



# Home Energy Evaluation Report for House Four



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**Customer Information:**

House Four  
Canterbury Woods Community  
Annandale, VA

**Inspection Date:** June 10, 2010

**Homeowner Energy Concerns:**

Whole house assessment.

**Inspection Summary:**

House Four is an approximately 3,165 s.f. colonial style house with a finished basement. The foundation walls are block, the first and second floor walls are framed with a brick veneer on the front first level. The house was built approximately 40 years ago and is heated by a gas furnace with central a/c. The combustion zone is located in a conditioned basement. The exterior envelope is fairly well defined and needs significant air sealing. House Four has a Home Energy Rating System score of 110 (a new house built to code is 100 and a net zero energy home is 0). The minimum score for a new ENERGY STAR® home is 85.

Based on an inspection, infrared thermography and blower door test, we recommend the following actions.

**Recommended Actions (prioritized):**

- 1) *Have plumber check and tighten gas pipe fittings – leakage detected in two locations, see pictures*
- 2) Install furnace filter in return duct slot
- 3) Air seal and insulate attic hatch
- 4) Terminate bath exhaust fan to exterior
- 5) Install insulated air barrier at attic knee walls – 3 sides of bedroom (1 above garage)
- 6) Air seal penetrations in ceiling/attic interface (pipes/ducts/electrical)
- 7) Seal ducts located in unconditioned space
- 8) Insulate attic to R-49
- 9) Seal penetrations in exterior walls

**Blower Door Test:**

The house was depressurized to a pressure difference of 50 Pa to the outside using a blower door test. The total volume of leakage under pressure is 2,860 cfm<sub>50</sub>. This is the equivalent of leaving one window open approximately 16 in. year round. The test revealed the home to be leaky in the following areas:

- 1) Attic access hatch
- 2) Top plates of walls at attic
- 3) Plumbing/wire/duct penetrations in attic
- 4) Recessed lights in family room
- 5) Band joist at family room and in basement
- 6) Bath fan in hall bathroom
- 7) Pipe penetrations in walls
- 8) Electrical boxes at exterior walls

