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Code of Practice

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Joints in flowing calcium sulphate screeds

Instructions and guidelines for planning and application of flowing calcium sulphate screeds

Code of Practice from the Industriegruppe Estrichstoffe im Bundesverband der Gipsindustrie e.V., Darmstadt, Germany and the Industrieverband WerkMörtel e.V., Duisburg, Germany

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Joints in flowing calcium sulphate screeds

Flowing calcium sulphate screeds (hereinafter referred to as flowing screeds) have proven themselves in indoor applications for decades thanks to their wide range of technical advantages.

This Code of Practice provides information on the constraints under which joints in flowing screeds must be planned and applied. Flowing screeds are characterized by an almost dimensionally stable behaviour during the setting and drying phase.

In practice, this facilitates large surface application in unheated and heating screed constructions without the requirement for movement joints.

However, jointless application of flowing screeds is limited in building practice by deformations (temperature changes, shrinking due to drying) that creates stresses in the screed slab. This also applies to conventional screeds. The stresses occur due to

- Friction towards the substrate
- Non-uniform heating application
- Differences in drying speeds (screed thickness, exposure to direct sunlight, non-uniform/improper ventilation and airing).

However, flowing screeds have the advantage that they are subject to fewer stresses arising from their lower shrinkage and usually absorb these stresses without damage due to their high strength (when applied correctly and professionally) meaning that fewer cracks arise.

Certain building-related conditions can cause excessive deformation stresses - usually when there is a combination of stresses, which require the preventative planning of movement joints even in flowing screeds. Such constraints can include:

- Complicated room geometries
- Direct contact between heated and unheated zones
- Doorways.

Evaluation of scientific studies [9, 10] and broad practical experience form the basis for the information in this Code of Practice.

1 Guidelines and standards

For planing and application of flowing screeds, the relevant standards and regulations apply such as the DIN 18560 – Floor screeds in building construction, parts 1 to 7 [1], DIN ATV 18353 – General technical specifications in construction contracts - Laying of floor screed[2].

Further information on correct application of screed in the Codes of Practice of the BEB [3, 4].

2 Joint types

2.1 Structural joints

Structural joints have to be continued in the screed without exception irrespective of the method of application[1, 3].

2.2 Edge joints

From the point of view of their function, edge joints are movement joints between the screed and wall as well as between the screed and the rising building and built-in components. They are generally formed by the application of an edge insulation strip. The thickness of the edge insulation strip with unheated screed constructions should not exceed 8 mm.

In the case of heating screed, the edge insulation strips must facilitate a horizontal movement of at least 5 mm in all areas, including the corners [1, 3]. The thickness of the edge insulation strip should not be less than 10 mm. In the case of large jointless surfaces, the edge joint has to be dimensioned correspondingly thicker. The expected temperature changes, the dimensions of the area and the corresponding specification of the manufacturer relating to the thermal expansion coefficient of approx. 0.011 to 0.016 mm/mK as well as other manufacturers specifications (e.g. swelling coefficient) **must be considered.** As a precaution, it should be assumed that the change in length occurs in only one direction.

2.3 Movement joints

Movement joints are intended to facilitate movement of the screed surfaces relative to each other and to decouple the transfer of sound and vibration.

The movement joints must be effective over the entire surface of the screed. It must be possible to compress the joint material by at least 5 mm. The thickness of the joint material may not be less than 10 mm. Corresponding joint profiles are commercially available. The joint profiles are applied so that no mortar can flow under them. In the case of construction type A heating screeds, the movement joints and edge joints may only be crossed by connecting tubes and only on a single level. In this case, the connecting tubes should be installed in a flexible protective tube about 0.3 m in length. Refer to DIN 18560 part 2 [1].

2.4 Dummy joints

Dummy joints as predetermined "frangible joints" are not required in flowing screeds in view of the dimensionally stable behaviour during the drying phase.

3 Planing of joints in unheated screed structures

Unheated screed surfaces made of calcium-sulphate flowing screed are generally applied without joints in contrast to cementitious screed surfaces. Joints are generally applied here only to decouple the longitudinal transmission of sound and vibration.

