



TEC1.2

Sound insulation



Objective

Ensuring sound insulation that is appropriate for the room usage type prevents excessive disturbances.

Benefits

Reducing disruptive noises has a significant impact on the well-being and satisfaction of users in a building. Good sound insulation enables users to concentrate better, helps ensure their privacy, provides them with better peace and quiet, and positively impacts their living comfort and health.

Contribution to overriding sustainability goals



CONTRIBUTION TO SUSTAINABLE DEVELOPMENT
GOALS (SDGS) OF UNITED NATIONS (UN)

CONTRIBUTION TO GERMAN
SUSTAINABILITY STRATEGY

3.4 Reduce mortality from non-communicable
diseases and promote mental health

3.1.a/b Health and food



Moderate



Outlook

There are currently no plans to make any of the requirements stricter.

Share of total score

	SHARE	WEIGHTING FACTOR
Office Education Residential Hotel	2.3%	3
Consumer market Shopping centre	0.0%	0
Department stores Logistics		
Production		



EVALUATION

The evaluation is based on the least favourable indoor situation. The sound insulation requirements in each case must always be met by all components in order to ensure that the corresponding quality level is reached. In this criterion, a total of 115 points can be achieved (100 points for **Residential**) but only a maximum of 100 points can actually be awarded.

No requirement/evaluation for **Consumer market** **Department stores** **Shopping centre** **Logistics** **Production**

NO.	INDICATOR	POINTS
1	Airborne sound insulation between rooms	
1.1	Within the room's own area – partition walls R'_w and corridor doors R_w	
	Office	Max. 20
	Rooms with normal requirements	+Max. 10
	Partition walls R'_w	
	■ ≥ 37 dB	5
	■ ≥ 42 dB	7.5
	■ ≥ 45 dB	10
	Doors R_w	
	■ ≥ 27 dB	5
	■ ≥ 32 dB	7.5
	■ ≥ 37 dB	10
	Rooms with increased requirements	+Max. 10
	Partition walls R'_w	
	■ ≥ 42 dB	5
	■ ≥ 45 dB	7.5
	■ ≥ 50 dB	10
	Doors R_w	
	■ ≥ 32 dB	5
	■ ≥ 37 dB	7.5
	■ ≥ 42 dB	10
1.2	Partition walls R'_w and doors R_w	
	Office	
	Insulation against noise from other areas – Partition walls R'_w	Max. 10
	■ Minimum requirements in accordance with DIN 4109-1 (53 dB)	5
	■ As above, but with over-fulfilment by 2 dB (≥ 55 dB)	7.5
	■ As above, but with over-fulfilment by 2 dB (≥ 57 dB)	10
	Hotel	Max. 40
	Partition walls R'_w (of hotel rooms)	+Max. 20
	■ Minimum requirements in accordance with DIN 4109-1 (47 dB)	5
	■ As above, but with over-fulfilment by 3 dB (≥ 50 dB)	10
	■ As above, but with over-fulfilment by 3 dB (≥ 53 dB)	15
	■ As above, but with over-fulfilment by 3 dB (≥ 56 dB)	20
	Doors R_w (from hotel rooms to corridors)	+Max. 20
	■ Minimum requirements in accordance with DIN 4109-1 (32 dB)	7.5
	■ As above, but with over-fulfilment by 5 dB (≥ 37 dB)	15
	■ As above, but with over-fulfilment by 5 dB (≥ 42 dB) or alternatively a design of a closed corridor/hallway	20

Comment: * Requirements and calculation methods to be applied in accordance with the valid building



regulations. DIN 4109-1: 2016-07 or 2018-01

Education

Insulation against noise from classrooms	Max. 35
Insulation against noise from other areas – Partition walls R'_w	
■ Minimum requirements in accordance with DIN 4109-1 (47 dB)	20
■ As above, but with over-fulfilment by 3 dB (≥ 50 dB)	35

1.3 Separating ceilings R'_w

Office

Separating ceilings in their own areas and other areas R'_w	Max. 10
■ Requirements in accordance with DIN 4109 (≥ 54 dB)	5
■ As above, but with over-fulfilment by 2 dB (≥ 56 dB)	7.5
■ As above, but with over-fulfilment by 2 dB (≥ 58 dB)	10

