Performing Correct and Accurate RH Testing in Concrete Slabs

By Jason Spangler

In order to prevent a moisture-related failure to a floor covering or coating installation, the concrete slab must be at the proper moisture level. Therefore, accuracy of the moisture readings is critical. As the scientifically superior in-situ relative humidity testing method for concrete slabs becomes more popular, you'll want to understand and adhere to this ASTM F2170 standard.

Currently, there are two common types of relative humidity testing methods. The older of the two methods requires a plastic cylindrical sleeve that is inserted into the drilled hole, and then a separate relative humidity probe is inserted into the sleeve to obtain the reading. (Photo 1) The newer type of test method utilizes a design that actually incorporates a microsensor into a sleeve-like insert. (Photo 2) With this newer style, the test results are obtained by a separate reading device. Both methods require patching of the hole prior to flooring installation.

Taking Readings at the Correct Depth

ASTM F2170 requires that relative humidity readings be performed at a depth equal to 40% of the thickness of the concrete (slab drying from one side; 20% if drying from two sides). For example, if you have a 6-inch-thick slab on grade, you'll need to drill your holes to a depth of 2.4 inches, completely clean them of loose debris, and then place the sleeves or integrated sensors/inserts into the holes.

If you are using the newer testing method with the sensor already integrated into the insert, and you have already drilled your hole to the correct depth, place the insert+sensor into the bottom of the hole. This will ensure that you're measuring the relative humidity at the right depth.

When using the older method with a separate sleeve/probe, check that your sleeve is properly positioned. Some sleeve methods are more depth-specific than others.

Regardless of the relative humidity test method you are using, make sure you obtain your readings at the correct

ABOUT THE AUTHOR

Jason has 20+ years' experience in sales and sales management in a spectrum of industries and has successfully launched a variety of products to the market, including the original Rapid RH® concrete moisture tests. He currently works with Wagner Meters as the Rapid RH® product sales manager. He can be reached at:
jspangler@wagnermeters.com

RAPIDRH L6

depth. Otherwise, you won't be adhering to the ASTM F2170 standard in every test situation.

The importance of the depth requirement was established from studies done by Dr. Göran Hedenblad of the Technical University of Lund in Sweden in the mid '90s. These studies are the basis for the depth requirements given in ASTM F2170.

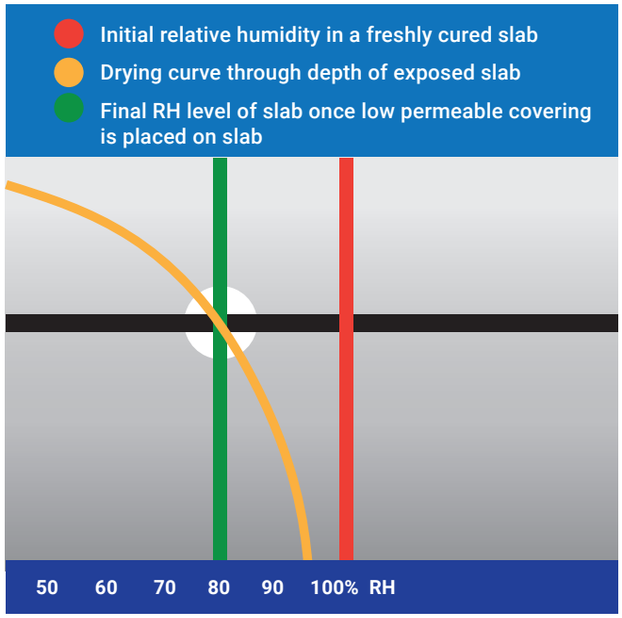
Sufficient Equilibration Time and the Problems with "Leap-Frogging"

The older separate sleeve/probe method can be time-consuming. Once you've inserted a probe into a sleeve, you will have to wait 45 minutes to a number of hours (depending on the sleeve design) for the probe to reach its full equilibration and give you an accurate reading. One of the most common mistakes in the field when using the separate sleeve/probe method is moving a probe too quickly from hole to hole (leap-frogging) without letting the probe have ample (45 minutes to several hours) equilibration time. The result is inaccurate relative humidity readings, usually significantly underestimating the true relative humidity. The newer integrated-sensor method takes much less time because the sensor is part of the insert and stays in the hole. After the initial equilibration time, you can obtain subsequent readings from the integrated sensors immediately and anytime thereafter with the reading device.

