THE SYSTEM-SOLUTION FOR THIN, CRACK-FREE FLOORING CONSTRUCTIONS

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Today I would like to introduce a technical revolution in the field of flooring assemblies to you.

The objective is to produce a deformation-free screed, because it is the guarantee for a crack free covering

Looking at a conventional floating screed, several serious disadvantages can be observed:

Since the screed is subject to deformation during curing or temperature fluctuations cracks occur, shear stresses result in delamination and irregular load stresses cause settling of the insulating material.

This picture for example shows a piece of a screed, which has been cut from a large surface. This piece is approximately 40 cm (16 inches) long and deformed about 1-2 cm (1/2"). Here, the screed was heated from below during curing.

Figure 1

Damages:
Curling, thus cracks in the covering.
Shear stresses, thus covering becomes loose.
Insulation is not loaded uniformly, thus cracked joints at the edge area.

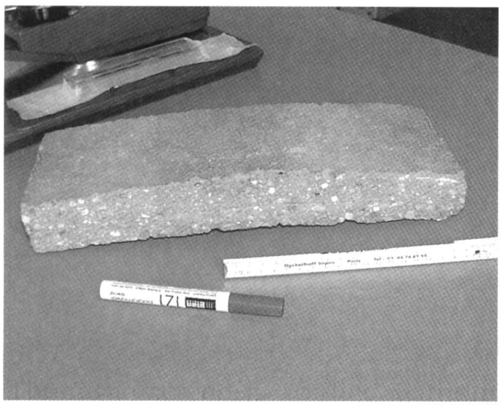


Figure 2

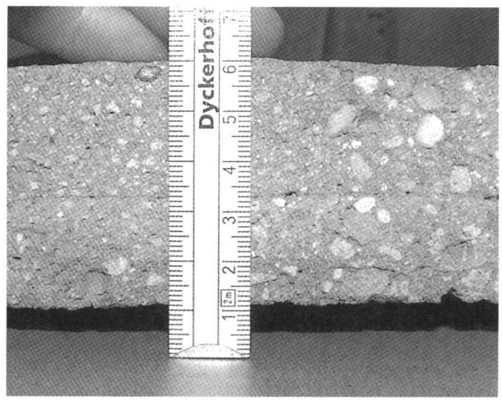


Figure 3

The following video *(Figure 4)* shows the various phases of screed movement very clearly. You can see the movement but also the implication to the insulation and the movement joints.

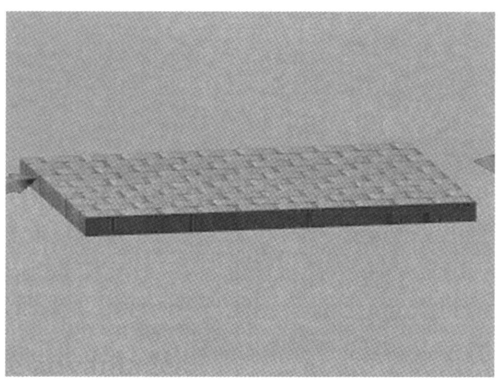


Figure 4

The heating adds another aspect since it also causes deformation of the screed, because, as we all know, screed expands with rising temperature. If subjected to heat on the surface, for example due to sun radiation through windows a convex deformation occurs. If the floor is heated during winter from below *(Figure 5)* it results in a concave deformation *(Figure 6).*

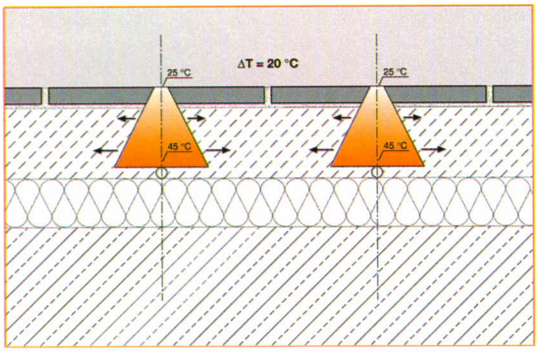


Figure 5.

