

## Using Infrared Thermography as an Added Diagnostic Tool in Building Inspections

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### ABSTRACT

When performing most common building inspections, the methodology used is mainly visual assessment. When there are no obvious signs or symptoms appearing it is difficult to determine one way or another. This may become a confidence issue for the inspector or result in loss of business. The client(s) may want to have a definitive answer and may turn to destructive testing – a costly expedition. If this is the scenario, here is the answer – Infrared thermography. The nice thing about infrared thermography is that you do not have to perform destructive testing to pinpoint the problem and its location.

### INTRODUCTION

Infrared thermography can be performed on most buildings with the following concerns: insulation, air leakage, and moisture, electrical, heating and cooling problems. Moreover, there are other similar applications such as construction defects, and qualify or quantify if there are materials added as specified and so on. All these applications can be carried out relatively easily without performing destructive testing.

### TYPICAL APPLICATIONS

#### Insulation

Figure 1 is an IR image of missing insulation on the ceiling below an open balcony in a brand new house. The owner was perplexed by why it was so drafty sitting on the couch by the exterior wall until we showed up with the IR camera and demonstrated the insufficient insulation in the ceiling space which created the air leakage. In fact, this design was the owner's idea in the first place – back to the drawing board!

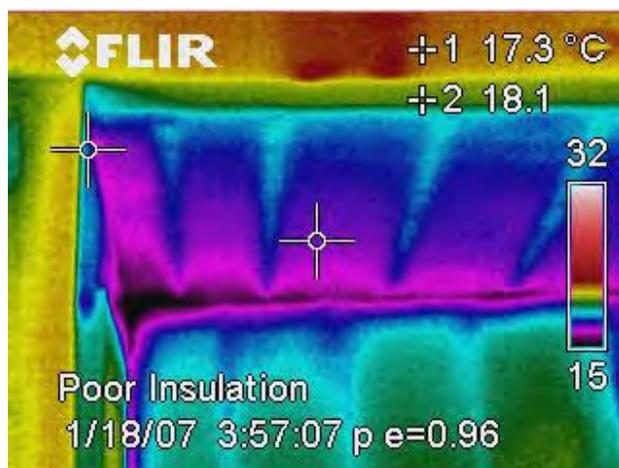


Figure 1. Thermogram and photo pair showing missing insulation on the ceiling below an open balcony.

#### Wet Insulation on Flat Roof

Figure 2 shows the IR image of the wet insulation under the single-ply flat roof which has premature leaks. The owner has a hard time finding the leaks until we showed up with our IR camera and found all the hot spots on the roof. Now, all they have to do is fix the marked areas.

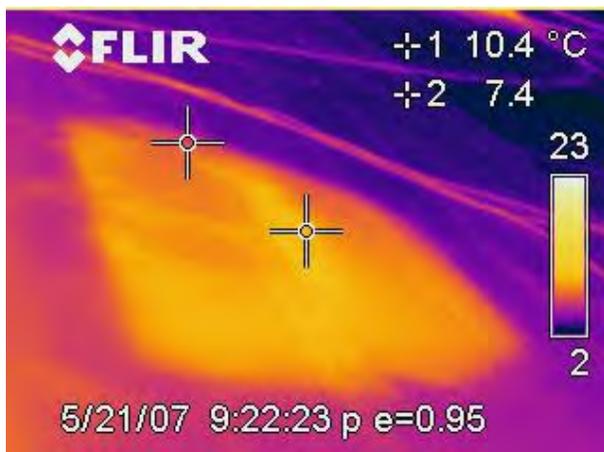


Figure 2. Thermogram and photo pair showing moisture embedded insulation on a single ply flat roof.

### Air Leakage

Figure 3 shows the IR image of the warm air coming out of the corner of the house during an inspection. IR thermography can be applied to perform an energy audit.



Figure 3. Thermogram and photo pair showing air leakage in a house inspection.

### Water Leak in a Radiant Floor System

Figure 4 shows the IR image of the water leak in a radiant floor heating pipe. Our service saves the owner from taking out all the flooring in order to find the leak. We can apply the IR camera and pinpoint the location to verify it.



Figure 4. Thermogram and photo pair showing broken pipe in the radiant floor heating system.

### Cooling Problem in an A/C System

Figure 5 shows the IR image of the non-performing brand new A/C system during an inspection. The owner has been finding puddles of water on tile and basement floors, and the relative humidity shot up after a new A/C system was installed. After a series of test by elimination, we finally determined that the problem was the non-performing A/C unit. The contractor has to return to fix it.



Figure 5. Thermogram and photo pair showing inefficient new A/C system.

### EIFS (Exterior Insulation Finish System) – Moisture Ingress

Figure 6 shows the IR image of moisture inside the stucco wall. The house was only six year old and from day one there were bubbles and patches. The builder has to return every year to patch the bubbles and within 6 years there were 50 or more patches. Finally, the owner decided to hire us to scan on all the EIFS walls and take up with the builder.

