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www.MechanicalinsulatorsLMCT.com
Pete Ielmini, *Executive Director* 732-210-7084 **Gina Walsh,** *Deputy Director* 314-683-6136

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.

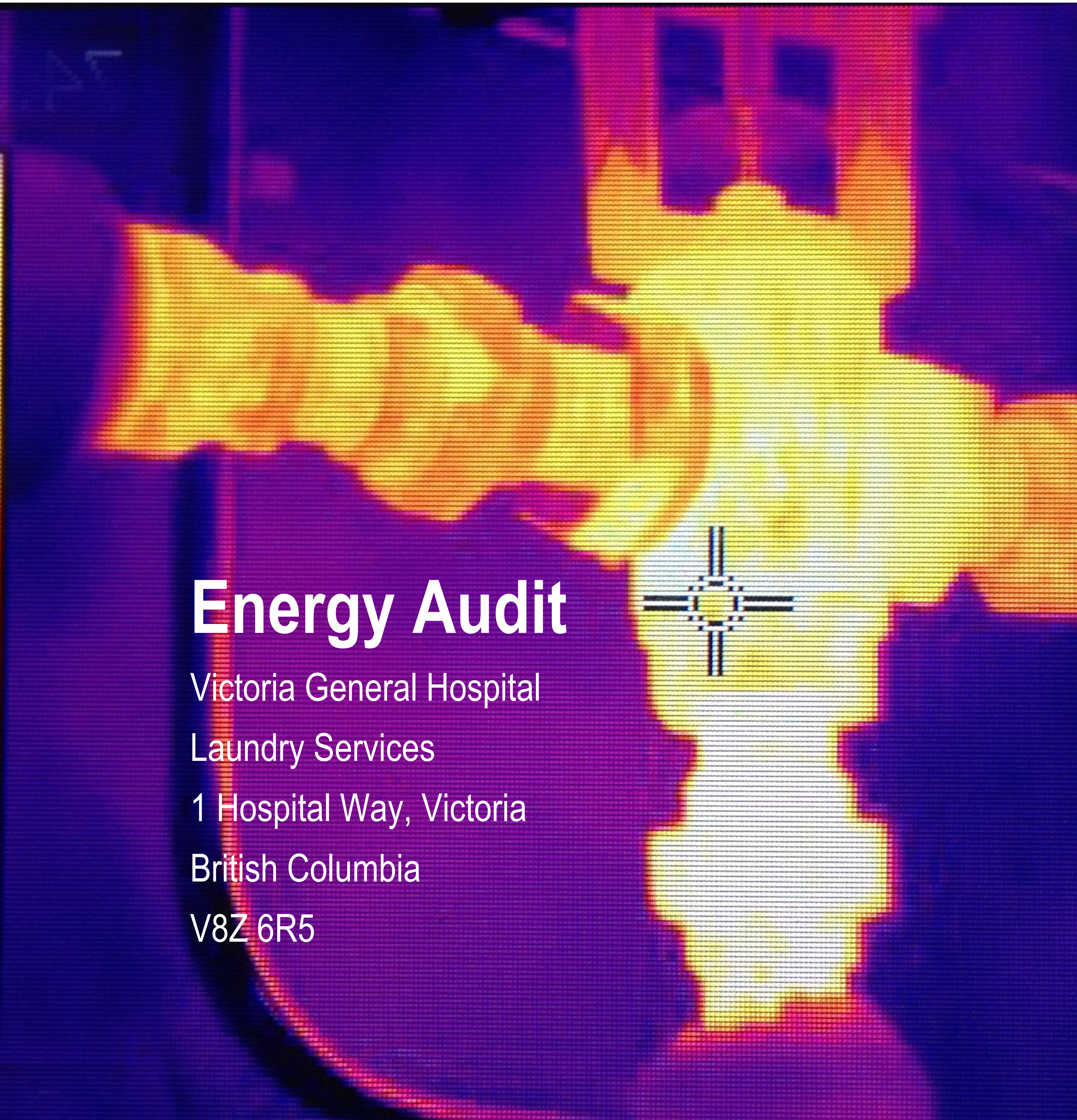
Please do not hesitate to contact me should you have any additional questions.
Thank you,

Peter Ielimi

Executive Director
Mechanical Insulators Labor Management Cooperative Trust

SALAMANDER INSPECTIONS LTD

Mechanical Insulation Energy Audits



Energy Audit

Victoria General Hospital

Laundry Services

1 Hospital Way, Victoria

British Columbia

V8Z 6R5

Executive Summary

Victoria General Hospital Laundry Operations is located at 1- Hospital Way, Victoria British Columbia. The laundry operation receives all soiled laundry from Victoria General and processes the laundry to a clean state and returns the laundry into service. For this report our inspection was for the Boiler Room and washing units only.