Education

Hotel*

Separating ceilings between common rooms R'_w	Max. 20
■ Requirements in accordance with DIN 4109 (≥ 54 dB Hotel), (≥ 55 dB Education)	7.5
■ As above, but with over-fulfilment by 2 dB (≥ 56 dB)	10
■ As above, but with over-fulfilment by 2 dB (≥ 58 dB)	20

1.4 Standard flanking transmission level difference $R_{I,w,R}$ or $D_{n,f,w,R}$

Office

$R_{I,w,R}$ or $D_{n,f,w,R}$ applies for all flanking components (floor, ceiling, façade) for each partition wall grid	Max. 15
■ ≥ 42 dB	5
■ ≥ 47 dB	10
■ ≥ 50 dB	15

2 Footfall sound insulation

2.1 Footfall sound insulation of dividing ceilings and stairs

Office

Education

2.1.1 In its own area (use of the same building)

Requirement $L'_{n,w}$ – Horizontal	Requirement $L'_{n,w}$ – Vertical	Max. 15
■ ≤ 60 dB	≤ 53 dB	5
■ ≤ 53 dB	≤ 46 dB	10
■ ≤ 46 dB	≤ 46 dB (not taking into account soft flexible floor coverings)	15

Note: * Requirements and calculation methods to be applied in accordance with the valid standard DIN 4109-1: 2016-07 or 2018-01



	Office	Education		
2.1.2	Insulation against noise from other areas (insulation against noise from other usages and from leasing of space)			Max. 15
	■	Minimum requirements in accordance with DIN 4109-1:* (≤ 53 dB)		5
	■	Increased sound insulation in accordance with Supplement 2 to DIN 4109 (≤ 46 dB)		10
	■	Increased sound insulation in accordance with Supplement 2 to DIN 4109, over-fulfilment by 3 dB (≤ 43 dB)		15
	Hotel			
	Insulation against noise from other areas (insulation against noise from other usages and from leasing of space)			Max. 20
	■	Minimum requirements in accordance with DIN 4109-1:* (≤ 53 dB)		7.5
	■	Increased sound insulation in accordance with Supplement 2 to DIN 4109 (≤ 46 dB)		15
	■	Increased sound insulation in accordance with Supplement 2 to DIN 4109, over-fulfilment by 3 dB (≤ 43 dB)		20
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3	Airborne sound insulation			
3.1	Airborne sound insulation against external noise			
	Office	Education	Hotel	Max. 15
	■	DIN 4109-1:* fulfilled, see Appendix 1		5
	■	DIN 4019-1:* over-fulfilment by 3 dB, see Appendix 1		10
	■	DIN 4019-1:* fulfilled, with Ctr. 100 – 5000, see Appendix 1		15
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4	Airborne sound insulation against noise from building services installations (water installations, other building services)			
4.1	Airborne sound insulation against building services installations			
	Office	Education		Max. 15
	■	DIN 4109-1:* fulfilled, see Appendix 1		5
	■	DIN 4109-1:* over-fulfilment by 3 dB		10
	■	DIN 4109-1:* over-fulfilment by 5 dB		15
	Hotel			Max. 20
	■	DIN 4109-1:* fulfilled, see Appendix 1		7.5
	■	DIN 4109-1:* over-fulfilment by 3 dB		15
	■	DIN 4109-1:* over-fulfilment by 5 dB		20
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5	Sound insulation in residential buildings			
5.1	Sound insulation requirements			
	Residential			Max. 100
	Creation of a concept plan for reducing disruptive noises, at least in the service phase 4 of the project at the latest.			
	The service phases described under the chapter “terms and definitions” (T&D_01) of the document “Evaluation and structure of the DGNB system”.			50
	The sound insulation concept has been implemented.			100



SUSTAINABILITY REPORTING AND SYNERGIES

Sustainability reporting

Appropriate key performance indicators (KPI) include communicating various sound insulation values.

