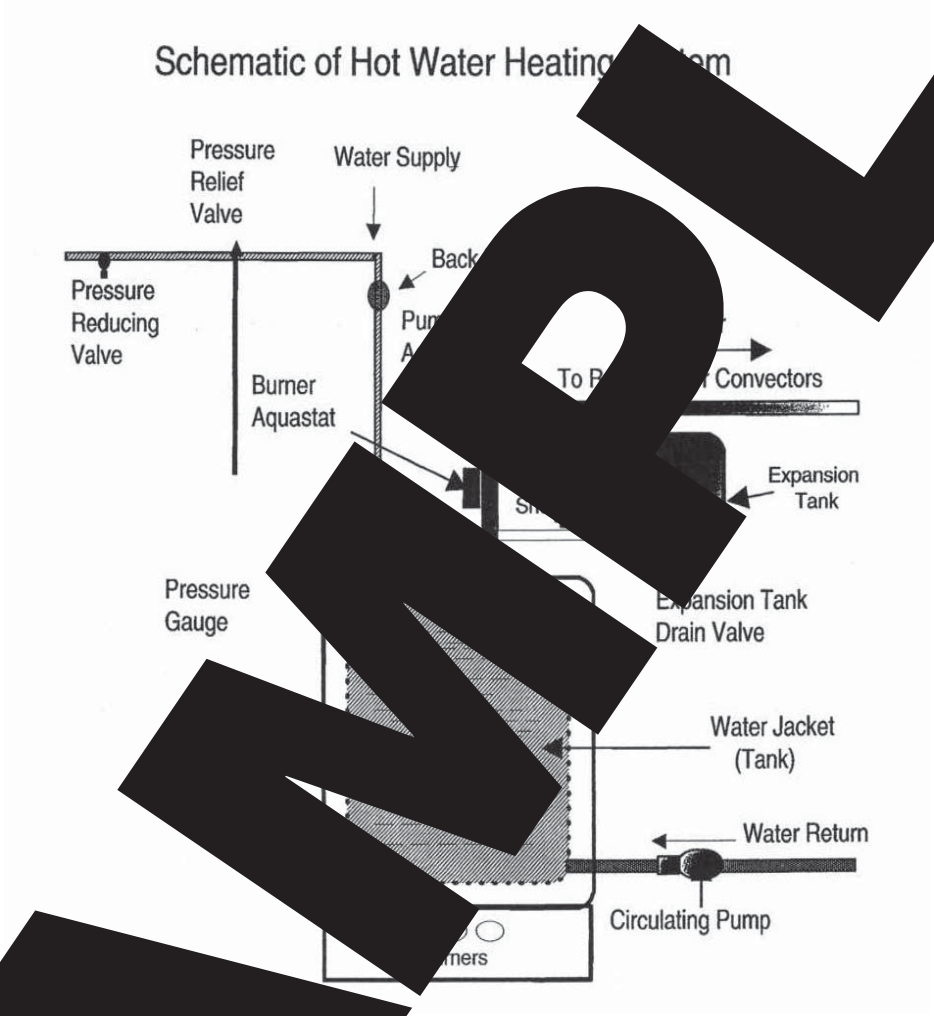
Maintenance is the key to dependable and efficient serv[illegible]turn and to maintaining safety. Both gas and oil furnaces should be [illegible]. A gas furnace is subject to rust, which can be caused by excess wat[illegible]e exhaust. When natural gas is burned, water vapor is one of the exhaust by[illegible]cts. In today's higher efficiency furnaces, a poorly [illegible]sted and poorly serviced gas furnace may be subject to excessive water vap[illegible] in the exha[illegible]d some of it can simply come back down the flue into t[illegible]ange[illegible] can start to build up, weakening the heat exchanger [illegible]. The[illegible]acks or pin-holes in the heat exchanger that can all[illegible]st ga[illegible]ith the house air you are breathing. Carbon monox[illegible]t can e[illegible] your home that way. Annual maintenance is a majo[illegible]oward[illegible]enting rust build-up and the problems it causes.

Oil furnaces need annual tun[illegible]s. All[illegible]ting parts should be cleaned, and the air/fuel oil ratio co[illegible]the bur[illegible] properly calibrated. Otherwise, the oil furnace ca[illegible]e soot[illegible]ack, powdery residue) due to inefficient combustion. [illegible]t the exhaust and can settle on your home's exterior. When it rains, [illegible]ine with soot to stain and streak your roof and home[illegible]ior. P[illegible]nnua[illegible]intenance can prevent this. An oil furnace has an oi[illegible]between the oil tank and the burner, put there to filter out [illegible]e line. This filter needs to be changed each year as part of [illegible] tune up.

Hot Wat[illegible]Boilers

Homes[illegible]er use a boiler which feeds heated water through pipes to radia[illegible]s, or pipes which run under the floor or in the ceiling in[illegible]s re[illegible]s radiant heat. When you turn up the thermostat, burners ign[illegible]tank (water jacket) to heat the water inside. The burners may use eithe[illegible]l for fuel. When the water reaches

a pre-set temperature, a circulating pump comes on, which forces water through the system. The hot water circulates through the house, and returns to the boiler in a separate piping system.



Hot water heating is a low-pressure system. Pressure is measured in pounds per square inch (psi). When the system is cold, the pressure should read approximately 15 psi. When the water is heated, the pressure should not measure above 30psi. If it exceeds that, safety devices will automatically trip and the system will

Expansion Tanks. The hot water boiler is 100%full of [illegible] When the burners come on, the water heats and expands. The system [illegible] expansion tank to receive a portion of the expanded water so that the [illegible] will [illegible]ize pressure and then circulate water through the house. In old [illegible]ems [illegible]xpan- sion tank is an elongated cylinder, filled with air. As the [illegible] pus[illegible] its way into the tank against the air cushion. Only so much [illegible]nte[illegible] expansion tank since the air cushion is pushing back against it. Th[illegible] operating pressure in the system. Then when the system shuts off, the [illegible]ols and the cushion of air pushes the cooled water ba[illegible]k to the boiler,refilling [illegible]

Newer hot water systems use a different style [illegible]n tank. [illegible]t, round cylinder—often red—often called a compression ta[illegible]r[illegible] These are located just above the boiler itself, some[illegible] the [illegible]an using air as a buffer, they contain a thin, flexibl[illegible] memb[illegible]his membrane stretches as the expanded hot water [illegible] aga[illegible] then pus[illegible]s water back as the water cools.

Older expansion tanks can become [illegible]e water absorbs the air in the tank and there is no cushion. [illegible] can f[illegible]ly with water. This acts to re- duce the amount of water a[illegible] the bo[illegible] remainder of the system, and pressure in the syste[illegible]ormal[illegible] system will then shut down as safety devices are activat[illegible] lief valve will activate and the pipe on that valve will discharge w[illegible] th[illegible]e remedy is to drain the expan- sion tank. To do thi[illegible] thes[illegible].

First turn off p[illegible] electrical service panel; look for the circuit breaker or fu[illegible] circuit[illegible] turn the expansion tank shut-off valve to the “off’ position. U[illegible] pansion tank you will find a faucet-like drain valve. Att[illegible]ch a garden hose[illegible] open the drain. Next look for a small air- release [illegible] tank itself.[illegible] a wrench and open it. The tank should now drain t[illegible] tank has drained, reverse the steps. Close the air release [illegible]hen c[illegible]n valve on the expansion tank. Open the shut-off valve part[illegible]t th[illegible]nt you should hear water running back into the expan- sion tank. W[illegible]d stops, open the shut-off valve the remainder of the way. [illegible] the pre[illegible]uge, and when it reaches 15 psi (pounds per square inch), [illegible] the power t[illegible]stem back on. One final step: when the system warms up, you w[illegible] b[illegible] air from the radiators or convectors. Start at the top floor an[illegible]

[illegible]r-loggi[illegible]ould not occur with a membrane compression tank. If it should occur[illegible] probably has a ruptured diaphragm inside. In this case, the

entire tank will have to be replaced. *Shut the system down and call your [illegible] person.*

Safety Devices. A hot water system has numerous safety devices [illegible] automatically trigger in case of a malfunction. There is a pressure reducing valve which reduces the pressure of the water coming into the system to the desired 15 psi level. There is a pressure relief valve which will trip if the pressure in the system exceeds 30 psi, releasing some water down an attached pipe. (This is similar to the TP valve on your water heater.) There is a burner aquastat—somewhat similar to a thermostat—that monitors the temperature of the water in the tank and shuts off the burners if the temperature gets too high. And there is also a pump aquastat, which is, strictly speaking, not a safety device, but rather automatically controls the operation of the circulating pump. When the temperature of the water reaches the pre-set point, the aquastat turns on the pump and allows the water temperature drops to a second pre-set level. Each of these controls makes the hot water heating system a dependable and enjoyable [illegible]

Steam Heating Systems

Hot water systems are replacing steam systems wherever possible. The two systems are similar in most respects, but with two significant differences. A steam system works by gravity: the hot moist air rises to the house being forced by a circulating pump, whereas most hot water systems circulate almost the hot water flow throughout. The other distinction is that boilers are not 100% full of water like those in the hot water system. A steam boiler will have its volume occupied by water, and the remainder occupied by steam. The combination of water—usually with minerals in it—and air leads to .a build-up of scale and sludge in the boiler and piping. These must be cleaned regularly if the system is to function. It is this cleaning requirement that has led homeowners with steam systems to convert to hat water systems when possible.

