



Home Energy Evaluation Report for House Five



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Customer Information:

House Five
Canterbury Woods Community
Annandale, VA

Inspection Date: June 10, 2010

Homeowner Energy Concerns:

Whole house assessment

Inspection Summary:

House Five is an approximately 2,928 s.f. split level style house with an unfinished lower basement and a finished upper basement. The foundation walls are block/brick and the walls are framed. The house was built approximately 45 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, but needs additional air barriers and air sealing. House Five has a Home Energy Rating System score of 135 (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 licensed plumber/hvac tech check the flue vent to ensure proper venting of combustion gases (fails spillage in worst case).
- 2) Disconnect humidifier and consult a mold inspector regarding possible remediation of the upper attic roof sheathing mold growth.
- 3) Remove attic ventilator and install ridge/gable/soffit vents for additional air movement.
- 4) Air seal penetrations in ceiling/attic interface (pipes/ducts/electrical), install air barrier above dropped soffit in kitchen
- 5) Insulate attic to R-49.
- 6) Seal duct chase open in basement.
- 7) Seal and insulate band joist in basement and utility room.
- 8) Seal ducts where accessible/reachable.
- 9) Seal penetrations in exterior walls.
- 10) Insulate basement 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 3,050 cfm. This is the equivalent of leaving one window open approximately 14 in. year round. The test revealed the home to be leaky in the following areas:

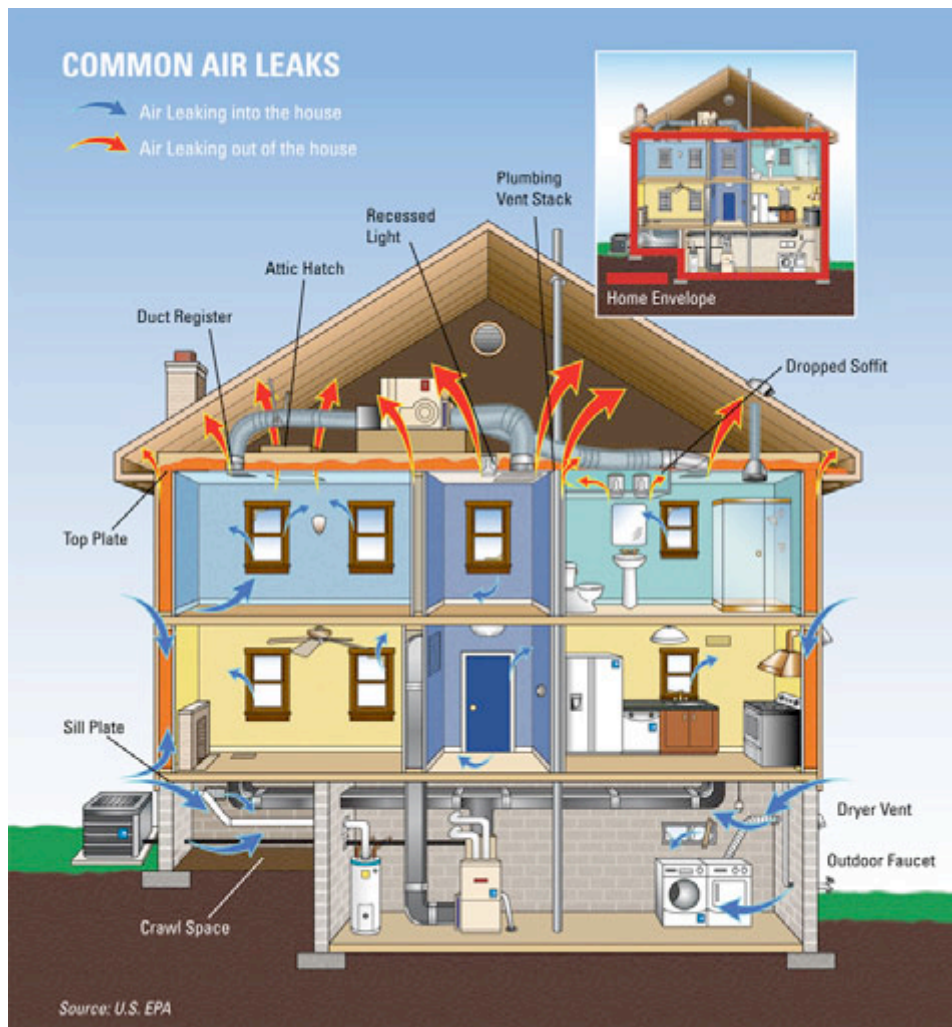
- 1) Attic knee wall between separate levels
- 2) Dropped soffit in kitchen
- 3) Top plates of walls
- 4) Attic hatch
- 5) Pipe penetrations
- 6) Electrical boxes
- 7) HWH vents

