TECHNICAL BULLETIN No. 30

DESCRIPTION

This Technical Bulletin describes various moisture test methods and damp-proof membranes in concrete sub- floors.

1. INTRODUCTION

Water is an integral part of the construction of a sub-floor. The amount of water used depends on the type of sub-floor, the required structural strength and the extent of curing. It is impossible to state a time period after which a sub-floor may be considered dry enough upon which to lay flooring. Factors such as ambient temperature, relative humidity, the thickness of the slab, type of finish required and methods used to cure the concrete, will affect this period.

Some practical considerations indicating when not to lay flooring because of excessive moisture content in the sub-floor are:

1.1 When the sub-floor fails a moisture test when carried out with a suitably approved Concrete Moisture Meter *(Tramex CME 4, Caisson/Romus VI-D4 Pinless Concrete Moisture Meter, GE Protimeter Mini or a Hygrometer)*, or by any other industry approved instrument.

1.2 If the sub-floor is in direct contact with the ground and contains no damp-proof membrane.

Some devices use infrared (IR), radio frequency (RF), or microwave techniques to evaporate water from a sample. Others determine moisture content by measuring a material's conductance, resistance, or capacitance and calculating a corresponding moisture value. Variables measured include relative humidity, absolute humidity, specific humidity, and dew point. Relative humidity is a measure of the amount of water in the air compared with the amount of water the air can hold at a measured temperature. By contrast, absolute humidity is the mass of water vapour in a given volume of air. Specific humidity is the absolute humidity divided by the total mass of the given volume of air.

It must be stated that any moisture testing is better than none. In terms of the industry norms and standards, it is now a prerequisite that concrete testing is carried out prior to installing a floor covering. A sensible approach is to firstly review the flooring manufacturer's installation instructions and warranty information to see if they require or favour a particular approach, and then select an appropriate recognised method.

2. VARIOUS METHODS OF TESTING

Of the instruments available for determining moisture levels in sub-floors, the most practical are the electronic meters *(Tramex CME 4, Caisson/Romus VI-D4 Pinless Concrete Moisture Meter, GE Protimeter Mini to name a few)* as they provide instantaneous results, however, they may not necessarily be the most accurate when compared against the older hygrometer or other methods. When a hygrometer is positioned on a sub-floor surface, the reading of the relative humidity of the entrapped air space is obtained. Other options are **phenolphthalein** or calcium chloride tests which are relatively easy and inexpensive to perform, however, they have shortcomings as there is no practical way to calibrate the apparatus, making it difficult to compare results against a benchmark. The test accuracy can be impacted by ambient conditions or variability in slab surface preparation. In addition, it only effectively tests moisture vapour emissions near the surface of the slab and, therefore, does not provide an accurate MVER (Moisture Vapour Emission Rate) measurement.

NOTE: Some floor manufacturers' warranties do not support or honour calcium chloride test results.

3. ANALOGUE METHOD

3.1. HYGROMETER TEST METHODS

There are two methods of testing sub-floors for the presence of moisture using a hygrometer. The first method is the preferred method as it gives a more precise result. The second method has an advantage in that, although less precise, it enables a number of readings in different areas to be obtained within a relatively short period of time.

3.1.1 METHOD 1

Obtain an initial reading of the relative humidity of the air above the sub-floor by placing the hygrometer on its edge on the sub-floor surface for a period of 15 minutes. When the initial reading has been recorded, place the hygrometer on the sub-floor surface beneath a 1,0m x 1,0m sheet of impervious, transparent plastic film e.g. polyethylene or PVC. Seal the edges of the plastic sheet to the sub-floor (either with masking tape or duct tape) and leave for 24 hours before taking a final reading.

3.1.2 METHOD 2

Seal the edges of a number of 1,0m x 1,0m sheets of impervious, transparent plastic film either with masking tape or duct tape) to the sub-floor at various locations on the building site and leave for 24 hours. At the end of this period, obtain and record an initial reading of the relative humidity of the air above the sub-floor, by placing a hygrometer on its edge on the sub-floor surface for a period of 15 minutes. Carefully lift a corner of one of the sheets of plastic film so that the hygrometer can be placed underneath. It is important that there is as little disturbance as possible to the air entrapped between the sub-floor surface and the plastic film. Once the hygrometer has been inserted underneath the film, immediately re-seal the edge. After 20 minutes has elapsed, note the final reading of the hygrometer. Remove it from beneath the plastic film and allow it to return to its initial reading before repeating the process with the other sheets of plastic film.

