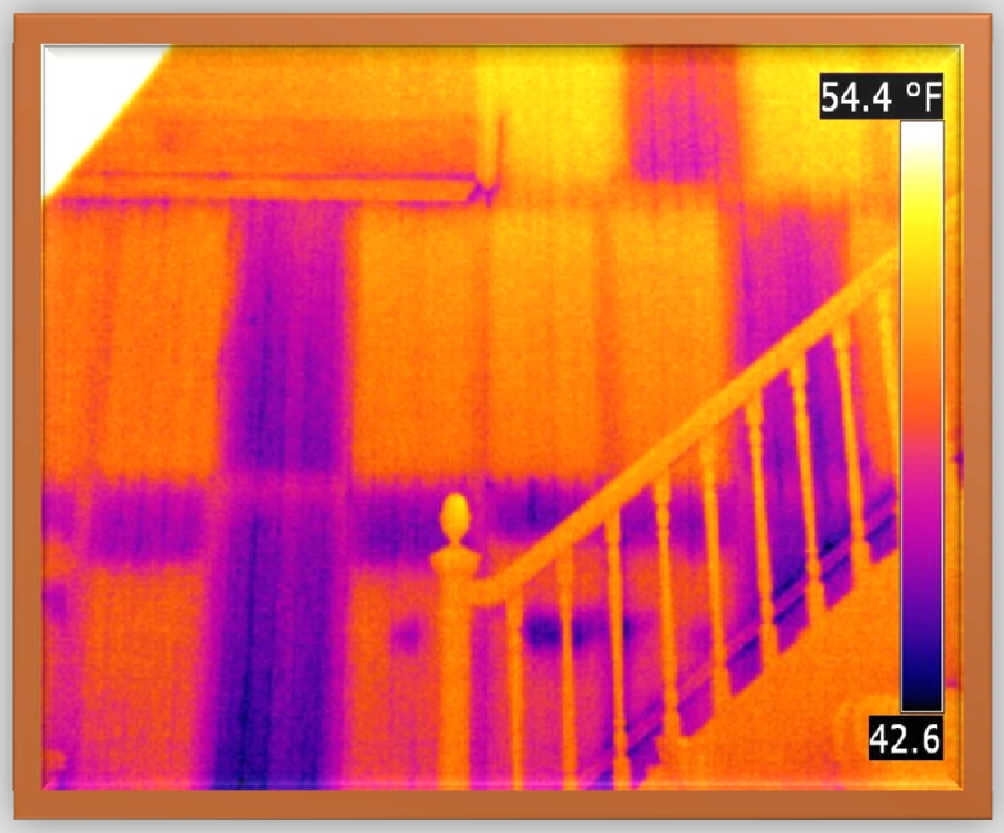
INFRARED TRAINING CENTER

Thermography for Construction



This is not new techniques!

1971 Home inspection with an AGA 700

Or … An outdoor inspection

1969 AGA 680

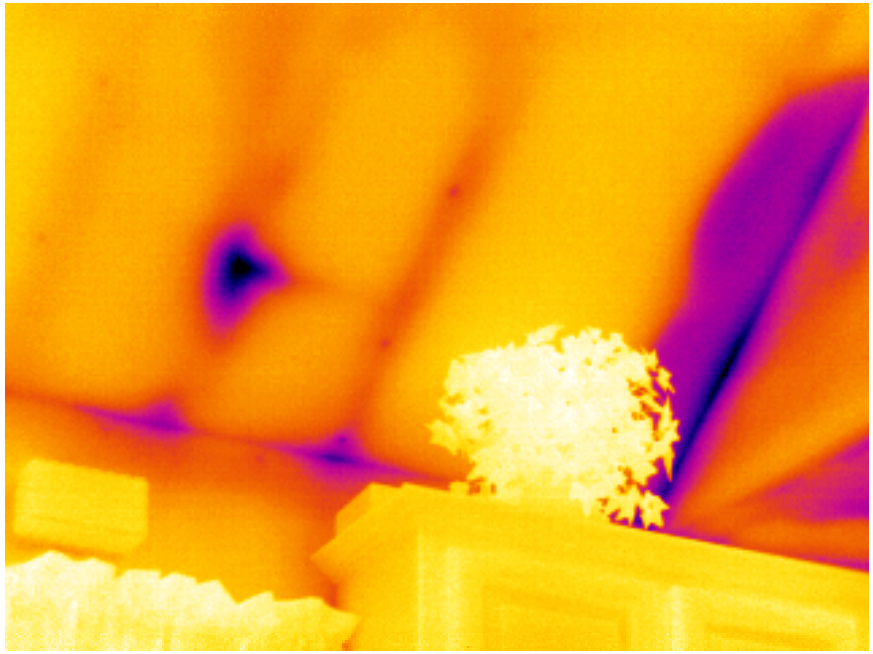
Why IR Building Inspections?

- Building performance
- Insulation verification
- Locate air leakage
- Structural verification
- Moisture intrusion

What Can Infrared Thermography Find?

- Moisture
  - Moisture Location(s) (Mapping)
  - Evaluate Window and door installations
  - Evaluate Roof Condition (ASTM C1153)
- Wall Condition
  - Framing locations
  - Structure issues
- Insulation Condition (ASTM C1060 – RESNET Guideline)
  - Effectiveness (R values)
  - Fill or Gaps
- Air infiltration
  - Location of air leakage points
- Electrical
- Mechanical
  - Pipe or duct locations

Seeing Through Walls???

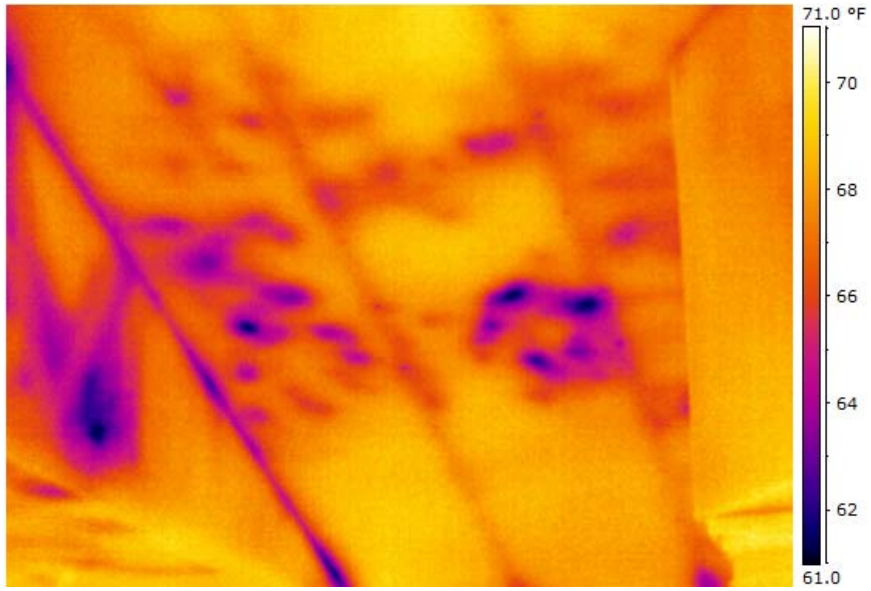


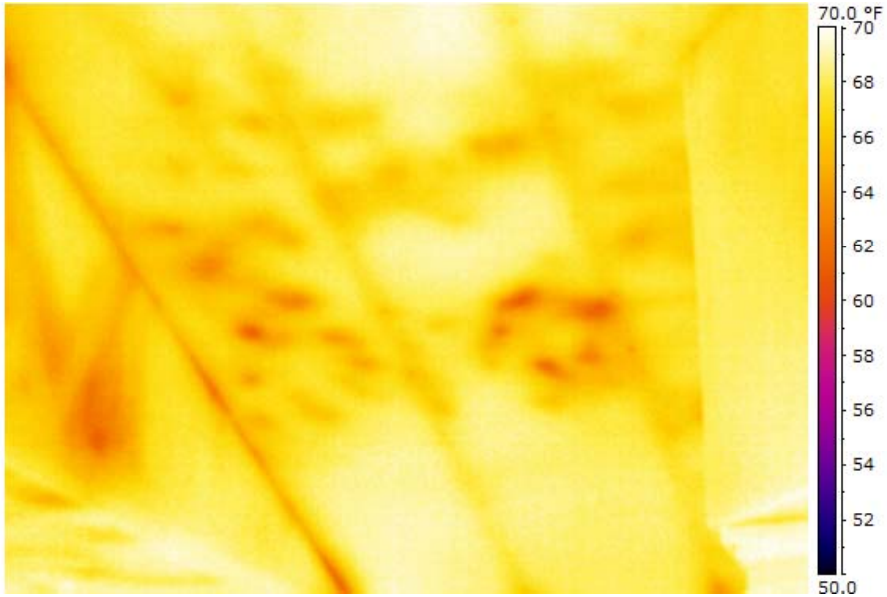
Infrared cameras are **NOT** X-ray machines and cannot see through common materials. They image infrared thermal energy from ***surface*** temperatures.

- Just point the IR camera at a target
- Put a measurement tool where needed
- Get an accurate temperature
- It's that easy

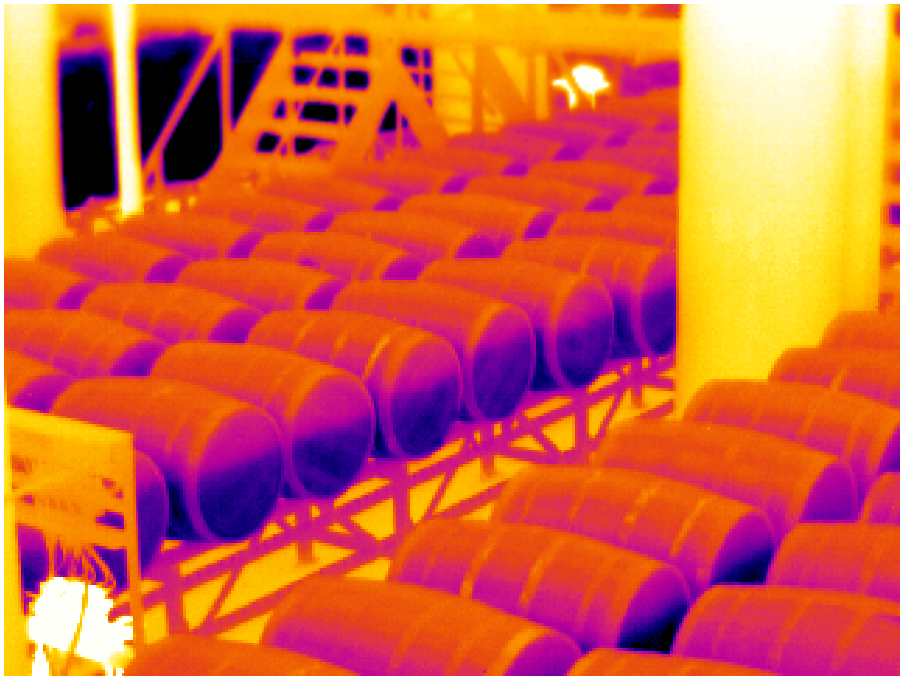
Or is it?

Proper Tuning





Inadequate Tuning



Wood Barrels – High Emissivity & Low Reflectivity

Shiny Metal – High Reflectivity & Low Emissivity

Tools

Blower Door

Moisture Meters

Anemometer

Borescope

Camera Selection

Now what camera????

Camera Options

- Resolution
- Laser pointer
- Lens versatility
- WiFi
- Touchscreen
- Auto focus vs. Manual adjust
- Video out
- Bluetooth