Combustion Appliances:

A gas fired hot water heater and furnace are located in a utility closet at the rear of the house. The hot water heater fails carbon monoxide spillage under worst case conditions. This situation passes BPI combustion safety since the carbon monoxide levels in the hot water heater byproducts is low. We recommend having it checked by a qualified service company.

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 ₅₀ | ACH ₅₀ | ACH _{nat} |
|-------------------|-------------------|-------------------|--------------------|
| Split Level House | 3,050 | 7.81 | 0.45 |

Typical Air Leakage Values

| Home | ACH ₅₀ | ACH _{nat} |
|-------------------|-------------------|--------------------|
| 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 |

CFM₅₀ = Cubic feet per minute at 50 Pascals

ACH₅₀ = Air changes per hour at 50 Pascals

ACH_{nat} = Air changes per hour at normal pressure

Attic:

There are 2 attics over the split level house. They are connected by a small 2-3 s.f. opening. The attic is framed with dimensional lumber and is vented by two gable vents and a power roof ventilator. The attic floor is insulated with blown fiberglass insulation. The effective R value of the existing 3" of insulation is R-7. The recommended R value for this area is R-49. Many thermal bypasses exist between the main living area and the attic. The attic knee wall does not have an air barrier and dirty insulation indicates significant air leakage. Extensive mold growth is present in the upper attic on the underside of the roof sheathing. Approximately 10-12 sheets of plywood appear to have been replaced with a recent roof replacement. Mrs. Tave indicated that the humidifier has been running on a high humidity level in the past but it has been adjusted. Humidifiers tend to create more problems in the home than the added comfort value. A well sealed and insulated home will keep the latent humidity in the home, reducing the need for a humidifier. The mold growth is present due to excessively moist air leaking to the attic through the ceiling. In the winter months, the warm moist air condenses on the underside of the cold roof sheathing. This is the cause of the rotten plywood that was replaced previously. Recent studies confirm that roof ventilators waste energy. The fans draw conditioned air from the house and do not adequately cool attic spaces, they only draw the conditioned air from the house to the attic. The symptoms of poor ventilation, prior work, and existing moisture signs indicate the problem has been present for some time, but has never been fixed.

Recommendations:

- 1) Disconnect roof fan or set on high setting to minimize operation.
- 2) Clean gable vents. Supplement with ridge vent and soffit vents where possible.
- 3) Inquire with mold inspector about the extent of remediation necessary.
- 4) Insulate and air seal attic hatch.
- 5) Insulate and air seal knee walls.
- 6) Air seal attic floor and insulate to R-49. We recommend borate stabilized cellulose.

Entry level:

The main living area has several areas of air leakage. The first area is at the electrical outlets at the exterior walls. A small amount of leakage was also detected at the ducts located in the perimeter walls. The kitchen exhaust fan leaks due to its age.

Recommendations:

- 1) Seal electrical boxes located in the exterior envelope.
- 2) Seal ducts where accessible/reachable.
- 3) Seal outside damper if possible.