NO.	KEY PERFORMANCE INDICATORS (KPIs)	UNIT
KPI 1	Airborne sound insulation against other rooms	[dB]
KPI 2	Footfall sound insulation for dividing ceilings (horizontal/vertical)	[dB]
KPI 3	Airborne sound insulation against external noise (over-fulfilment)	[dB]
KPI 4	Airborne sound insulation against building technology (over-fulfilment)	[dB]

Synergies with DGNB system applications

- **DGNB OPERATION:** Achieving good acoustic comfort via a good sound insulation (Buildings in use [BIU] criterion SOC9.1) is indirectly assessed positively for the evaluation of the user satisfaction.
- **DGNB RENOVATED BUILDINGS:** High synergies with criterion TEC1.2 in the REN scheme.
- **DGNB DISTRICT:** In schemes UD and BD, road traffic noise, noise in open spaces and industrial noise are assessed in criterion SOC1.9. This can be used as a basis for noise insulation requirements for buildings.
- **DGNB INTERIORS:** Criterion PRO1.1 establishes an incentive for taking sustainability aspects of the sound insulation into account as well when choosing rental spaces.



APPENDIX A – DETAILED DESCRIPTION

I. Relevance

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II. Additional explanation

As long as sound insulation is over and above the minimum requirements of DIN 4109, it is evaluated positively. Sound insulation measures should however still remain within a reasonable extent. Hence this criterion assesses whether requirements for sound insulation towards third party living and work spaces are met.

Retrospective improvements to sound insulation on existing structures are not possible or only possible to a limited extent. Therefore, decisions in the project development and planning phase are essential for the eventual fulfilment of sound insulation requirements.

III. Method

Assessment of the sound insulation quality of the building components is based on the sound insulation documentation referring to the requirements of DIN 4109 and Supplement 2 of DIN 4109 whereby following aspects have to be considered:

- Airborne sound insulation against noise from residential and work rooms, within their own areas and in other areas (walls, doors, ceilings)
- Footfall sound insulation against noise from residential and work rooms, within their own areas and in other areas (separating ceilings, staircases, landings)
- Airborne sound insulation against external noise (such as traffic noise)
- Airborne sound insulation against noise from building services installations (water installations, other building services)

Compliance with the requirements must be verified by providing mathematical documentation of the sound insulation and assessing the level of sound insulation provided by the planned components. All components must meet the relevant requirements. Sound insulation must be measurable during the construction. The calculation and documentation processes are based on the calculation methods from commonly recognised regulations.



IV. Usage-specific description

Indicator 1: Airborne sound insulation between rooms

Indicator 1.1: Within its own area– Partition walls R'_w and internal doors (from corridor to the dwelling or hotel room) R_w

Office

For this scheme, evaluation is done differently for rooms in their own areas and in other areas. For the evaluation of airborne sound insulation for walls and doors in the same area, a distinction is drawn between low requirements and higher requirements:

- Low requirements: Must generally be applied.
 - Higher requirements: Higher requirements pertain to, for instance, insulation between meeting and conference rooms, in offices for executives or adjacent rooms with different uses. In the case of doors in partition walls between rooms that require protection, the total sound reduction index for the doors and walls must generally be documented in accordance with the requirements for the partition wall (if these requirements cannot be implemented, a justification must be submitted as part of the verification process).

Indicator 1.2: Partition walls R'_w and doors R_w

Office

Insulation against noise from other areas – partition walls R'_w

The minimum requirements in accordance with DIN 4109 apply for other areas. Over-fulfilment of the minimum requirements is evaluated positively.

Hotel

Partition walls R'_w (between hotel rooms) and doors R_w (from hotel rooms to corridors)

The requirements of DIN 4109 apply as a minimum for partition walls between hotel rooms, and for hotel room doors which connect to corridors. Over-fulfilment of the minimum requirements is evaluated positively.

Education

Insulation against noise from classrooms

For partition walls and doors in classrooms, the requirements in accordance with DIN 4109 for "schools and comparable educational establishments" apply for office and meeting rooms as per the requirements in accordance with Supplement 2 to DIN 4109, Table 3. Over-fulfilment of the requirements between normal classrooms by 3 dB and for increased requirements for office partition walls with normal activities is evaluated positively.