Camera’s now talk with Tablets

Camera Selection

80 x 80

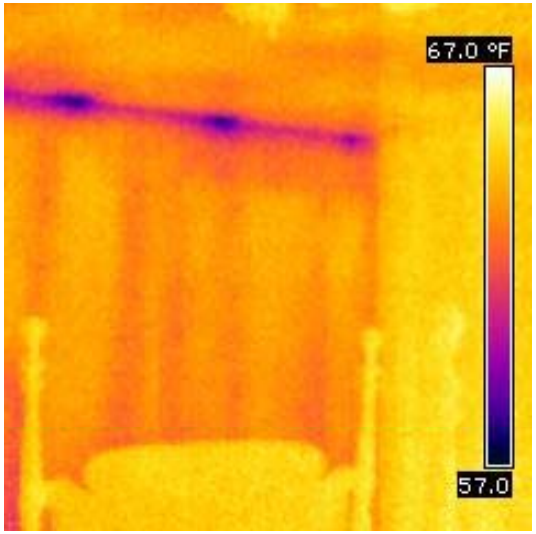
200 x 150

120 x 120

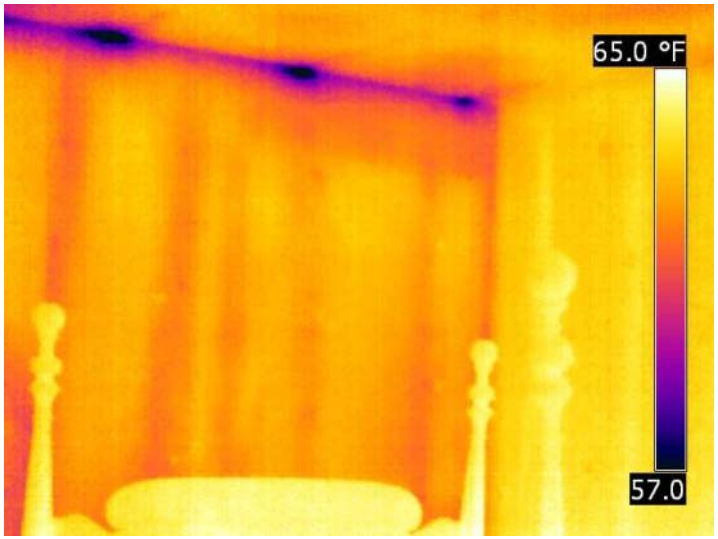
320 x 240

All images were captured at the same distance from the target

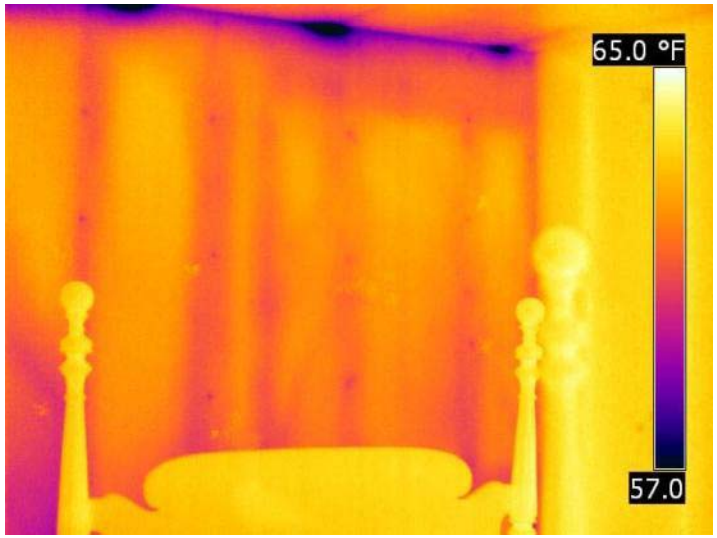
Camera Selection



140 x 140

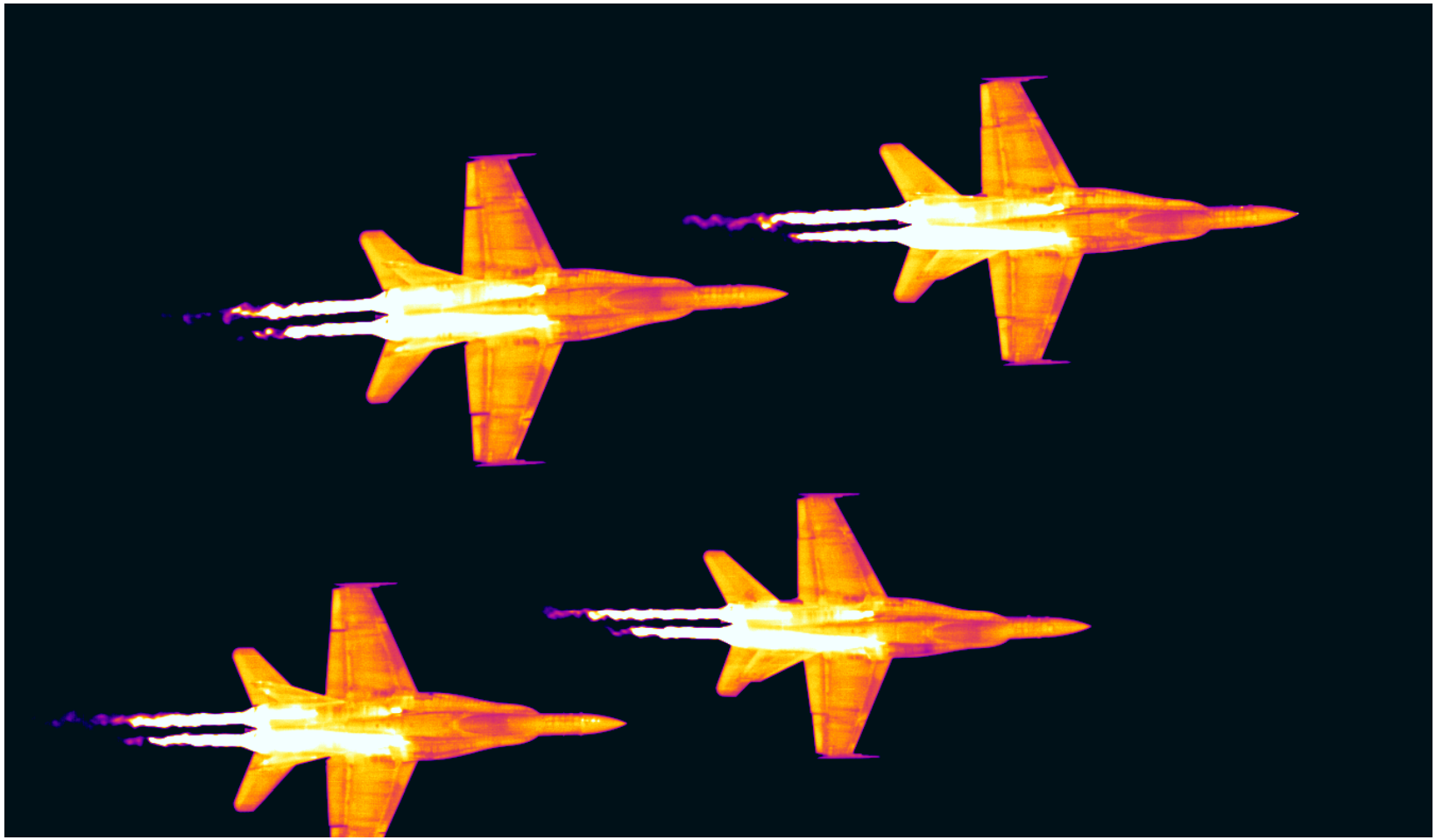


320 x 240



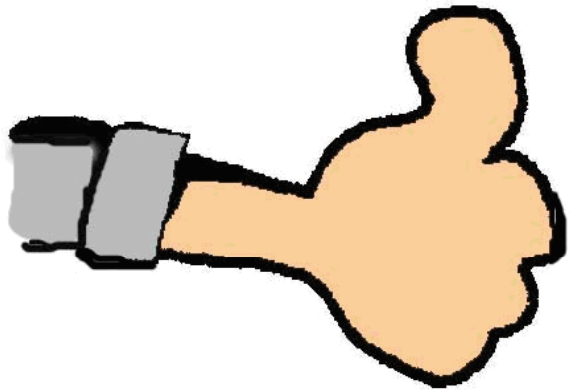
640 x 480

All images were captured at the same distance from the target



Recommendations for a residential energy auditor:

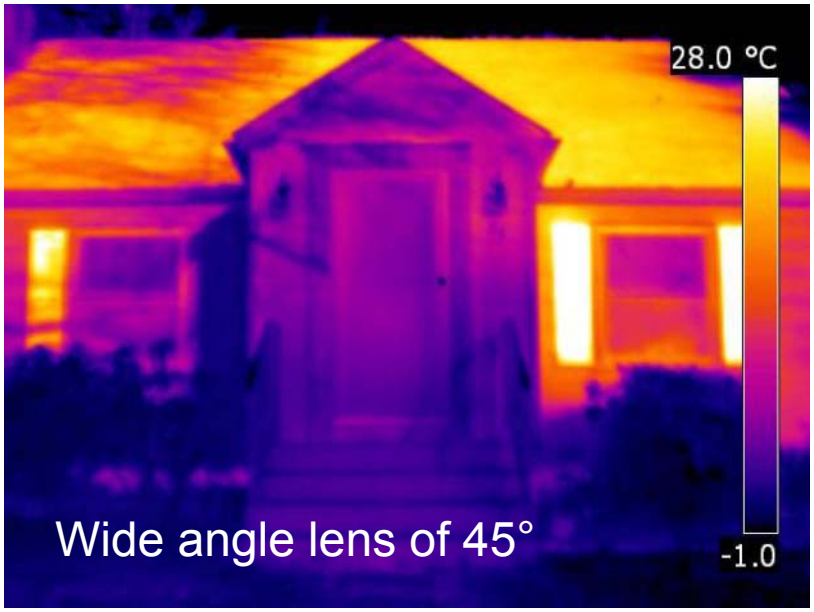
- RESNET Requires 120x120 detector or greater
- FOV not less 20º.

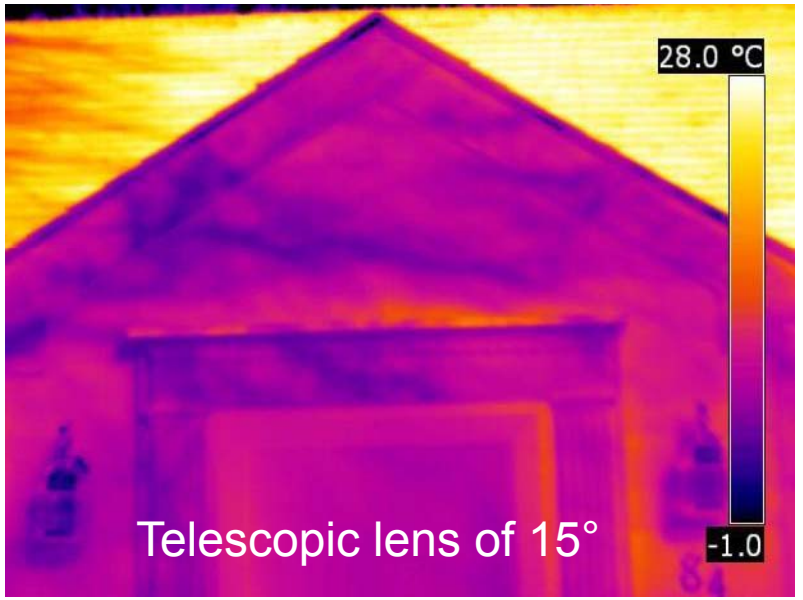


Can the camera change lens?

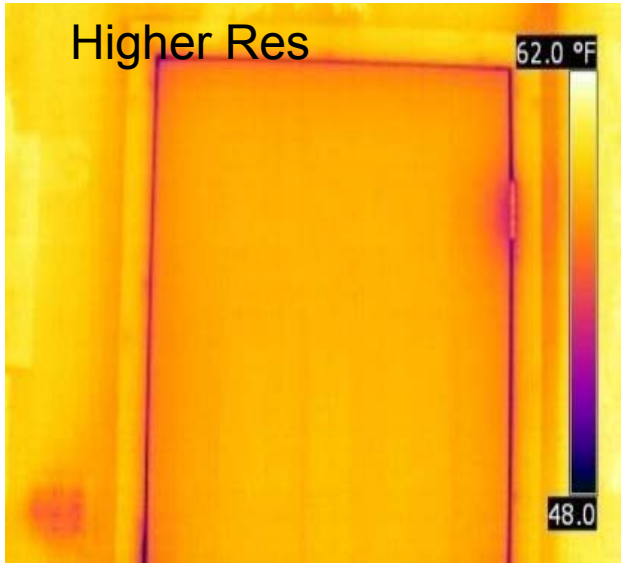
Do I need additional lens?

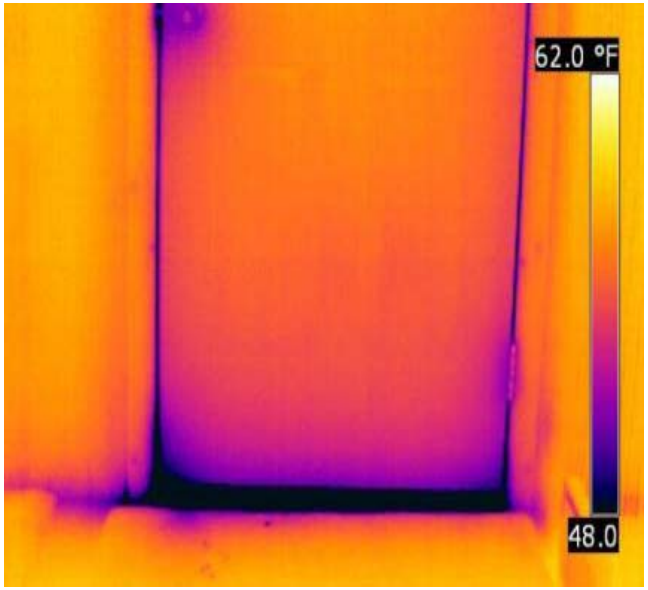
Lens





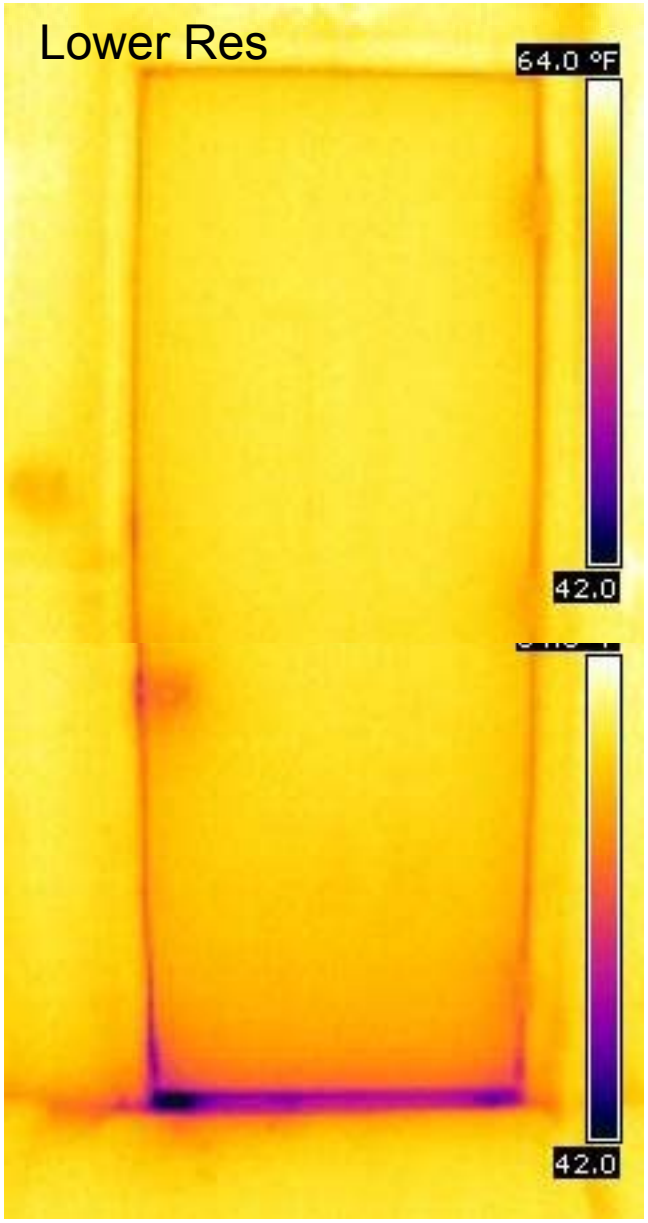
Lens





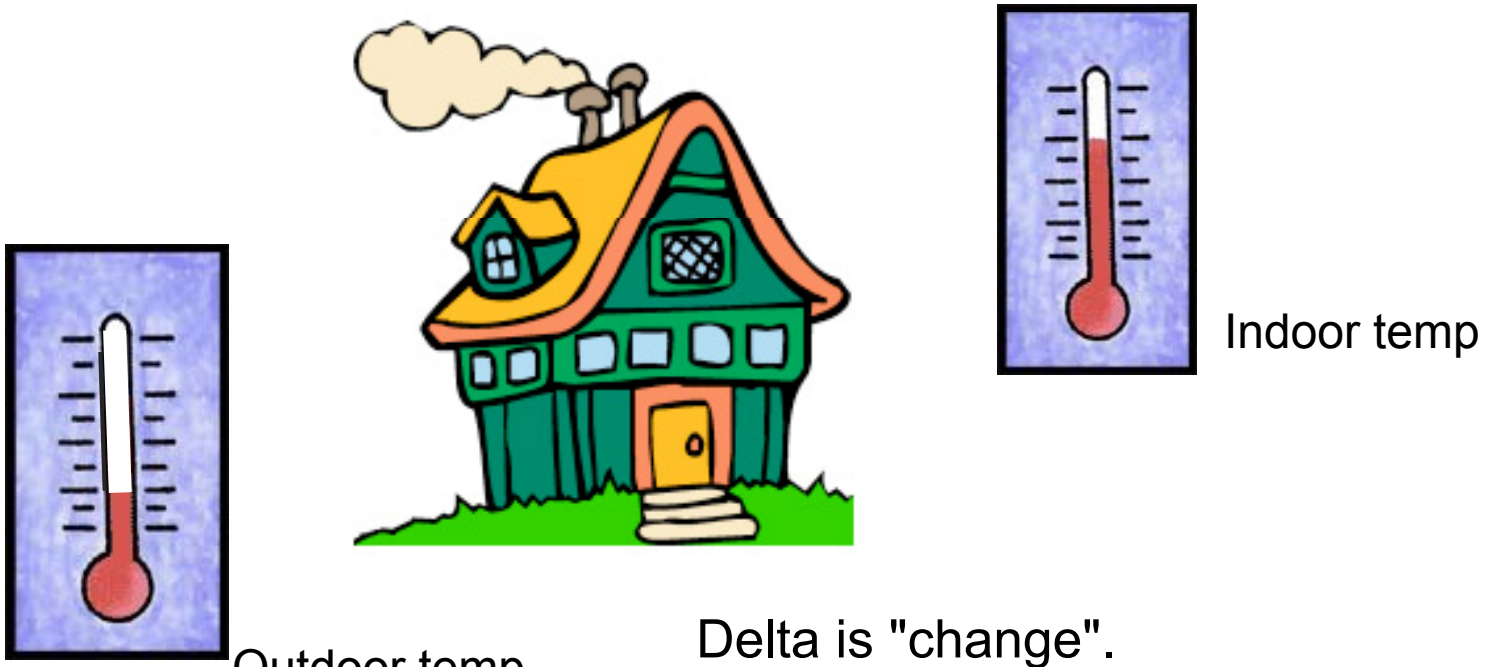
Another reason for a lens is to capture a space or object in one image.

