



TEC1.2

Sound insulation



Objective

Ensuring sound insulation appropriate for the use of the rooms that prevents unreasonable disturbances.

Benefits

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

Contribution to overriding sustainability goals



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

CONTRIBUTION TO THE GERMAN
SUSTAINABILITY STRATEGY



Moderate

3.4 Reduction of premature death,
promotion of good health/well-being

3.1.a/b Health and food



Outlook

There are 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
Business premises Logistics Production		



EVALUATION

The evaluation is based on the least favourable indoor situations. 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** **Business premises** **Shopping centre** **Logistics** **Production**

NO.	INDICATOR	POINTS	
1	Airborne sound insulation between rooms		
1.1	Within the own area– separating walls R'_w and corridor doors R_w		
	Office	Max. 20	
	Rooms with normal requirements	+Max. 10	
	Partition walls R'_w		
	Doors R_w		
	■ ≥ 37 dB	≥ 27 dB	5
	■ ≥ 42 dB	≥ 32 dB	7.5
	■ ≥ 45 dB	≥ 37 dB	10
	Rooms with increased requirements	+Max. 10	
	Partition walls R'_w		
	Doors R_w		
	■ ≥ 42 dB	≥ 32 dB	5
	■ ≥ 45 dB	≥ 37 dB	7.5
	■ ≥ 50 dB	≥ 42 dB	10
1.2	Separating walls R'_w and doors R_w		
	Office		
	Insulation against noise from other areas – separating walls R'_w	Max. 10	
	■ Minimum requirements in accordance with DIN 4109-1 (53 dB)	5	
	■ As above, but with overfulfilment by 2 dB (≥ 55 dB)	7.5	
	■ As above, but with overfulfilment by 2 dB (≥ 57 dB)	10	
	Hotel	Max. 40	
	Separating walls R'_w (of hotel rooms)	+Max. 20	
	■ Minimum requirements in accordance with DIN 4109-1 (47 dB)	5	
	■ As above, but with overfulfilment by 3 dB (≥ 50 dB)	10	
	■ As above, but with overfulfilment by 3 dB (≥ 53 dB)	15	
	■ As above, but with overfulfilment 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 overfulfilment by 5 dB (≥ 37 dB)	15	
	■ As above, but with overfulfilment by 5 dB (≥ 42 dB) or alternatively 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
<ul style="list-style-type: none"> ■ DIN 4109-1:* for “schools and comparable teaching premises”, office and meeting rooms in accordance with Supplement 2 to DIN 4109:1989-11, Table 3 (normal sound insulation) 20 ■ DIN 4109-1 for “schools and comparable teaching premises”, however separating walls between classrooms over fulfilled by 3 dB, for meeting rooms and private office rooms normal sound insulation and increased sound insulation for office rooms with normal activity in accordance with Supplement 2 to DIN 4109:1989-11, Table 3. 35 	

1.3 **Separating ceilings R’w**

Office

Separating ceilings in the own area and other areas R’w	Max. 10
<ul style="list-style-type: none"> ■ Requirements in accordance with DIN 4109 (≥ 54 dB) 5 ■ As above, but with overfulfilment by 2 dB (≥ 56 dB) 7.5 ■ As above, but with overfulfilment by 2 dB (≥ 58 dB) 10 	

Education Hotel*

Separating ceilings between common rooms R’w	Max. 20
<ul style="list-style-type: none"> ■ Requirements in accordance with DIN 4109 (≥ 54 dB Hotel), (≥ 55 dB Education) 7.5 ■ As above, but with overfulfilment by 2 dB (≥ 56 dB) 10 ■ As above, but with overfulfilment by 2 dB (≥ 58 dB) 20 	

1.4 **Standard flanking transmission level difference R_{I,w,R} bzw. D_{n,f,w,R}**

