



SOC1.3

Acoustic comfort



Objective

The objective is to achieve room acoustics conditions that correspond to the intended use and ensure appropriate user comfort.

Benefits

Good acoustic conditions are an important requirement for ensuring productivity and comfort of users.

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	2.0%	2
Education	2.7%	3
Hotel	2.9%	3
Residential Consumer market	0.0%	0
Shopping centre Business premises		
Logistics Production		



EVALUATION

Room acoustics comfort is evaluated in accordance with the use of the rooms over the reverberation time, in order to achieve appropriate user comfort. In this criterion, a total of 130 points can be achieved, including possible additional points, but only a maximum of 100 points can actually be awarded. In addition, an "Agenda 2030 Bonus" is awarded if all measures listed under indicators 1–5 have been implemented and verified via measurements. A total of 100 points can be achieved for this criterion or a maximum of 110 points including bonus.

Evaluation variants:

Two different variants are permitted for evaluation of this criterion. In both cases, at least 95% of the representative rooms must correspond to the evaluated quality level.

Variant 1: Weighted evaluation on the basis of the actual ratios of usable area (NUF) (R) in accordance with DIN 277-1; each of the indicators is weighted by percentage according to the area ratio for the associated use; the maximum possible number of evaluation points is based on the rooms that are actually available and under evaluation.

Variant 2: Simplified method without assignment of area ratios in accordance with the points assignment for the indicators.

NO.	INDICATOR	POINTS
1 Acoustic concept formulated during the planning process		
	Office Education Hotel	
1.1	Room acoustics concepts	
	Creation of a room acoustics concept updated during the planning process	20
2 Individual offices and multi-person offices up to 40 m²		
2.1	Compliance with the requirements for reverberation times	
	Office	Max. 20
	<ul style="list-style-type: none"> ■ Compliance with room acoustics class C in accordance with VDI 2569: 2016-02 (draft) 10 ■ Compliance with room acoustics class B in accordance with VDI 2569: 2016-02 (draft) 15 Alternatively: Verification in accordance with DIN 18041:2016-03 room group B: Cf. indicator 5 ■ Compliance with room acoustics class A in accordance with VDI 2569: 2016-02 (draft) 20 	
	Education Hotel	Max. 10
	<ul style="list-style-type: none"> ■ Compliance with room acoustics class C in accordance with VDI 2569: 2016-02 (draft) 5 ■ Compliance with room acoustics class B in accordance with VDI 2569: 2016-02 (draft) 7.5 Alternatively: Verification in accordance with DIN 18041:2016-03 room group B: 	



- Cf. indicator 5
- Compliance with room acoustics class A in accordance with VDI 2569: 2016-02 (draft) 10

3 Multi-person offices larger than 40 m²

3.1 Compliance with the requirements for reverberation times

Office Max. 30

- Compliance with room acoustics class C in accordance with VDI 2569: 2016-02 (draft) 2569. 10
Alternatively: Verification in accordance with DIN 18041:2016-03 room group B: Cf. indicator 5
- Compliance with room acoustics class B in accordance with VDI 2569: 2016-02 (draft) 20
- Compliance with room acoustics class A in accordance with VDI 2569: 2016-02 (draft) 30

Education Hotel Max. 10

- Compliance with room acoustics class C in accordance with VDI 2569: 2016-02 (draft) 2569. 5
Alternatively: Verification in accordance with DIN 18041:2016-03 room group B: Cf. indicator 5
- Compliance with room acoustics class B in accordance with VDI 2569: 2016-02 (draft) 7.5
- Compliance with room acoustics class A in accordance with VDI 2569: 2016-02 (draft) 10

Re 3 Possible additional points + Max. 10

Taking into account sound absorption areas on the ceiling in open office structures or on the ceiling and the room dividers in the case of room-height room dividers:

- 30% of the average equivalent sound absorption area on the ceiling and/or the room-height room dividers, as applicable 5
- 70% of the average equivalent sound absorption area on the ceiling and/or the room-height room dividers, as applicable 10

4 Rooms in accordance with DIN 18041:2016-03 (room group A1–A5) with special requirements in terms of speech intelligibility (such as meeting rooms, seminar rooms or classrooms)

Office Hotel Max. 20

4.1 Compliance with the requirements for reverberation time T_{target}

- Compliance of all rooms with requirements in accordance with DIN 18041:2016-03 has been documented. +10

Compliance with the requirements for inclusion

- Taking into account inclusive use in accordance with DIN 18041:2016-03 (teaching/communication inclusive, speech/lecture inclusive) +10

