



Evaluation of Air Leakage Control Measures Energy Analysis Report

Building Address: 07 AffA d i ^
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Date of Evaluation: September 21 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 Electricity.
- Unit cost of space heating fuel is \$/kWh \$ 0.14
- Unit cost of electricity: \$ 0.1400 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): 75%
- Maintained at 68 F or (20 C) for 14 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	984	ft
	Weatherstripping	-	ft
	Caulking (glazing perimeter)	-	ft
	Caulking (frame/wall perimeter)	1,537	ft
	Glazing corners	-	num
	hardware	-	num
Exterior Doors			
	Weatherstripping - Sliding/commercial	578	ft
	Weatherstripping - Patio doors	-	ft
	Weatherstripping - per door	123	num
	Caulking	-	ft
	Door sweeps	123	num
	Overhead garage/service doors, W/S	-	ft
Interior Doors			
	Weatherstripping (20' per door)	21	num
	Caulking	-	ft
	Door sweeps (3.5' each)	25	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)	-	ft
	Ground floor/basement joist headers	-	ft
	Electric baseboards - cable/conduits	-	num
	Electric baseboards - wall/floor joint	-	ft
	Electric outlets on exterior walls	242	num
	Electrical / mechanical panels	-	num
	Cable penetrations	-	num
	Pipe penetrations	1,094	num
	Attic or roof penetrations, 1' x 1'	1	num
	Attic or roof penetrations, 2' x 2'	2	num
	Mechanical room penetrations	2	num
	Vent housings (dryers and other)	-	num
	Plumbing / electrical bus bar conduits	-	num
	Ventilation duct perimeters (seal)	38	ft
	Skylights perimeters (seal)	-	ft
	Soffit joints	-	ft
	Door Jambs	242	ft
		-	num
Shafts and Other			
	Elevator cable penetrations	-	num
	Elevator control cable penetrations	-	num
	Garbage chute and access hatches	11	num
	Roof hatches and exhausts	6	num
	Mechanical room - duct penetrations	-	num
	Grilles for fresh air/exhaust perimeters	11	num
	Fire cabinets (pipes and edge)	11	num
	Elevator seal	-	ft
		-	num
		-	ft

The total cost of the above air-sealing measures is estimated at \$83839.47.

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	
\$ 83,839	\$ 18,045	\$ 260	\$ 18,305	4.6

2. Fuel use savings are as follows:

Functions	Fuel Savings	Type of Fuel
Space heating	128,890 kWh	Electricity
Make-up air heating	-	
Cooling	1,859 kWh	Electricity

3. Summary of electricity savings:

	kW	kWh
Winter on-peak	108.2	59,289
Winter off-peak	108.2	69,601
Total Winter	-	128,890
Summer on-peak	14.4	855
Summer off-peak	14.4	1,004
Total Summer	-	1,859
Total Annual Electricity	-	130,749

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

	Btu/hour	kW
Space Heating System	410,631	120.2
Space Cooling Equipment	54,529	16.0

