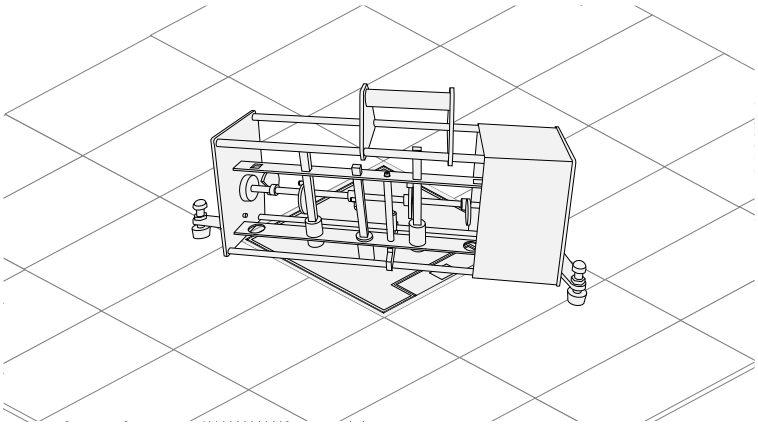
Technical information

Floor installation systems

Impact noise properties



Planning aid, taking impact noise properties into account

Floor installation systems and installation units

EKx, BKBx, BKGx, BKFx, UKx

CE

hager

DE

1 Sound protection and impact noise

General

The aim of sound protection in buildings is to prevent sound from being transferred between various rooms and/or floors. The DIN 4109 standard contains guidelines on sound and impact noise levels in residential buildings. Impact noise consists of two types of sound. Airborne sound travels through the air, whereas structure-borne sound travels through solid bodies.

Standard DIN 4109 specifies noise limits $L_{n,w}$ that must not be exceeded in certain areas of application.

Examples of segment-related noise limits:

- Office buildings: residential dividing ceilings and ceilings between third-party office rooms $L_{n,w} \leq 53$ dB
- Recreation rooms and hotels (increased sound protection requirements): $L_{n,w} \leq 46$ dB

The following always applies: The lower the values, the better the impact noise insulation. The value can be reduced, for instance, by laying a floor covering (such as carpet). The transfer of impact noise can also be reduced by laying the floor on an insulation layer (“floating screed”).

Impact noise reduction in Hager floor installation systems

Reducing the transfer of impact noise is also relevant when laying floor installation systems. A testing institute was therefore engaged to measure the impact noise reduction in selected Hager products. The requested test consisted of the measurement of the vertical spread of the structure-borne sound, in other words, the transmission of sound between floors.

Impact noise reduction was measured for the following Hager products:

- BKBx floor trunking brush outlet
- BKGx floor trunking
- BKFx screed-flush trunking (UDBx & UDHx universal floor box)
- EKSQx, EKSRx levellable heavy duty cassette
- EKQx; EKRx; MKQx; MKRx levellable cassette
- UDKQx floor box set

Preliminary investigations identified the products that demonstrated the most problematic impact noise reduction measured values. It can therefore be assumed that all other variants of these floor installation systems also reach the measured values of the tested products as a minimum.

An assessment of impact noise reduction was conducted for the following Hager products:

- UKx underfloor trunking

2 Impact noise reduction measurements on the ceiling test station

Müller-BBM GmbH measured the impact noise reduction on the ceiling test station in accordance with the DIN EN ISO 10140 standard and evaluated the findings in accordance with the ISO 717-2 standard.

Ceiling test station

The ceiling test station consists of two rooms positioned one above the other. The commissioned test measures the vertical spread of structure-borne sound – in other words, the transmission of sound between floors.

