

ASTM F2170 ASTM F 2170 RH (Relative Humidity) Testing Protocol:

ASTM Abstract:

Significance and Use

Moisture permeating from concrete floor slabs affects the performance of flooring systems such as resilient and textile floor coverings and coatings. Manufacturers of such systems generally require moisture testing to be performed before installation on concrete. Internal relative humidity testing is one such method.

Excessive moisture permeating from floor slabs after installation can cause floor covering system failures such as de-bonding and deterioration of finish flooring and coatings and microbial growth.

Moisture test results indicate the moisture condition of the slab only at the time of the test.

1. Scope

1.1 This test method covers the quantitative determination of percent relative humidity in concrete slabs for field or laboratory tests.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

Specific warnings are given in Section 7, 10.3.2, and 10.4.4.

2. Referenced Documents *(purchase separately)*

The documents listed below are referenced within the subject standard but are not provided as part of the standard.

ASTM Standards

[C511](#) Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

[E104](#) Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions

[F710](#) Practice for Preparing Concrete Floors to Receive Resilient Flooring

Keywords:

Concrete; flooring; floors; moisture; relative humidity: Concrete slabs; Field testing--concrete/aggregates; Flooring/floor covering systems (concrete); In-situ inspection/analysis; Laboratory testing; Moisture analysis--concrete; Quantitative analysis/measurement; Relative humidity (RH); Resilient flooring ;

ICS Code : ICS Number Code 91.080.40 (Concrete structures)

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ASTM F 2170 RH (Relative Humidity) Testing:

Concrete slab moisture is a major cause of resilient and other non-permeable flooring system failures. When concrete is mixed and poured, water vapor migrates from the bottom of the slab to the surface to evaporate. This process requires time and quantifiable concrete moisture measurements to verify. ASTM F2170 formally recognizes the use of *in situ* ("in-position") probes as a means of conducting relative humidity testing. The ASTM F2170 standard represents a fundamental change in how moisture is measured and to what degree of accuracy is to be obtained.

ASTM recognizes that floor coverings often fail due to unsuitable concrete moisture levels beneath them or arising out of the concrete substrate. When this is the case the slab has not had sufficient time for concrete moisture levels to equilibrate (reach *equilibrium moisture content*) according to *relative humidity* (RH). Concrete slab moisture problems can cause adhesives to fail thus causing floor-covering delamination, subsequent peeling, blistering, staining and sweating of various flooring materials.

In-Situ Method

In-situ probes measure the moisture content deeper in the concrete matrix. *In-situ* concrete moisture testing places sensors, or probes inside the slab itself. As concrete dries, moisture migrates from the bottom of the slab to the surface where it can evaporate away. Logically then, moisture levels at the bottom of a slab will read higher from those at the surface. *In-situ* probes provide *relative humidity* (RH) measurements at 40% of the slab's depth. This depth is for slab's drying from one surface only. For slabs drying from two sides ASTM F2170 specifies RH probes be placed at 20% of the slab's total depth. This depth has proven to more accurately portray the final RH levels of the slab if it were to be sealed at that point in time and the slab moisture allowed to fully equilibrate from bottom to top. In this way, *in situ* measurement provides a composite picture of overall slab moisture levels, and provides the data necessary to make decisions regarding flooring installations.

An in-situ RH probe installed in a concrete slab.



The Relative humidity, (RH), in a concrete slab can fluctuate with environmental changes, especially if the facility or space has not been climate stabilized (HVAC). Concrete will absorb water vapor from the air under high ambient humidity; concrete releases more water vapor when the humidity of the surrounding air is low. Surface-based test results will also fluctuate, even more, under these changes in environmental conditions. General contractors and installers must bear in mind the two interactive processes when they are looking at construction schedules: concrete slab drying, and internal changes in relative humidity as it applies to flooring installations.

In situ moisture measurement systems are evolving rapidly as a result of ATSM F2170 and reflect the industry realities of the concrete installation business. For example, Wagner Meters *Rapid RH* system includes probes, which remain in the slab for faster readings because a re-equilibration time is not needed. Many flooring associations are also recommending RH testing as giving greater accuracy and success with flooring installations. And installers are finding results are more accurate and more dependable with RH testing.

There are many RH in-situ probe Manufacturers, such as:

Rapid RH® digital RH in-situ probe read-out from Wagner;
www.wagnermeters.com



Various measurement readouts from Tramax®; Gardco CMExpert®, www.gardco.com

Lingo-Tec® RH meter and the RH BluePeg sensor for in-situ RH readings



ASTM F2170 Recap:

- Testing Apparatus – Humidity Probe and Digital Meter; Accuracy $\pm 2-3\%$;
- HVAC; Conditioning – Concrete slabs and air space above the floor slab shall be at service temperature and RH for 48 hours prior to measuring concrete RH;
- Testing Procedure - Slabs drying from one side, Drill holes 40% depth of concrete. Allow 72 hours to achieve moisture equilibrium within the hole before taking measurements;
- Minimum of three tests for first 1,000 ft² and 1 additional test for each 1,000 ft²;
- Normal placement is one test near the center with others being placed around the perimeter of the room