Infrared Roof Moisture Survey

Wallkill Central School District
Wallkill Senior High School

Date:

June 14, 2022

Prepared For:

Tetra Tech Architects & Engineers
10 Brown Road
Ithaca, NY 14850

Prepared By:

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Table of Contents

Operating Principles of Moisture Detection Equipment

Troxler 3216 Nuclear Moisture Detector:

The Nuclear Moisture Detector is an extremely accurate and sensitive device specifically designed for performing non-destructive roof moisture surveys. The nuclear detector can detect very small quantities of moisture regardless of where it is located within the roof system. This enables the detector to, in most cases, differentiate between damp and wet insulation. The maximum operating depth is about 8 inches. Contradictory to its name, the moisture detector does not directly measure or detect moisture. The instrument locates moisture by seeking out hydrogen atoms. Hydrogen atoms are present in organic materials and are most abundant in water.

A radioactive source of Americium 241:Beryllium is encapsulated and sealed within the instrument. When the instrument is activated, fast neutrons are produced by exposing the Americium to the Beryllium. The fast neutrons collide with hydrogen atoms and are "thermalized" or slowed down. The meter measures the rate of collision for a pre-set time period, similar to radar, and displays the count on a digital periodic rate meter. Since all hydrogen bearing materials contribute to the count rate, the meter must be calibrated for each roof to obtain absolute moisture readings and to keep operator interpretation to a minimum.

Flir E8 and E30bx Infrared Cameras:

This system measures temperature differentials found on the roof surface by detecting infrared radiation which is converted to an electrical signal and then to a video signal that is displayed on a small screen. Wet areas absorb and hold heat from solar radiation and from building heat loss longer than dry areas do. This is because wet insulation is a better conductor of heat than dry insulation is. Dry areas cool off quickly and therefore do not readily absorb and hold heat. The infrared camera locates the wet insulation by detecting the surface temperature differences between the wet and dry areas.

END OF SECTION

Moisture Survey Procedures

The following procedures were used to conduct this moisture survey:

1. The roof was scanned with an Infrared Camera. The moisture contours of all wet areas were marked on the roof surface with orange spray paint.

2. A roof plan was drawn to scale showing all roof top equipment and the locations and contours of all moisture laden insulation.

3. Thermograms were taken at selected anomalies.

4. As a final verification of the moisture testing, one or more core samples were taken to verify the conditions and to determine the exact roof construction.

5. This report defines; the roof construction and the conditions of the roof system at the core locations, and the square footage and percent of total roof area containing dry insulation and moisture laden insulation.

END OF SECTION

Moisture Survey Report

Scope of Survey

The intent of the survey was to document the location and extent of moisture intrusion into the roof system.

Anomalies

The roof system was scanned with a Flir E8 and a Flir E30bx infrared camera. The locations and contours of all anomalies have been marked on the roof surface with pink paint. Moisture content of the anomalies were verified using the nuclear moisture gauge. Thermograms of some of the anomalies are shown in this report

Thermograms

Thermograms are heat images taken with the infrared camera. Thermograms were taken of several anomalies located during the survey. The locations of the thermograms can be found on the drawing.

Core Sample Construction & Moisture Content

Roof 13 @ Core 1

- Granular Surface Silicone Membrane
- 1½"± Spray-In-Place Urethane Foam Insulation **(wet)**
- Asphalt Membrane **(did not cut)**
  - The remainder of the roof construction was not determined

Moisture Quantities

The subsurface moisture content of the roof system expressed in sq.ft., percentage of roof area, and number of moisture laden locations is as follows:

Roof 1 = 3,120 ± sq.ft.

Dry insulation = 2,364 ± sq.ft. or 76% of the roof area.

Damp to wet insulation = 756 ± sq.ft. or 24% of the roof area.

Number of moisture laden locations = 29 spots up to 1 sq.ft. and 16 areas up to 470 sq. ft.

Roof 2 = 6,280 ± sq.ft.

Dry insulation = 6,201 ± sq.ft. or 99% of the roof area.

Damp to wet insulation = 79 ± sq.ft. or 1% of the roof area.

Number of moisture laden locations = 9 spots up to 1 sq.ft. and 12 areas up to 28 sq. ft.

Roof 3 = 14,516 ± sq.ft.

Dry insulation = 12,757 ± sq.ft. or 88% of the roof area.

Damp to wet insulation = 1,759 ± sq.ft. or 12% of the roof area.

Number of moisture laden locations = 106 spots up to 1 sq.ft. and 92 areas up to 300 sq. ft.

Roof 4 = 10,464 ± sq.ft.

Dry insulation = 8,555 ± sq.ft. or 81% of the roof area.

Damp to wet insulation = 1,909 ± sq.ft. or 19% of the roof area.

Number of moisture laden locations = 47 spots up to 1 sq.ft. and 54 areas up to 580 sq. ft.

Roof 5 = 2,657 ± sq.ft.

Dry insulation = 2,592 ± sq.ft. or 97% of the roof area.

Damp to wet insulation = 65 ± sq.ft. or 3% of the roof area.

Number of moisture laden locations = 1 spots up to 1 sq.ft. and 6 areas up to 45 sq. ft.

Roof 6 = 3,522 ± sq.ft.

Dry insulation = 3,295 ± sq.ft. or 93% of the roof area.

Damp to wet insulation = 227 ± sq.ft. or 7% of the roof area.

Number of moisture laden locations = 10 spots up to 1 sq.ft. and 10 areas up to 160 sq. ft.

Roof 7 = 6,064 ± sq.ft.

Dry insulation = 5,424 ± sq.ft. or 89% of the roof area.

Damp to wet insulation = 640 ± sq.ft. or 11% of the roof area.

Number of moisture laden locations = 24 spots up to 1 sq.ft. and 25 areas up to 360 sq. ft.

Roof 8 = 1,590 ± sq.ft.

Dry insulation = 1,590 ± sq.ft. or 100% of the roof area.

Roof 9 = 680 ± sq.ft.

Dry insulation = 385 ± sq.ft. or 57% of the roof area.

Damp to wet insulation = 295 ± sq.ft. or 43% of the roof area.

Number of moisture laden locations = 7 spots up to 1 sq.ft. and 12 areas up to 80 sq. ft.

Roof 10 = 11,160 ± sq.ft.

Dry insulation = 9,200 ± sq.ft. or 82% of the roof area.

Damp to wet insulation = 1,960 ± sq.ft. or 18% of the roof area.

Number of moisture laden locations = 87 spots up to 1 sq.ft. and 79 areas up to 1,050 sq. ft.

Roof 11 = 2,196 ± sq.ft.

Dry insulation = 1,510 ± sq.ft. or 69% of the roof area.

Damp to wet insulation = 586 ± sq.ft. or 31% of the roof area.

Number of moisture laden locations = 29 spots up to 1 sq.ft. and 21 areas up to 260 sq. ft.

Roof 12 = 13,938 ± sq.ft.

Dry insulation = 13,723 ± sq.ft. or 98% of the roof area.

Damp to wet insulation = 215 ± sq.ft. or 2% of the roof area.

Number of moisture laden locations = 10 spots up to 1 sq.ft. and 21 areas up to 110 sq. ft.

Roof 13 = 7,793 ± sq.ft.

Dry insulation = 5,918 ± sq.ft. or 76% of the roof area.

Damp to wet insulation = 1,875 ± sq.ft. or 24% of the roof area.

Number of moisture laden locations = 46 spots up to 1 sq.ft. and 69 areas up to 990 sq. ft.

Roof 14 = 1,720 ± sq.ft.

Dry insulation = 1,700 ± sq.ft. or 99% of the roof area.

Damp to wet insulation = 20 ± sq.ft. or 1% of the roof area.

Number of moisture laden locations = 4 spots up to 1 sq.ft. and 3 areas up to 12 sq. ft.

Roof 15 = 5,177 ± sq.ft.

Dry insulation = 4,728 ± sq.ft. or 91% of the roof area.

Damp to wet insulation = 449 ± sq.ft. or 9% of the roof area.

Number of moisture laden locations = 59 spots up to 1 sq.ft. and 43 areas up to 72 sq. ft.

Roof 16 = 1,602 ± sq.ft.

Dry insulation = 1,602 ± sq.ft. or 100% of the roof area.

Roof 17 = 11,582 ± sq.ft.

Dry insulation = 9,003 ± sq.ft. or 97% of the roof area.

Damp to wet insulation = 2,579 ± sq.ft. or 3% of the roof area.

