

# **Infrared Thermographic Roof Moisture Analysis**

**PERFORMED FOR:** Viking Construction  
1387 Seaview Ave.  
Bridgeport, CT 06607

**LOCATION:** Westhill High School -  
Outbuildings  
Stamford, CT

**CONDUCTED ON:** July 30, 2019

**REQUESTED BY:** Jo Ann Michaels

**PERFORMED BY:** Joshua Wilson, Certified Thermographer

IR Analyzers / Vector Mapping  
65 Lyman Drive  
Williston, VT 05495  
(800) 879-1964

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August 7, 2019

Jo Ann Michaels  
Viking Construction  
1387 Seaview Ave.  
Bridgeport, CT 06607

Dear Jo Ann,

This report summarizes the findings of our Infrared Roof Moisture Analysis of the roofs at the Westhill High School - Outbuildings, Stamford, CT, performed on July 30, 2019.

Included in this report are 7 Thermograms and Control Photos taken during the inspection, and information about interpreting these images. Also included are four copies of an AutoCAD® map of the roofs. This report also includes descriptions of Infrared Thermography, as well as survey procedures and the weather conditions on the date of the infrared testing.

### **WEATHER CONDITIONS**

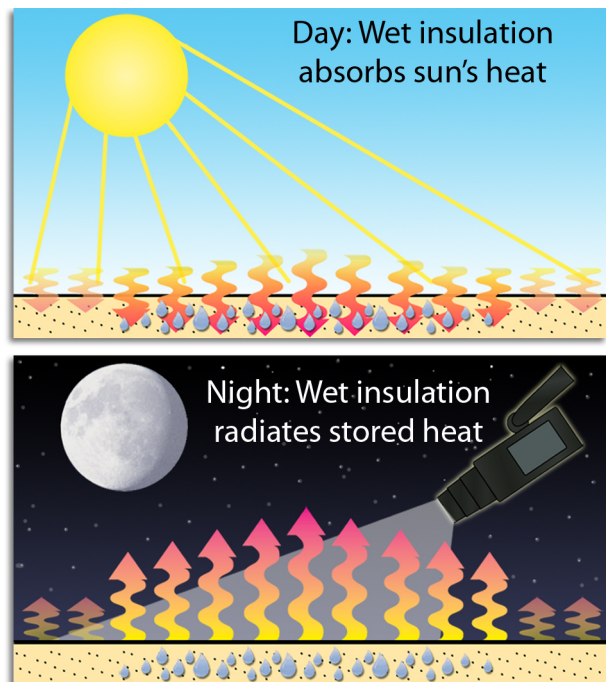
The Infrared Roof Moisture Survey was performed during the night of July 30, 2019. During the day the weather was sunny with a high temperature of approximately 96°F. At night the sky was clear with calm winds and an ambient nighttime temperature of approximately 83°F.

## INFRARED THERMOGRAPHY

All objects emit heat (i.e. infrared radiation). This radiation is constantly being absorbed and re-emitted by ourselves and everything around us. “Infrared scanning” and “thermography” are the terms used to describe the process of making this thermal radiation visible and capable of interpretation.

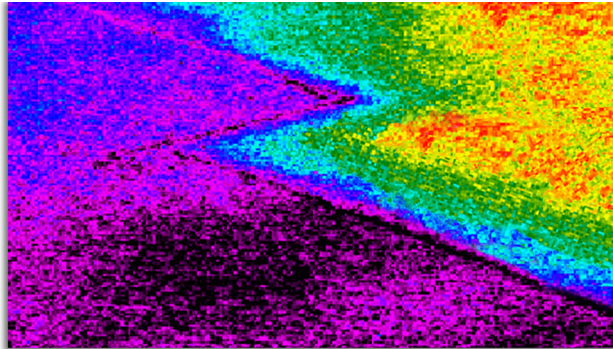
Infrared Roof Moisture Analysis locates areas of wet insulation within a flat roofing system. These areas of wet insulation can be pinpointed with the infrared scanner because wet and dry insulations have different abilities to conduct, absorb and retain heat. The thermal differences between wet and dry insulation are especially evident under two sets of circumstances.

