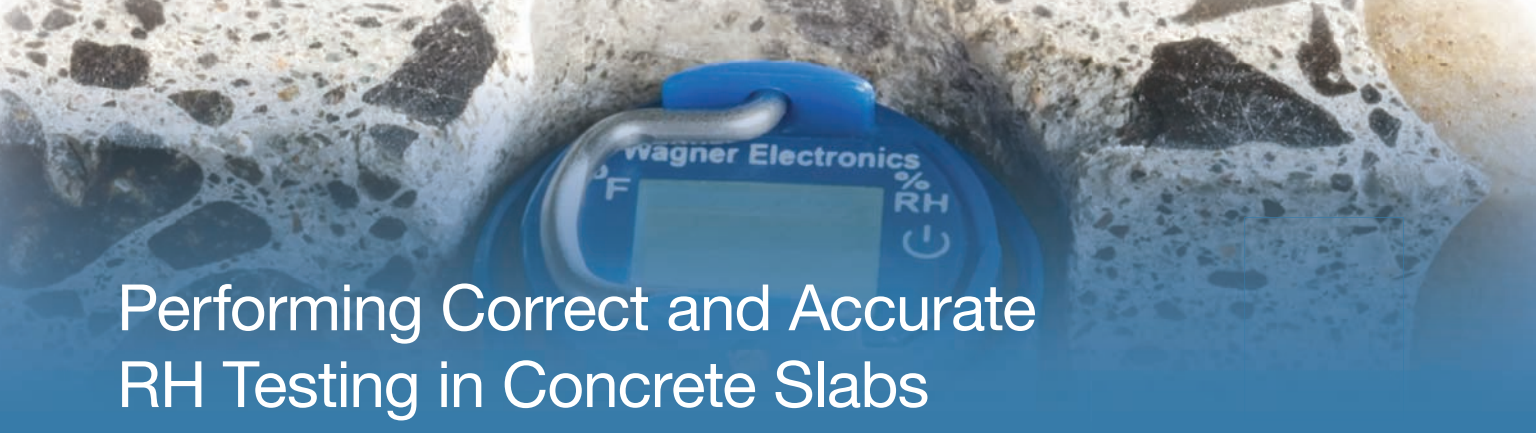

Performing Correct and Accurate RH Testing in Concrete Slabs

By **Ron Smith**

In order to prevent a moisture-related failure to a floor covering or coating installation, it is necessary to have the proper moisture level in the concrete slab. Therefore, accuracy of the moisture readings is obviously critical. With the increasing popularity of the scientifically superior in-situ relative humidity testing method for concrete slabs, correct understanding of, and adherence to this ASTM F2170-09 standard is very important.

Currently, there are two different types of relative humidity testing methods that are commonly used. The older of the two methods requires some type of separate, 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 micro-sensor 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 F2170-09 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, your holes must be drilled to a depth of 2.4 inches, completely cleaned of loose debris and then your sleeve or integrated sensor/insert placed into the hole.

If you are using the newer type of testing method with the sensor already integrated into the insert, and assuming you have drilled your hole to the correct depth, you will always be measuring the relative humidity at the correct depth by correctly inserting the insert+sensor to the bottom of the hole. When using the older method with separate sleeve/probe method, more care must be taken to assure that the sleeve being used allows you to only obtain the readings from the correct depth. Some sleeve methods are more depth-specific than others.

Photo 1

Photo 2

About the Author

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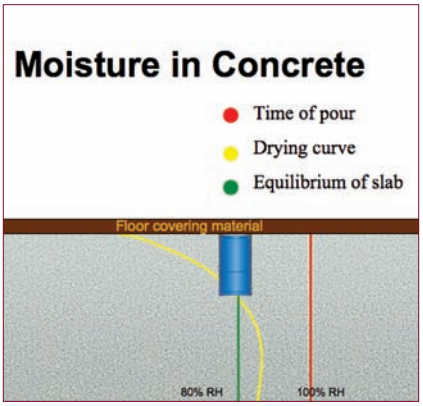

Once a floor covering is installed, the relative humidity equilibrates throughout the slab (green line). Taking readings at 40% depth (slab on grade) prior to installation of a floor covering tells us what the slab will eventually equilibrate to after the floor covering has been placed (intersection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

The Wagner Electronics Rapid RH™ Smart Sensor is ¾" in diameter, and measures both temperature and relative humidity within the slab.

Regardless of the relative humidity test method you are using, if you are obtaining your readings from anywhere but correct depth, you may not be adhering to the ASTM F2170-09 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 were the basis for the depth requirements given in ASTM F2170-09.

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

With the older, separate sleeve/probe method, once a probe is inserted into a sleeve, it will usually take 45 minutes to a number of hours (primarily depending on the sleeve design) for the probe to reach its full equilibration to 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 of insufficient equilibration time is that the relative humidity readings will be inaccurate, usually significantly underestimating the true relative humidity. With the newer, integrated-sensor method, because the sensor is part of the insert and stays in the hole, once the short, initial equilibration time has

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Drill to 40% depth of the concrete slab (or 20% if drying from both sides) per ASTM F2170-09. The hole must be free of any loose debris to prevent inaccurate readings. When a relative humidity sensor is inserted, it must be given adequate time to equilibrate. If using a removable sensor, this requires anywhere between 45 minutes to a number of hours (depending on manufacturer) each time a removable sensor is placed in a hole. If the sensor is the stay-in-place type (as shown), subsequent readings can be taken immediately after initial equilibration.

occurred you can obtain subsequent readings immediately from the integrated sensors and anytime thereafter with the reading device.

The ASTM F2170-09 testing method can give us much faster and more accurate results than the tedious, surface-biased calcium chloride test. Regardless, section 10.3.4 of ASTM F2170-09 currently states: "Allow 72 hours to achieve moisture equilibrium within the hole before making relative humidity measurements." The good news is that it has clearly been shown that after a few hours at most, nearly all relative humidity test methods (if done correctly) will give us a very good idea of where we stand regarding the moisture condition of a slab. This can be invaluable when starting to plan the floor covering phase of the project without necessarily having to wait a full 72 hours to get an idea of what is going on. Just remember that currently, the official, documented readings should adhere to the current ASTM F2170-09 standard.

Verifying Calibration

ASTM F2170-09 indicates that probe calibration be checked within 30 days before use. With re-use, relative humidity probes used with the older, separate sleeve/probe method can become un-calibrated (contaminants, etc.). According to Section 8 in ASTM F2170-09, 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, because the integrated sensor/insert stays in the hole and is not subject to the problems with reuse, no calibration verification is required.

Regardless of 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 F 2170-09, giving the probes or integrated sensors sufficient time to equilibrate and if required, keeping your instruments in calibration. **FCI**