Test setup

The measurements were taken as follows:

- On a reference surface: bare ceiling slab, insulation, screed, no floor covering
- On and next to the test body; in other words, the installed products in various configurations (siehe Tab. 2/ siehe Tab. 3/ siehe Tab. 4/ siehe Tab. 5)

Measurement

The measurement test setup is located in the transmission room. A standardised physical noise source known as a standard trip hammer is placed on the test setup (Fig. 1: Standard trip hammer). The standard trip hammer produces impacts that are measured in the room below with continuously moving microphones (Fig. 2: Microphone). This determines the standard impact noise level both in the reference area ($L_{n,0,w}$) and for the test body ($L_{n,r,w}$).

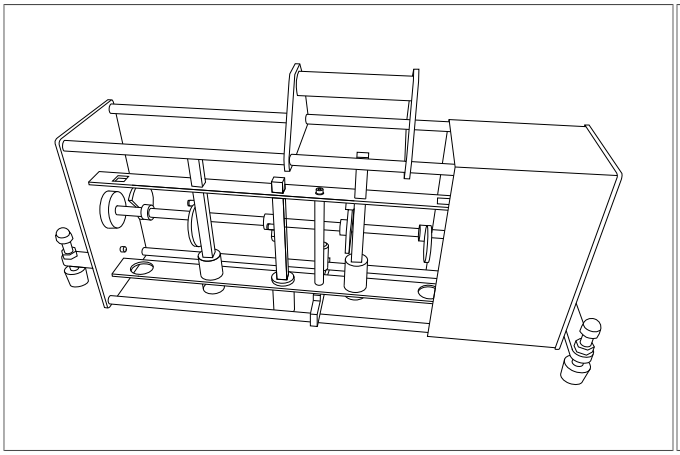


Fig. 1: Standard trip hammer

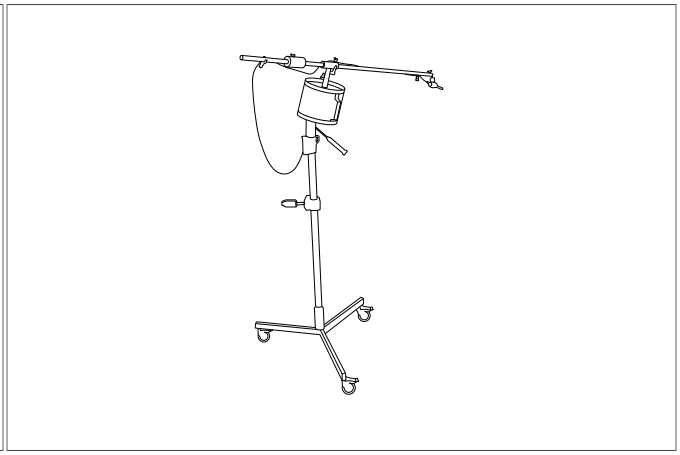


Fig. 2: Microphone

Impact noise reduction ΔL_w:

Impact noise reduction ΔL_w describes an improvement in the impact noise insulation of a bare ceiling slab achieved by coverings such as insulation, screed and carpet, for example. Impact noise reduction is the difference between the standard impact noise level of a bare ceiling slab with and without covering ($L_{n,0,w}$ - $L_{n,r,w}$).

3 Test results

3.1 Reference area

The measurements were taken on a reference area consisting of a bare ceiling slab, thermal insulation and screed. Flooring such as wood, tiles or carpet was not used.

