How do Moisture Meters Work – Quick Tips

A moisture meter is an essential instrument used in many industries to detect moisture content in materials. Home and building inspectors rely on moisture meters to identify potential problems and damage to structures from moisture buildup. Woodworking industries, such as furniture makers, use wood moisture meters to insure a quality product. Flooring contractors use moisture meters to determine ideal conditions when installing a floor over a concrete slab or subfloor.

Indicator scales on moisture meters can vary in appearance, but all will indicate moisture content in percent (%MC). While some moisture meters offer an analog scale, others read %MC digitally. The accuracy of the %MC readings, as well as the appropriate substrate scales, vary per meter and can vary by brand and type.

Most moisture meters are calibrated to wood, which provides a relatively accurate reading in wood moisture content. Typically, this scale ranges in the 5 to 40% range. When testing the moisture content in non-wood materials, such as concrete, a relative scale of 0 to 100 is often used, where 0 is bone dry and 100 is saturated. This is a relative scale. Moisture meters include visual LED indicators related to the percent reading on the scale for dry, moderate and saturated or wet readings. Additionally, some meters also offer a third scale for readings of gypsum. These scale readings can range from 0.2 to 50% moisture content. When selecting a moisture meter for sheetrock, it is advised that a moisture meter that offers a scale reading for gypsum be used.

Color indicators on moisture meters are helpful in determining whether the material being tested is considered dry or if there is a potential problem with moisture. The green (dry), yellow (moderate) and red (high) indicators typically identify where on the scale of %MC the readings occur. This can clear up confusion where one interprets a %MC as dry versus one that is moderate and may require more thorough investigation to determine if a problem

with moisture in the material exists, especially if a visible sign of moisture does not exist.

Types of Moisture Meters

There are three common types of moisture meters used for the inspection of building and structure materials: pin-type, pinless and pin/pinless/all-in-one. All three types of moisture meters offer specialized purpose and are unique to the end user's application in determining %MC in materials.

Pin-Type Moisture Meter

Pin-type moisture meters have two pins on the instrument, which are used to penetrate into the test surface at a desired depth. The %MC is measured at the depth of the head of the contact pins. These meters use the principle of electrical resistance to measure the %MC by measuring the conductivity between the pins and typically read up to 5/16″ deep. The tips of the pins are relatively sharp, uninsulated and penetrate into the surface for a sub-surface reading. This method is often viewed as an invasive process. With pin-type meters, you can also obtain a reading by touching the pins to the surface for testing.

Most pin-type moisture meters use a scale calibrated to wood, however this does not mean that the meters cannot be used to measure moisture in other substrates and materials. These types of moisture meters can also be used forconcrete, drywall, ceiling tiles, painted surfaces and more. When using the wood scale on a pin-type moisture meter, the %MC reading can range from 5% to 40% in moisture content. Generally, the low end of this reading will fall into the 5 to 12% range, the moderate range will be 15 to 17%, and the high or saturated range will read above 17%. Scales for %MC ranges are provided in the instrument instructions and should be consulted for specific surface materials measuring ranges.

A pin-type moisture meter is the best way to identify the exact location of moisture buildup. When insulated contact pins are used, only the uncoated tips are exposed, providing an accurate

reading of moisture content at various levels of penetration. Pin-type meters are the only instruments that allow the inspector to identify exact location of moisture at a given point. Using a pin-type meter is an effective way to determine the difference between shell and core moisture content.

Pinless Moisture Meter

Pinless or noninvasive moisture meters operate on the principle of electrical impedance.

This type of meter provides a nondestructive measurement of moisture in wood and other substrates, such as concrete and gypsum. A noninvasive moisture meter may also be called a nondestructive or a pinless moisture meter. Scales on these meters are similar to that of pin-type meters, where the wood scale reads %MC at 5 to 30%, but also reads %MC for nonwood materials (typically concrete) on a relative scale of 0 to 100. They can read up to a typical depth of ¾ inch or 1 inch into a subsurface. They are useful for detecting problem moisture buildup where visual indicators are not evident.

Pinless moisture meters are commonly used to determine moisture content on a relative scale of 0-100 in concrete subfloors and flooring prior to laying a wood floor or other decorative flooring surface. They are also used for identifying possible moisture buildup behind bathroom/shower tiles, under vinyl flooring and other finished surfaces, as well as to determine if water-borne finishes are adequately dry prior to a second application.

