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Beratende Ingenieure VBI

Test report

02.10.2024
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Project-No.: 22_020
Test report: 0071.24

Sports floor
REGUPOL sonusfit m 517 (AUS), 48 mm

Reduction of impact sound pressure level
on a solid reference ceiling
according to DIN EN ISO 10140

Maximum sound pressure level with drop weight
excitation (ball drop test)

Bau- und Raumakustik,
Schallimmissionsschutz,
Thermische Bauphysik,
Erschütterungsschutz

Schalltechnisches Labor, Prüfstelle
für die Erteilung allgemeiner
bauaufsichtlicher Prüfzeugnisse,
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Test report

Sports floor
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1. General

1.1 Project participants

Client: REGUPOL Germany GmbH & Co. KG
Am Hilgenacker 24, 57319 Bad Berleburg - Germany

1.2 Task Designation

For a **"Sports floor REGUPOL sonusfit m 517 (AUS), 48 mm"**, the reduction of impact sound pressure level on a heavyweight reference floor had to be determined in accordance with DIN EN ISO 10140 [1]. Furthermore, the maximum sound pressure levels were to be analysed when a dropped steel ball was used for impulse excitation. The steel ball was provided by the client.

2. Processing bases

2.1 Relevant regulations

[1] DIN EN ISO 10140:2021-09 "Acoustics – Laboratory measurement of sound insulation of building elements"
- part 1 "Application rules for specific products"
- part 3 "Measurement of impact sound insulation"
- part 4 "Measurement procedures and requirements"
- part 5 "Requirements for test facilities and equipment"

[2] DIN EN ISO 717-2 "Rating of sound insulation in buildings and of building elements"
- part 4 "Measurement procedures and requirements"

[3] DIN EN ISO 3382-2:2008-09 "Measurement of room acoustic parameters"
- part 2: "Reverberation time in ordinary rooms"

[4] DIN EN ISO 12999-1 "Acoustics - Determination and application of measurement uncertainties in building acoustics"
- part 1: 2021-04 "Sound insulation"

[5] DIN 4109-4:2016-07: "Schallschutz im Hochbau"
- part 4: "Bauakustische Prüfungen" (Regulation, valid in Germany)

[6] Beschlussbuch des Arbeitskreises der Prüfstellen für die Erteilung allgemeiner bauaufsichtlicher Prüfzeugnisse für den Schallschutz im Hochbau - Arbeitskreis Schallprüfstellen, Stand 18.03.2019 (Regulation, valid in Germany)

3. Test Date

The tests were conducted on 10 October 2022 in the ITA ceiling test rooms P-D1.

4. Test Arrangement

4.1 Test set-up

The following sports floor was analysed:

Sports floor REGUPOL sonusfit m 517 (AUS), 48 mm
Mass per unit area m' = 18,9 kg/m²
(The exact structure is known to the test laboratory)

A single specimen measuring 1000 mm x 500 mm was placed on the floor in five positions one after the other.

4.2 Installation situation in the test room

The floor covering was placed in the building acoustics ceiling test stand P-D1 with a permanently installed heavyweight reference ceiling, d = 15 cm, in accordance with DIN EN ISO 10140-5:2021-09 [1]. The installation situation in the test room is shown in annexes 1 and 2.

5. Measurement Method

5.1 Normalized impact sound pressure level

The tests were conducted according to DIN EN ISO 10140-3:2021-09 [1].

The normalised impact sound pressure level L_n was calculated as follows:

$$L_{n,j} = L_j + 10 \log \frac{A}{A_0} \text{ in dB} \qquad \text{(eq. 1)}$$

$$L_n = 10 \log \frac{1}{m} \sum_{j=1}^{m} 10^{Ln,j/10} \text{ in dB} \qquad \text{(eq. 2)}$$

The abbreviations stand for:

$L_{n,j}$ = normalised impact sound pressure level in dB at tapping machine position j
L_j = impact sound pressure level in receiving room in dB at tapping machine position j
A = equivalent absorption area of receiving room in m²
A_0 = reference absorption area = 10 m².
m = number of tapping machine positions.

The normalised impact sound pressure level was determined at two individual positions for each of the five positions of the tapping machine. The tested material is a flexible covering defined in DIN EN ISO 10140-4:2021-09 [1], for which small test specimens can be used. The test specimen was placed in a total of five different positions in the test room. The energetically averaged sound pressure level was calculated according to the results of the different positions. The integration time per microphone position was 20 s each.

The background noise level was not low enough so that an appropriate correction according to DIN EN ISO 10140-3:2021-09 [1] was necessary. If the difference between the receiving room level and the background noise level is < 6 dB, a correction of 1.3 dB is made according to DIN EN ISO 10140-3:2021-09 [1]. This correction of the results is marked with "≥" in the annexes.

