TKB-Technical Briefing Note 18

KRL Method

Measuring and assessing the moisture content of mineral screeds

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Prepared by the Technische Kommission Bauklebstoffe (TKB) (Technical Commission on Construction Adhesives) of Industrieverband Klebstoffe e.V. (German Adhesives Association), Düsseldorf

Industrieverband Klebstoffe e.V.
www.klebstoffe.com

This briefing note is available for download free of charge from the Industrieverband Klebstoffe e.V., Völklinger Str. 4, D-40219 Düsseldorf, phone:+49/211/6 79 31-10, info@klebstoffe.com, www.klebstoffe.com

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1 Preface

Mineral screeds used as substrates for the installation of textile and elastic floor coverings as well as for wood floors and parquet shall only be covered once the screed is ready for installation.
Over the past 10 years the TKB has been working to determine the basis for the measurement of the corresponding relative (air) humidity (r.h.) of mineral screeds and to establish a testing method suited for on-site testing, meeting the technical requirements of the trade in German speaking countries.
The results of the related work were published in TKB reports (TKB-Berichte) 1 to 4.[1,2,3,4]
In a collaborative study with experts, a large number of moisture measurements were performed on building sites which have also proven the suitability of the KRL method. The respective data was published in TKB report 5.[5]
The immediate and material independed information regarding the moisture state is one of the great advantages of the KRL measurement. It increases the reliability of the determination of readiness for installation, especially for screeds with additives.
This technical briefing note describes the measuring method in detail, offers information regarding the assessment of the measurement results and includes a protocol for documenting the measured values.

2 Definitions

Readiness for installation
Readiness for installation designates "the state of a screed, when it is ready to receive a permanent floor covering, without the risk of damage or defects".[6,7,8]

Corresponding relative air humidity
The corresponding relative air humidity is the relative air humidity in percent [% r. h.], which is present in the air above a sample of the material at equilibrium.

KRL method
With the KRL (from German: “Korrespondierende relative Luftfeuchte”, English: “Corresponding relative air humidity”) method, the moisture state of a substrate for installation of floor coverings and parquet is determined by measuring the corresponding air humidity at a sample taken from the substrate. The KRL measurement value is a reliable indicator for the moisture status of the screed to be covered.

3 Performing the moisture content measurement according to KRL method

3.1 Appropriate measuring devices

To measure the relative air humidity according to the KRL method, only appropriate measuring devices shall be used. Details regarding the respective suitability tests are described in TKB report 3. So far, the following devices can be recommended:

- Rotronic Hygropalm (www.rotronic.com)
- Testo Robust (testo.com)

Qualifying examinations are performed e.g. by the Technical University Hamburg-Harburg.

[1] TKB-Bericht 1: Belegreife und Feuchte - Versuche zur Trocknung von Estrichen, Technische Kommission Bauklebstoffe im Industrieverband Klebstoffe e.V., Düsseldorf, 2012.

[2] TKB-Bericht 2: Belegreife und Feuchte - Die KRL-Methode zur Bestimmung der Feuchte in Estrichen; Technische Kommission Bauklebstoffe im Industrieverband Klebstoffe e.V., Düsseldorf, 2013.

[3] TKB-Bericht 3: Belegreife und Feuchte - Geeignete Messgeräte zur Feuchtebestimmung nach der KRL-Methode; Technische Kommission Bauklebstoffe im Industrieverband Klebstoffe e.V., Düsseldorf, 2016.

[4] TKB-Bericht 4: Belegreife und Feuchte – Sorptionsisothermen und die Interpretation von KRL-Messungen; Technische Kommission Bauklebstoffe im Industrieverband Klebstoffe e.V., Düsseldorf, 2018.

[5] TKB-Bericht 5: Belegreife und Feuchte – Ein Ringversuch zur Feuchtemessung mit der KRL-Methode; Technische Kommission Bauklebstoffe im Industrieverband Klebstoffe e.V., 2018.

[6] TKB Technical Briefing Note 14: Rapid Screeds and Cement Screeds with Screed Additives, publ. August 11, 2015. Technische Kommission Bauklebstoffe (TKB/Technical Commission on Construction Adhesives) of Industrieverband Klebstoffe e.V. (German Adhesives Association) 2015

[7] W. Schnell, Zur Ermittlung von Belegreife und Ausgleichsfeuchte von mineralisch gebundenen Estrichen, BWD 1/1985.

[8] W. Schnell, Das Trocknungsverhalten von Estrichen - Beurteilung und Schlussfolgerungen für die Praxis, in: Rainer Oswald (Hrsg.), „Aachener Bausachverständigentage 1994“, Neubauprobleme – Feuchtigkeit und Wärmeschutz, AIBau, Bauverlag GmbH, Wiesbaden 1994.

3.2 Prior to sample taking

Before taking samples, the following measures must be taken:

- Prepare test protocol (indicate building site address, floor, room, date of test, tester and test result).
- Measuring devices shall be calibrated according to manufacturer specifications. When measuring results are dubious, perform new calibration.
- Check measuring sensors. Sensor and protective cap must be free of dust and adhesions. When sensor is contaminated with screed particle matter this may lead to faulty measuring results.
- Prepare scale.
- Prepare bowl, hammer, chisel and spoon.
- Keep a sealable, clean and dry container at hand (PE freezer bag with adhesive tape, CM flask or PE flask with volume of approx. 250 ml).
- Temperature of sample material, test device, measuring sensor and ambient air shall be near equal.