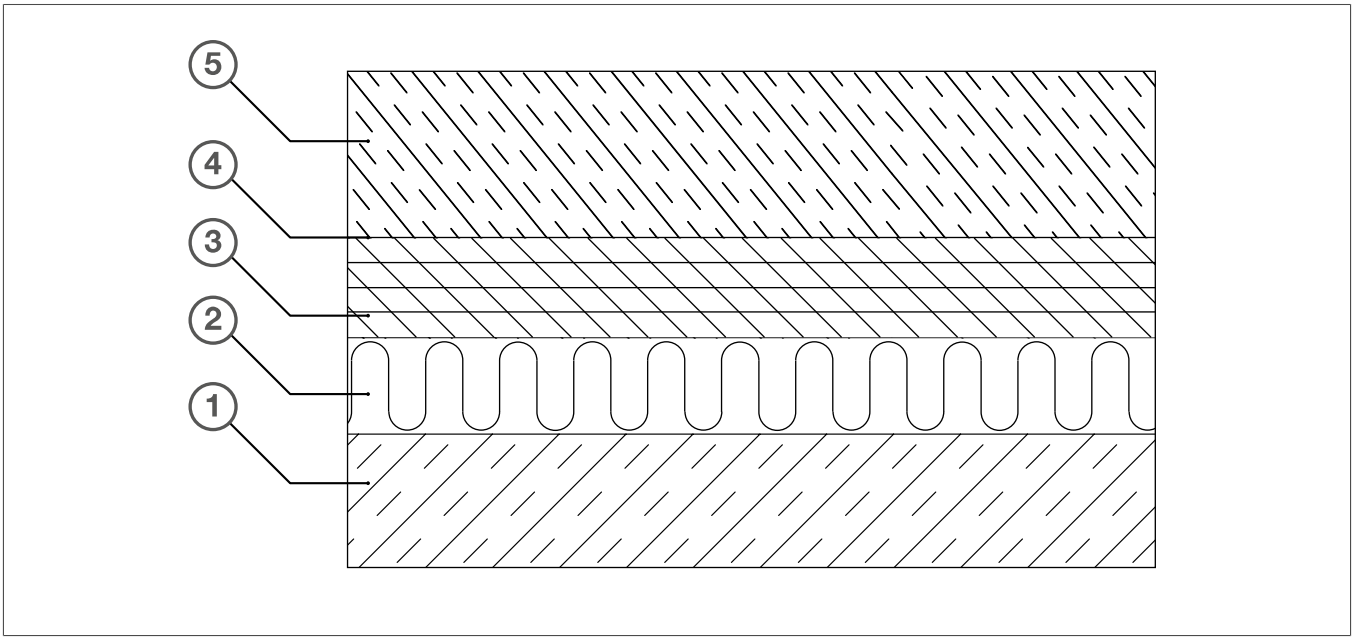


Fig. 3: Concept drawing of the test setup in the reference area on the ceiling test station

1. Bare ceiling slab
2. 40 mm thermal insulation (styrofoam)
3. 30 mm impact noise insulation
4. 0.2 mm PE film
5. 50 mm cement screed

Test setup	Impact noise reduction ΔL_w
Reference area	29 dB

Table 1: Measured value for impact noise reduction in the reference area

Impact noise reduction: Example calculation

List of abbreviations:

- $L_{n,w}$ = evaluated standard impact noise level (e.g. 53 dB for office buildings)
- $L_{n,0,w}$ = evaluated standard impact noise level of the bare ceiling slab (76 dB during the test)
- $L_{n,r,w}$ = evaluated standard impact noise level of the reference ceiling with the tested ceiling covering (e.g. 29 dB for finished floor)
- ΔL_w = test body of impact noise reduction (e.g. BKGx No.A 30 dB, siehe Tab. 3)

Example calculation:

The example calculation is based on an assumed evaluated standard impact noise level for the bare ceiling slab of 76 dB ($L_{n,0,w}$) and impact noise reduction achieved with the test body of 30 dB (ΔL_w).

$L_{n,w} = L_{n,0,w} - \Delta L_w$

$L_{n,w}$ = 76 dB - 30 dB

$L_{n,w}$ = 46 dB

The calculated value of 46 dB is less than the segment-related noise limit for office buildings of 53 dB (46 dB < 53 dB). In this situation, the construction work therefore complies with the standards.

3.2 BKBx floor trunking with brush outlet

The BKBx floor trunking with brush outlet shown in the image (Bild 4) was installed on the wall.