Salamander Inspections performed an energy audit of the insulation systems within the Boiler Room and on the main floor of the laundry at the washer units. The purpose of the audit was to determine the current state of mechanical insulation applied to the heating and domestic hot water systems.

Our findings indicate that there are opportunities to improve the mechanical insulation systems in a cost effective manner. The benefits are itemized below. Any deviation from following the Best Practices Guideline[1] developed by the North American Insulation Institute will reduce the potential savings and benefits. For example, we know that the elimination of canvas jacket 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 required for maintenance to ensure that the insulation systems remain intact for as long as possible.

Undertaking the projects we have identified in our review will yield:

1) Annual reduction of heat loss **- 223 GJ** and a **ROI of 6.4 years**
2) Annual cost savings derived through properly insulated piping - **$1,978.00**
3) Potential savings on maintenance costs for equipment
4) Elimination of personal protection hazards

[1] Refer to http://insulationinstitute.org/tools-resources/resource-library/codes-standards/ for more information in mechanical insulation systems.

Table of Contents

Introduction

Ms. Claudette Poirier, Energy Specialist for Island Health retained Salamander Inspections Ltd. to complete a review of mechanical insulation systems applied to the boiler system, domestic hot water and heat recovery system at the Laundry Operations located at Victoria General, Victoria, British Columbia. The goal of the assessment is to find energy savings for Laundry Services.

About Salamander Inspections and the FLIR Thermographic Camera

Salamander Inspections Ltd. is a third party inspection service providing energy audits for mechanical 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 plate exchanger, as photographed by the FLIR camera uses sensors built 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.

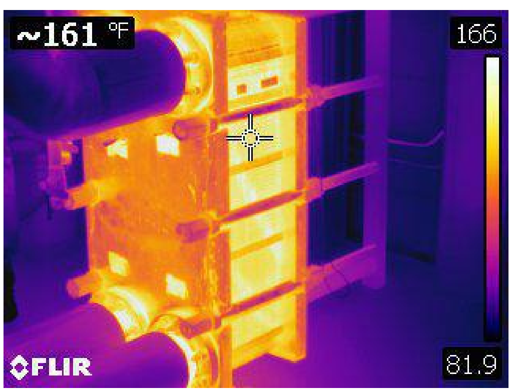


Figure 1 This is an infrared photo of a heat exchanger showing the areas with where large temperature differences create high rates of heat transfer.

Figure 2 This photo shows the same plate heat exchanger.

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. High rates of heat transfer are indicated in areas where there are large color differences between the background elements within the area.

After identifying the problem areas with an infrared camera, we then completed simulations of different mechanical insulation systems. In this way, we were able to develop a cost versus benefit model for different insulation systems

Study Findings

Boiler Room

In general, workmanship on the existing insulation systems is below average and there are some large deficiencies if we compare the systems to the standards established in Best Practices Guideline[2] developed the North American Insulation Institute. For instance, valves, pumps and or fittings should have been insulated at the time of construction. However, we note that some specifications expressly omit this requirement thereby increasing operating costs for the owner. We are continuing our efforts to reach out to the engineering community to get elements such as these changed in specifications.

We have assessed the boiler room and found that the insulation applied to the mechanical systems is in poor to fair condition. We noted that the existing insulation is 1 1/2 (40 mm) inch thick. Current best practices and ASHRAE 90.1 (2010) requires that the insulation applied to heating systems be 1 ½ (40) mm inch thick. The insulation that is applied is in poor to moderate condition, most has been installed correctly but there is substantial damage done through maintenance and a large amount of material has not been replaced.

However, there are some instances where pumps, fittings and piping have no insulation applied and therefore, there is an opportunity to reduce operation costs. During the course of this inspection we counted at least (160m) of piping, (2) heat exchangers, (10) pumps that should be insulated.

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[2] Refer to http://insulationinstitute.org/tools-resources/resource-library/codes-standards/ for more information in mechanical insulation systems.