Number of moisture laden locations = 3 spots up to 1 sq.ft. and 9 areas up to 1,250 sq. ft.

Roof 18 = 3,878 ± sq.ft.

Dry insulation = 7,661 ± sq.ft. or 97% of the roof area.

Damp to wet insulation = 217 ± sq.ft. or 3% of the roof area.

Number of moisture laden locations = 6 spots up to 1 sq.ft. and 17 areas up to 42 sq. ft.

Roof 19 = 900 ± sq.ft.

Dry insulation = 900 ± sq.ft. or 100% of the roof area.

Roof 20 = 300 ± sq.ft.

Dry insulation = 300 ± sq.ft. or 100% of the roof area.

Building Total = 109,139 ± sq.ft.

Dry insulation = 66,919 ± sq.ft. or 93% of the roof area.

Damp to wet insulation = 13,631 ± sq.ft. or 7% of the roof area.

Number of moisture laden locations = 477 spots up to 1 sq.ft. and 489 areas up to 1,250 sq. ft.

Summary

The moisture survey indicates as accurately as existing conditions permit, the subsurface conditions of the roofs at the time the survey was conducted.

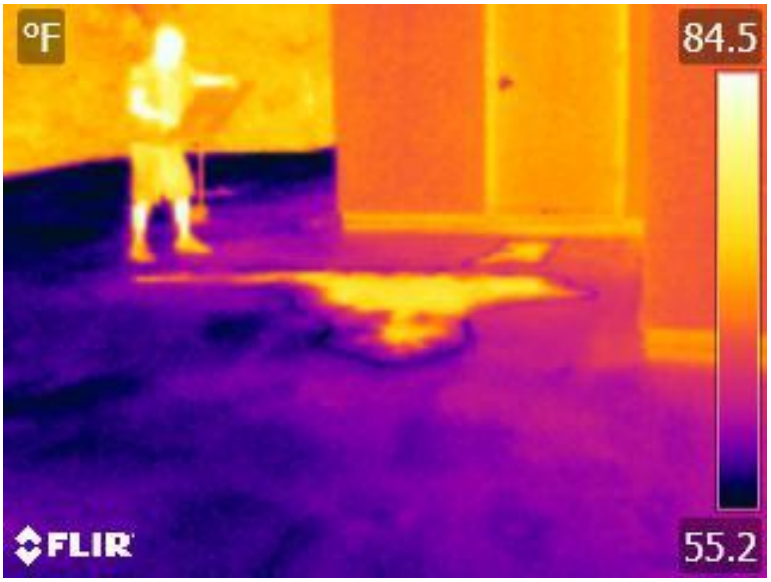
If there will be a long delay between the time the survey was conducted and when the repair or replacement work will begin, we suggest the wet areas be remarked with spray paint before the paint that defines the areas fades away. The paint that was applied during the survey should last at least 3 to 6 months before repainting may be required.

If the moisture laden insulation is to be removed as part of a repair or replacement project, we suggest that it would be advisable to increase the known quantity by a certain percentage to allow for undetected moisture, if any, and for moisture that may enter the system after the survey was completed.

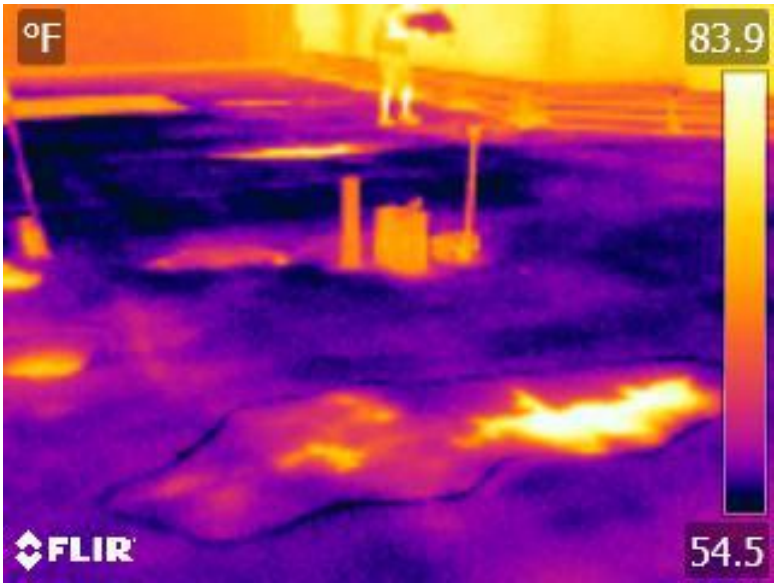
END OF SECTION

Thermograms

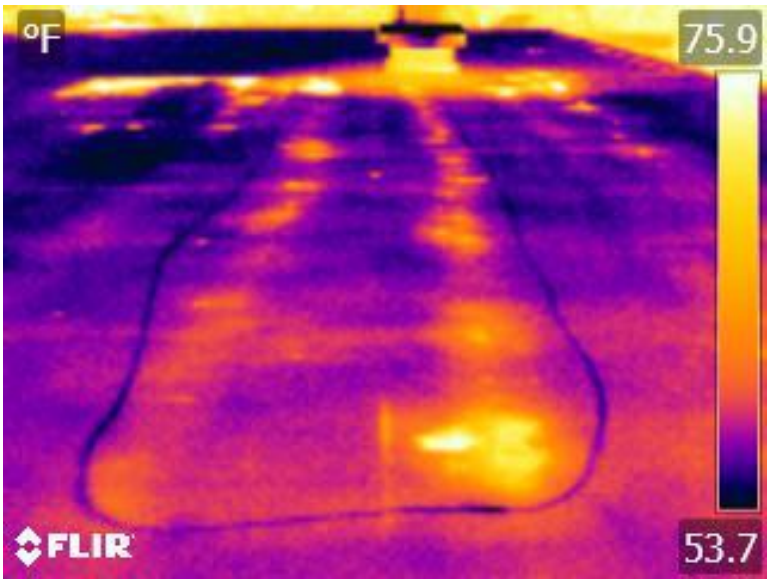
Thermograms were taken of roof areas and select anomalies located during the survey. The bright orange/yellow areas indicate spots/areas of moisture intrusion while the black/purple areas indicate a dry roof condition. The majority of thermograms taken during this survey show groups of wet and/or random wet areas relative to their locations which are identified on the accompanying drawing.



Thermogram 1



Thermogram 2



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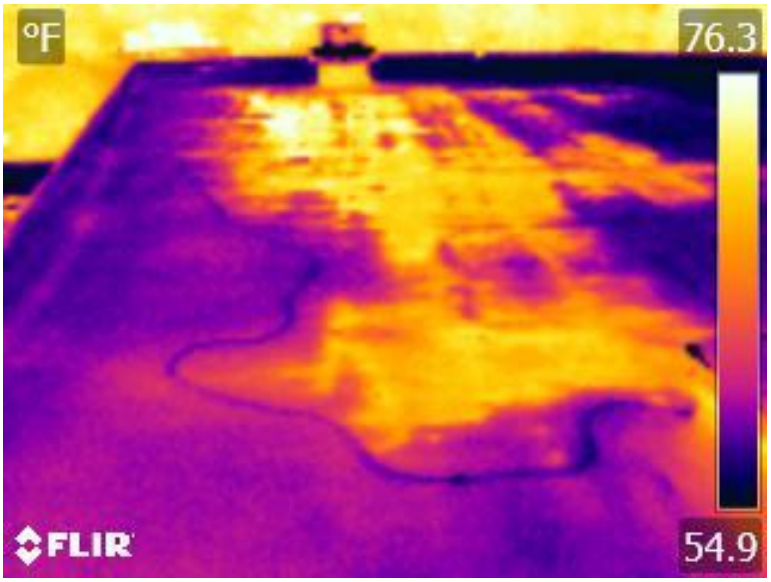