In the case of strong sunshine effective over larger window surfaces that causes highly non-uniform warming of the screed area, a movement joint may be required with rigid coverings and a side length of more than 20 metres (benchmark value). The joints must be adapted to suit the room geometry and covering design.

Example for dimensioning of the edge insulation strip:

Side length:	15 m
Thermal expansion coefficient:	0,015 mm/m K
Temperature differential: (e.g. from 15°C to 45°C)	30 K
Thermal expansion:	**15 x 0,015 x 30 = 6,75 mm**
Assumed compressibility of the edge insulation strip:	70 %
Minimum thickness of the edge insulation strip:	**6,75 : 0,70 = 9,64 mm**
An edge insulation strip of 10 mm is sufficient in this case.	

4 Planning of joints in heating screed structures

During drying shrinkage and cooling of the screed, its edges move toward the focal point of the surface. This physical principle forms the basis for the following planning instructions (see Appendix).

A differentiation is made with heating screeds between:

- Screeds heated across the full surface
- Screeds not heated across the full surface.

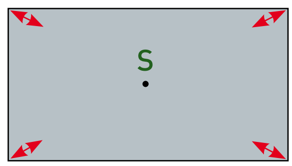
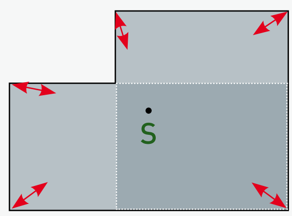
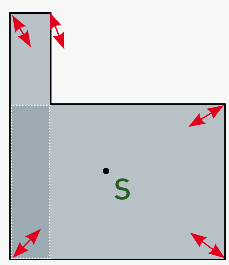
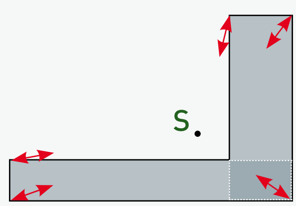
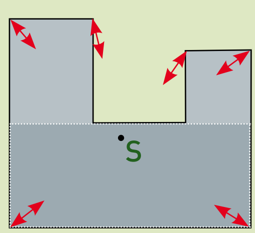
4.1 Screeds not heated across the full surface

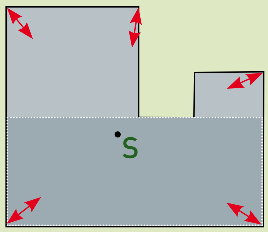
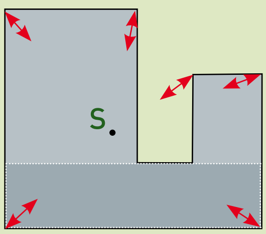
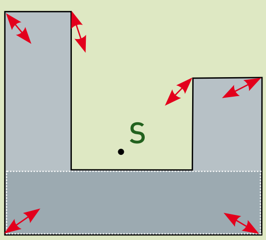
Screeds not heated across the full surface only have heating elements in some areas. This results in heated and unheated partial surfaces that must be separated from one another by a joint irrespective of the room geometry. This does not apply to unheated margin zones up to 1 m wide such as those for planned kitchen units and built-in cupboards.

Generally, however, it is advantageous to heat screed surfaces across the entire surface since the screed and covering are subjected to less stresses and no tedious screeding work is required to eliminate cold zones when the room usage has changed.

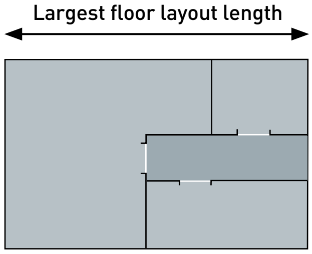
4.2 Screeds heated across the full surface – influence of the floor plan

The following procedure for screeds heated across the full surface is practical depending on the room geometry. Here, the specified edge lengths represent benchmark values for the reasons specified in Sections 1 and 2.

