

VALUCARE FOR YOUR HOME

INTRODUCTION: “ValuCare” is an organized collection of instructions for maintaining the overall value of your home and its systems. The advice is not exhaustive so we suggest that you consult your home inspector with any specific question that is not answered herein. You may wish to remove the ValuCare Maintenance Chart from this report and post it where it may serve as a quick reminder for routine maintenance needs. An excellent home owner maintenance series of companion publications to our VALUCARE effort is published by Building Research Council of the University of Illinois School of Architecture. Call 1-800-336-0616 for a list and prices.



PART I: EXTERIOR MAINTENANCE

ROOFING: Different roof coverings have different requirements and characteristics.

SLATE roofs require that the ridge be tarred about every five years, unless the roof has a metal cap piece at the ridge. This procedure takes about two hours and costs approximately \$400. Any fallen or displaced slates need to be resecured or replaced. Any galvanized metal flashings for valleys, chimneys, or plumbing vents, need to be painted every five years. This can be done at the time that the ridge is retarred for an additional cost of about \$200. Take care not to walk on a slate roof. The contractor should work from a ladder that rests on the slate supported by ridge hooks. Inspect your roof sheathing from the attic about once a year to check for leaks and, if you have board sheathing, look between the boards for any white powdery residue on the roofing paper. This is a sign of moisture and slate oxidation. If this condition is found throughout, plan to replace your slate sometime over the

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next three years. Good slate is heavy, about 15 lbs. per square foot. There are light weight synthetic slates available as well as light weight cement tiles weighting about 5 lbs. per square foot. They synthetic slates have not performed well.

SHAKES AND SHINGLES: Wood roofing can be White Cyprus, Western Red Cedar, Northern White Cedar, Redwood, White Pine, and White Oak. The Washington D.C. area uses predominantly Cedar, in both red and white variety. Cedar roofing can be either a shake or shingle. Shakes are distinguished from shingles by their rough, non-uniform appearance. In order to extend the service life of your Cedar roof we suggest the following: Keep pine needles, leaves and other organic debris off of the roof. These things trap moisture and encourage rot causing moss and fungus. Use a regular chemical cleaning. One such formula recommended by the Texas Forest Service is a 10% solution of Copper - 8 (Copper Quinoliolate) in water. This solution is non-toxic to vegetation and animals. Wear eye and skin protection when applying. Note: Oils and preservatives are controversial because they are expensive, not proven to extend the wood's life, and rapidly leach out of the wood.

METAL ROOFS: Metal roofs come in a variety of types and forms. There is the standing seam which can be pre-coated aluminum, copper, or zinc coated aluminum if your house is less than 25 years old. The older houses with standing seam are most likely tin roof. The former need virtually no maintenance whereas the older variety need to be cleaned and painted about every five years. Avoid using asphalt based paints and mastics over these older roofs. Try using a good metal roof paint and clean the roof first of chipping paint, dirt, and debris. Flat seam metal roofs are generally soldered joint type that, unless copper, also need regular painting. The shingled panel metal roof uses a die formed metal shingle that has a factory applied metallic coating. These systems are virtually maintenance free. The corrugated panels with a ribbed profile are usually galvanized steel and, like the standing seam tin, need to be painted regularly. Additional information about metal roof systems can be obtained from the Roofing Industry Educational Institute (RIEI) 14 Inverness Drive E, Building H Suite 110, Inglewood, Colorado, 80112.

RUBBER ROOFS: The so called "rubber roofs" are applied as one ply over a flat or low slope roof and are referred to in the industry as single-ply membrane roofing. This membrane type roof comes in a variety of materials, but in our area most residential use of single ply membrane is either synthetic rubber, most notably EPDM (ethylene propylene diene monomer) or else modified bitumen. The modified bitumen is heavy, reinforced and the most prevalent of the two. These roofs are almost maintenance free if installed properly. However, since they can be punctured, keep dead limbs and other dangers away from where they could fall and puncture the roof. These roofing types should be applied with enough of a slope to shed water. Water that sits for more than 48 hours can damage the material and shorten the service life. We recommend that the modified bitumen be painted every five years. For additional information, contact the Single-Ply Roofing Institute at 104 Wilmont Rd. Suite 201, Deerfield, Illinois, 60015.

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ASPHALT SHINGLES: Asphalt shingles can be all asphalt (organic) or asphalt composition (containing fiberglass). The former is characteristic of pre-1975 applications, although one can still buy and install an asphalt shingle. Most asphalt and asphalt composition shingles are twenty year rated, three tab shingles. The multilayered shingle sometimes referred to as a dimensional or architectural shingle are designed to render a longer service life of 25 to 30 years. Once installed properly, there is no maintenance required for an asphalt or asphalt composition shingle. Most asphalt shingle manufacturers have a special type of shingle recommended for humid, shady areas. These shingles inhibit moss and mildew. Should you notice algae growing on your shingles there is an excellent product that can be installed at the ridge to inhibit algae growth—"Z Strip". This product is zinc coated and with rain the strap releases zinc ions that are carried across the shingle. Algae won't grow near zinc.

CEMENT ASBESTOS: Roof shingles are typical of homes built in the Forties, Fifties, and Sixties. This shingle is rigid, fragile, and not meant to be walked on. Any cracked shingles should either be replaced or sealed with clear silicone caulk. When cleaning gutters, valleys etc. work from a ladder supported from hooks at the ridge. These shingles are heavy and represent an added cost for disposal when reroofing due to their asbestos content.

BUILT-UP ROOFS (BUR): This type of roofing is rarely used anymore, having been largely replaced by the single-ply membrane systems. Also known as tar and gravel roofs, this type is intended for low sloped roofs. It consists of layers or roofing felt alternated with mopped on layers of either melted tar or coal tar pitch and topped with gravel or slag, stone. This type of roof should be inspected regularly for bare spots, soft spots, cracking, and "alligatoring" surface, (bubbled pattern resembling an alligator's skin). Repairs are difficult since the point of water entry is difficult to determine.

