



REPORT

**Thermographic Review of the
Bradley Berneche Home/EcoTerra
Home near Magog, Québec**

Presented to:

Mr. Pierre Couture
National Sales and Marketing Manager
BASF Spray Polyurethane Products
162 Barr Street
St. Laurent, Quebec H4T 1Y4

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
1.1 Fundamentals of Thermography	1
1.2 Limitations	1
2. BRADLEY-BERNECHE HOME	2
2.1 Construction Details	2
2.2 Thermographic Results	2
3. ECOTERRA HOME	3
3.1 Construction Details	3
3.2 Thermographic Results	3

1. INTRODUCTION

Morrison Hershfield Limited (MH) was retained by BASF Canada to undertake a thermographic review on two single family homes located near Magog, Québec. The thermographic review was conducted on January 21, 2008 by Mr. Michael McKay, CET and Ms. Sanjula Raveendra both of MH.

1.1 Fundamentals of Thermography

All objects at temperatures above absolute zero radiate energy to their surroundings. Both the frequency and intensity of radiation are functions of absolute temperature. The sensor in the thermographic equipment absorbs radiation given off by objects in its field of view. This information is converted into a visual image which then appears on the system's display screen for analysis. Since the thermographic system can determine the surface temperature of an object, any physical process that affects the surface temperature can be detected. For instance, a low-resistance thermal bridge that conducts heat, raising the temperature of the outside surface, can be detected. In the same way, warm air impinging on cool outer cladding produces a warm zone that can be detected.

Irregular thermographic patterns are referred to as thermal anomalies. Typical anomalies that can be identified include air leakage and thermal bridging. Air leakage is the passage of air through elements of the building envelope such as walls, windows and joints. Leakage from the interior is referred to as exfiltration. Thermal bridging is generally caused by structural components which penetrate the insulation. As a result, conduction of heat takes place along these thermal short circuit paths through the insulation. Thermal bridges show up as light (warm) areas with distinct, well-defined edges generally in the shape of the structural components causing the bridge.

Thermographic images and corresponding daylight photos are attached to this report. The variation in colours in the thermograms corresponds to variations in the amount of heat radiated by specific spots on the surface. The lighter tones indicate higher radiation levels and, therefore, a higher apparent surface temperature. The darker tones indicate lower radiation levels and, therefore, lower apparent surface temperatures.

A blower door was used to create a positive pressure of approximately 75 Pa in each of the homes. By inducing a positive pressure it is possible to identify any points of air leakage that may not otherwise be visible under ambient pressure.

1.2 Limitations

The results presented in this report are limited to the observations and measurements made by Morrison Hershfield Ltd. Morrison Hershfield Ltd. was not involved in the design nor was any field review undertaken during construction.

2. BRADLEY BERNECHE HOME

The weather conditions at the time of the review were an exterior temperature of -14°C with calm winds.

2.1 Construction Details

The drawings provided by the builder indicate that the construction of the exterior walls of the home is as follows (interior to exterior):

- Drywall
- Type 1 vapour barrier
- 5 ½" Enertite low density polyurethane foam insulation between 2x6 studs @ 24"
- 7/16" OSB sheathing
- 1 ½" Walltite sprayed urethane foam
- Air barrier
- 1 x 3 furring
- Exterior cladding

Walltite sprayed urethane foam was also installed on the interior and exterior faces of the foundation wall.

2.2 Thermographic Results

The thermographic images for this home are attached to this report in Appendix A.

No thermal anomalies were observed at penetrations through the envelope such as electrical fixtures or hose bibs where air leakage would typically be expected in conventional construction.

Anomalies immediately adjacent to windows may be related to the installation of spray foam between the window frame and the rough opening (thermographic images A3 and A7).

The thermal anomalies along the roof/wall intersections (thermographic images A2 and A9) are believed to be typical of this type of detail in conventional construction.

Of note is that a thermal anomaly is clearly visible on one side of the roof intersection at the dormer (thermographic image A9) while it is not visible at the similar detail on the other side of the dormer (thermographic image A2).

The cause of the thermal anomalies either side of the chimney and the mottled patterns on the south elevation are unknown.

The thermal anomalies observed at the canopy at the main entrance are possibly due to air leakage occurring where the beams penetrate the envelope.

3. ECOTERRA HOME

The weather conditions at the time of the review were an exterior temperature of -17°C with calm winds.

3.1 Construction Details

The EcoTerra home is a factory built home that consists of a number of modules that are assembled on site. The drawings provided by the builder indicate that the construction of the exterior walls of the home is as follows (interior to exterior):

- Drywall
- Walltite sprayed urethane foam (min 2") between 2x6 studs @ 24"
- 3 ½" Enertite low density polyurethane foam insulation between 2x6 studs @ 24"
- Neopor insulation panel
- 2"x2" horizontal battens
- 1" Walltite sprayed urethane foam
- 1"x3" vertical battens
- Exterior cladding

Walltite sprayed urethane foam was also installed on the interior and exterior faces of the foundation wall.

