

# Compact Knowledge

Sound insulation –  
a major contribution towards  
the value stability of a  
building and the health  
of its residents



## At a glance

✓ **Benefits of sound insulation**

Sound insulation makes a major contribution towards the value stability of a building and the health of its residents / users.

✓ **Application**

Sound insulation in drainage technology, level-access showers in particular

✓ **Participants**

Acting companies, architects, planners, manufacturers of building products, owners, users of residential buildings.

✓ **Task of sound insulation in level-access showers**

Protection against functional sound and footfall sound.

✓ **Relevant standards and guidelines**

The standard DIN 4109 specifies the minimum standards for sound insulation, the VDI guideline 4100 formulates increased requirements.

✓ **Dallmer sound insulation values**

Dallmer's drainage systems either meet or exceed the requirements of DIN 4109 and VDI 4100.

# Sound and sound insulation

Sound insulation in drainage technology falls under the jurisdiction of building acoustics. Aims include protection against sounds from building technology systems, such as supply / wastewater pipes. Sound insulation products prevent / reduce sound

transmission from the source to the ear of the unwilling listener. When it comes to the sound insulation of level-access showers, there are two types of sound: Functional sound and footfall sound.

## Functional sound

Functional sound, also known as installation noise, includes flow noise, i.e. the sound of water flowing, and impact sound, such as that occurring when the water jet hits the shower floor. The volume of installation noise depends primarily on transmission from the

wastewater pipe to the building structure. As it is impossible to avoid contact points between installation technology, drain and pipework, the task of sound insulation technology is to absorb functional sound as far as possible, thus preventing sound transmission.


## Footfall sound

Footfall sound is caused by the mechanical stimulation of steps, screed, tiles and bare flooring, such as walking or moving a chair. This sound is transmitted to the rooms below, partially as structure-borne sound via the floor and flanking components, and partially as airborne sound, which is why floors, and thus the entire floor structure in buildings, need to meet the requirements for airborne and footfall sound insulation. The minimum requirements are stipulated in

the standard DIN 4109. The right floor structure – the mass and sound-absorbing properties of floating screed have proven particularly beneficial – and high-quality footfall sound insulation can significantly reduce footfall sound. Our footfall sound insulation is made of mineral and EPS insulation as per the respective test report. In this case, footfall sound can no longer be heard in the rooms below, or only very quietly.

## Dallmer sound insulation values: Level-access showers

### DallFlex system

	<b>Functional sound</b> Drain flow noises	<b>DallFlex or CeraFlex drain body with                  CeraFloor or CeraWall shower channels</b>
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Calculated installation noise level $L_{A, \text{Freq}, n}$ in dB(A) according to DIN 4109 from comparative measurements, based on DIN 52219 with stimulation from standard structure-borne sound	<b>Requirement acc. to DIN 4109                  (version A1: 2001)</b>				<b>Requirement acc. to VDI 4100                  (version 2012-10)</b>			
	Upper edge of screed on drain body	Measured values	Minimum requirements 30 dB	Increased requirements 25 dB	Measured values	Sound insulation levels		
		Basement rear				Basement rear	SST I	SST II
<b>Samples</b>					30 dB* 30 dB**	27 dB* 25 dB**	24 dB* 22 dB**	

#### DallFlex drain body

with CeraFloor Select shower channel and sound-proofing pad (P-BA 146/2015)	95 mm	15 dB	met	met	12 dB	met	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 148/2015)	95 mm	18 dB	met	met	14 dB	met	met	met

#### DallFlex Plan drain body

with CeraWall Select shower channel and sound-proofing pad (P-BA 144/2015)	70 mm	21 dB	met	met	17 dB	met	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 142/2015)	70 mm	18 dB	met	met	14 dB	met	met	met

#### CeraFlex drain body


with CeraWall Select shower channel and sound-proofing pad (P-BA 148/2015)	98 mm	19 dB	met	met	16 dB	met	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 148/2015)	98 mm	18 dB	met	met	14 dB	met	met	met

#### CeraFlex Plan drain body

with CeraWall Select shower channel and sound-proofing pad (P-BA 144/2015)	78 mm	21 dB	met	met	17 dB	met	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 142/2015)	78 mm	18 dB	met	met	14 dB	met	met	met

\* Apartment block

\*\* Detached, semi-detached and terraced house

 Values measured on a 190 mm thick reinforced concrete ceiling by the Fraunhofer Institute for Building Physics.

