

# **Large format tiles and the pitfalls.**

**- Damage caused by PTS -**

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***What is PTS damage ?***

**P - as in planning chaos**

**T - as in insufficient drying time and poor workmanship**

**S - as in stinginess is cool !**

**P - as in planning**

What is important during planning? What type of subfloor is present?

1. Calcium sulfate based screed
2. Cement screed
3. Heating screed
4. Number of joints, joint widths
5. Layout plan / room geometry
6. Smoothness of subfloor surface
7. Smoothness of tile surface
8. Workmanship

## 1. Calcium sulfate screeds – characteristics

Requirements for 1,00m<sup>2</sup>

- factory specifications for thin-set mortar :

Toothed trowel 10 mm ca. 3,00 – 4,00 kg/m<sup>2</sup> (ø3,5 kg/m<sup>2</sup>)

Oval notch trowel (Medium-bed) 13/20 ca. 5,00 – 6,00 kg/m<sup>2</sup> (ø5,5 kg/m<sup>2</sup>)

Water requirements ca. 0,20 – 0,30 l/kg (ø0,25 l/kg)

= 3,5 kg/m<sup>2</sup> x 0,25 l/kg = 0,875 l/m<sup>2</sup>

= 5,5 kg/m<sup>2</sup> x 0,25 l/kg = 1,375 l/m<sup>2</sup>

1,00 m<sup>2</sup> calcium sulfate screed 40 mm thick = ca. 80 kg

Calculated water absorption of thin-set mortar:

0,875 l ./ 80 kg = 1,094 CM / wt. %

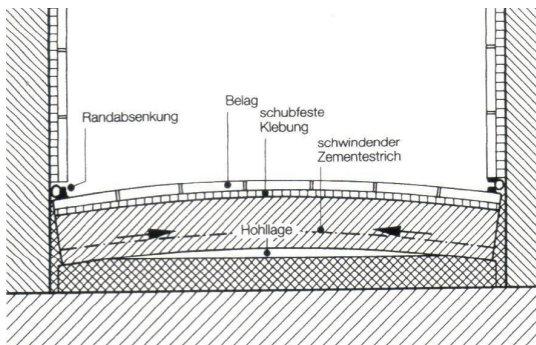
1,375 l ./ 80 kg = 1,719 CM / wt. %

In the German data sheet 7.2. "Tiling on Calcium Sulfate Screeds" *It is stipulated that:* When laying large format tiles and natural stone, calcium sulfate screed surfaces must be protected against water penetration originating from thin-set mortar.

## 2. Cement screeds

How does moisture absorption effect this type of screed? The water used in mixing cement screeds adds more moisture and requires a longer drying time which causes additional deformation.

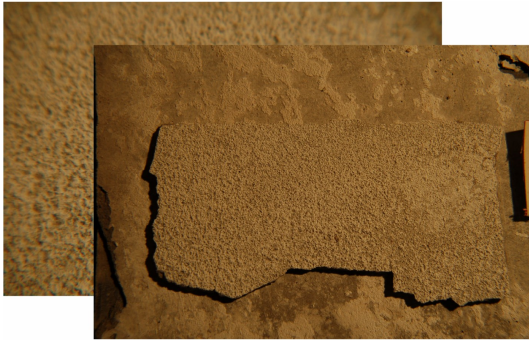
Problems with thermal insulated and sound-proofed subfloors: *(98% of tiling is done in this manner in Germany)*



Tile loosening results from contraction and residual moisture absorption.



## Peripheral depressions



Tile loosening

### 3. Heating screeds

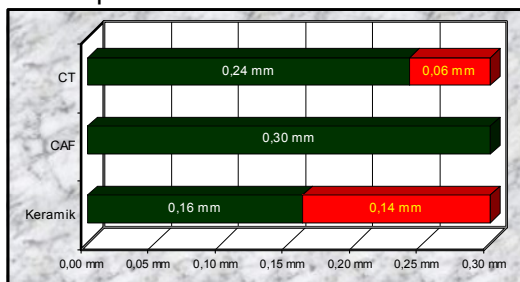
How does it look with heating screeds? (ca. 75% of tiling in Germany)

Longitudinal expansion in heating screeds

Ceramic expands each 5 m x 40° Kelvin x 0,008 mm = 0,16 mm

CAF expands each 5 m x 40° Kelvin x 0,015 mm = 0,30 mm (almost double)

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What are the solutions? Considerable shear stress occurs in adhesive beds. The thinner the adhesive layer and the more inferior the adhesive bond, tiles will loosen all the quicker from the adhesive bed.