Basement level:

The foundation is exposed and uninsulated in the lower basement. The upper basement is finished. Some leakage was detected at the perimeter of the foundation wall where exposed. An open duct chase is located at the entrance to the lower basement. A portion of the band joist is exposed in the upper basement utility room. The lower basement windows are the original metal single pane windows.

Recommendations:

- 1) Spray foam band joist where accessible.
- 2) Seal ducts and pipes at floor penetrations in both lower basement and utility room chases.
- 3) Replace older windows with Energy Star qualified windows.

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 (Products and Home Improvement Tabs) and reviewing factsheets located at www.southface.org (Resources Tab) for more information.

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/ 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
- 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>

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). 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

New American Dream has information on Green Seal certified paint manufacturers: 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, 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.

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.

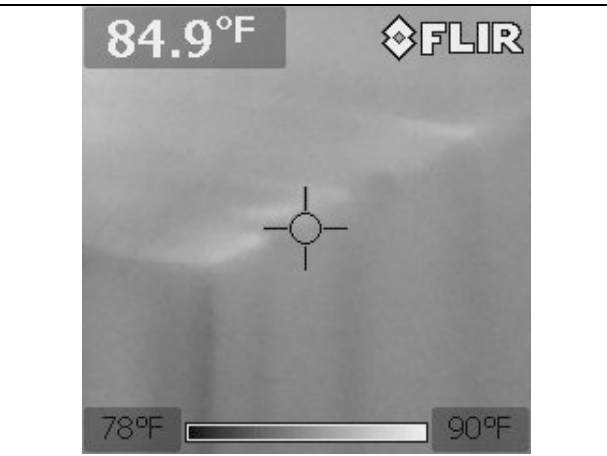
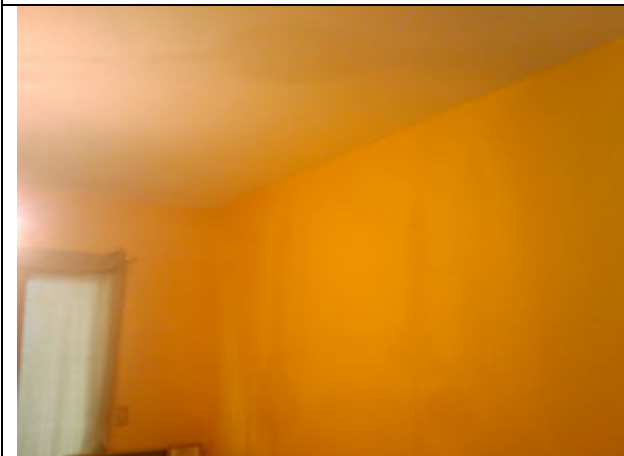
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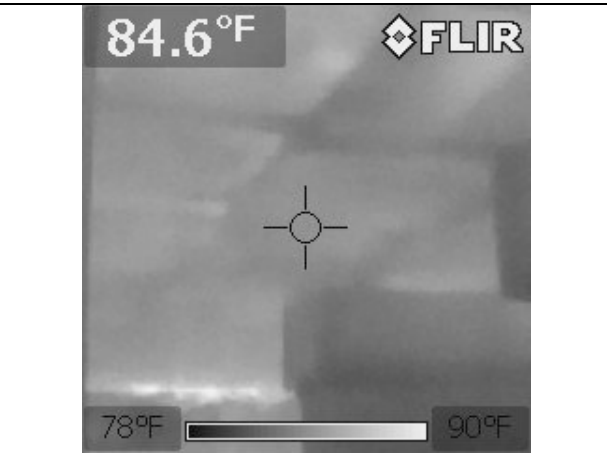
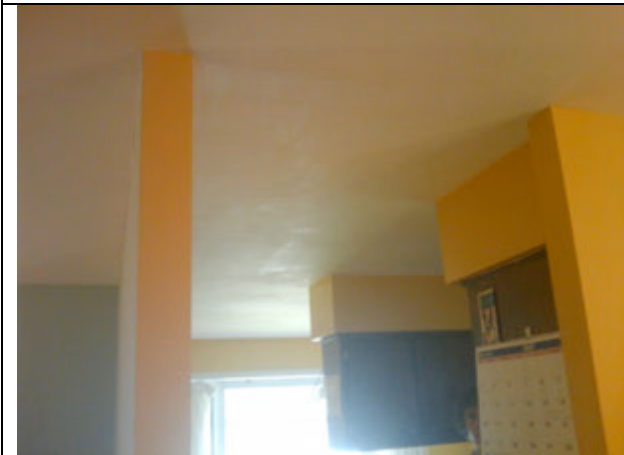
Air seal and insulate band joists