Example shown; the space can't allow room to physically move further away to get this door in one image.



Delta T

- X2.1 Infrared inspection requires a sufficient difference in temperature from inside to outside (ΔT) for a sufficiently long period of time, to produce discernible differences between areas with studs and areas that may contain insulation.



Delta is "change".
Delta T is (T_{in}-T_{out})

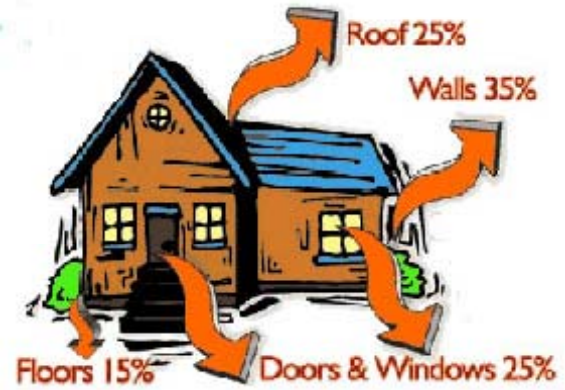
Solar

Solar

Solar

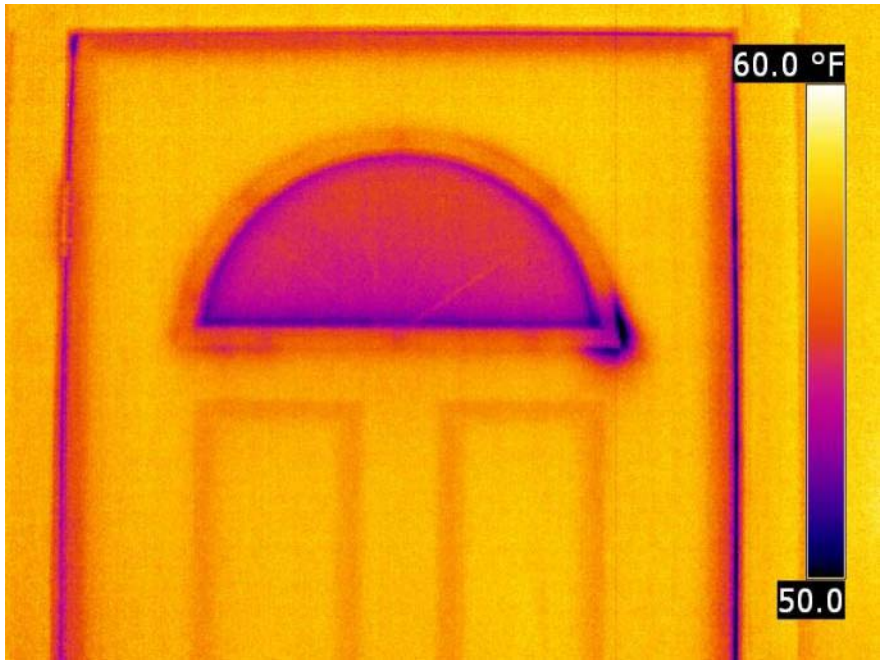
Air Flow

- Air flow through a building can have a powerful impact on comfort, expense, and air quality.
- Blower doors provide a way to quantify air flow and the resulting heat loss, along with a way to pinpoint specific leaks.
- The benefits of their use have been understood and documented enough that most professionals now consider them essential for effective (and cost-effective) air sealing.

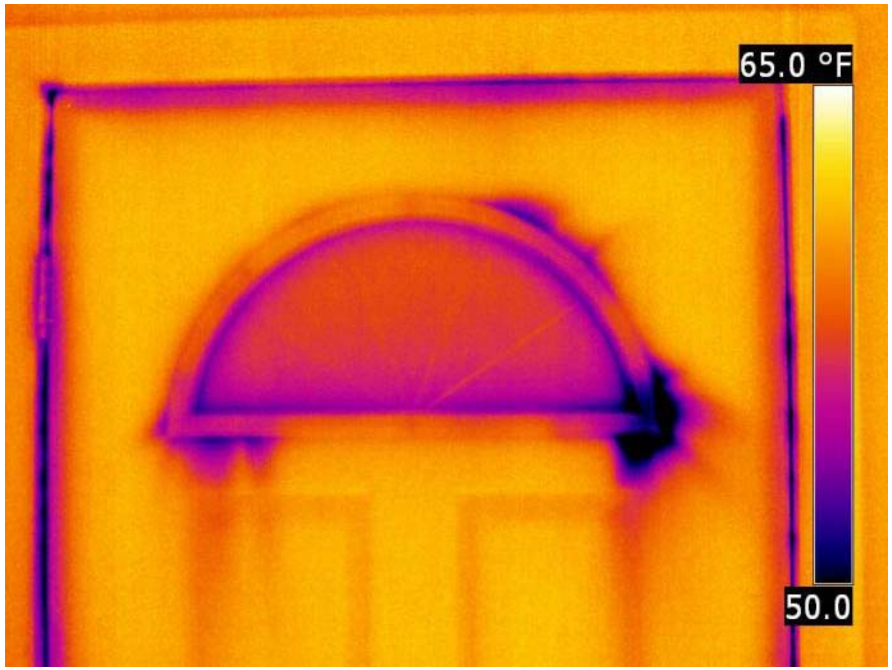


Blower Door

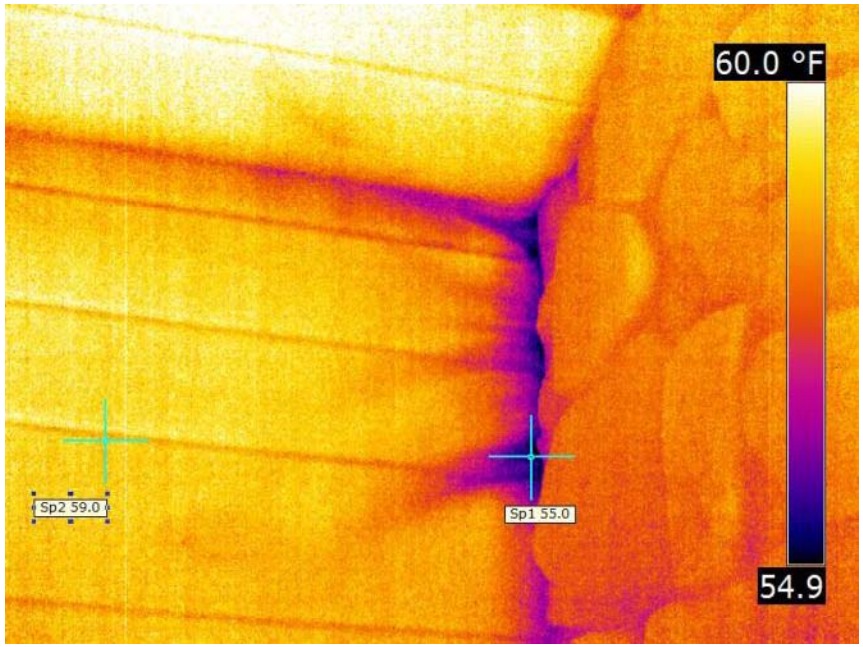
@10pa



@50pa



Blower Door



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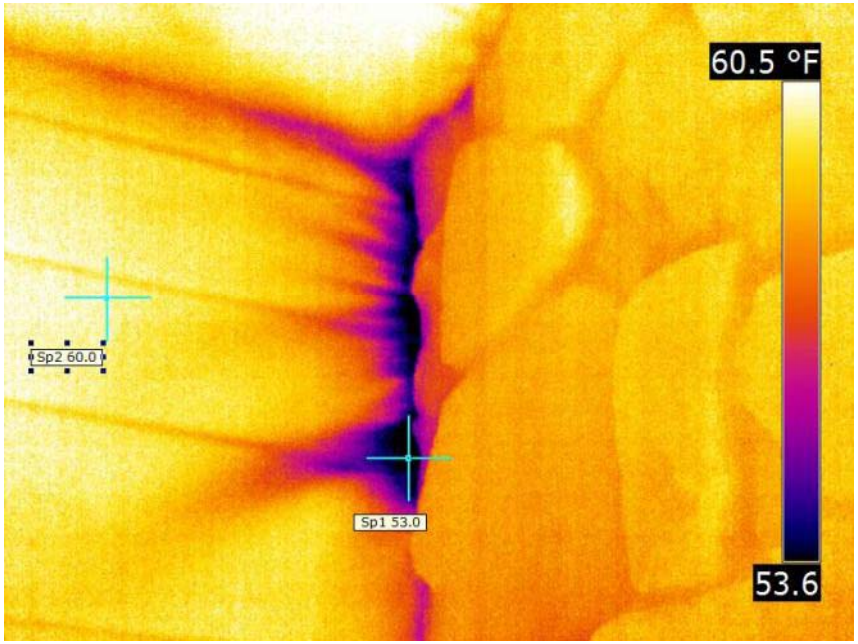
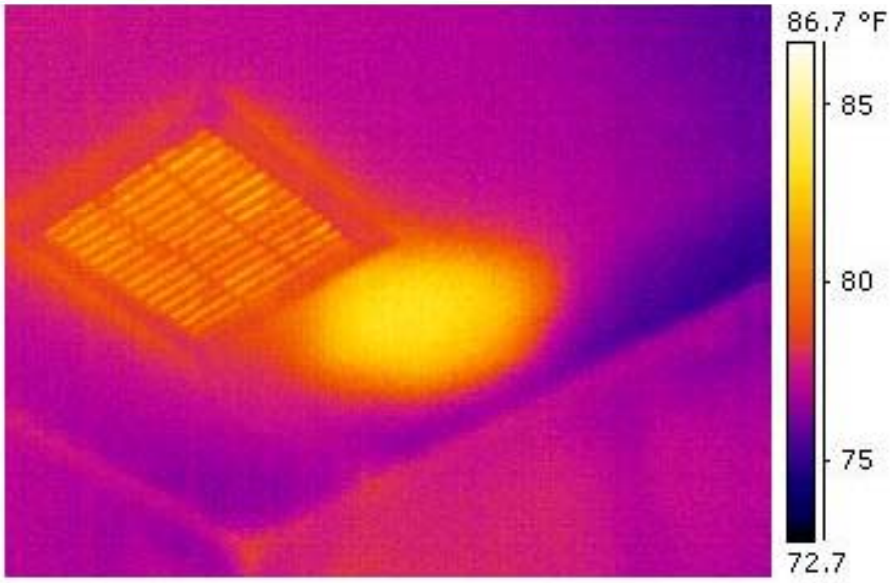


@50pa

Blower Door and Ducts



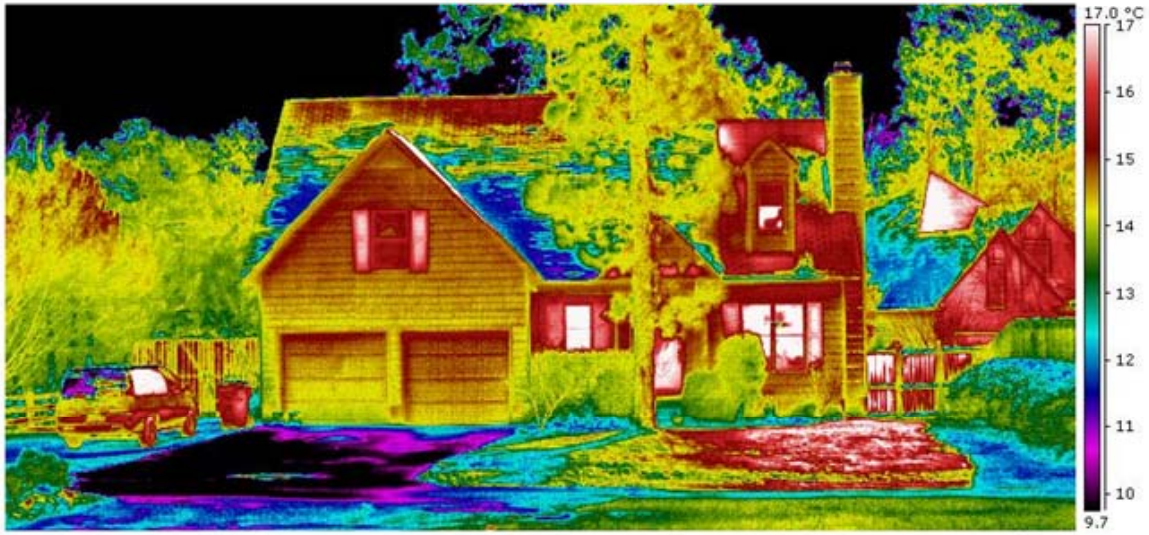
Duct not placed correctly

Transition Fit and seal

Library Images for Discussion

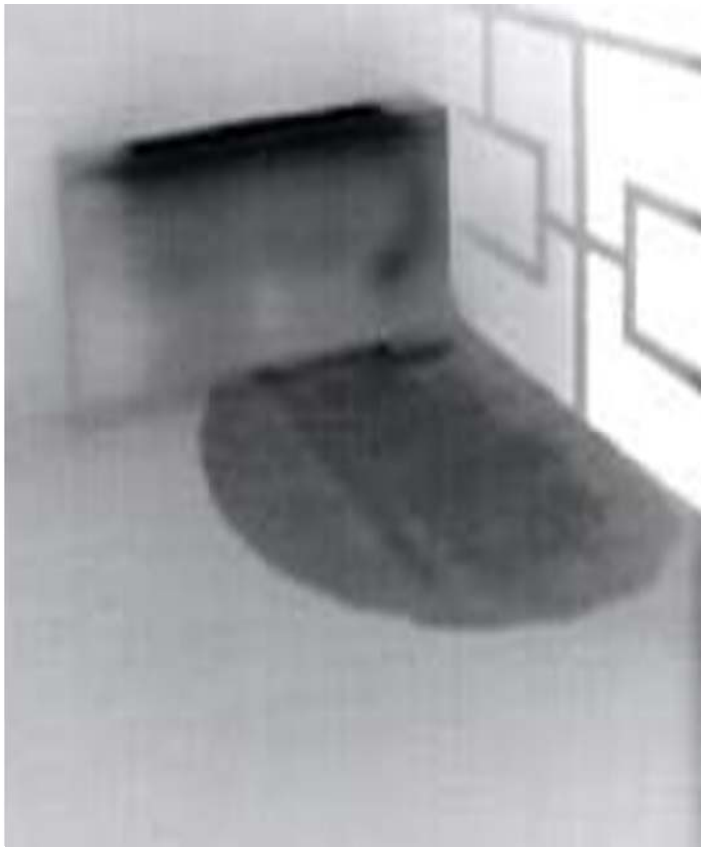
Infrared Uses

- Moisture detection
- Missing insulation
- Window failures
- Air Infiltration
- Electrical uses

