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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

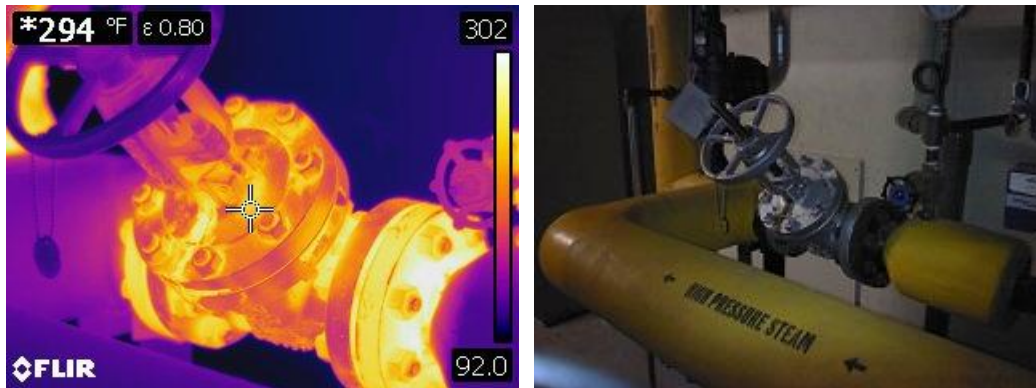
A thermal image of a building facade, showing heat signatures in yellow and orange against a dark blue background. A white crosshair is overlaid on the image, centered on a vertical pipe or structure. The image has a halftone or dithered texture.

Energy Audit

April 6, 2016

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Bare steam valves in the 2nd floor mechanical room at the OS Longman building.

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 bare steam valve, as photographed by the FLIR camera uses sensors within the camera to show the heat radiating from the valve. 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

The OS Longman Laboratory Building is located at 6909 – 116 Street, Edmonton Alberta. This building comprises governmental testing services.

Salamander Inspections has performed an energy audit of the heating system within the Boiler Room, 2nd floor Mechanical Room, and a separate mechanical space on the 9th floor. The purpose of the audit was to determine the current state of mechanical insulation applied to the systems. These areas are the three areas within our scope of work.



There are some areas where pumps, valves and piping remain without insulation applied.

“We are pleased to tell you that if all areas within this report are addressed will save 6,026 GJ per year saving \$24,102. The cost associated with the insulation of items contained within this report is \$12,472 with a ROI of approximately 6 months. *The insulation costs do not include the finish ie: PVC elbows and canvas. The ROI is determined by dividing costs by the savings.*”

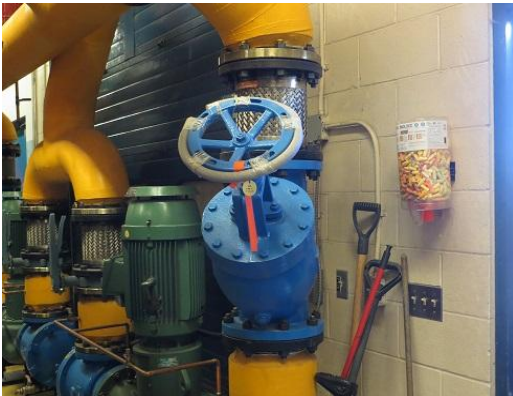
We have calculated from the 6,026 GJ savings a 300 Mt reduction of CO2 emissions. There will also be a reduction of NOx emissions from .081 Mt to .009 Mt per year.

