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The following pages will outline a case study, which shows the benefits in energy and cost savings of properly installed mechanical insulation.

Insulation is a proven means for conserving energy, reducing greenhouse gas emissions, increasing process productivity, providing a safer and more productive work environment, controlling condensation (which can lead to mold growth), supporting sustainable design technology and a host of other benefits.

Mechanical insulation does all of this, while providing a return on investment (ROI) rate, which is seldom rivaled. Despite the proven ROI, insulation is often overlooked and its benefits undervalued. Insulation is truly the lost or forgotten technology. Can you think of a more important time than now to think about how insulation can help you?

An insulation system is a technology, which needs to be engineered and maintained throughout the entire process. Several studies have estimated roughly 10 to 30 percent of all installed insulation is now missing or damaged.

The practice of not replacing or maintaining an insulation system in a timely and correct manner reduces the full benefits of insulation, and in return, decreases the ROI. In many cases, significant other issues - such as excessive energy loss, corrosion under insulation (CUI), mold development, increased cost of operations and reduced process productivity or efficiency - develop.

You can learn more on www.MechanicalInsulatorsLMCT.com, where additional case studies can be viewed.

Please do not hesitate to contact me should you have any additional questions.
Thank you,

Peter Ielimi

Executive Director
Mechanical Insulators Labor Management Cooperative Trust

SALAMANDER INSPECTIONS LTD

Mechanical Insulation Energy Audits

Energy Audit

For Alberta Infrastructure
Building 6950 – 113 Street, Edmonton
Alberta

April 7th, 2016

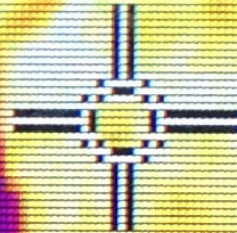
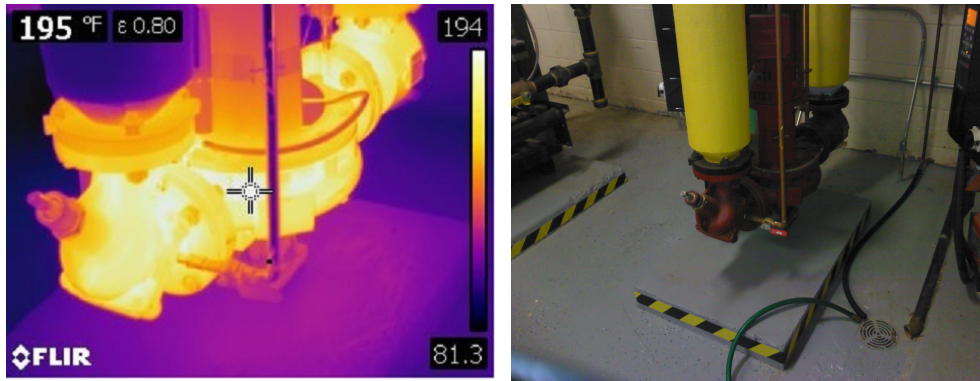


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Heating pumps in the Alberta Infrastructure Building boiler room.

About Salamander Inspections and the FLIR Thermographic Camera

Salamander Inspections Ltd. is a third party inspection service providing energy audits for mechanical insulation systems in the Commercial /Institutional sector. We are utilizing a state of the art FLIR thermographic camera to provide us with accurate measurements and photographs of heat loss and gain on mechanical systems within the scope of work determined by our clients.

This heating pump, as photographed by the FLIR camera uses sensors within the camera to show the heat radiating from the pump. The brighter the color the hotter the temperature of the object. The camera must be set up to filter out the ambient heat from surrounding objects to ensure that the temperatures are accurate. The camera then takes a thermal image as well as a digital picture for reference.

Methodology

The audit was performed by systematically inspecting the condition of all mechanical systems within the scope of work. The type of system, condition, temperature and footage was recorded and used to determine outcomes that will be beneficial to the operation of the building. The areas targeted within the scope of work have been checked using a FLIR digital thermal imaging camera which shows clearly problem areas that may not be seen with the naked eye. The photographs clearly show the areas of concern which can be addressed by applying mechanical insulation products.

Executive Summary

Alberta Infrastructure Building is located at 6950 -113 St Edmonton, Alberta which contains several Alberta governmental services. Salamander Inspections has performed an energy audit of the heating system and domestic hot water system within the Boiler Room and three separate Mechanical Rooms housing the chillers and associated piping. The audit of the mechanical piping within the boiler room and mechanical rooms is to determine the current state of mechanical insulation applied to the systems. We have also assessed the parking garage to look at the mechanical piping that runs through that space.