Sample photos are provided below showing various components of the mechanical systems where repairing the mechanical insulation will reduce operating costs by reducing energy consumption and extending the service life of equipment and also improve personnel safety (Figures 3 to 34).

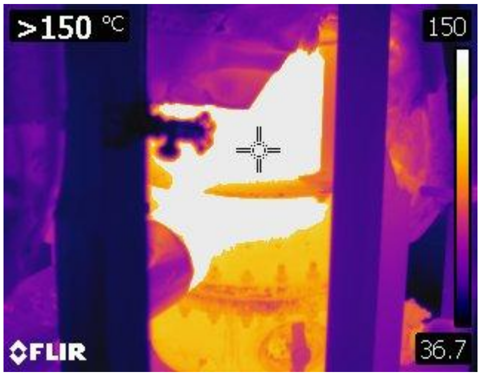


Figure 3 This thermographic image of the bottom of Steam Pac 1 at 150º C or 302º F.

Figure 4 This is a conventional photo of the same bottom section of Steam Pac 1.

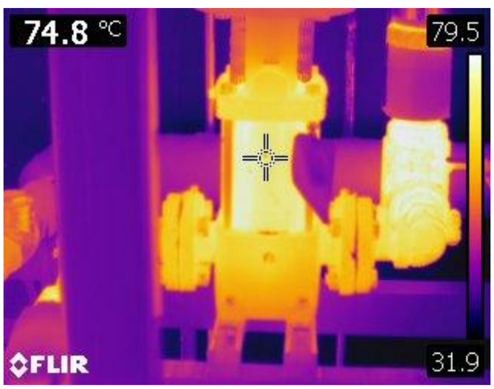


Figure 5 This thermographic image is of a pump located adjacent to Steam Pac 1. Also associated piping is not insulated at 74º C or 154º F

Figure 6 This conventional photo shows the same piping.

Figure 7 This thermographic image of a heat exchanger above Steam Pac 1 at 95º C or 203º F.

Figure 8 This is a conventional photo of the heat exchanger.

Figure 9 This thermographic image is of the sight glass and blow off/piping from this vessel at 132º C or 289º F.

Figure 10 This is a conventional photo of the same sight glass and blow off/piping.

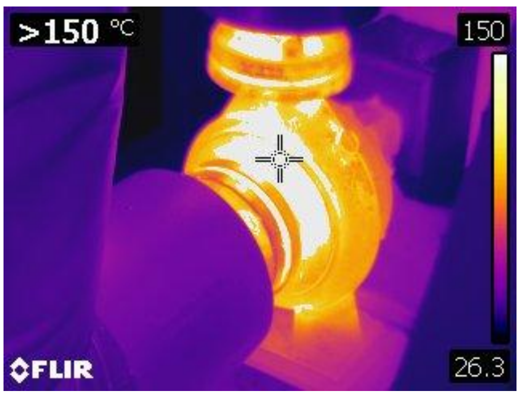


Figure 11 This thermo graphic image is of a motorized circulation pump at150º C or 302º F.

Figure 12 This is the conventional image of the same motorized pump.

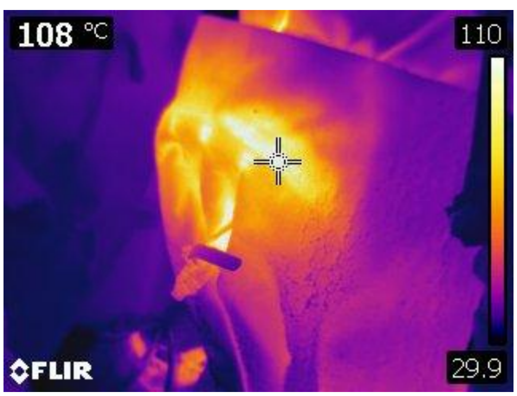


Figure 13 This thermographic image is of a heating supply strainer covered with cloth at108º C or 226º F. this item is above 65C which is over the personal protective limit.

Figure 14 This is a conventional image of the same strainers covered by cloth.

Figure 15 This thermographic image is of supply piping at top of boiler at150º C or 302º F.

Figure 16 This is a conventional image of the same pipe at the top of the boiler.

