MECHANICAL INSULATORS
LMCT
Labor Management Cooperative Trust
ENERGY CONSERVATION SPECIALISTS

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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.

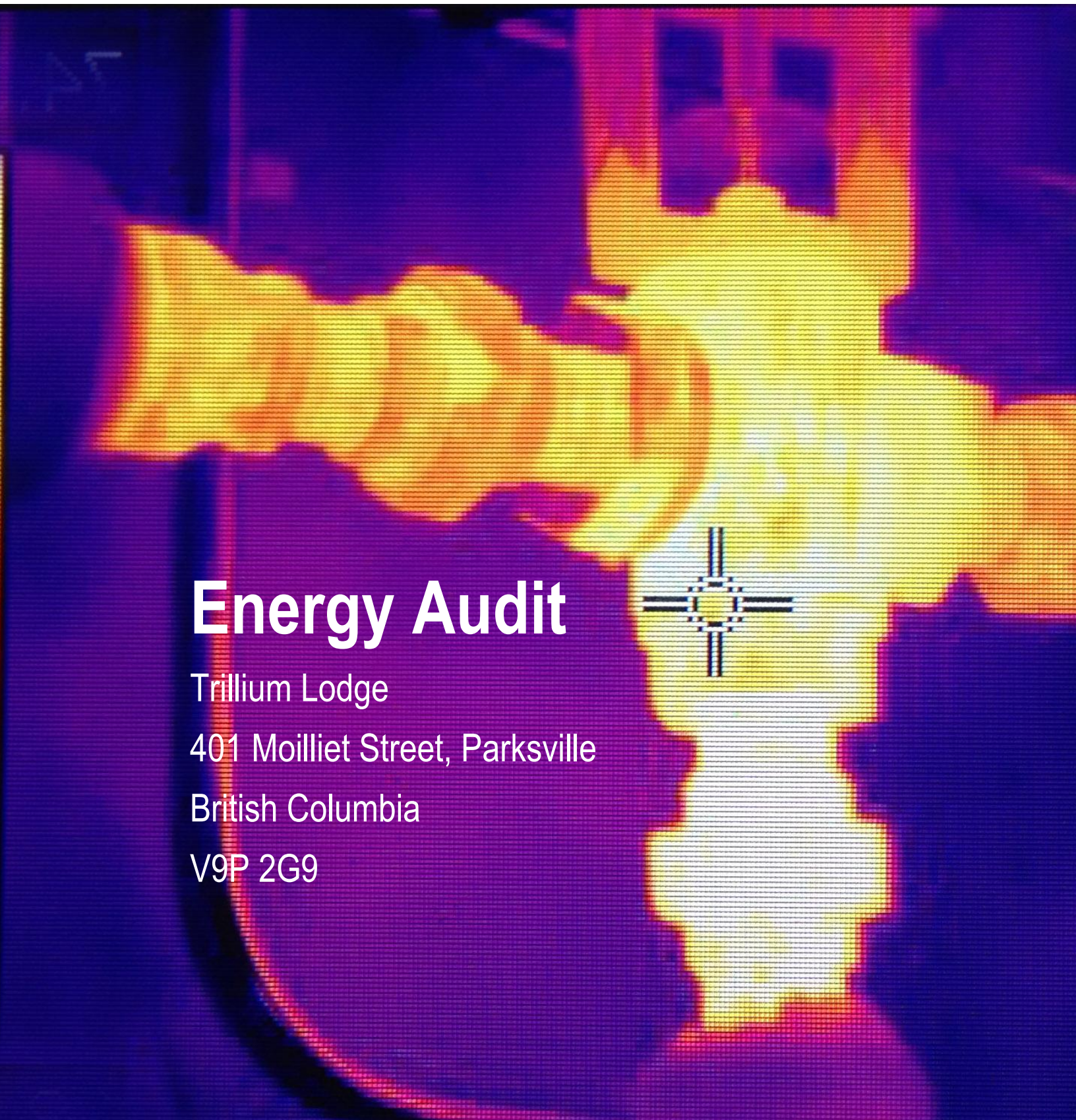
Please do not hesitate to contact me should you have any additional questions.
Thank you,

Peter Ielimi

Executive Director
Mechanical Insulators Labor Management Cooperative Trust

SALAMANDER INSPECTIONS LTD

Mechanical Insulation Energy Audits



Energy Audit

Trillium Lodge

401 Moilliet Street, Parksville

British Columbia

V9P 2G9

Executive Summary

Trillium Lodge is located at 4021 Moilliet Street, Parksville, British Columbia. The lodge is a subsidized residential healthcare operated by Island Health Authority. For this report our inspection was for this buildings mechanical room and fan rooms only.