REPLACEMENT COSTS: Asphalt and Asphalt Composition: \$2.00 to \$3.00 / sq. ft. (figure an additional 30¢ per sq. ft. for tear off and disposal of old roofing and \$1.00 per sq. ft. if the old roofing is cement asbestos) **Slate:** Tear off and Replacement about \$12 per sq. ft. **Wood Shake Number One Quality:** About \$10.00 per sq. ft. **Metal Standing Seam:** Copper @ about \$16 per sq. ft. and other types at about \$12 per sq. ft. **Single Ply Membranes** cost about \$4.00 to \$5.00 per sq. ft.

TROUBLE SHOOTING ROOF LEAKS: This is generally a two person job. One should use a hose with an agreed upon pattern. The other person is positioned in the attic. A walkie talkie or message relay person would also be helpful.

FLASHING, CHIMNEYS, GUTTERS: Flashings are materials used to prevent leaks at intersections and penetrations of a roof. Usually made of metal, these flashings need to be inspected yearly for any breaks or rust. If you have galvanized metal flashings they need to be cleaned and repainted every five years. A good wire brushing, cleaning, and a spray can of "Rustoleum" or similar metal paint is all you will need. Often times areas that have been poorly flashed have been over caulked with roof mastic. Roof mastic is not intended to cover large areas or compensate for poorly cut and formed flashings.

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Chimneys need maintenance, particularly if masonry. The combination of flue gases and weather can cause deteriorated crowns, loose and spalled bricks, and deteriorated flue liners. Masonry chimneys need a Portland cement wash cap, two inches thick and with a bond break next to the flue tile. This wash cap sheds the rain water from entering and damaging the chimney. Once the brick face spalls away from the brick due to the freeze thaw cycle, it is difficult to repair since penetrating sealers such as ThoroSeal, Phenoseal, and UGL need a sound surface. Brick replacement is the fix. The flue needs to be protected from weather with a rain cap. Rain caps usually come with side screens (spark arrestors) installed to keep animals out and sparks in. This flue liner in a masonry chimney is usually terra cotta material. Ideally, the liner should be continuous and unbroken from the top of the smoke chamber to its termination at the chimney top. Practically speaking, however, it is indeed rare to find a perfectly installed flue liner. Chimney Sweeps will often “seize the opportunity” to use minor flue misalignment or small joint breaks to “justify” a recommended relining of the terra cotta flue with metal liner. The cost for this retrofit is approximately \$1,300 and is many times not needed. Always ask for pictures of the “defect” and get a second opinion. The authority for chimneys is the National Fire Protection Association (Standard 211). There are several ways to increase the efficiency of your wood burning chimney. If your fireplace is a pre-1980 unit it probably takes combustion air from the living space - not very efficient. You can have a Mason or Chimney Sweep install an outside air feed. Also, your logs will last longer if they are placed over a grate that has a 1/2” hardware cloth piece between the logs and the grate. Finally, for the deep hearth units, try a cast iron fireback to increase the reflective surface and move that surface closer to the room to be heated. Frequency of fireplace cleaning is a function of how much wood you use, what kind of wood it is, how old the wood, whether your chimney is on an outside wall, and how hot you keep the fire. Therefore, it is impossible to have a hard and fast time rule on cleaning. A better approach is to open the damper and view the smoke chamber and flue from below. If you can no longer distinguish brick from liner or mortar from brick then it’s time to get a cleaning. Make sure that the Sweep cleans both flue and smoke chamber for the average \$150 fee. Chimneys that back draft deserve special trouble shooting. Call us for specific trouble shooting details should you be a victim of chimney backdrafting. Should your masonry chimney be visible in the attic, make sure that there are no soot marks around mortar joints. Should you see such soot marks, call a Chimney Sweep to investigate any liner breaks. Metal chimneys do not need to be cleaned as often as masonry chimneys due to design and construction differences. Also, metal pre-fabricated chimneys are easier to clean since they have so smoke chamber above the damper. Finally, for those damp days when you get a strong smell of creosote from the not in use fireplace, try a few shots of “Pam” into the smoke chamber (without a fire, of course). This should neutralize the smell for a day or so. Before purchasing a free standing wood stove or insert, read the EPA brochures, “Buying an EPA-Certified Woodstove” and “Noncatalytic Woodstoves”. These are free brochures. These and other technical assistance on the matter is available from the following: 1-800-490-9198; 1-202-260-5922.

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Gutters and downspouts come in a range of shapes, metals, and thickness. When they are not aligned properly, not sized properly, or not maintained free of leaves and other debris, they can cause water damage to the house. Inspect your gutters twice a year, when they are cleaned. Should you tire of cleaning the gutters, try a product that covers the gutter but allows normal roof drainage- Not Screens. There are patented systems such as “Gutter Helmet” which are guaranteed not to clog up- or the installer will clear the blockage (1-800-947-4056). Anytime your downspouts are extended underground, use a leaf strainer over the downspout entry hole in the gutter, unless you have a gutter guard such as “Gutter Helmet”. Gutter realignment will not be a requirement if you start with a commercial grade gutter that is not the minimum 3 inch wide but rather 5 or 6 inch wide. In addition, if your house is twenty years old or better, don’t use gutter spikes to secure the gutters, the wood rafter tail pieces will not have the original holding power. Instead, use a roof strap system with a fascia hanger. Gutters need a one inch fall over sixteen feet of length in order to drain properly. If your gutter system is sectional and not a continuous gutter (without seams) then reseal the seams after every five years or if you observe leaks at these seams.