First, wet roof insulation absorbs much more heat than dry insulation. Moisture-damaged insulation also stores more heat over a longer period of time than intact, dry materials. During the day, the sun’s heat raises the temperature of wet insulation in the roofing system. As the roof cools off at night, the areas of wet insulation will stay warm longer than the dry areas. During the evening, this stored “solar gain” is released as radiant heat that is detectable with the infrared camera. As the evening progresses, areas of wet insulation will appear warmer to the camera than adjacent dry roofing.



Second, when there is a significant difference in ambient temperature between the interior and exterior of the building, heat losses from inside the building will be greater through the wet areas due to the reduced R-value of the wet insulation. This is especially true during the heating

season. In both instances, when viewed from the roof side, wet insulation will show up as warmer in the infrared image. Often these two phenomena work together, creating strong, long-lasting thermal images that clearly illustrate the differences between wet and dry insulation.



Thermographic image from infrared camera



Control image, wet sections marked for removal

Our Infrared cameras can also be used in a variety of other Nondestructive testing applications:

- Infrared Electrical/Mechanical Inspections pinpoint developing problems in power delivery systems. The infrared scanner can “see” hot spots where there are going to be failures, before they happen. This Predictive Maintenance approach provides for time to repair these problem areas before they cause equipment damage, unscheduled outages, and downtime. Problem areas are pinpointed, prioritized and fully documented.
- Infrared Steam System Inspections pinpoint failing steam traps, malfunctioning heat exchangers and boiler problems. These surveys can save thousands of dollars by reducing energy usage.
- Infrared Building Envelope Analysis locates and documents building heat loss problems, including sources of mold, drafts, and excess moisture. Infrared thermography is the only nondestructive and complete system for locating the causes of frozen pipes, ice dams, missing or wet insulation and high heating costs. Infrared Building Envelope Surveys provide valuable performance data for newly constructed buildings and energy retrofits.

### **INSTRUMENTATION**

Your roofs were inspected with a FLIR T420, a professional long wave infrared camera. In combination with the powerful FLIR Tools+ software, the T420 system enables highly detailed image/data processing in the Windows® environment.

<b>FLIR® T-420 Specifications</b>	
Detector	FPA uncooled microbolometer 320 x 240
Spectral band	7.5 to 13 µm
Sensitivity (NETD @ 30°C)	< 0.045°C
Temperature measurement range	-20 to 650° C
Focus range	9" to infinity
FOV (standard lens)	25° x 19°
Zoom	4x continuous
Minimum Focus Distance	0.4 meters
Video/Image Output Format	MPEG-4, USB, Wi-Fi

### **SURVEY PROCEDURES**

The IR Analyzers Certified Thermographers followed defined survey procedures when inspecting your roof.

GUIDELINES: Every square foot of roofing in the contract was scanned a minimum of two times.

VERIFICATION: These roofs were under a manufacturer's warranty. Therefore, to avoid any possibility of jeopardizing this warranty, the Certified Thermographer did not take core samples or moisture probes of the roof to verify presence of water. The Infrared Cameras we use are extremely sensitive and accurate when locating areas of wet insulation. However, as with any non-destructive testing technique, there exists a slight possibility that false positives or false

negatives may occur. Due to the lack of absolute physical verification, the areas marked on your roof and on the maps should be considered to represent suspected or probable areas of wet insulation, rather than verified areas of wet insulation.

MAPPING: After all the scanning and verification were completed, the roof was mapped. A draft copy of your drawing was made at the site, documenting all the information generated during the inspection. A final copy of the map was plotted in the office using an AutoCAD System. Please note that the measurements displayed in these maps should not be used as a substitute for as-built drawings.

### **FINDINGS**

As per our survey procedures, the entire roof area in the contract was scanned a minimum of two times. No areas of suspected wet insulation were detected in the top layer of roofing.

The total size of the roofs that were inspected with the infrared camera is approximately 12,067 square feet. Please refer to these maps when reviewing the report.