## Dallmer sound insulation values: Level-access showers

### DallFlex system



**Footfall sound reduction**  
for minimum ceiling thickness of 190 mm

**DallFlex or CeraFlex drain body with  
CeraFloor or CeraWall shower channels**

Assessed footfall sound reduction and spectrum adjustment value according to DIN EN ISO 717- $\Delta L_w$ ( $C_1$ 100-2500)	Upper edge of screed on drain body	Reinforced concrete ceiling without plaster or compound screed (raw density 2300 kg/m <sup>3</sup> )	Equivalent assessed standard footfall sound level of the solid ceiling according to DIN 4109 $L'_{n,w,eq,R}$ (dB) <sup>1)2)</sup>	Assessed footfall sound reduction $\Delta L_w$ ( $C_1$ 100-2500) (dB)	Existing assessed standard footfall sound level $L'_{n,w,R}$ (dB)	Requirements for air and footfall sound insulation of ceilings according to DIN 4109 (issue 89)	
						Minimum requirements for footfall sound $L'_{n,w}$ (53 dB)	Increased sound insulation for footfall sound $L'_{n,w}$ (46 dB)
<b>Samples</b>							
<b>DallFlex drain body</b>							
with CeraFloor Select shower channel and sound-proofing pad (P-BA 146/2015)	95 mm	190 mm	72 dB	28 dB	46 dB <sup>3)</sup>	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 148/2015)	95 mm	190 mm	72 dB	30 dB	44 dB <sup>3)</sup>	met	met
<b>DallFlex Plan drain body</b>							
with CeraWall Select shower channel and sound-proofing pad (P-BA 144/2015)	70 mm	190 mm	72 dB	30 dB	44 dB <sup>3)</sup>	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 142/2015)	70 mm	190 mm	72 dB	29 dB	45 dB <sup>3)</sup>	met	met
<b>CeraFlex drain body</b>							
with CeraWall Select shower channel and sound-proofing pad (P-BA 148/2015)	98 mm	190 mm	72 dB	30 dB	44 dB <sup>3)</sup>	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 148/2015)	98 mm	190 mm	72 dB	30 dB	44 dB <sup>3)</sup>	met	met
<b>CeraFlex Plan drain body</b>							
with CeraWall Select shower channel and sound-proofing pad (P-BA 144/2015)	78 mm	190 mm	72 dB	30 dB	44 dB <sup>3)</sup>	met	met
with CeraWall Individual shower channel and sound-proofing pad (P-BA 142/2015)	78 mm	190 mm	72 dB	29 dB	45 dB <sup>3)</sup>	met	met

<sup>1)</sup> Values according to DIN 4109 with hard floorings


<sup>2)</sup> For other ceiling constructions the values specified by the manufacturer must be used

<sup>3)</sup> Including allowance (+ 2 dB)

 Values measured on a 190 mm thick reinforced concrete ceiling by the Fraunhofer Institute for Building Physics.


## Dallmer sound insulation values: Level-access showers

### CeraLine shower channel and floor drains

 <b>Functional sound</b> Drain flow noises	CeraLine shower channel, CeraDrain, TistoPlan and DallDrain floor drains								
	Calculated installation noise level $L_{A, \text{Freq}, n}$ in dB(A) according to DIN 4109 from comparative measurements, based on DIN 52219 with stimulation from standard structure-borne sound	Requirement acc. to DIN 4109 (version A1: 2001)				Requirement acc. to VDI 4100 (version 2012-10)			
		Upper edge of screed on drain body	Measured values Basement rear	Minimum requirements 30 dB	Increased requirements 25 dB	Measured values Basement rear	Sound insulation levels		
Samples						SST I 30 dB* 30 dB**	SST II 27 dB* 25 dB**	SST III 24 dB* 22 dB**	
<b>CeraLine</b>									
CeraLine Plan W shower channel with sound-proofing pad (P-BA 53/2013)	98 mm	21 dB	met	met	17 dB	met	met	met	
CeraLine Nano W shower channel with sound-proofing pad (P-BA 54/2013)	76 mm	22 dB	met	met	18 dB	met	met	met	
<b>CeraDrain</b>									
CeraDrain Plan floor drain with sound-proofing pad (P-BA 271/2014)	84 mm	15 dB	met	met	11 dB	met	met	met	
<b>TistoPlan</b>									
TistoPlan floor drain with sound-proofing pad (P-BA 226/2008)	86 mm	21 dB	met	met	17 dB	met	met	met	
<b>DallDrain</b>									
DallDrain floor drain with sound insulation mat	90 mm	12 dB	met	met	< 10 dB	met	met	met	
DallDrain Plan floor drain with sound insulation mat	60 mm	20 dB	met	met	17 dB	met	met	met	

\* Apartment block

\*\* Detached, semi-detached and terraced house

 Values measured on a 190 mm thick reinforced concrete ceiling by the Fraunhofer Institute for Building Physics.

