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Unwanted Moisture in Buildings - Part 2

Overview

Last month's Technical Bulletin reviewed unwanted moisture in buildings and some of the problems it can cause. Due to the potential effects on occupant health and building damage, the presence of unwanted moisture should be investigated as soon as it is suspected or signs appear.

This article discusses means that are available to investigate the presence of unwanted moisture so that problems can be identified and corrective actions can be implemented. Two commonly available tools to identify unwanted moisture are thermal imaging cameras and moisture meters.

Thermal Imaging Cameras

Thermal imaging, or infrared thermography (IRT) detects radiation in the long-infrared range of the electromagnetic spectrum (8,000 - 13,000 nanometers)[1] that is beyond the range of human perception (400 – 780 nanometers)[2]. The infrared energy emitted by an object is directly related to its temperature, so an IRT image is a visual representation of temperature variation. Thermal radiation can detect temperature variation in inaccessible and concealed spaces like the interior of walls, inner layers of a roofing system, sealed chases and plenums.

Temperature variation is a good indicator of the presence of moisture because excess moisture affects the temperature of material in a number of ways:

Evaporation Moisture cools the surface of a material as it evaporates, so wet materials are cooler than dry materials.

Thermal Lag Water is dense, so a porous materials with excessive moisture will change temperature more slowly than dry materials.

Thermal Resistance Porous materials with excessive moisture have a lower R (thermal resistance) value than dry materials.

Conduction Water is conductive, hence materials with excessive moisture will transfer heat by direct contact faster than dry materials.

The distribution and characteristics of temperature in a material is not always intuitive, so thermal images can be difficult to interpret accurately. Examination of thermal images by an experienced professional can provide insight into the condition of inaccessible spaces without invasive testing. The goal of thermal imaging should be identification of areas with potential temperature anomalies which should be the focus of further investigations, including invasive testing.

Moisture Meters

Moisture meters measure the electrical conductivity of a material. Because water is more conductive than most porous construction materials (e.g. wood, gypsum board), electrical conductivity is a good indicator of moisture content.

The use of a moisture meter requires direct contact with the material to be tested. This may require demolition to access materials in concealed spaces.

Moisture meters should be used with an understanding of their limitations and capabilities. All construction materials normally contain moisture, so a positive reading does not necessarily indicate excessive moisture. The measurement of many meters display a percentage of moisture content, which is often calibrated for a particular material (often construction-grade lumber) which may not be accurate for other materials. However, meters can be very useful in measuring relative moisture content between sections of the same material. It is very important that records be kept of the location and time of readings for future reference because moisture content changes and readings may not be repeatable.

Pin-type meters have two sharp pins which penetrate the test material. The moisture content is determined by measuring the electrical resistance to an electrical current passing between the pins. Pin-type meters are very accurate but are somewhat destructive as they leave holes in the material tested. Pin-type meters only work with materials that are soft enough to be penetrated by the pins.

Pinless meters produce an electromagnetic field to measure the dielectric properties of the material. Pinless meters are not as accurate, but are non-destructive and can be used more quickly over a large area.

Conclusion

Thermal imaging cameras and moisture meters are two common tools that provide temperature variation and relative moisture content, both of which are good indications of unwanted moisture in building material. Their use should be considered as means for identifying areas for further investigations so that permanent corrective actions can be taken.

References

[1]Balaras, C.A., Argiriou, A.A. (2002) Infrared Thermography for Building Diagnostics, *Energy and Buildings*

[2]Practical Aspects of Locating and Measuring Moisture in Buildings, *National Institute of Building Science*, https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/BEST/BEST1_002.pdf