### **THERMOGRAM INTERPRETATION AND DOCUMENTATION**

Hard copy documentation of the survey findings is provided through the use of two different types of photographs. Color Thermograms (photographs of the infrared image) and Control Photos (conventional pictures of the same scene taken during the inspection) are provided of sample wet areas uncovered during the inspection. Dry areas of roofing are cooler, while wet areas are warmer. In the thermograms, temperatures are indicated in various colors. The following is a chart illustrating the hierarchy of colors that the ThermoCAM PM390 uses to represent the relative temperature differences of the wet areas and adjacent dry roofing:



The next section of the report contains the 7 sets of thermograms and control photos that were generated during the inspection. The locations and directions from which these photos were taken are marked on the roof maps and directly on the roof surface with spray paint.



### **ROOF MAPS**

The last part of the bound hard-copy version of this report contains four copies each of a map of the roofs. These scaled drawings were plotted on an AutoCAD system and complete the documentation of the findings of the survey.

No information regarding the integrity of the roofing system or building is provided or implied in this report. Many factors, including sunlight, precipitation, wind, foot traffic, and building movement and the like can affect a roof over a short period of time. Regular inspections ensure early detection of problems and can extend the life of a roof membrane.

Jo Ann, thank you for using our Infrared Services. Please call me if you have any questions regarding this report, or if I can help in any way.