## Dallmer sound insulation values: Level-access showers

### CeraLine shower channel and floor drains



**Footfall sound reduction**  
for minimum ceiling thickness of 190 mm

**CeraLine shower channel, CeraDrain,  
TistoPlan and DallDrain floor drains**

Assessed footfall sound reduction and spectrum adjustment value according to DIN EN ISO 717- $\Delta L_w$ (C <sub>1</sub> 100-2500)	Upper edge of screed on drain body	Reinforced concrete ceiling without plaster or compound screed (raw density 2300 kg/m <sup>3</sup> )	Equivalent assessed standard footfall sound level of the solid ceiling according to DIN 4109 $L'_{n,w,eq,R}$ (dB) <sup>1)2)</sup>	Assessed footfall sound reduction $\Delta L_w$ (C <sub>1</sub> 100-2500)	Existing assessed standard footfall sound level $L'_{n,w,R}$ (dB)	Requirements for air and footfall sound insulation of ceilings according to DIN 4109 (issue 89)	
						Minimum requirements for footfall sound $L'_{n,w}$ (53 dB)	Increased sound insulation for footfall sound $L'_{n,w}$ (46 dB)
Samples							
<b>CeraLine</b>							
CeraLine Plan W shower channel with sound-proofing pad (P-BA 53/2013)	98 mm	190 mm	72 dB	29 dB	45 dB <sup>3)</sup>	met	met
CeraLine Nano W shower channel with sound-proofing pad (P-BA 54/2013)	76 mm	190 mm	72 dB	27 dB	47 dB <sup>3)</sup>	met	–
<b>CeraDrain</b>							
CeraDrain Plan floor drain with sound-proofing pad (P-BA 271/2014)	84 mm	190 mm	72 dB	31 dB	43 dB <sup>3)</sup>	met	met
<b>TistoPlan</b>							
TistoPlan floor drain with sound-proofing pad (P-BA 226/2008)	86 mm	190 mm	72 dB	36 dB	38 dB <sup>3)</sup>	met	met
<b>DallDrain</b>							
DallDrain floor drain with sound insulation mat	90 mm	190 mm	72 dB	35 dB	39 dB <sup>3)</sup>	met	met
DallDrain Plan floor drain with sound insulation mat	60 mm	190 mm	72 dB	27 dB	47 dB <sup>3)</sup>	met	met

<sup>1)</sup> Values according to DIN 4109 with hard floorings

<sup>2)</sup> For other ceiling constructions the values specified by the manufacturer must be used