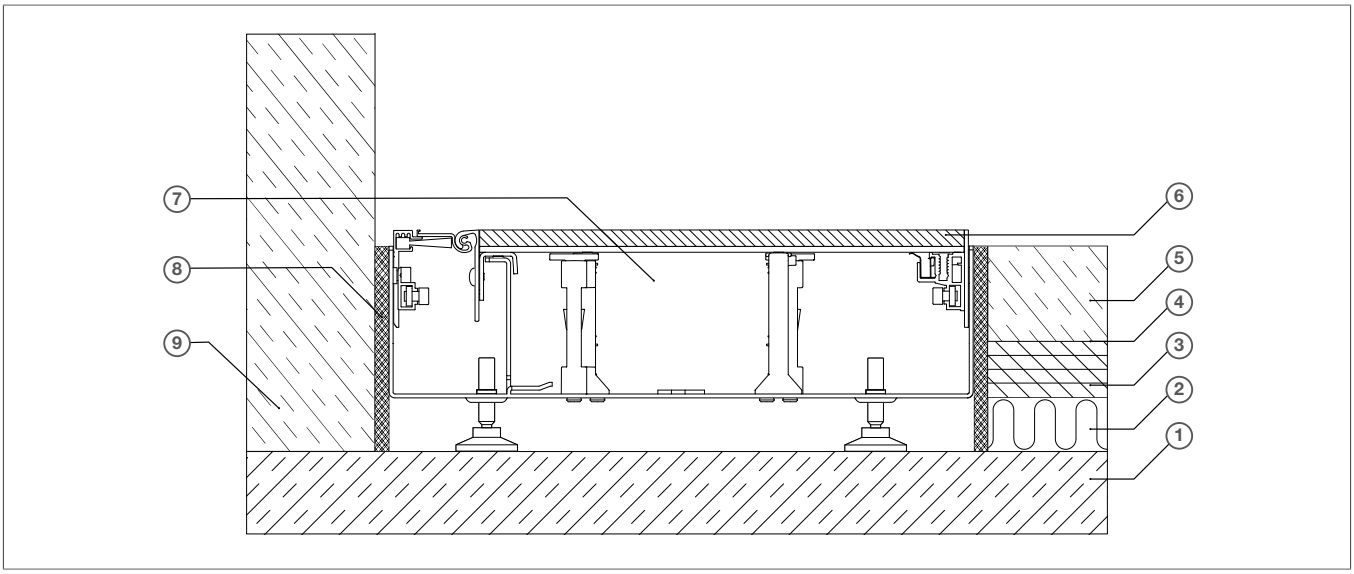


Fig. 4: Concept drawing of the test setup for the BKBx floor trunking with brush outlet on the ceiling test station

1. Bare ceiling slab
2. 40 mm thermal insulation (styrofoam)
3. 30 mm impact noise insulation
4. 0.2 mm PE film
5. 50 mm cement screed
6. Floor covering
7. BKBx floor trunking with brush outlet
8. 8 mm perimeter insulating strip
9. Wall

No.	Test position / type	Levelling feet	Cable	Bolted joint	Floor covering	Impact noise reduction ΔL_w	Reference area ΔL_w
A	On BKBx	BKBNSD 80 (insulation: felt)	Yes (50 %)	4 screws + wall plugs	Wood	28 dB	29 dB
B			No			26 dB	
C					Tiles	28 dB	
D					Carpet	30 dB	
E				No	Wood	28 dB	
F	Next to BKBx				-	31 dB	

Table 2: Measured values for impact noise reduction, BKBx

Summary of test results

– Cable occupation:
  Cable occupation has a positive effect on impact noise reduction: impact noise reduction for “50 % cable occupation” is approx. 2 dB higher than “without cable occupation”.
– Floor covering:
  Carpet achieves the highest impact noise reduction (ΔL_w = 30 dB).
  On tiles, impact noise reduction is approx. 2 dB lower than the measured values with carpet.
  On wood, impact noise reduction is approx. 4 dB lower than the measured values with carpet.
– Comparison without/with bolted joint on bare concrete floor:
  A bolted joint on the bare concrete floor has a negative effect on impact noise reduction:
  impact noise reduction for “without bolted joint” is approx. 2 dB more than “with bolted joint”.
– Effect of the floor trunking on the surrounding screed:
  Installing the floor trunking has no significant effect on the impact noise reduction of the screed.