3.3 Taking samples and preparation

A proven method for taking and handling of samples taken from substrate prior to actual measurement is the CM measurement. Therefore, these steps of the KRL method correspond to those of CM measurement.

Generally, it must be ensured – as with all other moisture measurement methods – that while preparing the samples, humidity is neither lost nor introduced from the outside. Hence, it follows:

- Sample taking must be performed as quickly as possible.
- For sample taking, no processes shall be used which are associated with generation of heat, e.g. drilling or cutting or input of water.
- Always avoid direct exposure to sunlight or drafts while taking samples.

3.4 Performing the test

1. The sample to be measured shall be taken evenly over the complete cross-section of the screed (avoid formation of craters).
2. The sample shall only be crushed to the extent that the overall test material has a grain size of less than 8 mm.
3. Weight of sample taken: 150 +/- 20 g test material.[9]
4. Filling the measuring container:

   When using a PE bag:
   Carefully insert the measuring sensor into bag and place it on the coarse grain of the test material.
   Squeeze out most of the air by hand. Next, position bag opening very closely around the rod of the measuring sensor and close with adhesive tape (tape bag lip to sensor rod).

   When using a PE or steel flask:
   After filling in the test material, immediately close flask cap with built-in measuring sensor and secure tightly.
5. During measurement, the temperature of sample and ambient temperature must correspond. Consequently, the container with test material and measuring sensor must be kept on the floor where sample was taken at a constant temperature until equilibrium is achieved (test temperature between 15 und 25 °C). Protect container from direct sunlight or other effects which might lead to a change in temperature. Do not hold container in your hands for extended period of time since this might lead to the sample warming up.

3.5 Recording measured values

The corresponding relative humidity is read from measuring device once state of equilibrium is reached. Equilibrium is considered reached once the indicated measured value does not substantially change over a period of 3 minutes (+/- 1 % r. h.). Depending on the used type of measuring device this is normally the case after at least 30 minutes.

When performing measurements using the KRL method, maximum fluctuations of +/- 2 % r. h. are to be expected in a temperature range of 20 °C +/- 5 °C.[10]

The measurement results are documented in the prepared measurement protocol (Appendix to this data sheet).

[9] In the event that the test sample is later submitted to a CM measurement, the weight of sample shall be 50 g (CT) or 100 g (CA).

[10] Dr. Gernod Deckelmann: Das Feuchteaufnahme und –abgabeverhalten zementgebundener Estriche und Konsequenzen für die Bestimmung der KRL.
Tagungsband der TKB-Fachtagung 2018, Köln, 14.03.2018, Industrieverband Klebstoffe e.V.

4 KRL method and readiness for installation

For installation materials and floor coverings, no harmful effects are to be expected up to a relative humidity of 75 % r. h.
Currently, TKB report 2 gives two reference values for the corresponding relative humidity of 75 % r. h. (non-heated) or . 65 % r. h. (heated) when samples are taken evenly over screed cross-section.
The results of the collaborative study confirm the reference value of 75 % r. h. as a safe threshold value for readiness for installation of non-heated screeds, measured over the screed cross-section.
According to the results of the KRL collaborative study, the reduction value of 0.2-CM-% for heated screeds corresponds to a difference for KRL value of 5 % r. h. As a matter of precaution, the reference value of 65 % r. h. for heated screeds mentioned in TKB report 2 should be adhered to for the time being, until a sufficient number of additional on-site measurements can justify an adjustment of the reference value.
Therefore, the KRL threshold values for readiness for installation are as follows:
75 % r. h. for non-heated screeds
65 % r. h. for heated screeds.

Appendix

Protocol of screed moisture measurement using KRL method

Information regarding location of screed in building					
Building / property: address Construction phase / part of building Floor / Number of apartment					
Contractor for floor covering/parquet work					
Name, address, contact					
Customer / awarding authority for floor covering/parquet work					
Name, address, contact					
Information provided by customer regarding screed (where appropriate after consultation with screed manufacturer) Information must be given **for each room individually!**					
Screed construction/ type of installation	a) floating floor b) screed on separating layer				
Binding agent type	a) cement-based screed (CT) a) 1. cement type (e.g. CEM I, CEM II/A-LL) a) 2. Aggregate used b) calcium sulphate screed (CA) c) rapid cement screed				
Date of screed installation	Where appropriate, differentiated by installed sections				
Nominal thickness of screed	[mm]				
Maximum screed thickness	[mm]				
Warm water underfloor heating	Yes / No				
Documentation of measuring results for screed moisture content					
Measuring point No.		**1**	**2**	**3**	**4**
Date					
Tester					
Air temperature	[°C]				
Relative humidity	[%]				
Substrate-surface temperature	[°C]				
For underfloor heating systems: Heating protocol available?	Yes / No				
Measuring points for underfloor heating system marked/shown?	Yes / No				
Screed thickness	[mm]				
Weight of test material	[g]				
Corresponding relative humidity (KRL value)	[%]				
KRL value read after	[min]				
Sample container (PE bag/B, PE flask/F, steel flask/S)					
Type of measuring device					
Moisture threshold value met	**Yes / No**				
Notes					
Confirmation of measuring results					
Date / Signature of tester		**Date / Signature of customer**			