Salamander Inspections performed an energy audit of the insulation systems within the main Boiler Room and Fan Rooms. The purpose of the audit was to determine the current state of mechanical insulation applied to the 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 - **34889 Kwh** and a **ROI of 5.8 years**
2) Annual cost savings derived through properly insulated piping - **$1,395.56**
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.

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Introduction

Mr. Kevin Ramlu, Energy Specialist for Island Health retained Salamander Inspections Ltd. to complete a review of mechanical insulation systems applied to the heating systems at Trillium Lodge located in Parksville, British Columbia. The goal of the assessment is to find energy savings for the care home.

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.

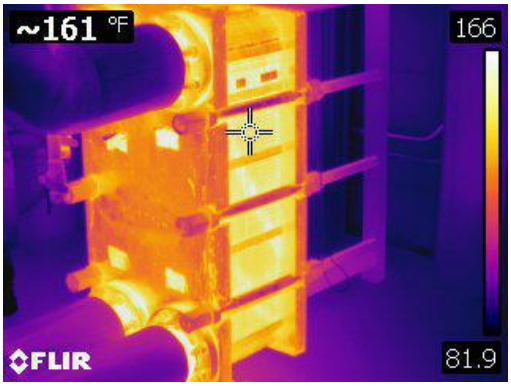

Figure 1 This is an infrared photo of the heat exchanger showing the areas with where large temperature differences create high rates of heat transfer.

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 colour 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 fair but there were some 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, flanges 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 generally fair condition. We noted that the existing insulation is 1inch thick (25mm). Current best practices and ASHRAE 90.1 (2010) requires that the insulation applied to heating systems be 1½ inch thick (40) mm. The insulation that is applied is showing its age and there are obvious signs of maintenance where materials have been removed and not replaced.

However, there are some instances where pumps, valves 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 (21) valves or valve bonnets, (2) strainers, (10) pumps that should be insulated. In addition, there are other areas where there would be opportunities to install or upgrade the mechanical insulation systems.

[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 upgrading 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 37).

Figure 3 This thermographic image of exposed valve bonnets on the supply line from the E-Plus boiler.

Figure 4 This is a conventional photo of the same piping from the E-Plus boiler.

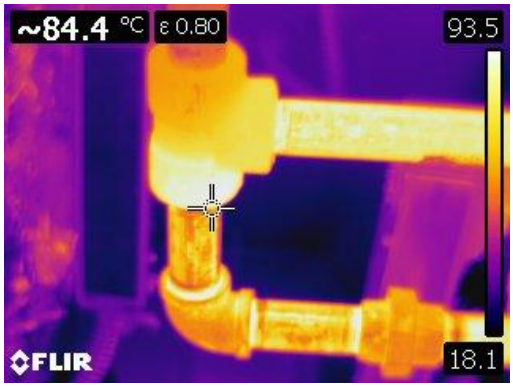

Figure 5 This Thermographic image of supply lines to a heat recovery coils.

Figure 6 This conventional photo shows the same piping and also shows that the insulation was removed for maintenance.

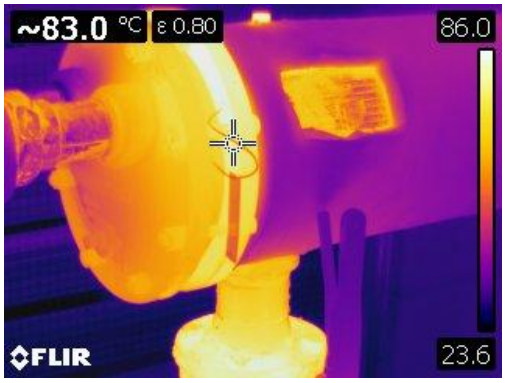

Figure 7 This is a thermographic image of the bare end of a heat exchanger.

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

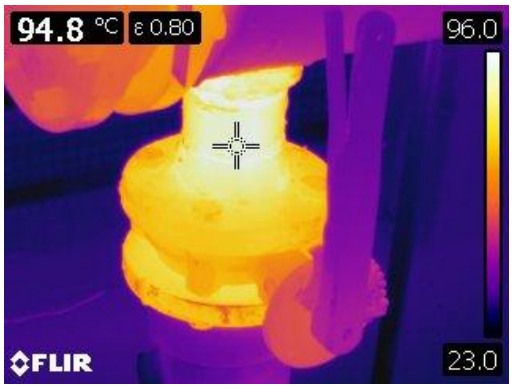

Figure 9 This is a thermographic image of a bare gate valve below the heat exchanger.

Figure 10 This is the conventional image of the same bare valve in the boiler room.