Education Max. 30

Compliance with the requirements for reverberation time T_{target}



■ Compliance of all rooms with requirements in accordance with DIN 18041:2016-03 has been documented.	+15			
Compliance with the requirements for inclusion				
■ Taking into account inclusive use in accordance with DIN 18041:2016-03 (teaching/communication inclusive, speech/lecture inclusive)	+15			
<table border="0" style="width: 100%;"> <tr> <td style="width: 33%;">Office</td> <td style="width: 33%;">Education</td> <td style="width: 33%;">Hotel</td> </tr> </table>		Office	Education	Hotel
Office	Education	Hotel		
Re 4 Possible additional points	10			
Implementation of a detailed acoustic simulation of an open-plan office on the basis of DIN 3382 or for evaluation of other room acoustics parameters for open-plan offices and rooms in room group A $\geq 500 \text{ m}^3$				

5 Rooms with recommendations in accordance with DIN 18041:2016-03 (building use B3–B5) with special requirements for noise reduction and/or room acoustics comfort (such as cafeterias, libraries or break rooms)

5.1 Compliance with the recommendations for the A/V ratio in the frequency range 250–2000 Hz	
Office	10
Education	30
Hotel	40

6 AGENDA 2030 BONUS – STRESS REDUCTION, HEALTH AND WELL-BEING



+10

6.1 The objective of the AGENDA 2030 BONUS is to reduce premature death and promote good health and well-being.
Noise reduction: Indicators 2–5 achieve at least the reference value, have been implemented and have been confirmed via measurements. On this basis, it is possible to achieve a high level of acoustic quality in the building and a high level of acoustic comfort for building users. This minimises noise as a harmful factor and supports sustained, long-term user performance.



SUSTAINABILITY REPORTING AND SYNERGIES

Sustainability reporting

Information regarding reverberation times and the sound absorption area can be used as key performance indicators (KPI) for the communication.

NO.	KEY PERFORMANCE INDICATORS (KPIS)	UNIT
KPI 1	Room acoustics classes in accordance with VDI 2569	[s]
KPI 2	Average value of the reverberation times (differentiated for different rooms)	[s]
KPI 3	Average equivalent sound absorption area	[%]

Synergies with DGNB system applications

- **DGNB OPERATION:** Achieving high levels of quality in this criterion provides a great deal of potential for achieving high satisfaction rates during ongoing operation for criterion 9.1 of the Buildings in use (BIU) scheme (user satisfaction).
- **DGNB RENOVATED BUILDINGS:** High synergies with criterion SOC1.3 in the REN scheme.
- **DGNB INTERIORS:** High synergies with criterion SOC1.3 in the NIR scheme.



APPENDIX A – DETAILED DESCRIPTION

I. Relevance

Depending on the size and use of a room, different measures may be necessary in order to achieve good acoustic conditions. In rooms designed for spoken communication, the focus is on a good level of speech intelligibility between the positions of the speakers and the positions of the listeners. In call centres and in dining rooms, achieving a low background noise pressure level and good speech intelligibility over short distances is prioritised. In music rooms, promoting the music experience throughout the room takes priority. Compliance with the different requirements described in the DGNB criterion is required in order to achieve good room acoustic conditions in accordance with the use of the rooms.

II. Additional explanation

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III. Method

Acoustic comfort is evaluated via several individual indicators on the basis of the different room types. The basis of the evaluation is the specifications of DIN 18041:2016-03 "Acoustic quality in rooms" or VDI 2569: 2016-02 (DRAFT) "Sound protection and acoustical design in offices".

If a detailed acoustic simulation is carried out, additional points can be achieved in the criterion.

When evaluating the acoustic comfort, the rooms specified in the indicators are relevant for the analysis (DIN 18041:2016-03: Rooms in group A and B, VDI 2569: 2016-02 (draft): Individual offices and multi-person offices in accordance with room acoustics classes A, B and C). Any other permitted alternative verification options are listed in the relevant indicators.

Indicator 1: Acoustic concept formulated during the planning process

Indicator 1.1: Creation of a room acoustics concept updated during the planning process

Rooms have different acoustics requirements depending on their use. Careful planning is required to ensure good yet cost-effective use-specific room acoustics. The objective is therefore to create an acoustic concept as early as possible during the planning process (room acoustics concept in accordance with the German fee structure for architects and engineers (HOAI)). The concept takes into account both architectural planning and interaction with other construction tasks. The concept contains room groups A and B in accordance with DIN 18041:2016-03. This prevents the need to make subsequent, and generally cost-intensive, improvements to the room acoustics.

Indicator 2: Individual offices and multi-person offices up to an area of 40 m²

In particular, this indicator takes office rooms and multi-person offices up to an area of 40 m² into account. The recommendations of VDI 2569: 2016-02 (draft) "Sound protection and acoustical design in offices" must be complied with and documented for room acoustics classes A, B or C. Noise damping measures in individual offices can be assessed on the basis of the reverberation time. The reverberation time in furnished rooms when in use is extremely dependent on the distribution of sound-absorbing surfaces within the room, the furnishings and the number and type of objects used by the user in question. This indicator therefore evaluates whether basic noise damping of the room has been ensured via the sound absorption of the room division surfaces installed on site.

