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.

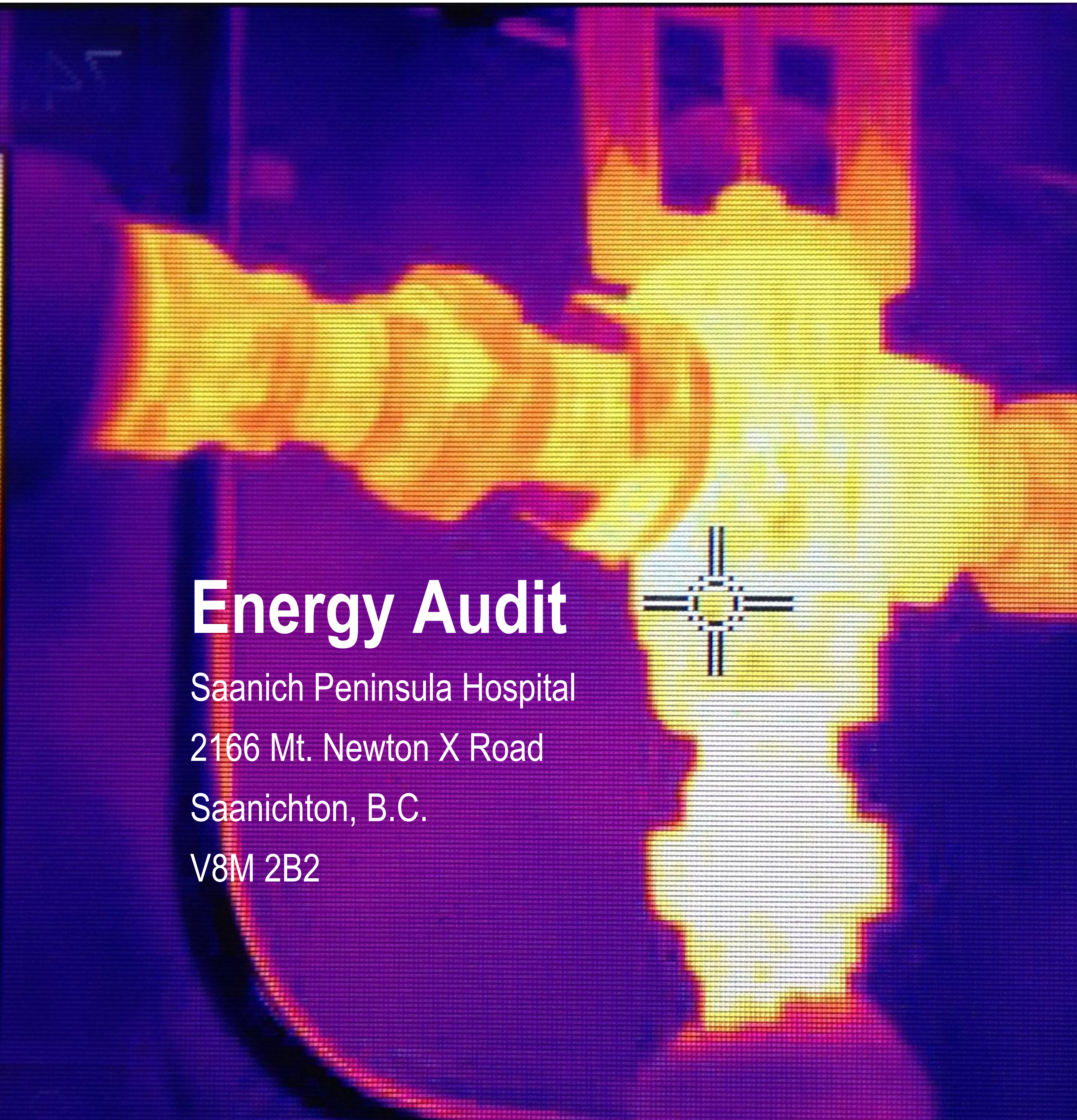
Please do not hesitate to contact me should you have any additional questions.
Thank you,

Peter Ielimi

Executive Director
Mechanical Insulators Labor Management Cooperative Trust

SALAMANDER INSPECTIONS LTD

Mechanical Insulation Energy Audits



Energy Audit

Saanich Peninsula Hospital

2166 Mt. Newton X Road

Saanichton, B.C.