Landscaping and Drainage: We maintain nicely landscaped and graded grounds for the beauty of it but, beyond the beauty there is an important function to proper grounds maintenance - Water Control and Energy Conservation. Proper grading and roof water control reduces the chance of a wet basement or crawl space with accompanying rot, termite infestation, mold, and mildew. Proper plantings serve to reduce heating and cooling costs by creating windbreaks and shading. There is a wealth of information available to the homeowner in these areas from The U.S.D.A. Soil Conservation Service, The County Extension Service. Large landscape and Nursery companies, and of course, the Public Library. One excellent source for selecting proper trees and shrubs is Landscaping Your Home, by: W.R. Nelson, Jr., Univ. of Illinois, 1975. We suggest that you keep the area around your foundation free of ponding water by either regrading with a positive slope for six to eight feet away from the foundation walls or, if plantings obstruct such regrading, install an underground drain to “daylight” away from the foundation. This drain would run from a low point drain where you have graded purposely to slope toward this floor drain and continue at a minimum of 1/4 inch per foot slope to the point of discharge. Use a non-perforated buried pipe to transport this water. Don’t allow roof water to contribute to this ponding. Use splash blocks under downspout elbows and, where needed, use leaders to extend the discharge.

Exterior Painting and Sealing: **Natural wood siding and decking** needs periodic maintenance to preserve its appearance and service life. Maintenance consists of cleaning to remove surface mildew, dirt, and fastener stains followed by

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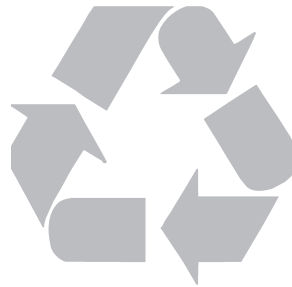
sealing with penetrating oil based water repellents. Cleaning Cedar and Redwood is best done with a mild mixture of Oxalic Acid (4 ozs. in a gallon of warm water) applied with a soft sponge mop. In case of severe discoloration several applications may be necessary. Wood should be allowed to dry between applications and then any Oxalic acid residue should be flushed away with a water rinse. For particularly stubborn mildew stains use a commercial mildeicide or household bleach in a one to three solution with warm water (mix in a glass or plastic container and protect skin, eyes and shrubs when using any cleaner). Be careful if using a power wash with detergent cleaners since in the hands of the unskilled tradesman it can gouge the soft cedar and redwood. These same cleaners can be sued on treated pine decking or you can use a commercial cleaner such as Olympic "Deck Brite". The next step, water repellents, are used to maintain color and wood stability. The best stains have a high level of linseed oil and ultraviolet blockers as well as fungicide additives for mold and fungal growth. Some well known penetrating water repellent companies are: Olympic, Cabot, Amteco, Pratt & Lambers. There are some very low maintenance decking products now available. Osmose makes a wax impregnated wood known as "Americas Wood". Mobile makes a wood polymer lumber known as "Trex"

Caulks are true to the old adage "you get what you pay for". However, the very best performing caulks are either hard to purchase retail or else difficult to apply. The caulks that are readily available should be selected by intended application. Stay away from oil and vinyl latex based caulks, they don't last. Don't use pure silicone caulk where you intend to paint or against plastic. Acrylic latex is a good choice where the gap is less than 3/8 inch or where the seal is against plastic or vinyl. For gaps greater than 3/8 inch and not against plastic or vinyl, use Silicon Acrylic latex. For large gaps in masonry to masonry or concrete to concrete (3/4 inch to 1 inch) use polysulfide or polyurethane (usually available from a swimming pool supply house). For smaller masonry or concrete gaps use butyl rubber. These caulks are not structural and therefore should not be used to bridge and seal foundation wall cracks. Structural sealants are generally epoxies applied under pressure with special injection equipment

Surface Preparation for Painting is about 1/2 of the work in an older home setting. Experts will tell you that premature paint failures are due to poor preparation and/or moisture; rarely is the paint manufacturer to blame. Chemical strippers can be expensive and dangerous. These strippers can cost up to \$2.50 per square foot and if they contain methylene chloride they may cause heart and kidney damage. We like heat gun stripping with some mechanical stripping. As long as you use a HEPA filter mask and clean up the droppings properly, the gun and some wire brushing and wet sandpaper is your best bet. A good quality heat gun (Black and Decker 9756 or Milwaukee 750) will cost about seventy five dollars and heats to a safe temperature of less than 700 degrees. The gun does a thorough job. Some additional tips: a. Always prime raw wood and use a clear shellac over

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knots. b. Never paint over a wet first coat. c. Never paint over dirt and dust. d. Never paint outside when the temperature is less than 50 degrees. e. Never paint directly in the hot sun. For additional information about paints and coatings contact **The National Paint and Coatings Association**, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005, Tel (202) 462-6272. **Concrete Flat Work** maintenance for drives and walks involves protection from salts for deicing, not allowing wrought iron rails to rust at the base and expand and spall the concrete, and repairing breaks before they allow water to damage more of the concrete. Patches of less than 2 inches usually do not hold. When patching, use a bonding agent such as BondX or some similar concrete bonder. Concrete sealers are marginally effective but should you wish to try one, particularly in the garage to seal against oil and grease contact: UGL 570-344-202, H.B. Fuller at 1-800-468-6358, or Thoroseal. Were the expansion joint has deteriorated use a flexible caulk to protect these joints from water damage. Polysulfide and polyurethane are best. Sakrete makes an excellent product for removing oil spots from concrete- "Fade".