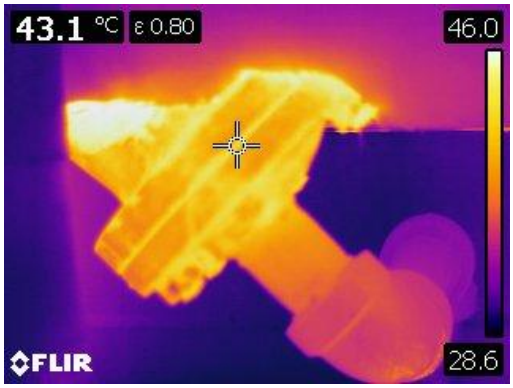

Figure 11 This thermographic image is of bare drain from the heat exchanger.

Figure12 This is a conventional image of the same group of pipe, fittings and valves.

Figure 13 This thermographic image is of a bare valve bonnet.

Figure 14 This is a conventional image of the same valve bonnet.

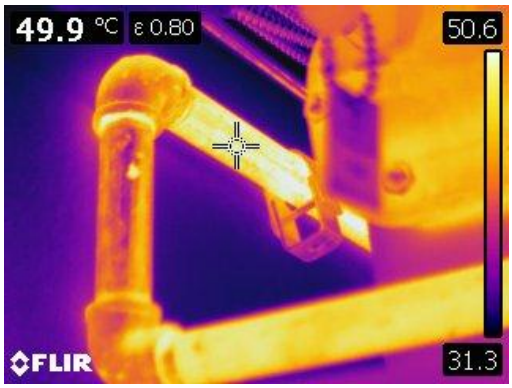

Figure 15 This thermographic image is of a bare 1 inch line adjacent to valve bonnet.

Figure 16 This conventional image is of the same 1 inch line.

Figure 17 Thermographic image of the same 1 inch line at the other end.

Figure 18 Conventional image of the same 1 inch line with valves and fittings.

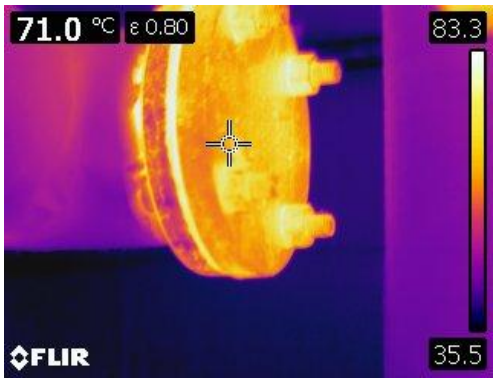

Figure 19 Thermographic image of a bare flange/endcap.

Figure 20 Conventional image of the same flange/endcap.

Figure 21 Thermographic image of a bare gate valve.

Figure 22 Conventional image of the same valve.

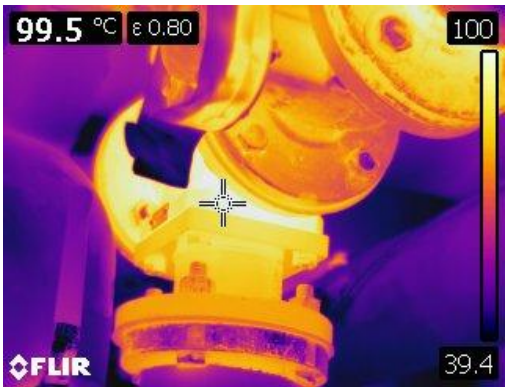

Figure 23 Thermographic image of a three way mixing valve and a gate valve.

Figure 24 Conventional image of the same valve assembly.

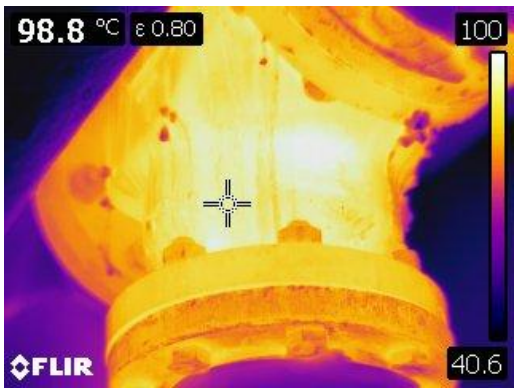

Figure 25 Thermographic image of a large bore three way valve.

Figure 26 Conventional image of the same three way valve against back wall.

Figure 27 Thermographic image of motorized heating pumps.

Figure 28 Conventional picture of the same pumps.

Figure 28 Thermographic image of motorized heating pumps in boiler room.

Figure 29 Conventional image of motorized heating pumps in boiler room.

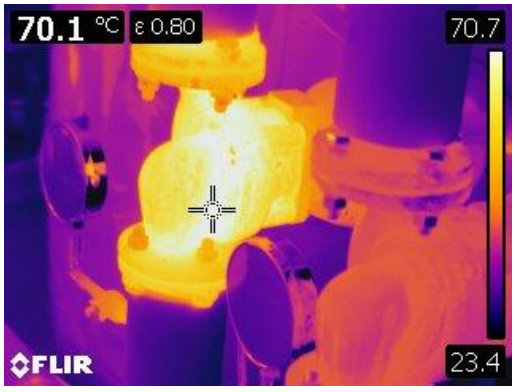

Figure 30 Thermographic image of motorized pumps from hot water tank.