V8M 2B2

Executive Summary

Saanich Peninsula Hospital is located at 2166 Mt. Newton X Road, Saanichton, British Columbia. This hospital is a multi level healthcare facility operated by Island Health Authority. For this report our inspection was for this buildings boiler room and fan rooms only.

Salamander Inspections performed an energy audit of the insulation systems within the main Boiler Room, Roof Top Fan Rooms and the OR Fan Room and ECU2 Fan Room. 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 **- 236 Gj** and a **ROI of 4 years**
2) Annual cost savings derived through properly insulated piping - **$2,336.40**
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

Ms. Claudette Poirier, Energy Specialist for Island Health agreed to have Salamander Inspections Ltd. complete a review of mechanical insulation systems applied to the heating systems at Saanich Peninsula Hospital located in Saanichton, British Columbia. The goal of the assessment is to find energy savings for the hospital.

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.

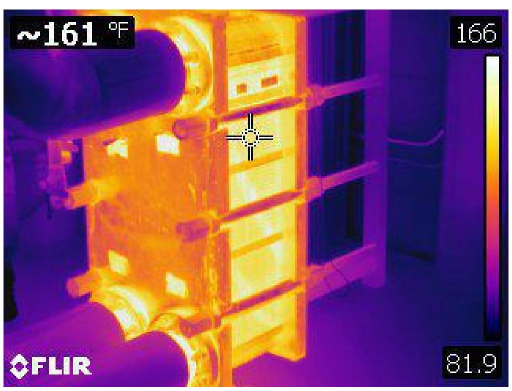

Figure 1 This is an infrared photo of the heat exchanger showing the areas with where large temperature differences create high rates of heat transfer.

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 insulation systems is very good considering the age of the insulation applied. But there were some deficiencies if we compare the systems to the standards established in Best Practices Guideline[2] developed by the North American Insulation Institute. For instance, valves, pumps, flanges and or fittings should have been insulated at the time of the initial installation of the mechanical insulation systems. However, we note that some specifications expressly ommited 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 older existing mechanical systems is in generally good condition. We noted that the insulation is a mixture of 1 inch thick (25mm) and 1 ½ inch thick (40mm). Current best practices and ASHRAE 90.1 (2010) requires that the insulation applied to heating systems be 1 ½ inch thick (40mm). The mechanical heating systems follows ASHRAE 90.1 but the installers (company) did not completely insulate the systems leaving opportunities to save energy and lower GHG output.

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 (23) valves, (33) valve bonnets (6) strainers, (17) flanges and (23) 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.

Boiler Room

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 38).

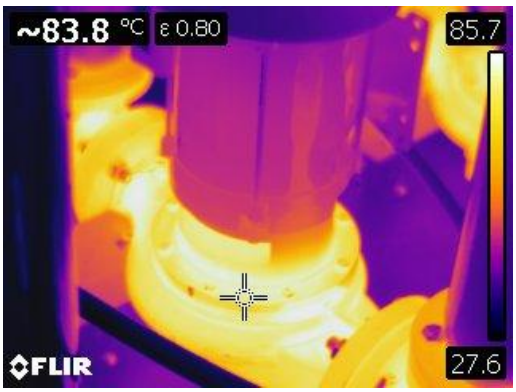

Figure 3 This thermographic image of an exposed motorized heating pump at 83º C or 181º F.

Figure 4 This is a conventional photo of the same pump. There is also an exposed strainer and control valve.

Figure 5 This Thermographic image of a HWR supply valve assembly at 66º C or 152º F.

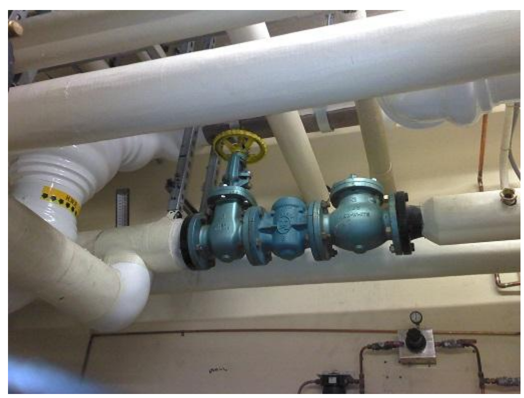

Figure 6 This conventional photo shows the same valve assembly. This assembly should be insulated for cost savings purposes.