Bare heating pumps in the Boiler Room

If all areas within this report were addressed Alberta Infrastructure would save 341 GJ per year which is \$1,366 in savings. The cost associated with the items contained within this report is \$2,725 with a ROI of approximately 1.9 years. *The insulation costs do not include the finish ie: PVC elbows and canvas. The ROI is calculated by dividing the costs by the savings.*

We have calculated from the 341 GJ savings a 17 Mt reduction of CO2 emissions. There will also be a reduction of NOx emissions from .0046 Mt to .0003 Mt per month.

Boiler Room

We have assessed the boiler room and found that the insulation applied to the mechanical systems is in good condition. However there are some instances where heating pumps, valves and piping remain without insulation applied and therefore, an opportunity to receive some savings is available. There has been recent maintenance work done in the Boiler Room and the piping to the domestic hot water tanks was replaced as well as the tanks, but insulation was not applied to the copper piping servicing the tanks which should have been included when the work was completed. **The boiler room comprises 95% of all items on the 3e spreadsheet.**

There are also control valves and motorized pumps which have been left exposed at the back of the boilers. These valves and pumps are a source of heat loss and the main reason why the boiler room is so warm. These pumps should be insulated and we would recommend that removable pads be used to ease maintenance. These types of insulating pads however need to be re-applied whenever work is done as insulation laying on the floor defeats its purpose.

We also recommend that best practices be followed on all insulation work new or retro fit, and that certified insulators do the work to ensure that best practices are followed. This report contains visual inspection of these systems utilizing thermo graphic analysis and conventional digital photographs for reference.





Occupied Areas

We have also learned through our conversations with maintenance personnel that there are many heating/cooling coils above the ceiling on each floor and in each individual department. These were not inspected but we know that as observed in other areas, that the last few feet of piping to the coils may not be insulated.

Parking Garage

Our walkthrough of the parking garage revealed that there are many areas where insulation has been removed for maintenance repairs and upgrade, but upon the completion of the work once again the insulation was not applied. We also observed that the original insulation applied was in good condition but we noticed that whoever did the original work did not cover the knuckles on the Victaulic fittings. This is very unusual as this practice compromises any attempt at having a vapor barrier that is integral on the domestic cold and chilled systems and a small amount of heat loss on the heating systems. This type of poor detail work can become a problem especially on cold and chilled systems as there is an opportunity for moisture to form on the piping and corrosion to take place.



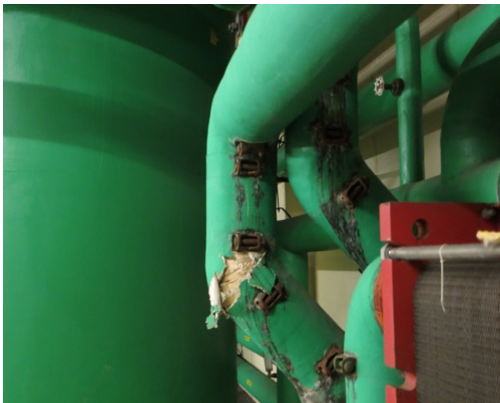
Chiller Rooms

We have inspected the chiller room on the parking garage level. The insulation applied to the chilled systems in fair condition, but there are many instances where insulation has been removed for maintenance and the upgrade of chillers and many other areas where there are bare knuckles on the Victaulic fittings. There are many areas where what appears to be black mold around these knuckles and other areas where the vapor barrier is compromised from poor insulation practices. We noticed that many elbows (PVC) were cracked or broken showing us that the insulation underneath was bare fiberglass with no integral vapor barrier. The contractor was intending that the PVC elbow would provide the vapor barrier, however, PVC is one component of an effective vapor barrier system and not a “stand alone” vapor barrier, especially as soon as there is damage to the PVC covering the vapor barrier is compromised. We did a physical count of just the exposed knuckles and noted that the count was eighty (80). Looking at pipe where there was no insulation corrosion was built up on the elbows and piping, insulation contractors must ensure a 100% vapor barrier to prevent the buildup of corrosion.

Penthouse Chilled Systems

We walked through the two penthouse mechanical rooms to inspect the chilled and heating systems. We found that the insulation applied on the chilled systems was in the same state as the insulation found in the chiller room adjacent to the parking garage. We observed black mold forming at the Victaulic elbows and clamps as was the case in the other mechanical room and we also did a physical count of exposed Victaulic clamp ears and found that 140-160 knuckles exposed causing the vapor barrier to fail and consequently producing what appears to be black mold. The heating system was intact and with the exception of exposed unions, workmanship is good the system was intact.





