

Think Thermally®

June 2004

Practical news for practicing thermographers

See inside:

- 3 Thermal Solutions®
- 4 Did You Know?
- 4 Infrared Tips of the Week
- 5 Low-Cost IR Systems
- 5 Dear John

Roof Moisture Inspections with Infrared Thermography

The use of infrared for roof moisture inspections has grown tremendously over the past decade and is widely accepted as a cost-effective maintenance tool. There are literally tens of thousands of acres of flat commercial and industrial roofs throughout the world with replacement values totaling in the billions of dollars.

Many roofs develop leaks within a year or two of being installed. These leaks develop for reasons related to design, installation or maintenance. While the damage actually caused by the leak can be substantial, it is the long-term damage that will be far more costly. When water enters the roof system, it usually never dries out again; instead it causes the roof materials to degrade and fail prematurely.

By locating and replacing the wet roof insulation, subsurface moisture is eliminated and the life of a roof can be greatly extended.

Summer is often the best time to conduct infrared inspections of roofs. As a service to our subscribers, we thought it a good time to provide some refresher information.

First, how does an infrared roof moisture inspection work?

The sun provides energy that heats up the roof. If the night is clear and free of wind (or light wind—less than 10 mph), an excellent opportunity to inspect will come one to two hours after sunset. This happens when the roof has cooled to a point where the wet and dry insulation are different temperatures. It is then possible to locate the areas of wet insulation by their warmer thermal signature and characteristic shapes.

The apparent wet areas should be marked visually with spray paint applied directly to the roof surface. If necessary, the presence of moisture in a wet area can be confirmed with a moisture probe or other test method. It is possible, on a fairly uncluttered roof, to inspect upwards to 500,000 square feet in a night. The inspection window will often remain open long into the evening, until it is closed by wind or the heavy formation of dew.

Inspections may be conducted during daylight hours if the sky is overcast and the indoor temperatures are approximately 10°C (18°F) warmer than the outdoors. Under these conditions, heat will transfer through the wet insulation at a greater rate and these areas will appear warmer from the roof. Inspecting in direct sunshine can be problematic on most roofs and is generally not recommended.

continued on page 2

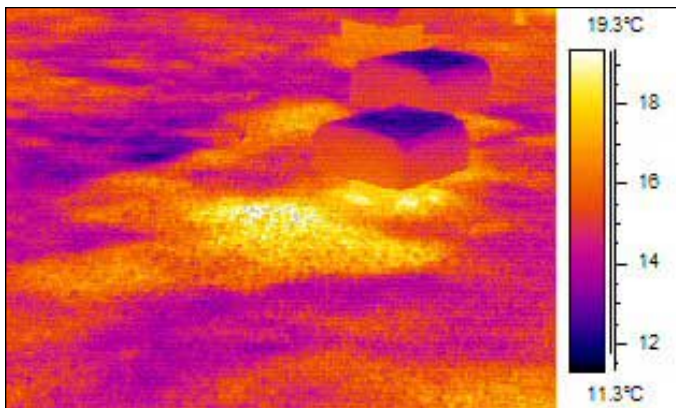


Roof Moisture Inspections, *continued from first page*

Typically, radiometric temperatures are not recorded during the inspection. Documentation is best provided with digital images of each wet area or a videotape of the entire inspection. Most thermographers work in a black and white or a monochromatic color palette with very narrow thermal “span” settings that result in high thermal contrast.

Exactly what pattern will be seen, and when?

The exact patterns that will be seen depend on environmental conditions and the type of roof insulation. Absorbent insulation types, such as fiberglass, wood fiber and perlite, yield clear signatures within an hour or two of sunset. These types of insulation are often found in built-up roofs. A “board-edge pattern,” with its characteristic right angles, results because each board of insulation tends to become saturated with water before the next board is wetted and saturated.



Thermal image of board pattern

Nonabsorbent insulation, often some type of foam, can be more difficult—if not impossible—to inspect because so little water is trapped in the structure. While these types of insulation, typically used in single-ply roofs systems, are not as readily saturated, more than enough water is trapped in the roof system to cause degradation.

Interestingly, the roof industry recommends installing an absorbent layer of insulation on top of all foam boards. Unfortunately, this recommendation is often ignored. If that layer is not installed, infrared can have limited value as an inspection tool, especially when the roof is new. Many single-ply roofs are also ballasted with a heavy layer of stone which can result in thermal signatures that are less indicative. Clearly the potential for inspection should be considered at the time of design.