Sincerely,

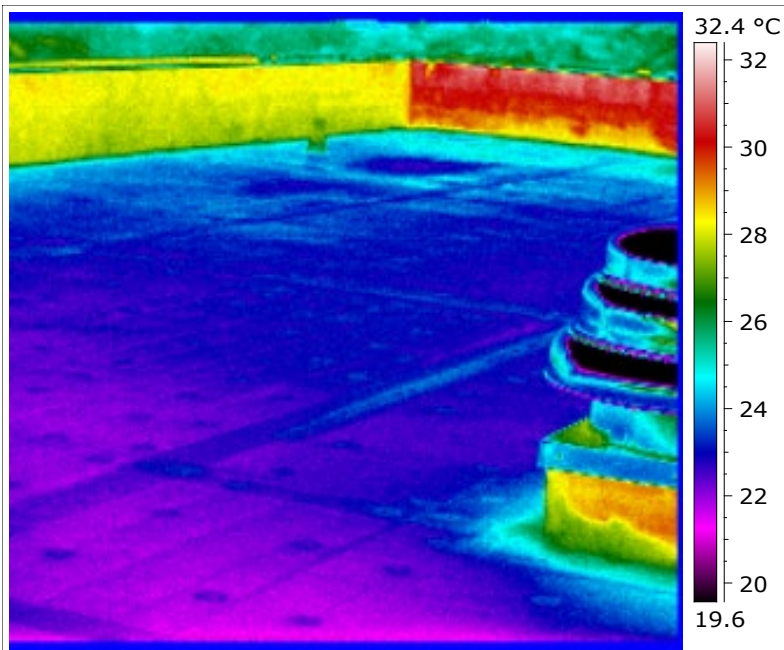
J.P. Phillips  
Director of Operations

**Control Photo:**  
Visible Light  
Image



Dry Area of Roofing –Building 1

**Thermogram:**  
Infrared  
Image



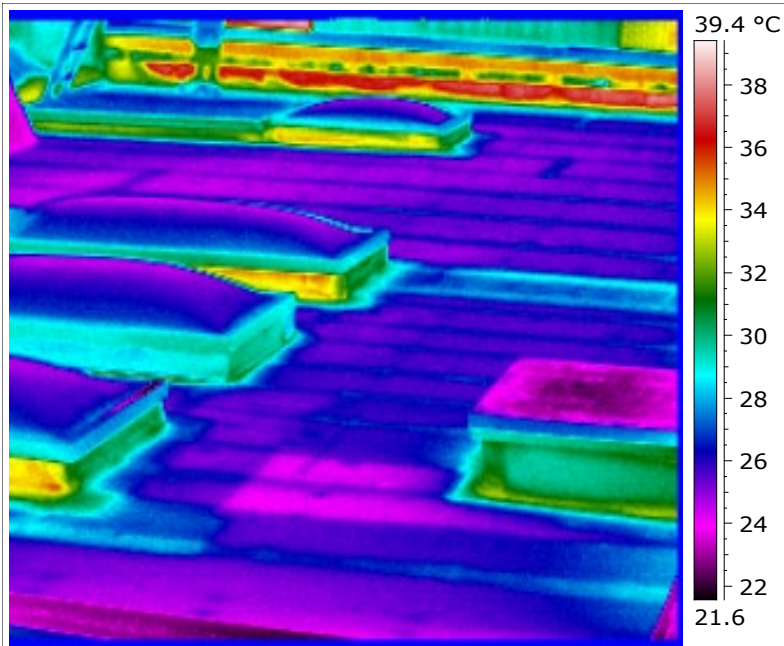
Thermogram # 1

Control Photo:  
Visible Light  
Image



Dry Area of Roofing – Buliding 1

Thermogram:  
Infrared  
Image

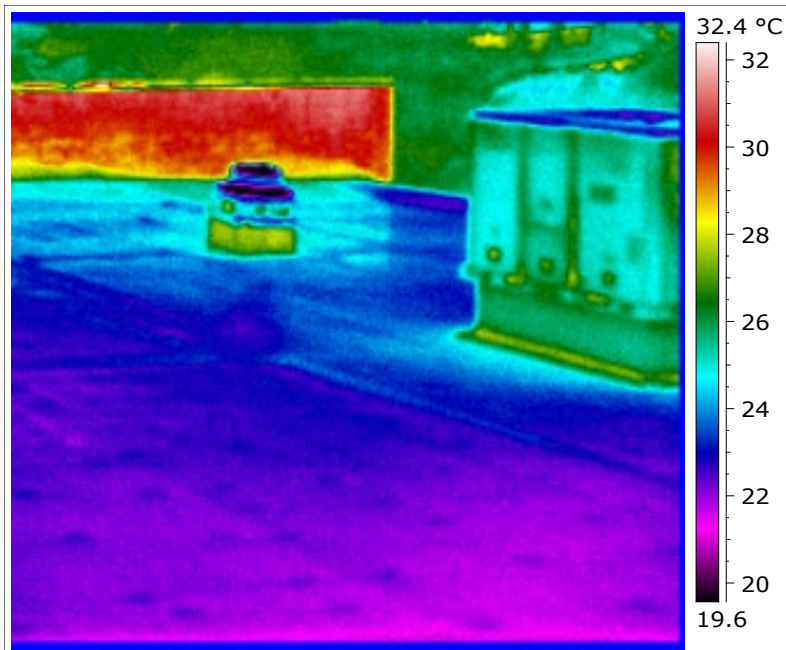


Thermogram # 2

**Control Photo:**  
Visible Light  