Personnel Protection

We also would like to address the hazards that the hot exposed items present to personnel. The boiler rooms and fan rooms generally are tightly packed with equipment and piping systems operating up to 121°C, the systems and equipment which are not insulated leave many opportunities for employees and maintenance personnel to come in contact with these surfaces which can burn skin. Properly insulated systems and equipment eliminate the possibility of individuals coming into contact with these hot surfaces and will prevent accidental burns which will add value by individuals not having claims and or lost time incidents.



The following is a list of calculations using energy calculators and the known cost of fuel. The heat loss number (BTU) is derived from the 3EPlus spreadsheet using the information gathered during the site visits, known temperatures and the measurements of known missing and or damaged insulation.

Energy Calculations

Alberta Infrastructure	Heating System Cycle @ 6480 hours of operation	Boiler room and mechanical fan rooms
Heat Loss per hour	36,573 btu	
@24hrs	877,752 btu	
@31 day's	27,210,312 btu	
total	28.70 GJ @ 1 month	9 months = 258.30 GJ
Heat Loss per hour	36,573 btu	
@24hrs	877,572 btu	
@ 30 days	26,332,560 btu	
total	27.78 GJ @ 1 month	3 months = 83.34 GJ
	total	341.64 GJ &
	Cost of fuel	\$ 4.00/GJ
	Savings per year	\$1,366.56

Insulation Costs

This is a list of materials needed to insulate areas noted during our inspection, these are used as input for the 3EPlus spreadsheet for heat loss calculations. The insulation costs are estimates and should not be used as actual costs.

Small bore pipe	3/4" iron @ 18 ft	\$70.74
Control Valve Bonnets	4" @ 8ft	\$38.32
Piping/Valves	4" @ 4ft	\$28.16
Piping/Valves	3" @ 8ft	\$48.80
Piping/Valves	5" @ 10.28ft	\$82.13
Piping/Valves	6" @ 13.14 ft	\$115.76
Piping/Valves	8" @ 52.98ft	\$571.65
Valves/Strainers	10" @ 35.82ft	\$472.82
Pumps	12" @ 2ft	\$29.56
Pumps	14" @ 4 ft	\$67.16
	Based on 1 ½ wall material	
Total materials cost		\$1,525.10
Work days	3@ \$400per day	\$1,200.00
Total materials & labor		\$2,725.10

The calculations from the spreadsheet indicate that if mechanical insulation were to be applied to all areas that are highlighted by this report, energy savings would be realized. We also recommend that insulation be re applied to equipment so as to increase its longevity and the time between service intervals.

Recommendations and Conclusions

Upon consideration of all observed conditions and the information gathered from the 3EPlus program, we recommend that all areas identified within this report be insulated or repaired. We also recommend that **Best Practices** be followed when applying insulation to these items as any deviation will reduce any potential savings. For example, we know that the elimination of canvas can shorten the lifespan of fiberglass with an ASJ finish because of the lack of a protective cladding system. We also recommend using removable insulating pads where necessary or feasible. This will allow maintenance to take place by simply removing the insulation pad whenever maintenance needs to take place.

If all areas are addressed, you will receive:

- 1) Reduction of heat loss - **341 GJ**
- 2) Cost savings derived through properly insulated piping, valves, strainers and equipment - **\$1,366**
- 3) Potential savings on maintenance costs for equipment
- 4) Elimination of personal protection hazards

Disclosure

We have no relevant financial or non-financial relationships to disclose.

Limitations

This building was assessed at the winter/spring changeover where the building was utilizing free cooling. The chilled areas were not in operation and the heating cycle was not running at its highest point. The building is occupied and inspection above the ceiling spaces was not done. We have used information provided to us from various sources but information such as operational heating cycles and cooling cycles are based on conversations with maintenance personnel.

Disclaimer

Results stated in this report are estimated and based upon the data supplied or determined during the audit process. Only the previously agreed to areas have been included in this report. These results are not covered by warranty nor are they guaranteed. Results may vary depending upon the information provided and actual operating conditions. The results are intended to portray a reasonable estimate of potential energy savings and emissions reduction with the use of an upgraded and maintained insulation system.

Please contact the undersigned with any questions about this report.

Best regards,

Report prepared by:
Salamander Inspections



Bob Barter (Project Coordinator)

Reviewed by:
Besant and Associates Engineers Ltd.



Jeff Besant, MBA, P.Eng.

PHOTOGRAPHS