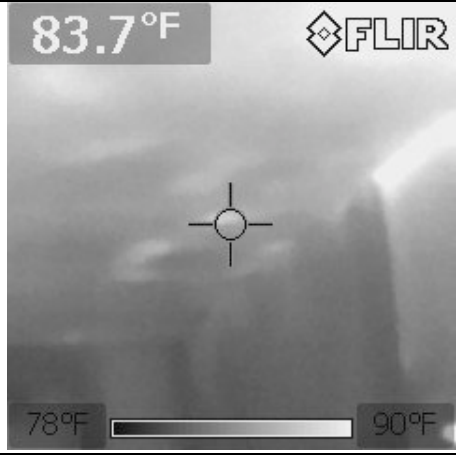
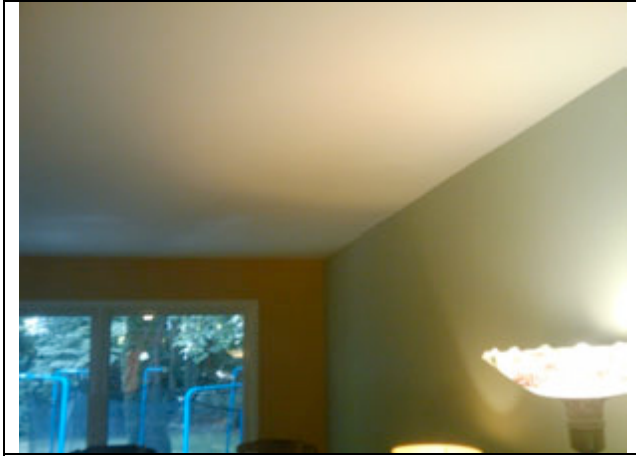
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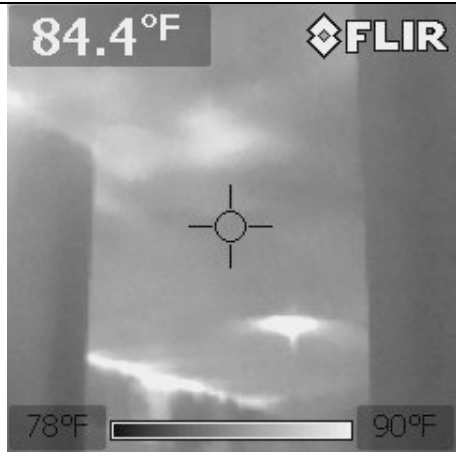
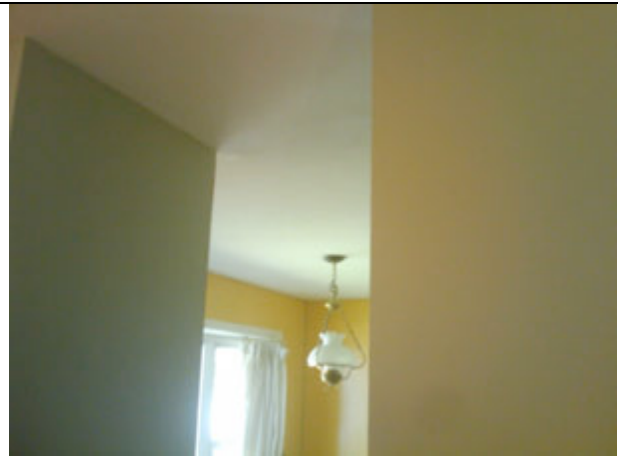
Air leakage at top plates of walls