Image

Dry Area of Roofing – Building 1  
Control Photo not Available

**Thermogram:**  
Infrared  
Image

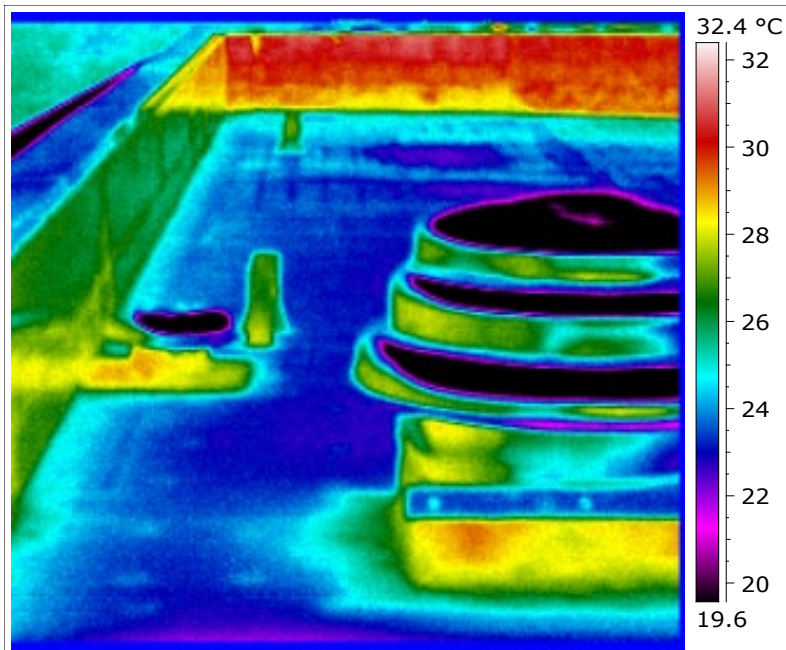


Thermogram # 3

**Control Photo:**  
Visible Light  
Image

Dry Area of Roofing – Building 1  
Control Photo not Available

**Thermogram:**  
Infrared  
Image



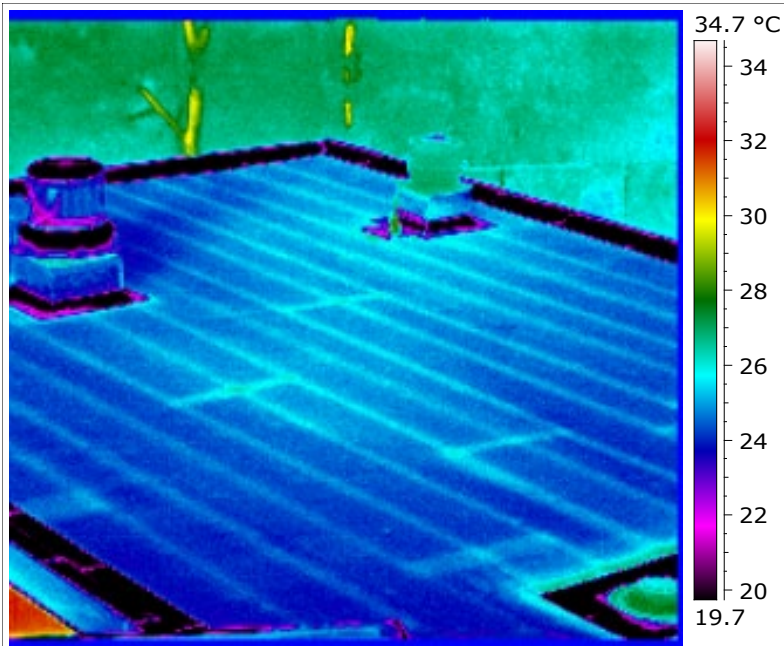
Thermogram # 4





**Control Photo:**  
Visible Light  
Image

Dry Area of Roofing – Building 2