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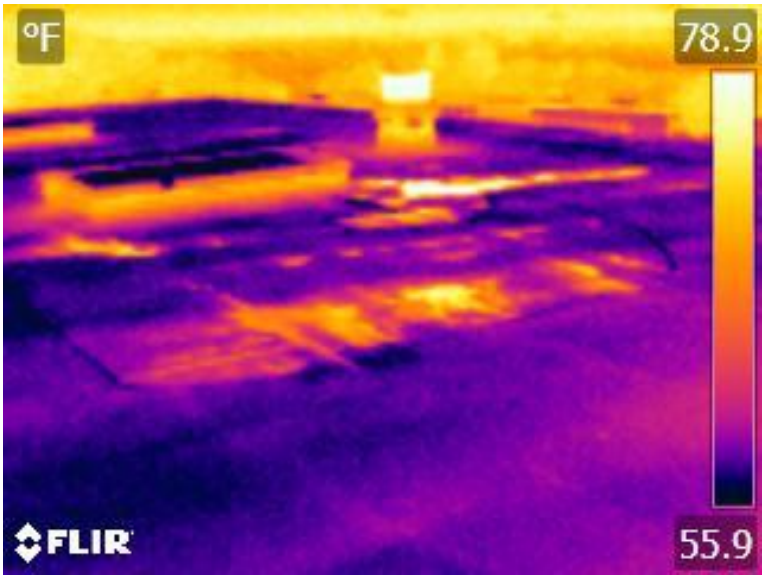

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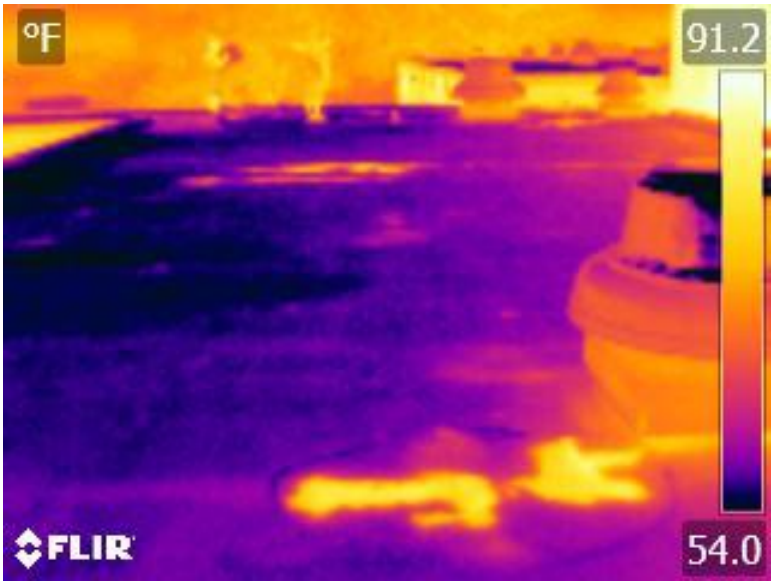

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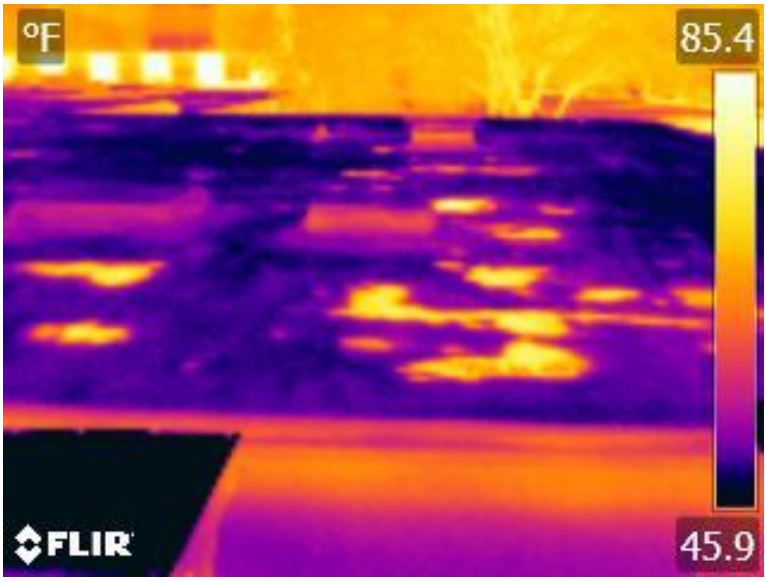

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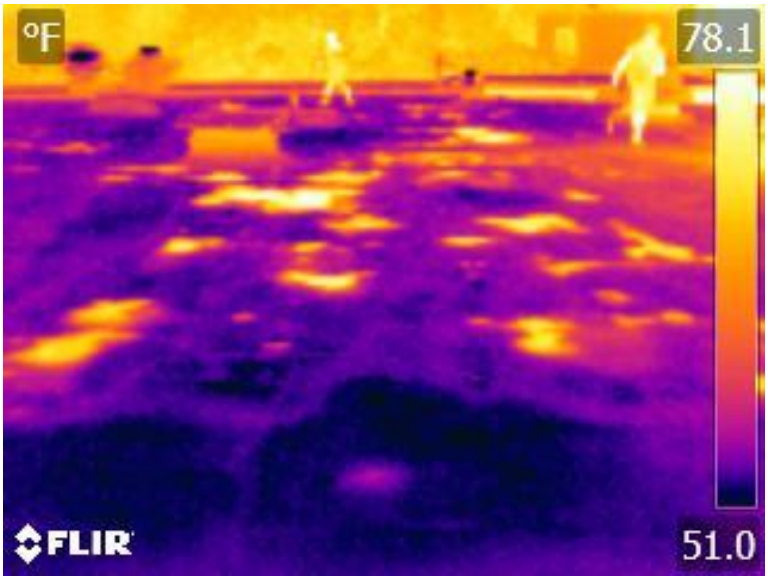

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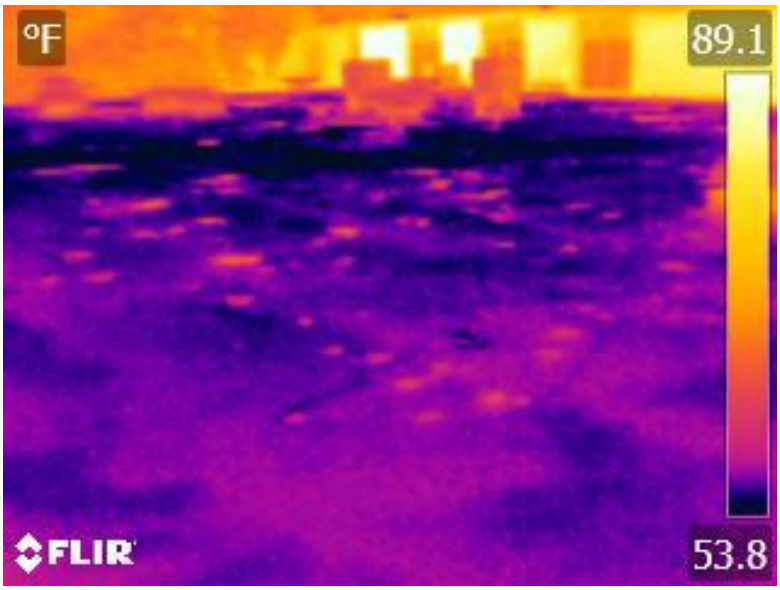

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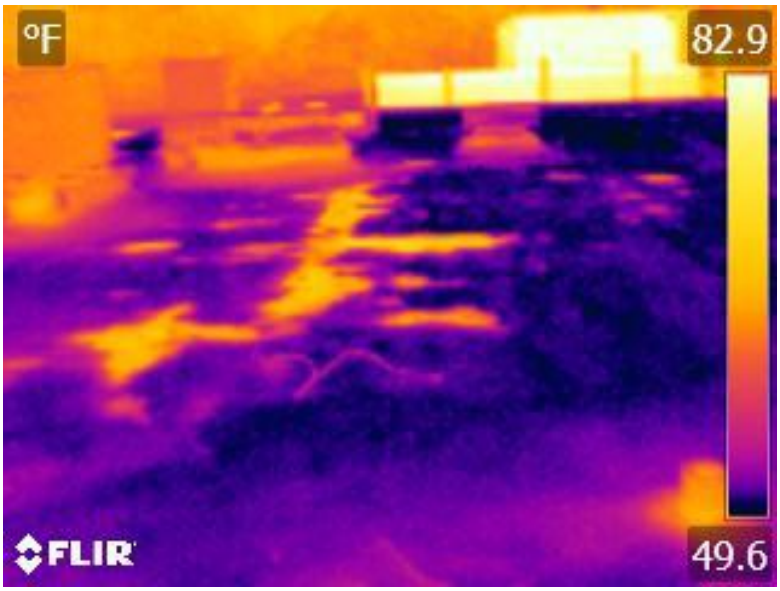

