



## Residential Energy Audit Test Format:

The audit steps consist of:

- A. Visual Inspection: The purpose of the visual inspection, both interior and exterior, is to familiarize the auditor with the structure. This will provide the auditor with a general understanding of the homes arrangement and potential areas to review during the balance of the audit.
- B. Energy Consumption: This phase consist of a review of the utility bills for the past 12 months. This review will trend the energy consumption which is important for proper evaluation of the seasonal heating and cooling costs. Such evaluations are helpful in determining the energy saving potential for the home.
- C. Blower Door Test: A Blower Door is used to test the air tightness of the home. It is a fan that mounts into the frame of an exterior door and pulls air out of the house, lowering the inside air pressure. The blower door equipment consist of a fan, adjustable frame, air tight covering and monometer.

The test requires that all other exterior doors and windows be closed while the fan is operated. The standard test pressure is -50 pascals (1 Pascal = 1/250 inches water column). The amount of air leaving the house is measured as an indicator of how air tight the structure is. The less air the tighter the house. Air infiltration can amount to 30% of the home's energy consumption.

- D. Combustion Safety: A combustion safety test is preformed on all carbon burning appliances, i.e. gas or oil fired furnaces, boilers, stoves, water heaters, etc. Each appliance is test by for spillage, draft, efficiency, temperature and levels of CO, O<sub>2</sub>, & CO<sub>2</sub>. The purpose of the testing is to identify problematic appliances which may require service or replacement.

Testing requirements consist of:

- Testing the draft of the appliance(s) under worst case depressurization conditions. Worst case conditions are created by operating all the exhaust fans and other combustion appliances to maximize the depressurization of the Combustion Air Zone (CAZ). Operation of fireplaces or wood stove is beyond the requirements of this study. For this house the CAZ was taken as the entire basement.

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- Testing and recording the CO emissions from the appliance to determine if spillage is occurring.
  - Testing and recording the SSE of the flue gas to determine how efficient the appliance is operating.
- E. Recommendations and Findings: A report is generated explaining the findings and making appropriate recommendations for improvement with estimated costs and payback data.
- F. Upgrade Verification: The final phase consists of working with home owner and contractor(s) or as a contractor to perform the work selected to be done. Not all improvements are cost effective. This phase includes a final blower door test to verify the improvements have accomplished the goals established.



## Energy Audit Report

Location: 36 Buzzell Lane  
Eliot, ME

Date of Audit: September 16, 2008

Report Date: September 23<sup>rd</sup>, 2008

Report Submitted by: Ed Henningsen

This audit was performed as part of Maine Home Performance's mentoring program for the training of individuals seeking certification as an auditor. The Home Performance Energy Star program is an U.S. EPA partnership with the State of Maine. The goal of Maine Home Performance Energy Audit is to train and certify contractors to perform audits and conduct energy improvements on existing homes.

The primary audit areas are; a) levels and quality of insulation, b) paths for air infiltration, c) sources for potential indoor air quality problems, and d) the safe operation of all combustion appliances.

### A) Visual Inspection:

The home is a two story cape with a combination of post & beam and standard stick construction on a full basement. There is an enclosed porch which was not included in the audit. The first floor interior consists of kitchen, living room, family room, master bedroom and bath. The second floor has three bedrooms and a bath. The total floor area was estimated at 1,663 ft<sup>2</sup>, not including the basement. The volume of the first and second floor was estimated at 13,800 ft<sup>3</sup>. Wall construction was standard 2 x 4 framing with plywood sheathing and clapboard siding on the exterior. The interior was finished with painted sheetrock. The insulation is blown in cellulose in the walls and ceilings.

### B) Review of Utility Bills:

Not performed for this audit.

### C) Blower Door Test:

Test results are:

a) CFM<sub>50</sub> leakage rate (1<sup>st</sup> & 2<sup>nd</sup> floors) = 2300 cfm.