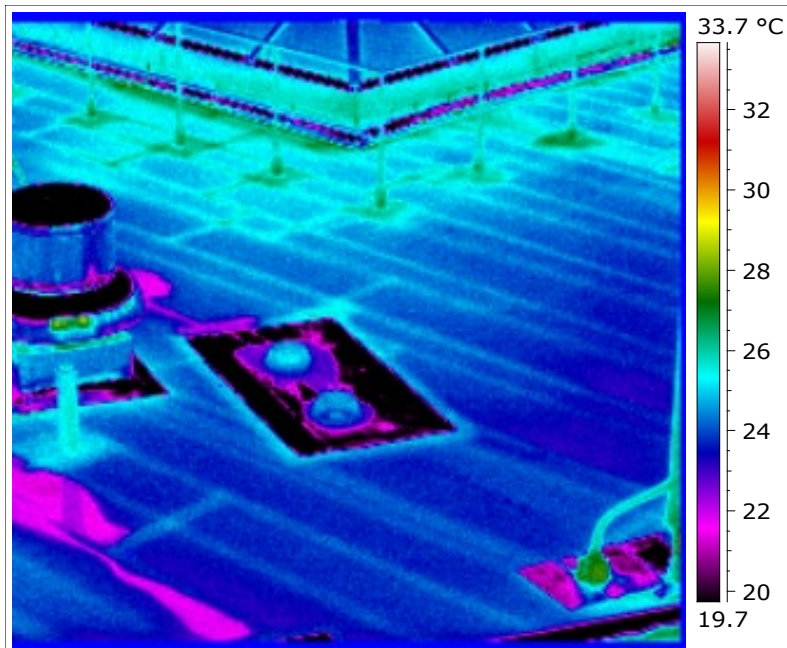
**Thermogram:**  
Infrared  
Image

Thermogram # 5



**Control Photo:**  
Visible Light  
Image

Dry Area of Roofing – Building 2



**Thermogram:**  
Infrared  
Image

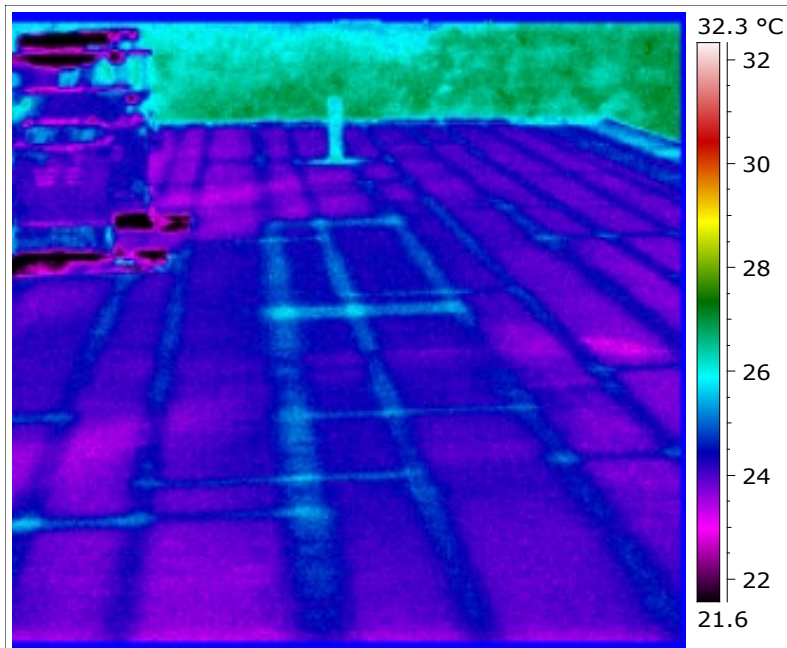
Thermogram # 6





**Control Photo:**  
Visible Light  
Image

Dry Area of Roofing – Building 2



**Thermogram:**  
Infrared  
Image

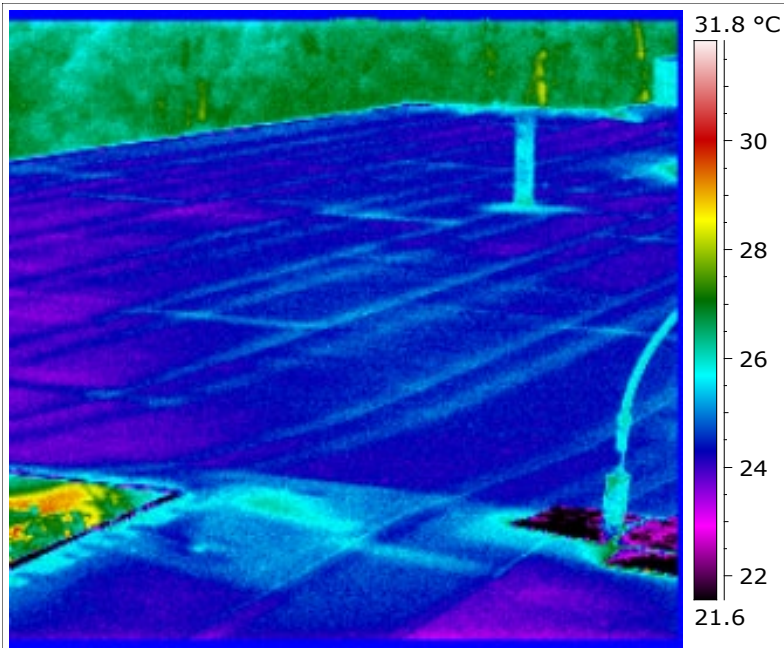
Thermogram # 7

**Control Photo:**  
Visible Light  