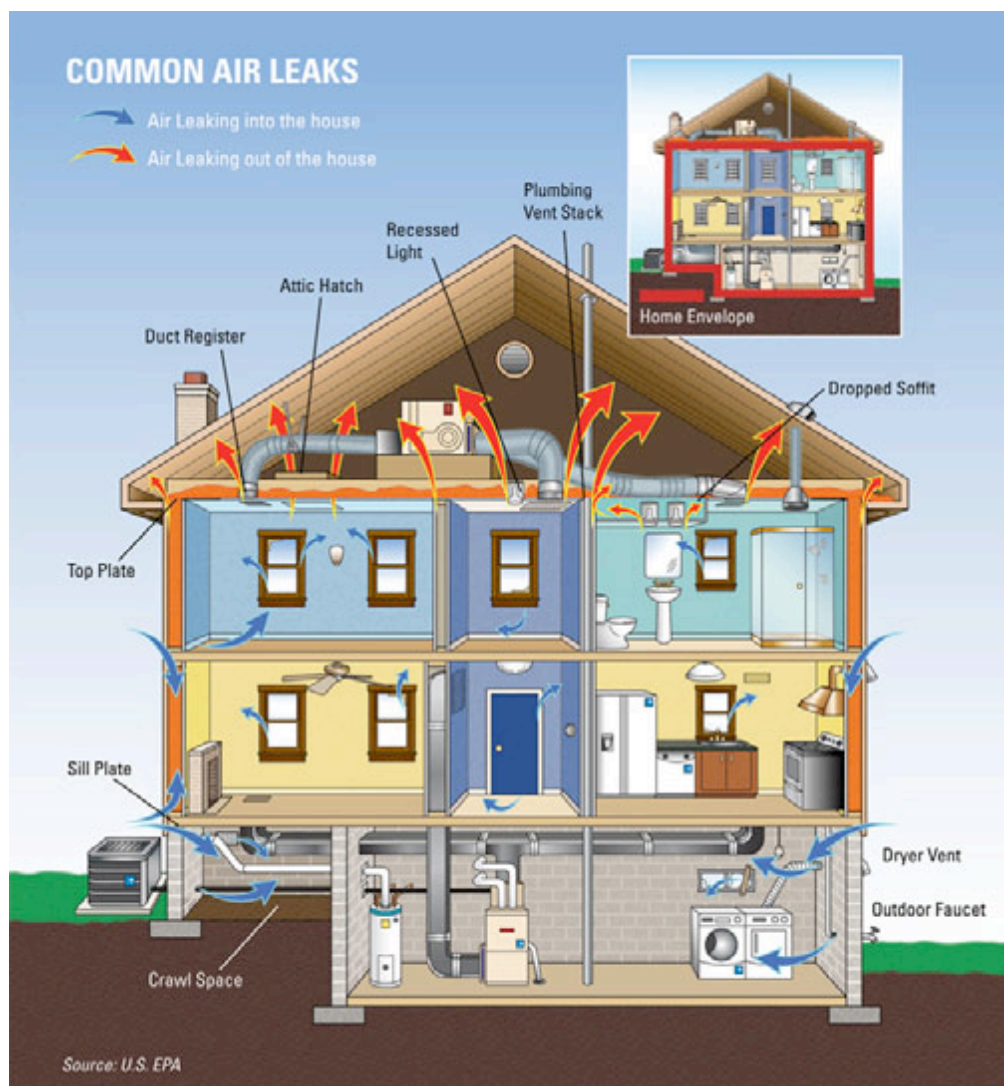
**Combustion Appliances:**

A gas fired hot water heater and furnace are located in a utility room in a finished basement. The hot water heater and furnace pass carbon monoxide spillage and drafting tests. Two small

gas leaks were detected in the gas lines. ***These should be tightened by a qualified service company before any home envelope sealing is undertaken.***

### **Air Sealing:**

Air infiltration in homes can amount to as much as 30-40% of heating and cooling losses. Air infiltrates through the exterior envelope making it more difficult to maintain the conditioned air inside the envelope. This occurs through a loss of heat in the cooler months and a gain in humidity in the warmer months. Humid air takes more energy to cool and dehumidify. Leakage generally occurs at a *thermal bypass*. A thermal bypass is a design or building flaw which allows heat to enter or leave the building and increases the cost of heating and cooling your home. A bypass compromises the thermal properties of your insulating and sheathing materials. In many cases, a bypass can interfere with the insulation of a wall or building system, causing higher energy use, moisture-related material destruction, and decreased comfort for those living in your home. A comprehensive air sealing effort will eliminate the majority of the existing leaks. An increase in the tightness of the envelope requires increased fresh air ventilation and use of bathroom fans regularly to extract excess moisture. *Additional fresh air ventilation provisions may be required upon completion of air sealing.*



## Actual Air Leakage Values

Site	CFM <sub>50</sub>	ACH <sub>50</sub>	ACH <sub>nat</sub>
Colonial with Finished Basement	2,860	7.0	0.41

## Typical Air Leakage Values

Home	ACH <sub>50</sub>	ACH <sub>nat</sub>
High Performance	1.5 - 4.0	0.25
Energy Efficient	4.0 - 7.0	0.33
Standard New	8.0 - 12.0	0.80
Standard Existing	11.0 - 21.0	1.00
Standard Older	18.0 - 35.0	1.75

*CFM<sub>50</sub> = Cubic feet per minute at 50 Pascals*

*ACH<sub>50</sub> = Air changes per hour at 50 Pascals*

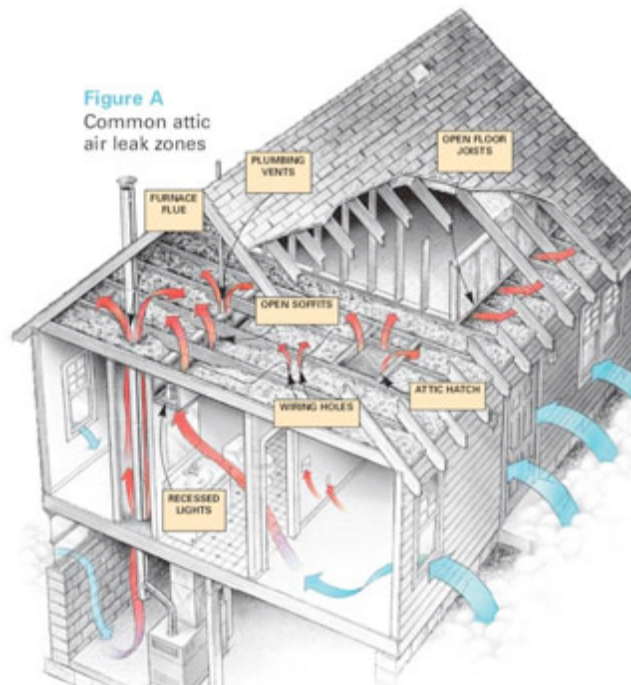
*ACH<sub>nat</sub> = Air changes per hour at normal pressure*

### Attic:

The attic is unfinished and conventionally framed. The attic hatch is not sealed or insulated. A duct supply trunk and return is located in the attic. There are significant thermal bypasses located at the penetrations and several areas of little to no insulation. The top plates of the 2<sup>nd</sup> floor walls are very leaky. The bedroom with attic knee walls does not have an air barrier and the joist cavities below are open to the exterior. The band joist between the garage and living space does not have an air barrier. The overall effective insulation value is approximately R-5

### Recommendations:

- 1) Air seal and insulate the attic hatch.
- 2) Terminate bath exhaust fan through the roof.
- 3) Seal wall top plates and all penetrations between the attic and 2<sup>nd</sup> floor ceiling.
- 4) Insulate the attic to R-49 thickness.
- 5) Seal ducts located in attic.