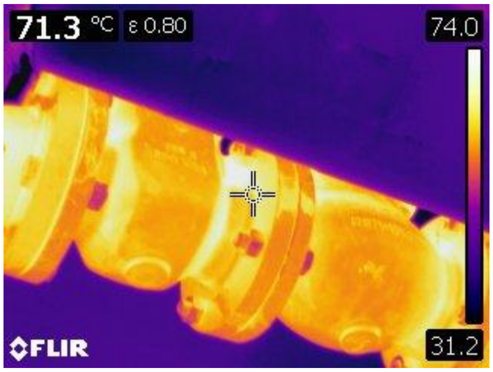

Figure 7 This is a thermographic image of another set of valves at 71º C or 161º F.

Figure 8 This is a conventional photo of the same valve assembly and a further valve in the picture.

Figure 9 This is a thermographic image of a backflow preventer at 76º C or 168ºF.

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

Figure 11 This is a thermographic image of an upright tank at 36º C or 104ºF.

Figure 12 This is the conventional image of the same tank.

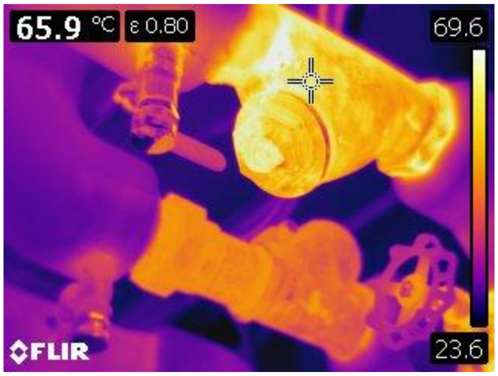

Figure 13 Thermographic image of non insulated fittings on the pre heat from a heat exchanger at 66º C or 150ºF.

Figure14 This is a conventional image of the same valves and fittings.

Figure 15 This thermographic image is of bare flange on a heat exchanger at 66º C or 150ºF.

Figure 16 conventional image of the same heat exchanger.

Figure 16 Thermographic image of a heat exchanger in a hot water tank at 79º C or 174ºF.

Figure 17 Conventional image of the same heat exchanger in the hot water tank.

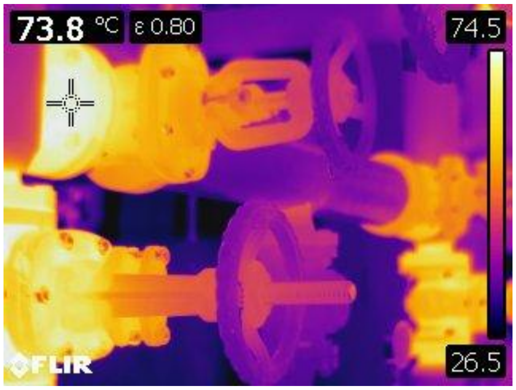

Figure 18 Thermographic image of a number of non insulated valves at 74º C or 164 ºF.

Figure 19 Conventional image of the same group of bare valves.

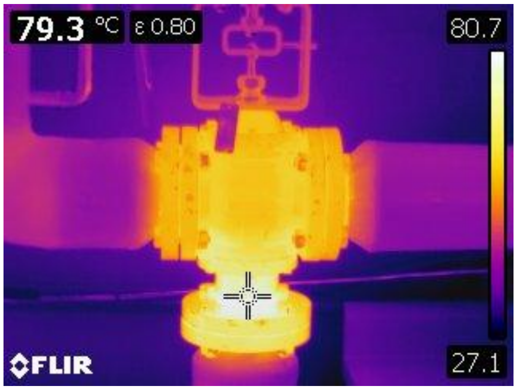

Figure 20 Thermographic image of a three way valve at 79º C or 176º F.

Figure 21 Conventional picture of the same three way valve.

Figure 22 Thermographic image of a single bare valve at 69º C or 156 F.