Please note: For classrooms with very high requirements (music and lecture halls), over-fulfilment of the objective by 3 dB is generally not feasible. In this case, it can generally be recognised as an over-fulfilment of 3 dB for partition walls between (normal) classrooms.

1.3 Separating ceilings R_w

Office

Separating ceilings in its own area and other areas R'_w

For separating ceilings in its own area and other areas, the requirements specified in the indicator apply as a minimum.

Education Hotel

Separating ceilings and ceilings R'_w (between hotel rooms)

The minimum requirements in accordance with DIN 4109 apply for separating ceilings and ceilings of hotel rooms and classrooms. Over-fulfilment of the minimum requirements is evaluated positively.

1.4 Standard sound level difference $R_{l,w,R}$ or $D_{n,f,w,R}$

The standard sound level difference or the linear sound reduction measurement are important parameters for as-



sessing flexible office room design. If the $R_{L,w,R}$ or $D_{n,f,w,R}$ meets the increased requirements for all flanking components (floor, ceiling, façade) for each partition wall grid, this is evaluated positively.

Indicator 2: Footfall sound insulation

Indicator 2.1: Footfall sound insulation of dividing ceilings and stairs

Rooms in their own areas and in other areas are taken into account differently in this scheme.

Office **Education** **Hotel**

In its own area (use of the same building)

For the evaluation of the footfall sound insulation of dividing ceilings and stairs in the same area, different requirements apply regarding the evaluated $L'_{n,w}$ – horizontal and $L'_{n,w}$ – vertical standard footfall sound levels.

Insulation against noise from other areas (insulation against noise from other usages and from leasing of space)

The minimum requirements in accordance with DIN 4109 apply for evaluating the footfall sound insulation of dividing ceilings and stairs against other areas. Implementation of increased sound insulation in accordance with Supplement 2 to DIN 4109 or the over-fulfilment of the same are evaluated positively.

Indicator 3: Airborne sound insulation

Indicator 3.1: Airborne sound insulation against external noise

Office **Education** **Hotel**

The requirements in accordance with DIN 4109 apply for the evaluation of airborne sound insulation against external noise.

Airborne sound insulation against external noise that is 3 dB better than the requirements of DIN 4109 or documentation of better airborne sound insulation taking into account the spectrum adaptation value for traffic noise (C_{tr} in accordance with DIN 717) in the frequency range of 100 to 5000 Hz is evaluated positively. The spectrum adaptation value only applies to transparent components (windows).

If there is significant noise pollution from external noise (above significant threshold of > 66 dB(A)), ventilation that is not reliant on windows is necessary for the proper evaluation of the sub-target value and target value.

This generally means that a mechanical ventilation system is required.

Indicator 4: Airborne sound insulation against noise from building services installations (water installations, other building services)

Airborne sound insulation against building services installations

Office **Education** **Hotel**

The requirements of DIN 4109 apply as a minimum for airborne sound insulation against noise from building services installations (water installations, other building services). Over-fulfilment of the minimum requirements is evaluated positively.

Indicator 5: Sound insulation in residential buildings

Sound insulation requirements

Residential

For new buildings, a distinction is made between five sound insulation classes:

- Class A*: Residential unit with very good sound insulation that enables residents to live undisturbed with almost no need to worry about disturbing neighbours.
- Class A: Residential unit with very good sound insulation that enables residents to live undisturbed without significant need to worry about disturbing neighbours. Increased sound



- insulation in semi-detached and terraced houses.
- Class B: Residential unit with good sound insulation that provides residents with peace and quiet, and largely ensures their privacy, given a mutual consideration among neighbours.
- High sound insulation in apartment buildings.
- Normal sound insulation in semi-detached and terraced houses.
 - Class C: Residential unit with noticeably better sound insulation than Class D, generally providing residents with peace and quiet and ensuring their privacy with normal, considerate living behaviour.
- Increased sound insulation in apartment buildings.
 - Class D: Residential unit with sound insulation that largely meets the requirements in accordance with DIN 4109:2018-01 for multi-storey buildings with apartments and work rooms, and thereby protects residents in common rooms against excessive nuisance due to sound transmission from other residential units and from the outside, for the purposes of health protection. It cannot be expected that noises from other residential units or from the outside are inaudible anymore. As a result, mutual consideration is required to prevent excessive noise. These requirements assume that unusually loud noises are not produced in neighbouring rooms.
- Normal sound insulation in apartment buildings.