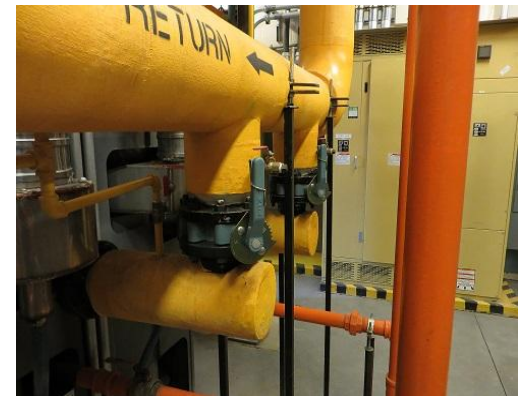
Boiler Room

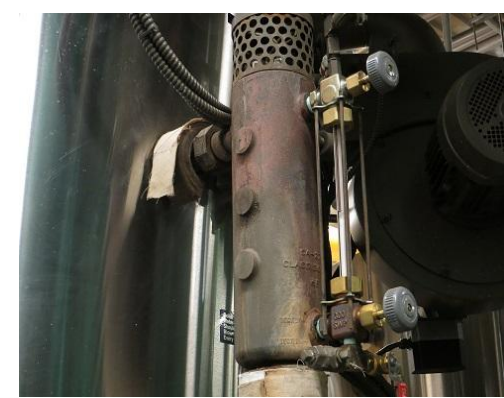
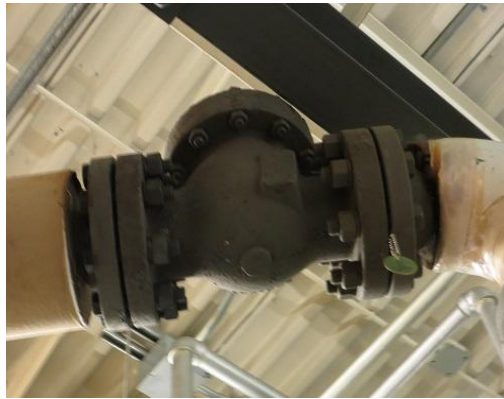
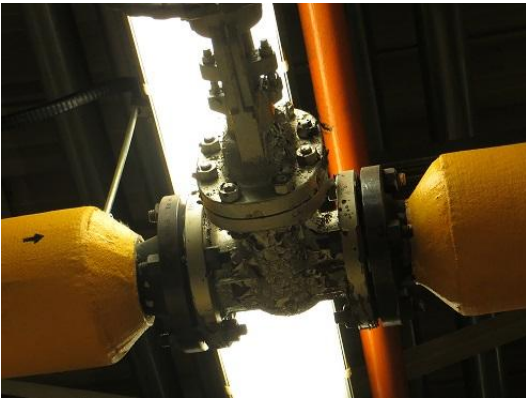
We have assessed the boiler room and found that the insulation applied to the mechanical systems is in good condition. However, there are some instances where pumps, valves and piping have no insulation applied and therefore, an opportunity to receive some savings is available.

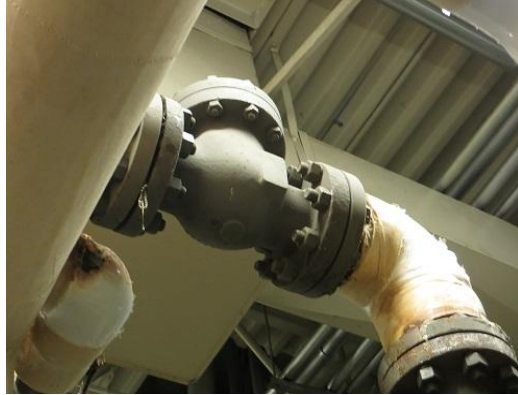
The workmanship of the existing insulation is in good condition but some bad practices were followed when these materials were installed. During the course of this inspection we counted at least (24) valves, (2) strainers, (4) pumps and a number of flanges and couplings as well as and other areas which are not insulated. We also found areas where there isn't any insulation under the PVC fittings, they are literally melted to the pipe. There isn't a good reason to not insulate valves, piping and or fittings but to achieve cost savings at the time of construction or a specification which allowed these practices to take place. We can now show that not insulating pipes hot or cold will cost money for the operation of the building and or repairs to equipment or piping. The report contains visual inspection of these systems utilizing thermographic analysis and conventional digital photographs for reference.

The boiler house at the facility is losing 1,012 GJ per year.







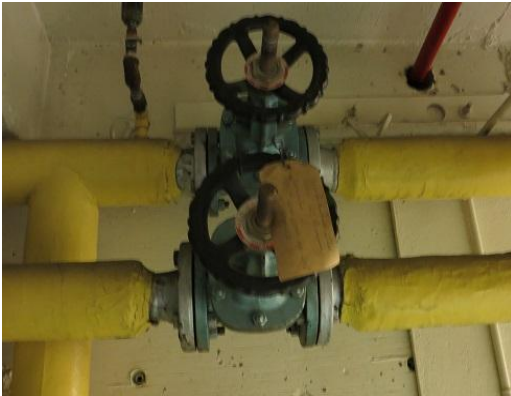


Looking at the work done in the boiler room there appears to be two different contractors doing the work. There are areas of mechanical around the steam boilers that are not finished properly. The temperature of the lines coming off the boilers approach 148C, if you look closely at the pictures you can see burnt canvas and melted PVC elbows from lack of insulation underneath.

