eZing, Inc.

Energy Guidance You Can Trust

1145 S. Lombard Ave., Oak Park, IL 60304
708-848-3066 708-704-8464 (c) 708-848-4341 (fax)
www.ezing.pro

Energy Survey Report

Prepared for

Mary and Joe Citizen

123 Street, Chicagoland, USA

Survey Date

22-Feb-09

Insulation

123 Street, Chicagoland, USA

Surface to be Insulated	R-value, USDOE Recommended[1]	R-Value Observed or *Assumed	Added R-Value to Consider	% Defective Placement	Consider Defect Correction	Pre-Insulation Prep Needed	Priority
Ceiling of Finished Attic	R-49	R-40	none				
Sloped Finished Attic	R-38	R-10	none	33	yes		A
Gable Finished Attic	R-18/22	R-0	fill	40	yes		A
Wall of Dormer	R-18/22	R-0	fill				A
Knee Wall	R-18/22	R-0	13 blanket w/ 1.5in foam board cold				A
Outer Ceiling Joists	R-49	R-0	49				A
Wall, Frame	R-18/22	R-0	fill	see sketch			A
Wall, Stair to Attic	R-18/22	R-0	fill w/ cellulose				A
Perimeter Floor Cavity, 2nd	R-18/22	R-0	seal to isolate, see Outer Joists				A
Floor - exposed	R-25	R-0	25	fill cavity completely			A
Floor Above Unheated	R-25	R-18		40% Fror	Yes		A
Perimeter Floor Cavity, 1st	R-18/22	R-0	10 or more foam board & seal				A
Bsmt Above Grade, no finish	R-11/19	R-11	complete as necessary				A
Crawl Space Wall	R-19	R-0	10 or more foam board, front crawl				A
Wall Between Bsmt / Crawl	R-11/19	R-11	not necessary w/ crawl wall insl				
Below Grade Foundation	R-11/19	R-0	R-13 frame & insulate				B

[1] "Energy Savers," http://www1.eere.energy.gov/consumer/tips/pdfs/energy_savers.pdf, p.7 Climate zone 2, gas / electric heat
Higher R-values are better. Refer to Insulation page for types of materials.

Priority **A - Take action as soon as possible**

B - Less cost effective, doesn't directly address concerns

Air Tightness

Severity of Direct Air Leakage

All ratings reflect the condition of your house compared to what is typically seen.

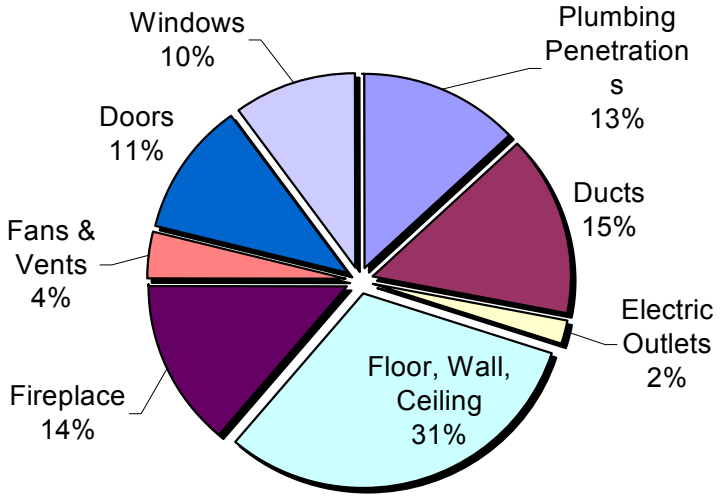
ACH50 or Air Changes per Hour at 50 pascals fan pressure					15.57
Your ACH50 rating is:	Exc, 0-2	Good, 2-4	Avg, 4-8	Poor, >8	Poor
ACH natural or Air Changes per Hour, on average, during a typical winter					1.05

Indirect Leak Severity	None	Mild	Average	Severe	Average

Guide to Air Tightness

Leak Locations

There are many places where air leaks into and out of a house. Study of air leakage in recent decades, places leakage of windows and doors at about 20% of house leakage. On average 80% of air leaks in houses are at other locations. [1]



Leakage by Location
For an AverageHouse

Measuring House 'Air Changes'

Leakiness is expressed as 'air changes per hour' of the house. That is, how many times the volume of indoor air is exchanged for outdoor air in one hour. Basing leakage on house volume allows comparison of leakiness among houses of different sizes. We have measured air leakage at a standard air pressure of 50 Pascal.[2]

How Much Leakage is Typical?

The range of leakage among houses is quite large. Most houses built before the 1980 are within a range of 3 to 12 ACH50. More recent construction is to a standard that reflects consciousness of efficiency, and most are in a range of 2 to 6 ACH50. Leakage less than 2ACH50 is usually achieved when the house is built to a tightness protocol.