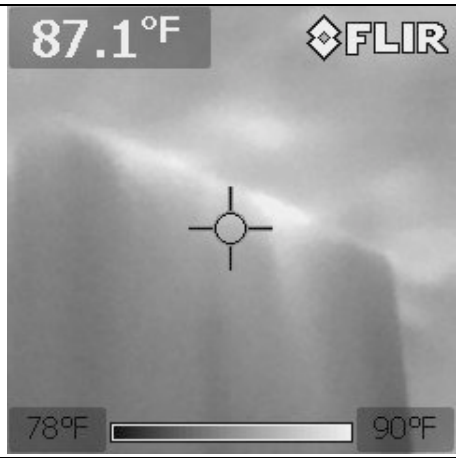
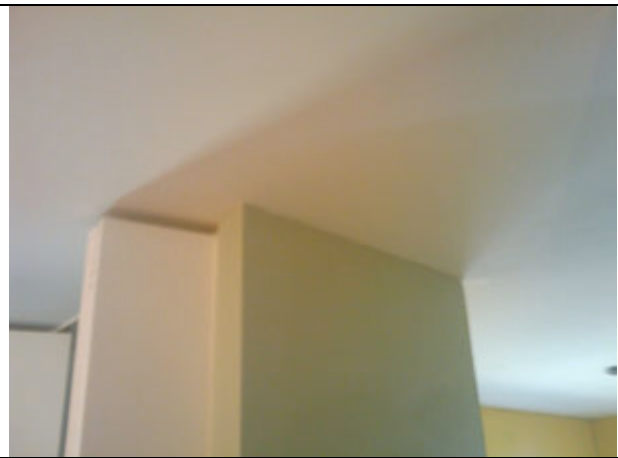
Thin insulation, air leakage at dropped ceiling



Thin insulation, air leakage at top plates



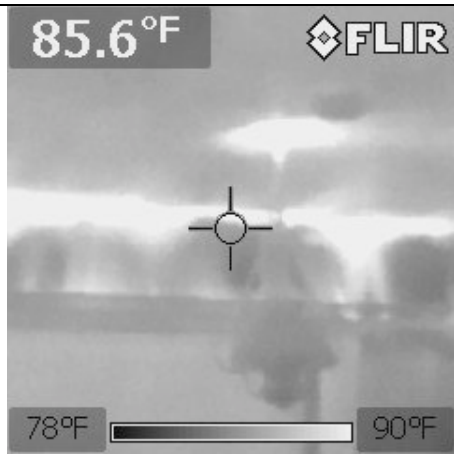
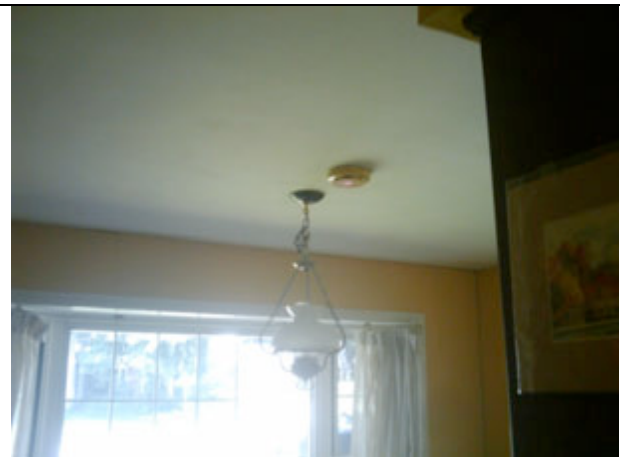
Thin insulation, wire box and top plate air leakage