**Living Areas:**

The main living area has several areas of air leakage. The unsealed band joist between the family room and the garage allows significant air leakage to the outside. Air leakage was also detected at the exterior wall outlets.

**Recommendations:**

- 1) Install air barrier between garage attic and living space.
- 2) Seal electrical boxes located in the exterior envelope.
- 3) Install air tight recessed light trims if available (depends on manufacturer).

**Basement level:**

The house is built on a block foundation and the majority of the basement is finished. The homeowner indicated a draft present in the front bulkhead. This is often due to convective loops of air moving from hot to cold, but significant air leakage through the thermal envelope was not detected. The rear of the utility room has some leakage at the band board. Under pressurization, the sill plate was found to be leaky. The basement bath fan showed air movement under depressurization.

**Recommendations:**

- 1) Caulk bottom of siding along the rear of the house
- 2) Seal plumbing chase and wire penetrations
- 3) Spray foam band boards where accessible

**Additional Energy Efficiency Measures****General**

The first portion of this report is derived from testing of your home. These home specific recommendations are the first place to start in improving the comfort and efficiency of your home. Please contact us should you have any questions regarding the test results. We also recommend visiting [www.energystar.gov](http://www.energystar.gov) (Products and Home Improvement Tabs) and reviewing factsheets located at [www.southface.org](http://www.southface.org) (Resources Tab) for more information.

**Programmable Thermostat**

Heating and air conditioning equipment operating when not necessary can account for 20% of the energy you use. A programmable thermostat helps make it easy for you to save by offering four pre-programmed settings to regulate your home's temperature in both summer and winter - when you are asleep or away. Homeowners can save up to 20% with a properly installed and operating programmable thermostat.

**Lighting Options.**

Compact fluorescent light bulbs use only one-fourth the electricity consumed by incandescent bulbs, yet last up to thirteen times longer. They produce less heat, are available in warm colors, and can be screwed into your existing light fixtures. While they cost more initially, their energy savings and long-life saves money and hassles in the long run. To make your home's lighting even more energy efficient, consider installing hardwired fluorescent lights in your study or den and in your kitchen. If you have outside lights, you may wish to consider putting them on a sensor so that they are lit only when someone approaches the house.

**Ceiling Fans**

During the winter, ceiling fans set at slow speed can push warm air away from the ceiling and move it around the room, spreading heat evenly and making you feel more comfortable without creating a draft. During the summer, ceiling fans will move the air to make you feel cooler.

## **Fireplace**

A fireplace can be a major drain on home energy. A fire requires air to burn and will draw warm air from your rooms to be replaced by cold outside air. Also, warm air will escape through the chimney to the outside when the damper is not completely closed or completely sealed, often causing an uncomfortable draft. The fireplace should have well-closing glass doors and a direct source of outside air. Make sure the fireplace flue is closed when you are not using it, and if you do not use your fireplace at all, seal the damper in order not to lose warm air up the chimney. There are products available in hardware stores and online to temporarily seal off the flue and stop air from escaping up the chimney. One product is an inflatable plug or balloon that you insert into the fireplace beneath the damper. This product is easy to use and can often pay for itself in one mid-winter heating bill.

## **Energy-saving showerheads**

Energy-efficient showerheads have become more common in recent years and have been required in new homes since 1994. A good quality efficient showerhead saves a significant amount of energy and water.

## **Appliance Energy Settings**

Use the energy-saving settings on all your appliances, such as refrigerators, dishwashers, washing machines, and clothes dryers.

## **Refrigerator**

Refrigerators use up to 20% of your electricity. ENERGY STAR® refrigerators are required to be 20% more efficient than non ENERGY STAR® refrigerators. Replacing an aged model can decrease your refrigeration energy by 40-50%.

## **Dishwasher**

ENERGY STAR® dishwashers are 30% more efficient than the 1994 standards. Models with an “energy-saver” or short-wash cycle option use less hot water. Reduce the total number of loads washed by running full loads. Turn off the drying heater so that dishes air dry.

## **Stove and Range**

Solid disk elements and radiant elements take longer to heat up, and use more electricity than halogen and induction elements. Self-cleaning ovens use less electricity than ovens without that feature because they are better insulated. Use a microwave, or toaster oven, rather than a full-sized oven or the stove. Smaller appliances use less energy than a stove and can reduce cooking time.