Roof-top conditions themselves also help determine patterns. A roof section that is in the sun shadow of a higher wall, for instance, will not be heated to the same degree as the rest of the roof. A west facing wall, on the other hand, will re-radiate its energy to the roof long into the night, often preventing it from cooling adequately. Extra gravel or flashing material will stay

warmer, sometimes masking over wet insulation beneath. Where the roof has been previously repaired differences in the type of insulation may cause variations in the thermal signature.

How often should an inspection be conducted?

Ideally, roofs should be inspected shortly after installation to establish a baseline signature. Other suggested times include after a large weather event such as a severe thunderstorm (hail damage) or hurricane (wind). If a leak is present, quick follow-up inspections may help locate the leak and indicate the extent of the wet insulation needing repair. A well-designed and maintained roof that is not leaking may need to be inspected as infrequently as every 3–5 years.

What about safety?

Great care must be used during roof inspections to prevent accidents and injuries. Look for safe access to the roof. Never work on the roof alone at any time, day or night. The thermographer is most vulnerable because the brightness of their camera display prevents their eyes from adjusting to the low-light conditions found on the roof. At that time, they are, essentially night blind!

Be familiar with and adhere to any relevant company or government regulations, especially when people are within 3 meters (10 feet) of the roof edge. It is important to be protected from an accidental fall by using a “spotter,” an appropriate barrier or a fall-protection device. However, falling over the edge of a roof is not the only danger! Even stumbling over a small change in elevation can result in serious injury or a damaged infrared camera. It is also vital to notify all local security officials of your presence as it may be construed as a security threat—and challenged as such.

Any final thoughts?

A walking, rooftop inspection is obviously very labor intensive, relatively slow, and highly dependent on favorable weather. A great deal of information can be obtained very quickly by performing an aerial infrared roof moisture inspection. Using either a helicopter or fixed wing aircraft, the camera can be flown at altitudes between 500 and 1,500 feet depending on local air traffic requirements and the spatial resolution of the instrument. Of course, bad weather or roof conditions can result in a costly cancellation of the mission. While it may be possible to conduct aerial surveys with hand-held cameras, a dedicated infrared system is probably more appropriate for surveys of larger areas.

The potential savings from infrared roof moisture surveys are astounding. It is not unusual to extend the life of a roof by a factor to two or more. As waste disposal costs continue to climb, especially for the hazardous materials that are contained in many roofs, there is a strong incentive to repair and keep a roof rather than replace it. The bottom line is that roof maintenance, using the condition-based information provided by an infrared roof moisture inspection, is one of the best investments a maintenance professional can make.

Thermal Solutions®: The Best Choice for an Infrared Conference

If you are looking for an infrared conference and not willing to gamble your money on professional development, consider Thermal Solutions® a sure bet! This professional conference is an independent community of infrared thermographers open to everyone regardless of equipment preference, previous training or company affiliation.

Thermal Solutions® provides an exciting opportunity for thermographers to share their work with others in the greater infrared community. As the largest, vendor-neutral, infrared thermography conference available, attendees are surrounded by a wealth of information not found

anywhere else in the world of infrared.

Thermal Solutions® returns to Clearwater Beach, Florida, January 24-27, 2005. Don't miss this opportunity to share your accomplishments and insights with other thermographers.

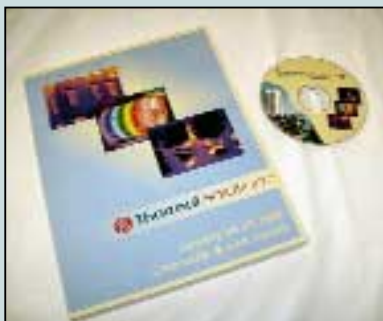
Please send abstracts to: Thermal Solutions®, P.O. Box 6, Montpelier, VT 05601-0006 or via e-mail at abstracts@thermalsolutions.org. <http://www.thermalsolutions.org>



Proceedings from Previous Conferences Available at the **Snell Infrared Web Store**

- **Over 100 presentations available from five years of conferences**
- **Full-color electronic version on CD-ROM**
- **An invaluable resource that can be a part of your predictive maintenance library**