3.3 BKGx floor trunking

The BKGx floor trunking shown in the image (Fig. 5) was installed in the room.

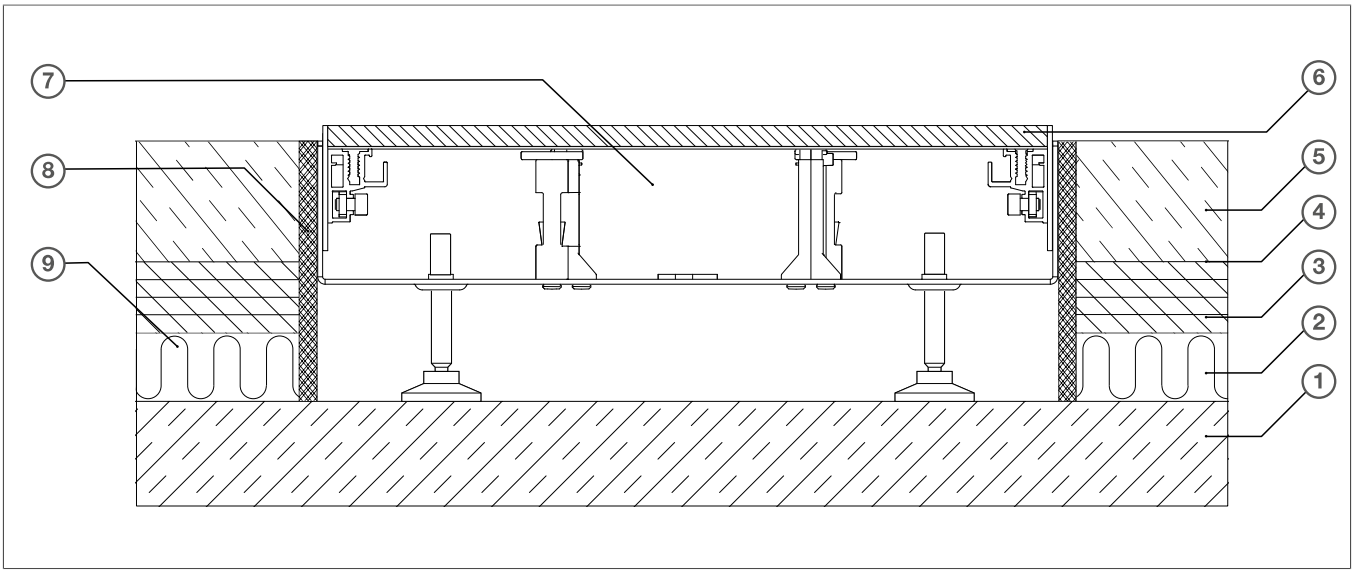


Fig. 5: Concept drawing of the test setup for the BKGx floor trunking on the ceiling test station

1. Bare ceiling slab
2. 40 mm thermal insulation (styrofoam)
3. 30 mm impact noise insulation
4. 0.2 mm PE film
5. 50 mm cement screed
6. Floor covering (carpet 11 mm, tiles 7 mm, wood 7 mm)
7. BKGx floor trunking

No.	Test position / type	Levelling feet	Cable	Bolted joint	Floor covering	Impact noise reduction ΔL_w	Reference area ΔL_w
A	On BKGx	BKBNSD 80 (insulation: felt)	Yes (50 %)	4 screws + wall plugs	Wood	30 dB	29 dB
B			No			28 dB	
C					Tiles	31 dB	
D					Carpet	32 dB	
E				No	Wood	29 dB	
F					Tiles	32 dB	
G					Carpet	32 dB	
F	Next to BKGx				-	32 dB	