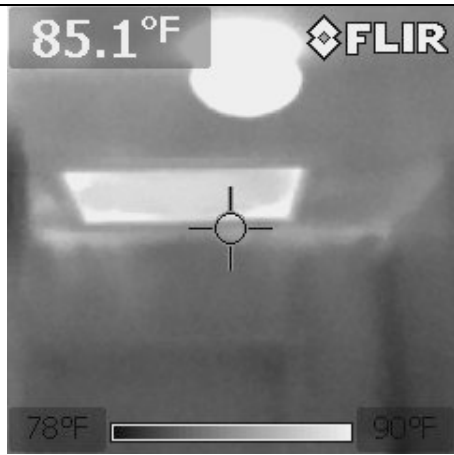
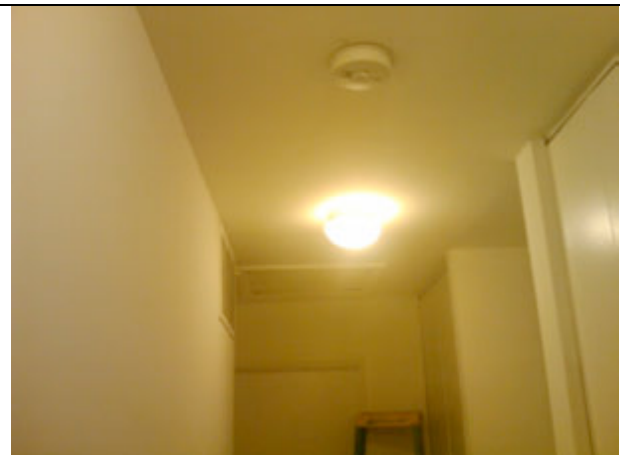
Seal top plates of walls and wire penetrations



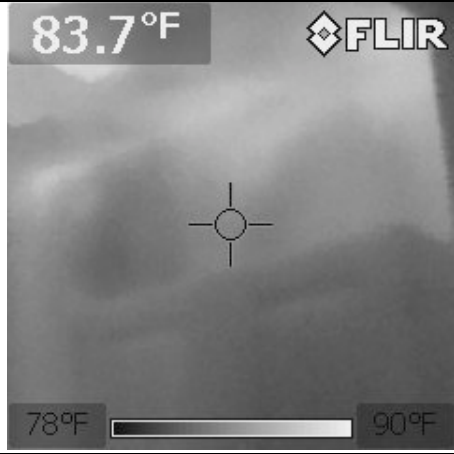
Open duct chase needs air barrier and sealing



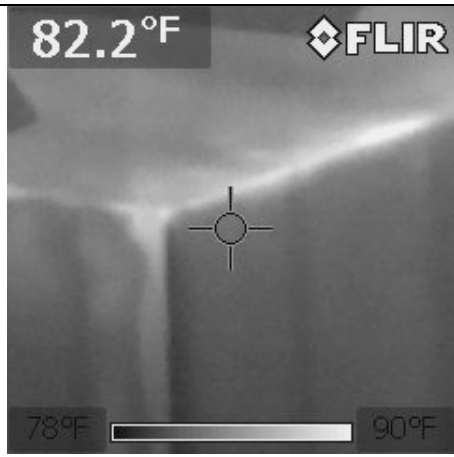
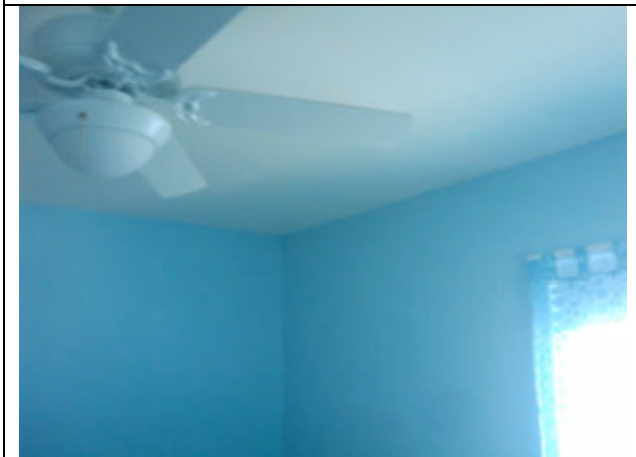
Air leakage at top plate and electrical penetrations