Heating With Electricity: Electric Furnaces, Heat Pumps

Electric Furnaces

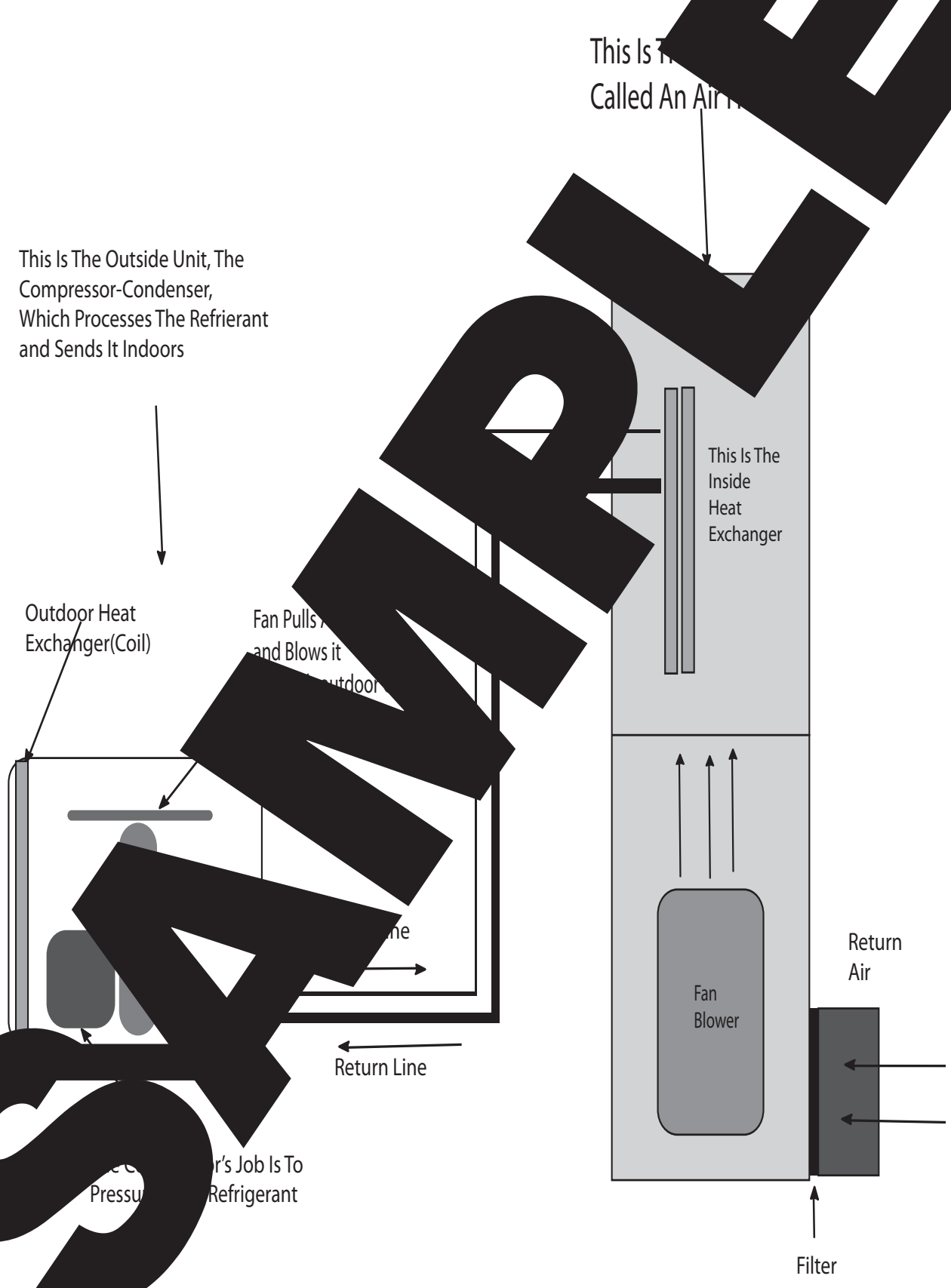
In many homes the heating system is electrically powered. The system is the electric furnace, which functions like a gas or oil furnace but does not use combustion to produce heat. Rather it uses electrical resistance heating elements to provide warmth to the air that blows throughout the house. Because there is no combustion, there are no concerns about carbon monoxide or water vapor in the exhaust gases. There is no exhaust since nothing is burning. The electric furnace is a dependable and long-lived heating system and will perform satisfactorily for many years. However, it is an expensive system to operate. The cost of electrical power far exceeds the cost of gas or oil in most areas of the country. For this reason, electric furnaces are rarely installed in new construction.

Heat Pumps

In electrically powered systems, a more popular alternative to the electric furnace has been the heat pump. Like an electric furnace, the heat pump does not use combustion to produce warm air. It does not produce warm air from any heating element. Rather, it uses principles of thermodynamics to absorb warmth from a source (usually, the outside air), transport it inside the house and release the warmth to the house air. To do this, it uses a refrigerant, usually R-22 and sometimes Freon, Freo DuPont's brand name. R-22 has the unusual property of being able to absorb warm air from a source, transporting it and releasing it elsewhere. As noted, the typical heat pump draws warmth from outside the home, and is referred to as an air source heat pump for this reason. In the heating mode, the heat pump will draw warmth from outside air, transport it in copper tubes and then release it inside the house.

Air Handler. The heat pump consists of two units. First is the inside unit, often called the air handler, with two compartments. Inside one is a large fan (the blower). Inside the other is a device that looks something like an automobile's radiator. It consists of a series of coils weaving through a finned metal structure. This is the air exchanger where R-22 circulates through coils, meets the inside house air and the warmth collected outside is released into the inside air. The warmed air is then blown throughout the house by the fan, and is channeled through a system called

A Heat Pump Consists of 2 Units



Clean equipment is key to the proper functioning of a heat pu[mp]. The first step is to maintain a clean filter. The filter cleans the air before it [passes] through the air exchanger. Dirty filters lead to clogged air exchangers, [which] in turn [damage] the system. Change or clean the filter regularly—every 30 day[s].

The filter is inside the return air ductwork, usually at the bo[ttom] of the air handler in the basement. (However, sometimes it is mounted inside a [wall].) Electronic filters are often mounted on heat pumps and perform extremely well in these installations.

Compressor. The second part of a heat p[ump] is outside, and is commonly referred to as the compressor. (Actually the unit is [called] the compressor and condenser.) It houses equipment which [pumps] the refrigerant gases it to and from the unit inside the house. There is a fan inside the unit, and proper operation of this fan is vital to the system functioning. Keep shrubs and bushes away from the unit and the fan. Allow approximately 24 inches of free space on all sides to provide proper ventilation. Also, if a dryer vent is nearby, be aware that lint from the dryer vent will be drawn into the fan, and can clog the unit's operation. So you would be smart to relocate the dryer vent.

The compressor unit must be kept level. Vital refrigerant liquids and gases are flowing inside, and a severe tilt can cause them to separate, causing leaks or a malfunction. It is common to see tilted compressors in relatively new homes. This is caused by settlement around the foundation, especially in the backfill area established during the construction. This area tends to settle, and since this is typically where the compressor is placed, when settlement occurs, the compressor tilts. If you have a heat pump, be aware of this, and at the first sign of tilting, have the unit re-leveled.

The compressor is a unit which must be periodically replaced. The design life of the compressor is usually 15 to 20 years, but few make it past year 10. The average life is 6 to 8 years. The reason is that many homeowners don't understand that heat pumps need regular servicing—at least once each year. And they have to have adequate air flow, which means a clean filter. If you change the filter regularly, and if you have a qualified heating and cooling company service your heat pump annually, you should be able to get the full 10 years or more from your compressor. On the other hand, if the filter isn't changed regularly, and if the system is not serviced, it may not even last for 6 years! The compressor is typically not repairable at the factory when it is manufactured, and few can be repaired in the field. For this reason, when your compressor fails, more than likely the compressor-condenser will have to be replaced.