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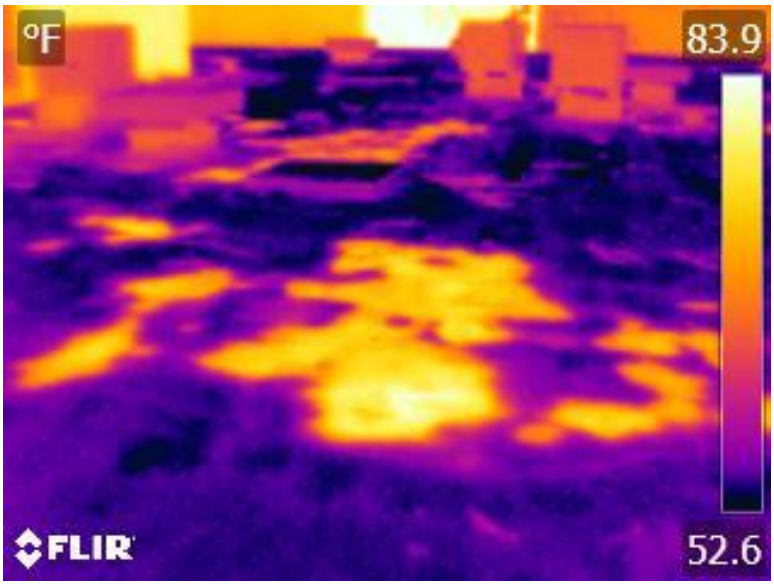

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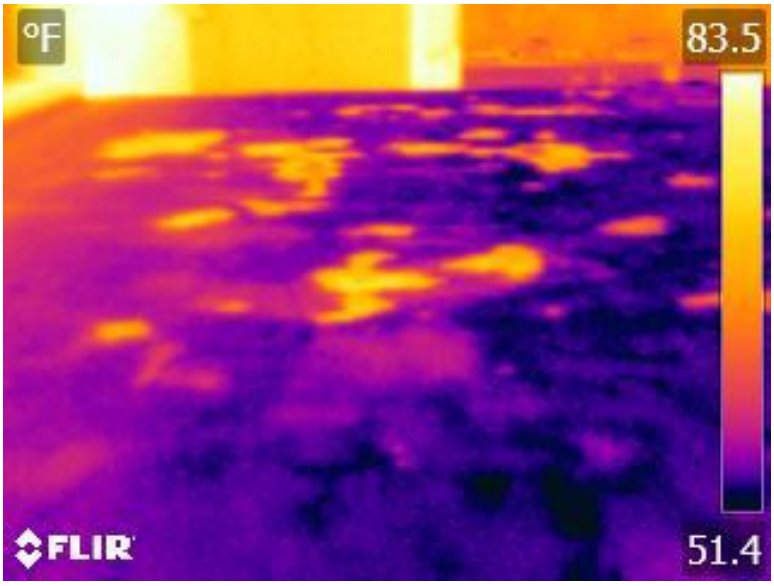

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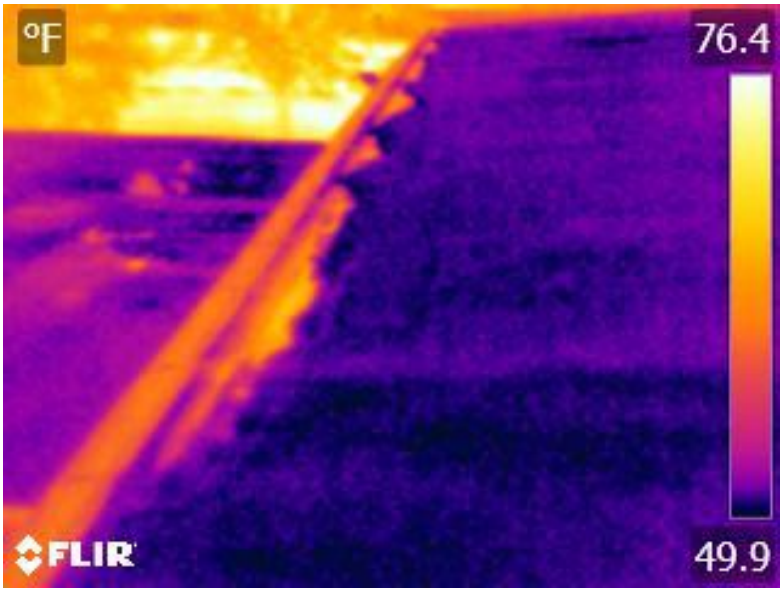

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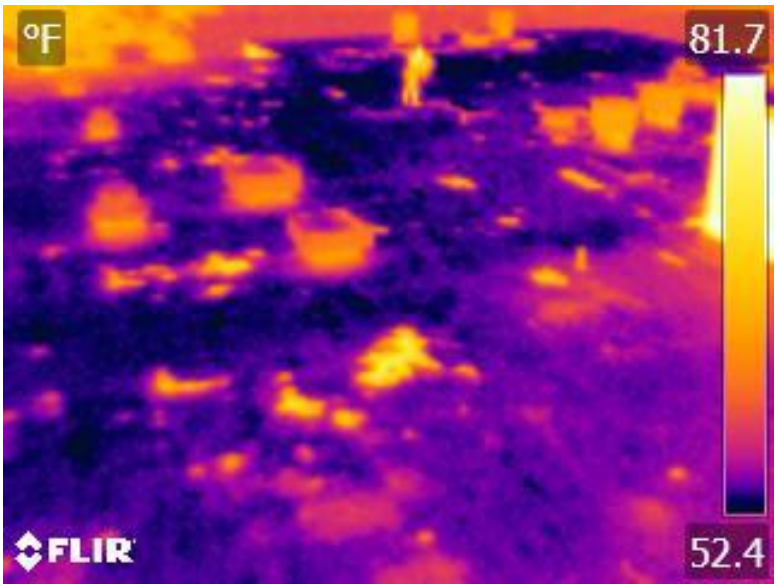
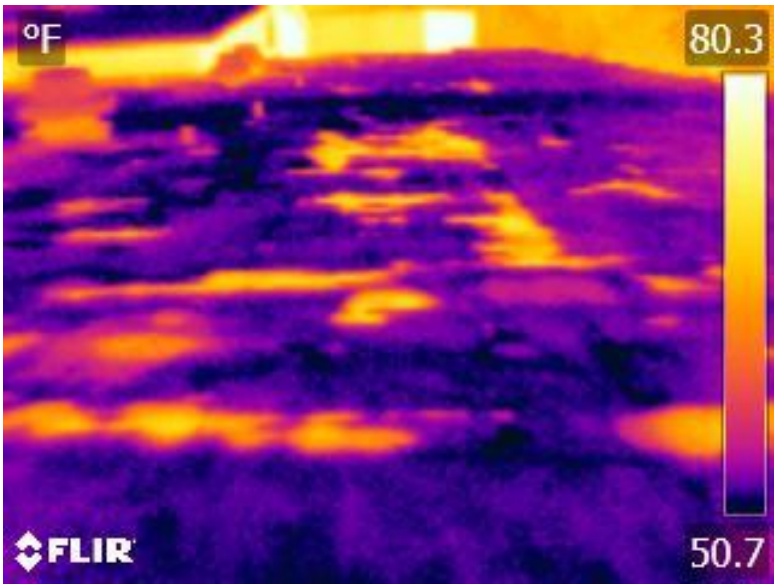
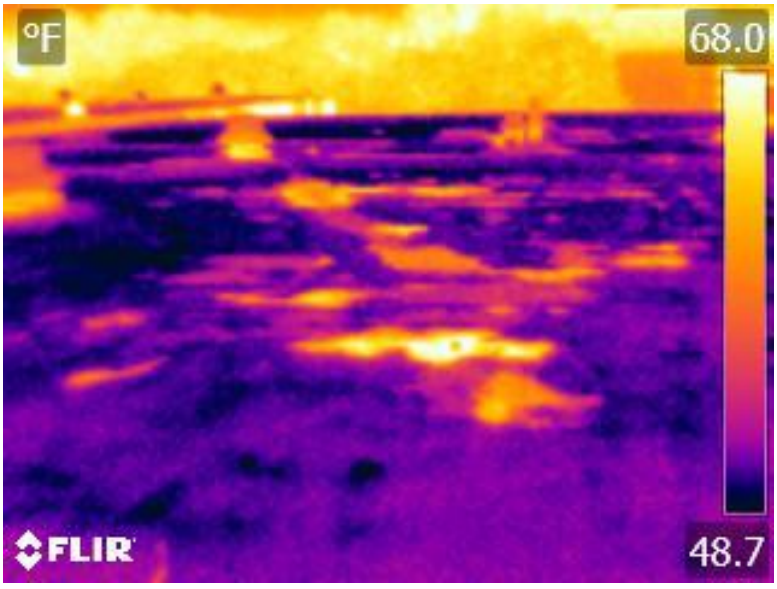