Table 3: Measured values for impact noise reduction, BKGx

Summary of test results

– Cable occupation:
  Cable occupation has a positive effect on impact noise reduction: impact noise reduction for “50 % cable occupation” is approx. 2 dB higher than “without cable occupation”.
– Floor covering:
  Carpet achieves the highest impact noise reduction (ΔL_w = 32 dB).
  On tiles, impact noise reduction is approx. 1 dB lower than the measured values with carpet.
  On wood, impact noise reduction is approx. 4 dB lower than the measured values with carpet.
– Comparison without/with bolted joint on bare concrete floor:
  A bolted joint on the bare concrete floor has a slightly negative effect on impact noise reduction: impact noise reduction for “without bolted joint” is approx. 1 dB more than “with bolted joint”.
– Effect of the floor trunking on the surrounding screed:
  Installing the floor trunking has no significant effect on the impact noise reduction of the screed.

3.4 EKQx levellable cassette

The EKQx levellable cassette shown in the image (Bild 6) was installed in the room.

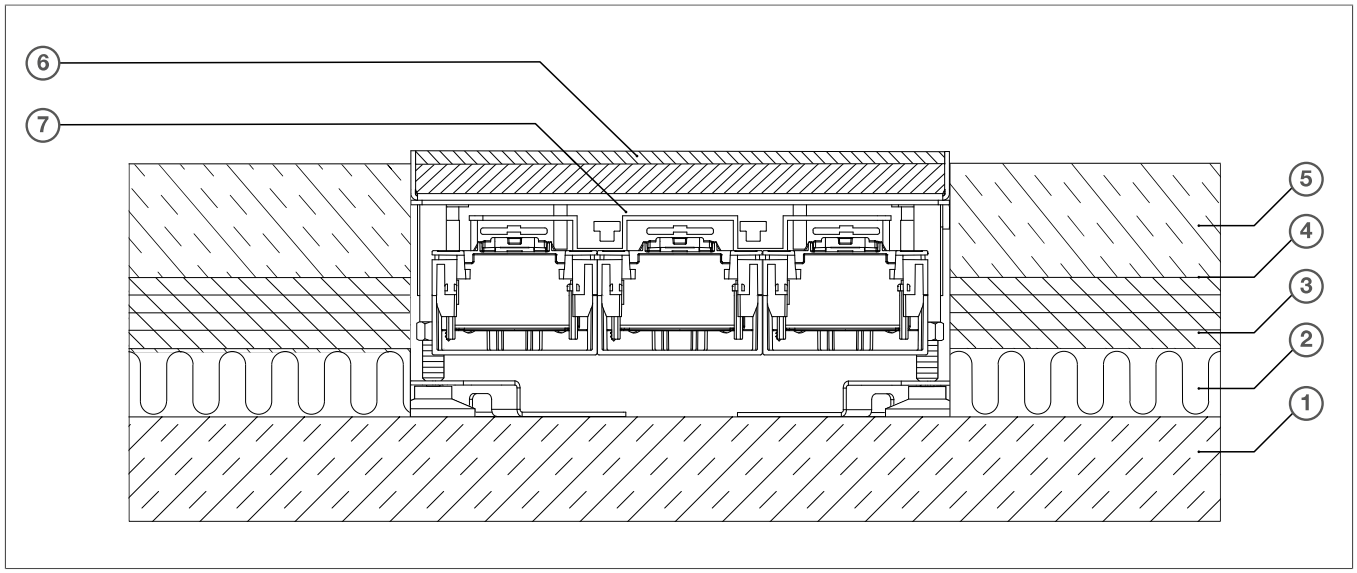


Fig. 6: Concept drawing of the test setup in the EKQx levellable cassette on the ceiling test station

1. Bare ceiling slab
2. 40 mm thermal insulation (styrofoam)
3. 30 mm impact noise insulation
4. 0.2 mm PE film
5. 50 mm cement screed
6. Floor covering (carpet 11 mm, tiles 7 mm, wood 7 mm)
7. Levellable cassette with device casing