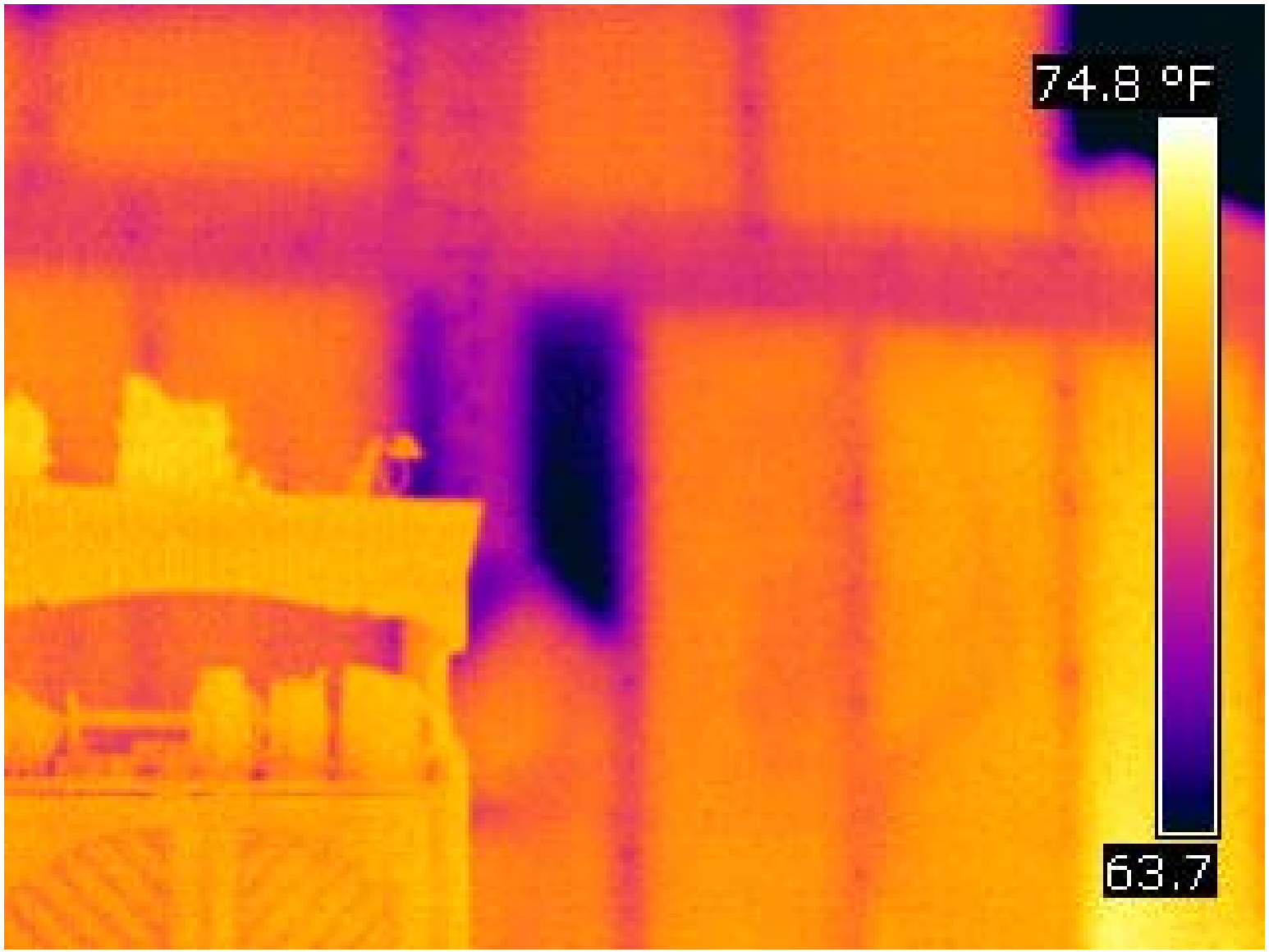


Moisture Detection

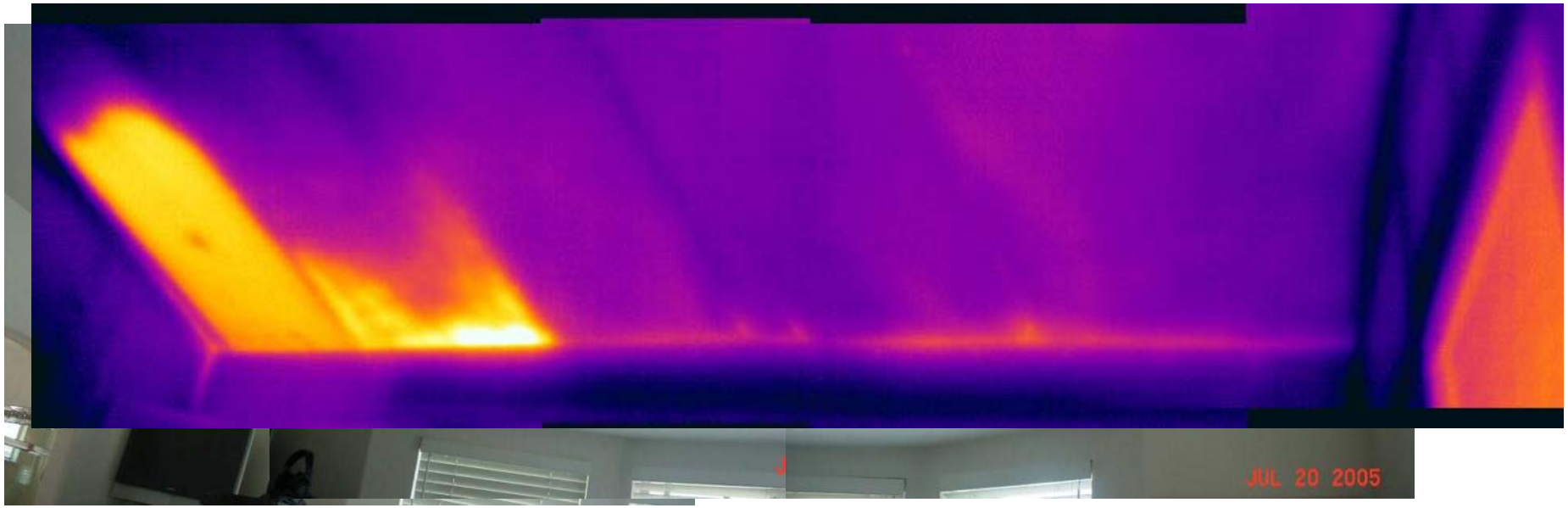
Air conditioner leak



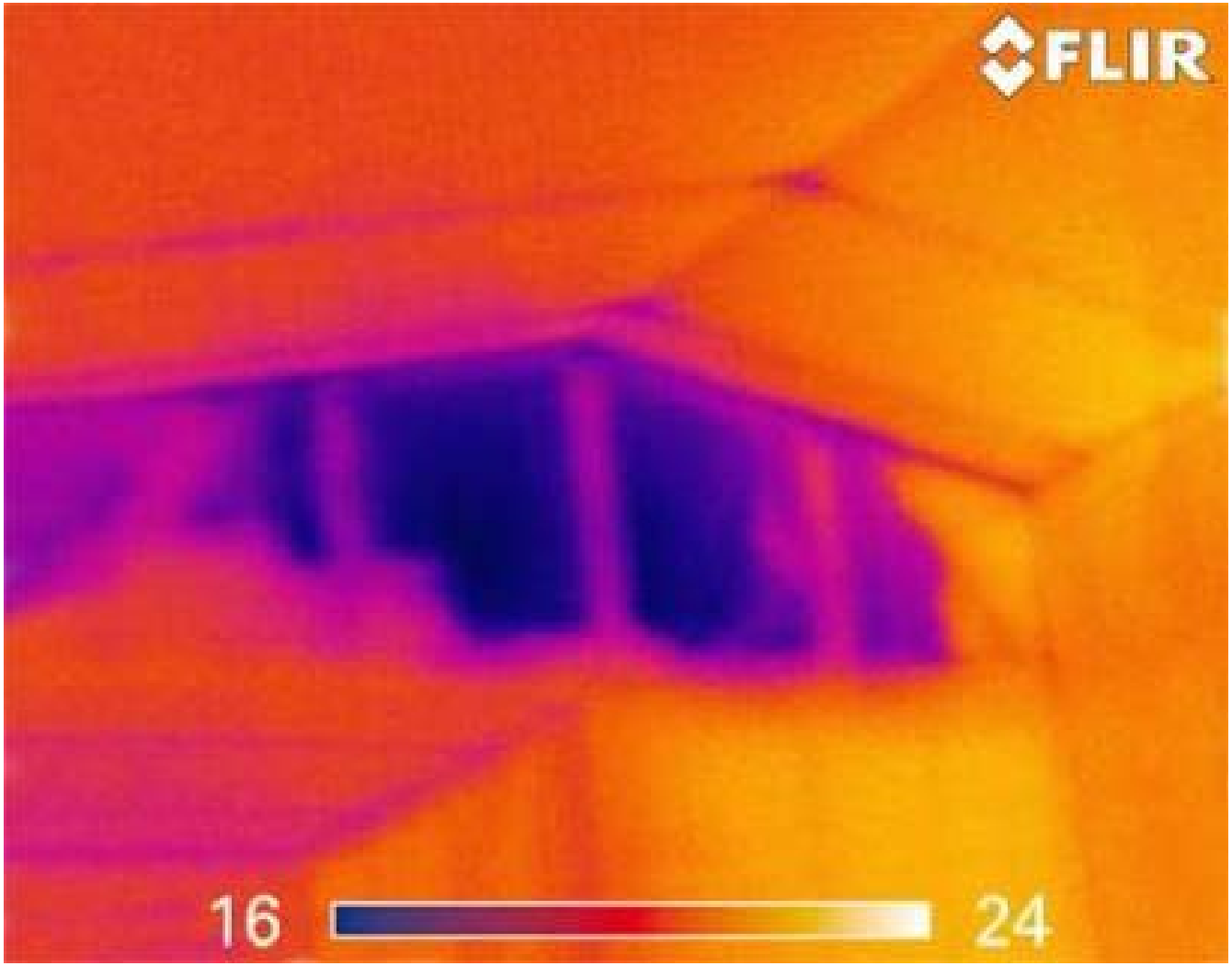
Missing Insulation



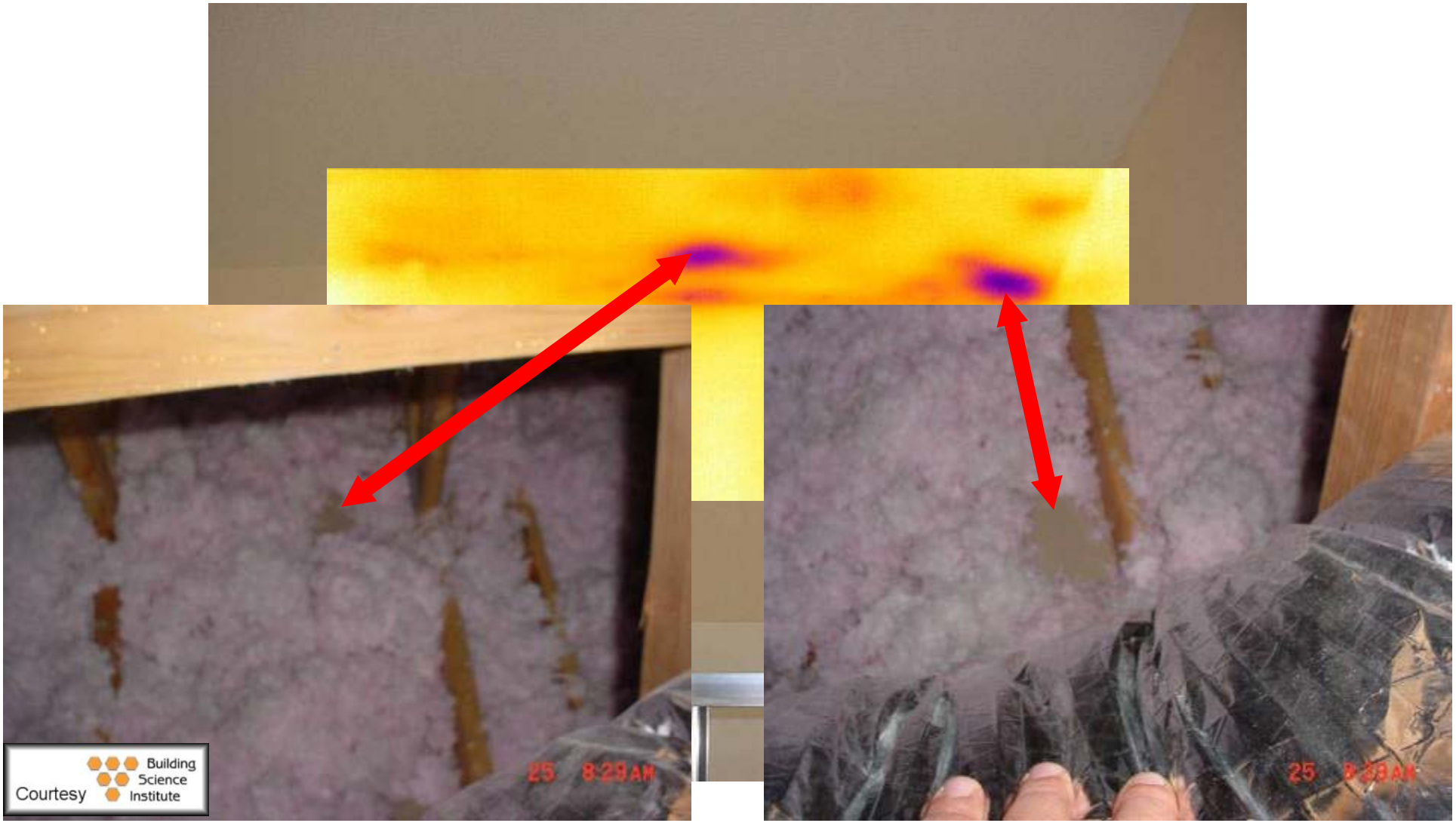
Missing Insulation



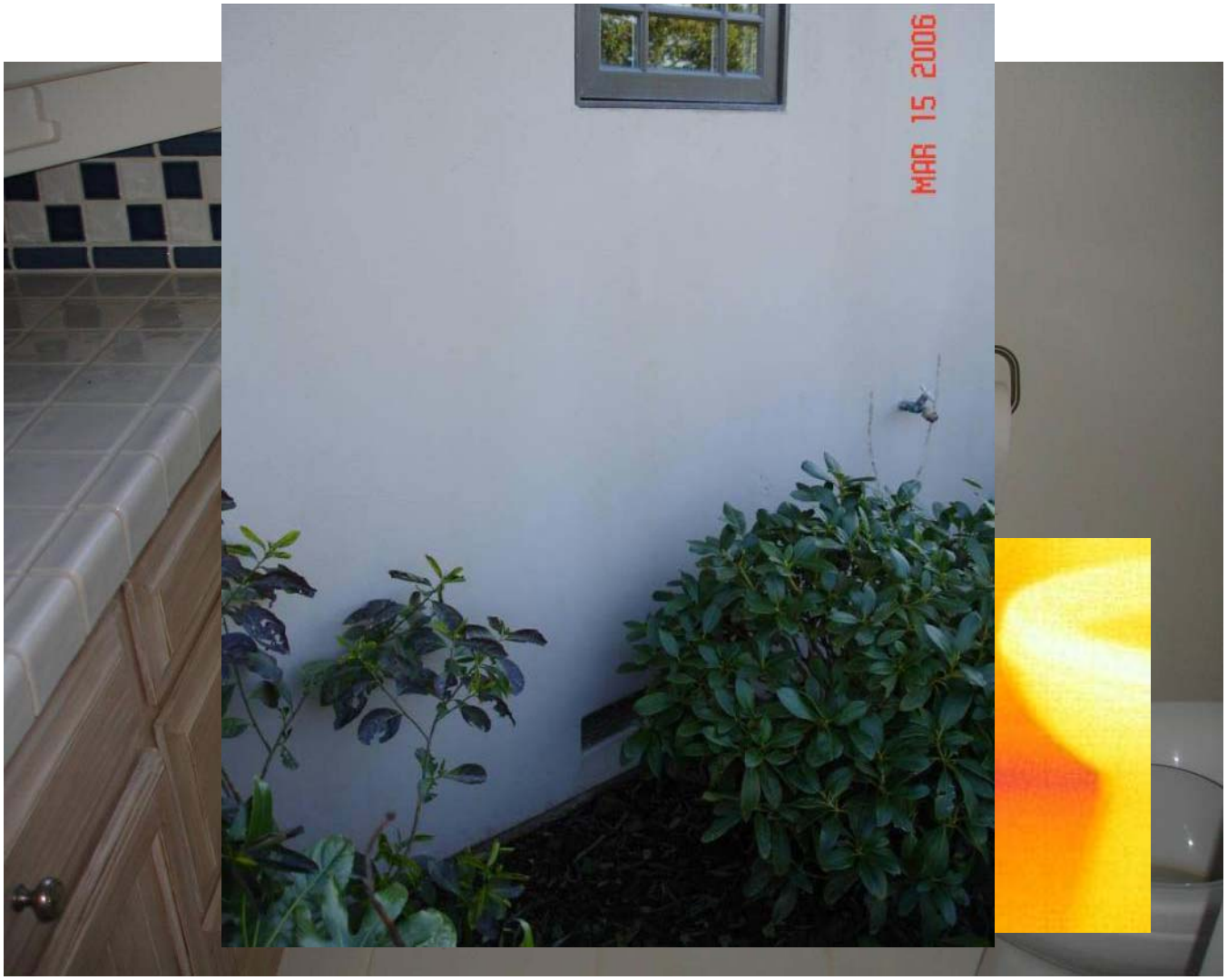
Missing Insulation



Water or Missing Insulation?

