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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 the Food Processing
Development Center
6309 – 45 Street Leduc, Alberta

April 11, 2016

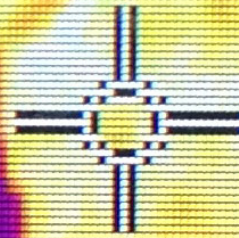


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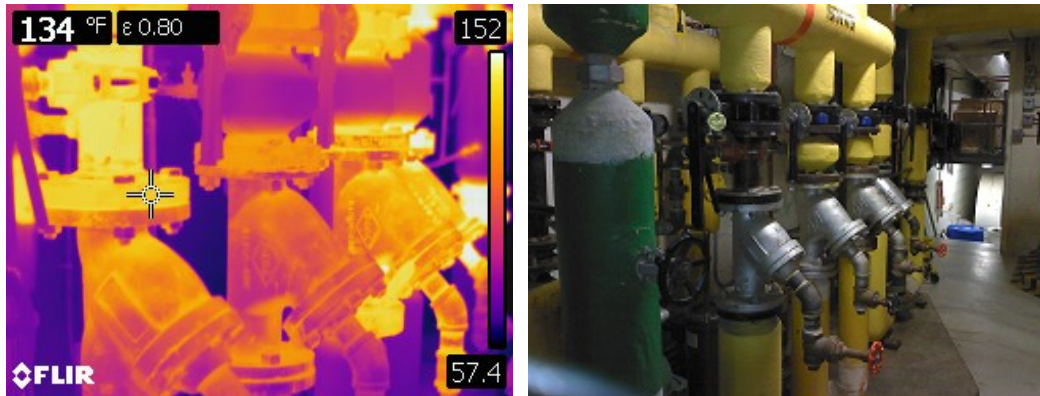
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A row of uninsulated valves and strainers in the Leduc Food Processing Center boiler room as seen by the thermographic camera.

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 row of valves and strainers, 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 Leduc Food Processing Development Center is located at 6309 – 45 Street, Leduc Alberta. This building comprises governmental testing and developmental services in the food industry.

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



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

The aggregate savings for the Leduc Food Processing Center will be 2,527 GJ annually resulting a cost saving \$10,100. The cost associated of the insulation upgrades required achieve these savings is \$7,530 delivering an ROI of approximately seven (7) months (Note: The insulation costs do not include the finishes such as PVC elbows and canvas).

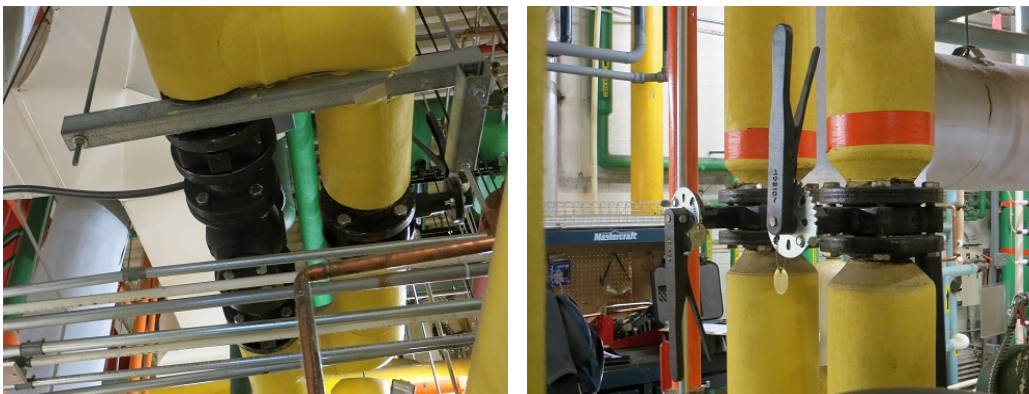
The 2,527 GJ in energy savings result in a 125 Mt reduction of CO2 emissions annually. NOx emissions will be reduced by 0.032 Mt annually.