Sound insulation in the same living space:

- Class EW1: Sound insulation in the same living space, where privacy cannot be expected.
- Class EW2: Sound insulation in the same living space, where a minimum level of privacy can be ensured and significant disturbances are prevented.
- Class EW3: Sound insulation in the same living space, where privacy can be ensured and disturbances are prevented.

A sound insulation certificate based on the multi-stage sound insulation concept enables simple classification of the sound insulation of entire residential units or entire buildings. The sound insulation certificate provides people involved in the planning process and in particular users (buyers, residents) with a simple, understandable and user-oriented evaluation. This enables all persons involved in the construction process to come to a mutual, well-informed agreement on a desired sound insulation level. The overall classification of the structural sound insulation into a quality class may at most be one class better than the worst evaluation of any of the criteria.

The sound insulation certificate can be issued for an entire house as well as for individual residential units within a building. The latter option enables specific classification of residential units on the basis of their location within the building and taking into account different construction designs, particularly for mixed uses.

The sound insulation certificate for a residential unit must always be created on the basis of the least favourable situation in terms of noise. When using values from forecast calculations or measurements, the least favourable value must be taken into account for each criterion.

If certificates are to be issued for all apartments in a building, at least 80% of the apartments must meet the requirements for the intended class, and 20% of the apartments may be no more than one class lower than the intended class. The points awarded for structural sound insulation are then determined using the average value of all apartments evaluated in the building.



APPENDIX B – DOCUMENTATION

I. Required documentation

Examples of possible documentation include the following items. The documentation submitted for the evaluation of individual indicators should comprehensively and clearly demonstrate compliance with the relevant requirements

- Documentation that the acoustic requirements in accordance with the relevant evaluation level are complied with by referencing critical details of the construction (sound insulation documentation required under construction law).
- Clear presentation of the results for airborne sound insulation, comparing the values achieved with the minimum requirements in accordance with DIN 4109, which is used as a basis for over-fulfilment where applicable
- Construction plan for the documented components with associated values
- Mathematical sound insulation documentation in accordance with DIN 4109
- Measurement-based test certificates

The values must be clearly marked in the documentation and assigned to the corresponding indicators.

Documentation of compliance must be provided during the planning phase via mathematical documentation in accordance with DIN 4109. Compliance with the project planning values must be documented via measurements taken randomly at critical locations.

The parameters required for calculation can be found in the following documents:

- Sound insulation documentation

Please note:

Completed measurement results are evaluated in the criterion "PRO2.2 – Quality assurance of the construction". In order to use a measurement-based documentation to demonstrate the compliance of standard components with the requirements, at least two measurements must be carried out per standard component. Documentation: measurement and test reports.



APPENDIX C – LITERATURE

I. Version

Change log based on version 2020

PAGE	EXPLANATION	DATE
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II. Literature

- DIN 4109: 2016-07 and 2018-01. Sound insulation in buildings, incl. Supplements 1 and 2. Berlin: Beuth Verlag

Supplementary literature:

- DIN 45680. Measurement and assessment of low-frequency noise immissions in the neighbourhood. Berlin: Beuth Verlag. March 1997
- DIN 45680 Supplement 1. Measurement and assessment of low-frequency noise immissions in the neighbourhood - Guidelines for the assessment for industrial plants. Berlin: Beuth Verlag. September 2013
- DIN EN 12354. Estimation of acoustic performance of buildings from the performance of elements. Berlin: Beuth Verlag. December 2000
- DIN EN ISO 16283-1:2014-11 Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation;
- DIN EN ISO 16283-2:2016-05 Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 2: Impact sound insulation (ISO 16283-2:2015);
- DIN EN ISO 16283-3:2017-09 – Draft; Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 2: Impact sound insulation
- DIN EN ISO 717 2013-06 Rating of sound insulation in buildings and of building elements. Berlin: Beuth Verlag.
- DIN EN ISO 10052. Acoustics – Field measurements of airborne and impact sound insulation and of service equipment sound – Survey method. Berlin: Beuth Verlag. October 2010
- DIN EN ISO 16032. Acoustics – Measurement of sound pressure level from service equipment in buildings – Engineering method. Berlin: Beuth Verlag. December 2004
- Sixth General Administrative Regulation to the Federal Immission Control Act (Technical instructions on protection against noise (TA Lärm)), published 1998
- VDI 4100: 2012-10 Sound insulation in dwellings
- STEP GmbH: "Schallschutz bei Wohnungstreppe – Ein Handbuch über den Trittschallschutz von Leichtbautreppen im Wohnungsbau" [Sound insulation for residential staircases – A manual for the footfall sound insulation of lightweight staircases in residential construction], first edition, 2007, ed. Treppenmeister GmbH