Can't a House be Too Tight?

Yes, but bear in mind that an air tight house is fine if it has controlled ventilation. And a leaky house is not necessarily well ventilated. A leaky house may retain air contaminants when there is little wind or temperature difference to cause air movement.

Indirect (or 'by-pass') air leakage

Most houses harbor air paths that connect between the attic and basement. By-pass leakage also connects a 'flat' roof or crawl space attic and a foundation crawl space. Air 'expressways' typically concealed within wall and floor framing provide a path around or through fluffy insulation. Snow melting at certain spots on the roof, and ice dams, are clues that warm air sneaks through attic insulation and heats the roof.

In some cases, a by-pass simply routes air between a warm and cold area without indoor/outdoor leakage. In some cases house leaks are connected to by-pass leaks. And in some cases an air by-pass is entirely separate from measured house leakage.

The hidden pathways of bypass leakage can be revealed with an infrared scanner. The scanner displays temperatures that are colder than desired in winter and warmer in summer. An abnormal surface temperature is associated with hidden leaks.

By-passes can have leaks that open to conditioned rooms. The blower door pulls air through these paths to make them more detectable.

AIR LEAKAGE CHECKLIST

123 Street, Chicagoland, USA

LEAKS ARE RANKED SUCH THAT MILD LEAK = 1 and SEVERE LEAK = 5, C0MPARED TO TYPICAL SEVERITY.

AIR LEAKAGE TYPES	*Severity*	*Location(s)*	*Correction*
Attic			
Attic hatch	5		Weatherstrip, add rigid insulation board, and add weight to hatch
Finished Attic			
Attic Knee Walls	3	2nd floor	Seal joist cavity beneath, insl board
Attic Knee Wall Access Door	5	2nd floor	not req'd if rafters and exterior 18 inch wall are insulated
Ducts Behind Knee Wall	na		
Framing and Chases			
Stud Cavities Open at Attic Floor	5	Comment: Fill and air seal the small "knee-wall" above attic subfloor.	Fill exterior wall cavities thru exterior with insulation, seal tops of interior wall cavities open at attic floor. (See comment)
Chimney frame-out	3	Basement and Attic (Leak at roof at chimney)	Fire rated foam or sealant (red/orng), or non-combustible such as sheet metal.
Piping Chases	4	Openings outside knee walls	Foam sealant or cut/fit foam board. Seal at attic floor and at basement ceiling
Built-Ins			
Kitchen	3		Seal openings behind base cabinets, west wall. Insulation is present, though coordinate w/ insulator in case additional insulation can be placed before sealing wall.
Tub Surround		Where at exterior wall	Foam between wall & tub @ ext wall
Finishes			
Floor-Wall Junction	4		Caulk w/ clear silicone
Casing, Ceiling Mold, etc.	3		Caulk -- see Blue tape
Recessed Fixtures	3	First Fl. Bath	caulk or low expanding foam AND in kitchen add air tight baffle insert to can light
HVAC & Utility Room			
Pipe to Heating Terminal	check		
Vent Connection at Chimney	0		
Combustion Air Opening			Install outdoor combustion air if permitted for boiler.
Controlled Outdoor Combustion Air			consider installing near heating eqmt
Fireplace			

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AIR LEAKAGE TYPES	*Severity*	*Location(s)*	*Correction*
Windows/Doors/Skylights			
Window Opening / Trim			Wood trim -- caulk the gap
Window	3	esp at 1st floor front	
Parting Rail (Lock Stile	3		V-strip
Sash at Bottom	4		V-strip
Pulley Seal	4		Pulley seal
Door	5,3	Basement (5), 1st Fl Rr (3)	Polypropylene pre-formed V
Ventilation for Interior			
Bathroom Fan	2		Seal behind cover at drywall cut
Kitchen Fan to Outdoors			needed
Foundation and Utilities			

See www.efi.org for specialty air seal and ventilation products.

AIR LEAKAGE MEASUREMENT

123 Street, Chicagoland, USA

House Volume in Cubic Feet: 16189

Test #1	Date: 1-Feb-09			Test #2	Date:		
Outside Temp.	37			Outside Temp.			
Indoor Temp.	69			Indoor Temp.			
Wind Speed	5 to 10			Wind Speed			
ΔP	+ or -	Base ΔP		ΔP	+ or -	Base ΔP	
House P (Pa)	Fan P (Pa)	Ring O or ABC	Flow (CFM)	House P (Pa)	Fan P (Pa)	Ring O or ABC	Flow (CFM)
24.5			2793				
32.6			3195				
@50			4200				

CFM50:	4200	CFM50:	
ACH50:	15.57	ACH50:	
ACH natural:	1.05	ACH natural:	
Effective Leakage Area:	560 sq. in.	Effective Leakage Area:	
MPLS Leakage Ratio:		MPLS Leakage Ratio:	
Equivalent Leakage Area:		Equivalent Leakage Area:	

Natural air changes per hour (ACH_{nat}) is average house air leakage rate, useful for estimating heating cost due to leakage. ACH_{nat} is calculated as an adjustment to ACH50 rate described above, taking account for local climate, height of the house, and wind shielding air leakage under natural conditions (also called "accidental ventilation") would not be sufficient.