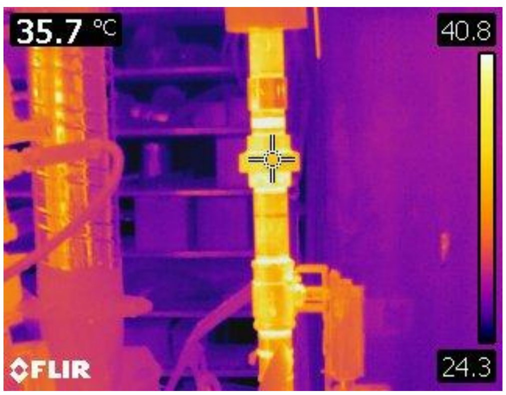


Figure 17 This thermographic image is of a pipe to motorized pump at 35º C or 95º F.

Figure 18 This conventional image is of the same pipe to the motorized pump.

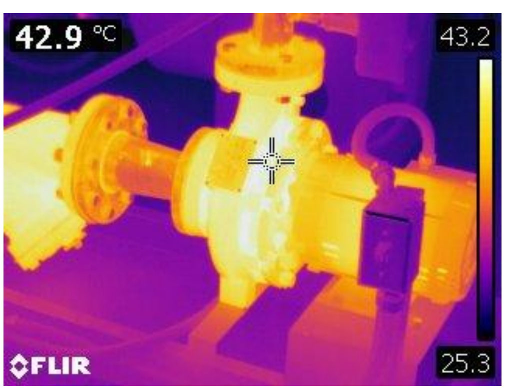


Figure 19 Thermographic image of a motorized pump and pipe at 42º C or 107º F.

Figure 20 conventional image of the same pump and piping.

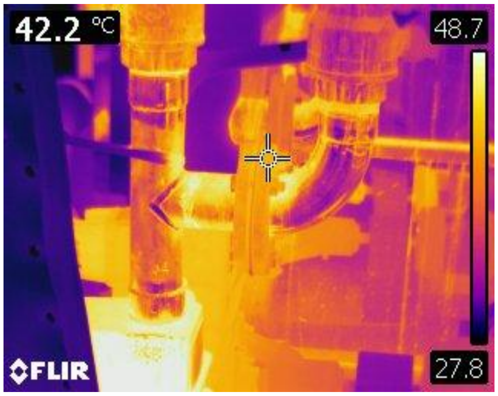


Figure 21 Thermographic image of bare piping and valves at 42º C or 107º F.

Figure 22 Conventional image of the same piping and valves.

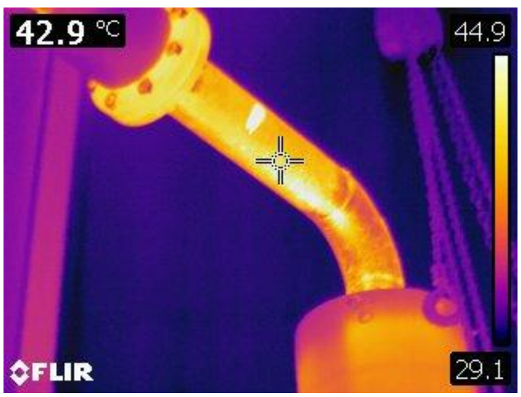


Figure 23 Thermographic image of bare piping and flange at 42º C or 107º F.

Figure 24 Conventional image of the same piping and flange.

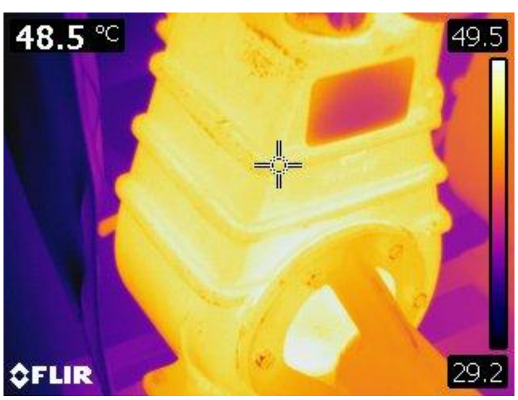


Figure 25 Thermographic image of bare pump and flange at 48º C or 118º F.

Figure 26 Conventional image of the same pump and flange.