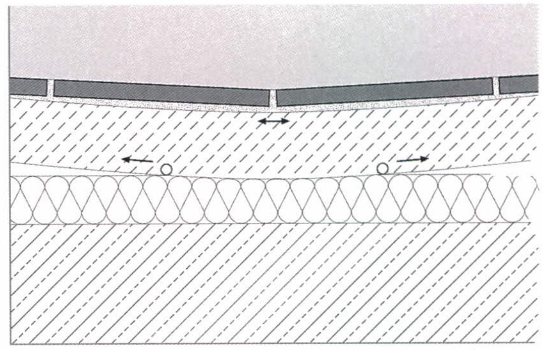


Figure 6.

The fact that ceramic tiles crack and that the shear stresses cause delamination is therefore not surprising.

Therefore we can draw the following conclusion:

Floating screeds and ceramic tile coverings are basically not compatible.

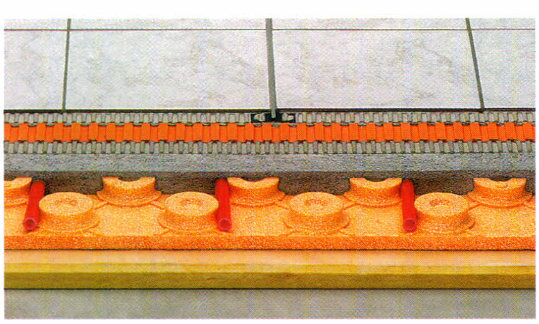
As we have to work with this combination on a daily basis, Mr. Schlüter had the idea to design a screed, which has no inherent stresses.

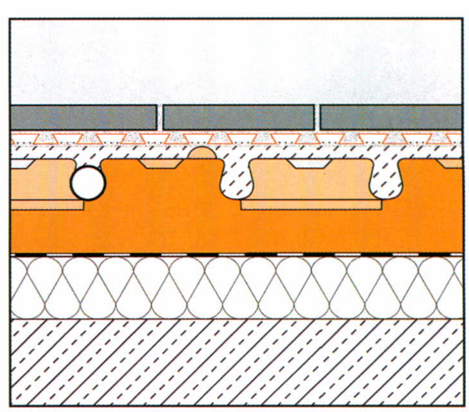
The result is an assembly with a special studded screed panel accepting extremely thin-layered screeds which can optionally also be equipped with heating pipes to act as a radiant heated screed *(Figures 7 & 8)*.

Naturally, the screed applied to this studded screed panel cures and shrinks the same way as any other conventional screed. However, the significant difference is that during the curing phase the studs control the hairline cracking. One could say that the screed is divided into many small screeds.

These properties have substantial advantages:

Because the cracking of the screed is controlled, stresses do not occur *(Figure 9)*. No accumulating stresses mean no deformation occurs. No deformation means no shear stresses and cracking for the ceramic tile covering. In addition the insulation is evenly loaded preventing the cracking of the joints at the edge areas.





Figures 7 & 8: *The system supports screed layers with low thickness. The stress within the screed is neutralized through micro- fine cracks within the grid of the studs. The possibility of heating pipe integration is given.*

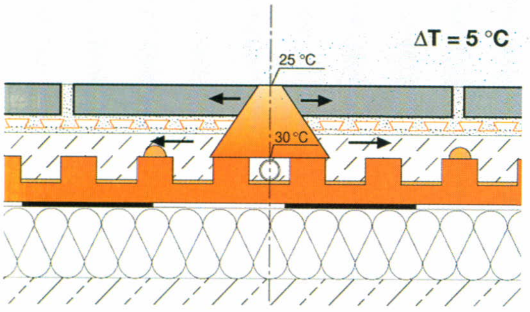


Figure 9. No Damages:
No curling, thus no cracks in the covering.
No shear stresses, thus covering remains solidly bonded.
Insulation is not loaded uniformly, thus cracked joints at the edge area.

Additionally, a beneficial side effect of this assembly is that no control joints or reinforcing has to be incorporated. A screed free of stresses cannot cause failures.