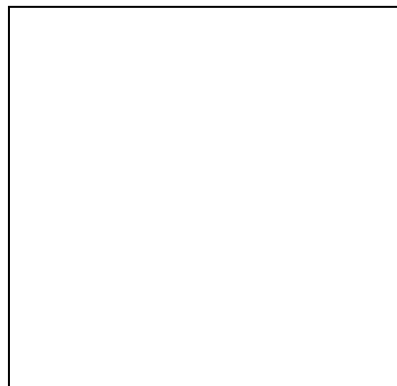
*Longitudinal expansion can only be regulated through the joints!*



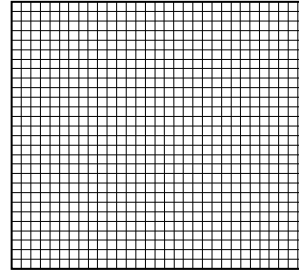
Tile loosening

4. What effect does the number of joints per field have?

60 24



60



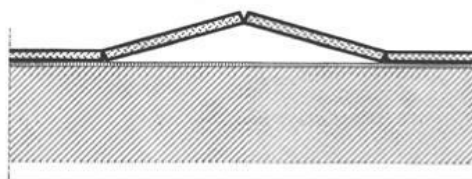
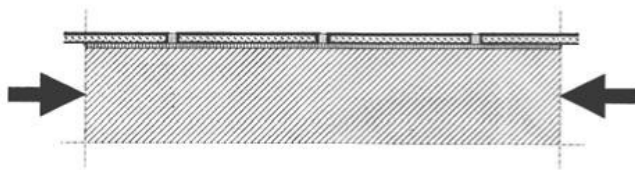
24

4. Joints per 5 meters

Tile size	Number of tiles	Number of joints	Joint width	Total per 5 meters
60 x 60	8	8	2 mm	16 mm
2,5 x 2,5	200	40 x 5	200 mm	400 mm
30 x 30	17	17	4 mm	68 mm

With 60x60 cm tiles the difference between the longitudinal expansions of ceramic and calcium sulfate screed is 0,14 mm each 5 meter length and 16 mm joint width. = ca. 10% joint width

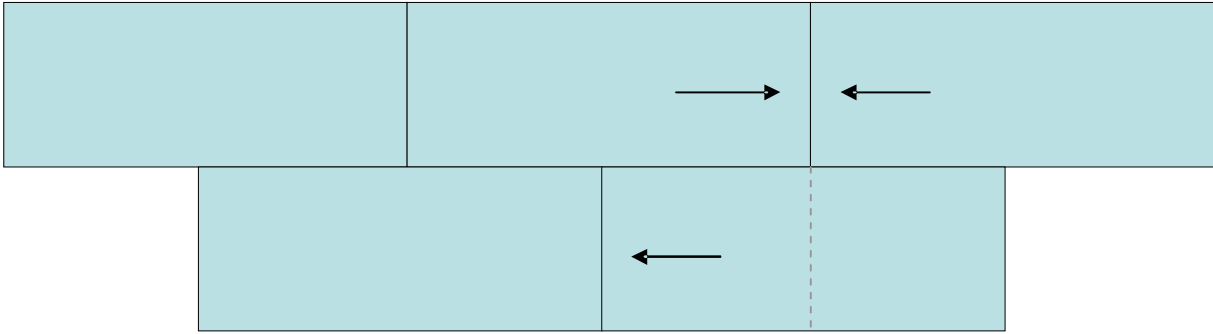
With 30x30 cm tiles longitudinal expansion is 0,14 mm when joint widths are 68 mm. The difference is negligible!



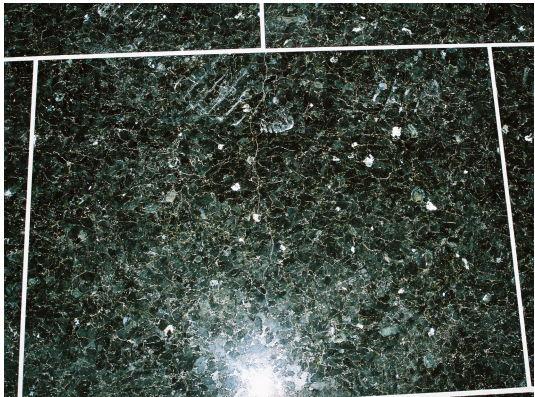
Joint widths must correspond to tile quality and expected longitudinal expansion. The narrower the joints, the more height differences are visible between tiles.

Please no cross-joint offsetting!



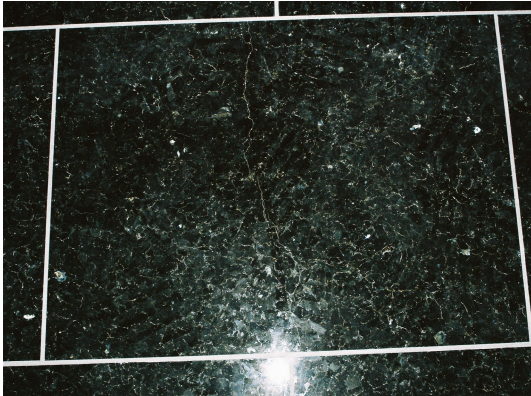


Danger of tile cracking and unnecessary height differences!