Pin/Pinless/All-in-One Moisture Meter

A third and possibly more useful moisture meter would be a pin/pinless/all-in-one moisture meter. This type of moisture meter utilizes both methods for measuring %MC. and therefore one meter may be used to identify problem areas and then also used to pinpoint the exact location where moisture damage or buildup is occurring. Essentially, this type of meter would utilize the same scales of %MC for wood and nonwood substrates and allow the end user the versatility necessary for a full inspection in

determining areas where moisture is an issue.

Ideally, due to its diversity, this type of meter could be utilized by flooring specialists, indoor air quality (IAQ) specialists, general contractors and home/building inspectors.

Accessories for Additional Monitoring Capability

Generally, pin-type and pinless moisture meters provide moisture readings that are limited in depth. However, in some applications, readings of moisture deeper than 5/16″ are necessary. If this is the case, many meters are equipped with a connection option to add accessory probes that can be inserted further into a substrate for more accurate core or depth detection. An example would be for Exterior Insulated Finish Systems (EIFS) testing. Moisture problems in EIFS are typically found within stucco surfaces and stem from poor sealant application around window and door frames or are a result of faulty flashing installation. EIFS probes are used to test for %MC within these structures.

For deep penetration, long-insulated contact pins may be used to obtain a moisture content measurement taken at depth. Holes may need to be drilled into the surface for testing and then the extra-deep pins are inserted into the pre-drilled holes and %MC measurements are taken at the tip of the pins where they are not insulated. Insulating all but the tips of these pins prevents a false moisture content reading and provides a more accurate reading at the depth where the tips of the pins are exposed.

In order to obtain a depth without drilling holes into the surface, a hammer probe can be used to measure moisture content in wood at different levels of penetration by inserting a long pin into a wood surface for up to 1-1/2″ depth readings. Hammer probes are ideal for shell and core tests to detect moisture gradients and to test lumber with wet surfaces.

Other applications may require measuring %MC on surfaces that are out of reach or in a relatively inaccessible area, such as under sinks or in ventilation areas. If this is the case, then using a pin-type moisture meter attachment may come in handy so the

reading can still be obtained on the meter while the measurement is being taken at the source. Not all meters offer attachment ports for remote testing, EIFS testing or deep penetration. Typically this is an optional feature.

Commonly Asked Questions

Q: How do I care for my moisture meter?

A: Moisture meters used for inspection are generally factory calibrated. To keep your meter in good working condition:

- Store the meter in a clean, dry location
- Change batteries and pins as needed. Running a moisture meter on low batteries may cause the meter to go out of calibration
- Keep the electrodes and meter clean by using a biodegradable cleaner sparingly on external parts only

If repairs or re-calibrations must be done on the meter, it is suggested to return the meter to the manufacturer or manufacturer service center for service and re-calibration to original standards.

Q: What type of moisture meter works best for water-damaged structures?

A: To quickly identify wet areas in walls and floors, pinless meters are easy to use. They offer the convenience of testing a large area quickly and help you determine if further testing is required in certain spots.

On the other hand, a pin-type moisture meter is the best way to identify the exact location of water damage behind walls, in subfloors or in any other area where moisture may be hidden behind another surface. The key to finding hidden moisture is to use an electrode with insulated contact pins. These pins read only at their uninsulated pin tips, allowing the user to drive the pins into material at various depths, noting readings at each level of penetration.

Q: How far should I drive non-insulated pins into wood?

A: Drive pins into the wood at full depth if possible. At moisture levels below 10%, it is essential to make positive contact with the substrate to get an accurate reading.

Q: Can I use a moisture meter to check for pest infestation?

A: Yes. A few meter readings in key locations of the structure will quickly indicate if the areas are safe or in danger of infestation. Using pin-type meters for pest control applications is the best way to identify the exact point of infestation behind walls and ceilings. The meters make this possible by detecting moisture in areas where pests can grow and thrive without human interaction. While fungi and mold begin to grow in wood with moisture content around 20%, some species of insects thrive in wood with only 12%MC.

Sources

How Does a Moisture Meter Work, Anyway?

Extech

Extech Frequently Asked Questions

General Tools

Tramax Meters

Source: Grainger Know How – https://www.grainger.com/know-how