Figure 23 Conventional picture of the same valve.

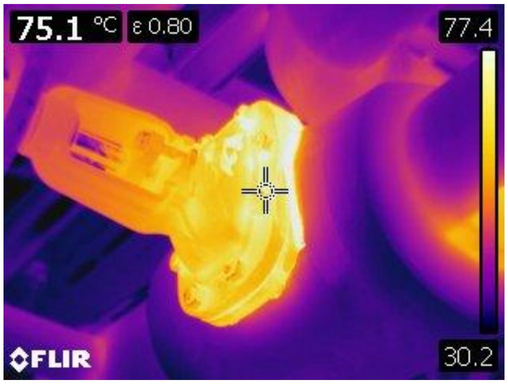

Figure 21 Thermographic image of a typical bare valve bonnet at 75º C or 167 F.

Figure 22 Conventional image of the same valve.

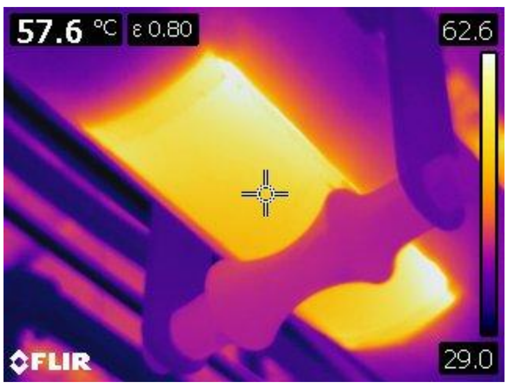

Figure 23 Thermographic image of pipe supports at 57º C or 134 F. (1 of 22)

Figure 24 Conventional image of the same pipe supports.

Figure 25 Thermographic image of multiple valves at 85º C or 185 F.

Figure 26 Conventional image of the same valves.

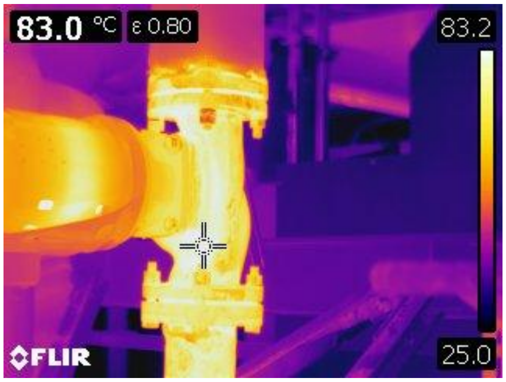

Figure 27 Thermographic image of a motorized pump at 83º C or 181 F.

Figure 28 Conventional image of the same motorized pump.

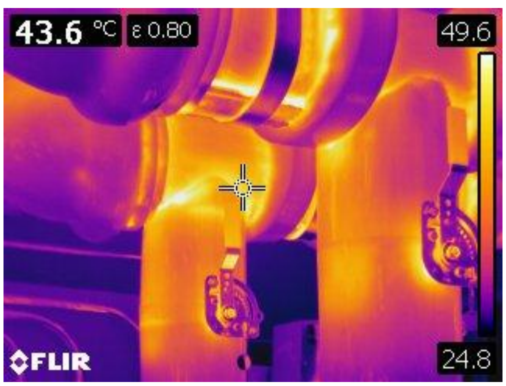

Figure 29 Thermographic image of new work with material backcut too much allowing heat transfer at 43º C or 111 F.

Figure 30 Conventional image of the same new work.

Figure 31 Thermographic image of an access hatch on a hot water tank (57º C or 134 F.)

Figure 32 Conventional image of the same access hatch.

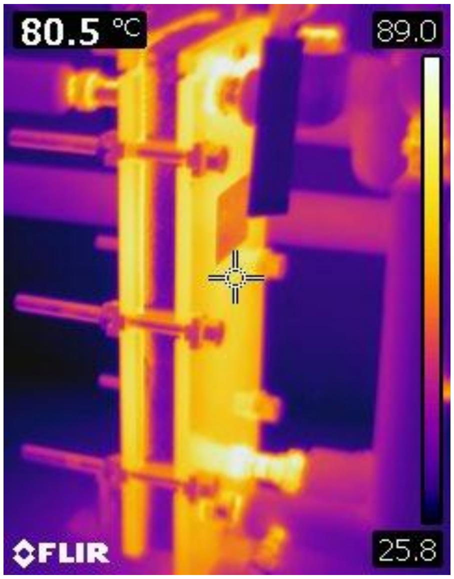

Figure 33 Thermographic image of a plate exchanger at 80º C or 176 F.