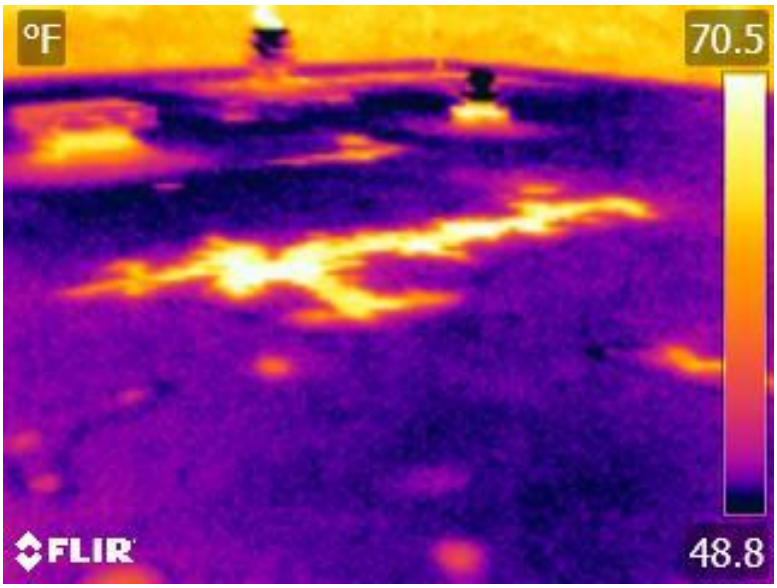
Thermogram 14



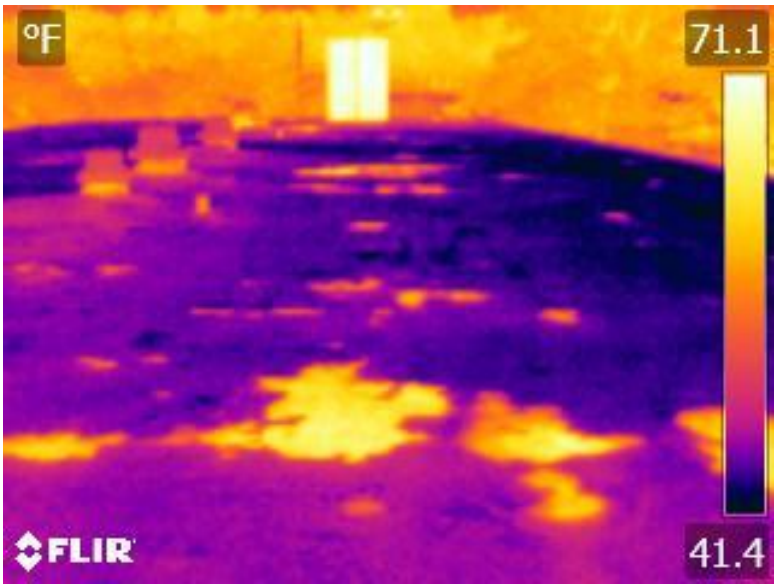
Thermogram 15



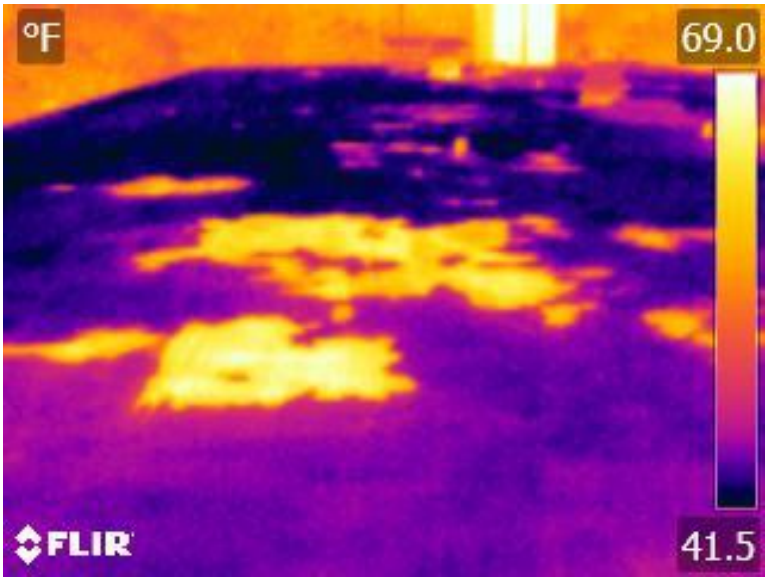
Thermogram 16



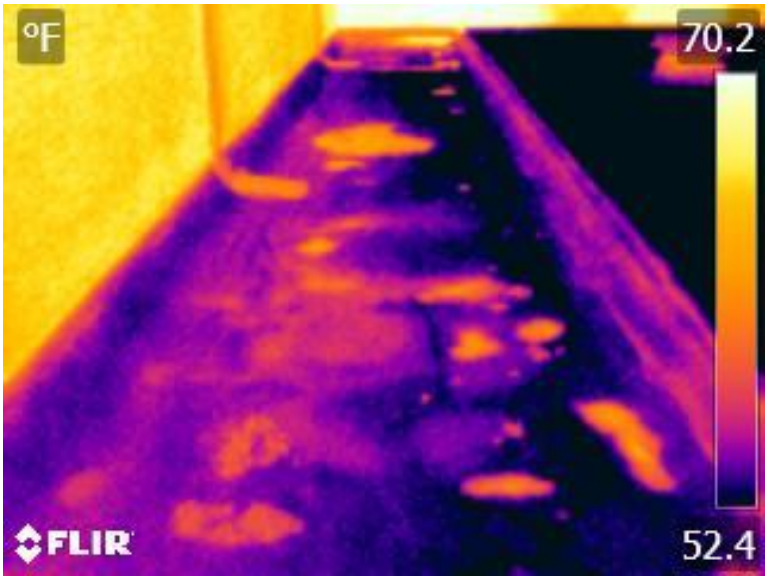
Thermogram 17



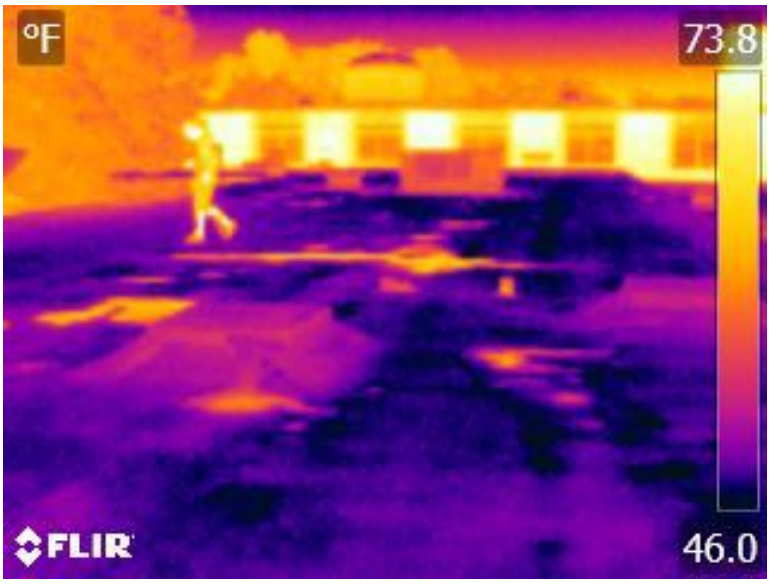
Thermogram 18



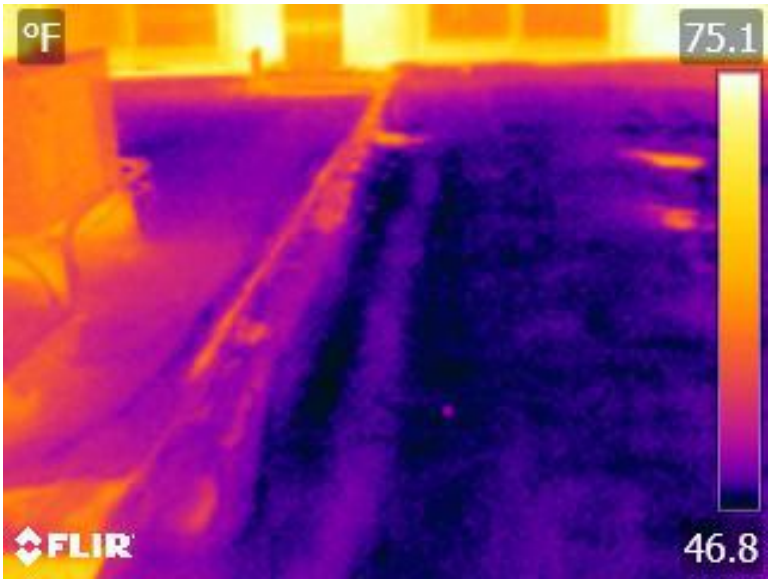
Thermogram 19



Thermogram 20



Thermogram 21



Thermogram 22

END OF REPORT

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Wallkill Central School District
John G. Borden Middle School

Date:

June 14, 2022

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The following procedures were used to conduct this moisture survey:

1. The roof was scanned with an Infrared Camera. The moisture contours of all wet areas were marked on the roof surface with orange spray paint.