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- b) Computed natural air changes per hour are .562 ACH. This represents approximately 230 in<sup>2</sup> of openings allowing air into the thermal envelope.
- c) ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers) recommendation is 0.35 ACH for homes. That would equate to approximately 140 in<sup>2</sup> of leakage area. Leaving a net balance of 90 in<sup>2</sup> that need to be sealed.
- d) The CFM<sub>50</sub> leakage includes some minor infiltration from the basement through the stairwell, vent systems and around the blockage placed in the chimney opening.

D) Combustion Appliances:

<b>Combustion Appliance Test Results</b>		
Appliance: Atmospheric Gas Fired Burners	Readings	Acceptable Ranges <sup>(a)</sup>
Base Pressure (pascals)	-0.5	< -2.0
Induced Pressure (pascals)	-1	< -5.0 <sup>(b)</sup>
Ambient CO Level (ppm)	0	0 to 9 <sup>(c)</sup>
Flue Gas CO level (ppm)	50	<100 <sup>(d)</sup>
Flue Gas O <sup>2</sup> level (%)	not recorded	3 to 13 <sup>(d)</sup>
Flue Gas CO <sub>2</sub> level (%)	not recorded	3 to 13 <sup>(d)</sup>
Steady State Efficiency (%)	79.5	> 80
Stack Draft (pascals)	-10	-10 to -15
Ambient Temperature (°F)	65	NA
Stack Temperature (°F)	638	< 570
Net Stack Temperature (°F)	573	300 - 500 <sup>(d)</sup>

**Footnotes:**

- a) Acceptable Ranges are provided for guidance only. It is important that the home owner follow the manufacturer's recommendations, which should be available in the installation manual.
- b) A worst case depressurization test should be repeated after installing insulation or sealing to confirm heating appliances are drafting properly.
- c) 9 ppm is EPA's maximum 8 hour exposure for room air.
- d) Taken from chapter 6 of Residential Energy by Krigger & Dorsi, 4th Edition

Furnace operation appears to be acceptable. Annual servicing of oil fired appliances will increase their efficiency by 3 to 30%.

The hot water heater was not tested because the LPG is disconnected.



## Findings and Recommendations:

### Energy Conservation Items:

- The exterior entrance to the basement requires insulation, sealing and weather stripping. A second option is to install an interior wall and door at the bottom of the steps. This wall and door should be insulated and weather stripped to make air tight.
- The main stairwell from the basement to the first floor requires insulation and sheet rock to reduce the thermal bypass of the air gaps in the underside of the second floor stairs. These gaps will allow air infiltration between the main living space and basement. The direction and amount of infiltration will be dependent on the pressure differential between the two spaces.
- Portions of the return ducts in the basement run between the floor joists. The joist and subflooring make up three sides of the ductwork with a sheet metal pan on the bottom. The seams between the joist, subflooring and sheet metal should be made air tight with caulk.
- The electrical wiring for the house has been run through holes drilled in the floor joist. In several cases these holes were drilled in joist that are framing the return duct system. These holes need to be sealed with expanding foam to eliminate moist cold basement air from mixing with the return air.
- Infrared scanning showed air infiltration along the rig beam at the peak of the roof. It is recommended that caulking be applied between the ceiling sheetrock and rig beam. See attached infrared report.
- All three of the second floor skylights leak air at the seams and require caulking.
- All non-insulated areas along the rim joist should be sealed and insulated.
- If not already installed, a programmable thermostat should be used to control the house temperature setting.

### Health and Safety Items:

- There is a third thimble into the chimney that also services the gas water heater and oil fired furnace. This thimble should be capped permanently.
- A CO monitor should be mounted in rooms with wood burning airtight stoves or vent-less heating appliances.
- Upon completion of the recommended upgrades a second worst case depressurization test should be performed on the water heater and furnace drafts to confirm they are drafting properly.

### Upgrade Verification:

Will not be performed at this time.

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Notes:

The energy audit was performed under the supervision of Maine Home Performance consultant. The audit is part of a certification process leading to a Building Performance Institute certification and Energy Star privileges.

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