No.	Test position / type	Levelling feet	Equipment	Floor covering	Impact noise reduction ΔL_w	Reference area ΔL_w
A	On EKQx	EKNSx (insulation: none)	3 x GTVR400, 12 socket outlets	Wood	21 dB	29 dB
B				Tiles	21 dB	
C				Carpet	23 dB	
D	Next to EKQx		No	-	31 dB	

Table 4: Measured values for impact noise reduction, EKQ120BL25

Summary of test results

– Floor covering:
  Carpet achieves the highest impact noise reduction (ΔL_w = 23 dB).
  On tiles, impact noise reduction is approx. 2 dB lower than the measured values with carpet.
  On wood, impact noise reduction is approx. 4 dB lower than the measured values with carpet.
– Effect of the levellable cassette on the surrounding screed:
  Installing the levellable cassette has no significant effect on the impact noise reduction of the screed.

3.5 BKFx screed-flush trunking

The BKFx screed-flush trunking shown in the image (Bild 7) was installed in the room.

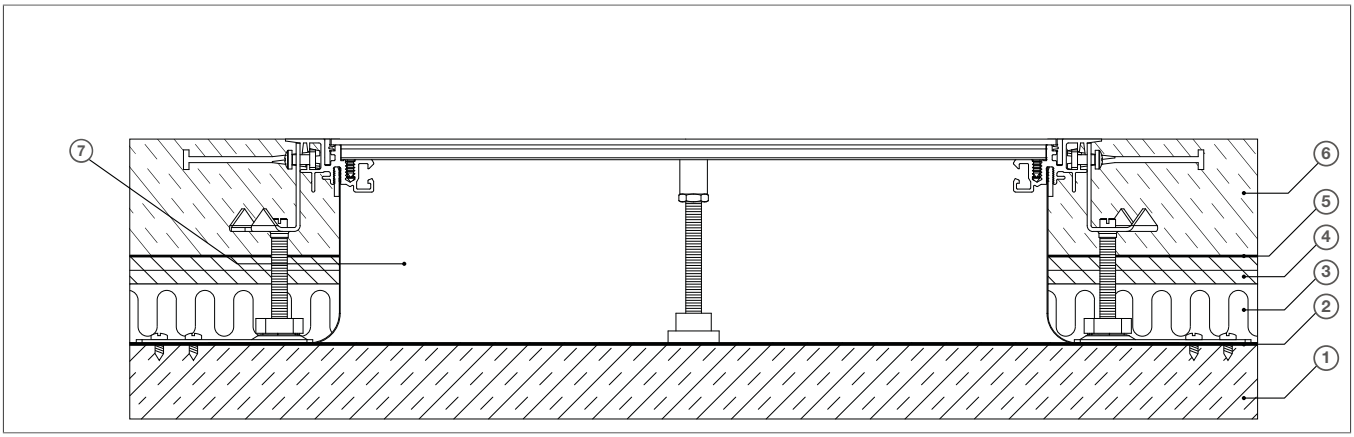


Fig. 7: Concept drawing of the test setup for the BKFx screed-flush trunking on the ceiling test station

1. Bare ceiling slab (140 mm concrete ceiling slab)
2. 2 x 0.2 PE film, loosely applied
3. 30 mm thermal insulation (styrofoam)
4. 10 mm impact noise insulation (mineral wool)
5. 0.2 mm PE film
6. 60 mm cement screed
7. BKFx screed-flush trunking

No.	Test position / type	Bolted joint	Impact noise reduction ΔL_w	Reference area ΔL_w
A	Next to BKFx	Screws + wall plugs	25 dB	26 dB

Table 5: Measured values for impact noise reduction, BKFx

Summary of test results

- Effect of the screeed-flush trunking on the surrounding screed:
  Installing the screed-flushtrunking has no significant effect on the impact noise reduction of the screed.
- Transferability of the test results to the UDBx & UDHx universal floor boxes:
  The structure of the UDBx & UDHx universal floor boxes is very similar to that of the BKFx screed-flush trunking. Compared to the BKFx screed-flush trunking , the UDBx & UDHx universal floor boxes are not expected to have a more significant effect on the impact noise reduction properties of the floor structure.