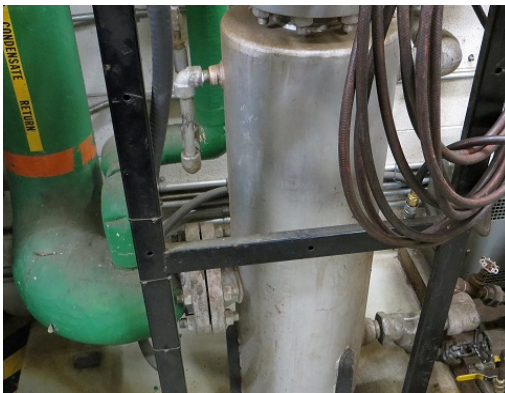
Boiler Room

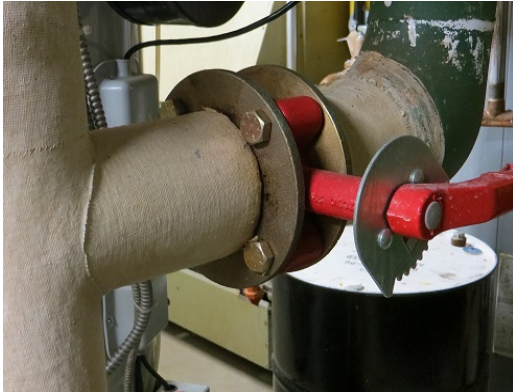
We have assessed the boiler room and found that the insulation applied to the mechanical systems is in fair to good condition. However, there are some instances where pumps, valves and piping have no insulation applied and therefore, an opportunity to receive some savings is available.

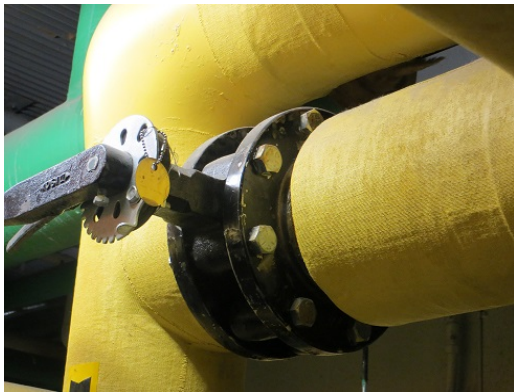
The workmanship of the existing insulation is in fair to good condition but some bad practices were followed when these materials were installed. During the course of this inspection we counted at least (30+) valves, (6+) strainers, (30) pumps and a number of flanges and couplings as well as and other areas which have not been insulated. We also found areas where the mechanical insulation is damaged, missing and worn out from mechanical abuse. 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.

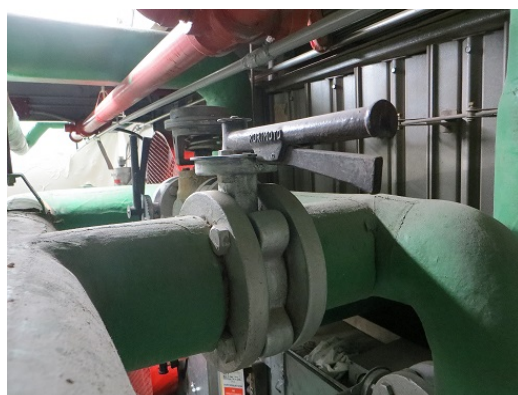
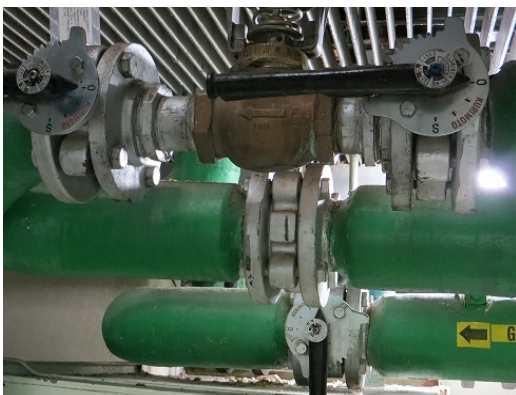
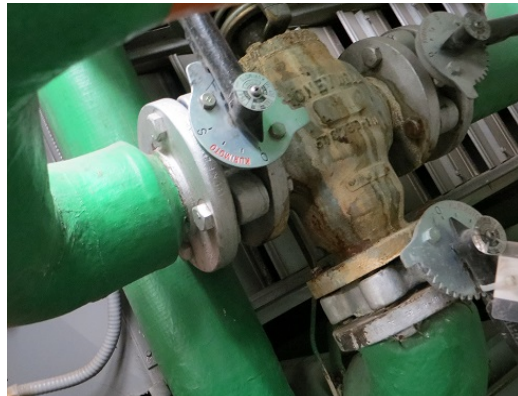
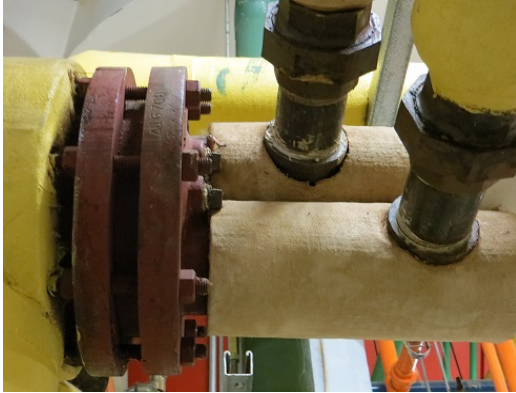
The energy wasted in the boiler room in the Leduc facility as a result of the poor performance of the insulation systems is approximately 1,242 GJ per year.