3.2 Thermographic Results


The thermographic images for this home are attached to this report in Appendix B.

No thermal anomalies were observed at penetrations through the envelope such as electrical fixtures or hose bibs where air leakage would typically be expected in conventional construction.

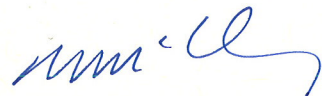
Anomalies immediately adjacent to windows may be related to the installation of spray foam between the window frame and the rough opening.

In discussion with a representative of les Maisons Allouette on site, it is possible that many of the thermal anomalies observed are related to detailing between the individual modules from which the home is constructed.

Morrison Hershfield Limited



Allison Huffman, P.Eng.
Project Manager

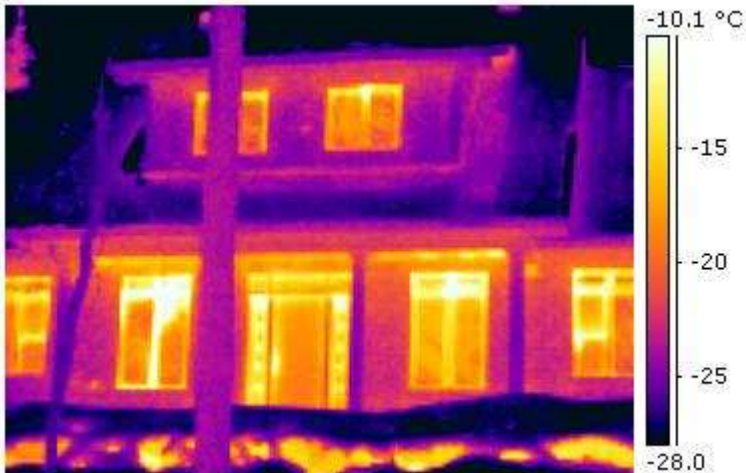



Michael McKay, CET
Associate, Senior Technologist

Appendix A

Thermographic Images
Bradley Berneche Home



<p>Thermographic Image A1</p>	
<p>Daylight Photo</p>	
<p>Remarks</p>	<p>Overall view of front (east) elevation.</p>

Thermographic
Image A2



Daylight Photo



Remarks

North elevation – thermal anomaly observed at roof/wall intersection.

Thermographic
Image A3

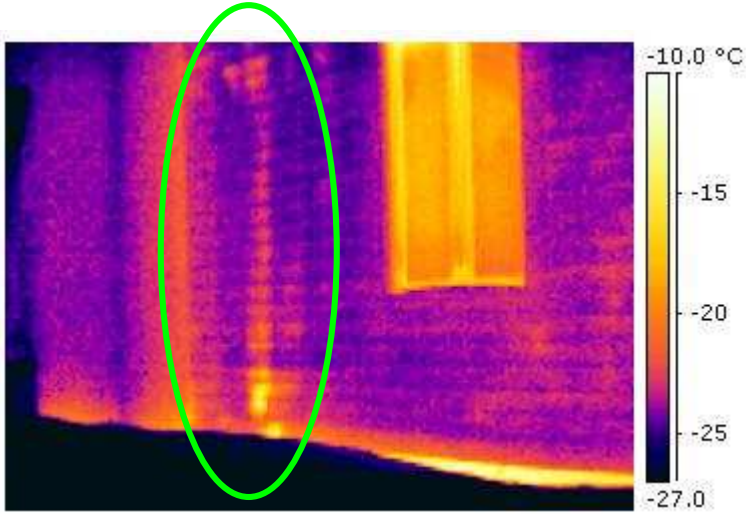



Daylight Photo

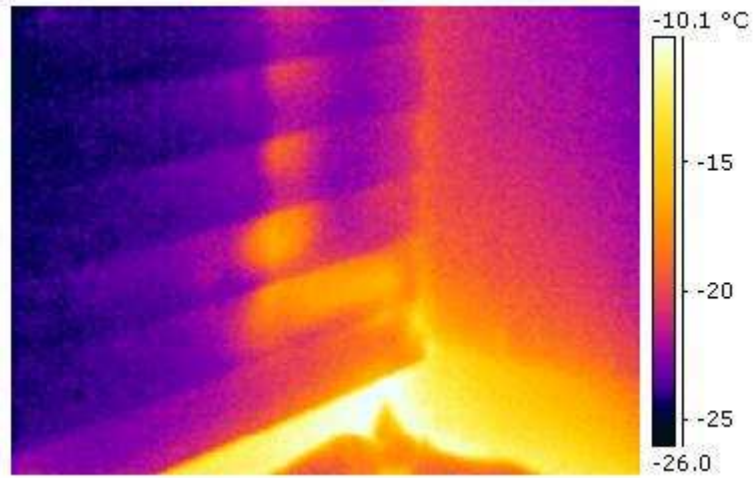


Remarks

North elevation – possible air leakage observed at top corners of window.