2. A roof plan was drawn to scale showing all roof top equipment and the locations and contours of all moisture laden insulation.

3. Thermograms were taken at selected anomalies.

4. As a final verification of the moisture testing, one or more core samples were taken to verify the conditions and to determine the exact roof construction.

5. This report defines; the roof construction and the conditions of the roof system at the core locations, and the square footage and percent of total roof area containing dry insulation and moisture laden insulation.

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Moisture Survey Report

Scope of Survey

The intent of the survey was to document the location and extent of moisture intrusion into the roof system.

Anomalies

The roof system was scanned with a Flir E8 and a Flir E30bx infrared camera. The locations and contours of all anomalies have been marked on the roof surface with pink paint. Moisture content of the anomalies were verified using the nuclear moisture gauge. Thermograms of some of the anomalies are shown in this report

Thermograms

Thermograms are heat images taken with the infrared camera. Thermograms were taken of several anomalies located during the survey. The locations of the thermograms can be found on the drawing.

Core Sample Construction & Moisture Content

Roof 13 @ Core 1

- Granular Surface Silicone Membrane
- 2½"± Spray-In-Place Urethane Foam Insulation **(wet)**
- Asphalt Membrane **(did not cut)**
  - The remainder of the roof construction was not determined

Moisture Quantities

The subsurface moisture content of the roof system expressed in sq.ft., percentage of roof area, and number of moisture laden locations is as follows:

Roof 1 = 8,090 ± sq.ft.

Dry insulation = 7,354 ± sq.ft. or 91% of the roof area.

Damp to wet insulation = 736 ± sq.ft. or 9% of the roof area.

Number of moisture laden locations = 55 spots up to 1 sq.ft. and 33 areas up to 240 sq. ft.

Roof 2 = 3,400 ± sq.ft.

Dry insulation = 3,225 ± sq.ft. or 99% of the roof area.

Damp to wet insulation = 175 ± sq.ft. or 1% of the roof area.

Number of moisture laden locations = 15 spots up to 1 sq.ft. and 15 areas up to 36 sq. ft.

Roof 3 = 720 ± sq.ft.

Dry insulation = 660 ± sq.ft. or 92% of the roof area.

Damp to wet insulation = 60 ± sq.ft. or 8% of the roof area.

Number of moisture laden locations = 6 spots up to 1 sq.ft. and 4 areas up to 42 sq. ft.

Roof 4 = 1,000 ± sq.ft.

Dry insulation = 1,000 ± sq.ft. or 100% of the roof area.

Roof 5 = 4,517 ± sq.ft.

Dry insulation = 3,195 ± sq.ft. or 71% of the roof area.

Damp to wet insulation = 1,322 ± sq.ft. or 29% of the roof area.

Number of moisture laden locations = 20 spots up to 1 sq.ft. and 33 areas up to 336 sq. ft.

Roof 6 = 940 ± sq.ft.

Dry insulation = 879 ± sq.ft. or 93% of the roof area.

Damp to wet insulation = 61 ± sq.ft. or 7% of the roof area.

Number of moisture laden locations = 3 spots up to 1 sq.ft. and 3 areas up to 49 sq. ft.

Roof 7 = 6,132 ± sq.ft.

Dry insulation = 4,512 ± sq.ft. or 89% of the roof area.

Damp to wet insulation = 1,620 ± sq.ft. or 11% of the roof area.

Number of moisture laden locations = 39 spots up to 1 sq.ft. and 30 areas up to 960 sq. ft.

Roof 8 = 200 ± sq.ft.

Dry insulation = 200 ± sq.ft. or 100% of the roof area.

Roof 9 = 3,054 ± sq.ft.

Dry insulation = 2,923 ± sq.ft. or 57% of the roof area.

Damp to wet insulation = 131 ± sq.ft. or 43% of the roof area.

Number of moisture laden locations = 10 spots up to 1 sq.ft. and 9 areas up to 48 sq. ft.

Roof 10 = 464 ± sq.ft.

Dry insulation = 459 ± sq.ft. or 99% of the roof area.

Damp to wet insulation = 5 ± sq.ft. or 1% of the roof area.

Number of moisture laden locations = 5 spots up to 1 sq.ft.

Roof 11 = 54 ± sq.ft.

Dry insulation = 54 ± sq.ft. or 100% of the roof area.

Roof 12 = 5,537 ± sq.ft.

Dry insulation = 4,070 ± sq.ft. or 73% of the roof area.

Damp to wet insulation = 1,467 ± sq.ft. or 7% of the roof area.

Number of moisture laden locations = 10 spots up to 1 sq.ft. and 21 areas up to 110 sq. ft.

Roof 13 = 3,537 ± sq.ft.

Dry insulation = 3,401 ± sq.ft. or 96% of the roof area.

Damp to wet insulation = 136 ± sq.ft. or 4% of the roof area.

Number of moisture laden locations = 7 spots up to 1 sq.ft. and 8 areas up to 82 sq. ft.

Roof 14 = 188 ± sq.ft.

Dry insulation = 188 ± sq.ft. or 100% of the roof area.

Roof 15 = 6,256 ± sq.ft.

Dry insulation = 6,195 ± sq.ft. or 99% of the roof area.

Damp to wet insulation = 61 ± sq.ft. or 1% of the roof area.

Number of moisture laden locations = 11 spots up to 1 sq.ft. and 7 areas up to 24 sq. ft.

Building Total = 44,089 ± sq.ft.

Dry insulation = 38,315 ± sq.ft. or 87% of the roof area.

Damp to wet insulation = 5,774 ± sq.ft. or 13% of the roof area.

Number of moisture laden locations = 184 spots up to 1 sq.ft. and 162 areas up to 1,240 sq. ft.

Summary

The moisture survey indicates as accurately as existing conditions permit, the subsurface conditions of the roofs at the time the survey was conducted.

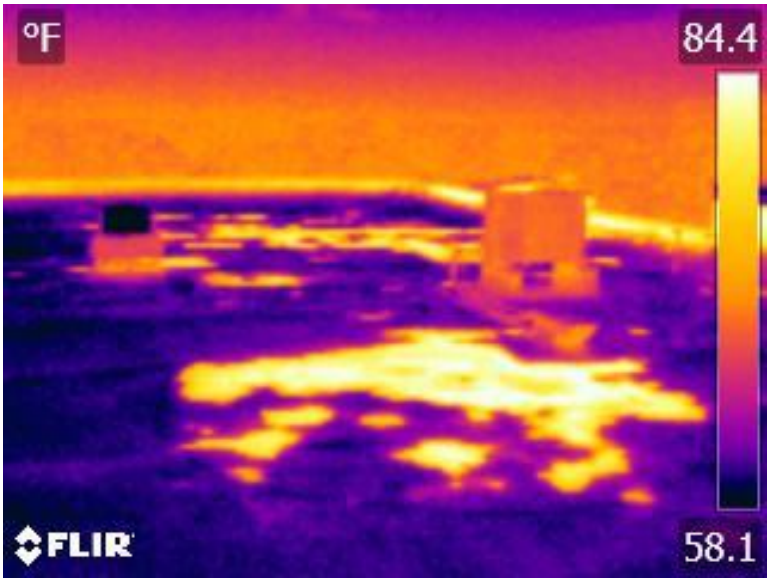
If there will be a long delay between the time the survey was conducted and when the repair or replacement work will begin, we suggest the wet areas be remarked with spray paint before the paint that defines the areas fades away. The paint that was applied during the survey should last at least 3 to 6 months before repainting may be required.