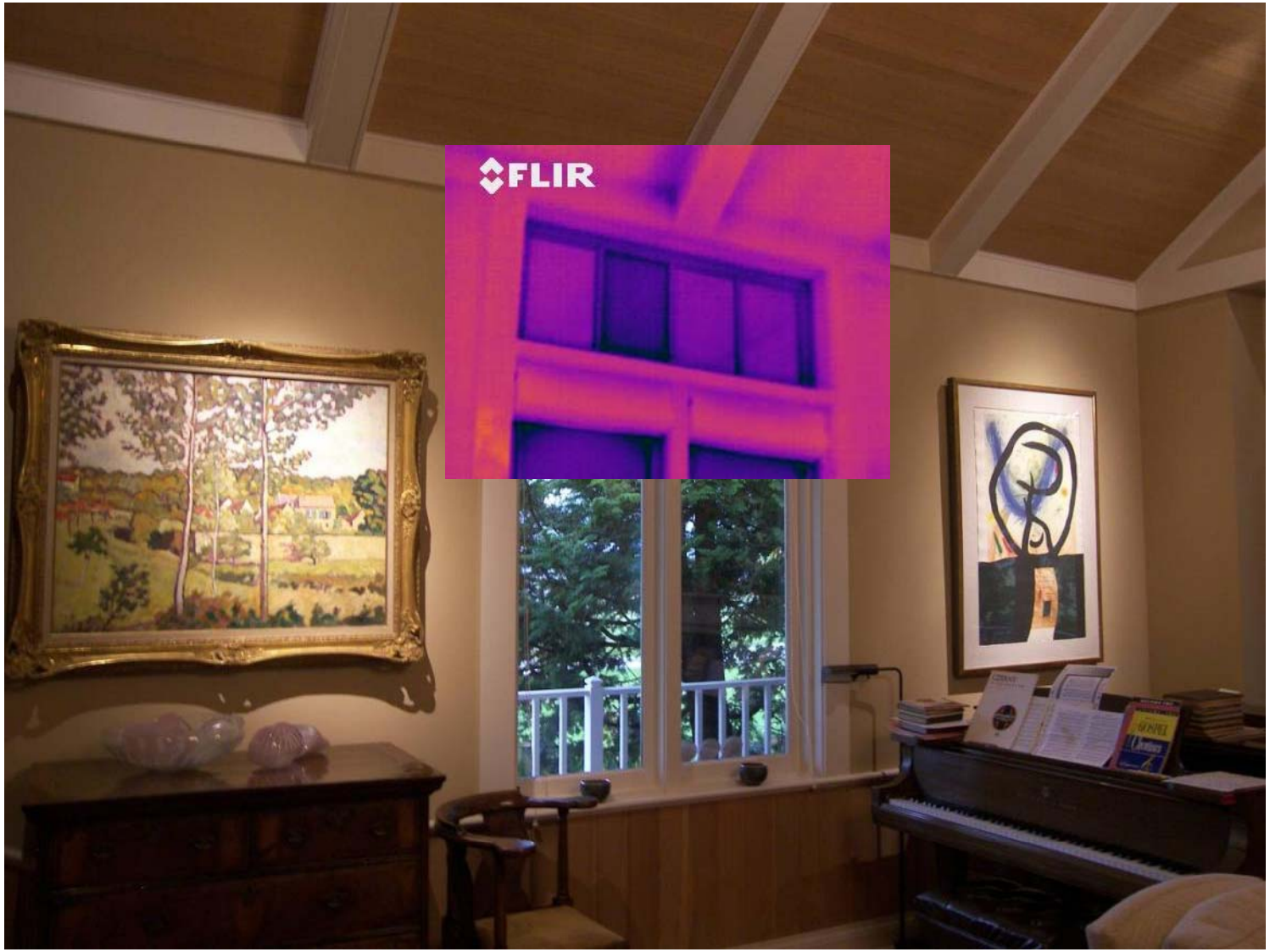


A cool spot

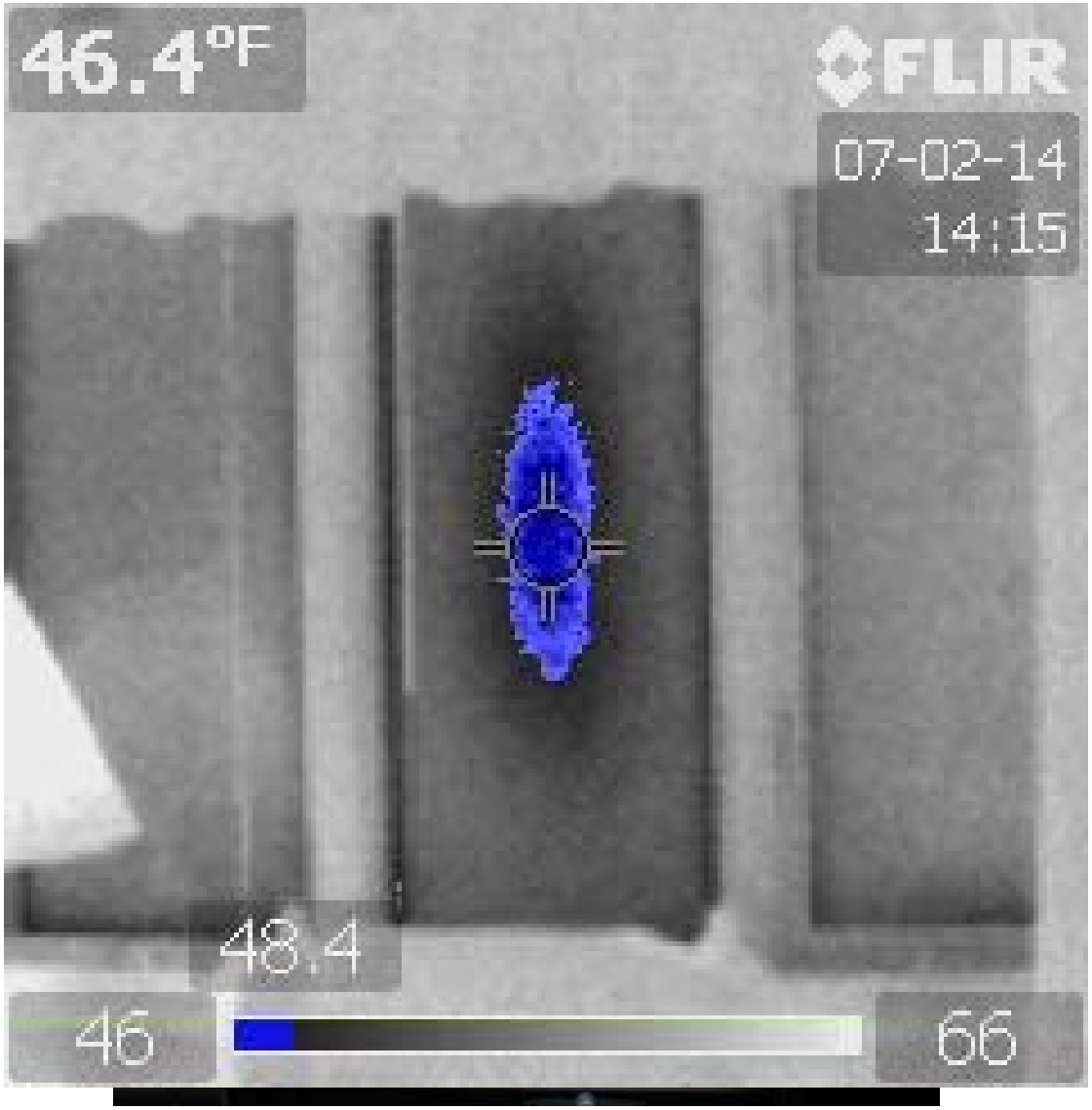


Cool spot

Window

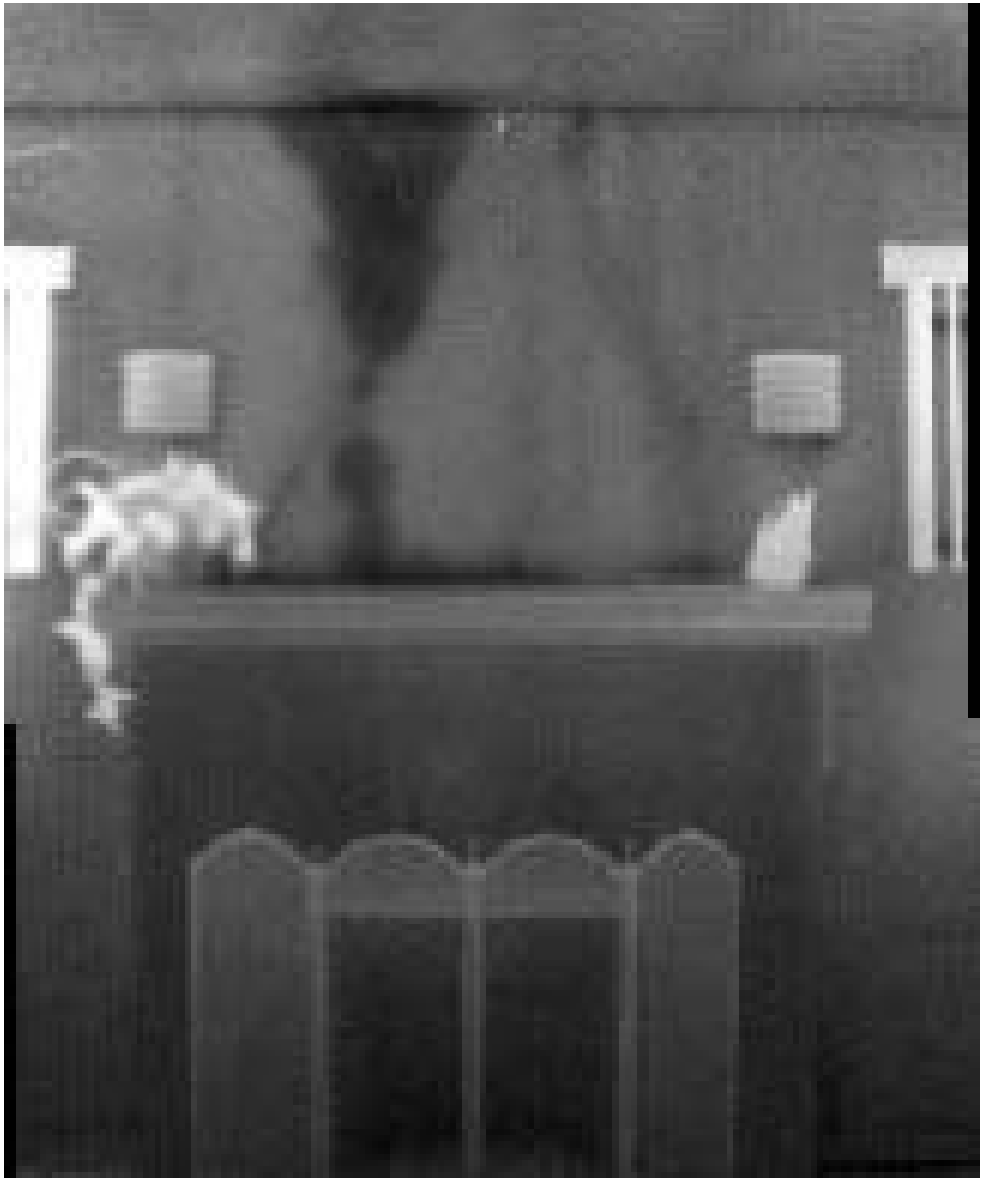


Window Failure



Courtesy Bernie Lyon, ITC

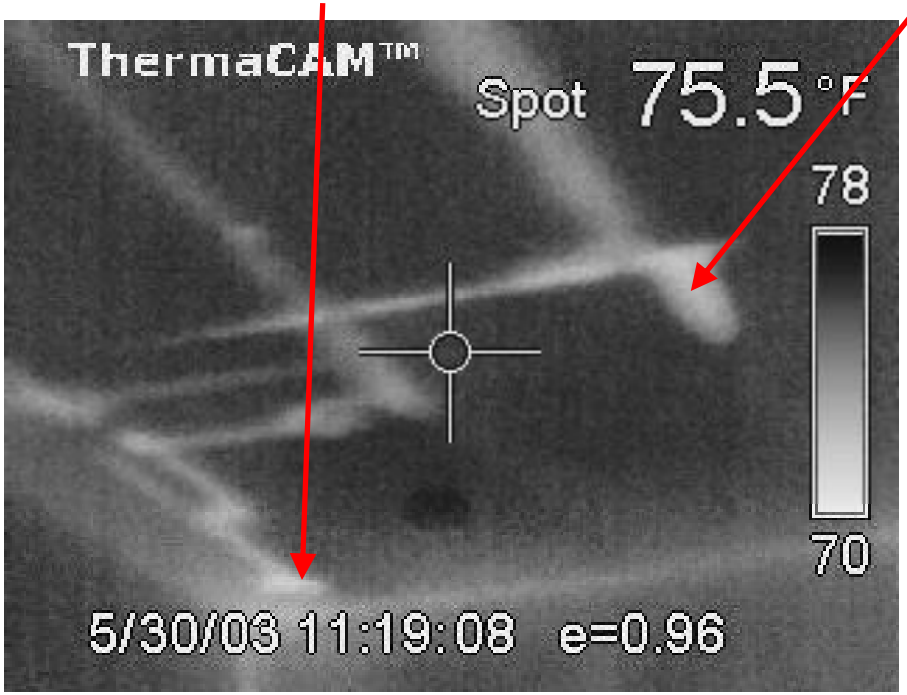
Leaking Chimney



Water Intrusion Discovery

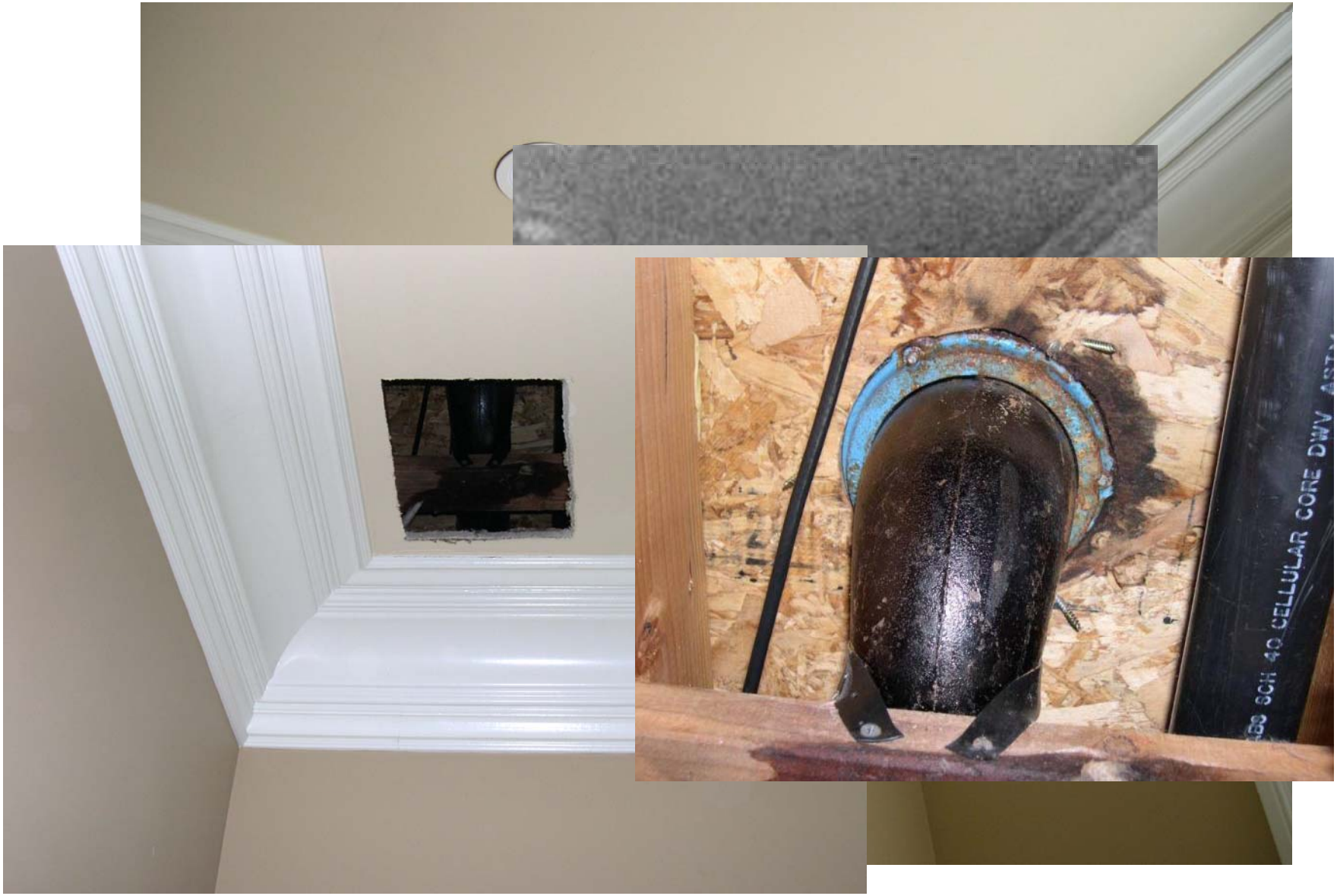
Point of entry

Visible leak

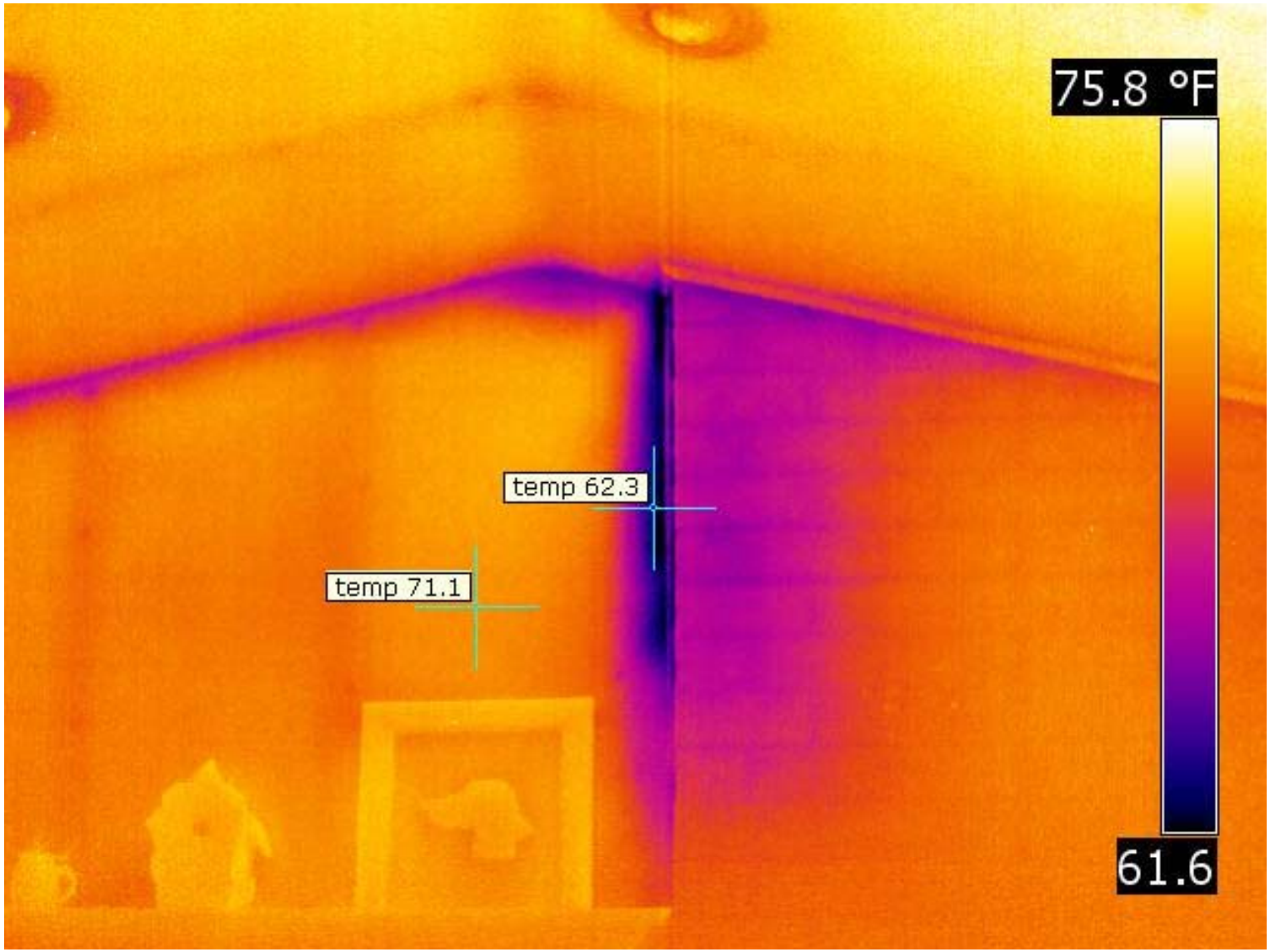