The Art of Heating With A Heat Pump. A heat pump should n[illegible]eated like furnace. A heat pump works best at maintaining a temperatu[illegible]t all[illegible]s the basic thermodynamics of the R-22 to operate at high efficie[illegible]you[illegible]own a heat pump thermostat at night, and then quickly turn it h[illegible]in t[illegible]rnin you overwhelm the heat pump's capability to respond. It [illegible]upon back-up source of heat: electrical resistance heating elements [illegible]h tem. Auxiliary electrical heating elements are built into the inside [illegible]e back-up heat in very cold weather, and to serve you in case of an emer[illegible]As the outside temperature drops, these elements wi[illegible]n on periodically[illegible]o assist the R-22 based process of absorbing outside hea[illegible]y have a s[illegible]ight on your thermostat that comes on when the electrica[illegible]are a[illegible]d.) If you rapidly turn the thermostat up, you will tri[illegible]thes[illegible]g elements yourself. You'll get the extra heat, but a[illegible]pply [illegible]ermostat at a desired temperature, and keep it there[illegible]et[illegible]orget it.[illegible]ave the thermostat alone. Your system will operate[illegible]intain[illegible]emperature and it will do it automatically at its most efficient[illegible] mode of operation.

Those same back-up heati[illegible]ts are [illegible]if your compressor ever gives out in the middle of[illegible]hat hap[illegible]you will lose all your heating capability. But, don't pa[illegible]he thermostat setting to emergency heat. That converts the unit int[illegible]lect[illegible]e, and you'll get heat in a hurry. But the heat is expe[illegible]ince i[illegible]% el[illegible]ic resistance heating.

Defrosting. On a co[illegible]day yo[illegible]may be startled to see your heat pump compressor explode in a [illegible]oke. Don't be alarmed. Ice has built up and it has auto[illegible]lly defrosted.[illegible]rily it blows hot air through the compressor, and wh[illegible]not sm[illegible]ke.

Heating With Wood: Your Fireplace

Many people use fireplaces, fireplace inserts or wood stov[illegible] heati[illegible]ices. One of the critical components of this heating approach [illegible]chimn[illegible] and flue.

Escape Route For Exhaust Gases

A masonry chimney consists of an outer shell a[illegible]d an interior flue liner m[illegible]e of clay tile (terra cotta), poured concrete, or meta[illegible]ue directs exh[illegible]gases up the chimney, and protects the chimney wall fr[illegible]nage a[illegible]osion. A flue is sized according to the type of equipment it se[illegible]more than one flue, each designed for a specific tas[illegible]

Masonry chimneys that are well built[illegible]st for[illegible]ations, but they can experience problems. Deposits can build[illegible]de, bl[illegible]g the flow of exhaust gases, and causing a deterioration of the[illegible]

There are a number of mate[illegible]ich ca[illegible]osits in your flue and chimney. The primary concern[illegible]r vape[illegible]ge and creosote.

Soot From Oil-Fired Equ[illegible]t

Soot is a natural by[illegible]uct of [illegible]mbu[illegible]. The amount of soot produced is dependent upon h[illegible]ur[illegible]e tuned, that is, adjusted for proper fuel/air mixing, and [illegible]ir for proper combustion. Poorly tuned units produce exce[illegible]. The [illegible]n accumulate on the walls of the flue liner, and can lead to a [illegible]n of the liner itself.

Water [illegible]tion From [illegible]ning Gas

When [illegible]vapor is a byproduct released into the exhaust. When th[illegible]ust te[illegible]s high, the water vapor simply evaporates. But lower exha[illegible]pe[illegible]es can cause condensation to occur inside the flue liner. The water le[illegible]loration of the terra cotta flue tiles in thechimney, and this [illegible]oration c[illegible]to blockage of the flue itself. When gas logs are installed [illegible]firepl[illegible]the[illegible]special requirements for venting the exhaust gases up the flue[illegible]hat[illegible]e installer has indeed followed those instructions so that you [illegible]he flue tiles.

Creosote From Fireplaces, Stoles and Stove Inserts

When you burn wood in your fireplace, combustion produces a by-product called creosote. Creosote is a brown or black flammable residue that deposits on the smoke chamber of the chimney and the flue liner. In severe cases, creosote can glaze and become hard as ceramic. Creosote can ignite and burn with intense heat, reaching almost 2,000 degrees F. *Creosote needs to be swept from your chimney by a professional chimney sweep every 1 or 2 years, depending upon the amount of wood you burn.*

The typical fireplace has a large firebox and an exceedingly large flue vent to accommodate it. However, if you have a wood stove, you will have to make some modifications. A wood stove has a small firebox and requires a smaller flue. If a wood stove is accidentally hooked to a large fireplace flue without adaptation, exhaust gases will slow and cool as they rise in the oversized flue. They can produce water vapor, or condensation, which is typically where the more dangerous form of creosote called pyroligneous originates. To overcome this problem, at a minimum there should be a stovepipe extension pipe added to the back of the stove, which then extends inside the fireplace to join the flue liner. Even better, the new stove vent should extend all the way to the top of the chimney. The vent may be made of stainless steel, a poured-in-place (or pumped) concrete, or a new ceramic tile liner can be installed. (If the stove is removed, the new flue liner will have to be removed.) And when you burn wood stove, it is very important to have a chimney sweep your chimney annually.

Your Air Conditioning

Central air conditioning is now a standard feature in hom[illegible]ntra[illegible] means that there is one system which serves the entire house. [illegible]co[illegible] tioners consist of two parts. The first is inside. It houses an evape[illegible] a fan (blower). This unit is often referred to as an air handler. It is co[illegible]o ductwork which distributes the cooled air throu[illegible]out the house. If you h[illegible]e a furnace for heating, the evaporator coil will u[illegible] mounted on[illegible]f it so that the furnace's fan can also serve the air co[illegible]. There [illegible]a small pipe at the bottom of the air conditioning unit Thi[illegible]on which precipitates as the air conditioner cools t[illegible]ture [illegible] pan below the evaporator coil, flows into the co[illegible]and the[illegible]ws out of the house.

The second unit is typically located outside the house in the yar[illegible] unit is referred to as the compressor. There is a large fan inside, with s[illegible] ope[illegible]gs in the frame. Inside there is also a sealed compressor, which m[illegible]ates [illegible]ger-ant, which many people call Freon® (actually DuPont's t[illegible]e f[illegible] pro-uct) to produce the cooling effect. The refrigerant is transp[illegible] exte[illegible] compressor-condenser unit to the evaporator coil inside the ho[illegible] in copper tube. It flows through a series of tubes built into the coil, a[illegible]t from the house. The heated refrigerant is then conveyed back outside via [illegible]nd, larger copper tube wrapped in insulation, where [illegible] heat is then relea[illegible]ed into the air. This process cools the house. And it pulls [illegible] from the air [illegible]densation. This is critical because if the moisture cont[illegible] high[illegible]ould feel as though you're living in a cold wet cave.

Maintenance Procedures

Most maintenance tasks should be l[illegible] quali[illegible]ating/air conditioning contractor or service. The unit should [illegible]ed [illegible]other year, at which time the technician will check all operating [illegible]luding the refrigerant levels in the compressor-condenser. In[illegible]dition t[illegible]sional servicing, though, your primary responsibility is to [illegible] clean [illegible]ery 30 days, install a new filter (if you're using dis[illegible] wash[illegible] filter if you have the reusable type. Don't run your sy[illegible]lter. Dirty filters allow dirt and dust to accumulate on the bottom o[illegible]ir c[illegible] restricting air flow, and forcing the unit to struggle [illegible]ain a[illegible]ient a[illegible]ow. This can damage the system.

Periodically che[illegible]e t[illegible]nsate line is working. Is water actually coming out of i[illegible] air conditioning is operating? From time to time, the condensate line can g[illegible] with a piece of dirt, lint or rust. If this should happen, t[illegible]ndensate will c[illegible] to build in the pan and then will overflow. It can get [illegible]mponents and cause rust. Observe the condensate pipe when t[illegible] water is coming out. If not, call your air conditioning se[illegible]or a c[illegible]

Also check pe[illegible] to insure that your outside unit—the compressorcondenser—is level. Th[illegible] critical fluids and gases circulating inside the unit, and it must h[illegible] o[illegible]e properly. In many houses, especially new homes, there can[illegible] within the first 4 to 6 feet from the foundation wall. This can [illegible] co[illegible]ssor to tilt at an awkward angle, and a severe tilt can cause serious damage[illegible]e. If you see your compressor/condenser begin to tilt, you can shim i[illegible]el it.