Figure 34 Conventional image of the same plate exchanger.

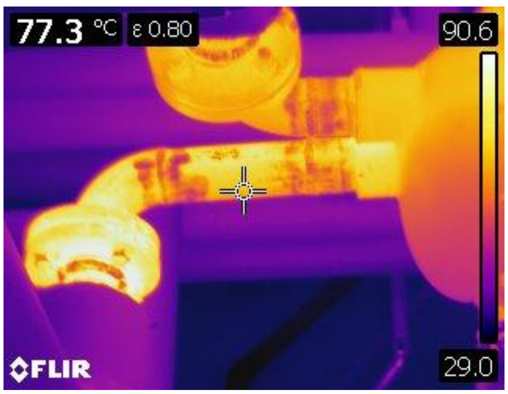

Figure 35 Thermographic image of bare piping to heat exchanger at 77º C or 170F.

Figure 36 Conventional image of the same piping to the heat exchanger.

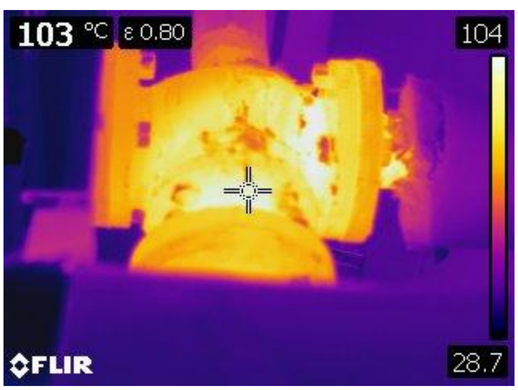

Figure 37 Thermographic image of bare valve 103º C or 219F.

Figure 38 Conventional image of bare valve.

Fan Rooms

The inspection of all of the fan room mechanical areas has revealed that the insulation is generally applied correctly. There were (4) fan rooms that had been completely redone with new equipment and new mechanical insulation. The workmanship in these fan rooms was excellent, however the practice of applying flexible wrap to Victaulic fittings is a contentious practice. The issue remains however that there are fan rooms where insulation is missing on some of the piping and pumps supplying heating/glycol to the coils. When the contractors retrofitted the mechanical systems they should have also correctly installed the mechanical insulation systems. Unfortunately, the contractor missed this opportunity. Failure to complete the insulation system has left opportunities to improve or upgrade the insulation and receive benefits to the cost of operation. (figures 39– 58)

Figure 39 Thermographic image of bare piping within a mechanical room at 53º C or 127F.

Figure 40 Conventional image of the same bare piping.

Figure 41 Thermographic image of bare motorized heating pump and piping at 77º C or 170F.

Figure 42 Conventional image of the same pump and piping.

Figure 43 Thermographic image of bare heating supply to coils at 77º C or 152F.

Figure 44 Conventional image of bare small bore heating supply to coils.

Figure 45 Thermographic image of bare heating supply to valves at 64º C or 147F.

Figure 46 Conventional image of bare supply and return valves.

Figure 47 Thermographic image of bare heating supply control valves at 61º C or 141F.

Figure 48 Conventional image of bare supply and return valves.

Figure 49 Thermographic image of bare copper heating supply to coils at 61º C or 138F.

Figure 50 Conventional image of bare small bore heating supply and return to coils.

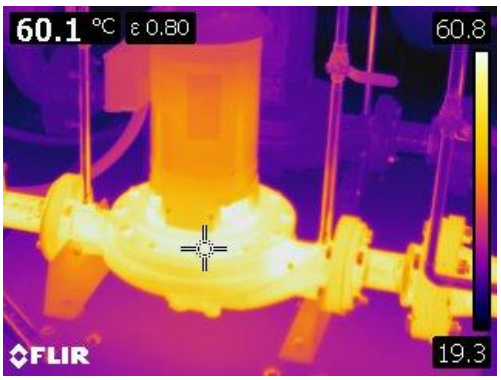

Figure 51 Thermographic image of bare heating supply pumps at 61º C or 140F.