Courtesy Building Science Institute

Water Leak

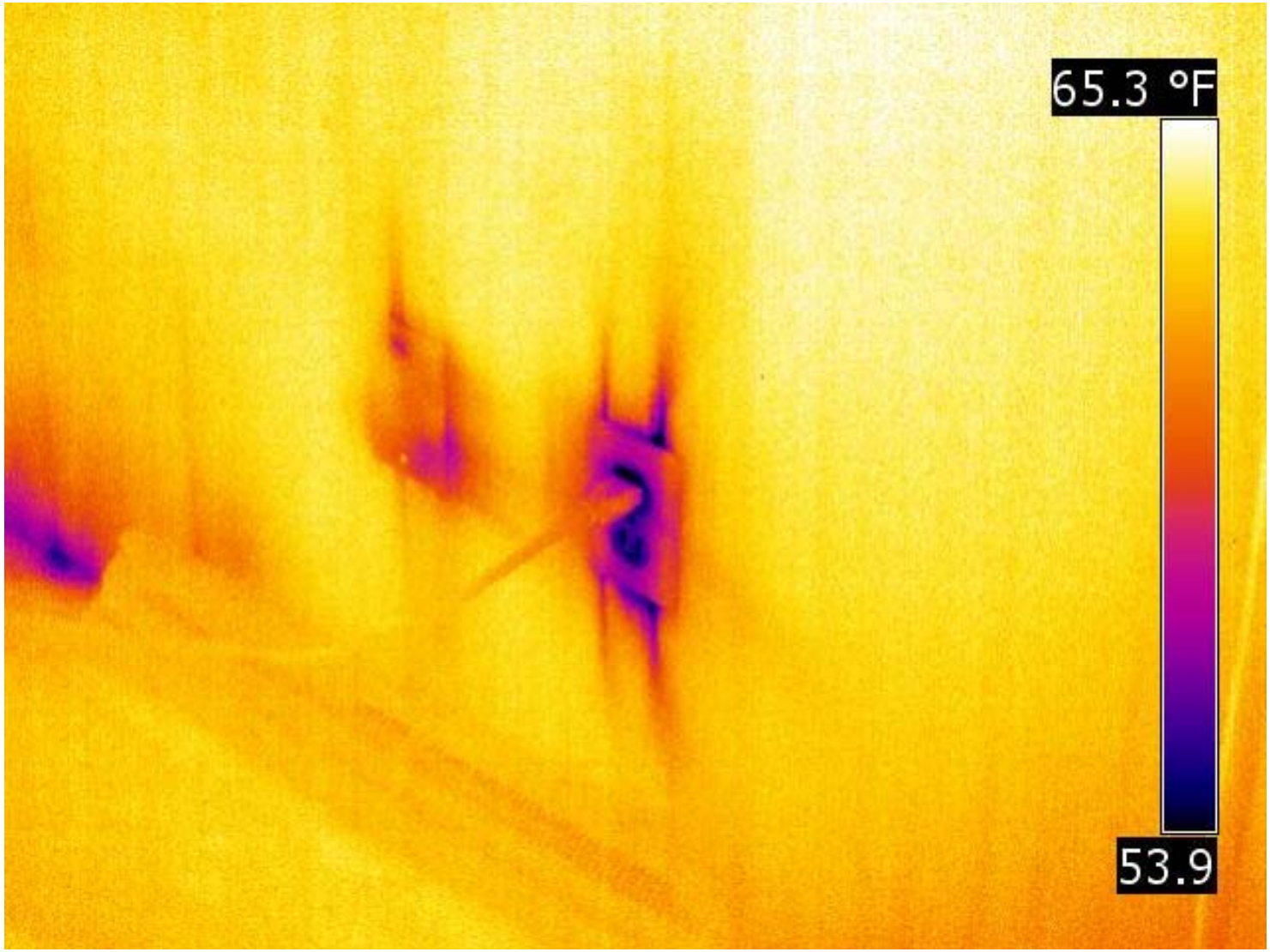


Wall Intersections



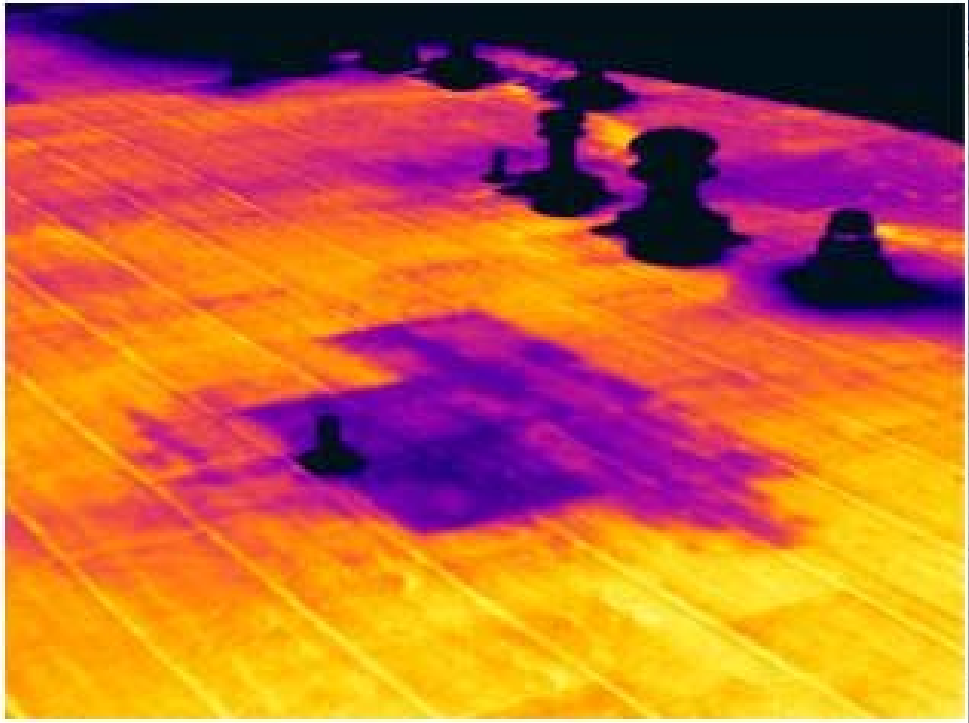
Infiltration

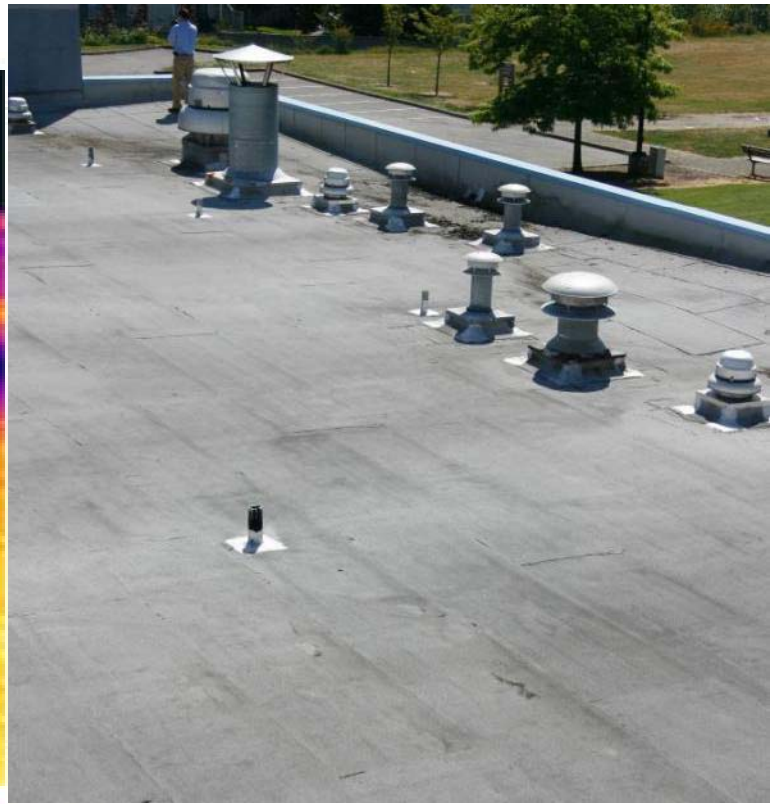
Blower Enhanced Infiltration



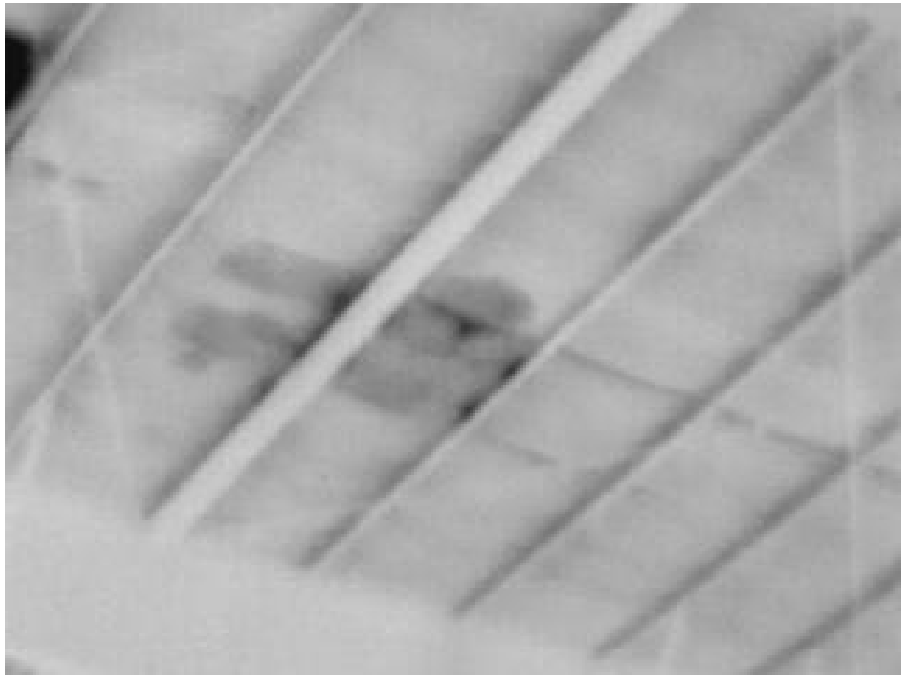
Exterior Block Wall

Roof

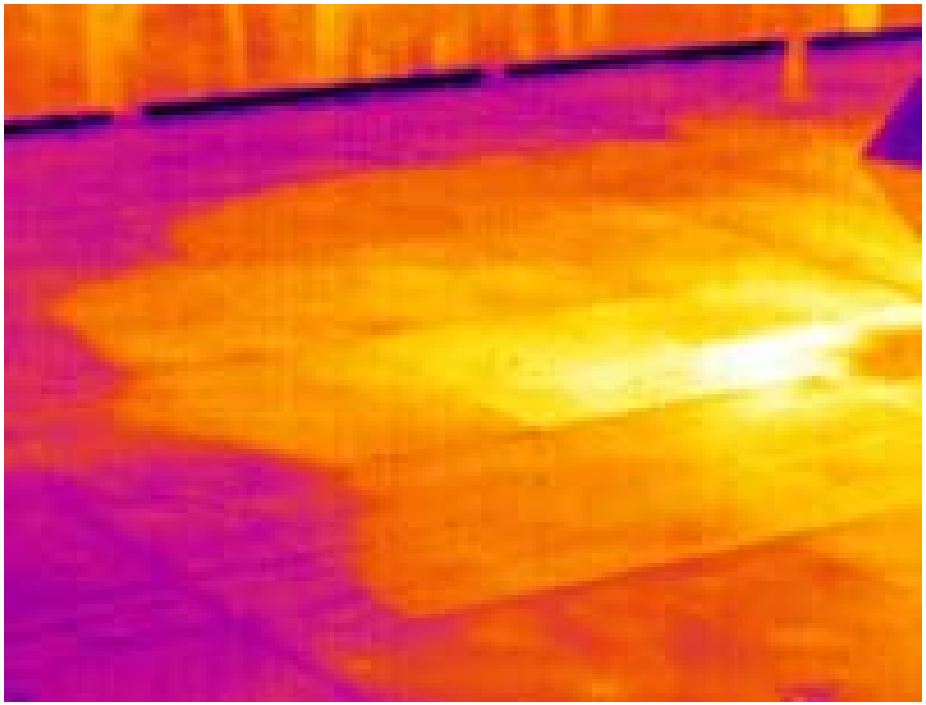




Roof

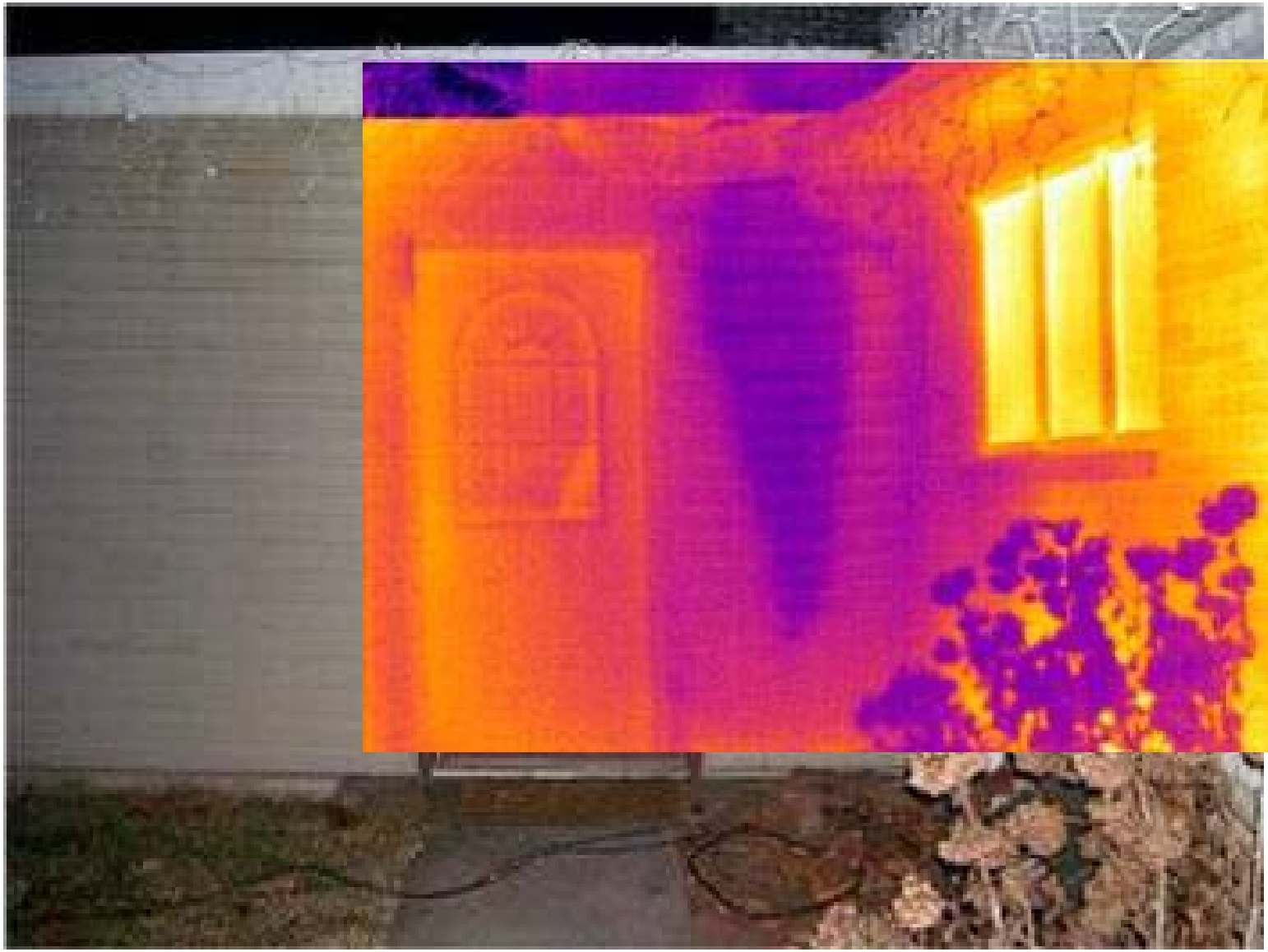


Inside