Your Home's Electrical System

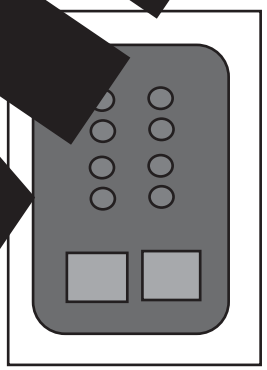
Your home's electrical system is somewhat similar to the b... nervo... stem with a brain and nerves running throughout the house. T... ectri... panel box. Inside this box, main power lines bring electricity ... use... branch lines (circuits) take electrical power to the parts of the ... lines are called service entry lines. In most homes there are two, e... g 120 volts into the house. Smaller circuits—those for lights, outlets and mo... ppli-ances—use 120 volts. Heavier appliances will r... 0 volts. There i... so a third main line called the neutral, sometimes called ... d condu... his wire carries electricity back out of the house, to the tran... r or... ginated.

Grounding

There is also one more main wire, ... grounding wire. This wire runsfro... connection at the neutralto meta... in the earth. This might be a metal w... line. Or it might be a separa... driv-en into the earth. Should y... the neutral connection, ... follow this wire to ground, ... earth. If your incom... water ... has a heavy-duty elec... to it, in all likeli... wire. On the othe... our g... is outside the house, it ... r your electric meter. You will se... n-ning to ... where it at... s to the top...

e Of Ele... anel Box
Uses ... or OverCurrent Protection.
The ... Type Uses Circuit Breakers.

... d For ...
Pr...



This One Uses
Circuit Breakers

Overcurr... ...ot...

Your electric... ...x will contain either fuses or circuit breakers. These are ... as over... devices. They prevent dangerous heat build-up and a po-...tial fire. If a c... becomes overloaded, or experiences a rapid power surge, heat ... i... e circuit wire inside the walls. Unless the flow of current is s... ...ation around the wire can melt, and the heat can cause a fire. The ...d pr... r is designed to prevent this. The heat is

transferred to the circuit breaker or fuse in the electrical panel b[illegible] reaches a pre-set level, the breaker then trips, or the fuse blows, shuttin[illegible] urre[illegible] in the circuit. Should this happen, determine the reason. Once the c[illegible] ider[illegible] re-set the circuit breaker, or replace the fuse. *(If you determin[illegible] he [illegible] was faulty appliance, be sure to have it repaired or replaced.)*

Circuit breakers and fuses—and wires conducting current—are [illegible] handle both the current flowing through them and the devices each ci[illegible] v-ing. The size is expressed in terms of voltage and amperage. Voltage is th[illegible]sh" in an electrical current. In most houses, both 12[illegible]240 volts are av[illegible]ble, to be matched to the requirements of the appliance [illegible]t on the c[illegible] Amper-age is the ability of a wire to allow that flow to g[illegible] the [illegible] the wire, the more electrical energy that can safely g[illegible]gh [illegible]ent and ap-pliances—air conditioners, electric sto[illegible]dryer[illegible]nce—require large wires and overload protection to [illegible]ets and [illegible]ng circuits use smaller wires.

Wire size is expressed as a gauge [illegible]gh it may sound backwards at first, the larger the gauge, the [illegible]naller [illegible]. The smallest wire commonly used for electrical systems is [illegible] lighti[illegible]outlets, and is typically #14 and #12 AWG. When larg[illegible]s wire[illegible]e gauge number drops but the wire size increases: #[illegible]G wire[illegible]are commonly used on these devices and each is much lar[illegible]n[illegible]or lighting circuit wiring. Smaller size wires cannot ca[illegible]y as muc[illegible]ent [illegible]overheat quickly if subjected to too much demand[illegible]am s[illegible]a sh[illegible]t circuit. Each component must be properly sized if[illegible]ely.

Don't accidentally c[illegible]balance[illegible] For example, if you are ever tempted to increase the size (amp[illegible] fuse (or a circuit breaker) that is continually blowing [illegible]tripping)—don t[illegible]rger fuse or circuit breaker will require far more h[illegible]n the wi[illegible]n the circuit is designed for, so the wire will contin[illegible]ulation around it melts or bursts into flame, but the prote[illegible]evice[illegible]reaker) may not be activated because, ironically, there may [illegible]no[illegible]eat at the device to tell it that something is wrong. A fire can be the re[illegible]

[illegible]same proble[illegible]rs when electrical extension cords are used to extend the electri[illegible]e t[illegible]eas of the house that don't have adequate circuits. Only the si[illegible]uch worse. An extension cord typically can stand so much less [illegible]n the [illegible]or breaker needs to detect the problem before it melts and bursts [illegible]flame, [illegible]e certainty of a fire tends to grow quickly. If you must use exten-sion c[illegible]them only to extend the reach of one outlet to one

appliance or device. (Exceptions include the multiple outlet, heavy-duty cords that serve a work station, such as a computer station. However, some laser printers will pull so much power when operating that loss of power to other outlets of the circuit can be experienced—lights dimming, for example.)

Never use extension cords to wire a room that doesn't have electrical power. Sometimes it may be tempting. You may be creating a small office or workshop in previously unused space, and it would be simple to string extension cords to that area for lights and equipment. But remember that you are literally playing with fire. The money you save by not having an electrician install a proper circuit may literally go up in smoke if a house fire breaks out.

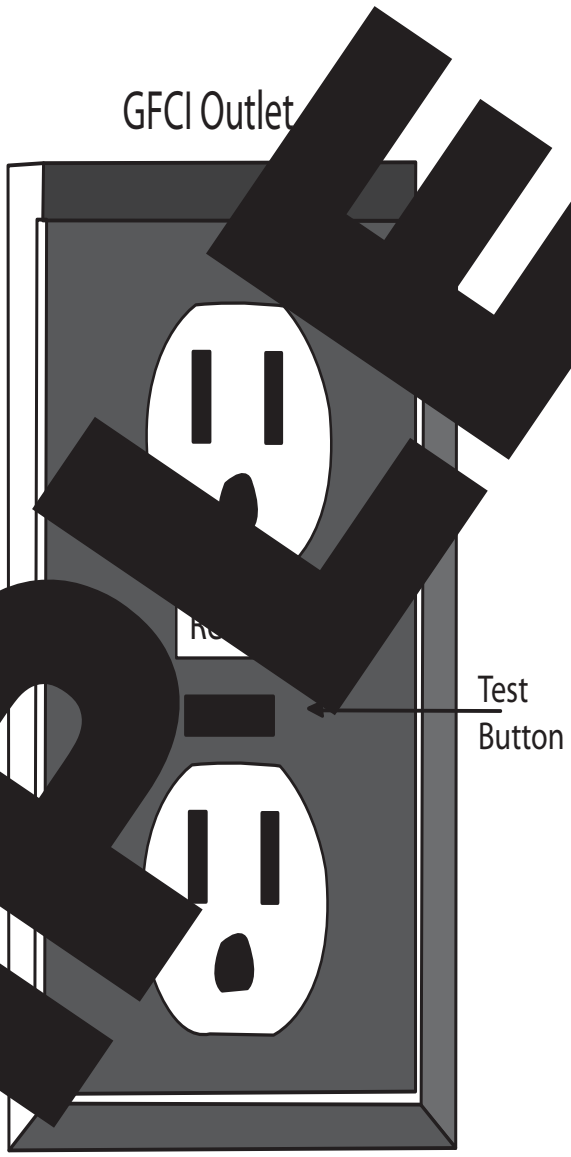
Maintaining Your Circuit Breakers

If you have circuit breakers, here's a simple maintenance task you should perform every 6 to 12 months. Open the door to your panel box cover. Then one by one, turn off the circuit breaker and turn it back on. Do not do this with the main breaker if you have one, just individual circuits. If you have any critical equipment on a circuit that could be affected by power loss, have that one alone too. There is a possibility that the breaker will not reset and will have to be replaced. In fact, that's what you are testing for—to be sure that they are operating properly. So use good judgment in selecting circuits to test.

GFCI: Ground Fault Circuit Interrupter

Many homes have GFCIs to prevent fatal electrical shock. All homes should. They're also called GFIs, for Ground Fault Circuit Interrupter. They shut off power from the outlet if it is redirected to you rather than to the appliance you are using. Without a GFCI, the full flow of current from that outlet can travel to your heart. That's 15 to 20 amps of power, and it only takes 3 amps to stop your heart. Electrical accidents usually happen in bathrooms or in the kitchen—you're just out of the shower, drying your hair with a hair dryer, which has a loose connection, or your teenager fishes a knife into the toaster to dislodge a stuck slice of bread. Accidents occur in garages when a worker using a power drill has a loose wire that touches the outer case just as you pick it up. It only takes a split second for tragedy to strike. That's where a GFCI comes into play. It is sensitive and fast. It can detect as little as a .005 amp variation in electrical flow, and will shut off power in 1/40th of a second! Not bad for a device that costs only $7 to $8 for parts.