If the moisture laden insulation is to be removed as part of a repair or replacement project, we suggest that it would be advisable to increase the known quantity by a certain percentage to allow for undetected moisture, if any, and for moisture that may enter the system after the survey was completed.

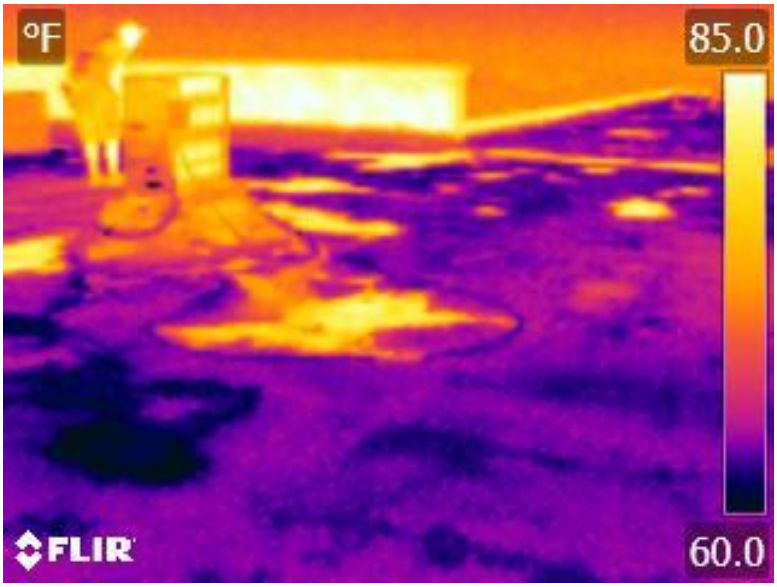
END OF SECTION

Thermograms

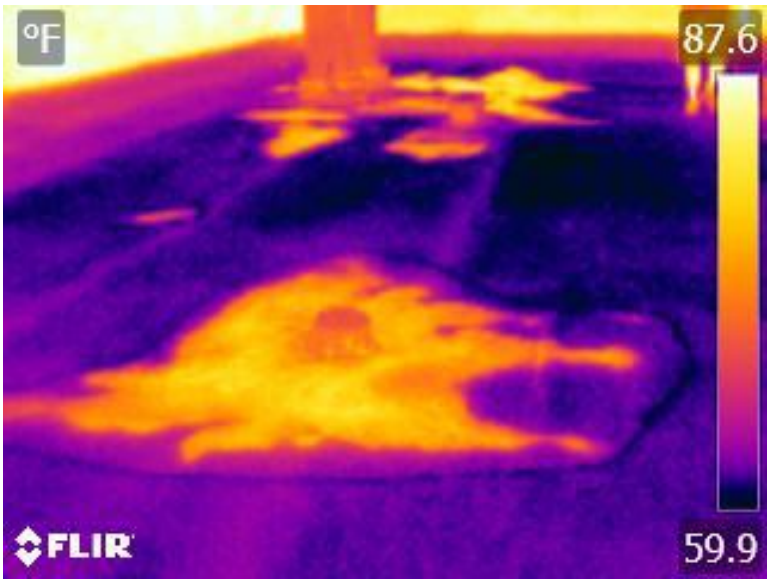
Thermograms were taken of roof areas and select anomalies located during the survey. The bright orange/yellow areas indicate spots/areas of moisture intrusion while the black/purple areas indicate a dry roof condition. The majority of thermograms taken during this survey show groups of wet and/or random wet areas relative to their locations which are identified on the accompanying drawing.