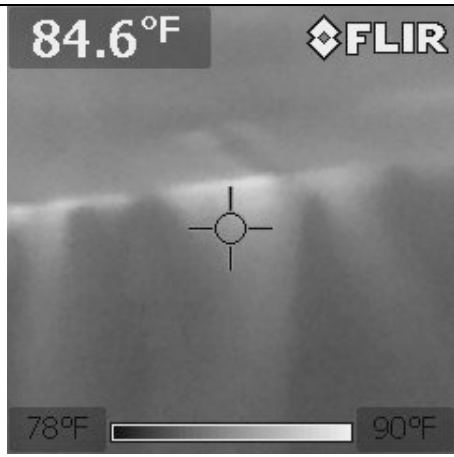
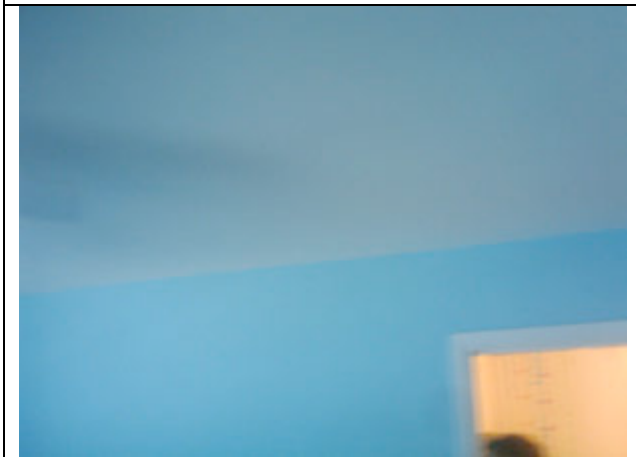
Air seal and insulate attic hatch



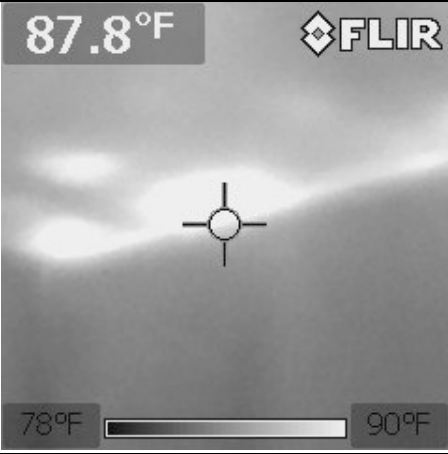
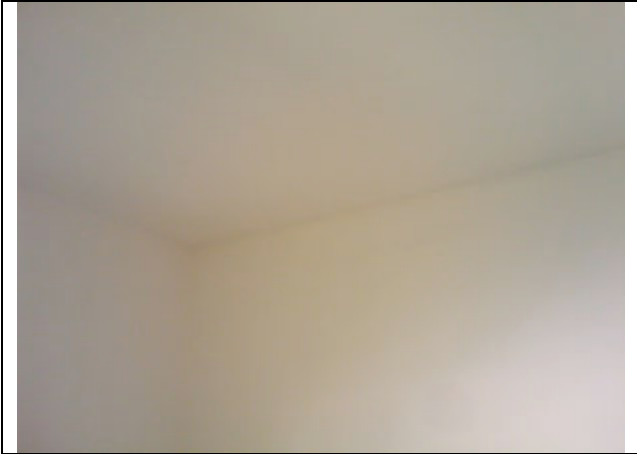
Air movement – top plates need air sealing



Air movement above bedroom



Top plate air sealing needed



Little to no insulation