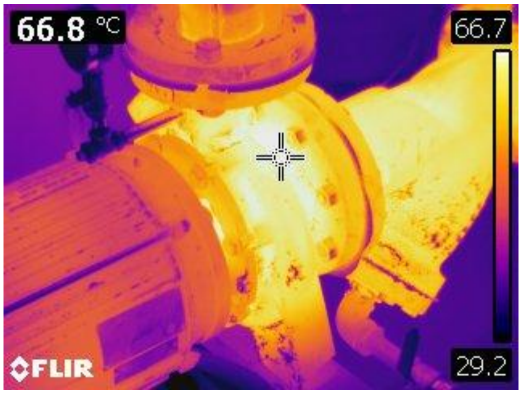


Figure 27 Thermographic image of bare pump and flange at 66º C or 150º F.

Figure 28 Conventional image of the same pump and flange.

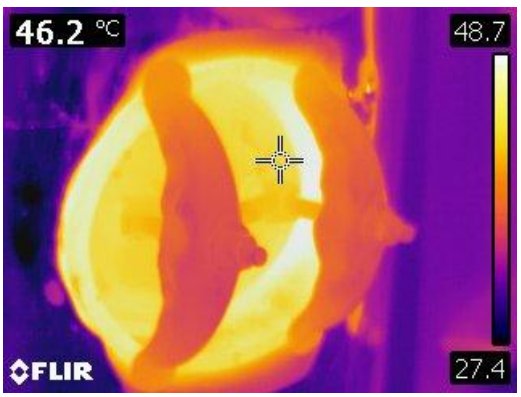


Figure 29 Thermographic image of the access hatch on vessel at 46º C or 114º F.

Figure 30 Conventional image of the same access hatch and piping.

Figure 31 Thermographic image of a heat exchanger in vessel at 102º C or 215º F.

Figure 32 Conventional image of the same heat exchanger and piping.

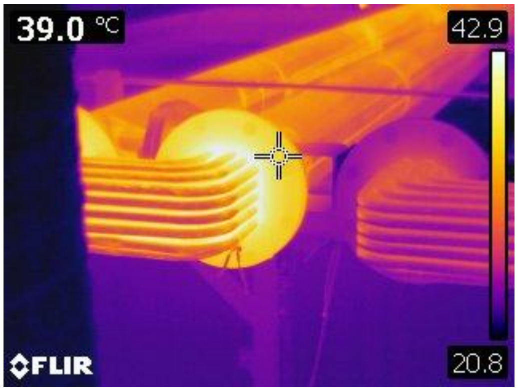


Figure 33 Thermographic image of heat recovery piping at 39º C or 102º F.

Figure 34 Conventional image of the same heat recovery piping.

Laundry Main Floor - Washers

Figure 35 Thermographic image of steam supply to washers at 127º C or 260º F.

Figure 36 Conventional image of the same steam supply piping.

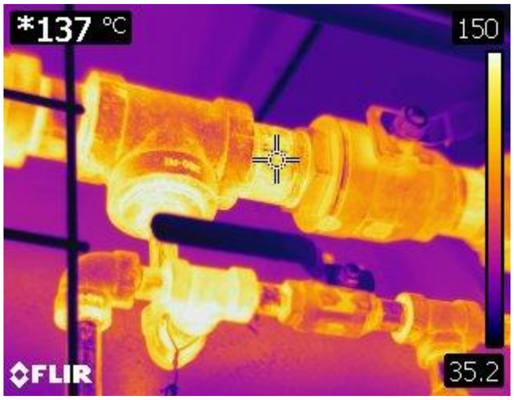
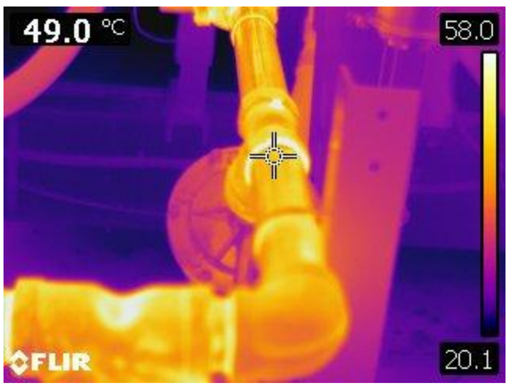


Figure 37 Thermographic image of a steam supply line to washers at 137º C or 278º F.

Figure 38 Conventional image of the same steam supply piping.