APPENDIX 1

Requirements in accordance to the DIN 4109

Airborne sound insulation against outside external noise

„Relevant external noise level“ in dB	Room types		
	Bedded rooms in hospitals and sanatoriums	Sitting rooms in apartment, overnight stays rooms in accommodation establishments, teaching rooms und similar	Office spaces and similar
	R' _w total of outdoor components in dB		
to 55	35	30	—
56 to 60	35	30	30
61 to 65	40	35	30
66 to 70	45	40	35
71 to 75	50	45	40
76 to 80	b	50	45
> 80	b	b	50

Maximum permissible A-evaluated sound pressure level in protection required external rooms, generated by technical buildings equipment and structurally with the building related usage	1	2	3	4
Row	Noise sources		Maximum permissible A-evaluated sound pressure level dB	
			Living spaces and bedrooms	Teaching- und workrooms
1	Sanitary equipment/water installations (Water supply and wastewater system collectively)		$L_{AF,max,n} \leq 30^{a,b,c}$	$L_{AF,max,n} \leq 35^{a,b,c}$
2	Other in-house appliances, permanently installed sound sources of technical equipment, Supply and disposal like garage facilities		$L_{AF,max,n} \leq 30^c$	$L_{AF,max,n} \leq 35^c$



3	Restaurants including kitchens, Sales outlets, business places and similar.	Days from 6:00 until 22:00	$L_r \leq 35$ $L_{AF,max} \leq 45$	$L_r \leq 35$ $L_{AF,max} \leq 45$
4		Nights until 6:00	$L_r \leq 25$ $L_{AF,max} \leq 35$	$L_r \leq 35$ $L_{AF,max} \leq 45$

a single short-time noise spikes, which generated when water taps and devices are actuated according to the table 11 (opening, closing, switching, interrupting), are currently not considered.

b requirements for the fulfillment of the permissible sound pressure level:

— The execution documentation must regard the requirements of Sound insulation, i. e. For the construction components the required sound proofs must be available;

— In addition, the responsible construction company must be named and for a partial decrease before closing or cladding of the installation must be consulted.

c Deviating from DIN EN ISO 10052: 2010-10, 6.3.3, is dispensed with measurement in the loudest room corner (see also DIN 4109-4).

Requirements for Maximum permissible A-evaluated sound pressure level in protection required rooms, in the same apartment, generated by air conditioning systems in the same living area

Column	1	2	3
Row	Noise sources	Maximum permissible A-evaluated sound pressure level dB	
		Living spaces and bedrooms	Kitchen
1	Permanently installed sound sources of air conditioning systems in the same living- and workspace	$L_{AF,max,n} \leq 30_{a,b,c,d}$	$L_{AF,max,n} \leq 33_{a,b,c,d}$

a single short-time noise spikes, which generated when the systems are switched on and off, may exceed a maximum of 5 dB.

b requirements for the fulfillment of the permissible sound pressure level:

— The execution documentation must regard the requirements of Sound insulation, i. e. For the construction components the required sound proofs must be available;

— In addition, the responsible construction company must be named and for a partial decrease before closing or cladding of the installation must be consulted.

c Deviating from DIN EN ISO 10052: 2010-10, 6.3.3, is dispensed with measurement in the loudest room corner (see also DIN 4109-4).

d It is allowed by 5 dB higher values, if it is continuous noises without noticeable single tones.