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

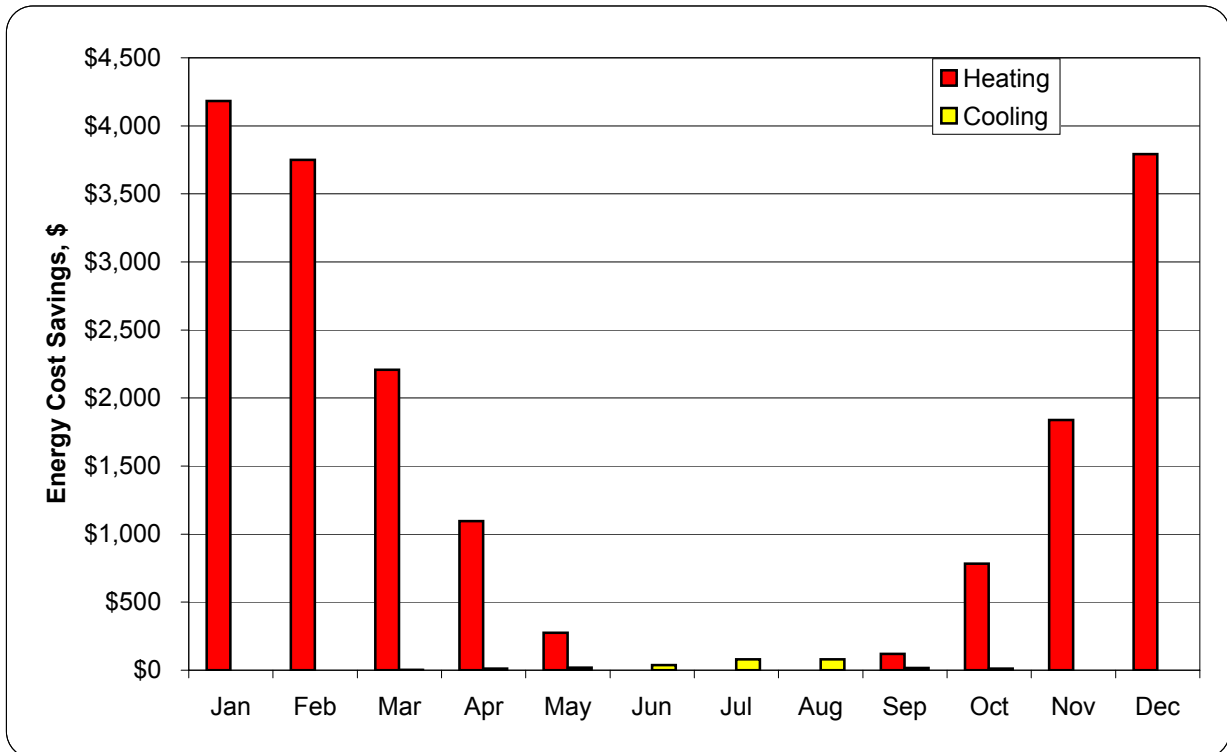
5. Contribution to energy savings from air-sealing measures:

Windows and fenestration	6%
Exterior and interior doors	69%
Building envelope joints	23%
Shafts and other penetrations	2%

6. Approximate Green House Gas (GHG) emissions reduction: 20,670 kg/year

General Comments

Figure 1. Monthly profile of energy cost savings.



Summary

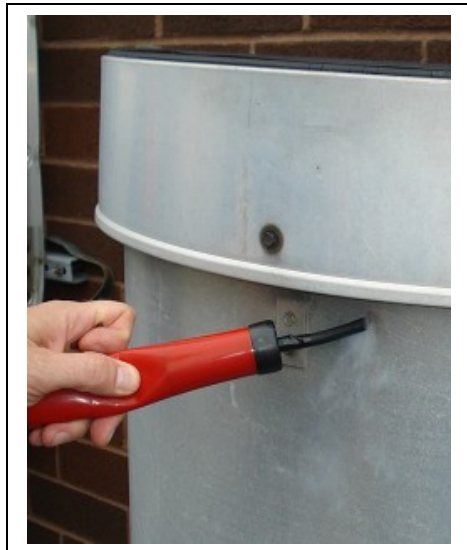
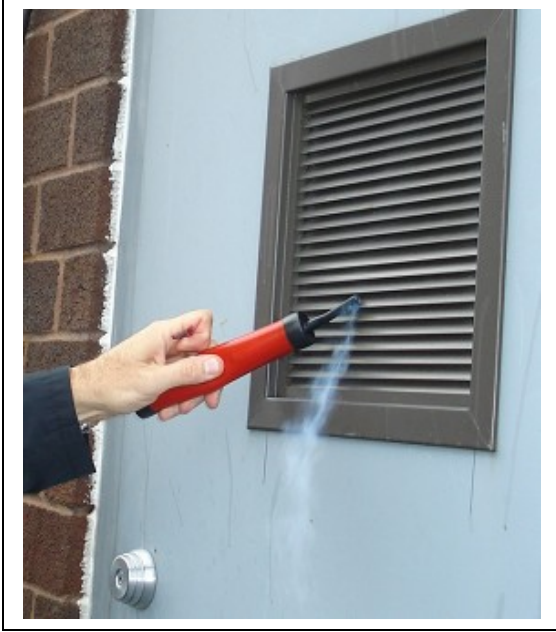
In this building, air-sealing upgrades would reduce the utility costs by \$ 18,305 every year, resulting in a simple payback period of 4.6 years.