Looking at the work done in the boiler room, the existing work was well done judging by the condition of the materials applied. However, there are many areas that will need to be insulated to ensure that each type of system is covered appropriately. The heating and steam system is missing substantial amounts of insulation from the valves, strainers, pumps and equipment. This is typically throughout the plant and will provide the most savings when insulated. The domestic hot and cold are missing insulation materials also due mostly to maintenance work at which time reapplication never happened.

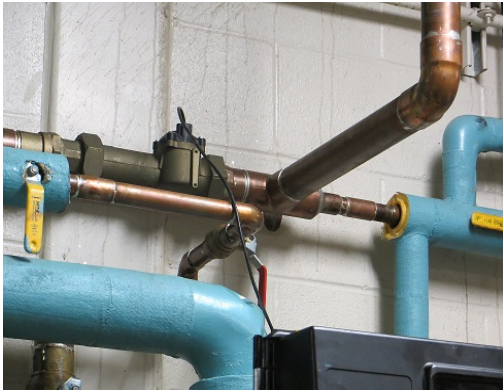
Mechanical Room 2nd floor

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 many areas which have no insulation applied which is the main reason why this area is so warm at 30C.

Deficiencies in the insulation systems for the mechanical room on the 2nd floor result in a loss of approximately 1,217 GJ per year.

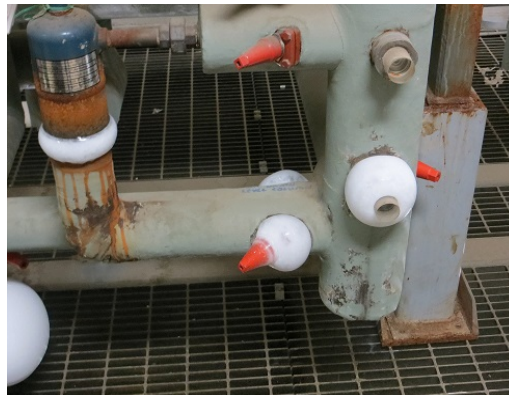






2nd Floor Mechanical Room Ammonia System

We have inspected the ammonia system piping in the 2nd floor mechanical room and found that the work and the condition of materials is excellent. We found a few minor areas where materials had been removed and the ice that has formed in those areas is the evidence that the vapor barrier was compromised. We observed a few areas where there was what appeared to be black mold formed on the canvas jacketing this is probably because of a failure of the vapor barrier.





2nd Floor Mechanical Space

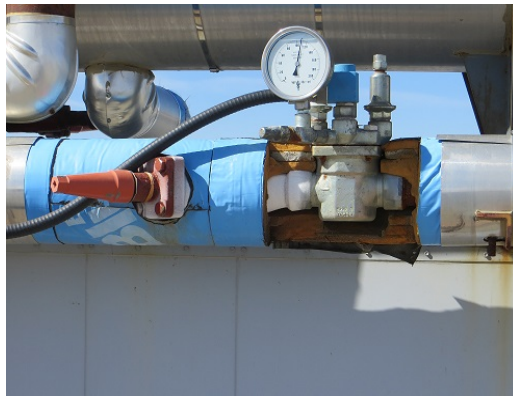
The insulation materials applied to the piping in the mechanical space adjacent to the 2nd floor mechanical room were found to be in good condition with some amounts of material missing due to maintenance of systems supplying the lower process floor.