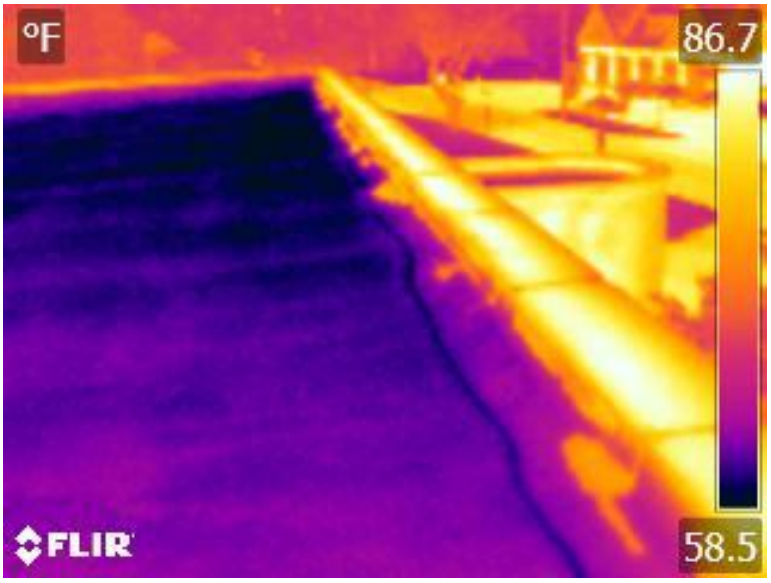
Thermogram 1



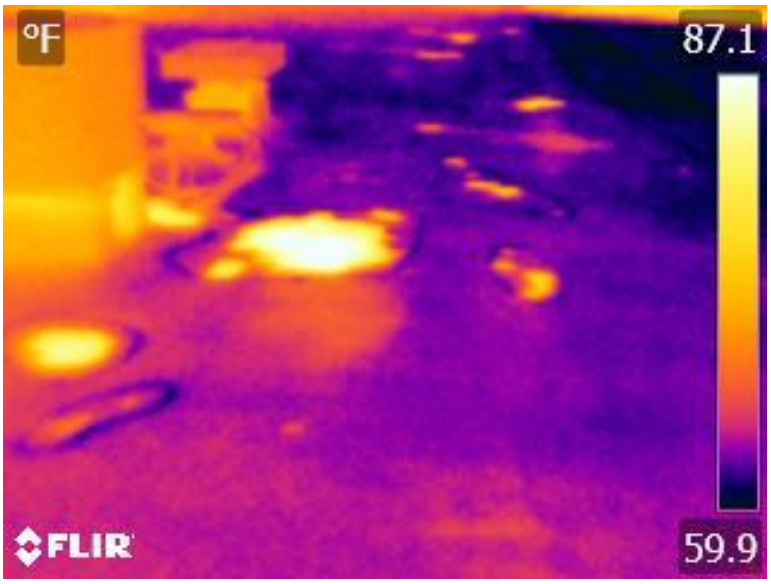
Thermogram 2



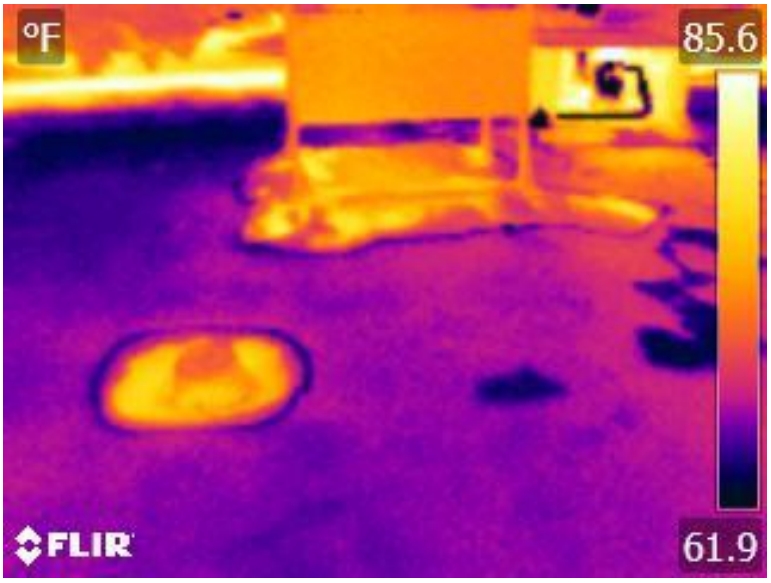
Thermogram 3



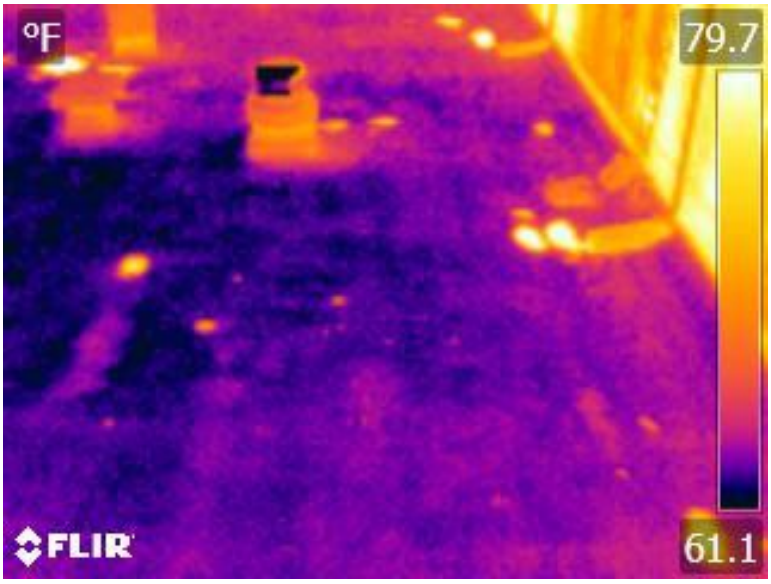
Thermogram 4



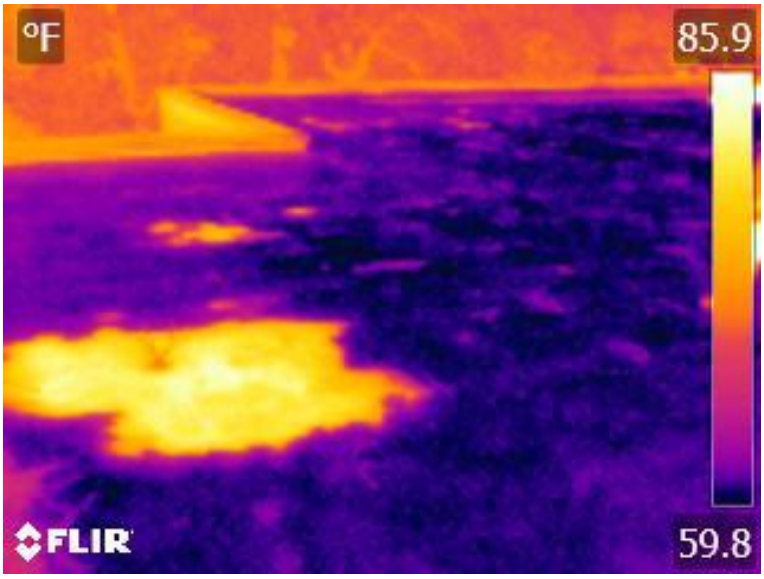
Thermogram 5



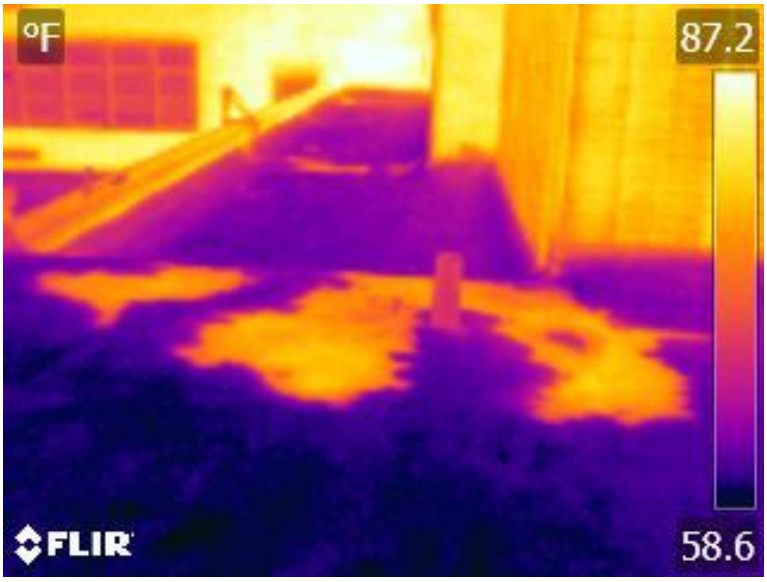
Thermogram 6



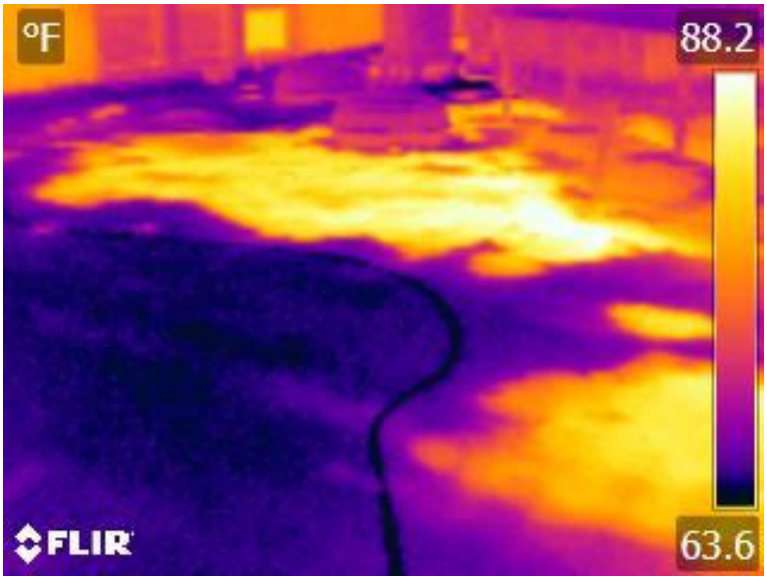
Thermogram 7



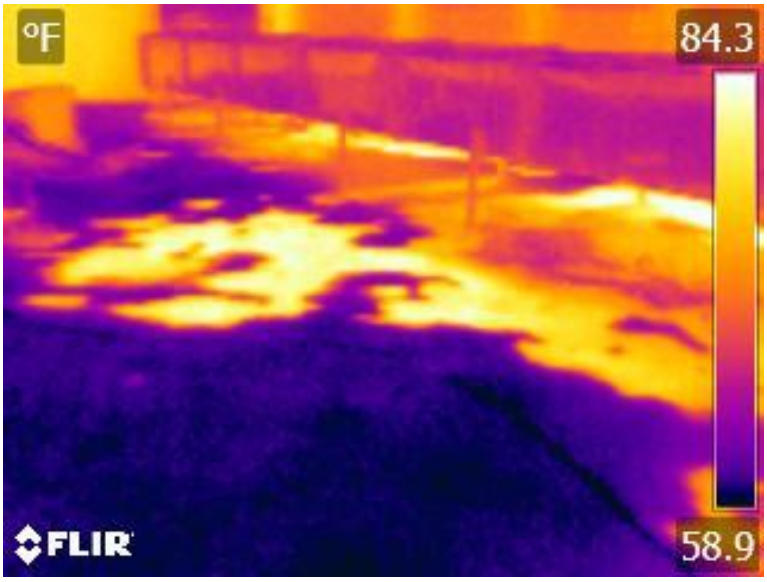
Thermogram 8



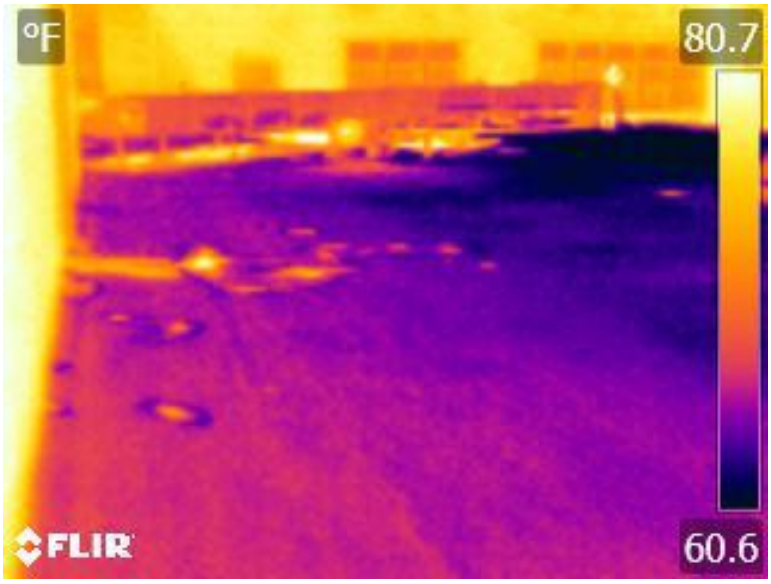
Thermogram 9



Thermogram 10



Thermogram 11



Thermogram 12

END OF REPORT