Thermal Imaging for Home Inspectors

Structural member placement

The gabled end of a cathedral ceiling. Note the studs and the ceiling joists with blocking. What is that glow in the upper right hand corner?
Here is a tricky one. What are the cold spots in the thermal image?

Water? Mold?

No. It’s just wood knots, which are denser than the surrounding wood.
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Structural member placement

Structural members in a stepped ceiling.
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Structural member placement

This picture shows triple studs at a joist which supports a doubled joist under a wall on the upper floor.

Care must be taken when interpreting thermal images. Never rely only on the picture. Check for other signs and do other tests to confirm your findings.
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Plumbing Problems

Water freely flows throughout most houses.

It’s called plumbing.

Pipes leak. Drain pipes get clogged and back up. Plumbing fixtures come loose and allow water to go where it’s not supposed to go.

Pipes in houses can also carry heated water and steam, for heating.

When evaluating the plumbing in a house, all the water sources (sinks, basins, bathtubs, dishwashers) should be run for at least 5 minutes to properly illustrate the pipe positions and allow leaks to form.

It is best to run hot water in the winter and cold water in the summer to obtain the proper Delta T for imaging.
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Plumbing Problems

Here is a classic problem.

Improper sealing of the plumbing fixtures to the tile shower enclosure has led to water infiltration behind the wall.
Ceiling water from a leaky toilet wax ring.

It is just as important to scan interior walls and ceilings as it is to check exterior walls.

Picture courtesy of Jeff Pope
How do you check toilets for wax seal leaks? Thermal imaging can add to your technique.
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Plumbing Problems

It is always very important to check for water leaks in houses that have been “weather proofed”. The people who shut down the water do not always do such a good job.
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Electrical problems

Whenever electrical power flows, it meets resistance which causes some of the current to be converted into heat. Seeing higher temperatures in electrical wiring is common. Seeing much higher temperatures is not.

As with all thermal imaging, care must be taken in interpreting what is seen. Just because something is hot (or cold) does not necessarily mean it is defective.

It is also important to remember that the temperature difference seen in the colors of the image are not enough. Actual numerical temperature readings of the hottest and coldest areas are needed to determine if the temperature differences are sufficient to be a problem.
Two electrical connections at a sub-station. The one on the right exhibits almost 3 times the temperature, indicative of a loose connection, most commonly caused by corrosion and/or a loose connection.

Picture courtesy of Commonwealth Edison.
Likewise, hot spots at the utility pole can also be an indication of problems. While not part of a home inspection, documentation will give the client help in understanding what to expect.
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Electrical problems - Residential

It’s always a good idea to check the house’s drop splices. You never know what you will find.

Picture
Courtesy of John Fricot, FLIR

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Electrical problems - Switches

Visual inspection of a ceiling fan switch reveals no apparent problems.

Thermal imaging reveals a hot switch. Note the warmth in the shared hot wire with the other switch.

Why is the one switch hotter?
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Electrical problems – Electrical Panels

This image shows an electrical distribution panel in a condominium unit.

No apparent problems are seen.

What does thermal imaging show?
The GFCI breaker at the upper left is warm and the breaker (and wire) at the lower right is also warmer.

When the dead front was removed, the GFCI breaker started to arc.

The breaker at the lower right was rated for 15 amps, but was supplying a 20 amp furnace blower motor.
On closer examination, the greatest temperature difference can be seen where the breaker attaches to the buss bar, where the arcing is occurring.
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Electrical problems

The other breaker displays greater temperature not only at the breaker, but also at the conductor (14 AWG) that it serves.
Rectangular air return duct in a plaster wall. Where was the duct installed.

Note thermal images during both heating and A/C operation.

Which is which?
This is a duct encased in a ceiling soffit in a finished basement.

Note the framing of the soffit as well as the hot spot at the far end, where the duct had been physically damaged.
Here we see a branch duct off the main duct and its termination at a supply register.
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Pipe Placement – Hydronic Heating

Hydronic heating pipes under the floor in an office building floor.
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Pipe Placement

Radiant heating pipes under tile flooring. Note the rug and sofa.
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Pipe Placement - Leaking

A leaking hydronic heating pipe in a slab floor at the wall.
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Pipe Placement

Concrete slab construction with radiant heat.

Seen by thermal imaging, the placement of the pipes can be seen and any leakage can be noted.
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Pipe Placement

Barrel ceiling in an older house. No problems seen.

With a substantial radiant heating system in the ceiling.
What kind of problems will this configuration potentially cause?
Thermal imaging revealed that the copper tubing, under the slab, was leaking which was allowing air to enter the system and causing the cavitation.

Thermal imaging was able to locate the leak and only a small section of floor was involved.
Thermal Imaging for Home Inspectors
Pipe Placement

Driveway with heat pipes. The upper section was not functioning and the client wanted the leak point located.
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Pipe Placement

With careful adjustment of the span and level of the image, pipe leaks can be localized. Look for a dramatic decrease in the temperature of the pipe at one place.
Thermal Imaging for Home Inspectors
Pipe Placement

Proper adjustment of the span, level and reflectivity settings of the camera can even allow for accurate exterior scanning.

Here we see the lines of a heat pump system running inside the wall to the attic air handler system.