The equivalent sound absorption area A was calculated according to the reverberation time in the receiving room with the following equation:

$$A = 0{,}16 \frac{V}{T} \text{ in } m^2 \qquad \text{(eq. 3)}$$

The abbreviations stand for

V = volume of the receiving room in m^3
T = reverberation time in the receiving room in s.

The reverberation time was determined according to the specifications of DIN EN ISO 10140-4:2021-09 [1], section 4.6.2 "Measurement of the reverberation time". Reference is made to ISO 3382-2:2008-09 [3].

The method with interrupted noise was used. Two measurements were taken at each of three microphone positions at one loudspeaker position. The arithmetic average was formed from the individual measured values.

The single numerical value $L_{n,w}$ as well as the spectrum weighting values are determined according to ISO 717-2:2021-05 [2].

For the present measurement situation A according to DIN EN ISO 12999-1:2021-04 [4] the comparative standard uncertainty for the weighted normalised impact sound pressure level is $\sigma_R = 1{,}5$ dB.

The results in the frequency range from 50 Hz to 80 Hz are influenced by the geometric conditions of the test rooms; the presentation of these measured values is only informative.

5.2 Improvement of impact sound insulation

In order to determine the reduction of impact sound ΔL_w the normalised impact noise pressure level of the heavyweight reference floor was evaluated in the test room with and without floor covering in accordance with DIN EN ISO 10140-1: 2021-09 [1]. The reduction of impact sound was calculated according to the following equation:

$$\Delta L = L_{n,0} - L_n \text{ in dB.} \qquad \text{(eq. 4)}$$

The abbreviations stand for

ΔL = reduction of impact sound pressure level in dB
$L_{n,0}$ = normalised impact sound pressure level of the reference floor without floor covering in dB.
L_n = normalised impact sound pressure level of the reference floor with floor covering in dB.

Subsequently the reduction of impact sound pressure level ΔL of the floor covering determined in accordance with the frequency was deducted from the values of the normalised impact noise pressure level $L_{n,r,0}$ of the reference floor according to DIN EN ISO 717-2:2021-05 [2], table 4:

$$L_{n,r} = L_{n,r,0} - \Delta L \text{ in dB.} \qquad \text{(eq. 5)}$$

The abbreviations stand for

$L_{n,r,0}$ = specified normalised impact sound pressure level of the reference floor (DIN EN ISO 717-2 [3], Table 4) in dB
ΔL = reduction of impact sound pressure level in dB

The weighed reduction of impact sound pressure level ΔL_w of the floor covering was calculated according to the equation:

$$\Delta L_w = L_{n,r,0,w} - L_{n,r,w} \text{ in dB.} \qquad \text{(eq. 6)}$$

The abbreviations stand for

$\Delta L_{w,}$ = Weighted reduction of impact sound pressure level in dB
$L_{n,r,0,w}$ = Weighed normalised impact sound pressure level of the heavyweight reference floor $L_{n,r,0,w}$ =78 dB (77,6 dB)
$L_{n,r,w}$ = Weighed normalised impact sound pressure level of the heavyweight reference floor with the ceiling covering in dB

In addition the spectrum adaptation values $C_{I\Delta}$ and $C_{I,r}$ were determined according to DIN EN ISO 717-2:2021-05 [2].

5.3 Maximum sound pressure level with drop weight excitation (ball drop test)

The sound emissions caused by dropped weights were determined, in this case by a steel ball with a weight of 30 kg provided by the client. The excitations were carried out on the floor covering at a total of five individual positions in the upper room of the ceiling test room. The steel ball was dropped onto the floor covering from a height of 40 cm (= lower edge of steel ball to upper edge of sports floor). The measured values were recorded in the lower room at one microphone position.

Three excitations per position were recorded, resulting in a total of 15 measurement series.

To ensure comparability of the measurement results, the measured values were normalised to the reverberation time in the receiving room.

The A-weighted maximum normalised sound pressure level L^*_{AFmax} was determined using the following equations:

$$\overline{L_{AFmax}} = 10 \log \frac{1}{m} \sum_{j=1}^{m} 10^{L_{AFmax,j}/10} \text{ in dB} \qquad \text{(eq. 7)}$$

$$L^*_{AFmax} = \overline{L_{AFmax}} - 10 \log \frac{T}{T_0} \text{ in dB} \qquad \text{(eq. 8)}$$

The abbreviations stand for

$L_{AFmax,j}$ = maximum sound pressure level in dB with measurement series j
$\overline{L_{AFmax}}$ = average maximum sound level over all measurement series
L^*_{AFmax} = maximum normalised sound pressure level
T = reverberation time in the receiving room in s
T_0 = reference reverberation time = 0,5 s
m = number of excitations/measurement series.