But what if those GFCI outlets aren't working? Almost a third of GFCI's tested still carry electrical power, but the safety feature doesn't work. How can this happen? Maybe the GFCI wasn't installed properly, or perhaps the product was flawed in manufacturing. Maybe the outlet has been painted. Whatever the reason, you may be counting on protection that isn't there! How can you know? Your best bet is to use an outlet tester with a GFCI test button, which will show whether the protective system is working. Anothe is to push the button marked "test". T "reset" button should pop out, an current in the outlet should stop. T push the reset, and the pow hould come back on. Do this ever If either the "test" button button does not work prope power fails to shut off, have a ri- cian replace the GF



GFCI protection ca stalle a dedicated circuit in the main electrical panel box, with a sp breaker. The circuit breaker will look different from the other breakers bec have a large button (sometimes red, white or yello "Test." Loc ns in the home needing GFCI protection are tied in is there to be used. On a regular basis, simply push it. uit br d trip to the "off" position. Then reset the breaker to restore If utton won't push in, and the breaker won't trip, call an electrician in and have the breaker replaced. It's not working, and you have shoc tion at key locations in your home. Some older homes may have GFCI pr on at all, but should. The solution is simple and relatively inex ve licensed electrician install GFCI outlets at key locations—h n, garage, exterior outlets, for example. The few dollars you could your life.

Your Home's Interior

Today interior walls are generally constructed of gypsum b[illegible] often[illegible]ed t[illegible] as drywall or wallboard.

The gypsum board is nailed or screwed to vertical support pieces, [illegible] wood, referred to as studs. Where drywall sections join, joints are co[illegible] a strip of special tape, and with metal pieces at cor[illegible]s. Joints are then finish[illegible] with a joint compound, sometimes referred to as sp[illegible]

Nail Pops In Drywall

If you have a new home, you're familiar [illegible] bur[illegible]n your walls that appeared in the first year you wer[illegible] These [illegible]mmonly called nail pops. These are points where a [illegible]g na[illegible]crew is pushing, or pulling, against the finished surface of the [illegible]ypical[illegible]e appear due to a drying—and slight shrinking—in the wood [illegible]ywall, and because the house is settling in on its new founda[illegible]on. Th[illegible]ghout the structure is drying to a stabilized level. In the proc[illegible]hrinks [illegible]e gypsum board attached to it does not shrink, so whe[illegible]ttache[illegible]wood will pull on the joint, and the gypsum board su[illegible]slight movements in the house puts stress on these points of attac[illegible]a[illegible]lt in nail pops or small cracks at the joints.

These blemishe[illegible]orrected. The pops can be repaired by scraping or cutting [illegible] filling [illegible] joint compound (spackle) and lightly sanding after the spacki[illegible] Then touch up with the same paint as originally used. Cracks and opening[illegible]ear at the edges of walls as well, where the edging [illegible]d. The li[illegible] the tape shows, with a hairline crack. These too ca[illegible]nner as the nail pop, with joint compound, sanding and [illegible]ng. A[illegible]enging repair is called for if the gypsum board is hit, and bro[illegible]p[illegible]ed. Typically the broken area must be removed, replaced with a plug o[illegible]at is the same thickness, and the edges carefully spackled [illegible]anded. Sm[illegible]nts and dings can be covered with a piece of special per-[illegible]ted [illegible]tape[illegible]ly coated with spackle, and then carefully sanded before pain[illegible]e c[illegible]epair work requires training and experience, and is best left [illegible]

Plaster Walls

Many older homes have plaster walls. Plaster was installed o... appo... truc-
ture called lath, often thin strips of wood, with the plaste... zing... een,
curling around and locking on. Sometimes plaster was i... ov... psu...
board with holes in it which allowed the plaster to enter an... . Pla...
is somewhat like cement, but thinner, and there is not any fle...
wall, so it is prone to cracking. Over the years your house will settle... t
stresses are put on the plaster walls, and then the plaster cracks, especi... the
corners of windows and doors. If the crack is hai... you can easily p...tch it. With
a little care, the wall can be restored to its orig...tion.

The biggest problem for plaster walls is wat... Water l... ing fixtures
not only create problems for the plaste... woo... eath or cause
gypsum lath to crumble. If this should ... major r... job ahead, be-
cause the damaged plaster and the r... ood m... oth be cut out. Plaster work
is an art. If you have a home wit... wal... recommend that you locate
someone who is experienced and a... with plaster. Ask at hardware
or paint stores for the names ... ualifie...

Ceilings

Ceilings are like walls. The... nstructed of gypsum board placed
over wood supports, while th... r o... laster over either wood lath or
gypsum lath. The s... inciple... y to ... n as apply to walls. Maintenance
usually is minim... e crack where the ceiling joins the wall
where joint com... dhe... ause there has been some movement.
If the crack is small, ... with cau... and repainting ought to do the trick.
On the other hand, if the ... is larger, it will be difficult to completely hide
it. You m... nt to think abo... ling crown molding to cover the separation
and ad...

On occas... ilings... . This may be due to the gypsum drywall panels
loosening, ... plaster, the plaster coats may be pulling away from the
lath underne... ght also be structural, such as an overloading of a ceiling
... or truss abo... t could be water—a leak which is working its way behind
and un... ein... material and causing deterioration. If this condition devel-
ops... all for professional help.

Windows

Windows should be as airtight as possible, and they should op clos sily. Windows are the primary avenues for warm air to escape th in and for cold air to leak in. Air filtration can occur around a w Wi ne to be well sealed with caulk around the framing. If you e gl the cold can come straight through the glass. You can install replace existing windows with multi-pane (insulated) glass. The ad n windows will be less expensive. One type is the seasonal storm window fit on the exterior window frame, secured by hook clamps, and cov the entire window. They will admit light, but are fixed a be opened winter, they are taken down.

An alternative is the permanent sash, e od, nyl, installed on tracks either inside or outside yo ws, th n be opened or closed. One type of panel features a nati orm windows and screens, which allow the storm windows t ed, screens can be closed.

Bear in mind that most stor windo cial drain holes (weep holes) installed at the bottom part me to ture on the inside to drain out, keeping the frame a wood ney must be kept open. In your zest to caulk windo horoughly, don't caulk these! Also remember that windows shou a sily. When you are putting paint on them, it's easy to the pa nter, dry, in the area where the edge of the window fits i w this, you're going to have paint stuck windows.

Doors

Many int doors are holl here is a skeleton of wood members inside with a t it. They a ight and relatively inexpensive. But it doesn't take m unch a hole in one. If this happens, don't spend time tryi pair our local hardware store and purchase a replacement. In m s hould be able to mount the new one with the same hardware. Someti starts to stick at one corner. This is typically due to some ment or s t in the house, causing the door frame to be out of plumb. isn' us, oor can be removed and the sticking edge planed down sligh the problem.

e othe d, if the door is severely sticking, and if any other doors or windows in th e area are sticking as well, they could be out of rack, which may indi e complex problem involving the home's structural system.

Potentially there has been substantial movement in the house and should be investigated. As a first step, call a professional home inspector to investigate and let the inspector determine whether a licensed structural engineer should be called for consultation.

Attics

Attic design and construction has changed remarkably. Houses today have a supporting structure for the roof made from trusses—engineered structures built of small dimensional lumber, but which have great strength. The truss keeps its strength so long as each member is in proper alignment, is properly connected and is not under undue stress. But if you place a great deal of weight on the bottom piece, that chord can deflect, placing stress on the connector plates which hold the truss pieces together. The bottom chord can deflect downward causing bowing in the ceiling below. So don't store heavy objects up there. Never cut or remove any section of a truss. *The engineered structural balance inherent in the truss will be disturbed and the structural integrity of your roof can be severely compromised.*

Your Home's Exterior...

A home's exterior consists of exterior trim, wall coverin… …ws, t… roof covering, porches, the garage or carport, chimney, gu… …nsp… Some of these have already been discussed and won't be covered here.

Fortunately, newer homes have exteriors planned to be as maintenance free as possible. A newer home may feature brick veneer at the front, combined with either aluminum or vinyl siding on the sides and rear elevations. Thes… materials are, for the most part, maintenance-free. But your … may not be new, and the … may not be quite as mai… free. Even if new, your hom… terior will still need a periodic … nan… m to protect the materials found there. The specific … gra… depe… upon the materials used and their current condition…

The single biggest th… home's exterior is water. High winds might tear off roof shingles, hail can … num siding or crack vinyl siding; but rain—and the … contained in … bushes and shrubs—has the most relentless attack … ts between bricks or stones and deteriorate mortar; small p… w… and cause the mortar or the face of the stone to pop off. W… n g… od siding or trim, and the wood can rot.