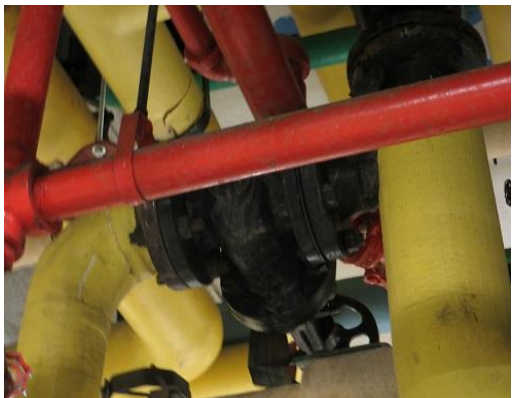
Mechanical Room 2nd floor

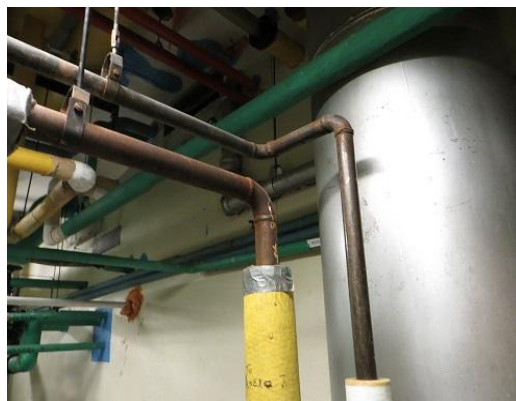
We have walked through and inspected the mechanical room on the second floor and found numerous areas which will require insulation to be applied to achieve thermal efficiency. The overall workmanship is good but as seen in other areas insulation has not been applied to any valves, strainers, pumps or heat exchangers. There are areas where pipe covering has been removed for maintenance work this material should have been replaced at the time when work was done. There are a number of valves, strainers and pipes which are High Pressure Steam operating at 148C which are contributing to the elevated temperature in this space.

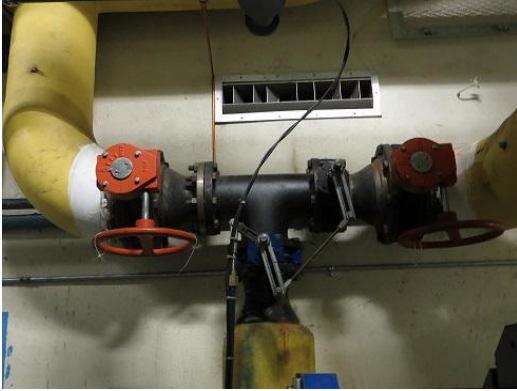
The 2nd floor mechanical room at the facility is losing 4,908 GJ per year.











Mechanical Room Glycol System

We have inspected the glycol piping in the 2nd floor mechanical room and found that there are valves, piping, pumps and a heat exchanger that have not been insulated. There are signs of maintenance that have been done and the mechanical insulation has not been repaired or replaced.