The reverberation time was determined as described in section 5.1.

Furthermore, the sound pressure levels were also determined as a function of frequency in the range from 50 to 5,000 Hz. The calculation of the normalised maximum one-third octave sound pressure level L^*_{fFmax} is carried out in the same way according to equations 7 and 8.

The results in the frequency range from 50 Hz to 80 Hz are influenced by the geometric conditions of the test rooms; the presentation of these measured values is only informative.

6. Measuring instruments

Description	Type	Serial number
Realtime analyser channel A (calibrated until 2024*)	Norsonic 145	14529842/22
in conjunction with:		
Condenser microphone (channel A)	Norsonic 1225	491237
Microphone amplifier (channel A)	Norsonic 1209	23385
Realtime analyser channel A (calibrated until 2024*)	Norsonic 145	14529843/22
in conjunction with:		
Condenser microphone (channel B)	Norsonic 1225	491259
Microphone amplifier (channel B)	Norsonic 1209	23386
Calibration device	Norsonic 1256	125626712
Speaker combination (dodecahedron)	Norsonic 276	2766343
Power amplifier	Norsonic 280	2803954
Haar-Hygrometer mit Thermometer	FISCHER 111T	
Tapping machine	Norsonic 277	2776368

* At the time of the measurements

The measuring instruments were calibrated before and after the measurements. No deviations occurred.

7. Test results

The graphical representation of the results is shown in annexes 3 (impact sound reduction) and 4 (ball drop test) to this report.

For the **"Sports floor REGUPOL sonusfit m 517 (AUS), 48 mm"** the values entered in the following tables were determined.

Tabelle 1: Measurement results impact sound, weighted normalised impact sound pressure level $L_{n,w}$ in dB, weighted reduction of impact sound pressure level ΔL_w in dB (Test stand values)

Designation	Test result in dB	
	$L_{n,w}$	$L_{n,w} \pm \sigma_R$ *
Heavyweight reference floor 150 mm reinforced concrete slab	73	72,7 ± 1,5
Tested floor covering on Heavyweight reference floor	44	43,7 ± 1,5
weighted reduction of impact sound pressure level	**ΔL_w = 28 dB** ΔL_w = 28,3 dB ± 1,1 dB*	

* The weighted impact sound reduction index determined according to DIN EN ISO 717-2:2021-05 [2] in 1/10 dB specification with measurement uncertainty. The stated measurement uncertainty is the mean standard deviation for test stand measurements according to DIN EN ISO 12999-1:2021-04 [4]. For product declaration (e.g., for CE labelling), an integer value of the weighted impact sound reduction index must be used.

Tabelle 2: Measurement results ball drop test, A-weighted normalised maximum sound pressure level L^*_{AFmax} in dB (test stand value)

Designation	Test result
A-weighted normalised maximum sound pressure level for impulse excitation by drop weight (steel ball 30 kg, drop height h = 40 cm)	**L^*_{AFmax} = 68,5 dB**

8. General information

The results of this report only refer to the measured objects.

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This test report is a translation of the German-language original. The German-language version is legally binding. No warranty can be given for translation errors.

This report contains 8 pages and 4 annexes.

Wiesbaden, 02.10.2024

ita Ingenieurgesellschaft
für Technische Akustik mbH

Georg Eßer	Michael Sommer
Geschäftsführer Prüfstellenleiter	Fachbearbeiter Leiter der Messtechnik

Ceiling test stand P-D1
with supressed flanking transmission according to DIN EN ISO 10140-5 with heavyweight reference floor d = 15 cm

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Sports floor
REGUPOL sonusfit m 517 (AUS), 48 mm

Project-No.: 22_020
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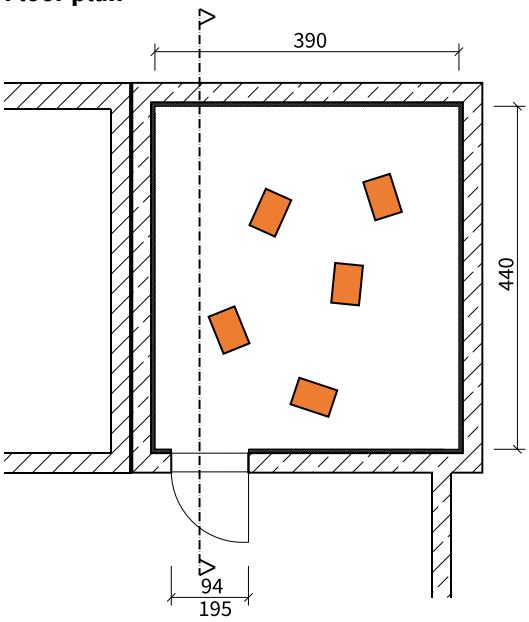
Annex 1
Test set-up