PART II: ENERGY CONSERVATION

Energy Conservation, as discussed herein, is not intended to be a primer on global or even National strategies. We are going to discuss energy conservation in lower case, that is, those practical measures which yield the quickest, most significant economic payback for the least outlay in initial capital. For example, if an 80% efficient gas furnace is good, is a 90% efficient furnace better? Answer: "Not Necessarily" because the additional \$1,000 in capital outlay may take longer to recover in fuel savings than time that we intend to spend in the property. In otherwords, the "payback" period is too long when we figure the "Life Cycle Costing" of the improvement. An excellent companion for our notes is "Energy Management in the Home" from the Building Research Council (1-800-336-0616). The following is a listing of "practical" energy conservation methods, repairs, and practices:

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Sealing The Envelope: Most homes built prior to 1980 have seemingly minuscule openings that in reality average about two square feet of open area. This open area permits infiltration (intrusion of outside cold air) which accounts for about 25 per cent of the Winter heating bills and a significant portion of Summer cooling bill. Weather-strip and caulk around all penetrations in the building envelope. Specifically, around window and door frames (see above for caulks), light and plumbing penetrations in the attic floor, electrical outlets and switches, on exterior walls, at wood sill on masonry/concrete foundation. **Insulation** is next: Make sure that the basement ceiling, where accessible, is insulated above the foundation wall; use an R-19 fiberglass at these locations. Note: Fiberglass now comes in a plastic wrap to contain fibers. The attic deserves an R-30 level which in loose fill is equal to about twelve inches and in roll is 9 1/2 inches. When installing take care not to block the low eave soffit vents-use baffles to preserve an air channel. If the finished walls are not insulated, don't bother; its too expensive for the pay-back. However, if your windows are single pane use an insulated drape. In crawl spaces either insulate the ceiling with an R-19 level (6 inches) or insulate the walls with an R-13 and install a ground vapor barrier over any dirt floor.

Use Timers on the air-conditioning condenser, water heater, and thermostat. Most local electric power providers have remote-control devices that install on the A/C and Water Heater and allow the power company to briefly interrupt service. The savings paid directly by the power company is about \$55 per year and costs you nothing. The set back thermostats for heating and cooling can save about ten percent on your heating and cooling bills and cost about \$40. a good example of these program-mable thermostats is the "Set 'n Save Plus" from Hunter Fan Company 1-800-971-3267. **Vent Dampers** installed on fossil fuel furnaces and water heaters will typically save another ten percent. These automatic vent dampers close the flue to reduce standby heat loss up the chimney. The non-electric bi-metal variety costs about \$75 installed. **Move the Air** with ceiling fans which allow air conditioner set backs of 5 to 10 degrees resulting in at least a 20 per cent savings in cooling costs. Attic fans are also useful when set to run at 90 degrees. They flush the attic of hot air that, even with proper insulation, can radiate through the ceilings and into the living space. Figure these at about 1 C.F.M. per square foot of horizontal attic area. Remember that they need an outside air intake (gable vent, soffit vent or roof vent). **Reduce Water Usage** by following these tips from the Washington Suburban Sanitary Commission (WSSC) and the Fairfax County Water Authority: *Turn off the tap while brushing teeth (3 gallons); *Turn off tap while shaving (6 gallons); *Shorten shower by 5 minutes (Up to 25 gallons), *Run dishwasher only when full (15 gallons per day), *Water lawn not driveway (hose uses 10 gallons per minute), *Wash clothes on short cycle (10 gallons per load), *Install a low-flush 1.6 gallon toilet (family of four saves 50 gallons per day), *Use xeriscaping (water efficient landscaping) See "Water Efficient Landscaping" WSSC publication. A single drip from a faucet can consume 150 gallons per day. **Cocktail fact:** In an average day 11.5 billion gallons of water flows down the Potomac. Municipal diversions of this water for surrounding residents equals about 320 million gallons daily or 3% of the total flow. **Set back your water heater** to

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120 degrees. **Keep Your heating at 68 degrees and cooling at 75 degrees. Plant deciduous shade trees at the South side of your home. Get an energy audit from your local power company. Install radiator reflectors** of aluminum foil covered board or foil faced insulation to reduce heat loss through the walls.

Use energy efficient light bulbs. “Tweak” the furnace with regular adjustments and cleaning by a qualified Heating contractor. Use smooth metal dryer vent, not plastic, and clean annually.

Do these things and you will eat out more often!



PART III: INSIDE THE HOUSE

Heating and Cooling: If you heat and circulate air through the house you have a furnace; if you heat and circulate water you have a boiler. Furnaces and boilers can be fueled with electricity, oil, gas, coal or wood. Boilers can heat and circulate water or steam. Maintenance of your heating system consists of the following:

Furnace: Clean and change the filter(s) regularly. Most filters need cleaning or replacement every 60 days. Electrostatic filters need to be washed every month. A good overall filter is a pleated polyester type. If you have allergies try an electrostatic filter. These require no external power source, are generally guaranteed for ten years, and will eliminate down to virus size. One good source is “Allergy Free” 1-800-Allergy. The last time we checked they had a ten year filter for \$160. Another good quality electrostatic filter is “The Web” 1-800-342-5880. Caution if you are lazy with chores- the electrostatic must be cleaned monthly or it can ruin your heating and cooling system. If your furnace is a pre- 1980 model it probably has a fan motor that needs periodic lubrication oil once a year (4-5 drops per port). Look on the end of the motor for oil caps or oil tubes. Indirect drive blowers have fan belts that, like a car, need periodic replacement. Once a year, your furnace needs a cleaning (unless it is a heat