We took pictures of the overhead runs of pipe which were insulated and found one particular pipe which had a higher than desired surface temperature. We have included thermal photos to show the 98.1 surface temperature of the pipe. There is also a heat exchanger that should be insulated as well.

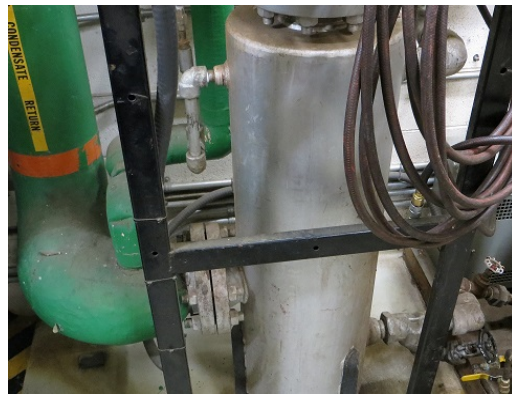
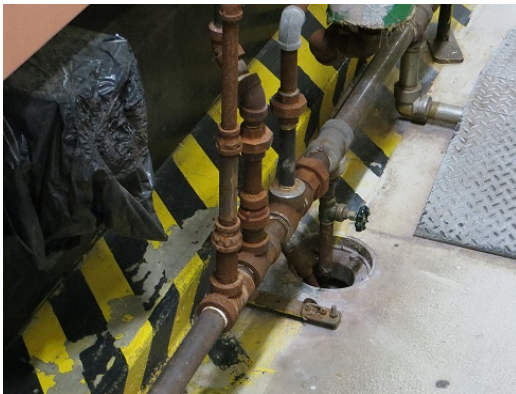
Roof Top Units

We have inspected the piping on the roof of the production facility and found all but one area where the piping and cladding in great overall condition.



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

| Leduc Facility | Heating/Steam systems 8760 hours operation | |
|-------------------------|---|-------------------------------|
| Heat Loss per hour | 272,663 btu | |
| @24 hrs | 6,543,912 btu | |
| @29 days | 189,773,448 btu | |
| total | 200.22 GJ @ 1 month | 1 month = 200.22 GJ |
| Heat Loss per hour | 272,663 btu | |
| @24hrs | 6,543,912 btu | |
| @30 days | 196,317,360 btu | |
| total | 207.12 GJ @ 1 month | 4 months = 828.48 GJ |
| Heat Loss per hour | 272,663 btu | |
| @24hrs | 6,543,912 btu | |
| @31 days | 202,861,272 btu | |
| total | 214.02 GJ @ 1 month | 7 months = 1,498.14 GJ |
| | total | 2,526.84 GJ |
| | Cost of fuel | \$ 4.00/GJ |
| Savings per year | | \$10,107.36 |

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 insulation costs are estimates and should not be used as actual costs.*

| | | |
|------------------------------------|------------------------------|-------------------|
| pipng | 3/4" @ 1.92 ft | \$ 17.28 |
| pipng | 1" @ 11 ft | \$ 23.76 |
| pipng | 2 1/8" @ 3 ft | \$ 15.36 |
| pipng | 1 1/4" @ 20 ft | \$ 43.20 |
| pipng | 1 1/2" @ 21 ft | \$ 100.59 |
| pipng | 2" @ 25.08 ft | \$128.40 |
| pipng | 2 1/2" @ 35.28 ft | \$197.92 |
| pipng | 3" @ 21.28 ft | \$129.80 |
| pipng | 4 " @ 33.56 ft | \$236.26 |
| Piping/valves | 6" @ 85.76ft | \$755.54 |
| Piping/valves | 8" @ 28.46 ft | \$307.08 |
| Valves | 10" @ 3 ft | \$ 39.60 |
| Heat Exchangers 2 | 21.65 sq ft | \$ 35.93 |
| Pumps | 14" @ 41.6 | \$698.46 |
| | | |
| | | |
| | | |
| | Based on 1 1/2 wall material | |
| Total materials cost | | \$2,729.18 |
| Work days | 12@ \$400 per day | \$4,800.00 |
| Total materials & labor | | \$7,529.18 |

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) Annual reduction of heat loss - **2,527 GJ**
- 2) Annual cost savings derived through properly insulated piping, valves, strainers, and equipment - **\$10,100**
- 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

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 should you have 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