## **Homeowner Resources**

- U.S. Department of Energy homeowner information: 1-800-363-3732 or [http://www.eere.energy.gov/consumer/your\\_home/](http://www.eere.energy.gov/consumer/your_home/) or <http://www.doe.gov/yourhome.htm>
- U.S. Department of Energy Energy Savers: Tips on Saving Energy & Money at home: 1-877-337-3463 or [http://www.eere.energy.gov/consumer/tips/pdfs/energy\\_savers.pdf](http://www.eere.energy.gov/consumer/tips/pdfs/energy_savers.pdf)
- EPA ENERGY STAR® consumer information: 1-888-782-7937 or <http://www.energystar.gov/>
- Alliance to Save Energy resources: [http://www.ase.org/section/\\_audience/consumers](http://www.ase.org/section/_audience/consumers)

## **Guidance on Indoor Air Quality**

### **Weatherizing Your Home**

Most older homes need be weatherized to reduce energy loss. Measures such as installing storm windows, weather stripping, caulking, and blown-in wall insulation can reduce the amount of

outdoor air infiltrating the home. Consequently, after weatherization, the home may have inadequate ventilation and concentrations of indoor air pollutants from sources inside the home can increase. Residents should be alert to the emergence of signs of inadequate ventilation, such as stuffy air, moisture condensation on cold surfaces, or mold and mildew growth (see [www.epa.gov/mold](http://www.epa.gov/mold)). If the house appears to be too tight, an air-to-air energy recovery ventilator should be installed to increase air circulation without losing much heat. Having an adequate air exchange rate is important for maintaining good indoor air quality.

### **Reducing Toxins**

Equally important is using less toxic materials in the home. Unfortunately, many home improvement products have significant “off-gassing,” where the chemicals leach out of the product and into the indoor air. Painting and carpeting are the two most common household improvements that people make when moving into a house, and both contain toxic chemicals

### **Paints**

There are serious health and environmental concerns surrounding paint. Using paints that are free of Volatile Organic Compounds (VOCs) such as benzene and toluene, free of heavy metals such as lead or cadmium, and/or made of post-consumer recycled content can aid in reducing exposure to toxics for both you and your environment. However, the fact that a paint is VOC-free does not necessarily mean that it is free of toxins such as formaldehyde, ammonia, acetone or odor-masking agents. Fortunately, paints with reduced levels of VOCs, or even VOC-free, are available.

### **Carpeting**

Scientists have not yet determined whether the chemicals emitted by new carpets are responsible for causing a variety of symptoms in household residents. Therefore, if you are installing new carpet, you may wish to take the following steps:

- Ask the carpet retailer for information on emissions from carpet.
- Ask the retailer to unroll and air out the carpet before installation.
- Ask for low-emitting adhesives (if adhesives are needed).
- Consider leaving the premises during and immediately after carpet installation
- Make sure the installer follows the Carpet and Rug Institute's installation guidelines.
- Ventilate the house during and after installation to exhaust fumes to the outdoors for 48 to 72 hours after the new carpet is installed.
- Contact your carpet retailer if objectionable odors persist.
- Follow the manufacturer's instructions for proper carpet maintenance.

### **Resources**

The Environmental Protection Agency (EPA) has a consumer booklet, *The Inside Story: A Guide to Indoor Air Quality*. [www.epa.gov/iaq/pubs/insidest.html](http://www.epa.gov/iaq/pubs/insidest.html)

New American Dream has information on Green Seal certified paint manufacturers:  
[www.newdream.org/consumer/paint.php](http://www.newdream.org/consumer/paint.php)

### **Financing Energy Efficiency**

Energy improvements are unique because they create a stream of income in reduced monthly energy bills that may cover the monthly cost of the investment. Financing energy efficiency improvements as part of your home mortgage is the best possible way to go—you have the advantage of (i) low monthly payments due to a 30-year term and a relatively low interest rate; and (ii) interest that is deductible from your income tax.

## Nation-Wide Financing Resources

### Streamlined (k)

The **Streamlined (k) Limited Repair Program** allows homebuyers and existing homeowners to make energy-efficiency improvements and upgrades to existing homes. Homebuyers can finance up to an additional \$35,000 in their mortgage for improvements which may have been identified by a home inspector or FHA appraiser. Features of the financing include: no minimum repair cost threshold; the maximum mortgage amount for repair costs is \$35,000; the loan can be issued by any FHA lender. The improvements can include: replacement or upgrade of existing HVAC systems; weatherization, including storm windows and doors, insulation, and weather stripping; purchase and installation of appliances, including free-standing ranges, refrigerators, washers/dryers, and dishwashers; Window and door replacements and exterior wall residing. HUD's Mortgagee Letter 2005-50 explains the Streamlined (k) Limited Repair Program in detail.