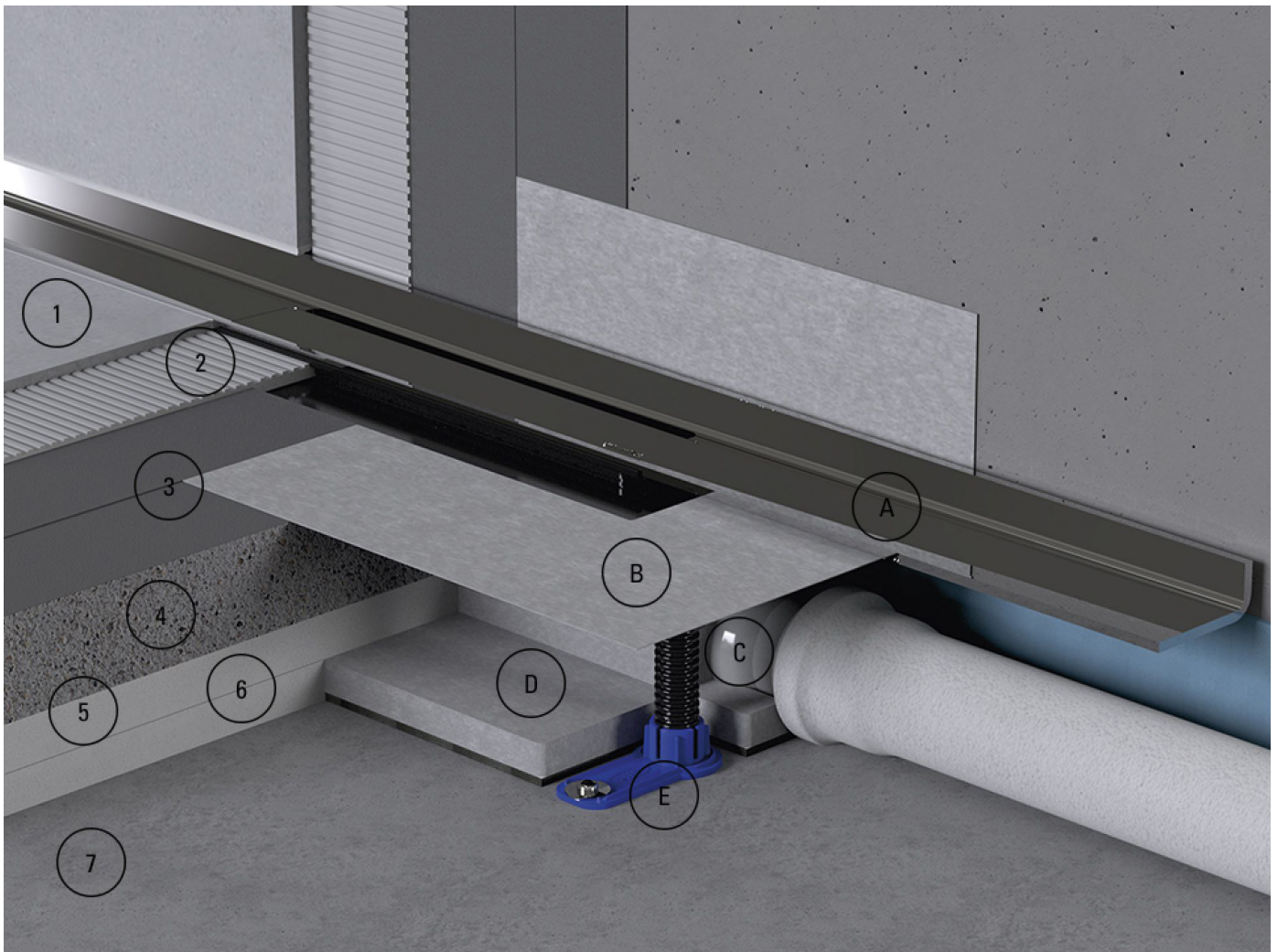
<sup>3)</sup> Including allowance (+ 2 dB)



Values measured on a 190 mm thick reinforced concrete ceiling by the Fraunhofer Institute for Building Physics.

# System design & floor structure with sound-proofing pad + footfall sound insulation

Shown here with CeraWall Select + DallFlex drain body and DallFlex sound-proofing pad  
(installation according to P-BA 148/2015 which meets the increased sound insulation requirements of DIN 4109 and VDI 4100)



## Floor structure

- 1 Ceramic floor covering
- 2 Tile adhesive in thin bed mortar
- 3 Bonded waterproofing
- 4 Screed
- 5 Separating layer
- 6 Footfall sound / thermal insulation
- 7 Concrete surface

## System design

- A CeraWall Select shower channel
- B Sealing sleeve
- C DallFlex drain body
- D Sound-proofing pad
- E Levelling feet

Installation products, such as the DallFlex sound-proofing pad shown above, separate the drain body from the surrounding screed and significantly dampen functional sound. For installation acc. to test report P-BA 146/2015 (for CeraFloor, Zentrix and CeraNiveau shower channels) or P-BA 148/2015 (for CeraWall shower channels) – suitable for meeting the increased sound insulation requirements as per DIN 4109 and VDI 4100.

# DIN 4109 and VDI 4100

Two codes of practice are relevant for sound insulation: the DIN 4109 standard and VDI 4100 guideline. The DIN stipulates the minimum requirements for regular sound insulation, while the VDI guidelines define the requirements for increased sound insulation.

## DIN 4109

### Sound insulation in high-rise buildings

**Published by:** DIN Deutsches Institut für Normung (German Institute for Standardisation)

**Aim:** The Regional Building Code requires that buildings are fitted with appropriate sound insulation in order to protect residents / users against unreasonable annoyances and harmful effects on their health. It specifies the minimum requirements, while supplementary sheet 2 also contains recommendations for increased sound insulation.

### Scope

DIN 4109 is part of the construction law of the federal states. It is applicable in the housing sector, as well as in schools, hospitals, commercially rented accommodation and office blocks.

### Limit values

#### Limit values for functional sound

In the case of functional sound, the installation noise level  $L_{AFmax,n}$  ( $L_{AFeq,n}$ ) is applicable. Installation noise level refers to the sound pressure level caused by the sanitary facilities, which is also a quantity for describing the intensity of the sound event. The increased requirements prohibit the installation noise level from exceeding 30 dB or 25 dB.

