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Relative Humidity Testing -- New Technology for Concrete Testing

by Christopher Capobianco



By drilling a hole in the concrete, the F2170 method can measure moisture deep inside the slab.

In my first FCI column last October, we explored the reasons why floors fail because of concrete moisture problems, and looked at prevention and testing. This month, I want to tell you about a “new” method of moisture testing that many feel is the best way to get an accurate prediction of future moisture problems after the floor is installed.

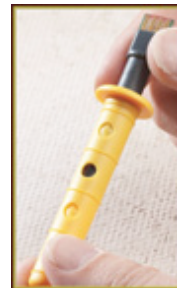
The relative humidity probe method, also known as the RH test or the “in situ” test has been in use in Europe for over twenty years, but is relatively new to the United States. Published by ASTM in 2002, this test is known as ASTM F 2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes. This method involves drilling holes in the concrete to measure the dampness inside. Here are some common questions and answers about this method.

What equipment is needed?

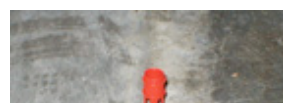
You'll need a hammer drill capable of drilling a 1/2-inch diameter hole in concrete, a vacuum with a small nozzle to clean out the hole, and the RH test kit which contains plastic sleeves, RH probes, and the meter for reading the results.

How is the test done?

A hole of approximately 1/2-inch in diameter is drilled in a concrete slab to a depth of 40



The plastic sleeve inserted into the hole seals the hole except for the specific depth where moisture will be measured.



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percent of the slab thickness. That usually means about 2 inches deep. After vacuuming the hole to remove all dust and debris, a special plastic sleeve with openings at specific locations is placed into the hole and allowed to sit for three days. Then, a probe is placed in the hole, and a relative humidity reading is taken.



Relative humidity probes are used to measure internal moisture.

Why is this better than the Calcium Chloride test?

Scientific testing has showed that ASTM F 1869 (the calcium chloride test) only measures vapor emission from the top one inch or so of the concrete slab. Since most concrete slabs dry from the top down, this may not measure moisture down below. This explains why a floor can test “dry” with an F 1869 test and then become “wet” again after the floor is installed. F 1869 tests give a “snapshot” of the moisture condition, while F 2170 RH tests can monitor trends and indicate the rate of drying, allowing us to predict when a floor will be dry enough for installation.

Are there any other advantages of this test method?

The calcium chloride test takes four days to run – grind the slab, wait a day, place the kit, wait three days. To do another kit in the same spot, it's another 3-day test. The F 2170 test also involves a three-day waiting period, but only the first time. Once the sleeve is placed and capped, you can come back at any time and get an instant reading. If the initial reading is too high, you can cap the hole, come back a week later, quickly read it again, and continue the process until the slab is at an acceptable level. There is no three-day waiting period once the hole is drilled and the sleeve is placed.



Once the hole is drilled and sealed, the moisture can be checked almost at any time with very little waiting.

What if I have a low calcium chloride test result and a high relative humidity? Is it safe to install the floor?

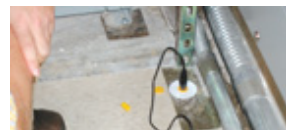
No. Many factors can produce a low result, (called Moisture Vapor Emission Rate or MVER) on the F 1869 calcium chloride test. These factors could include a sealer or curing compound on the surface of the concrete, a dense hard-troweled finish, old adhesive residue, very dry atmosphere over the floor, or cooler than normal temperature. The floor may appear dry at the surface but high moisture conditions are lurking deeper down.

How about vice versa?

A high result on the F 1869 Calcium Chloride test and a low result on F 2170 Relative Humidity test may indicate that the floor was wet. It could have been exposed to moisture on the surface such as a water leak or excessive cleaning solutions. It also could be that the calcium chloride test was performed improperly, which is often the case. If the floor is adequately dry deeper down, you might simply need to let the surface dry before installation. This can be accelerated by fans, heat, getting the air conditioning up and running, and so on.

Is this test really "the wave of the future" as some people have predicted?

For the answer to this question, I contacted Mr. Howard Kanare of Construction Technology



Laboratories (CTL) of Skokie, IL, one of the premier concrete testing laboratories in the world. Mr. Kanare, whom I met through my work on ASTM Committee F.06 on Resilient Flooring, is recognized as one of the foremost authorities on the issue of concrete floor slab moisture problems.



Relative humidity meter connected to the probe gives an internal moisture reading.

Mr. Kanare explained, “F 2170 is another tool in the floor tester’s bag. It has several advantages over older methods including the plastic sheet, mat bond, and calcium chloride kit tests. We have used F2170 RH probes to monitor drying of wet floors and to predict many weeks ahead when a floor would be acceptable for installation. RH probes also can be wired into a “smart building” that monitors itself and alerts the facility manager if a moisture problem is developing. That sounds like the wave of the future to us!”

NOTE: If you are interested in doing this test, you can get a copy of the method from ASTM (www.astm.org), and check with your floor covering manufacturer to learn what their maximum allowable RH results are for the floor covering you plan to install.

Thanks to Mr. Kanare for his assistance, and thanks to Mr. Sean Fallon of Tramex and Mr. Chris Ranwell of GE Protimeter for sharing their photographs of the method.



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