Air sealing retrofits would reduce the total energy costs by 9% every year.

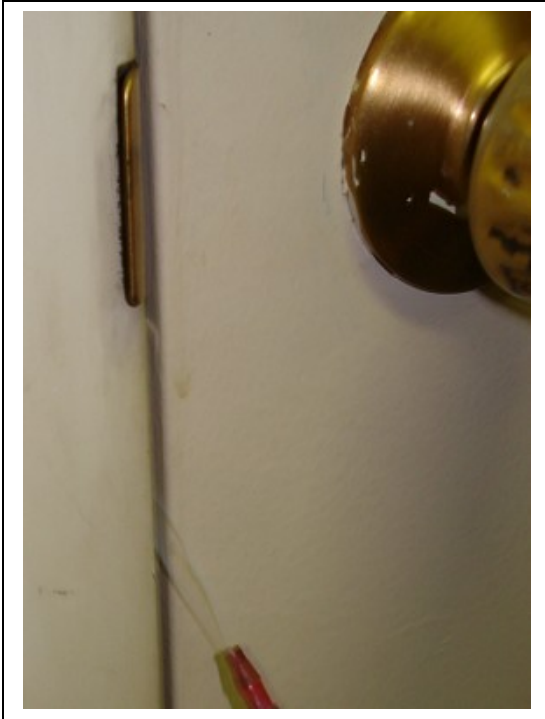
We believe that there are opportunities for building retrofits. These cost-effective retrofits, however small in terms of an overall energy cost implications, can result in the realization of benefits, including:

- 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.

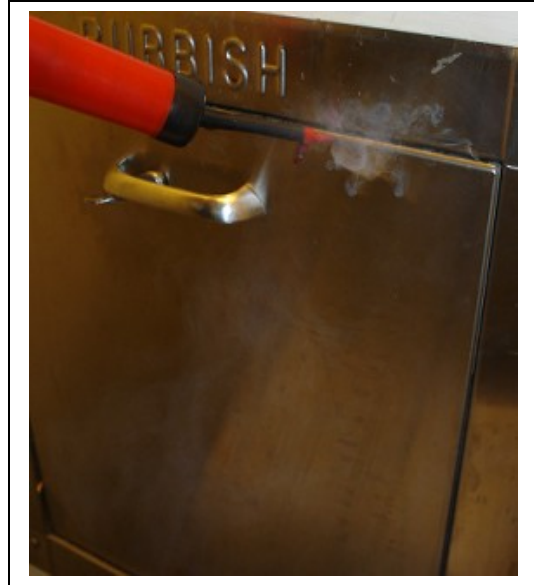
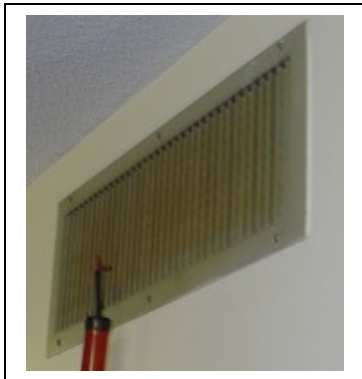
Based on the comprehensive walk-through air-sealing assessment of the building, we conclude that the air-sealing measures will be beneficial in reducing the utility costs and also in improving the general comfort conditions.



Stack effect creates strong pressure at many weak spots at the top of the building, including door grilles and open pipes in rooftop mechanical rooms, rooftop ventilators, grates in the floor of the elevator room, and the large gap at the perimeter of the cover to the garbage chute (right)



Because the hallways are pressurized, each floor will be compartmentalized by sealing the hallway doors and the ventilation grille perimeters.



Garbage chutes and the clean-out boxes above them will be weatherstripped.



Each floor has a fire hose box with air leakage at the pipe chases and seams.