<p>Thermographic Image A4</p>	
<p>Daylight Photo</p>	
<p>Remarks</p>	<p>North elevation – thermal anomaly observed on right side of chimney.</p>

Thermographic
Image A5



Daylight Photo



Remarks

North elevation – thermal anomaly observed on left side of chimney.

Thermographic
Image A6



Daylight Photo



Remarks

South elevation – Thermal anomalies below second floor window and above foundation wall.

Thermographic
Image A7



Daylight Photo



Remarks

South elevation - suspected air leakage above second floor window.

Thermographic
Image A8



Daylight Photo



Remarks

South elevation – Suspected air leakage at wall/soffit interface.

Thermographic Image A9





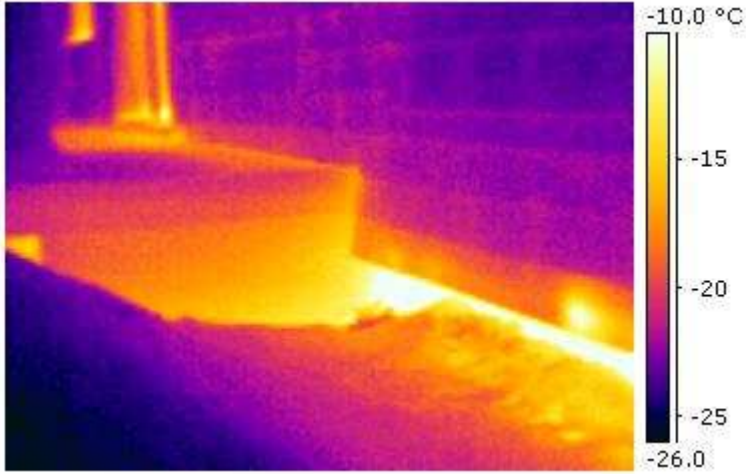

Daylight Photo







Remarks

East elevation – suspected air leakage at roof intersection and thermal anomaly at roof/wall interface.

<p>Thermographic Image A10</p>	 <p>The thermographic image shows a wall with two penetrations. The 'Electrical outlet' is labeled with a green arrow pointing to a small red spot. The 'Hose bib' is labeled with a green arrow pointing to another small red spot. A color scale on the right indicates temperatures from -10.0 °C (top, yellow) to -26.0 °C (bottom, black).</p>
<p>Daylight Photo</p>	 <p>The daylight photo shows a two-story house with a snow-covered roof and a chimney. A green circle highlights a tree trunk in the foreground, which is positioned in front of the house's east elevation.</p>
<p>Remarks</p>	<p>East elevation – no air leakage observed at electrical outlet and hose bib penetrations through wall. The cause of the thermal anomaly beneath the cantilevered concrete slab is unknown.</p>

<p>Thermographic Image A11</p>	
<p>Daylight Photo</p>	
<p>Remarks</p>	<p>East elevation – The cause of the thermal anomaly beneath the cantilevered concrete slab is unknown.</p>

<p>Thermographic Image A12</p>	
<p>Daylight Photo</p>	
<p>Remarks</p>	<p>East elevation – suspected air leakage at canopy above main entrance.</p>



<p>Thermographic Image A13</p>	
<p>Daylight Photo</p>	
<p>Remarks</p>	<p>East elevation – suspected air leakage at canopy above main entrance.</p>