Figure 31 conventional image of the same pumps at the hot water tank.

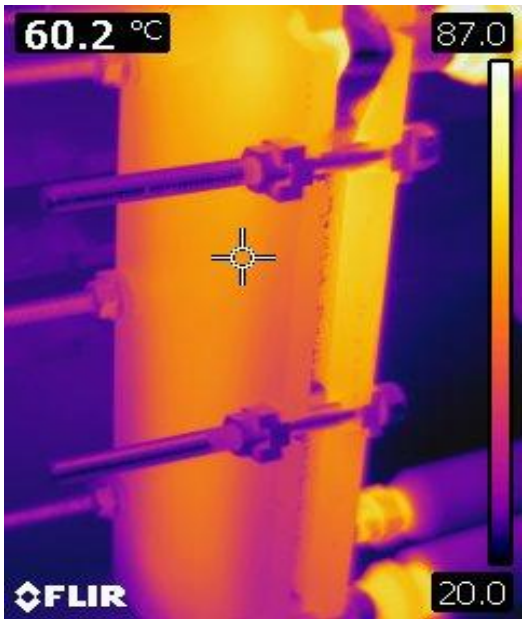

Figure 32 Thermographic image of the plate exchanger in mechanical area by boiler.

Figure 33 Conventional image of the same plate exchanger.

Figure 34 Thermographic image of another motorized heating pump in the boiler room.

Figure 35 Conventional image of the same motorized pump in the boiler room.

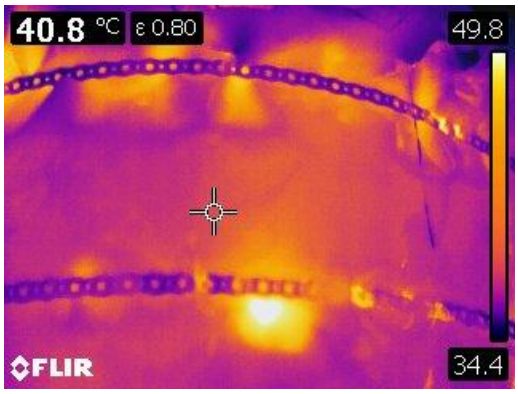

Figure 36 Thermographic image of the domestic hot water tank in boiler room. The insulation is not preventing the necessary heat loss as the surface temperature is 40.8

Figure 37 Thermographic image of the domestic hot water tank showing the damage to the insulation.

Fan Rooms

The inspection of all of the fan room mechanical areas has revealed that the insulation was generally applied correctly. The issue remains however that there are (8) fan rooms where insulation is missing on some of the piping supplying heating water to the coils and re-heat coils. The mechanical has been redone for greater efficiency and the insulation that should have been installed was never done. Failure to complete the insulation system has left many opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. There is approximately (37) meters of insulation missing from the mechanical within these mechanical rooms. (No pictures have been taken due to very low light conditions.)

Personnel Protection

It is also important to recognize the hazards that hot exposed surfaces present to personnel. The boiler rooms and fan rooms generally are tightly packed with equipment and piping systems operating at temperatures of nearly 77ºC. (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.

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	34,899	125.6
	Cost of fuel	$ .04
	total	**$1,395.56**

Table 2.0 Greenhouse Gas Emissions

Greenhouse Gas	CO2	NOx
Total removed	6.2 tonnes	0.0 tonnes

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	93 sq ft @ 29.09	$ 2705.37
5/8		
½		
1	154 ft @ $ 18.08	$ 2,784.32
1 1/4	4 ft @ $ 18.64	$ 74.56
1 1/8		
1 ½		
2	5 ft @ $ 19.35	$ 96.75
2 1/8		
2 ½		
2 5/8		
3	10ft @ $ 20.63	$ 206.30
3 1/8		
4	21.78 ft @ $ 21.88	$ 476.54
5		
6	11 ft @ $ 24.14	$ 265.54
7	8.08 ft @ $ 25.12	$ 202.96
8	28.81 ft @ $ 26.59	$ 766.05
10	2.1 ft @ $ 29.56	$ 62.07
12	2.7 ft @ $ 31.65	$ 85.45
14	11.9 ft @ $ 33.87	$ 403.05
	Total	$ 8,128.96

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 - **34,899 Kwh** or **125.6 GJ**
2) Annual cost savings derived through properly insulated piping - **$1,395.56**
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.

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.

[3] Ibid.

Best regards,

Report prepared by:
Salamander Inspections

Bob Barter (Project Coordinator)

Reviewed by:
Besant and Associates Engineers Ltd.

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Jeff Besant, MBA, P.Eng.