

## **German regulations on building acoustics - The new standard DIN 4109**

**Körper, Steffen**  
Umweltbundesamt  
Wörlitzer Platz 1  
06844 Dessau-Roßlau

### **ABSTRACT**

**The German standard DIN 4109 "Sound insulation in building construction" contains the minimum requirements for sound insulation for all new buildings in Germany. The standard was first revised and published in 2016. In 2018, two parts were changed and republished. In particular the changes affect the sound insulation of facades to protect the indoor space and the residents against external noise. A major deficit of the old DIN 4109 from 1989 was the inadequate protection in buildings from nocturnal noise. For the maintenance of the psychomotor efficiency and health, undisturbed sleep in sufficient duration is of central importance. Therefore, the external noise levels at nighttime must be taken into account now when determining the required exterior sound insulation of buildings. In most cases this entails an increase of the requirements for the external building components in comparison to DIN 4109:1989.**

**The presentation shows the German standard values in building acoustics and the subject of external noise. The remaining and new problems of the current standard DIN 4109:2018 will also be discussed.**

**Keywords:** Building acoustics, Outdoor noise, Regulations, Germany, DIN 4109

**I-INCE Classification of Subject Number:** 82

### **1. LEGAL CLASSIFICATION OF DIN 4109**

The DIN 4109 "Sound insulation in building construction" [1] has a special task in Germany as a central standard in the field of sound insulation of buildings. As a result of the country-wide introduction of the federal states (Bundesländer) via the Technical Building Regulations into the respective state building regulations, DIN 4109 is binding for most construction projects in Germany.

In 2016, the standard was reissued as part of a revision of the entire DIN 4109 of 1989 [2] with its numerous supplements and extensions. Since then, the standard consists of a total of 4 parts that deal with different aspects of sound insulation. Two parts, the DIN 4109-1 "Minimum requirements" and 4109-2 "Computational proof of compliance with requirements" have already been revised and published in 2018.

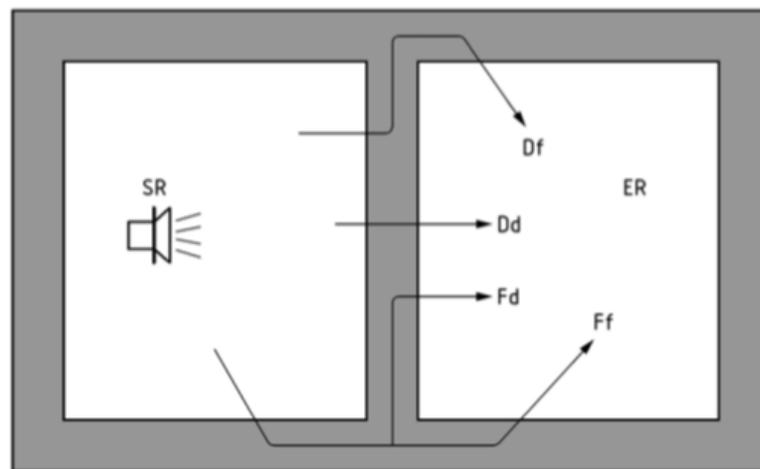
## 2. APPLICATION OF DIN 4109:2018

The DIN 4109 consists of part 1 “Minimum requirements”, part 2 “Computational proof of compliance”, part 3 “Component catalog“ and part 4: “Building acoustic tests”. A fifth part “Increased requirements” is currently on its way.

Part 1 includes requirements for buildings with living and working areas, as apartment buildings, office buildings and mixed use areas, detached houses, terraced houses, semi-detached houses. Also it includes requirements for non-residential buildings as hotels, hospitals, sanatoriums and schools. Part 1 also defines requirements for soundinsulation to outside noise and building services like sanitary equipment, water installations, lifts, ventilation systems in own living areas, fittings and appliances of drinking water installation.

Part 2 consists calculation models for airborne sound insulation in buildings with double-shell massive house partition (single-family terraced houses and semi-detached houses), airborne sound insulation in wood-, light- and dry construction, impact sound insulation in buildings and transmission of outside noise into buildings as well as uncertainty estimate.

As figure 1 shows the calculation models are mainly based on the ISO 12354 [3] standard, that considers thirteen transmission parts including the weighted sound reduction index with its coupling length and the vibration reduction index for the transmission paths.



*Figure 1: Considered transmission paths in DIN 4109*

Part 3, the component catalog, contains about 230 pages with data for solid, wood, light and dry constructions, attachment constructions in front of solid components, elements, windows, doors, curtain walls and building services systems. The component catalog is a result of years of measurements in acoustic test benches.