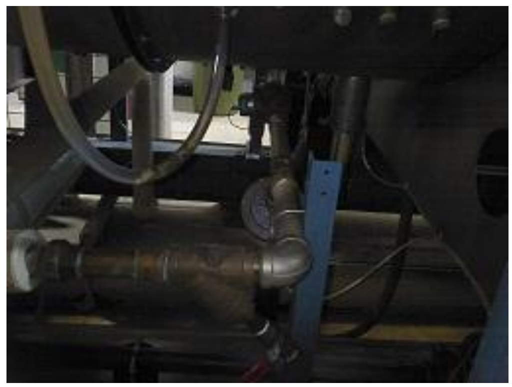


Figure 39 Thermographic image of a supply line at the bottom of the washers at 137º C or 278º F.

Figure 40 Conventional image of the supply line at the bottom of the washers.

Personnel Protection

It is also important to recognize the hazards that hot exposed surfaces present to personnel. The boiler room is tightly packed with equipment and piping systems operating at temperatures of nearly 67ºC. (People experience burns at temperatures above 65C). Un-insulated or exposed surfaces at these high temperatures are to be considered a serious risk for staff and personnel. Properly insulated systems and equipment eliminate the possibility of individuals coming into contact with these hot surfaces and will prevent accidental burns. This is an important life safety and financial consideration. The maximum temperature observed in this mechanical room was 150C found at Steam Pac 1 and 2 and motorized pumps.

Energy Calculations

Table 1.0 below summarizes our energy calculation. We completed our calculations using a program developed by the Insulation Institute (see insulationinstitute.org) called 3E Plus. We can make our detailed calculations available upon request.

The summary provides an aggregate heat loss rate for...

Table 1.0 Energy and Financial Savings

Hours of Operation	KWh from Spreadsheet	Gigajoules Saved
8760	62,073.62	223
	Cost of fuel	$8.87
	total	**$1,978.00**

Table 2.0 Greenhouse Gas and Emissions Reduction

Greenhouse Gas	CO2	NOx
before	29037	58.24
after	2897	5.81
Total removed	46.4 tonnes	.3 tonnes

*calculated from NRCAN www.nrcan.gc.ca/energy/software-tools/7417

Insulation Materials

Table 3.0 provides 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 only and should not be used as actual costs.

Table 3.0 Insulation Upgrade Pricing Summary

Pipe Sizes	Square footage or Lineal feet	Cost of Material
Tank Wrap	160 @ $ 17.82	$ 2,851.21
18	15.82 ft @ $ 35.47	$ 561.13
½		
¾	31 ft @ $ 17.92	$ 555.52
1 1/4	14 ft @ $ 18.64	$ 290.96
1 1/8		
1 ½		
2	132ft @ $ 19.35	$ 2,554.20
2 1/8		
2 ½	9 ft @ $20.19	$ 181.71
2 5/8		
3	6 ft @ $20.63	$ 123.78
3 1/8		
4	42.43 ft @ $ 21.88	$ 928.36
5		
6	106 ft @ $ 24.14	$ 2,765.36
7	17.52 ft @ $ 25.12	$ 440.10
8	4 ft @ $ 26.59	$ 106.36
10	12.13 ft @ $ 29.56	$ 358.56
12	22.04 ft @ $ 31.65	$ 697.56
14	7.3 ft @ $ 33.87	$ 247.25
	Total	**$ 12,662.06**

All materials noted in the above tables are to be of a wall thickness of 1.5 inches or greater dependent upon temperature rating. The costs for insulation include PVC cladding, elbows and fittings. The cost of labor is also part of the lineal footage costs. Price also includes 5% for PST. We highly recommend that Island Health get three quotes to compare. This price is an estimate only and may not be considered an exact amount.

Recommendations and Conclusions

Our findings indicate that there are opportunities to improve the mechanical insulation systems in a cost effective manner. The benefits are itemized below. Any deviation from following the Best Practices Guideline[3] developed by the North American Insulation Institute will reduce the potential savings and benefits. For example, we know that the elimination of canvas jacket 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 required for maintenance to ensure that the insulation systems remain intact for as long as possible.

If all areas are addressed, the benefits shall include:

1) Annual reduction of heat loss - **223 GJ**
2) Annual cost savings derived through properly insulated piping - **$1,978.00**
3) Potential savings on maintenance costs for equipment
4) Elimination of personal protection hazards Disclosure
5) We have no relevant financial or non-financial relationships to disclose.

[3] Ibid.

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 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.