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pump or electric furnace). If Oil fired; have your heating contractor replace the fuel nozzle and oil strainer and clean and adjust the burner as required by testing the stack temperature, sulphur and CO₂ levels. If your furnace is gas fired, clean the burners with an ordinary vacuum cleaner and also clean the surrounding cabinet (vestibule, diverter pan, and air handler compartment). Should you observe a predominantly yellow burner flame, contact your licensed heating contractor for an air/gas adjustment. Yellow flame means incomplete combustion and the production of carbon monoxide. Test your chimney for backdrafting by holding a match at the draft diverter with the furnace burners on, if the flame blows back toward you, there is blockage. The same test can be performed with glasses. If the glasses fog there is backdrafting. Remember that fossil fuel burning appliances need combustion air. The amount of air needed depends on where it comes from as well as the BTU/h input rating of the appliance. Don't forget to calculate the water heater if figuring the vent area requirement. The simplest way to achieve this air is to use a louvered furnace room door. Outdoor air feeds are tricky and best left to the heating contractor to balance efficiency with air requirements. Most furnace ducts leak and are inefficient. Seal all duct joints not with "duct tape" but with high quality mastics and special insulated tapes. Two such quality products are "Uni-Mastic" and "Save 'n Seal" both from McGill Air Seal Corporation, 1-800-624-5535. Duct cleaning should only be necessary if the occupant has diagnosed allergies or if the filter has been neglected for a long period of time. Duct cleaning generally costs about \$300 per house when professionally done with high CFM vacuum systems. Typically the cleaning is terminated with an antiseptic spray in the system to kill any lingering dust mites and bacteria. Balance your duct system by adjusting the supply diffusers and leaving adequate clearance under doors (3/4"-1") if you have central return grills and not returns in each room. There are many more choices of heating equipment than twenty years ago so call your Home Inspector for advice when the time comes. **NOTE:** Whether you have a furnace or a boiler, if it is gas or oil fired use a Carbon Monoxide detector in your home. The Consumer Reports "Best buy" in Carbon Monoxide Detectors is the "Nighthawk" with a suggested retail price of \$40 and available at Wal-Mart or Best stores. **Boilers** have a little different maintenance program. Water boilers need to be cleaned annually and the valves and gauges tested for proper functioning. If the boiler is a forced water type with a circulating pump, oil the pump annually with 20 weight oil at each port (usually three). Test the boiler for proper operating pressure which on most residential boilers is less than 30 PSI. The flame color rule still applies and if your boiler has a draft hood, check for backdrafting as described above. Inspect the metal vent connector for your boiler and furnace (The pipe connecting the heater to the vertical chimney) for any rust holes or loose and disconnected sections of pipe. Remember that this vent connector needs to rise away from the heater at a minimum of 1/4 inch per foot of pipe run. If this vent connector pipe does not have an embossed "Type B" vent it is a single wall metal and needs to be a minimum of six inches from combustibles. Steam boilers need to be "blown down" every week during heating season. This consists of placing a 2.5 gallon bucket under the blow down valve on the side of the unit and opening the valve to fill the bucket. The sight glass above the blow-

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down valve should refill to half glass with relatively clean water. This process blows off sediment laden water from the system. There are many modifications available to increase the performance and efficiency of older hydronic, as well as air systems. Some such modifications are as follows: A. Flow control dampers which automatically vary air volume in existing duct runs. B. Thermostatic Radiator Valves (TRVs) used for decades in Europe, these mount on individual steam or water radiators and control the flow to the radiator allowing the occupant to tailor the amount of heat to a given space. In effect, you can create multiple zones with a single central heater. C. Weather-Responsive Controls, also known as a modulating aquastat. This device senses the outdoor temperature and adjusts the boiler water temperature accordingly via the aquastat. The system allows you to never heat the water more than necessary to keep the house at the desired temperature. As a rule of thumb you lower your heating bill by 1% for every 3 degrees (°F) reduction in boiler water temperature. The savings can be significant. The cost to install is about \$500. There are three good models to consider: 1. Honeywell 1-800- 328-5111, Stadler, 1-800- 370-3122, and Tekmar Control, 1-604-545-7749. **Humidifiers** are used on forced air systems to restore the protective moisture on your body surface and thus allow you to be comfortable at a lower thermostat setting. We suggest that you install a water filter in the 1/4 inch water supply line to your humidifier. You will need a plumber or heating contractor for this installation. Once installed with a compression fitting, you can replace the cartridges yourself, as part of annual maintenance. Even with a filter your humidifier needs annual cleaning. The atomizer types, such as “Spray-Clean” has a backflow valve for backflushing the unit. The evaporative type such as AprilAire have a wetting screen that must be removed and cleaned. Try using a vinegar mix of 50% white vinegar and 50% water for a good overall cleaner of the filter, tray and spray nozzle. The suggested setting for your humidifier is 35-40 per-cent relative humidity. **Heat Pumps** have less maintenance requirements than fossil fuel systems. Heat pumps are classified according to their heat source (the medium from which the heat is extracted) and heat sink (the medium to which heat is delivered). Our area uses mostly air to air heat pumps. However, there are air to water, water to air, water to water, earth couple, and solar assisted type heat pumps. Maintenance of the air to air pump consists primarily of keeping both coils clean and keeping the outside unit level and clear of debris and vegetation, and inspecting the condensate line for any blockage or breaks. Your local electric utility company will no doubt have an excellent guide for the selection and maintenance of your heat pump. There are a number of fairly new modifications to the heat pump basic design which increase the circulating air temperature. The Heat Comfort Control (HCC), one such device taps into the supplemental resistance heat strip in a very efficient way so as to not increase the overall operating cost. The initial cost however, is about \$500, installed. Another innovation is the “Heat Pump Helper” which “marries” the heat pump with any oil fire water heater that has a water coil in the duct of the heat pump. The idea is to substitute oil back-up for the conventional electric resistance strip back-up. This unit has a high initial cost (about \$3,000) but reportedly excellent performance. Post 1992 heat pumps are more efficient (by law) and employ improved technology that provides better performance