Appendix B

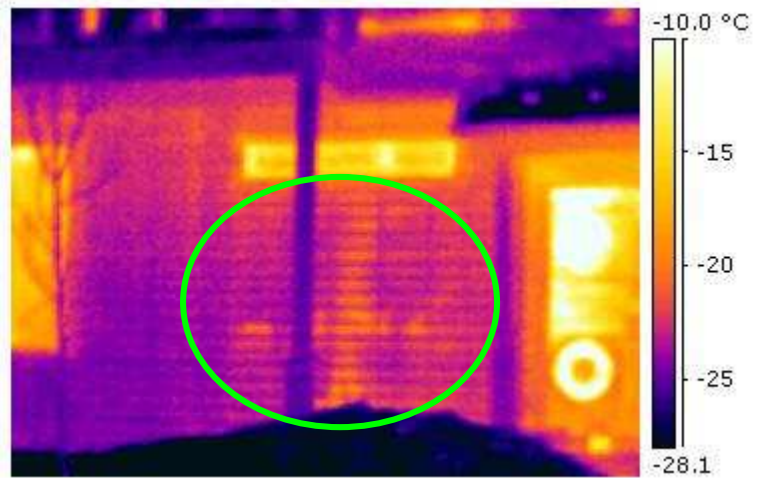
Thermographic Images

Maison EcoTerra



<p>Thermographic Image B1</p>	 <p>A thermographic image showing a brick wall. A green oval highlights a vertical thermal anomaly between two windows. A color scale on the right indicates temperatures from -10.0 °C (yellow) to -25.0 °C (dark purple).</p>
<p>Daylight Photo</p>	 <p>A daylight photograph of a two-story house with grey siding and a gabled roof. A green oval highlights a vertical joint on the right elevation, corresponding to the thermal anomaly in the thermographic image.</p>
<p>Remarks</p>	<p>Right elevation - Minor thermal anomaly between windows. The cause of this anomaly is unknown but may be related to joints between the modular components of this home.</p>

Thermographic
Image B2



Daylight Photo



Remarks

Right elevation – Thermal anomaly below window. The cause of this anomaly is unknown.

Thermographic Image B3



Daylight Photo



Remarks

Right elevation – possible air leakage above canopy roof. The cause of this anomaly is unknown.

Thermographic
Image B4



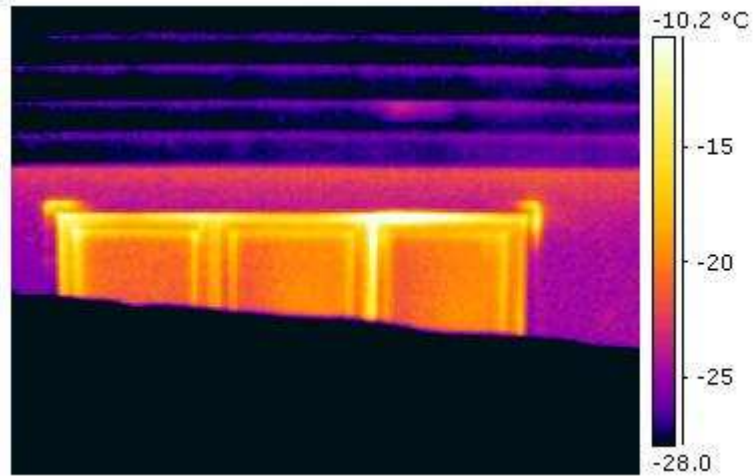
Daylight Photo



Remarks

Front elevation – Overall view, no thermal anomalies observed in this image.

Thermographic
Image B5



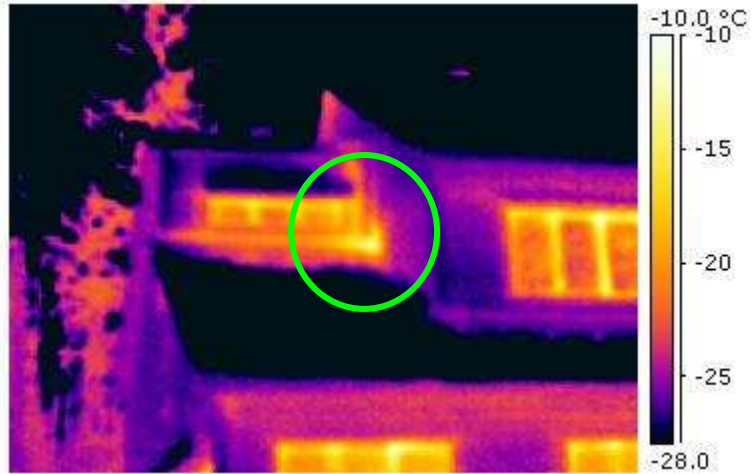
Daylight Photo



Remarks

Front elevation – suspected air leakage at top corners of windows.
This was typical at all three of these windows.

Thermographic Image B6



Daylight Photo



Remarks

Front elevation – suspected air leakage at roof/wall interface on second floor. The cause of this anomaly is unknown but may be related to joints between the modular components of this home.

Thermographic Image B7





Daylight Photo



Remarks

Left elevation – thermal anomalies observed left of patio door.
The cause of this anomaly is unknown but may be related to joints between the modular components of this home.

<p>Thermographic Image B8</p>	
<p>Daylight Photo</p>	
<p>Remarks</p>	<p>Left elevation – thermal anomalies observed above and left of patio door. This image also shows the suspected air leakage at the second floor presented in image B6. The cause of this anomaly is unknown but may be related to joints between the modular components of this home.</p>