The ASTM F2170 testing method can give you much faster and more accurate results than the tedious, surface-biased calcium chloride test. Regardless, ASTM F2170 currently states: "Allow 24 hours to achieve moisture equilibrium within the hole before making relative humidity measurements." But good news! Nearly all relative humidity test methods (if done correctly) give us a very good idea of the moisture condition of a slab after a few hours at most. This can be invaluable when you're planning the floor covering phase of a project and you don't want to wait a full 24 hours to get an idea of what's going on. Just remember that the official, documented readings should adhere to the current ASTM F2170 standard.

Verifying Calibration

ASTM F2170 indicates that probe calibration be checked within 30 days before use. With reuse, relative humidity probes used with the older separate sleeve/probe method can become uncalibrated (by contaminants, etc.). According to Section 8 in ASTM F2170, verifying a probe's measurement accuracy requires testing the probe with a salt solution or with a humidity chamber. With the newer integrated sensor/insert method, you won't need to verify calibration because the sensor/insert stays in the hole and doesn't have problems with reuse. Regardless of



Once a floor covering is installed, the relative humidity equilibrates throughout the slab (green line). Taking readings at 40% depth (slab on grade) prior to installation of a floor covering tells us what the slab will eventually equilibrate to after the floor covering has been placed (intersection of yellow and green line).

GOOD NEWS!
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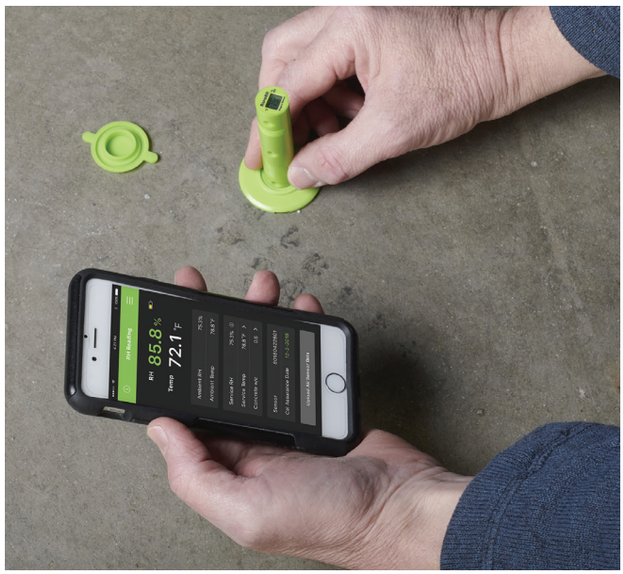
The Wagner Meters Rapid RH® L6 Smart Sensor is ¾" in diameter and measures both temperature and relative humidity within the slab



The Rapid RH L6 system for concrete moisture testing offers many advanced technological features, including a smart device app that makes reading, recording, and reporting your test data extremely fast and easy.

method, the probes or integrated sensors/inserts should always come with a certificate of calibration traceable to the National Institute of Standards and Technology (NIST).

As with any test method, performing the test correctly is vital to obtaining correct and useful test results. When measuring the RH in concrete slabs, this includes measuring at the correct depth as outlined in ASTM F2170, giving the probes or integrated sensors sufficient time to equilibrate and, if required, keeping your instruments in calibration.

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RapidRH L6

1. Drill to 40% depth of the concrete slab (or 20% if drying from both sides) per ASTM F2170.

2. The hole must be free of any loose debris to prevent inaccurate readings. When you insert a relative humidity sensor, give it adequate time to equilibrate.

3. If using a removable sensor, you may need to wait anywhere between 45 minutes and several hours (depending on the manufacturer) each time you place it in a hole. If the sensor is the stay-in-place type (as shown), you can take subsequent readings immediately after the initial equilibration.