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at lower costs over a greatly extended predictable service life. Here are some tips for proper heat pump operation: a. in the Winter months, operate in the 60's, not in the 70's. b. never move the thermostat from cool to heat or heat to cool without stopping at off for 5 mins. c. never restrict the outside air discharge by placing decks, debris, etc. within five feet of the fan discharge or crowding the coil with objects closer than 1 foot from the coil. d. do not turn the thermostat off or way down in the Winter months. e. clean or replace that filter regularly. **Efficiency Tips:** There are several things that you can do to increase the performance of your old furnace: 1. Balance the duct system: In order to have a good distribution of heat and cooling for that matter, you must have a balanced air flow of supply and return air. Simply put, what comes out should be equal to what goes back. Is it? One way to find out is to put your hand in front of what comes out at an air register. Now have someone remove the cover to the blower compartment and see if there is a significant increase in air flow at the same register. If so, you need more return grills in the house to permanently balance the air flow. Another simple test is to place your hand on the duct directly above the furnace (plenum) on a gas or oil furnace. If the duct is too hot to touch then there is excess heat due to an imbalanced system or possibly an oversized burner. 2. If your furnace has a belt driven fan with pulleys, then the belt can be shortened to increase the fan speed pushing more air across the heat exchanger and increasing the furnace efficiency. 3. Most older furnaces have a fan limit switch with high and low settings that determine when the fan comes on and goes off. These are generally set to come on and move air at 140 - 150 degrees and turn off at about 110 degrees. If you or your Heating Contractor resets the limit switch to come on at a lower temperature and turn off at a lower temperature, the fan stays on longer and captures more of the heat that would normally go up the chimney. 4. If you have a heat pump, avoid wide swings in thermostat settings during Winter months; stay in the 60's and your pocketbook will be healthier. **Cooling** in our area is either with an electric compressor, heat pump, or in some cases, a gas chiller. Maintaining your cooling equipment is largely a matter of keeping the inside and outside units clean. This means a regular filter replacement or cleaning program, an occasional duct cleaning (every five years) and keeping the outside unit clear of weeds, dirt, debris, and coil fin pings and dents from lawn mowers, baseballs, etc. Remember that dirt and dust are insulators and they, therefore, make it more difficult to transfer heat from the inside air to the transport medium (refrigerant) and ultimately from the outside coil (condenser) to the outside air. Electric compressors and Heat Pumps are now rated (for cooling purposes) by their "Seasonal Energy Efficiency Ratio" or "SEER". The SEER is the ratio between the total cooling output during a normal season divided by the total electric power input for the same season. For example, a 10 SEER means that the BTU/h is ten times the input. The higher the SEER, the lower the operating cost and the higher the efficiency. However, past a certain SEER level more is not necessarily better because the system can cool the house off too fast to remove significant humidity from the air. A properly cooling system should drop the temperature 12 - 18 degrees across the inside coil (evaporative coil). The higher efficiency units of SEER 10 and above will generally drop the temperature 20 - 22 degrees. Remember, however, that on

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an extremely hot day you may not get the same performance. Air Conditioning by definition is the equipment's ability to drop the inside temperature 15 degrees below outside temperature. Therefore, if the outside temperature is 95 degrees, and the inside temperature is 80 degrees, then we have a properly operating air conditioner. Try to keep your thermostat set at 80 degrees if you are relaxing and 75 degrees if active. Reduce the heating load on the house by keeping the blinds drawn on the South exposure during sunny days and by installing a thermostatically controlled attic fan (tip: size the fan in Cubic Feet per Minute (CFM) by multiplying the horizontal square feet of the attic by 1.5, this is double the threshold code requirement). There is an excellent article in The Family Handyman, Feb. 1996, pp. 50-56, that takes you step by step through how to install an attic fan. **Gas Chillers** use water as the circulating refrigerant and natural gas to heat an ammonia/distilled water bath. When heated the ammonia separates from the water and a pump drives the ammonia vapor through a coil where the refrigerant water trickles over the now cold coil and is then pumped into the house and through the evaporative coil. These units need annual maintenance to check the fluid levels of water, antifreeze and hydraulic fluid. In addition, a good maintenance program will cover belts, checking water fountain height, and water temperature in operation. If you can actually smell the ammonia, you probably have a ruptured generator. Many units have easy to use thermometer wells on the water lines. If the Generator is working properly, there should be a ten degree temperature difference (delta T) between the two water lines. This technology is expensive, not very efficient, and being replaced by the new gas fired heat pump, "Triathalon" which achieves a SEER of 16 using a "Briggs and Stratton" engine to drive the system. **Service Life:** Furnaces usually provide twenty to twenty-five years service. Boilers on the other hand provide about double the service life of a furnace. Central air conditioners provide about ten years service for pre-1992 models and post-1992 models can be expected to last about fifteen years. Gas-fired air conditioners should last about fifteen years.

Electrical: Your home's electrical system is probably the lowest maintenance system in the house- if installed properly. Proper installation must also be accompanied by proper use. All systems have limitations that once exceeded can lead to damage and loss to property and personnel. Original electrical systems often times become dangerous as they are expanded without increasing the size of the main power feed to the house. The expanded uses cause the original feed (known as the Service Entrance Cable) to draw more current than it is rated to carry resulting in overheating and possibly a fire. Since the home inspection is not technically exhaustive and since any device or system can subsequently fail, we suggest that you keep the following basic rules/practices in mind: 1. Do not use extension cords in traffic areas where they can be damaged. 2. Don't use lightbulbs that are too strong for the stamped rating of the light fixture. 3. Don't use a light bulb over twenty five watts in a small closet. 4. Replace any extension cord that gets excessively hot from use with a moderately heavy appliance such as an iron after 15 minutes. 5. Place your hand on any receptacle cover where you use a space heater, iron, toaster, or other resistance type load