The only remaining question is; Is this screed still solid enough to also endure heavier loads without causing failure?

We commissioned a test institute to establish these values. It revealed that the different values were related to the rigidity of the insulation placed below. Particularly satisfying was that the result over very soft insulation was still 3 times higher than the required norm (Figure 10).

gesellschaft für forschung und materialprüfung im bauwesen mbh **bautest**

Auszug aus dem Prüfbericht A 1152/97 zum Schlüter®-BEKOTEC System

Auftraggeber: Firma Schlüter-Systems GmbH, Schmölestraße 7, 58640 Iserlohn

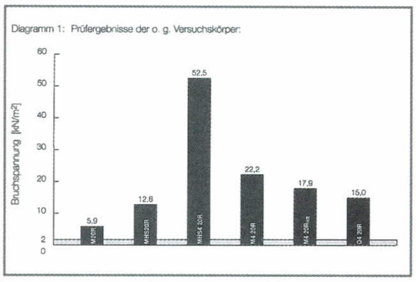
Auftrags-Nr.: A 1152/97 (Auszug)

System: Schlüter®-BEKOTEC Belagskonstruktion
Auftragserteilung: 17. März 1997
Auftrag: Herstellung und Prüfung von Estrichen und Musterplatten bei Verwendung von Produkten der Fa. Schlüter-Systems GmbH
Probeneingang: im März und Juli 1997
Prüfungsdurchführung: im nach DIN EN 45 001 akkreditierten Labor Augsburg der Fa. BAUTEST
Prüfzeitraum: März - August 1997

Augsburg, 29. Januar 1998
gr/lu

Abteilungsleiter — bautest GmbH (Forschung- und Materialprüfung im Bauwesen) — Prüfstellenleiter

BAUTEST GmbH, Augsburg



Belastungstests an Prüfplatten des Formats 1,01 x 1,01 m

Tabelle 1: Kennzeichnung der Prüfplatten

Anzahl der Prüfstempel	1 Stempel Ø 10 cm	4 Stempel Ø 10 cm	4 Stempel Ø 10 cm	4 Stempel Ø 10 cm	1 Stempel Ø 10 cm	4 Stempel Ø 10 cm
Zementestrich	ZE 20					
Dämmaterial	Mineralfaser				Hartschaum	
Prüfplatten-Kennzeichnung	M20R	M4 20R	M4 20R HR	O4 20R	MHS20R	MHS4 20R

Zeichenerklärung:

M = mit Schlüter®-DITRA und mit Fliesenbelag
R = Estrich ohne Nachbehandlung, Aushärtung an der Raumluft
O = ohne Schlüter®-DITRA und ohne Fliesenbelag
M4 = / O4 = mit, bzw. ohne Schlüter®-DITRA, Belastungsprüfung durch gleichzeitige Lasteintragung über 4 Stempel Ø 10 mm
HS = Dämmaterial Hartschaum
HR = Versuchskörper mit Heizrohren

Prüfergebnis

Die erzielten Bruchspannungen sind im Balken-Diagramm 1 auf Seite 5 dargestellt. Sie übertreffen den geforderten Rechenwert der DIN 1055 für Lastannahmen in Wohn- und Büroräumen von 2,0 kN/m².

Die Bruchspannungen an Prüfkörpern mit Hartschaum-Dämmaterial übertreffen diejenigen der vergleichbaren Versuchskörper mit Mineralfaserdämmung um mehr als das doppelte.

Figure 10. *Result: Even with soft insulation below the load-bearing capability significantly exceeds the loads required by norms for residential areas (2.0 kN/m²). For higher load requirements (up to 5 kN/m²) the insulation below must be correspondingly pressures table*

Figure 11.

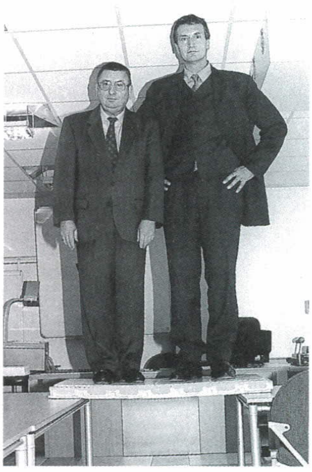


Figure 12.