3.1.3 INTERPRETATION OF RESULTS

In accordance with SANS 10070 clause 7.2.2.4.

- A final hygrometer reading of less than 70% indicates that the sub-floor is sufficiently dry for the acceptance of a floor covering to be laid upon it.
- If the hygrometer indicates a final reading of more than 70% when the initial reading of the atmosphere was less than 70%, then the sub-floor is unacceptably damp and must be allowed to dry out before any flooring is installed.
- If the hygrometer indicates a final reading of more than 70% when the initial reading of the atmospheric humidity was also greater than 70%, as can occur in coastal areas, then the following applies:

> If the final reading is significantly higher than the initial reading, then the sub-floor must be considered to be unacceptably damp.

> If the final reading is similar to, or less than the initial reading, then the moisture content of both the atmosphere and the sub-floor are similar. In this instance, the **FloorworX Technical Department** should be consulted before any flooring is installed.

3.2 GENERAL NOTES ON THE USE OF HYGROMETERS

Although it is the responsibility of the Flooring Contractor to determine when a sub-floor is dry enough for the flooring to be installed, it is advisable that the builder tests every sub-floor himself as well. Remember that the hygrometer is a precision instrument and should at all times be handled with care. It is recommended that each hygrometer be calibrated against another for accuracy on an annual basis.

4. DIGITAL METHODS

4.1 TRAMEX CONCRETE MOISTURE ENCOUNTER (C.M.E.)

Tramex Concrete Encounter CME 4 is a handheld portable electronic moisture meter operating on the principle of non-destructive impedance measurement. Parallel co-planer electrodes are mounted on the base which during operation, transmit low-frequency signals into the concrete floor screed to a depth of approx. 12.5 mm (0.5in). While concrete under normal conditions can never be completely dry, the instrument has been calibrated on acceptably dry material. In operation, it compares the change in impedance caused by the presence of dampness and displays this on a clear, easy to read analogue dial.

The CME 4 is calibrated to give percentage moisture content readings on a clean, bare, dust-free concrete floor slab, therefore readings taken on concrete slabs through paint, coating, adhesives or other materials on the surface of the slab should be regarded as qualitative or comparative and not quantitative.

The CME 4 has three scales and will provide an instant reading of moisture content up to 6% on concrete %H2O scale; up to 0 - 10 comparatives on Gypsum Floor Screed

scale, and 0 to 100% on the lower scale, enabling you to make an informed decision on when to install the floor covering.

4.1.1 OPERATING PROCEDURE

4.1.1.1 Before use, to check the calibration and battery strength, place CME 4 on a non-conductive surface such as polystyrene foam or glass, power up CME 4 by pressing the ON button, then press the CAL button and hold down until needle position is checked. The needle should lie between CAL lines on the meter face. If not, replace battery and repeat procedure.(Note not all models have a CAL option).

4.1.1.2 Remove any dust from the electrodes and also from the area of concrete before commencing tests.

4.1.1.3 Place instrument firmly on a concrete surface, fully compressing the spring loaded pins on the base of CME 4, read moisture measurement from the analogue dial. Repeat randomly throughout the room.

4.2 INTERPRETATION OF RESULTS

Any reading on the **CME 4 of 50% or less (on the lower scale) or 3% or less (on the concrete %H2O scale)** indicates acceptable moisture content for the installation of a resilient floor covering.

5. CAISSON/ROMUS VI-D4 PINLESS MOISTURE ENCOUNTER

5.1 The Caisson/Romus VI-D4 concrete moisture meter offers a non-destructive method of accurately determining moisture content in concrete and cement without using pins. This method of moisture determination is both quick and easy without any need to drill holes or leave damage. Using a pinless moisture meter is becoming the industry standard due to the ease of use over the older style moisture meters using pins.

The VI-D4 meter calculates humidity of analysed material by measuring its electrical impedance. The relation between the humidity of a particular material and its impedance is directly proportional. Impedance is measured by generating a low-frequency electric field between electrodes. The meter measures low-intensity alternating current flowing through an electric field and on that basis calculates the moisture of the tested material.

With the Caisson/Romus VI-D4 pinless moisture meter, the sensors are positioned on the back of the moisture meter, allowing the user to use the device to measure moisture in very tight spaces and also being able to view the LCD display at all times. Non-destructive moisture meters also measure material moisture to a depth of around 40-50mm, giving a moisture content in a cross-sectional area of the material, rather than just surface moisture, typically measured by traditional moisture meters.