… with a vi… ection of the outside: simply walk around the exterior and … at it carefull… igher sections, you need not climb on a ladder. Use a pair of bi… a … era with a telescopic lens: these will effectively bring the h… llow an inspection of areas that are difficult to access or difficult … Use a … klist to determine which items require attention and then match … recomm… tions in the sections below to determine what actions should be taken…

Exterior Trim

The trim on most homes is made from wood, and can be fou nd v dows (frames and sill), doors, porch columns and attic louvers an ons o oof overhang and edge. The part of the roof overhang that runs tall allel the sky, is called the soffit. The trim piece mounted flat aga st b the soffit, or at the eaves (on the ends of the house) is called the fascia.

Each part of this trim needs to be kept well-caulked at joints and should have a good protective coat of paint or stain.

Should the joint caulking dry and fall out, or should the protectiv paint or stain coating wear thin and crack, peel or chip, the becomes vulnerable to wa rot.

Some parts of the trim are accessible than ot Workin on first floor win olumns is easy for the homeowner, and does not require climbing ar ll ladd A step ladder typically is sufficient. A trip to a quality hardware re can supply you with the necessary exterior caulk an d quality paint. at point, it's just a matter of budget

But othe are ly accessible: second story windows, fascia and soffit. Work require juggling caulk and paint at the top of an extension ladder a easily undertaken by the homeowner. Any work involving ts can pos rd, so for work on these parts of your home's trim, you probab to professional painter.

Exterior Wall Coverings

A wide variety of materials for exterior walls is available to the architect, home-builder and homeowner. Each has its own characteristics for maintenance you should become familiar with the particular requirements of the materials used on your home's exterior. There are some general rules-of-thumb that apply to most exterior wall coverings, though. First, when you do your regular walk-around to your home, look for changing conditions. Look for peeling paint, cracks in caulk or mortar between masonry joints; cracks that have appeared since your last observations; mildew or mold that is now growing on siding; bushes and shrubs that now touch the home's exterior. These are all clues that some maintenance action is needed. Second, keep the exterior clean and free of plant or tree trimmings. This is especially important for the gutter and downspout system. Clogged gutters or downspouts won't work, and you're inviting water problems for your house if they're left that way. If your siding is dirty, wash it with a household cleaner diluted in water. For stubborn cases, rent a power washer for a weekend and spray it clean. If there is a colony of mildew or mold, wash it with a diluted solution of TSP (tri-sodium phosphate) in water or a diluted household bleach/water mixture. (Be sure to test the bleach mixture in an inconspicuous place to make sure it doesn't change the color of the siding.) Keep flowering plant materials raked away from the foundation walls so that water that collects there will drain away, and not be retained where it might penetrate the foundation or masonry joints. A semi-annual exterior housecleaning is an important preventative maintenance process.

Wood Siding Wood siding is a term that covers a variety of materials. Wood siding may be bevel or lap siding installed either vertically or horizontally, wood shakes or shingles, panels made of exterior grade plywood or other composite materials such as hardboard or waferboard. Wood siding products have charm, but all are vulnerable to water. Two simple rules apply to maintaining wood exteriors:

1. The wood must be coated with a protective film, either paint or stain with a wood preservative.
2. All joints and openings must be caulked to prevent water intrusion.

When the protective coating starts to wear, it loses its ability to shed water, and the underlying wood becomes susceptible to water intrusion, warping and eventual rotting. So on your periodic stroll around your home's exterior, look for peeling or chipping paint or stain that has worn so thin that the wood grain is exposed and look for open joints, however small, where water can penetrate; open joints present problems even if the paint or stain coating itself is

in prime condition. Take action before wood rot sets in because [illegible] that occur, your only course may be to tear off the rotted section and [illegible] new materials. That's always more expensive.

Your best tools to help preserve your wood siding are (a) [illegible] or stain and (b) exterior caulk. Use only high quality materials. [illegible] duc may seem like a bargain when you price them, but they won't do [illegible] and you'll have to repeat the job more often. If you're tempted to cut [illegible] lars off a paint job on your home, consider this statistic from the National sociation of Home Builders: *"The cost of the ac[illegible]ating is about [illegible] of the total cost of the painting job; the rest is labor. [illegible]liture of a[illegible]tional $100 would improve many homes."* (***Builders' Gu[illegible]ts a[illegible]tings***, NAHB Research Center, Upper Marlboro, [illegible]land,

Typically, the maximum time interval [illegible] r re-sta[illegible]g and applying waterproofing is 7 to 10 years for w[illegible]nk si[illegible]r wood shingles; it's better to plan on a 5 to 7 year cycle. For [illegible]ood p[illegible]ls, its much less. Exterior plywood—sometimes called T-11[illegible]ed each year, and may need more frequent treatment. Parti[illegible]le boa[illegible]will need touch-up every year to avoid warping and disinte[illegible] Reme[illegible]xposed edges of any wood siding material—plank, sh[illegible]—are [illegible]s where water is most likely to penetrate and cat[illegible]ure th[illegible]those edges are well sealed with paint and caulk.

Brick, Ston[illegible]te (C[illegible]lock. Today exterior brick or stone is usually a veneer [illegible]pproximately 1" in front of the sheathing on the front [illegible] T[illegible]ovides air circulation and insulates the masonry from th[illegible]terior s[illegible]l of the house to help prevent moisture build-up on the masonry [illegible]ere are openings in the veneer called weep holes, ge[illegible]lly narrow slots [illegible]wer portion of the wall, which allow moistu[illegible]es inside [illegible] masonry veneer to drain out. In older homes mason[illegible] form the load bearing walls for the front of the house. R[illegible]ss of [illegible] masonry construction, a basic concern is water intrusion.

[illegible] can affe[illegible]nry in a variety of ways. It can affect the mortar, a special [illegible] of binding [illegible] applied at joints to hold the individual pieces of masonry toget[illegible] pe[illegible]d of time, water can erode the mortar, causing the original m[illegible]ntegrate. If there are cracks, there are more openings for water [illegible] If t[illegible]er then freezes, the result can be spalling, a [illegible]ition in[illegible]h the face of the masonry pops off. Or you may see a whitish film d[illegible]n the face of the masonry. This is called efflorescence and is the

result of dried mineral salts. Water in the masonry picks up miner[illegible] when the water meets the outside air it evaporates, leaving a residue of [illegible] salt[illegible]

If you see mortar falling out of joints, it's time for a touch-[illegible]ess[illegible] *tuck pointing*. Fresh mortar has to be put into those open joints, [illegible]ang[illegible] shaped trowel. If the open joints are easily accessible, and if y[illegible]ach[illegible] you can perform the work yourself. Just be sure to clean excess mo[illegible] sonry face; otherwise, it can cure and harden creating an unattractive appearance. If you decide to hire s[illegible]eone to do it, you can [illegible]re a mason or even a skilled handyman who has e[illegible]e in masonry [illegible]. If you see efflorescence, typically you can clean it off [illegible]rush. If [illegible]ed extra cleaning power, try a diluted solution of muriatic a[illegible]he residue and allow to dry.

Pay special attention to the joint bet[illegible]e ma[illegible] portion of the exterior and any other material such as vinyl [illegible]inum [illegible], or wood trim on window frames. Because the materials a[illegible] have different rates and characteristics of expansion and contracti[illegible]vement can open the joint even if it has been caulked, and th[illegible] allow[illegible]enter. The remedy is caulk: purchase a good grade of e[illegible] and s[illegible]ints.

Asbestos Shingles. Many [illegible]ered with shingles that contain asbestos fibers. These [illegible] referred [illegible]mil[illegible]r shingles. They are long lasting, and require little m[illegible] Bu[illegible] can c[illegible]ck or break if hit because they are brittle, and their [illegible]

If any of these condi[illegible]be your exterior asbestos shingles, your first inclination may be to remov[illegible]fore you do, here are some words of caution. Asbestos [illegible]idered to be a[illegible]ous material, a cause of lung cancer. It can be dan[illegible]lth when it reaches a state called *friable*—i.e., airborne. To reme[illegible] ntire house may have to be wrapped in a special plastic ma[illegible]o co[illegible] airborne fibers, and the workers will have to wear special clot[illegible] gear to protect them from airborne materials. As a result, th[illegible]ost of rem[illegible]ese shingles can mount quickly into the many thousands of [illegible]rs. A better [illegible]tive may be to either replace missing shingles or to paint [illegible]d s[illegible]. Yo[illegible]y also cover them with a new siding material, keeping the old [illegible]ct. Regardless of the course you choose, do not break, scrape, [illegible]se [illegible]e brush on them. They can also breed mildew, mold or even [illegible], where [illegible]ight is minimal and moisture is abundant. These fungi can usu[illegible]ly b[illegible] by scrubbing with a stiff brush, bolstered by a weakened version of h[illegible]bleach.