### Energy Efficient Mortgage

FHA Energy Efficient Mortgages allow homebuyers and those refinancing to make energy efficient improvements and include the costs up to \$8,000 into an FHA mortgage. The dollar value of the energy improvements must be greater than the additional amortized payment of the costs up to the \$8,000 threshold.

### Fannie Mae Energy Loan

Some lenders offer an unsecured **Fannie Mae Energy Loan** for \$1,000 to \$20,000. The approval for this loan is fast and simple. The Energy Loan's 10 year term and interest rates are generally better than those offered by contractors or suppliers.

## Local Financing Resources

### Utility Loan Program

Within your state there are a number of utilities that offer special energy loan programs. Program details may vary from what energy efficiency measures qualify for a loan to what the rate and term of the loan are. In some cases, utility loans may be the most favorable loans available to homeowners. Visit your utility's website to find out if it offers energy efficiency loans. Additional information may also be available at [www.dsireusa.org](http://www.dsireusa.org), a website dedicated to tracking state incentives for energy efficiency and renewable energy development.

### Energy Efficiency Tax Credit

During 2010, you can recoup your investment in energy efficient improvements by lowering your energy bills *and* by saving up to \$1,500 on your tax bills.

- For IRS purposes, the costs are considered paid when the original installation of the item is completed;
- The tax credit can be claimed on your taxes only at the end of the year;
- You must keep your dated receipts for all eligible purchases; and,
- The energy efficiency improvements must be for your primary residence.

Additional information on available tax credits is found at [www.energystar.gov](http://www.energystar.gov).

### What is a Tax Credit?

There is an important difference between a tax credit and a tax deduction. A **tax deduction** is subtracted from income before total tax liability is computed. On the other hand, a **tax credit** is subtracted directly from the total tax liability. This means that a deduction and a credit have very different values, with a credit being three or more times more advantageous to the taxpayer than a deduction. For example, a tax credit of \$1,500 for someone in the 28% tax bracket is equivalent to a tax deduction of \$5,357.

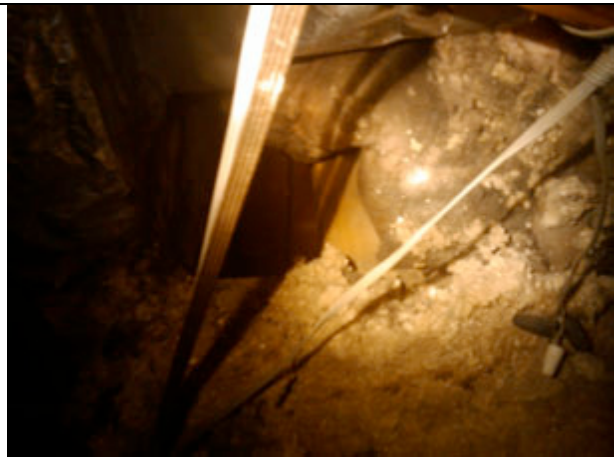
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Attic knee wall without a sealed air barrier