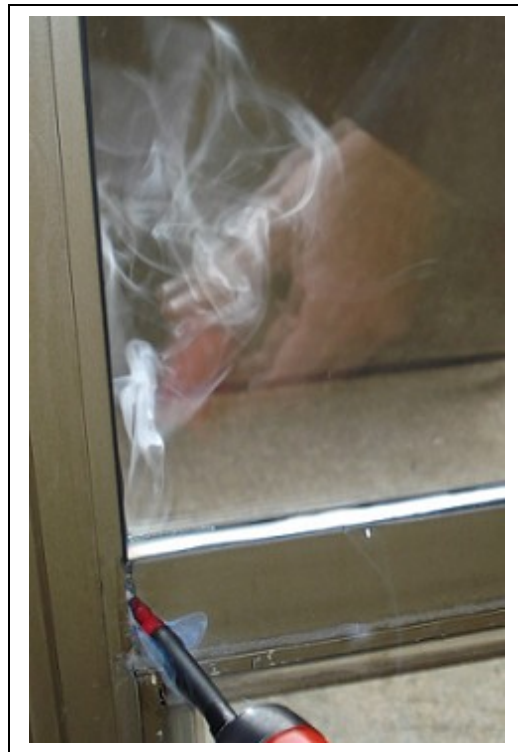
Attempts to seal the sliding glass doors have been ineffective



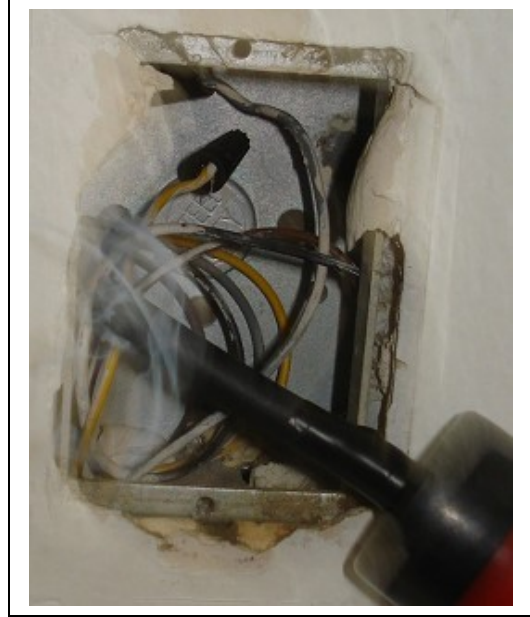
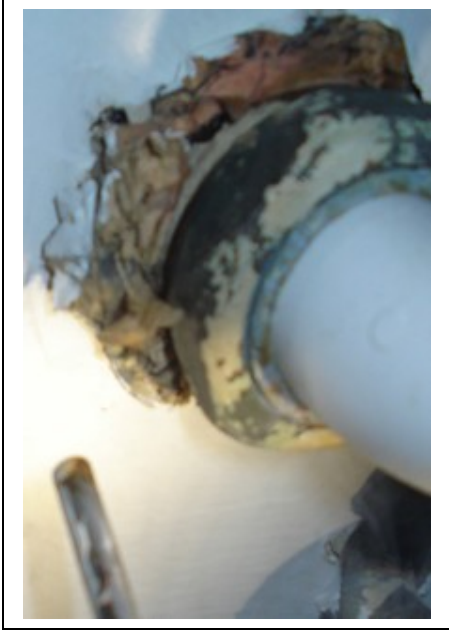
The windows need weather-stripping...



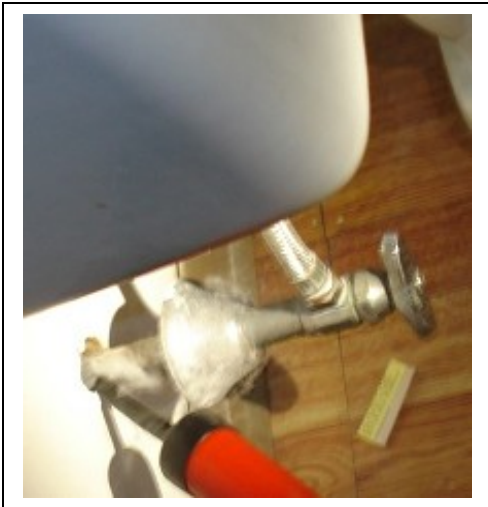
Smoke blown inside a door appears outside.



... as well as caulking at framing gaps.



There's a leakage path behind the cover plates of the old call boxes



Each apartment has several pipe chases in the bathroom and under the kitchen sink that allow air infiltration.



The door jambs are so leaky that many residents have inserted makeshift plugs to reduce the draft.



Leakage paths in common areas include the perimeter of this air-conditioner cover.



Lower mechanical room pipe chases need sealing.