Image



Dry Area of Roofing – Building 2

**Thermogram:**  
Infrared  
Image



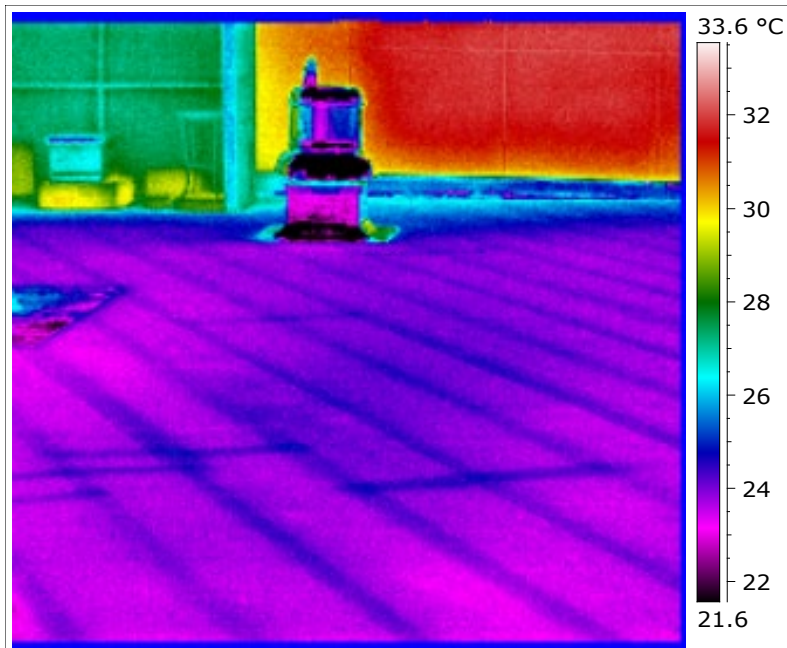
Thermogram # 8

**Control Photo:**  
Visible Light  
Image



Dry Area of Roofing – Building 2

**Thermogram:**  
Infrared  
Image

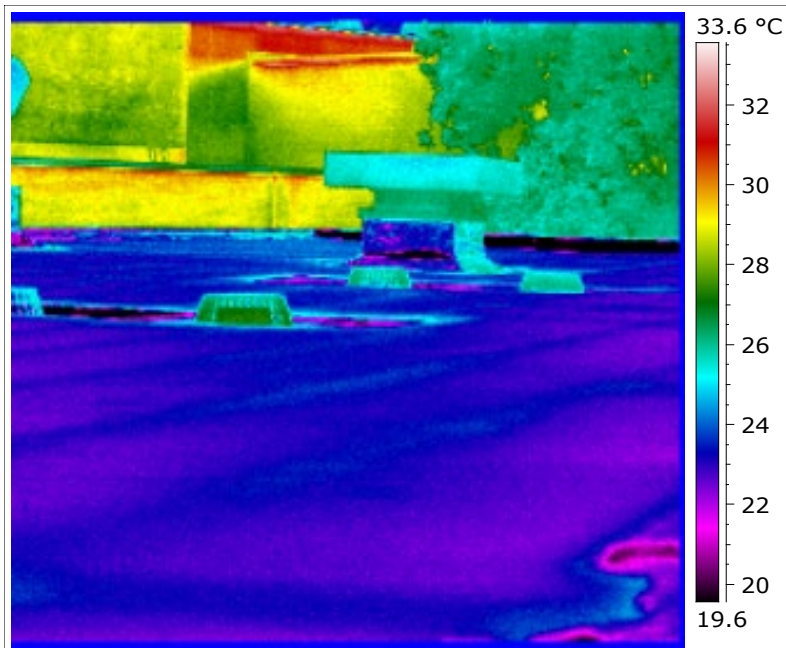


Thermogram # 9

**Control Photo:**  
Visible Light  
Image

Dry Area of Roofing – Building 2  
Control Photo not Available

**Thermogram:**  
Infrared  
Image



Thermogram # 10