Low insulation in small attic



Open duct chase from side



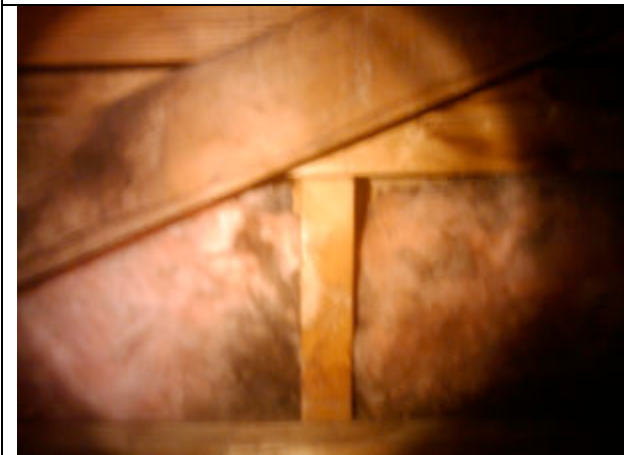
Open duct chase from top



Small attic above finished room



Dirty insulation from air movement



No air barrier between garage attic and living space  
note dirty insulation



Thermal bypass from living space to garage attic



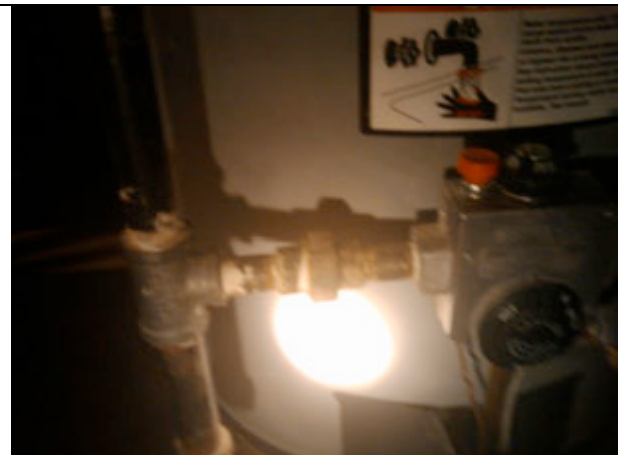
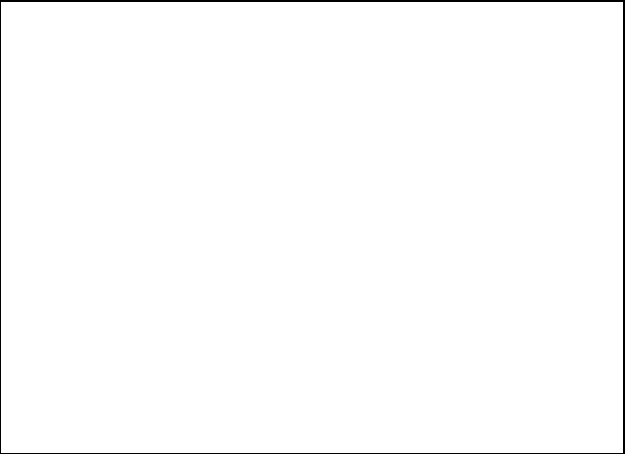
Seal flue chase



Seal top plates of walls and wire penetrations



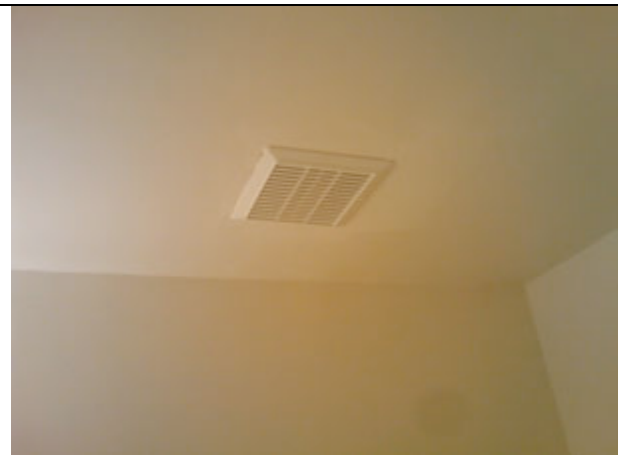
Seal top plates of walls and wire penetrations



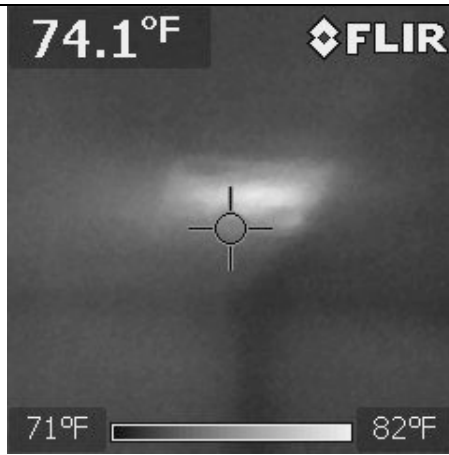
Small gas leak detected – have checked by licensed plumber/gas fitter



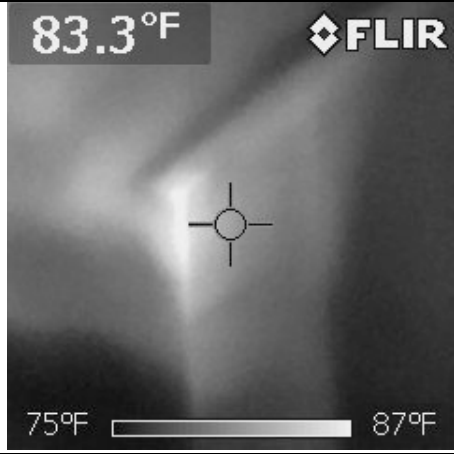
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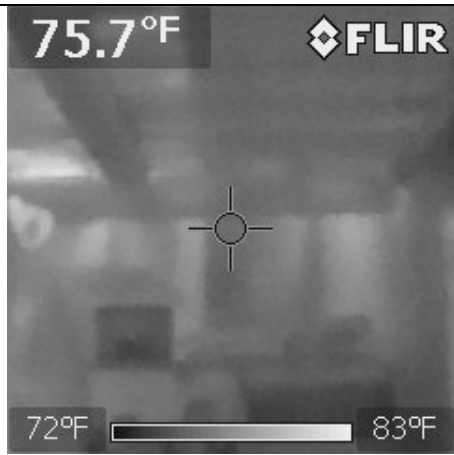
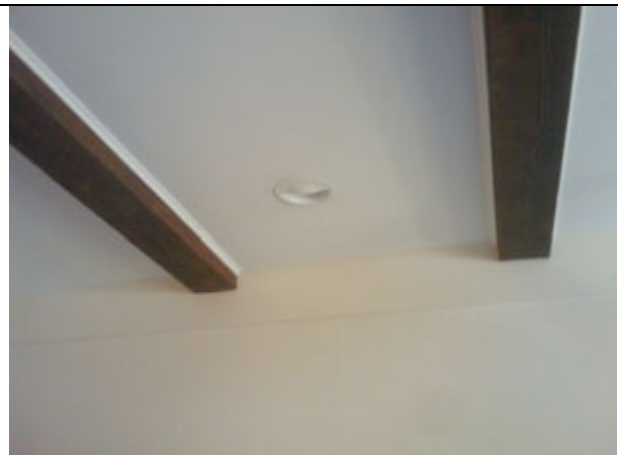
Bathroom vent connected to attic



