Designation: F2659 – 23

Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter[1]

This standard is issued under the fixed designation F2659; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide focuses on obtaining the comparative moisture condition within the upper 1.0 in. (25.4 mm) stratum in concrete, gypsum, anhydrite floor slabs and screeds for field tests. Due to the wide variation of material mixtures and additives used in floor slabs and screeds, this methodology may not be appropriate for all applications. See 1.2 through 1.8 and Section 11. Where appropriate or when specified, use further testing as outlined in Test Methods F1869 or F2170 before installing a resilient floor covering.

1.2 This guide is intended for use to determine if there are moisture-related conditions existing on, or in, the floor slabs that could adversely impact the successful application and performance of resilient flooring products.

1.3 This guide may be used to aid in the diagnosis of failures of installed resilient flooring.

1.4 This guide is intended to be used in conjunction with meter manufacturer's operation instructions and interpretive data where available.

1.5 Where possible or when results need to be quantified, use this guide to determine where additional testing such as Test Methods F1869 or F2170 as specified to characterize the floor slab and the test area environment for moisture, humidity and temperature conditions.

1.6 This guide may not be suitable for areas that have surface applied moisture migration systems, curing compounds or coatings that cannot be removed or cleaned off sufficiently to allow the moisture to move upwards through the slab. For a floor slab of 6 in. (150 mm) plus thickness, low porosity slabs, slabs with no vapor retarder installed, and slabs where the above surface environmental conditions can have a greater than normal influence on the moisture reduction gradient of the floor slab or screed, consider Test Method F2170 (below surface in situ rh method) as a more suitable test method under these circumstances.

1.7 This guide is not intended to provide quantitative results as a basis for acceptance of a floor for installation of moisture sensitive flooring finishes systems. Test Methods F1869 or F2170 provide quantitative information for determining if moisture levels are within specific limits. Results from this guide do not provide vital information when evaluating thick slabs, slabs without effective vapor retarders directly under the slab, lightweight aggregate concrete floors, and slabs with curing compound or sealers on the surface.

1.8 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.

1.9 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific warnings are given in Section 7.

1.10 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4259 Practice for Preparation of Concrete by Abrasion Prior to Coating Application

F1869 Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

[1] This guide is under the jurisdiction of ASTM Committee F06 on Resilient Floor Coverings and is the direct responsibility of Subcommittee F06.40 on Practices.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

F2170 Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

NOTE 1—Also see Related Materials at the end of this standard.

3. Terminology

3.1 *Definitions:*

3.1.1 *dew point, n*—dew point temperature is the temperature at which condensation begins. It is the temperature at which air must be cooled in order to reach saturation (assuming air pressure and moisture content are constant).

3.1.2 *moisture content (MC), n*—moisture content tests indicate the moisture content in the slab at the time of the test. This can be defined as the mass of moisture per unit mass of dry material, for example:

$$\frac{\text{Wet weight} - \text{Dry weight}}{\text{Dry weight}} \times 100$$

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3.1.3 *relative humidity, n*—ratio of the amount of water vapor actually in the air compared to the amount of water vapor required for saturation at that particular temperature and pressure, expressed as a percentage.

3.1.4 *service temperature and relative humidity, n*—the ambient air temperature and relative humidity that typically will be found in the building's occupied spaces during normal use.

3.1.5 *vapor emission, n*—moisture vapor emission is used to define the amount of water vapor emitting from the concrete floor slab when using the Anhydrous Calcium Chloride test. This is usually expressed in lb/1000 ft^2 during a 24 h period.

4. Summary of Guide

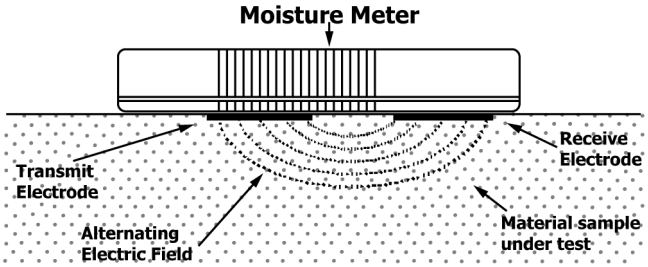
4.1 *Procedure:*

4.1.1 This guide covers a procedure in which a purpose-made and calibrated electronic moisture meter is used in conjunction with interpretive methods provided by meter or the meter manufacturer, or both, to determine the comparative moisture content in the upper 1 in. (25.4 mm) stratum of concrete and other floor slabs and screeds by non-destructively measuring the electrical ac impedance.

4.2 *Principles of Operation:*

4.2.1 The electrical impedance of a material varies in proportion to its comparative moisture condition. The electrical impedance of the floor slab directly under the footprint of the instrument is measured by creating an alternating electric field that penetrates the material under test. The small alternating current flowing through the field is inversely proportional to the impedance of the material. The instrument determines the current's amplitude and thus derives the moisture value. (See Fig. 1). Classifications of meters using this technology are impedance, capacitance based and electrical field change detecting devices.

4.2.2 The depth of the signal penetration will vary depending on the material and moisture content of the material being tested. It generally varies from 0.5 in. to 1.0 in. (12.7 mm to 25.4 mm).



NOTE 1—Not to scale.

FIG. 1 Typical Non-destructive Electronic Moisture Meter for Concrete

5. Significance and Use

5.1 Moisture in concrete floor slabs affects the performance of flooring systems such as resilient, wood, and textile floor coverings and coatings. Manufacturers of such systems generally require moisture testing be performed before installation of coverings on floor slabs and screeds. The measurement of sub-surface comparative moisture condition in the upper 1.0 in. (25.4 mm) stratum of a concrete slab with a non-destructive moisture meter is one such method.

5.2 Excessive moisture in floor slabs after installation can cause floor covering system failures such as delamination, bonding failure, deterioration of finish flooring and coatings, and microbial growth.

5.3 5.3 Comparative moisture content tests indicate the moisture in the slab, which is usually referenced to the percentage of dry weight. That is:

$$\frac{\text{Wet weight} - \text{Dry weight}}{\text{Dry weight}} \times 100$$

Results indicate conditions at the time of the test.

5.4 Methods of meter calibration and factors affecting equilibration are described in Section 8.

6. Apparatus for Non-Destructive Moisture Meter Testing Procedure

6.1 An electrical impedance moisture meter specifically developed and calibrated for the non-destructive measurement of the comparative moisture condition in concrete flooring slabs.

6.2 The moisture meter should have a clear display giving readings of the moisture condition for concrete and other floor slabs in meaningful and interpretable units of measurement.

6.3 The moisture meter should be placed in direct contact with the surface of the bare clean concrete in accordance with the meter manufacturer's recommendations. Direct contact between the instrument and the concrete itself is required so that there is no loss of signal sensitivity, which could occur as the sensing signals pass through the thickness of covering or coating materials on the material (floor slab) being tested.

6.4 The moisture meter should be capable of sending non-destructive signals through the surface into the concrete slab without damage. Examples of suitable meters are illustrated in Appendix Appendix X2.