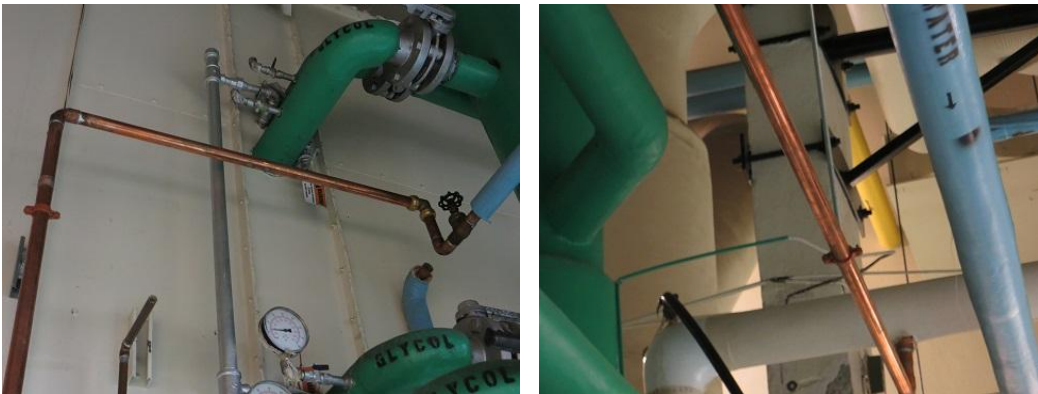




The thermographic images which are in the appendix Pictures show very low temperatures for glycol system. There are still many areas on this glycol system that should be insulated to maximize efficiency.

Upper Mechanical Room

The insulation materials applied to the piping in the 9th floor mechanical room are quite minimal. This room has all but been de-commissioned and there were few items to mention. However, there is a minor amount of domestic piping which has been repaired or replaced and is missing insulation.

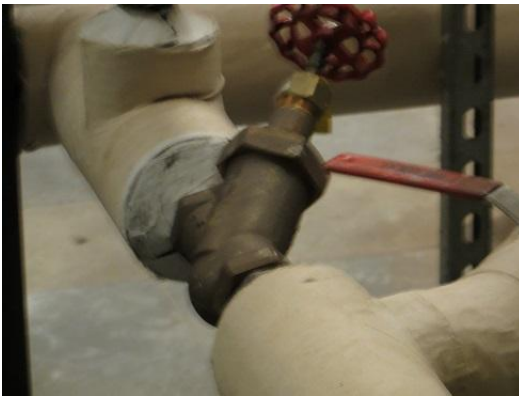




Personnel Protection

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

	Heating/Steam systems 8700 hours operation	Boiler room and two other mechanical spaces
Heat Loss per hour	650,478 btu	
@24 hrs	15,611,472 btu	
@29 days	452,732,688 btu	
total	477.65 GJ @ 1 month	1 month = 477 GJ
Heat Loss per hour	650,478 btu	
@24hrs	15,611,472 btu	
@30 days	468,344,160 btu	
total	494.12 GJ @ 1 month	4 months = 1,976 GJ
Heat Loss per hour	650,478 btu	
@24hrs	15,611,472 btu	
@31 days	483,955,632 btu	
total	510.23 GJ @ 1 month	7 months = 3,571 GJ
	total	6,025 GJ
	Cost of fuel	& \$ 4.00/GJ
	Savings per year	\$24,102

Insulation Materials

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 insulations costs are estimates and should not be used as an actual cost.

HPS Valves	12	8" @ 5.97 ft	\$158.40
HPS End Flange	1	8" @ 2 ft	\$ 21.58
HPS Pipe		10" @ 22 ft	\$290.40
HPS Valves	5	12" @ 24 ft	\$531.34
HPS Flanges	2	12" @ 2 ft	\$ 29.56
Pumps	3	12" @ 21.57 ft	\$318.80
HPS Valve/strainers	6	12" @ 21.61 ft	\$777.96
HPS Valve/strainers	18	10" @ 36 ft	\$691.20
Condensate pipe		1 ½" @ 16 ft	\$ 76.64
Pipe		1 1/2" @ 15ft	\$ 36.15
HPS Valves	12	8" @ 61.68 ft	\$665.52
HPS Control valves	4	8" @ 11.2 ft	\$120.84
Heat Exchangers	2	44 sq ft	\$ 86.24
Relief Tank	2	26 sq ft	\$ 43.16
HPS Coupling	4	12" @ 8 ft	\$118.24
HPS Valve	1	12" @ 7.19 ft	\$106.33
		Based on 1 ½ wall material	
Total materials cost			\$4,072.36
Work days	21 @ 400 per day		\$8,400.00
Total materials & labor			\$12,472.36

The calculations from the spreadsheet indicate that if mechanical insulation were to be applied to all areas that are highlighted by this report energy cost savings would be realized. We also recommend that insulation be reapplied 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 from applying insulation 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 removing the insulation pad whenever maintenance needs to take place.

If all areas are addressed, you will receive:

- 1) Reduction of heat loss - **6,026 GJ**
- 2) Cost savings derived through properly insulated piping, valves, strainers and equipment - **\$24,100**
- 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. 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