Part 4 includes metrological implementation of the verification of requirements in the installed state as well as in the test benches. The laboratory measurements procedures base on ISO 10140 [4] standard, the measurements of structures in situ mainly base on the ISO 16283 [5] standard.

### 3. REQUIREMENTS

#### 3.1 Minimum Requirements for components

Requirements to airborne sound in apartment buildings (f. e. ceilings and partitions walls) didn't change much from DIN 4109:1989 to DIN 4109:2018. The requirements to house partition walls increased significant. The requirements for impact sound increased from  $L'_{n,w} \leq 53$  to  $L'_{n,w} \leq 50$  for apartment ceilings. Table 1 shows the development of the minimum requirements for dwellings in Germany for the most important components.

Table 1: Selection of minimum requirements of DIN 4109:2018 [1]

Selection of components out of DIN 4109:2018	Minimum requirements of DIN 4109 in dB			
	1989	2018	1989	2018
	$R'_w/R_w$	$R'_w/R_w$		$L'_{n,w}$
Apartment ceilings (including stairs)	$\geq 54$	$\geq 54$	$\leq 53$	$\leq 50$
Apartment partitions walls	$\geq 53$	$\geq 53$	-	-
Doors leading from hallways or stairwells in closed corridors and floorboards of apartments	$\geq 27$	$\geq 27$	-	-
Doors leading from hallways or stairwells in living rooms of apartments	$\geq 37$	$\geq 37$	-	-
	$\geq 57$	$\geq 59$	-	-
House partition walls to living rooms, under which stands at least 1	$\geq 57$	$\geq 62$	-	-

#### 3.2 Sound insulation and indoor sound levels in DIN 4109

Requirements for sound insulation against external noise are specified in part 1 of DIN 4109 "Minimum requirements"

A major deficit of the old DIN 4109 from 1989 was the inadequate protection in buildings from nocturnal noise. For the maintenance of the psychomotor efficiency and health undisturbed sleep in sufficient duration is of central importance. Now, the external noise levels in the nighttime must be taken into account when determining the required external sound insulation of buildings. In addition, the tabulated 5 dB step contained in DIN 4109-1:1989 was replaced by a formula to determine the required sound insulation of the exterior components. As a result, the required sound insulation can be calculated accurately to 1 dB. The noise level of rail traffic noise is reduced by 5 dB take the frequency composition of railway traffic noise in conjunction with the frequency spectrum of the sound insulation of exterior components, like windows, into account.

In most cases this entails a tightening of the requirements for the external components in comparison to DIN 4109:1989. The requirements for sound insulation of facades now ensures calculative average indoor noise levels of 35 dB(A) during the daytime and 25 dB(A) during the nighttime or less.

With the amendments to the DIN 4109 standard, an average improvement in the sound insulation level for construction in the vicinity of roads and railways was achieved.

#### **4. CONCLUSIONS**

The requirements of the DIN 4109 standard contains binding minimum requirements for most construction projects in Germany. In 2016 and 2018, the standard was reissued. Since then, the standard consists of four parts. The calculation models are mainly based on the ISO 12354 standard. Required acoustic measurements are also based on international standards as ISO 10140 or ISO 16283.

Requirements to airborne sound in in apartment buildings didn't change much from DIN 4109:1989 to DIN 4109:2018, but the requirements for impact sound and house partition walls increased significant.

A major modification affects the requirements to façade sound insulation. The requirements for sound insulation of facades now ensures calculative average indoor noise levels of 35 dB(A) during the daytime and 25 dB(A) during the nighttime or less. With the amendments to the DIN 4109 standard, an average improvement in the sound insulation level for construction in the vicinity of roads and railways was achieved.

#### **5. REFERENCES**

1. Deutsches Institut für Normung, DIN 4109:2018-01, *Schallschutz im Hochbau*, Berlin: Beuth-Verlag (Januar 2018)
2. Deutsches Institut für Normung. DIN 4109:1989-11, *Schallschutz im Hochbau*; Berlin: Beuth-Verlag (November 1989)
3. International Organization for Standardization, ISO 12354:2017, *Building acoustics - Estimation of acoustic performance of buildings from the performance of elements*, Technical Committee: ISO/TC 43/SC 2 (July 2017)
4. International Organization for Standardization ISO 10140:2016, *Acoustics - Laboratory measurement of sound insulation of building elements*, Technical Committee: ISO/TC 43/SC 2 (August 2016)
5. International Organization for Standardization ISO 16283:2014, *Acoustics -- Field measurement of sound insulation in buildings and of building elements*, Technical Committee: ISO/TC 43/SC 2 (February 2014)