The classification of VDI 2569: 2016-02 (draft) refers to offices that have been constructed and are ready for occupancy but are not occupied.

Alternatively, verification for completed projects can be carried out via a measurement in accordance with the



standard method of DIN EN ISO 3382-2 in an unoccupied empty or furnished state.

Indicator 3: Multi-person offices with an area of more than 40 m²

In particular, this indicator takes multi-person offices with an area of more than 40 m² into account.

The recommendations of VDI 2569: 2016-02 (draft) "Sound protection and acoustical design in offices" must be complied with and documented for room acoustics classes A, B and C with regard to the reverberation time. The additional parameters used in these guidelines refer exclusively to the acoustic conditions of the room in conjunction with the furniture. If no information regarding the tenant fit out is available, the tenant fit out can only be shown without absorbing furnishings.

Multi-person offices must be assessed in accordance with VDI 2569: 2016-02 (draft) over the reverberation time. Simply assessing the room acoustics conditions on the basis of the room damping is not considered to be meaningful. In the case of large multi-person offices, in accordance with VDI 2569: 2016-02 (draft), the A-weighted sound pressure level of speech at a distance of 4 m $L_{p,A,S,4m}$ in dB and the decay rate of speech in the room $D_{2,S}$ in dB must be used for the classification process; these can only be documented via room acoustics simulations.

In large multi-person offices, highly comfortable room acoustics conditions can only be achieved in open office structures with a sound-absorbing ceiling and measures for shielding between workstation groups. As sound-absorbing areas on the ceiling have a significantly higher impact in terms of sound propagation damping than those on the floor, additional points can be achieved for these. Comfortable room acoustics conditions can also be achieved with room-height room dividers which absorb sound on both sides, and in this case the additional points for sound absorption areas on the ceiling and the room dividers can be awarded.

Alternatively, verification for completed projects can be carried out via a measurement in accordance with the standard method of DIN EN ISO 3382-2 in an unoccupied empty or furnished state.

Indicator 4: Rooms in accordance with DIN 18041:2016-03 (room group A1–A5) with special requirements in terms of speech intelligibility (such as meeting rooms, seminar rooms or classrooms)

For meeting or seminar rooms, the room acoustics recommendations for the building uses of room groups A1–A5 in accordance with DIN 18041:2016-03 "Acoustic quality in rooms – Specifications and instructions for the room acoustic design" must be calculated and their compliance with the requirements must be documented. The room groups that are to be documented are described in Table 1 of DIN **18041:2016-03**.

Noise damping measures in rooms for "speech/lecture" or "teaching/communication" can be assessed on the basis of the reverberation time in furnished rooms with 80% occupancy.

Verification is carried out via calculation of the reverberation time of the room under consideration while furnished and with 80% occupancy in accordance with the calculation specifications of DIN 18041:2016-03. The values used for sound absorption of persons and furnishings must be documented.

If all requirements for **inclusive** use in accordance with DIN 18041:2016-03 are additionally complied with, this is evaluated positively.

Alternatively, verification can be carried out via a measurement in accordance with the standard method of DIN EN ISO 3382-2 in an unoccupied furnished state. An occupancy level of 80% must be taken into account in the calculations.

Indicator 5: Rooms with recommendations in accordance with DIN 18041:2016-03 (building use B3–B5) with special requirements for noise reduction and/or room acoustics comfort (such as cafeterias, libraries or



break rooms)

The room damping in rooms of building uses B3–B5 with special requirements for noise reduction and/or the room acoustics comfort is implemented via the reverberation time while furnished and with 50% occupancy in accordance with DIN 18041. Compliance with the recommendations for the A/V ratio in the frequency range 250–2000 Hz is required to achieve good room acoustics conditions. The room groups are described in Table 2 of the DIN standard. The values used for sound absorption of persons and furnishings must be documented.

Alternatively, verification can be carried out via a measurement in accordance with the standard method of DIN EN ISO 3382-2 in an unoccupied furnished state. An occupancy level of 50% must be taken into account in the calculations.

As an alternative to indicators 1–5: Completion of a detailed acoustic simulation

Conventional statistical calculation methods can be used to determine average reverberation time values that are sufficient for assessing rooms with typical uses and geometries. For rooms with special geometries and requirements in terms of room acoustics quality, detailed calculation methods with location-specific parameters are required to develop optimal room acoustics conditions. Room acoustics simulation calculations can be used to determine the effectiveness of room acoustics measures in detail and check and evaluate even the more complex room acoustics conditions.