Office

RI,w,R or Dn,f,w,R applies for all flanking components (floor, ceiling, façade) for each separating wall grid	Max. 15
<ul style="list-style-type: none"> ■ ≥ 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 the own area (use of the same building)		Max. 15
Requirement L’ _{n,w} – Horizontal	Requirement L’ _{n,w} – Vertical	
<ul style="list-style-type: none"> ■ ≤ 60 dB 5 ■ ≤ 53 dB 10 ■ ≤ 46 dB 15 	<ul style="list-style-type: none"> ≤ 53 dB ≤ 46 dB ≤ 46 dB (not taking into account soft flexible floor coverings) 	

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 areas)	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, overfulfilment by 3 dB (≤ 43 dB) 15

Hotel

Insulation against noise from other areas (insulation against noise from use and letting of other areas) **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, overfulfilment by 3 dB (≤ 43 dB) 20

3 Airborne sound insulation

3.1 Airborne sound insulation against outside noise

Office Education Hotel

Max. 15

- DIN 4109-1:* fulfils 5
- DIN 4019-1:* over fulfilment by 3 dB 10
- DIN 4019-1:* fulfils, with Ctr. 100 – 5000 15

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

4.1 Airborne sound insulation against building technical installations

Office Education

Max. 15

- DIN 4109-1:* fulfils 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:* complied with 7.5
- DIN 4109-1:* over fulfilment by 3 dB 15
- DIN 4109-1:* over fulfilment by 5 dB 20

5 Sound insulation in residential buildings

5.1 Sound insulation requirements

Residential

Compliance with DIN 4109-1:*, the German Acoustical Society (DEGA) memorandum and **Max. 100**

class D in accordance with the German Acoustical Society (DEGA) sound insulation certificate

- with at least 80 points 50
- with at least 110 points 60

for structural sound insulation in the German Acoustical Society (DEGA) sound insulation certificate

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



class C in accordance with the German Acoustical Society (DEGA) sound insulation certificate	
■ with at least 145 points	70
■ with at least 175 points	80
for structural sound insulation in the German Acoustical Society (DEGA) sound insulation certificate	
class B in accordance with the German Acoustical Society (DEGA) sound insulation certificate	
■ with at least 210 points	90
■ with at least 240 points	100
for structural sound insulation in the German Acoustical Society (DEGA) sound insulation certificate	



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 outside noise (overfulfilment)	[dB]
KPI 4	Airborne sound insulation against building technology (overfulfilment)	[dB]
KPI 5	Sound insulation class in accordance with the German Acoustical Society (DEGA) sound insulation certificate (residential)	[-]

Synergies with DGNB system applications

- **DGNB OPERATION:** Achieving good acoustic comfort via a high sound insulation (Buildings in use (BIU) criterion SOC9.1) is indirectly incorporated positively into 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 selecting the rental space.



APPENDIX A – DETAILED DESCRIPTION

I. Relevance

–

II. Additional explanation

Sound insulation over and above the minimum requirements of DIN 4109 is evaluated positively. Sound insulation measures should, however, remain within an appropriate extent. Hence this criterion assesses whether requirements for sound insulation toward third party living and work spaces are met.

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

III. Method

Assessment of the level of sound insulation provided by the components on the basis of the sound insulation documentation, the German Acoustical Society (DEGA) sound insulation certificate or the tendered components. Review of whether the requirements of DIN 4109 and Supplement 2 of DIN 4109, German Acoustical Society (DEGA) Recommendation 103 have been complied with.

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

Compliance with the requirements must be verifiably checked by establishing 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. It must be possible to verify the sound insulation values in the construction. The calculation and documentation processes are based on the normal calculation methods of the generally recognised regulations.



IV. Usage-specific description

Indicator 1: Airborne sound insulation between rooms

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

Office

Rooms in the own area and in other areas are taken into account differently in this scheme. 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 include, for instance, insulation between meeting and conference rooms, in offices for executives or adjacent rooms with different uses. In the case of doors in separating 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 separating wall (if these requirements cannot be implemented, a justification must be submitted as part of the verification process).