Type of area, position of the focal point and effective forces	Information for joint planning
Rectangular areas	
	In the case of rectangular areas, positioning of a movement joint should be considered at edge lengths exceeding 20 metres, and in case of rigid coverings exceeding 10 metres. If the area is heated uniformly and across the full surface, meaning that all the heating circuits are controlled at the same time and with the same temperature, screeds with edge lengths exceeding 20 metres can be realised jointlessly if the covering is elastic.
L-shaped areas In case of L-shaped areas, it is decisive whether the focal point of the area lies in the middle, in one of the side bays or outside the area. Determining of the focal point is described in the appendix.	
	If the focal point lies in the middle bay of the area and the shorter arm is longer than 6 metres, positioning of a movement joint can be necessary.
	If the focal point lies in one of the arms and the shorter arm is longer than 3 metres, or if the distance between the focal point and the corner that is furthest away amounts to more than 3 metres, positioning of a movement joint can be necessary.
	If the focal point lies outside the area, a movement joint is advisable, irrespective of the arm length.
The joints should form partial bays that are as compact as possible. The rules specified above for rectangular areas apply to the partial bays.	
U-shaped areas U-shaped areas are also assessed on the basis of the area focal point.	
	If the focal point is located in the middle section of the base and one of the arms is longer than 3 metres, positioning of a joint may be necessary.

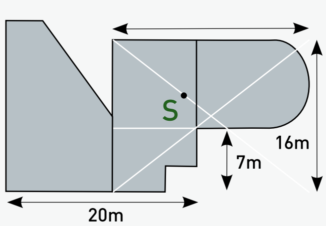
Type of area, position of the focal point and effective forces	Information for joint planning
	If the focal point is located in a side section of the base and one of the opposite arms is longer than 3 metres, positioning of a joint may be necessary.
	If the focal point is located in an arm, placement of a joint is useful.
	If the focal point is located outside the area, placement of the joint is useful.
The joints should form partial bays that are as compact as possible. This will result in bays that should be treated as if they are L-shaped or rectangular areas.	

Areas with doorways



Floor layouts with doorways are characterized by the long length of the floor layout. If 5 meters are exceeded with a rigid covering or 7 meters with an elastic covering, then the floor layout should be subdivided by a movement joint in the doorway that is applied laterally to the largest floor layout length. The resulting bays should again be treated according to the principle applying to the largest floor layout length. Furthermore, it is prudent to arrange movement joints in the respective doorways of areas with separate heating circuits (e.g. bathroom opposite bedroom) that will be heated in completely different ways.

Complex, asymmetrical areas



Complex, asymmetrical areas must be divided by movement joints so that bays with the simplest possible geometries result. The resulting rectangular, L and U shaped bays should then be treated in accordance with the process described.

Additional notes

Movement joints must be mirrored in the covering. Since they have a significant influence on the design of the floor, it is advisable that the planner or architect specifies the final position of the movement joints during a visit on site [1].

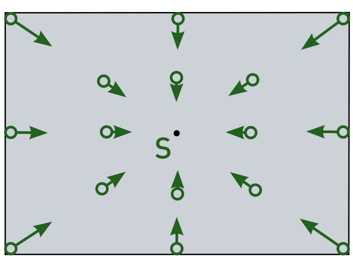
Any additional joints required in the covering, e.g. with ceramic tiles and natural stone, are not affected by this Code of Practice.

Unfavourable building conditions (see page 2) can cause cracks to arise even though the screed has been professionally applied. In the case of heating screeds, this may occur during dry heating or the subsequent cooling phase. The cracks are sealed using a synthetic resin when the screed is coverage ready. In the case of heating screeds, it is advisable to heat up the screed again after sealing the cracks (see Code of Practice No. 3 [7]). Professionally sealed cracks do not constitute a technical defect [1, 3, 7].

Appendix

The area focal point principle

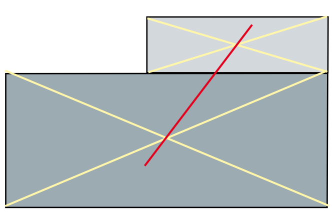
If a homogeneous material such as screed contracts or shrinks due to shrinkage or cooling, this will always occur from the edges of the solid body (the screed bay in this case) towards its focal point (S). The arrows represent the direction of shrinkage and the associated forces.