#### Limit values for footfall sound

When calculating footfall sound,  $L'_{n,w}$  is the deciding factor. This is the assessed standard footfall sound, i.e. the sound that can be heard in the room to be insulated. The lower the standard footfall sound, the quieter it is in the room. DIN 4109 sets the minimum requirement of 53 dB as the maximum permissible sound pressure level, while the increased requirements stipulate 46 dB in multi-dwelling residences for ceilings located underneath bathrooms and toilets.



# VDI Guideline 4100

## VDI directive 4100 “Sound insulation in high-rise buildings – apartments: assessment and proposals for increased sound insulation”

**Published by:** Verein Deutscher Ingenieure (Association of German Engineers)

**Aim:** The VDI guideline formulates increased requirements for sound insulation in order to increase privacy and life quality in apartments.

### Limit values

#### Sound insulation levels acc. to VDI 4100

The VDI guideline defines three sound insulation levels, which are based on how the sound is registered in the receiving room:

- **SST III:** the sound is not considered disruptive.
- **SST II:** the sound is not generally considered disruptive.
- **SST I:** the sound is generally considered minimally disruptive.

#### The 3 key quantities for describing sound insulation according to VDI 4100

- $D_{nT,W}$  = airborne sound insulation
- $L'_{nT,w}$  = footfall sound insulation
- $L_{AFmax,nT}^*$  = maximum level from building service installations

The last two quantities are particularly relevant to drainage technology. Which values require compliance depends on the type of building and whether it is a question of insulating other apartments against sound or sound insulation in one’s own home.

#### Limit values for functional sound ( $L_{AFmax,nT}^*$ )

The guideline stipulates the maximum permissible sound pressure level for all building service installations, including water supply and wastewater systems.

### Scope

The VDI 4100 is specially tailored to the sound insulation of apartment blocks, or buildings designed for residential use, such as retirement homes, student halls of residence or nursing homes. According to VDI 4100, all rooms larger than 8 m<sup>2</sup> and bathrooms of any size are considered in need of insulation. Unlike DIN 4109, sound insulation according to VDI 4100 must be contractually agreed if required.

Sound insulation levels	SSt I	SSt II	SSt III
Apartment blocks ( $L_{AFmax,nT}$ )	≤ 30 dB	≤ 27 dB	≤ 24 dB
Detached, semi-detached and terraced properties ( $L_{AFmax,nT}$ )	≤ 30 dB	≤ 25 dB	≤ 22 dB

Individual short-time noise peaks that occur when actuating fittings and devices (opening, closing, setting, interruption, etc.) must not exceed the values of SSt II and SSt III by more than 10 dB. This assumes use according to the designated purpose.

Sound insulation levels	SSt EBI	SSt EBII
Building service installations of own premises ( $L_{AFmax,nT}$ )	≤ 35 dB	≤ 30 dB

Individual short-time noise peaks that occur when actuating fittings and devices (opening, closing, setting, interruption, etc.) must not exceed the values of SSt II and SSt III by more than 10 dB. This assumes use according to the designated purpose.

\*The equation  $L_{AFmax,nT}$  already takes flanking transmission into account.

# VDI-Guideline 4100

Limit values for footfall sound ( $L'_{nT,w}$ )

VDI 4100:2012-10		
$L'_{nT,w}$	Footfall sound insulation in apartment blocks	
[dB]	Footfall sound is	
$\leq 37$	SSt III	not considered disruptive
$\leq 44$	SSt II	not generally considered disruptive
$\leq 51$	SSt I	generally considered minimally disruptive

VDI 4100:2012-10		
$L'_{nT,w}$	Footfall sound insulation in semi-detached and terraced properties	
[dB]	Footfall sound is	
$\leq 32$	SSt III	not considered disruptive
$\leq 39$	SSt II	not generally considered disruptive
$\leq 46$	SSt I	generally considered minimally disruptive

# Glossary

## DIN 4109

The standard “DIN 4109 – Sound insulation in high-rise buildings” stipulates the minimum requirements for regular sound insulation.

## Dynamic stiffness (s)

Dynamic stiffness describes the effectiveness of insulation material, i.e. how well it absorbs sound. Generally speaking, light-weight, low-density materials are best suited for this task. A low value indicates good sound insulation properties.

## Functional sounds

Functional sounds include flow noise, i.e. the sound of water flowing, and the sounds that occur when the water jet hits the shower floor.

## Installation noise level

The sound pressure level caused by sanitary installations.