5.1 OPERATING PROCEDURE

- To turn on the meter press ON/HOLD button.

- To set the scale press SET button.

There are 4 available scales:

> Concrete 0-6% H2O
> Carbide Method 0-6% H2O
> Relative Scale 0-100%
> Caisson/Romus Scale 0.3-15.3m

(Name of chosen scale will appear in the **scale indicator** field).

- To set the mode of measurement press ON/HOLD button. There are 2 available modes:

> Normal
> Max. Hold

(The display colour will change depending on which mode was chosen).

- To make a measurement press the meter against the tested surface until all spring electrodes are completely blocked.

CAUTION: Fingers SHOULD NOT touch the sensor plate and electrodes while measuring.

- The meter should be held in the middle while measuring.

- It is recommended to repeat the measurement in a few points situated next to each other as humidity has a tendency of uneven distribution. If the measurements vary, only the highest outcomes should be used.

- To switch off the meter press ON/HOLD button for around 2 seconds.

Preparation of the surface before measuring:

- All concrete heating/drying equipment should be switched off at least 96 hours before taking the final measurements otherwise the outcome may not reflect the actual humidity level or displacement of humidity in the tested material.

- Before the measurement may be taken, the analysed surface should be cleaned. (In the case of measuring concrete floors all covering materials like concrete additives, primers, paints, etc., should be removed in order to reveal pure concrete that is going to be measured.

- VI-D4 meter should not be used to measure concrete on which there is water in a liquid state.

- Measurements should be avoided in areas exposed to direct sunlight or other sources of heat.

Available Scales:

1. Concrete 0-6% H2O

The concrete scale may be used only for concrete surfaces. It shows the relation between the weight of pure water contained in the tested material with its dry weight. The scale range between 0 and 6%. The obtained results should not be confused with moisture emission or any other humidity measurement methods.

Any reading on the Caisson/Romus VI-D4 pinless moisture meter of 3% or less indicates acceptable moisture content for the installation of a resilient floor covering.

2. Carbide Method 0-4% H2O

Carbide scale shows concrete humidity according to the carbide method.

3. Relative Scale 0-100%

The relative scale may be used in humidity level comparison of various materials. Obtained results should not be interpreted as percentage content of water in tested surfaces. There is no linear correlation between the outcomes and relative humidity. The scale should be used only as a comparison technique. The scale may be used on the surfaces where direct contact with pure concrete is impossible because of some layer/covering. Any reading on the scale of 50% or less indicates acceptable moisture content for the installation of a resilient floor covering.

4. Caisson/Romus Scale 0.3-15.3m

Caisson/Romus scale works in a similar way as the Relative scale and can be used alongside meters with the same scale, which ranges between 0.3 and 15.3.

6. CHEMICAL METHOD

Anhydrous Calcium Chloride

The calcium chloride test method is relatively easy and inexpensive to perform and used to determine the moisture vapour emission rate (MVER) from a concrete slab. Calcium chloride testing involves sealing a small dish of calcium chloride on a clean section of concrete under a plastic dome. The salt absorbs moisture in that environment (and presumably coming from the concrete slab) and the weight gain after three days is used to calculate the MVER.

The test accuracy can be impacted by ambient conditions or variability in slab surface preparation. In addition, it only effectively tests moisture vapour emissions near the surface of the slab and, therefore, does not provide an accurate MVER measurement.

7. DAMP-PROOF MEMBRANE

To prevent problems associated with rising damp, it is essential that a damp-proof membrane is incorporated beneath sub-floors. The South African Standard Building Regulations require that all sub-floors in contact with the ground are so constructed as to be damp-proof. The SANS Code of practice 10070 for the Laying of Thermoplastic and Similar Types of Flooring strongly recommends the use of damp-proof membranes beneath sub-floors. The manner of installation and type of material used is vital in ensuring that the damp-proof membrane performs its function successfully. Polyethylene sheeting complying with SANS 952, is the most effective type of material against leakage. Adjoining sheets should have an overlap of at least 150mm and must be correctly sealed. The

sheets should be protected from damage during the casting of the slab. It is important to bear in mind that the drying time of a concrete slab will be extended when it is cast onto a damp-proof membrane.

For more information please contact the **FloorworX TECHNICAL DEPARTMENT** by sending your query to **technical@floorworx.co.za**