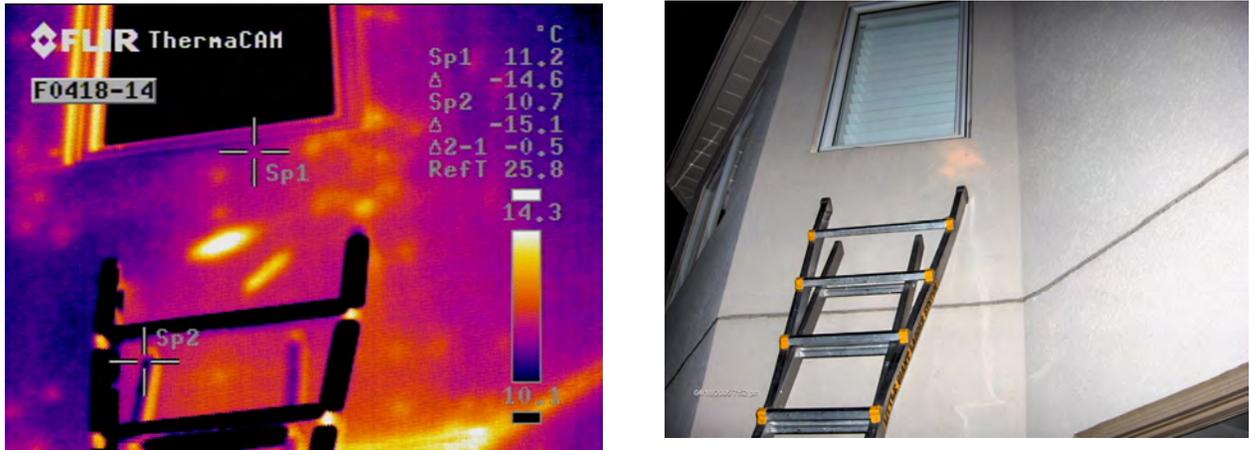


Figure 6. Thermogram and photo pair showing moisture inside the EIFS cladding.

### Poor Workmanship in Restoration after a House Fire

Figure 7 shows the IR image of the missing insulation inside the ceiling of a bedroom. The house has just been restored by a contractor after the house experienced a fire. Most of the second floor has rebuilt. After the restoration, my client moved back into the house and found the bedrooms to be very drafty and called us to investigate. We scanned the entire second floor and found almost every room experienced poor insulation and finally the insurance company agreed to allow my client to re-do the work again after taking out the previous inferior work.

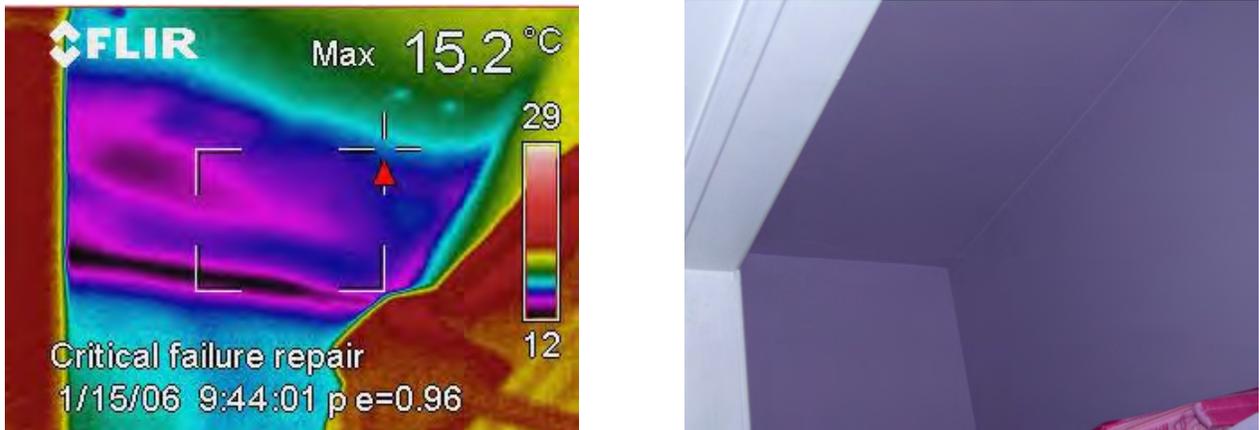


Figure 7. Thermogram and photo pair showing missing insulation in the ceiling.

### SUMMARY

The above examples show only some of the ways that IR thermography can be applied in building inspection. There are more applications when you look closer.

With the help of infrared thermography, we are certainly able to expand our condition assessments on buildings as well as be able to pin point the concerns and the locations. This is a definite plus in a competitive environment.

## **REFERENCES**

Practical Applications of Infrared Thermal Sensing and Imaging Equipment, Second Edition by Herbert Kaplan.

Exterior Insulation and Finish Systems, Best Practice Guide Building Technology published by Canadian Housing and Mortgage Corporation by Kevin Day and associates.

ASTM C-1060 Standard practice for thermographic inspection of insulation in envelope cavities of a framed building

ISO 6781 Thermal insulation, qualitative detection of thermal irregularities in building envelope, Infrared Method

## **ACKNOWLEDGEMENTS**

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## **ABOUT THE AUTHOR**

Roy is professional engineer and a Level II thermographer with over 15 years of building inspection experience.

