ZERO DRAFT

Evaluation of Air Leakage Control Measures

Energy Analysis Report

Building Address: *550,000 square foot two-story building in eastern New York*

Date of Evaluation: Sept 9th 2010

Introduction

This report documents and identifies appropriate air-sealing measures and estimates of potential energy and utility cost savings. Site specific information was gathered by Teresa Tsalaky on behalf of ZERO DRAFT.

Field Survey

The main goals of the field investigations were:

- to identify air leakage paths communicating between indoor and outdoors;
- to assess the effects of building ventilation systems on air leakage characteristics; and
- to evaluate possible air-sealing measures and their effectiveness to curtail uncontrolled air leakage and cold drafts.

The field investigations identified major air leakage paths and also potential sealing measures that could achieve reductions in uncontrolled air leakage thereby improving thermal comfort of occupants as well as reducing the associated heating and/or cooling loads. The measures would reduce the air leakage rates; however, it is expected that potential air-sealing measures will not totally eliminate air leakage. It is safely assumed that the implementation of proposed air-sealing measures identified in this report will not adversely affect the associated indoor air-quality and long-term moisture performance of building envelope.

Estimates of Energy and Cost Savings

The air leakage control measures were evaluated using the Air Leakage Control Assessment Procedure (AL-CAP). This method evaluates the airflow through the building envelope openings based on stack pressures due to indoor/outdoor temperature difference, average wind pressures and the effect of mechanical ventilation systems. The calculation methods have been validated using the measured data and have been properly refereed in several technical publications. The following assumptions were made to estimate the energy and costs savings:

- Main space heating fuel is Natural gas.
- Unit cost of space heating fuel is $/Mbtu $ 12.40
- Unit cost of electricity: $ 0.1700 per kWh
- The building-operating schedule was assumed as per the data provided and the heating season was assumed to begin in the mid-month of October and ending in the month of May.
- Effectiveness of air-sealing measures (based on experience): 91%
- Maintained at 72 F or (22 C) for 16 hours per day during the heating season. Setback to 66 F (19 C) for the night-time hours.
- Analysis was performed using the monthly average weather data.

Air Sealing Measures

The following air-sealing measures are considered for the building:

	Type of measures	Quantity	Unit
Windows			
	Weatherstripping	1,304	ft
	Weatherstripping	-	ft
	Caulking (glazing perimeter)	-	ft
	Caulking (frame/wall perimeter)	-	ft
	Glazing corners	-	num
	hardware	-	num
Exterior Doors			
	Weatherstripping - Sliding/commercial	-	ft
	Weatherstripping - Patio doors	-	ft
	Weatherstripping - per door	61	num
	Caulking	-	ft
	Door sweeps	61	num
	Overhead garage/service doors, W/S	96	ft
Interior Doors			
	Weatherstripping (20' per door)	3	num
	Caulking	-	ft
	Door sweeps (3.5' each)	3	num
Envelope			
	Wall / floor joints	-	ft
	Wall/wall corner joints	-	ft
	Wall / ceiling joints	-	ft
	Roof / wall joints	-	ft
	Roof / wall joints (low-rise buildings)	4,845	ft
	Ground floor/basement joist headers	-	ft
	Electric baseboards - cable/conduits	-	num
	Electric baseboards - wall/floor joint	-	ft
	Electric outlets on exterior walls	-	num
	Electrical / mechanical panels	-	num
	Cable penetrations	-	num
	Pipe penetrations	56	num
	Attic or roof penetrations, 1' x 1'	-	num
	Attic or roof penetrations, 2' x 2'	-	num
	Mechanical room penetrations	1	num
	Vent housings (dryers and other)	-	num
	Plumbing / electrical bus bar conduits	-	num
	Ventilation duct perimeters (seal)	44	ft
	Skylights perimeters (seal)	316	ft
	Soffit joints	-	ft
		-	ft
		-	num
Shafts and Other			
	Elevator cable penetrations	-	num
	Elevator control cable penetrations	-	num
	Garbage chute and access hatches	-	num
	Roof hatches and exhausts	106	num
	Mechanical room - duct penetrations	-	num
	Grilles for fresh air/exhaust perimeters	-	num
	Fire cabinets (pipes and edge)	-	num
	Elevator seal	-	ft
		-	num
		-	ft

The total cost of the above air-sealing measures is estimated at $70048.

Summary of Potential Energy Cost Savings from Air Sealing Measures

1. Energy cost savings are as follows:

Air-Sealing Measures Installation Cost	Energy Cost Savings			Payback Years
	Heating	Cooling	Total	
$ 70,048	$ 7,389	$ 3,334	$ 10,723	6.5

2. Fuel use savings are as follows:

Functions	Fuel Savings	Type of Fuel
Space heating	596 Mbtu	Natural gas
Make-up air heating	-	
Cooling	13,444 kWh	Electricity

3. Summary of electricity savings:

	kW	kWh
Winter on-peak	-	-
Winter off-peak	-	-
Total Winter	-	**-**
Summer on-peak	31.6	6,184
Summer off-peak	31.6	7,260
Total Summer	-	**13,444**
Total Annual Electricity	-	**13,444**

4. Potential reductions in HVAC equipment sizing with air-sealing measures:

	Btu/hour	kW
Space Heating System	485,429	142.1
Space Cooling Equipment	119,977	35.1

The above size reductions determined using the ASHRAE 2.5% design weather data.