Anyway, how much can the norms actually tell us? As you can see in this picture *(Figure 11)*, I have placed a piece of this screed assembly between 2 tables and actually stepped onto it myself. Certainly a type of loading that will never occur in actual applications. But even in this instance nothing breaks. Because the interlocking of the individual screed pieces is so strong it allows even 2 people to stand on it, though my colleague looks a bit frightened, it still held *(Figure 12)*.

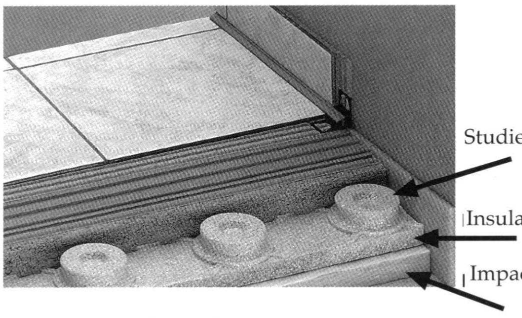


Figure 13.

To prove from our side how much confidence we have in this assembly, we have decided to give a 5-year warranty for the entire assembly. This means, that the installer not only has a better assembly but he has no risks.

The assembly *(Figure 13)* consists of the following components. The heat or impact sound insulation is placed on the structural slab. On top of insulation the studded screed panel is then installed. Following, the screed is applied on the studded panel and screeded off 8 mm above the studs. If ceramic tiles are to be installed the uncoupling membrane, which has channels to allow moisture within the screed to evaporate, can be applied as soon as the screed can be walked upon. Next the ceramic tiles are installed using the thin-set method.

Let's look at the installation step by step.

First the sound or heat insulation is applied. *(Figure 14)*

Figure 14.

Next, the edging strip is put into place *(Figure 15)*. It features an adhesive strip to allow connection to walls easily and a self-adhesive foil leg to ensure a good connection to the studded screed panel. The advantage of this solution is that the risk of thermal or sound bridges is eliminated even if a poured screed is applied.

Figure 15.

Then, the studded panels are positioned and are interconnected through keys *(Figure 16)*.

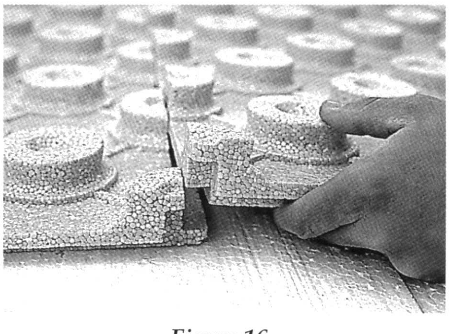


Figure 16.

If the assembly is to be used as a radiant heated screed, the heating pipes are incorporated *(Figure 17)*. This shows a substantial advantage of this assembly. The heating tubes can be placed for maximum efficiency. Since there are no control joints within the screed labour is made substantially easier.

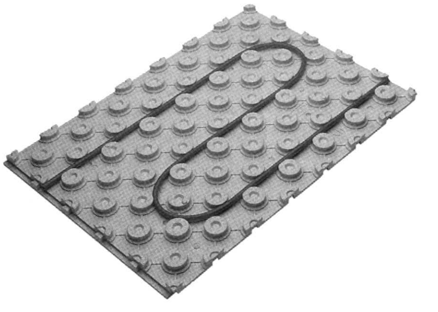


Figure 17.

Also this picture *(Figure 18)* shows quite clearly that the heating tubes are not subjected to movement joints.