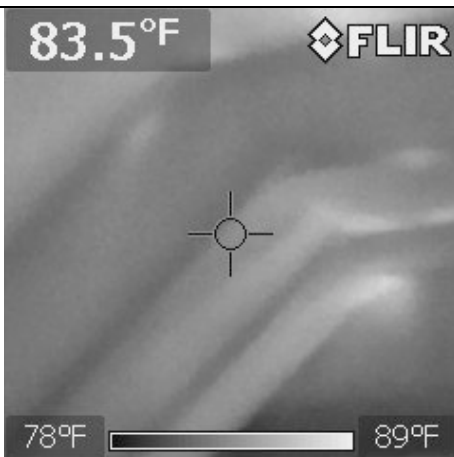
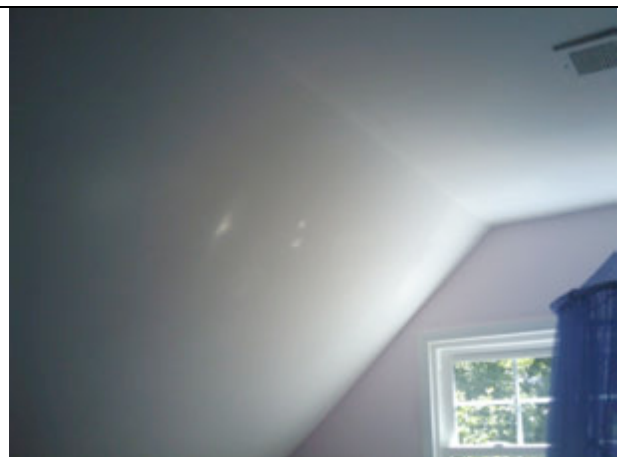
Infrared of vent showing air movement



Air movement – top plates need air sealing



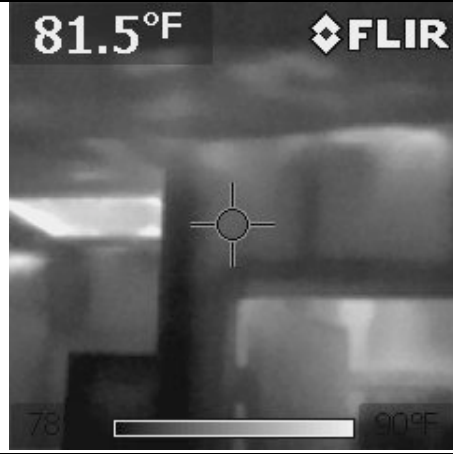
Infrared showing connection to garage and garage attic



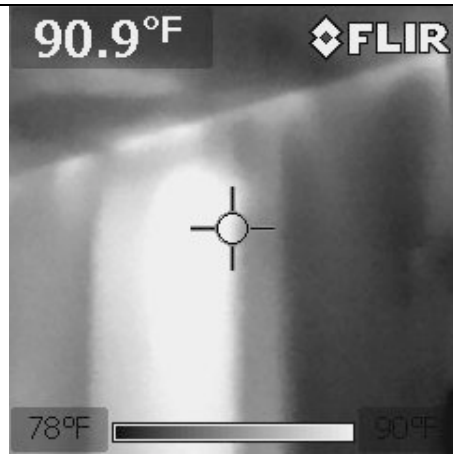
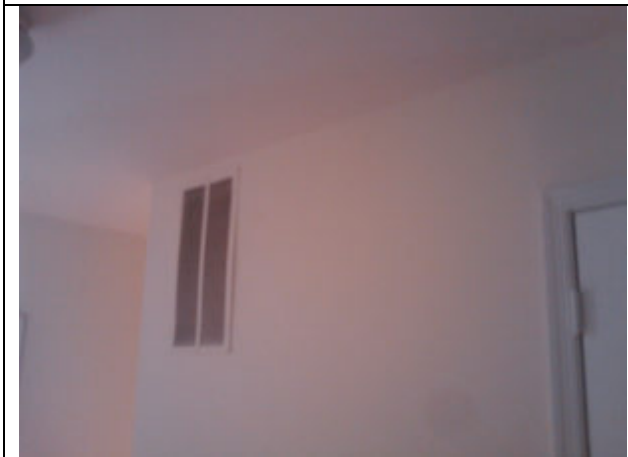
Air movement above bedroom