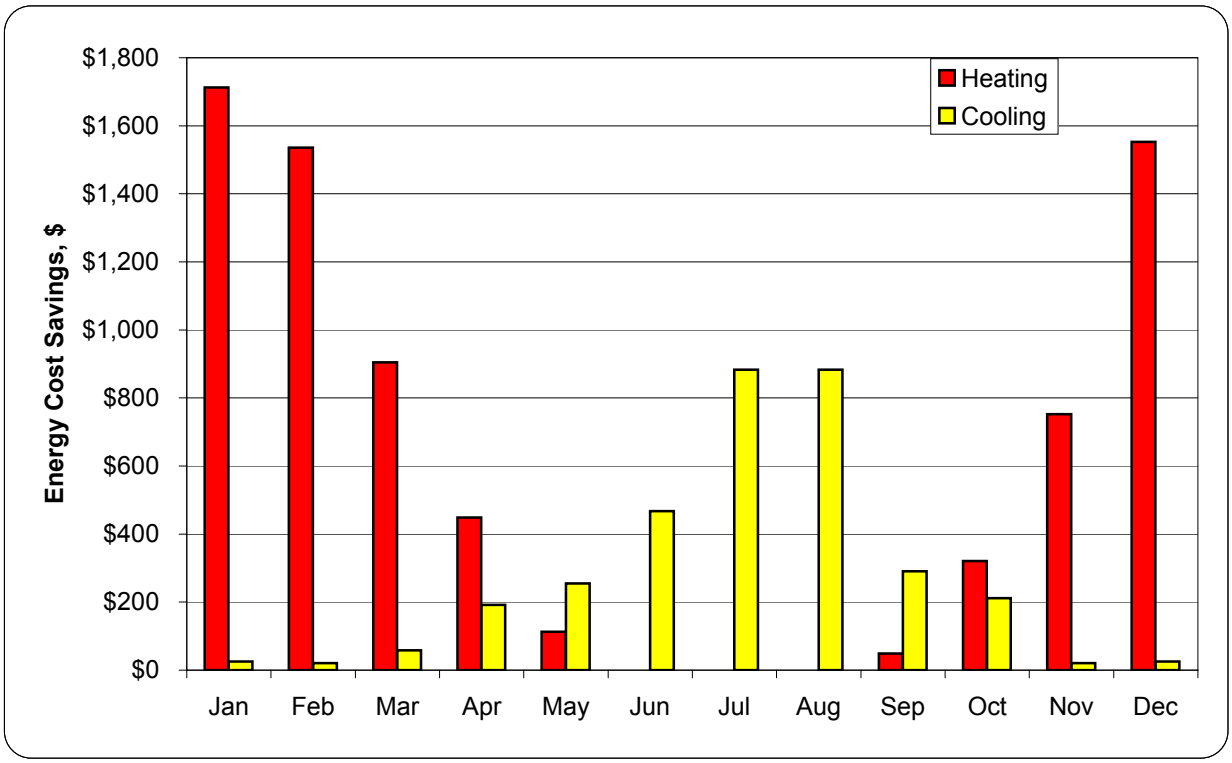
5. Contribution to energy savings from air-sealing measures:

Windows and fenestration	8%
Exterior and interior doors	43%
Building envelope joints	44%
Shafts and other penetrations	5%

6. Approximate Green House Gas (GHG) emissions reduction: 35,331 kg/year

General Comments

Figure 1. Monthly profile of energy cost savings.



Summary

In this building, air-sealing upgrades would reduce the utility costs by $ 10,723 every year, resulting in a simple payback period of 6.5 years.

Air sealing retrofits would reduce the total energy costs by 2% every year.

We believe that there are opportunities for building retrofits. These cost-effective retrofits, however small in terms of an overall energy cost implications, can result in the realization of benefits, including:

- reduced operating costs;
- improved durability of the structure;
- increased comfort and satisfaction of tenants;
- elimination interior condensation;
- improved quality of the indoor environment; and
- enhanced safety.

Based on the comprehensive walk-through air-sealing assessment of the building, we conclude that the air-sealing measures will be beneficial in reducing the utility costs and also in improving the general comfort conditions.

Originally built in 1985, an addition in 2006 expanded the building's size to 550,000 square feet.

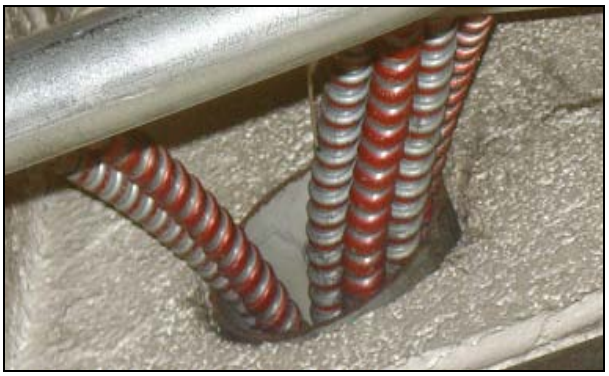
Skylight perimeters should be sealed.

Rooftop ventilators need perimeter sealing.

The roof deck in the addition has been insulated, sealing most of the roof/wall joint.

The roof/wall joint in the original building has a quarter-inch gap.

Because the boiler room is outside the thermal envelope, the door should be weather-stripped.



Mechanical room penetrations between conditioned and unconditioned spaces will be sealed.

This one is large enough for a bird's nest.

Duct perimeters need sealing.

Smoke testing shows where window weather-stripping has failed.

Most of the doors lack weather-stripping.

A smoke test shows positive pressure from the building's mechanical system pushes conditioned air outside.

Ineffective weather-stripping on a overhead service door's perimeter.

Daylight can be seen where a door sweep has failed.

Here, the weather-stripping is new, but it does not have the correct profile for the door.

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