Graphical determination of the area focal point using an L shaped area as an example

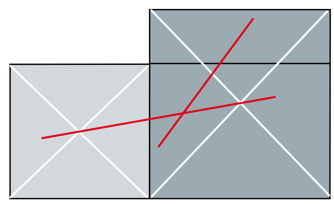
The focal point can be easily determined by theoretically separating an arm. The focal points of the two fields are determined by their intersecting diagonals. The line connecting the two partial focal points is then drawn (1).

1



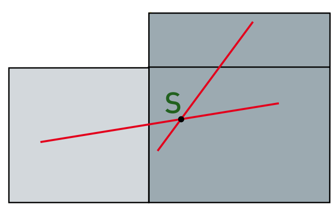
This process is repeated with the other arm of the L shaped bay being theoretically separated (2).

2



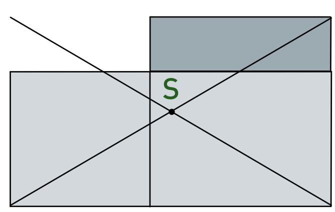
The intersecting point of both connecting lines represents the focal point of the entire area (3).

3



In many cases it is possible to estimate the position of the focal point (4). Comparisons show that determination using a graphical and an empirical method produce similar results. This also applies in many cases for complex geometries.

4



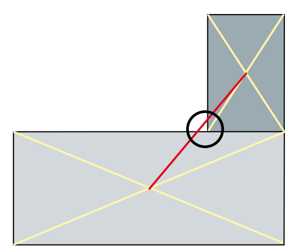
More detailed information for determining the focal point can be found on the Internet at **www.pro-fliessestrich.de**.

Simplified method for L and U shaped areas in residential buildings (Floor layout length up to 12 m)

The simplified method is based on the focal point method. This method can also be applied on the building site. Thus it is possible to check the planning parameters.

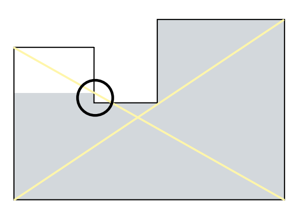
L shaped area example

1. When possible, divide the L shaped area into 2 compact bays.
2. Determine the centre point of both rectangular bays (by connecting the corner points) by drawing a line.
3. If the connecting lines intersect the middle point of the "internal" corners, the floor layout should be separated by a movement joint



U shaped area example

1. Connect the diagonally opposite outside corners with one another.
2. If the connecting lines intersect an „internal" corner of the U shaped area, an arm must be separated using a movement joint.
3. The resulting L shaped area must be reassessed.



Literature
Internet research

[1] DIN 18560 – Floor screeds in building construction, Parts 1 to 7

[2] ATV DIN 18353 – Laying of floor screed

[3] Hinweise zur Planung, Verarmung und Beurteilung sowie Oberflächenvorbereitung von Calciumsulfatestrichen *[Instructions for planning, application and evaluation as well as surface preparation of calcium sulphate screeds]*; September 2009 (Published by Bundesverband Estrich und Belag (BEB) e. V., Troisdorf, Germany)

[4] Höher belastbare Calciumsulfatestriche im Gewerbebau *[Calcium sulphate flowing screeds in highly trafficked areas]*; January 2007 (Published by Bundesverband Estrich und Belag (BEB) e. V., Troisdorf)

[5] Flowing calcium sulphate screeds in areas of high humidity – Code of Practice No. 1 2011 (Published by IGE and IWM)

[6] Drying of flowing calcium sulphate screeds – Code of Practice No. 2; 2011 (Published by IGE and IWM)

[7] Flowing calcium sulphate screeds on underfloor heating – Code of Practice No. 3; 2011 (Published by IGE and IWM)

[8] Assessment and treatment of the surfaces of flowing calcium sulphate screeds – Code of Practice No. 4; 2011 (Published by IGE and IWM)

[9] Austrocknungsverhalten von Calciumsulfat-Fließestrichen *[Drying behaviour of calcium sulphate flowing screeds]*; Schießl P. und Wiegrink K.-H. in ZKG International, issue 12-2004

[10] Spannungen und Verformungen in Calciumsulfat-Fließestrichen (Teile 1 und 2) *[Stresses and deformation in calcium sulphate flowing screeds (Parts 1 and 2)]*; Schießl P. and Wiegrink K.-H. in ZKG International, issues 4-2005 and 5-2005

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