Comments (Condition of vents, flues, and doors during test, major leakage sites, etc.)

Heating, Cooling, Water Heating

123 Street, Chicagoland, USA

Equipment Type	NAECA[4] Standard	Most Efficient	Model #	Est. Age	Capacity 1000 BTU	Est. Efficiency
Boiler - Hydronic - Peerless	**80 AFUE**	***99AFUE***	***MI-04-SV-WPC***			
Water Heater - Gas, Tank, ND	**EF 0.60**	***80AFUE***	***AOSmith FSG50-242***	***2 yrs***	***50G***	***.54***
Water Heater - Gas, Tankless	**0.62**	***0.98***	***see Navien***			
Central Air Conditioner	**13 SEER**	***18+***		***5 yrs***	***3.5 tons***	***10?***

[4] National Appliance Energy Conservation Act.

[5] Minimum Allowed Efficiency

AFUE	Annual Fuel Use Efficiency
EF	Energy Factor
SEER	Seasonal Energy Efficiency Ratio
ND	Natural Draft
ID	Induced Draft

Action Items

Consider pipe insulation for heating / hot water, esp if fan coil provides heating for basement.
Consider installing thermal vent damper on water heater vent if water heater is retained.
Consider removing gas space heater to stop air leakage to chimney. Install fan coil unit taking heat from boiler.
Fan coil would have separate temperature control, though boiler would be in use at times fan coil came on.
Explore water heater replacement before present unit fails. 98% tankless units available.
Use floor fan or air filtration unit to circulate air between rooms & meter water flow using radiator valve.
Install radiator reflectors against back side of raditor cabinets where they face exterior wall.
Ducting through knee wall cavity, if rafters are insulated, should be considered if central air is installed.
Heating potable water using heat exchanger from boiler ("sidearm") would be ineffient in summer

Room Temperature Survey	**Boiler Off**		**Boiler On ~ 10 minutes**		
Room	**Radiator**	Room	Radiator		Temp gain
Entry	**70**	68	84.5		14.5
LR	74	70	82.5		8.5
DR	76	69	87.5		11.5
Play	77	65	83.5		6.5
BR2n	79	68	86.5		7.5
BR2e	80	70	85.5		5.5
BR2s	79	69	83		4

Windows and Glazing s

123 Street, Chicagoland, USA

Type of Window	Glazing Rank	Type of Frame	Frame Rank	Interior Cover	Exterior Shade	Locations
Triple Glass w/ 2low-E, 2gas fill						
Triple Glass w/ 1low-E, 1gas fill						
Triple Glass w/ 2low-E						
Triple Glass w/ 1low-E						
Double Glass w/ low-E, Ar gas						
Double Glass w/ storm						
Double Glass w/ low-E	Good	Wood	Good	curtains	some	2nd fl N&E BR
Single glass, storm w/ low-E						recommended
Double Glass	Average	Wood	Good			play room
Single glass, storm	Average	Wood	Good			typical
Plastic Block						
Glass Block	Poor					Bath1west
Single glass	Poor	wood	good			kitchen

Source: www.nfrc.org and selected studies of storm glazing,

Glazing	Approx U-value	Rank
Better than IECC (Energy Code) maximum U-value U<0.35	~ 0.27	Excellent
At and somewhat higher than IECC U-value .35 <= U < .50	~ 0.35	Good
Typical double glazed clear or single glazed with storm	~ 0.5	Fair
glass block ~0.8, single glass ~1.1	0.8 - 1.30	Poor

Frame	Approx U-value	Rank
Insulated vinyl/insulated fiberglass	0.2 - 0.3	Excellent
Wood, clad wood, vinyl	0.3-0.6	Good
Aluminum (with thermal break)	1.0	Fair
Aluminum (no thermal break)	1.9-2.2	Poor

Blind	None
Shade	Some
Cellular	Most
Drape	total
Insulated	

Consider low-E storm windows or replace glass in existing storms w/ low-E
Check www.cozycurtains.com, install one unit if interested and see if satisfactory
Weatherstrip is seen on Air Leak Checklist
Access Oak Ridge Naional Lab booklet on integrating siding & window work
seal windows when siding work is in progress. Use low expanding can foam

If doors are replaced, upgrade to insulated core type, minimum R-7