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and if it is hot contact an Electrician. 6. Don't crowd light or fan fixtures in the attic with any combustible material. 7. Replace fuses or breakers with new ones that are compatible in size to the conductor (wire) size. 8. If any light dims or brightens with any heavy 120 volt load such as an iron, refrigerator or space heater, contact an Electrician. 9. Limber up your circuit breakers by turning them off, leaving off for two minutes, and then resetting to the on position. 10. Never use a fuse size greater than 20 amps. for any 120 volt use. 11. Keep a tight seal of duct sealant around the hole where the Service Entrance Cable (SEC) comes into the house. 12. If you have an old SEC with a cotton and tar insulative wrap, keep the cable jacket painted to protect from weather. 13. Don't paint ground clamps at the water lines. 14. Remove T.V. antennas that are not being used. 15. Don't use armored type cables (BX) outside. 16. Use grounding type receptacles in and around wet areas or where used permanently with appliances, computers, or TV and stereo equipment. 17. Use smoke detectors at each living level, test yearly and replace every 10 years. 18. Use Ground Fault Circuit Interrupters (GFCI) at bathrooms, outside, garages, basements and in kitchens to reduce the chance of electrocution and shock. 19. Never work on the electrical system without a clear understanding of electricity and without first turning off the power. We particularly recommend GFCI where a two wire system would make it costly to properly install a grounding type receptacle (3 hole receptacle). **Aluminum Wiring** for branch circuits can be dangerous if certain practices have not been followed. The nonstranded (solid) aluminum wiring in smaller gauges of AWG #12 and #14 has caused overheating and fires if the wiring is "old technology" pure aluminum conductor. There was overheating from mismatched alloys, back wiring and conductor size was often times made effectively smaller due to surface corrosion (oxidation). "New technology" aluminum wiring is aluminum alloy, which stays more stable under load than pure aluminum. Aluminum wiring should always be used with fixtures and receptacles rated for use with aluminum. The old "back-wired" receptacles can not be used with aluminum if backwired. Backwiring simply means a connection of the conductor to the receptacle through a hole at the back of the receptacle that holds the conductor against the contacts (there is no set screw involved). A receptacle acceptable for aluminum will so state on the receptacle (e.g. "U/L approved for A1/CU"). Aluminum wiring does not necessarily need to be replaced. A reasonable approach to using small gauge aluminum wiring is to have a licensed electrician inspect the connections and test some receptacles for heat under load. A voltage drop of eleven volts on a 15 amp. circuit and 13 volts on a 20 amp. circuit would be considered excessive and should be further investigated. The National Electrical Code (NEC) does not recommend voltage drops of more than 5% under load. Excessive heat with aluminum wiring could come from poor connections, surface corrosion, excessive uses on a single circuit or improper receptacles. For more reading on the subject, contact the U.S. Consumer Product Safety Commission for Bulletin CPSC #516 "Repairing Aluminum Wiring;". **Ceiling Fans** can fall. Any fan weighing more than 35 lbs. needs special support equipment like braces, steel outlet boxes, and boxes that grip the ceiling joist in saddle fashion. Most of our problems with ceiling fans pertain to pre-1988 models and the use of antique, heavy Casablanca units without ceiling braces.

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Heat Tape to prevent pipe freeze can be dangerous. Only use U/L approved heat tape. Low voltage tapes are a good option. Replace tape every five years.

Plumbing: Your water supply and waste disposal systems can be public, private or a combination of the two. If you receive a bill from a water and sewer authority then you are connected to a public system. Private systems mean that you have a well for potable water and a septic for waste disposal. Most septic systems are closed and without the introduction of oxygen for decomposition (anaerobic). Anaerobic systems are sensitive to what you throw down the drain. They have a hard time digesting kitchen scraps, cooking oil, and phosphate based detergents. A good rule of thumb for their maintenance is the “one in seven rule”. That is, if one person is using the septic, clean the tank out every seven years. If seven people are using the septic then clean it out yearly. Of course cleaning is professionally done. Your well water needs monitoring for pH, lead, turbidity, nitrates, coliform, and the 8 Volatile Organic Compounds. We suggest leaving it’s water quality in the hands of a private well and filter company. Public systems are less of a headache since there are Federal and State laws that monitor and regulate the operation of these systems. The “Safe Drinking Water Act” mandates safe levels of all contaminants as well as the pH of public water supplies. However, prior to the 1986 amendments to the Safe Drinking Water Act lead solder (50/50%) was allowed to sweat copper pipes. This lead can leak into the drinking water supply especially in the early years of use before the calcium in our water forms a barrier on the inside of the pipe. For this reason, we suggest that you test your water to determine lead levels if you live in a pre-1986 home with copper water pipes. The test is inexpensive and the solution is filtering or bottled water, if the level is higher than the EPA threshold of 15 PPB. We suggest that you read the February, 1993 Consumer Reports on water filters. Water piping material can be galvanized, copper, lead, polybutylene, Chlorinated Polyvinyl Chloride (CPVC) or Polyethylene. Each of these materials have limitations. Polybutylene pipe has been banned in the Washington Suburban Sanitary Commission (WSSC) district due to a high incidence of failure due to poor installation, chlorine affected fittings, and defective crimp rings or pipe. If you have polybutylene pipe inside the house (distribution lines) make sure that it is not too close to the water heater, that it is supported every 30- 33 inches, and that when it runs through a floor or wall, that it has a protective sleeve or grommet. The drain, waste and vent (DWV) system in your home can be copper, ABS, PVC, cast iron, extra strength vitrified clay pipe, brass or galvanized wrought iron. Sluggish drains can be a simple fix involving a chemical opener or an expensive fix involving excavation and sewer line replacement. All buried sewer lines eventually fail but you can extend their life by taking care not to plant deep root trees on the side of the house where the sewer line leaves the house. Particularly, be careful not to plant willows in these areas. Water and sewer rates are every day more expensive. For this reason, The U.S. Congress passed the National Energy Policy and Conservation Act in 1992. This law, among other things, made it unlawful to manufacture a toilet that takes more than 1.6

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gallons (6 liters) per flush and shower heads that use more than 2.5 gallons per minute flow. If you have a pre-1975 toilet it is probably worth considering a water saving retrofit instead of a full replacement. Post 1975 toilets normally use 3.5 gallons per flush whereas pre-1975 toilets use 5 gallons. The water saving devices that you will want to consider for the pre-1975 models are: early closure flappers, dual flushers that provide greatly reduced flush for liquid wastes, or water displacers (e.g. brick in a plastic bag). The water saver toilets can be either pressure flush or gravity flush. The pressure flush models are louder than gravity type. The following models won acclaim in a Consumer Reports survey of August 2005 at www.consumerreports.org; Eljer Titan-gravity, Gerber Ultra Flush-pressure, Mansfield Eco quantum-pressure, American Standard Champion-gravity, Elger Aqua Saver-pressure, and Toto Carlyle-gravity. A proper operating water saver toilet should save your family between 7500 and 8500 gallons of water per year (family of four).