Indicator 1.2: Separating walls R'_w and doors R_w

Office

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

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

Hotel

Separating 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 separating walls between hotel rooms and doors from hotel rooms to corridors. Overfulfilment of the minimum requirements is evaluated positively.

Education

Insulation against noise from classrooms

For separating 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. Overfulfilment of the requirements between normal classrooms by 3 dB and for increased requirements for office separating walls with normal activities is evaluated positively.

Please note: For classrooms with very high requirements (music and lecture halls), overfulfilment of the objective by 3 dB is generally not feasible. In this case, overfulfilment of the requirements by 3 dB can generally be considered in terms of separating walls between (normal) classrooms.

1.3 Separating ceilings R_w

Office

Separating ceilings for the own area and other areas R'_w

For separating ceilings in the 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. Overfulfilment of the minimum requirements is evaluated positively. **1.4 Standard sound level difference**
 $R_{l,w,R}$ bzw. $D_{n,f,w,R}$



The standard sound level difference or the linear sound reduction measurement are important parameters for assessing 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 separating wall grid, this is evaluated positively.

Indicator 2: Footfall sound insulation

Indicator 2.1: Footfall sound insulation of dividing ceilings and stairs

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

Office **Education** **Hotel**

In the 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 use and letting of other areas)

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 overfulfilment of the same is evaluated positively.

Indicator 3: Airborne sound insulation

Indicator 3.1: Airborne sound insulation against outside noise

Office **Education** **Hotel**

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

Airborne sound insulation against outside 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 due to outside noise, ventilation that is not reliant on windows is required at outside noise levels above a significant threshold of ≥ 66 dB(A) in order to enable evaluation of the sub-target value and the target value. This generally means that a mechanical ventilation system is required.

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

Airborne sound insulation against building technical installations

Office **Education** **Hotel**

The requirements of DIN 4109 apply as a minimum for airborne sound insulation against noise from building technical installations (water installations, other building services). Overfulfilment 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 being considerate to neighbours.



- Class A: Residential unit with very good sound insulation that enables residents to live undisturbed without significant need to worry about being considerate to 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 if there is mutual consideration between 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 unreasonable 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 no longer able to be perceived. As a result, mutual consideration is required to prevent unnecessary 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 be a maximum of one class better than the lowest evaluation in any single criterion.

The sound insulation certificate can be compiled both for an entire house and 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.

In accordance with the German Acoustical Society (DEGA) Recommendation 103, if a single certificate is issued for an entire building that contains multiple residential units, the least favourable residential unit in terms of noise must be used for the assessment.

If certificates are 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.

The German Acoustical Society (DEGA) sound insulation certificate awards points for the acoustic quality for each individual criterion, which are then added together for the structural sound insulation, and the total is compared with the values for the minimum evaluation points (point thresholds) for the various quality classes.



APPENDIX B – DOCUMENTATION

I. Required documentation

A range of different forms of documentation is listed below. The documentation submitted must comprehensively and clearly demonstrate compliance with the requirements for the target evaluation of the individual indicators.

- Documentation that the acoustic requirements in accordance with the applied evaluation level are complied with on the basis of 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 overfulfilment where applicable
- Construction plan for the documented components with associated values
- German Acoustical Society (DEGA) sound insulation certificate (simple and detailed certificate)
- 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 at randomly chosen 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". For a measurement-based documentation that standard components comply 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 2018

PAGE	EXPLANATION	DATE
------	-------------	------

II. Literature

- DIN 4109: 2016-07 and 2018-01. Sound insulation in buildings, incl. Supplements 1 and 2. Berlin: Beuth Verlag
- German Acoustical Society (DEGA) Recommendation 103 "Schallschutz im Wohnungsbau – Schallschutzausweis" [Sound insulation in housing construction – sound insulation certificate], January 2018)

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
- German Acoustical Society (DEGA) Memorandum BR 0101 "Die DIN 4109 und die allgemein anerkannten Regeln der Technik in der Bauakustik" [DIN 4109 and the generally accepted technical rules