Outside

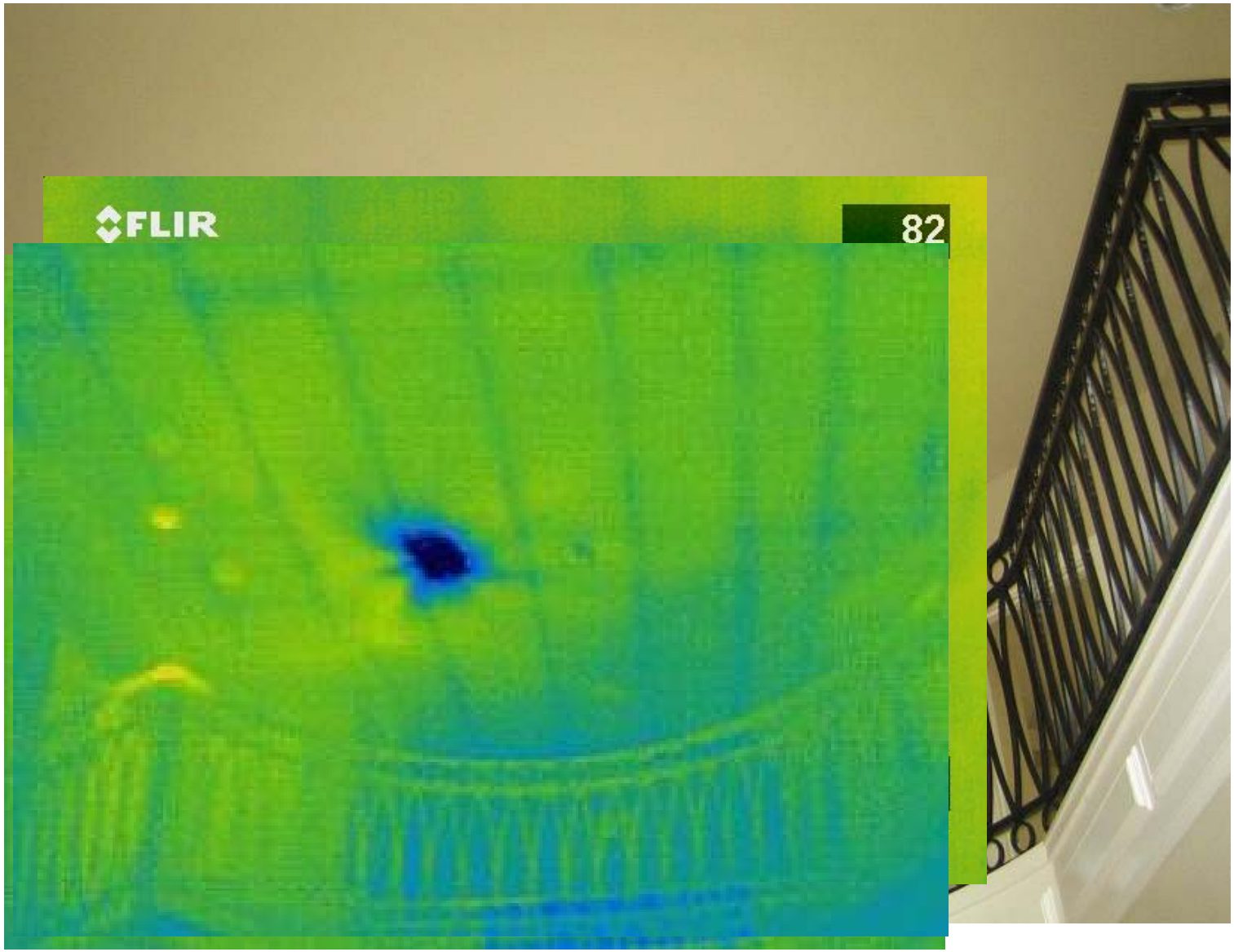
Wood Siding



Vinyl Siding

EFIS

Air Flow at Diffusers

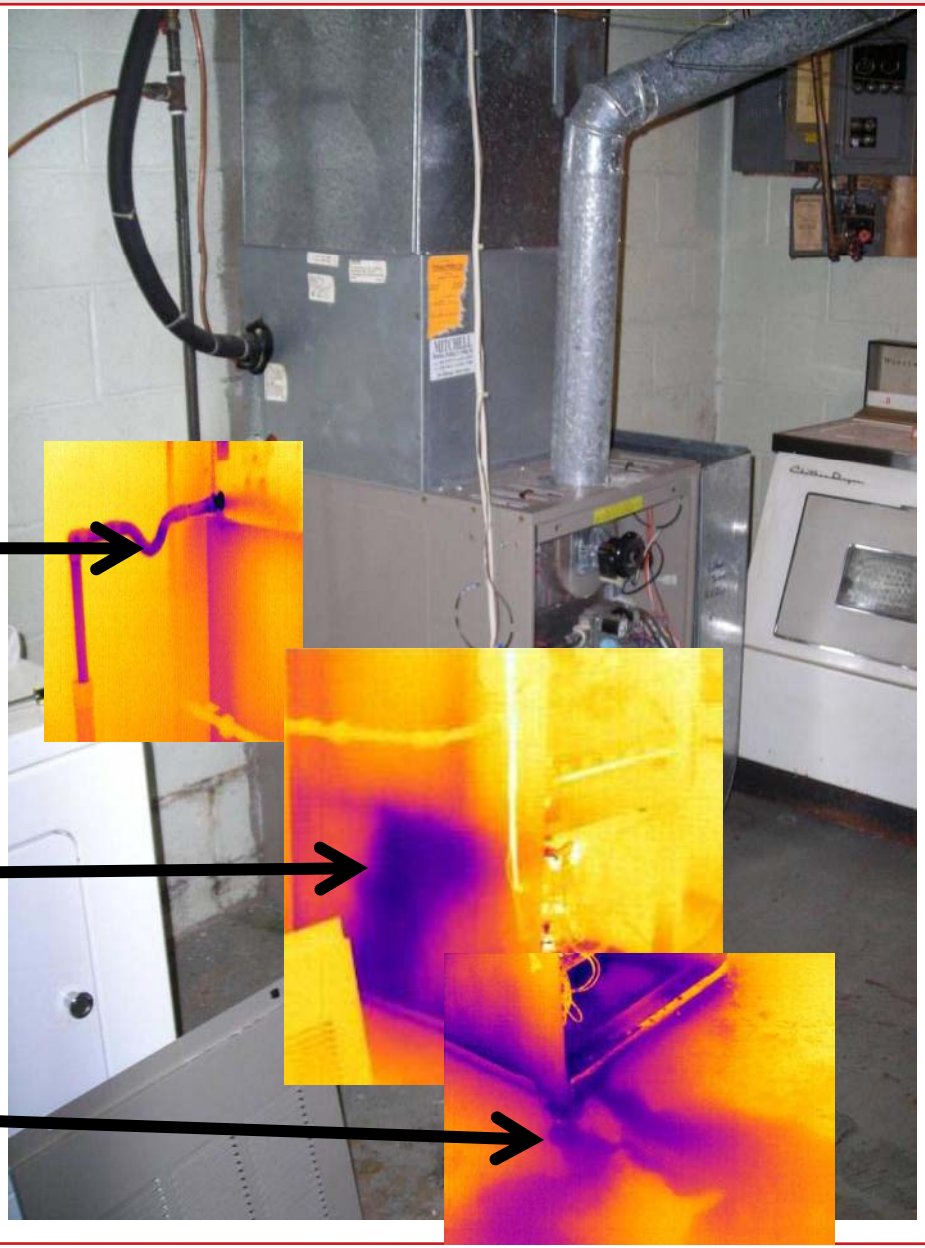


Mechanical

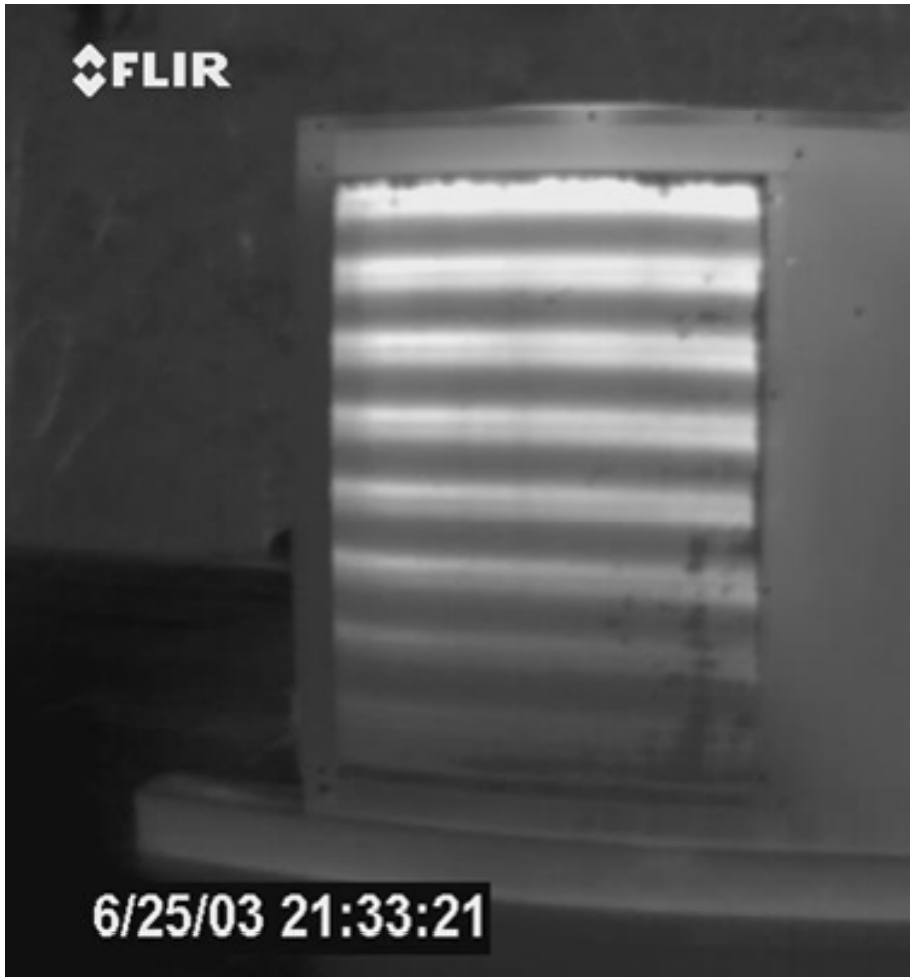
No water in trap

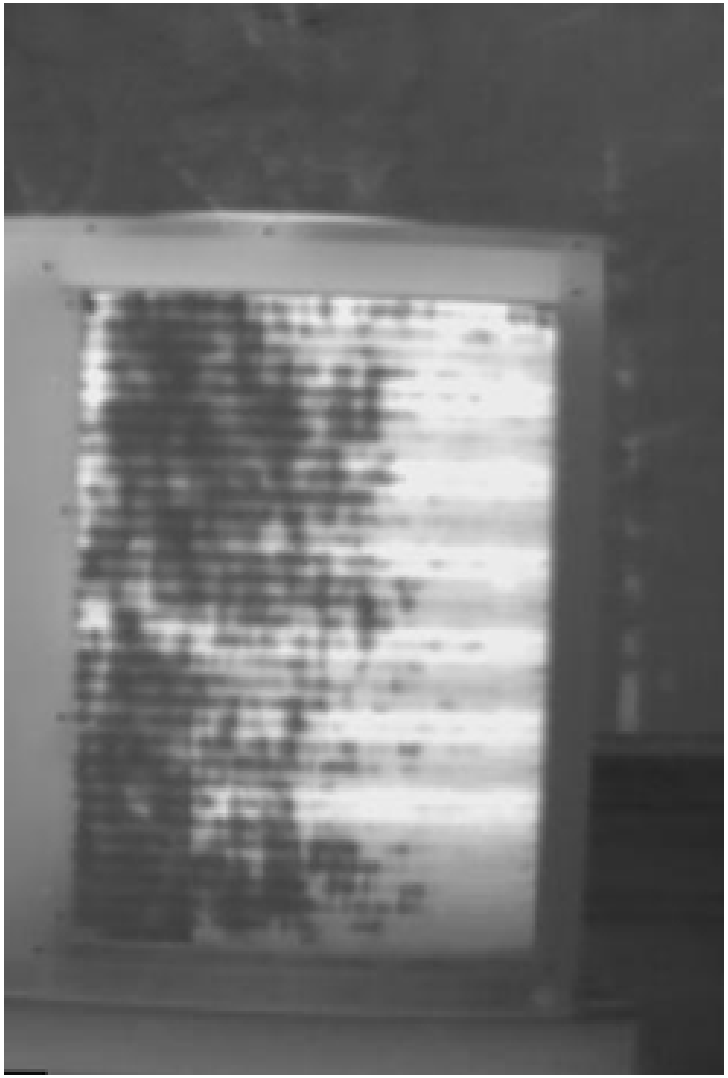
Water in unit

Water on Floor

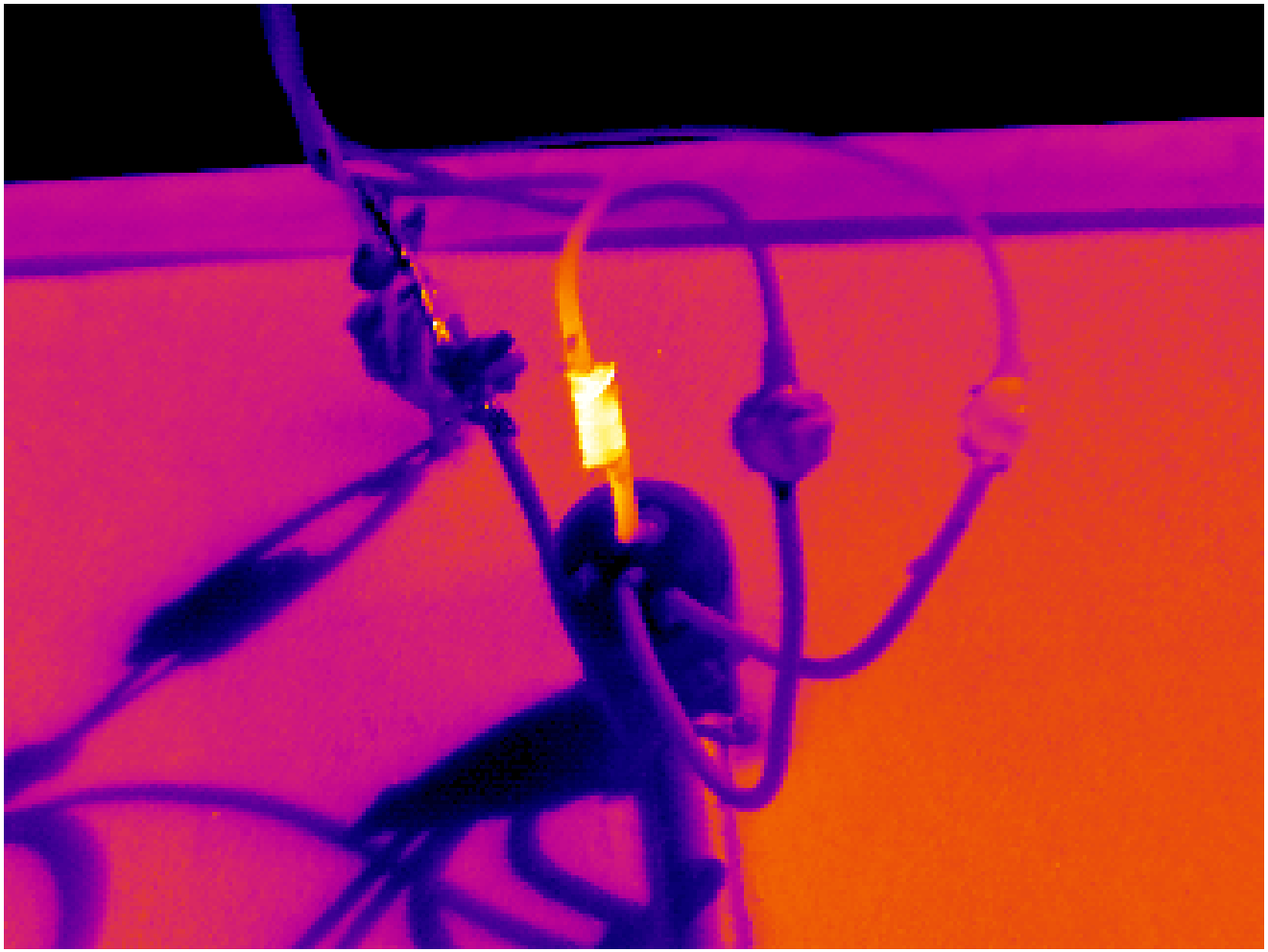


Mechanical





Electrical

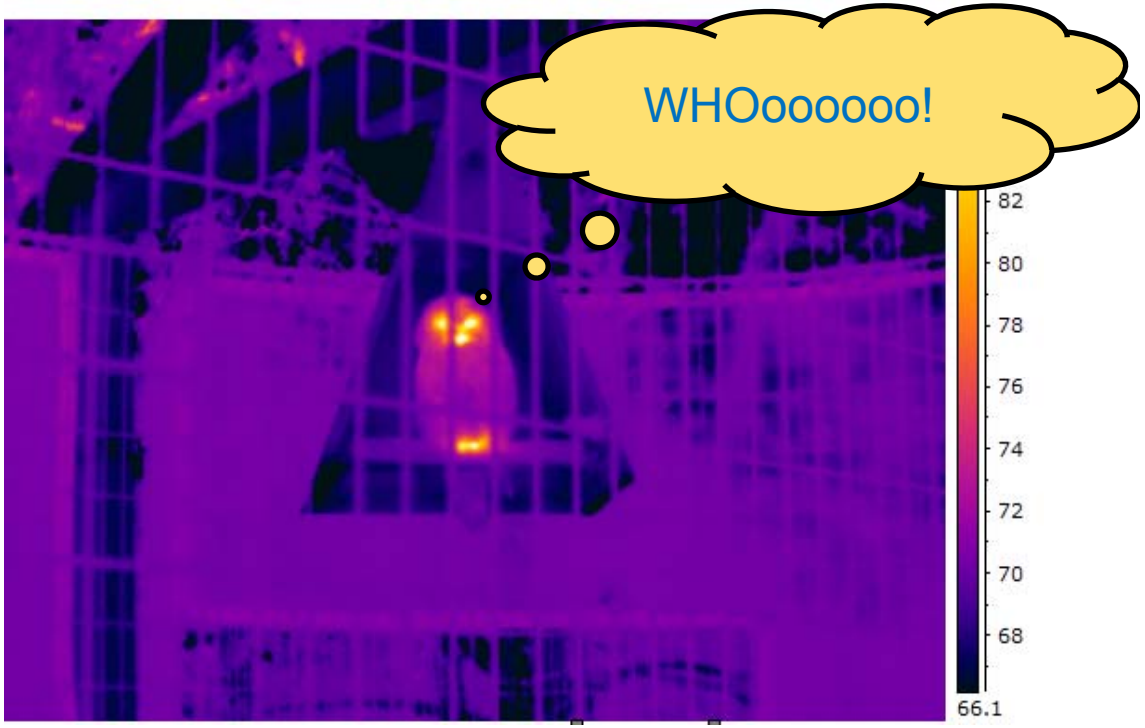