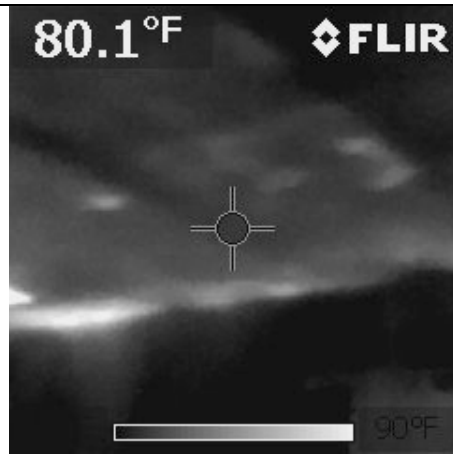
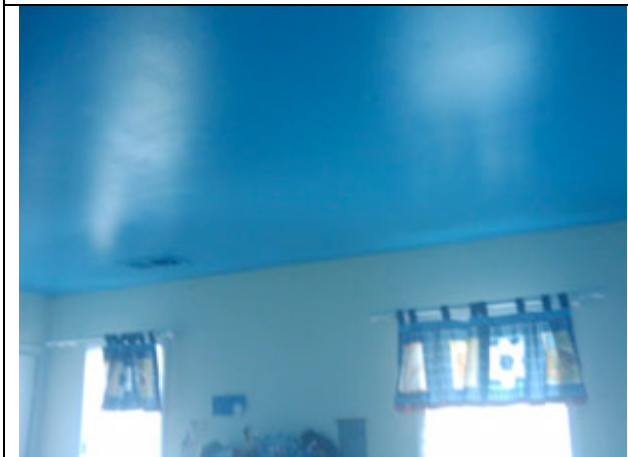
Upstairs hallway and attic hatch



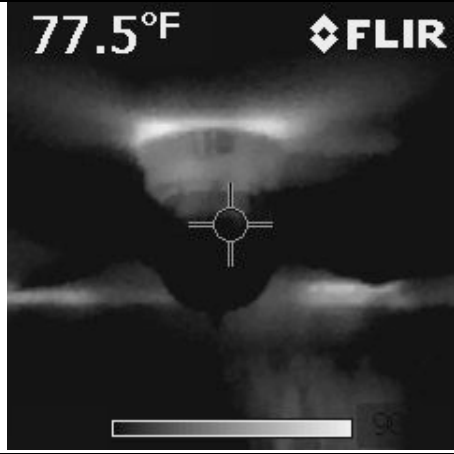
Attic hatch sealing, top plate sealing, increased insulation levels needed



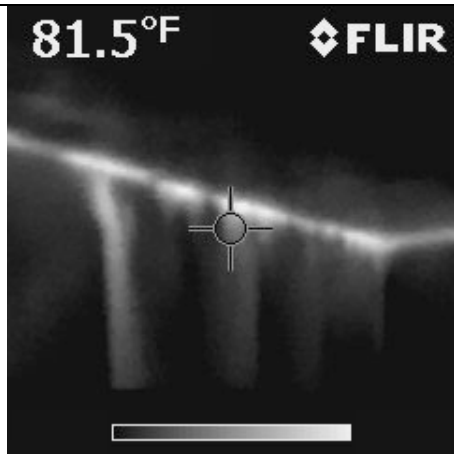
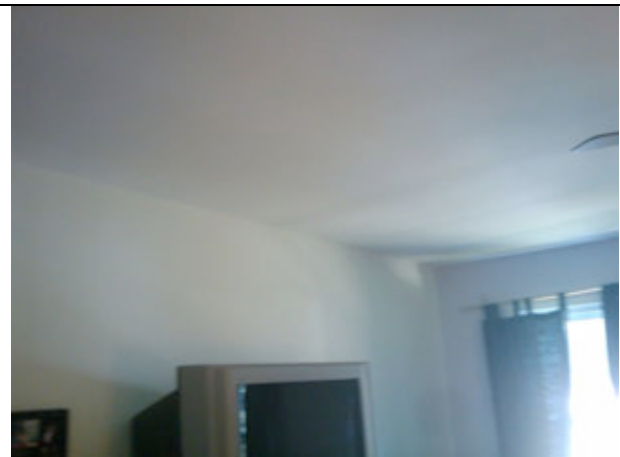
House connected to open duct chase in attic



Duct connected to attic and thin insulation levels



Electrical penetrations need air sealing



Wall top plates need sealing