Figure 52 Conventional image of the same heating pumps.

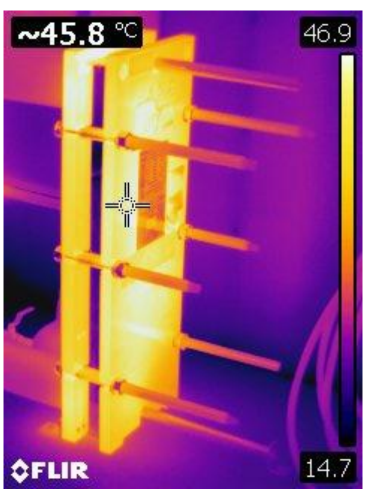

Figure 53 Thermographic image of a plate exchanger at 45º C or 114F.

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Figure 54 Conventional image of the same plate exchanger.

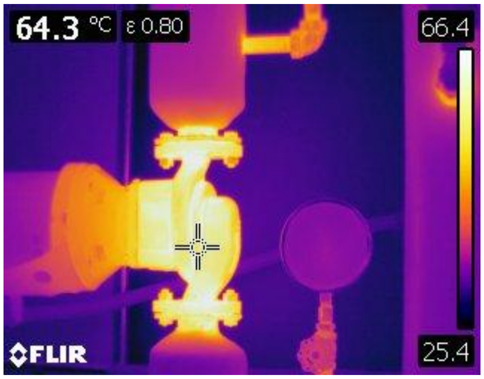

Figure 55 Thermographic image of a bare vertical motorized pump at 64º C or 147F.

Figure 56 Conventional image of the same motorized pump.

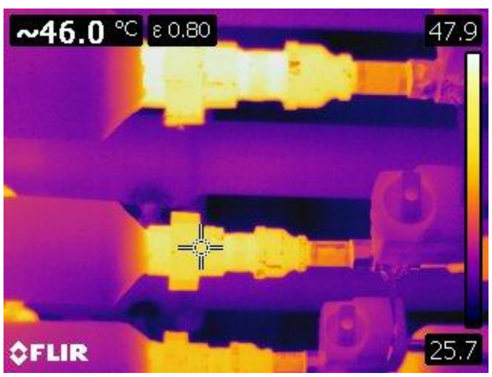

Figure 57 Thermographic image of a bare vertical supply/return and motorized valves at 46º C or 114F.

Figure 58 Conventional image of the same systems.

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 103ºC. (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	65,722	236
	Cost of fuel	$ 9.90
	total	**$2,336.40**

Table 2.0 Greenhouse Gas Emission Reduction

Greenhouse Gas	CO2	NOx
before	32,655 lbs	65.51lbs
after	3177 lbs	6.37 lbs
Total removed	11.7 tonnes	.1 tonnes

*taken from 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		
5/8		
½	20 ft@ $ 17.53	$ 350.60
3/4	57ft @ $ 17.92	$1,021.44
1	32 ft @ $ 18.08	$ 578.56
1 1/8		
1 ½	36 ft @ $ 18.92	$ 681.12
2	82 ft @ $ 19.35	$ 1,586.70
2 1/8		
2 ½	2 ft @ $ 20.19	$ 40.38
2 5/8		
3	49.5 ft @ $ 20.63	$ 1,021.18
3 1/8		
4	2 ft @ $ 21.88	$ 43.76
5	12.5 ft @ $ 23.00	$ 287.50
6	12.5 ft @ $ 24.14	$ 301.75
7	81 ft @ $ 25.12	$ 2,034.72
8	78 ft @ $ 26.59	$ 2,074.02
10	7 ft@ $ 29.56	$ 209.92
12	5 ft @ $ 31.65	$ 158.25
14	11 ft @ $ 33.87	$ 372.57
	Total	**$10,765.47**

All materials noted in the above table 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 - **236 GJ**
2) Annual cost savings derived through properly insulated piping - **$2,336.40**
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.