Thermal Solutions 2004: \$109 (CD & Book Combo)
Thermal Solutions 2003: \$99 (CD & Book Combo)
Thermal Solutions 2001 & 2002: \$49 (CD & Book Combo)

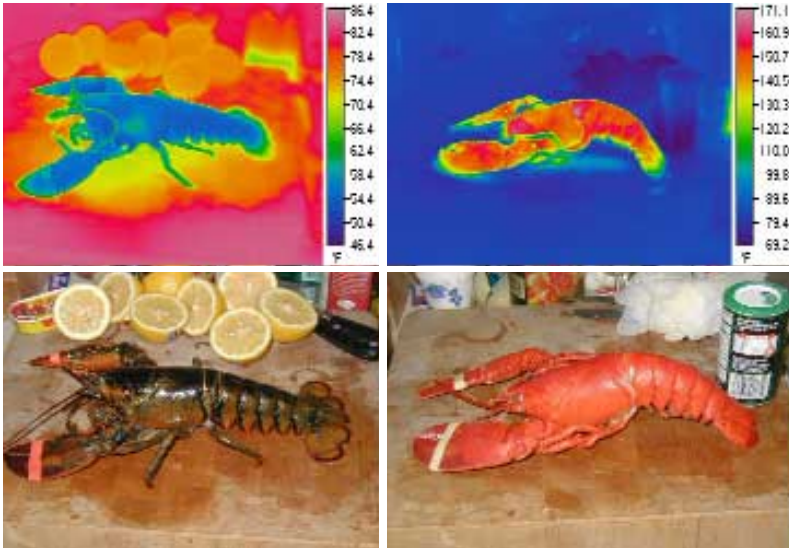


All conferences available on CD-ROM only:
2000-2001: \$39 each
2002-2004: \$59 each

www.snellinfrared.com/_store/



Did You Know???



Some Lobster Fun Facts

(Source: Lobster Institute www.lobsterinstitute.org)

- Lobsters are capable of detecting temperature changes of less than 2°C (3.6°F).
- Studies have shown that lobsters avoid water that is warmer than 19°C (66°F) or colder than 13°C (about 55°F).
- The temperature range which is thought to promote the maximum amount of growth in juvenile lobsters is between 15° and 20°C (59°–68°F).

INFRARED TIPS OF THE WEEK

Monday:

When you are working with low loads, either electrical or mechanical, the indications of a problem may be subtle or not even evident. For electrical systems, a minimum of 40% of design load is recommended (National Fire Protection Association NFPA 70B), and the higher the better. When you must inspect in low load situations, note all problems, even if they have a small temperature increase. While the exact change in temperature is often impossible to predict, all other things being equal, one thing is certain: as loads increase, so will the temperature of the high resistance hot spot.

Tuesday:

It is not unusual for some people in the office areas to complain about the temperature in their area. Often the problem is a simple one, related to a poorly designed heating or air conditioning system. Use your camera to look at the effects of incoming air and exhaust air over the ducts. If the space is being conditioned effectively, the two should be different! Also look around the room at walls and furniture. Again, if the system is designed and working properly, they should all be similar in temperature and that should be close to the temperature of the exhaust air. It is not unusual to find simple problems like misplaced ducts, fans blowing the wrong way, "short circuiting" of air, or massive air leakage into or out of the area. Once you know you have a problem, infrared is a great tool to help show where it is and suggest a solution.

Wednesday:

Until you find a problem you are interested in, don't even worry about measuring temperatures or setting emissivity! When you do find a "hot one" (or even a cold one!), that's the time to make a corrected temperature measurement. Many students coming into our courses get fixated on the temperature and forget to look at the image. By the end of Level I we've helped them put the "cart before the horse" and they are on the road to success.

Think Thermally!

Low-Cost Systems Gaining Popularity

The imaging industry is dynamic and exciting right now. Attendees at our annual conference—Thermal Solutions®—saw, and will see again, a whole new offering of infrared cameras. Even newer imagers have become available as you read this, many of them from relatively young players in the industry. All price points in the market have seen some change; however, it is the low-cost (under \$20,000) segment that has drawn some of the strongest interest. The availability of these products is bringing an entirely new group of thermographers to the marketplace.

Low-cost systems do give up features many traditional thermographers have come to expect as standard. However, this new group of new thermographers is finding they may not need all the horsepower others have often taken for granted.