Leaky toilet tanks can easily defeat any savings realized by water saving toilets. So inspect your toilet tank regularly for leaking through the overflow tube or the flapper mechanism. The same calcium that we mentioned above can accumulate in your water heater, particularly gas fired water heaters. Electric water heaters usually have a magnesium anode to attract calcium and other sediment. Rid the gas water heater of sediment by flushing off about ten gallons in the Spring and Fall. Some gas water heaters are self cleaning and do not need to be flushed, (e.g.: - State “Turbo Sandblaster”).

If you live in an area of freezing temperatures, drain your hose bibb lines in the fall. Turn off the inside hose bibb shut-off(s) and open the outside faucet(s).

If your dishwasher overflows through the countertop air gap, replaced the short, fat discharge hose (usually 7/8 in. diameter) and found under the sink. Next time you replace the sink try using a loop in the dishwasher discharge hose in place of a countertop air gap. This will provide the same protection against cross connection and avoid the periodic spillage across the counter from use of an air gap that clogs.

Finally, your job of washer and valve replacement of fixtures will be made a lot simpler if each fixture has shut off valves. We recommend that the main water shut-off as well as the water heater fill valve be the lever type and not, the prone to leak, gate valve variety. If your clothes washer water hoses are rubber, try replacing them with braided stainless steel, which will likely last longer with less chance of leaking.

Painting interior surfaces requires careful preparation of the surface. Remember paint won't stay on surfaces that move and, movement can be caused by excessive moisture. If a previously painted surface is damp or shows signs of moisture in the form of mold and mildew, it is not enough to remove the mold and mildew. You must discover and correct the source. Some of the more common sources of moisture inside the house are: 1. a humidifier that is set too high (above 40% relative humidity). 2. failing exterior caulk around windows and trim. 3. inadequate bathroom ventilation. 4. bath and kitchen fans that vent into the attic. 5. insulation damming at the eaves thus preventing good air flow in the attic. 6. no attic ventilation. 7. unvented dryers. 8.

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overpopulation of the living space. 9. poor grading and roof water control. 10. excessively high space heating temperature settings (80's). 11. no vapor barrier in the walls coupled with very tight replacement windows. Aside from moisture free, the surface to be painted must be free of dust, dirt, grease, and loose, unsound surface or sub-strata. Any drywall or plaster repairs need to be sealed with clear shellac, "kilz" or other quality primer/blocker. Glidden Coatings (www.glidden.com) makes a vapor barrier paint, "InsulAid" which is advertised to provide a substantial decrease in heat loss and is resistant to moisture passage. Always use the manufacturers best paint. A rating of interior paints was done by Consumer Reports in their May, 1991 issue. In addition, the National Paint and Coatings Association (202- 462-6272) publishes an excellent guide entitled "Household Paint Selector". Repairing textured ("popcorn") ceilings can be done by first removing any loose material and sealing the area to be painted with Kilz. Then hand mix vermiculite beads with joint compound and apply same with a small textured roller. Epoxy paints are at best temporary when used to resurface bath tubs. There is a method involving etching the old porcelain and recoating with ground up porcelain that is baked hard to the surface. This is a professional procedure and normally costs about \$250 for a tub. Don't forget to keep your tub and tile properly caulked and to check ceilings below plumbing fixtures regularly for any signs of leaking.

Doors that stick and drag the frame are easily fixed by first inspecting the hinges to make sure they have not loosened from the door or frame. Next, install two 8d finishing nails 4 inches apart at the friction point of the jamb (where the door rubs). Counterset the nails and caulk the holes. This should return the frame to its original square and stop the sticking.

Windows that are stiff to open may only need some lubrication in the track with a beeswax candle or silicone spray. After this treatment if they still stick they may need some room from the layers of paint over the years. Remove the paint with a heat gun (see above for suggested guns) or a good stripper such as 3M "Safest Stripper", a non-volatile, non-toxic, reasonably priced product. Remember that glass subject to human impact because of its location should be laminated or fully tempered glass. You will always see the manufacturer's stamp in the corner of the glass if it is safety glass (tempered or laminated). Tempered glass comes in stock sizes and cannot be cut like single or double strength glass. Some windows also have a reflective coating or actual extra layer of reflective glass (HURD windows) that is more efficient than a standard insulated glass window. If noise is a factor select an insulated glass window that is filled with inert gas (e.g. Argon). Window selection is a very difficult business. We suggest that you select a known brand such as Marvin, Caradco, Andersen, Pella, etc. There are over 20,000 different windows available in the United States. They are all listed in a rating publication from the National Fenestration Rating Council (NFRC). NFRC has been mandated by the U.S. Congress to standardize window ratings. They have developed a rating system and corresponding stamp that considers all energy factors into one window rating. Heretofore, a manufacturer could promote a window as, let's say R-5, but this R was only for the glazing and not the frame.

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Insulation can be a good thing if you don't go to extremes. This means that you should insulate those areas that have a good and quick rate of return in heating and cooling costs compared with the initial cost of installation. Areas that meet this criteria are: A. the band joist and joist bays above the foundation walls in a full basement. B. crawl space ceilings or walls. C. Attics. The level of insulation is a function of the climate conditions where you live. Around the greater Washington, D.C. area we use R-19 at the floors and band joists and R-30 at the attic. The R Value is a designation of resistance to the passage of heat through a material. Remember that heat is also transferred by radiation and insulation will not reduce radiant heat transfer. There are some reflective materials and products that do reduce radiant heat transfer. One such product is "Radiant Barrier", developed for the space program. When used in an attic, Radiant Barrier is advertised to provide a 15% or better reduction in heat transfer to the living space. This material also acts as an energy saver in the Winter by reflecting heat into the living space. Some utility companies provide energy audits for their customer's home at little or no charge. The audit will identify specific conservation methods aimed at energy savings.

Finally, should you wish additional information or reading on housing and housing systems, contact your Home Inspector.