Stucco. On older homes, stucco was used for the exteri[illegible]s. It was a plastering technique, involving a three-step process. A first co[illegible] spr[illegible] over wire mesh, secured to the wall. This coat was immediately so[illegible] or [illegible]ned so that a second coat would adhere; it was called, appropr[illegible]he [illegible] co[illegible] A second layer was then applied. It was called the brown [illegible] bro[illegible] ish color when applied. It was allowed to cure for two or three [illegible] it cracked—a normal result. A final finish coat was then applied ov[illegible]d brown coat. If the proper amount of time had been allowed for curing t[illegible]wn coat underneath, the final coat would seal crac[illegible]nd harden into a [illegible]mooth finished surface.

Over time, problems may plague stucco ext[illegible]. Pa[illegible]tucco finish may peel or flake away due to moisture[illegible] also [illegible]to settlement. The stucco finish is rigid, and as the h[illegible]ev[illegible]oves an[illegible]ifts on its foundation, the rigid surface can crack. I[illegible]ure ge[illegible]de those cracks, the surface can deteriorate further. Cracks sh[illegible]filled[illegible]more stucco or with a good quality caulk—latex, silicone or ur[illegible]

Very few new homes are c[illegible]th stuc[illegible]n the historic fashion. Instead, there are several hi[illegible]etic st[illegible]compounds which can provide the desired aesthetic re[illegible]ncerns of the older materials. These compounds are typically appli[illegible]r a [illegible]mesh applied to the wall sheathing used for insulat[illegible]/vater[illegible]ng. [illegible]mesh is wrapped over all exterior surfaces to be co[illegible]tucco. Some types of exterior sheathing are more adapta[illegible]nish than others. One such material is sheathing sold under[illegible]ame Dry[illegible]it.

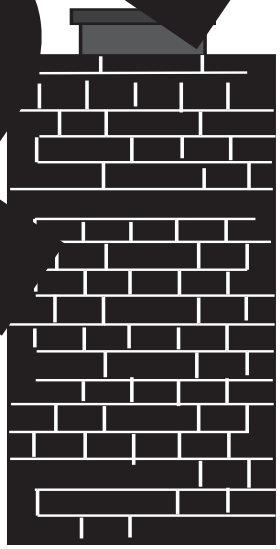
Al[illegible]um or Vinyl Si[illegible] uminum and vinyl siding require little regular mai[illegible]r on al[illegible]minum siding is baked on. The color on vinyl siding [illegible]ial. Aluminum siding will dent if hit by a hard object. Vi[illegible]ing m[illegible]k when cold, if hit hard. Over time, aluminum siding can oxi[illegible]a film on the surface, and dulling the color. This can be [illegible]oved by w[illegible]ith special compounds, available at your local [illegible]ware store. [illegible]uminum and vinyl siding may get dirty from airborne particles [illegible]as[illegible]can remove this dirt. For stubborn cases, you may want to co[illegible]washing with special hoses powered by an air compressor. You [illegible]rta[illegible] work yourself with the proper equipment. Just call your equip[illegible] rental[illegible]r to check on prices and instructions.

Shrubbery, Trees and Moisture

That lovely landscaping you've cultivated all these years is a moi tory ll living plants not only contain moisture, they transmit it to surfaces uch, are close to your exterior walls, they not only block sunlight and ai tion ansf water vapor too. This combination leads to fungal growth—n s. Th can leave a green or brown stain on your home's exterior. Trim y d s back to leave at least 1 foot of clear space between them and your ext low sunlight and air to enter and dry out the moisture that accumulates the ke up leaves, limbs or any other plant materials which may have accumulated nex your foundation wall.

Your Chimney

If you have a fireplace, you have a chimn Rain reen which is the exterior portion of the unit Chi homes have a metal chimney, which ma posed or it may be enclosed in a box it called a chase. If it is enclosed in he unit is not exposed to the elements, nance is typically limited to ha g a ch sweep clean the flue on a re . But the metal is exposed, it mu ted from rain to avoid rust. Usu tective coating installed by the t your task is simply to iodicall ine exterior to insure th is ntact and there is no ru r to repaint the exte pecia at withstands moisture an ratures.



Many ho masonry chi constructed of brick, stone or block. These sit on a se cture, and because of this there can be movement of the chimne You may see an open joint where the chimney abuts the house. lly t cause for concern but merely indicates this differential moveme oes need to be resealed with a high quality exterior caulk to prevent rain a om intruding and melting. On the other hand, should you ever a lean or e chimney itself, it may indicate a serious structural concern, ma e br or rebuilding of portions of the chimney structure. When lean or ti l a qualified chimney contractor for advice.

Typically, chimneys are well-constructed and remain free of pro[illegible]or many decades, but there are a few conditions requiring correction th[illegible]t oc[illegible]. Occasionally mortar in the masonry joints may come out, leavi[illegible]n ga[illegible]ese gaps are open invitations to water, and once water gets in, [illegible]ama[illegible] occur. When the water freezes, the brick facing may simp[illegible]ndit[illegible] called *spalling*. Open joints in chimneys, like open joints in [illegible]ric[illegible] walls, should be given a tuck-pointing touch-up with new mortar. [illegible] and chimney join, there should be flashing material—metal waterproo[illegible]re-vent water from creeping under the roof materia[illegible]nd following the chimne[illegible]line into the house. Over time, either settlement or [illegible]her can creat[illegible]ings in the flashing: it either pulls away from the chi[illegible]e beca[illegible]move-ment, or sealant materials around the flashing dry, [illegible]ut. Any deterioration of the flashing should be ad[illegible]ickly [illegible]ems devel-op. You may be able to check your flas[illegible]ulars [illegible]roof design allows full view. If not, when you ha[illegible]r chi[illegible]cleaned by professionals, ask them to check the flashing whi[illegible]are or[illegible]oof.

If your home is new and your chimne[illegible]u may see a whitish film form on the face of the brick. This[illegible]led efl[illegible]residue of mineral salts which moisture has collect[illegible]brick a[illegible]ted on the surface when it dried. It is relatively co[illegible]k, and[illegible]n be removed by brushing with a stiff brush or by using [illegible]f muriatic acid. You can stem the recurrence of efflorescence [illegible]ting [illegible]ck with a silicone-based sealing compound. If you l[illegible]er h[illegible]owe[illegible], and suddenly begin to notice efflorescence on th[illegible]er seen it before, you're probably dealing with a differe[illegible]Wa[illegible]trating the brick from above and is then coming through [illegible]eaching mineral salts as it moves. The two most likely sources of water ar[illegible]ue with no rain cap, and a cracked or broken cement s[illegible]hich caps the b[illegible]k. Either can be effectively corrected by a compe[illegible]or chimney contractor.

Porches [illegible]Deck[illegible]

Many home[illegible]orches and decks. Maintenance on either is not particularly strenuou[illegible]re are some conditions to watch for, and when they occur, [illegible]ctive actio[illegible]ssary.

[illegible]tairs. Porches are usually constructed of concrete, brick or [illegible]pe[illegible]upon the design of the home. Adjoining stairs usually are [illegible]ructed[illegible]the same materials. The principles that apply to exterior walls apply [illegible]s and stairs: keep them well sealed from water intrusion. Brick joint[illegible]

should be tuck-pointed whenever the mortar comes loose, and wood porches should be kept well painted or stained. Concrete porches require less attention generally, though applying a waterproof sealant can help extend the useful life of the concrete. If your concrete porch has a metal railing, be sure that the protective paint coating is in good condition; otherwise you'll have rust stains running down your porch. If your concrete porch surface begins to pit and flake away, exposing the gravel aggregate that was put into the concrete mix, be aware that your porch is near the end of its useful life. There's really no remedy for this situation other than tearing off the old porch and pouring a new one with fresh concrete.

The other condition often found at front porch/stair combinations is erosion of the soil base beneath them. Water can run against the foundation and can work its way under, eroding the gravel and/or soil beneath. If the erosion gets serious enough, water can pond beneath the porch or steps, and can work its way through your foundation wall by capillary action. You suddenly discover that you have got water in your basement!

If you see erosion, stop the flow of water to the porch/stair area by using compactable soil (high clay content) to top off and slope the areas next to the front foundation wall and at the sides of the structure. Create a slope away from those areas, toward the yard. Install gutters and extended downspouts to remove rainwater from the immediate vicinity. Keep the soil level and you should correct the situation. On the other hand, if it has progressed to the point that there is a sizable cavity beneath the porch or steps, you may have to hire a concrete contractor to inject concrete into the cavity. This is often referred to as mudjacking. Or you may have to have the porch or stairs removed and start over.

Some porches have columns commonly constructed from wood. These will need repainting on a regular basis, as will the wood trim on the house. Examine these columns for cracking due to exposure to the elements. Seal all cracks with exterior caulk. Also examine the bottom of the columns, looking for any open joints where water might get under the base of the column: this is where rot is most likely to occur since wood will wick water at the ends where the grain is exposed. If you see open joints, seal them with caulk also.