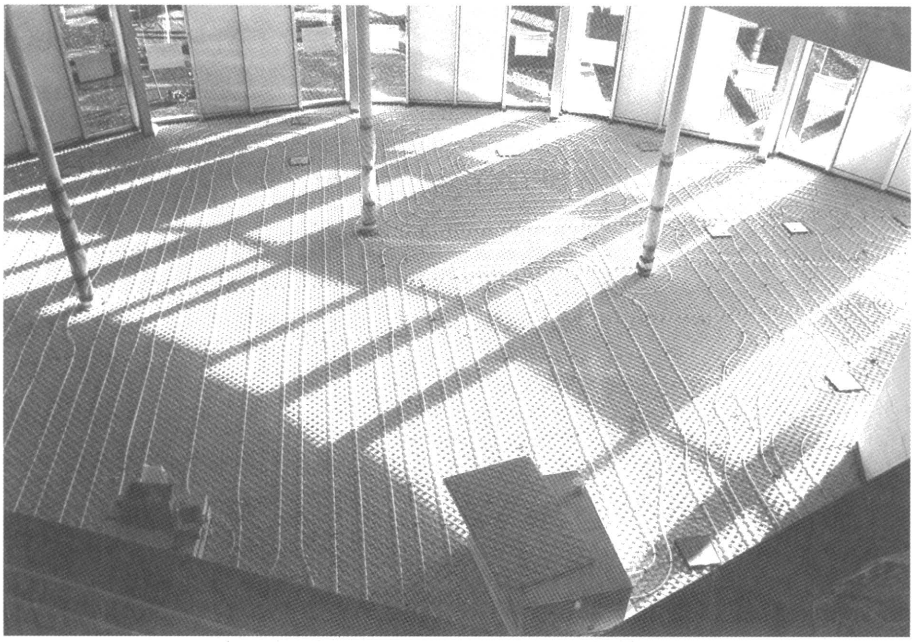


Figure 18.

Then, the screed is applied without joints. The screed can be either cement or gypsum based. On this picture *(Figure 19)* you can see a liquid poured cement screed.

Figura 19.

Let us summarise the advantages:

Saves time

Quick construction, in conjunction with the DITRA matting.

Ceramic tile and natural stone can be installed as soon as the screed can be walked upon.

Faster installation due to lower assembly height.

The screed does not require any heating or cooling cycles prior to the installation of the covering.

Ease of installation

No movement joints in the screed (jointless screed), consequently no co-ordination with the joint pattern in the surface covering *(Figure 20).*

No reinforcing of the screed required.

Lower weight of materials due to lower construction height (only 57 kg / m^2 compared to 131 kg / m^2 presently).

Just one type of board for all diameters of heating pipes (10-18 mm).

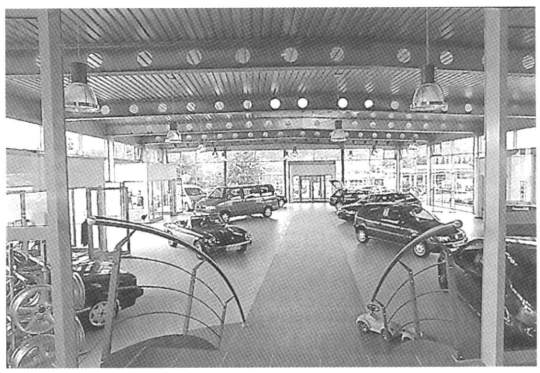


Figure 20. *The movement joints in the covering can be placed in coordination with the surface design because there are no joints in the screed that have to be followed.*

Assured function

No curling of the screed because of de-stressing.

Crack-free surface coverings due to de-stressing and

DITRA matting (for ceramic tile and natural stone).

No cracked joints at the edge areas.

Due to the low construction height, certain applications are only now possible.

Because of the low weight, certain applications are now possible.

Warranty agreement with the manufacturer (5 years).

Cost saving

The heating reacts faster due to lower assembly height thereby saving energy.

Lower material costs due to lower assembly height. (74 kg or 37 litre less screed per m^2).

We are convinced that producing this type of screeds will change the future of flooring assemblies and will lead us into an era of failure-free coverings.

We believe, this is the reason that we can truly speak of a revolution.