Indicator 6: AGENDA 2030 BONUS – Stress reduction, health and well-being

Long-term exposure to noise can have a huge impact on our cardiovascular system and sleeping patterns, and can lead to diseases such as high blood pressure, heart attacks and strokes. The objective is therefore to achieve a high level of acoustic quality and comfort for building users in order to minimise noise levels as a harmful factor. The minimum requirement for awarding points is that the quality listed below has been achieved and confirmed via measurements in indicators 2–5.

2.1 "Individual offices and multi-person offices up to 40 m²/compliance with the requirements for reverberation times"

- At least: Compliance with room acoustics class B in accordance with VDI 2569: 2016-02 (draft), alternative: Verification in accordance with DIN 18041:2016-03 room group B:

3.1 "Multi-person offices larger than 40 m²/compliance with the requirements for reverberation times"

- At least: Compliance with room acoustics class B in accordance with VDI 2569: 2016-02 (draft)

4.1 "Rooms in accordance with DIN 18041:2016-03 (room group A1–A5) with special requirements in terms of speech intelligibility (such as meeting rooms, seminar rooms or classrooms)/compliance with the requirements for the reverberation time T_{target}"

- Compliance with the requirements for inclusion

5.1 "Rooms with recommendations in accordance with DIN 18041:2016-03 (building uses B3–B5) with special requirements for noise reduction and/or room acoustics comfort (such as cafeterias, libraries or break rooms)"

- Compliance with the recommendations for the A/V ratio in the frequency range 250–2000 Hz as a minimum



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.

Indicator 1: Acoustic concept formulated during the planning process

- Room acoustics concept with detailed description of the measures implemented in the rooms in accordance with room groups A and B as per DIN 18041:2016-03, transparent representation of the updates during the planning process as well as transparent consideration of the interaction between room acoustics and architectural planning as well as the interaction with other construction tasks.

Indicator 2: Individual offices and multi-person offices up to an area of 40 m²

- The basis and result of the calculation as well as measurement of the reverberation time. Documentation of the values used for sound absorption of persons and furnishings.
- Documentation of compliance with the recommendations for the sound insulation classes in accordance with VDI 2569: 2016-02 (draft) "Sound protection and acoustical design in offices" for room acoustics classes A, B or C in the form of calculations or measurements.
- As an alternative to compliance with room acoustics class B in accordance with VDI 2569: 2016-02 (draft), documentation can be performed using the requirements for room group B in accordance with DIN 18041:2016-03: Cf. indicator 5.

Indicator 3: Multi-person offices with an area of more than 40 m²

- The basis and result of the calculation as well as measurement of the reverberation time.
- Documentation of the values used for sound absorption of persons and furnishings.
- Documentation of compliance with the recommendations for the sound insulation classes in accordance with VDI 2569: 2016-02 (draft) "Sound protection and acoustical design in offices" (draft) for room acoustics classes A, B or C in the form of calculations or measurements.
- As an alternative to compliance with room acoustics class C in accordance with VDI 2569: 2016-02 (draft), documentation can be performed using the requirements for room group B in accordance with DIN 18041:2016-03: Cf. indicator 5.
- Documentation of the sound absorption measures implemented on the ceiling or in the form of room dividers, e.g. by means of an order confirmation and photo documentation.



Indicator 4: Rooms in accordance with DIN 18041:2016-03 (room group A1–A5) with special requirements regarding speech intelligibility

- The basis and result of the calculation as well as measurement of the reverberation time of the sound-absorbing areas.
- Documentation of the values used for sound absorption of persons and furnishings.

Indicator 5: Rooms with recommendations in accordance with DIN 18041:2016-03 (building uses B3–B5) with special requirements regarding noise reduction

- The basis and result of the calculation as well as measurement of the reverberation time.
- Documentation of the values used for sound absorption of persons and furnishings.

In addition to indicators 1–5: Completion of a detailed acoustic simulation

- Basis and results of the completed detailed acoustic simulation.

Indicator 6: AGENDA 2030 BONUS – Stress reduction, health and well-being

- Description of the results of the calculation as well as the measurements carried out.



I. Version

Change log based on version 2017

PAGE	EXPLANATION	DATE
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II. Literature

- DIN 18041:2016-03. Acoustic quality in small to medium-sized rooms. Berlin: Beuth Verlag.
- DIN EN ISO 3382-2. Acoustics – Measurement of room acoustic parameters – Part 2: Reverberation time in ordinary rooms. Berlin: Beuth Verlag. September 2008
- DIN EN ISO 3382-2 Corrigendum 1:2009-09. Acoustics – Measurement of room acoustic parameters – Part 2: Reverberation time in ordinary rooms
- DIN EN ISO 354. Acoustics – Measurement of sound absorption in a reverberation room. Berlin: Beuth Verlag. December 2003
- VDI 2569: 2016-02 (draft) "Sound protection and acoustical design in offices". Düsseldorf: Verein Deutscher Ingenieure e.V.