3.6 UKx underfloor trunking

No measurements were taken for the UKx underfloor trunking shown (Bild 8). However, it is possible to say that the installation situation of the trunking system does not have a significant effect on the impact noise reduction of the screed.

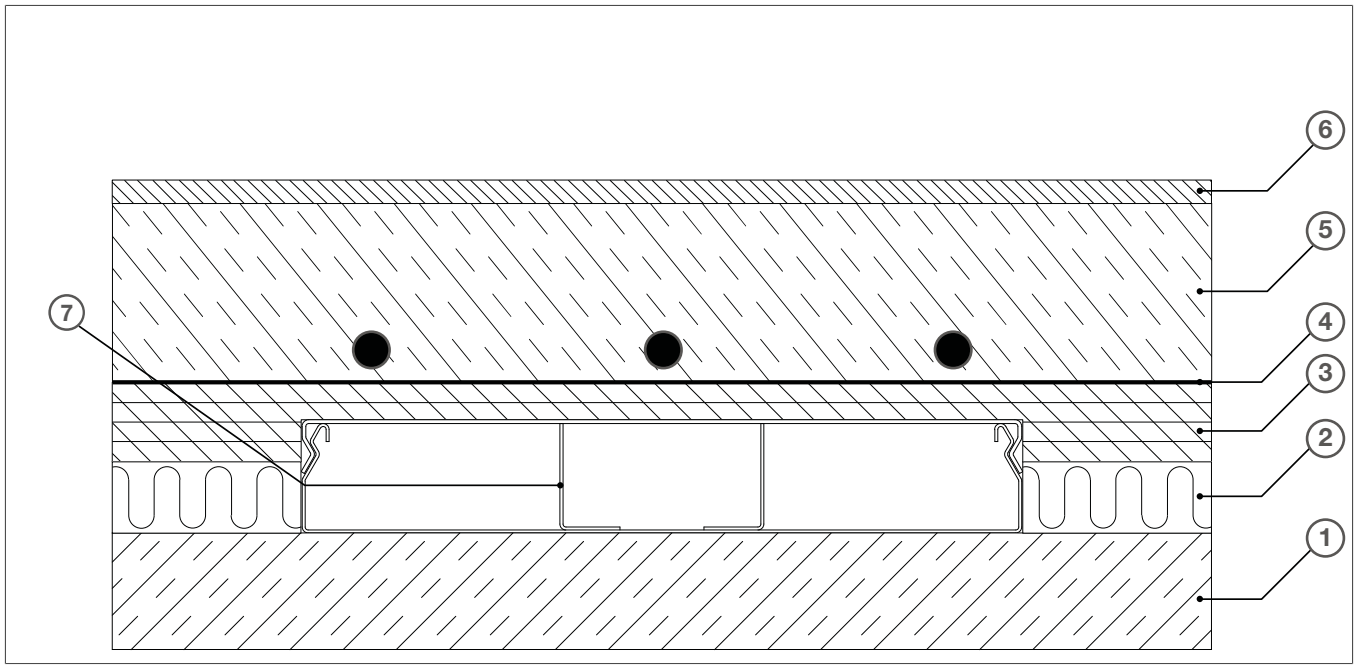


Fig. 8: Concept drawing of underfloor trunking UKx

1. Bare ceiling slab
2. 40 mm thermal insulation (styrofoam)
3. 30 mm impact noise insulation
4. 0.2 mm PE film
5. 50 mm cement screed with underfloor heating
6. Floor covering
7. UKx underfloor trunking

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2024-10

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