Decks. Assuming that your deck is made of wood and was properly built with appropriate materials and construction techniques, the primary maintenance is the preservation of the wood itself. Untreated floor boards and railings will show the effects of exposure to rain, wind and sun after a short period of time. Soon the wooden pieces may begin to warp, and the wood grain on all the pieces will protrude. Splinters will be commonplace. In time,

some of the wood sections may develop rot. You can prevent all or at least postpone it indefinitely—by applying a water-seal wood preservative on the deck. This should be done shortly after the deck is constructed if new. If the deck is older and has not been regularly treated to waterseal, clean it with it and give your deck a renewed look.

Over time exposed deck wood will weather and develop a gray tone. If you like that look, simply apply the waterseal on the deck as is. On the other hand, if you prefer an appearance closer to the way the wood originally looked, you can have the deck power-washed, with air-compressor devices, to strip the surface of the wood. Allow to dry thoroughly, then apply waterseal. Don't attempt to apply waterseal with a brush. It will work but take an extraordinary amount of time. Either use a roller and paint pad, which could cover walls, or rent a sprayer. You'll be able to apply several coats of waterseal in the same time that one hand-painted coat with a brush would require.

Garage/Carport

Your home may have a garage or carport. It may be separate but directly attached to the house, may be an integrally built part of the house, or may be free-standing nearby (referred to as detached structures). As with the other exterior components, examine the wood trim of the garage or carport with the same trained eye. Use the same inspection techniques on the front, rear or side elevations of the garage that similar materials on other exterior locations require. Pay particular attention to the area of the door on the garage, because often this is where water and insects are caught early, the damage can be controlled; if not, major restoration or replacement may be the only alternative.

Garage door operators should receive attention because they can malfunction, usually at the most inopportune time. Many electrical operators have a circuit board inside that can develop operational problems. Due to the cost of these boards, it may be more economical to replace the entire door operator unit if a problem arises. Another component which can cause problems due to improper adjustment is the safety reverse mechanism. In older models, there is a pressure-sensitive device that trips a reversing mechanism when resistance is encountered by the door. These adjustments can usually be made on the door operator itself. Newer operators incorporate an electronic beam that trips the automatic reverse when something crosses its path and blocks the beam. You should test the reversing mechanism periodically to insure that it is operating properly.

If you have the pressure sensitive mechanism, push the button [illegible] the door, then stand inside and slightly back from the door, extend your h[illegible]-pal[illegible]up—under the door bottom and catch the door as it is closing. T[illegible]or sh[illegible]stop closing and reverse itself. If it continues to close, don't fig[illegible]it; c[illegible]echn cian who can determine if an adjustment is needed, or if [illegible]em v the reversing mechanism itself. If you have the newer electric [illegible]f reverse, pass your foot through the beam to insure that the door wi[illegible]

Gutters, Downspouts and Yard Grade

A tour of the exterior includes a recheck of th[illegible]that control[illegible]nd prevent a wet basement. Start with the gutters. Gutt[illegible]e ke[illegible]n in order to function; leaves and debris should be clea[illegible]out re[illegible]amine them to see if there are any pinhole leaks or r[illegible]s tha[illegible]r. (Wait for a spring or summer shower, go outside a[illegible]e leaks w[illegible]rop water right next to your foundation wall, exactl[illegible]e you[illegible]want it. While it's possible that leaking gutters might be repai[illegible]est l[illegible]imply to replace any leaking sections. While you are looking fo[illegible]re that the rainwater is freely flowing through .the gutters a[illegible]into the[illegible]s. If not, your gutters may not be aligned correctly. Reme[illegible]shou[illegible]ard the downspout. Have an improper alignment c[illegible]y, beca[illegible]t will defeat the purpose of the gutter system.

Downspout pipes ([illegible]aders)[illegible]ld be[illegible]act, with no rust, holes, or broken sections. Most h[illegible]the installation of downspout extenders at the botto[illegible]whe[illegible]turns the water flow toward the yard. Extenders are availa[illegible]iety of [illegible]terials. Some are simply additional sections of metal pipe that [illegible]emainder of the downspout. Some extenders are hinge[illegible]that they may[illegible]up when you are mowing the yard. Other extend[illegible]heavy, flexible plastic pipe, which can be laid on top of the gro[illegible]ng[illegible]ost people prefer to bury it under sod or mulch, or tie it in[illegible]nder[illegible]ain. Whatever the material, the extender should be long enoug[illegible]nwater at least 3 feet from the house before depositing it on the ground[illegible]ould keep it away from your foundation and basement.

Examin[illegible]ard[illegible]e to insure that it is not sloping toward the house. The same appl[illegible]pervious surface that won't absorb water (patio or driveway, for [illegible]). I[illegible]urface directs water toward the house, it's only a matter of time [illegible]e that [illegible]winds up in your basement. The only answer is re-grading, but that d[illegible]essarily mean heavy earth-moving equipment

rolling across:your lawn. It could be as simple as several wheelbarrow loads of fill dirt put near the foundation wall and tamped down with a shovel, establishing a proper slope. It means a couple of weekends of work, but it can cope with a wet basement!

Concrete patios are another matter. Usually if they have an improper slope and pours water next to the house, it means removing them and starting over. However, there are circumstances where a new patio can be poured over the old one to correct the improper slope: it must be thick enough to provide the needed strength, and the new concrete won't bond to the old, but in some situations it can work.

Keeping your home's rain-shedding system properly maintained is one of your most important home maintenance tasks. It's a never-ending basement, but it prevents water from invading the interior wood superstructure of the home. While there are a number of steps that help waterproof a house's structural envelope, the most effective action is to keep water away. Waterproofing works only to a degree, because as the old adage says, "A house is not a boat; a boat is designed to float in water, a house is not.

Driveways, Sidewalks and Patios

Driveways: Driveways are typically made of either asphalt, concrete or gravel. All require a degree of maintenance. Gravel driveways often develop ruts, and if severe, may be needed in addition to more gravel. Concrete is a durable material, but it will start to crack as the ground under the driveway shifts slightly. These cracks should be filled with either cement or a special waterproof caulk. Otherwise water won't fill the crack and freeze during the winter. Another condition affecting concrete is called spalling. If water penetrates beneath the surface of concrete and freezes, parts of the face may pop off This will expose more aggregate in the concrete, creating the potential for further deterioration. There is no easy fix for a severely spalled concrete drive, short of tearing it out and rebuilding it. When new, the life of a concrete driveway can often be extended substantially by treating the surface with a silicone waterseal.

Asphalt driveways may experience sinking, or the surface can crack due to settlement. Fortunately asphalt can be patched. When severely deteriorated, an asphalt driveway can have a new topcoat added, provided that the additional coating will not create a problem at the garage entrance: the driveway elevation should be below the garage floor so that rain and melted snow will drain away from the house, not into it. An elevation mismatch can create a

water problem, so the old asphalt driveway may have to be rem and a new one laid, if the potential for that problem will arise.

Sidewalks and Walkways: The term sidewalk is u ese or th paved walking area that runs parallel to the street, while a w from street or driveway to the house. Sidewalks are typically concr may be concrete, asphalt, brick or stone, or even wood. Sidewalks area that is publicly controlled, a road right-of-way or an easement fo es. However, in many instances maintenance of the ewalk is the resp nsibility of the homeowner, as is the liability which migh erson is in ecause of a hazardous condition. Walkways are clearly sibil the homeowner.

Whatever the material, good mainten ing a wa ful eye for conditions that may cause tripping haz smeti lems or water drainage toward the house. Any tripping haz ld b inated through repair, ramping or lighting. Repairs are usually e condition of the material has deteriorated and created an e re. A ular attention to the direction of water flow in a heavy ra a side lkway is tilted toward the house, forcing water to t ll, the air is in order before water winds up in your basement. volve tearing out the existing sidewalk/walkway and re-installi not sk, but better than coping with a wet basement.

Maintenance Help For Your Home

Keep Names a[illegible]ne N[illegible]s of Contractors H[illegible]utur[illegible]enc[illegible]

Exterior

- Roofing and Gutter Repairs:
- Gutter Cleaning:
- Painting (Wood Trim & Siding):
- Chimney Cleaning and Repairs:
- Yard & Lawn Maintenance:
- Brick and Masonry Repairs:
- Driveway maintenance/Repaving:

Interior

- Heating and Cooling System Ma[illegible]
- Plumber:
- Electrician:
- Drywall/Plaster Repai[illegible]
- Appliance Maint[illegible]nance:
  - Dishwasher
  - Refrigera[illegible]
  - Washing Ma[illegible]
  - Clothes Dryer:

Handy[illegible]