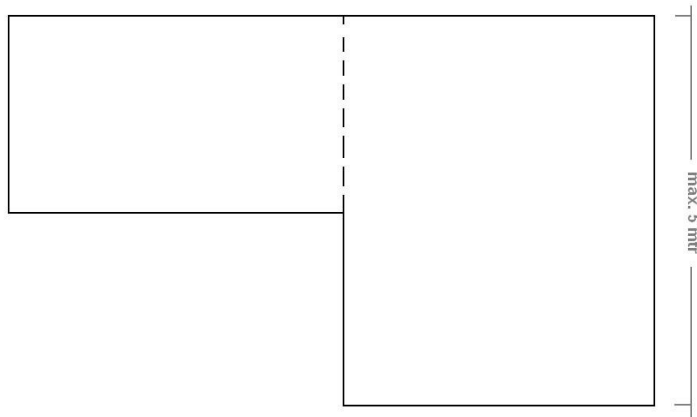
height displacement

Tile cracks



There is no pivotal motion possible – the result is cracking

5. We need a layout plan.  
Example "living room": 60 x 60 cm tiles, 2 mm joints



DIN 18560

"A joint layout plan must depict the types and arrangement of floor surface joints."  
A joint layout plan must be included in the specification documents which are submitted by the planner to the contractor.



If material expansion and room geometry is not adequately taken into consideration, tile cracking may occur!





6. Substrate irregularities are compensated by surface leveling

DIN 18202 Table 3 Line 3		Limits in mm				
		0,1m	1m	4m	10m	15m
3	Subfloors, i.e. screeds as finished flooring, screeds for floor coverings, tiles, mounted and glued coverings	2mm	4mm	10mm	12mm	15mm

7. Subfloor surfaces (draft for DIN 18157)

... According to DIN 18202 permitted surface level tolerances in subfloors for the installation of large format tiles or natural stone and mosaics may require compensatory measures.

8. Tile fitting

6.1 Types of thin-set mortar beds (draft DIN 18157)

6.1.2 Types dependant on surfacing materials

Ceramic tiles and natural stone larger than 30 cm x 30 cm require mortar with a classification of at least C2 as described in DIN EN 12004; those larger than 50 cm x 50 cm require mortar with a classification of at least C2 and S1 as described in DIN EN 12 004.

Tile sizes larger than ca. 60 x 60 cm may require additional stress decreasing measures. Furthermore, large formats may be required to be set in medium-bed mortar in order to avoid edges higher than tolerances allow

Caution: Not all medium-bed mortars fulfill EN DIN 12004 "increased water absorption".

For the secure adhesion of large format tiles and natural stone, a full surface application of scraping filler is essential!



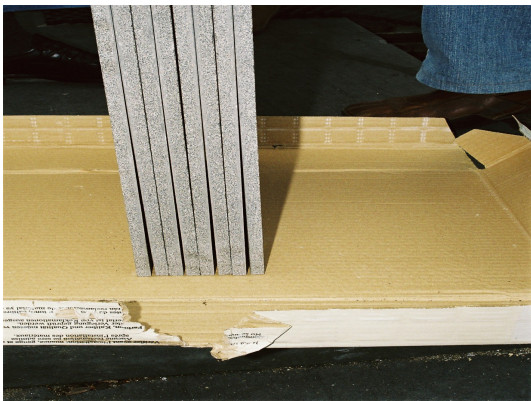
That's not enough!



That's much better!

## T as in time

- No time to advise customers in choosing tiles. Not all that is desired is possible to realize.
- Not all specifications and requirements can be fulfilled.
- Use caution in regard to specified materials (i.e. tiles). Does product quality fulfill job requirements? (i.e. unevenness and irregularities).



- Construction schedule.
- Impatience in regard to subfloor drying times.
- Walking on freshly laid surfaces after only a few hours.

## S as in stinginess is cool!

A calculation that doesn't add up.  
Priority on "cheap"!

No surface finishing  
No primer  
No tile cut-off waste



Quick and cheap

Lower quantity / m<sup>2</sup> does not translate automatically into quicker execution / m<sup>2</sup>

What can we do?

Especially those formats with more than 60 cm edge lengths require the appropriate floating system in order to reduce shear stress.

Large formats



Separation



What is important when installing large formats?

- Material tolerances of maximal 1 mm (independent of tile size)
- Separation mats for formats larger than 60x60 cm
- Joint widths of at least 4 mm
- Expansion joints *heated* 5 m  
*unheated* 8 m
- Adhesive, S1 class, EN 12004
- Careful installation after sufficient drying time

Success comes from cooperation!

Industry, Trade, and Publishing. If we all work together, then the large format ceramic will become a tile.