One difference in some of the products is the size of the detector matrix used, a 160x120 detector array versus the 320x240 arrays used in most Focal Plane Array (FPA) systems to date. Image quality can vary depending on the lens used and the image processing routines employed, but there are some remarkably viable options available in these products.

Also, several units have moved to spot temperature measurement with a fully radiometric image available in the desktop processing software. Apparently, this has not been seen as a major problem for hundreds of thermographers who are looking to enter the market. For some applications, such as roof moisture inspections, several non-radiometric systems have proven to be extremely popular and effective.

Training is, of course, still essential both in learning about and utilizing the technology. Snell Infrared has responded to these market changes by offering new ways to meet the Level I educational requirements of the American Society for Nondestructive Testing by combining two shorter courses. Snell Infrared continues to offer our traditional 32-hour Level I courses throughout the year as well.

If you are planning to purchase a new infrared camera, a replacement or even an additional system, please feel free to call us with any questions. While we have training agreements with many manufacturers, Snell Infrared remains completely independent of all product sales. You will experience an honest, well-informed discussion about your needs and the products that can meet them, including these exciting, new, low-cost imagers available today.

Dear John:

Q I'm just getting started in the IR inspection business (for maintenance) and was wondering what the fees/start-up costs are for your typical service provider?

A *Although there are many additional variables, here are some considerations as a starting point:*

Thermographers rates of pay vary widely depending on their skills, the market and the job they are tackling. It is common to see service providers that charge \$700–\$800/day for 6–8 hours of work. Typically expenses are added to this.

It is also not uncommon to see competition as low as \$450/day, usually a one-man shop with little or no credentials and an old IR system. We have seen examples where they do not even open electrical enclosures at this rate! On the high end you may find a few at \$2000/day who can add the value of engineering expertise, big name recognition and a higher end camera. A good practice is to find out from those working in your area what they are charging.

Rates can also vary depending on the number of days spent at a given job. For instance, the first day might be \$800 with subsequent days priced at \$750. Report time is another area which varies extensively and deserves careful consideration. Many thermographers simply count on spending the last hour/day at the job site writing up the day's work and build right into the daily rate. It makes sense in that if there are problems or questions, these can be handled smoothly. It also means you can have your evenings free, as opposed to writing reports in the hotel room, a common practice.

Thermographers are advised to press forth their qualifications rather than a lower price. It's important to first figure out what it takes to run a viable business (paying for training, professional development, camera, overhead, support, marketing and sales, benefits, etc.) BEFORE jumping in! You might learn that it can be difficult to make a go of it even at \$700-\$800 a day. If you are starting from scratch, plan on 18-30 months of building the business before it truly hits goal; this has often been the case in our experience.

You can reach Think Thermally® at:

Snell Infrared

P.O. Box 6, Montpelier, VT 05601-0006

Phone: 800-636-9820 / Fax: 802-223-0460

E-mail: thinkthermally@snellinfrared.com

Web Site: <http://www.snellinfrared.com>

Snell Infrared Remaining 2004 Course Schedule

Level I (\$1,495)

Minneapolis, MN	June 21–25
Montpelier, VT	August 9–13
Portland, OR	September 13–17
Charlotte, NC	October 4–8
Dallas, TX	November 8–12
Toronto, ON Canada	November 22–26
Montpelier, VT	December 6–10

Level II (\$1,495)

Minneapolis, MN	June 21–25
Montpelier, VT	September 13–17
Dallas, TX	November 8–12
Toronto, ON Canada	Nov. 29–Dec. 3

Level III, Best Practices (\$995)

Toronto, ON Canada	June 7–9
Indianapolis, IN	October 19–21

Specialty Courses (\$750)*

Mechanical Applications:

Phoenix, AZ Sept. 30–Oct. 1

Electrical Applications:

Phoenix, AZ September 28–29

Building Applications:

Toronto, ON Canada December 7–8

* Level I or extensive thermographic experience is a recommended pre-requisite for these two-day Specialty Courses.

**Don't forget Thermal Solutions®
January 24–27, 2005**

*Don't gamble on
professional development!
Consider Thermal Solutions®
a sure bet. Details inside.*

Snell Infrared 

Training, Certification and Support for Thermographers

P.O. BOX 6
MONTPELIER,
VERMONT
05601-0006

1.800.636.9820

FAX 802.223.0460