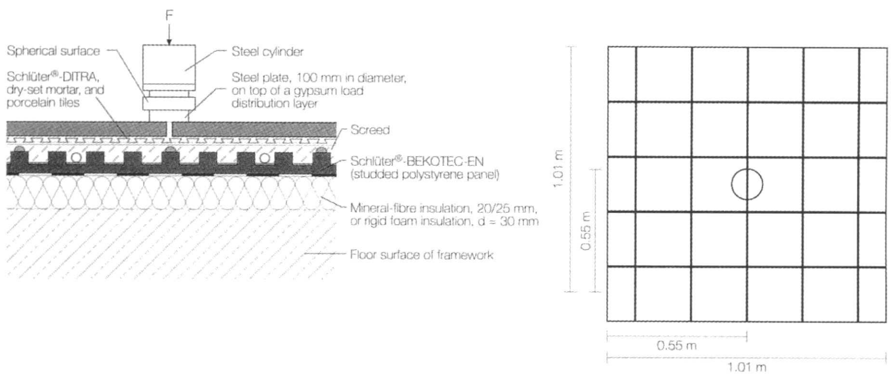
SUMMARY OF TEST A 1152/97 PERFORMED BY THE ACCREDITED LABORATORY BAUTEST ON THE STUDDED POLYSTYRENE PANELS COMMERCIALLY KNOWN AS BEKOTEC-EN

As set out, the studded polystyrene panels are part of a multilayer system that includes the separating layer and is suitable for decoupling the ceramic flooring from the background, obviating the construction of compression layers and the design and positioning of intermediate movement joints, while concurrently avoiding micro-cracking of these intermediate layers and stress transfer.

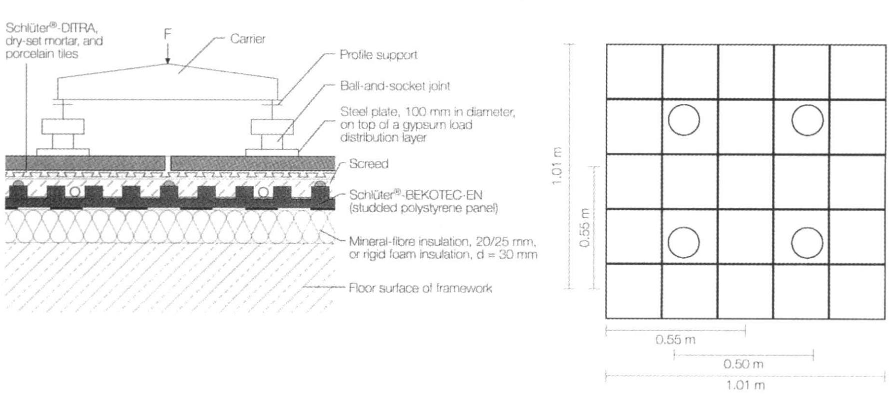
In this test, loading tests were performed on panels measuring 83 x 41.5 cm with a servo-hydraulic machine fitted with a 100-mm-diameter steel plate, applying the load at the centre of the panel. Loading tests were also run on panels of 0.1 x 0.1 m, loading at over 2.0 kN/m^2 without damages to the multilayer system.

Test A 1152/97 included different modes both in applied load (at one point and at four) and in the incorporation of different intermediate layers (acoustic insulation, concrete screeds, separating membrane, floor heating, etc.). For the load tests conducted on the panels presented in this communication, under size 0.1 x 0.1 m, stresses at failure were found of 52.5 kN/m^2 for multilayer systems that included ceramic flooring with the corresponding adhesive, separating layer and rigid foam-based acoustic insulation.

Test surface, 1.01 x 1.01 m, single load in the center



Test surface, 1.01 x 1.01 m, load distribution via 4 stamps, 10 cm in diameter



With regard to standard DIN 1055, on resistance to loading in dwellings and industrial areas where a minimum strength is required of 2,0 kN/m^2, the panels presented in this communication exceeded the minimum value specified in the standard. They also exceeded the required breaking strength values in multilayer systems that include insulation involving sheets of mineral fibre, the breaking strength of these panels being more than twice the value stipulated in the standard.

REFERENCES

bautest gesellschaft für forschung und materialprüfung im bauwesen mbh: Prüfbericht A 1152/97, Augsburg, 12.August 1997