Electrical

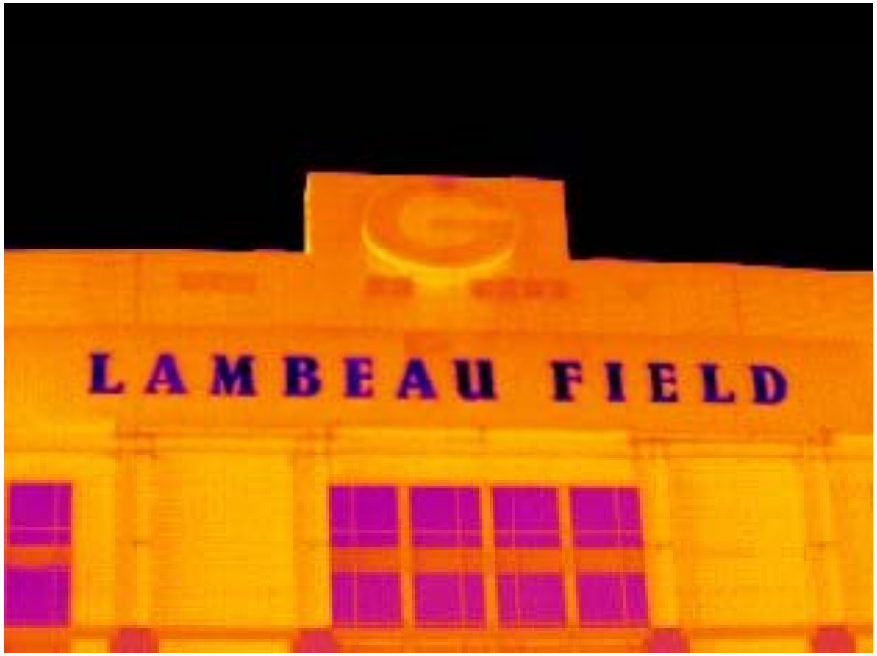
Bee Hive

Review

- **Today's cameras are easy to operate**
- **Understanding IR science is essential**
- **Understand your equipment operation**
- **You need proper training to be a thermographer**
- **Experiment!**
- **Practice!**



There is an endless application list for thermal cameras and trained thermographers.



Thank you and enjoy the thermal world!!