Floor plan



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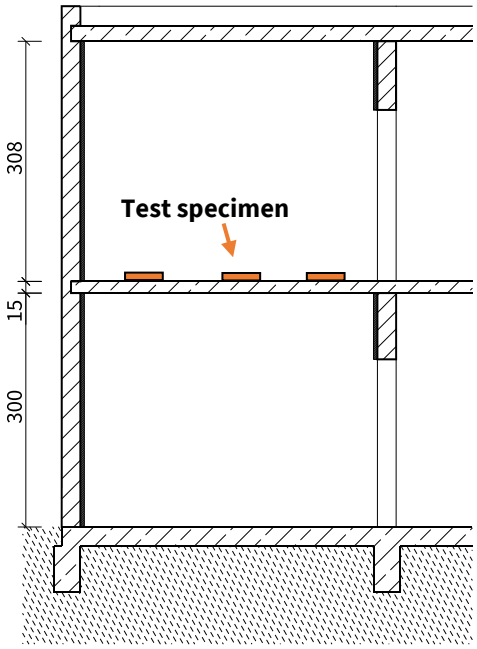

(approximate positions)

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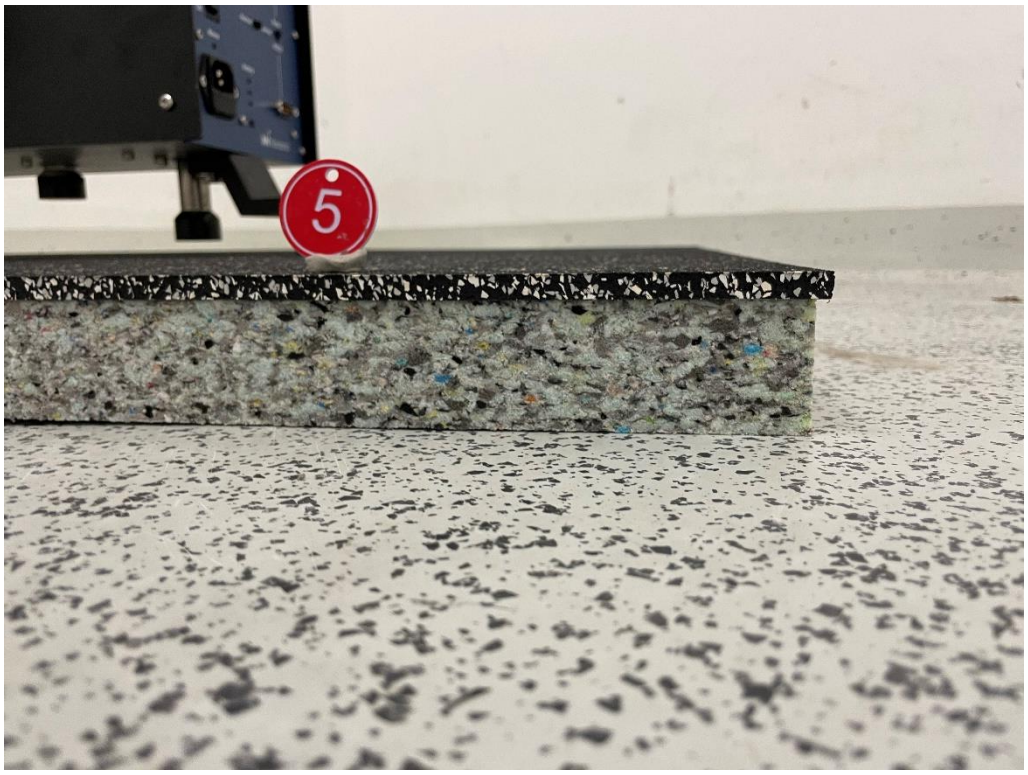
Annex 2
Photo documentation of test set-up



Ball drop test with a 30 kg steel ball and a drop height of 40 cm
(a different test object is shown in the photos)

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Annex 2
Photo documentation of test set-up

Reduction of impact sound pressure level in according to ISO 10140 (all parts)

Laboratory measurements of the reduction of transmitted impact sound by floor coverings on a heavyweight or lightweight reference floor

Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm

Client: REGUPOL Germany GmbH & Co. KG
Am Hilgenacker 24, 57319 Bad Berleburg - Germany

Test specimen: Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm
Test element mounted by: client
Test room identification: ceiling test stand P-D1 in accordance with DIN EN ISO 10 140
Description of test specimen and test arrangement:

Structure of the floor support (from top to bottom):
48 mm Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm
Mass per unit area m' = 18,9 kg/m²
(The exact structure is known to the test laboratory)

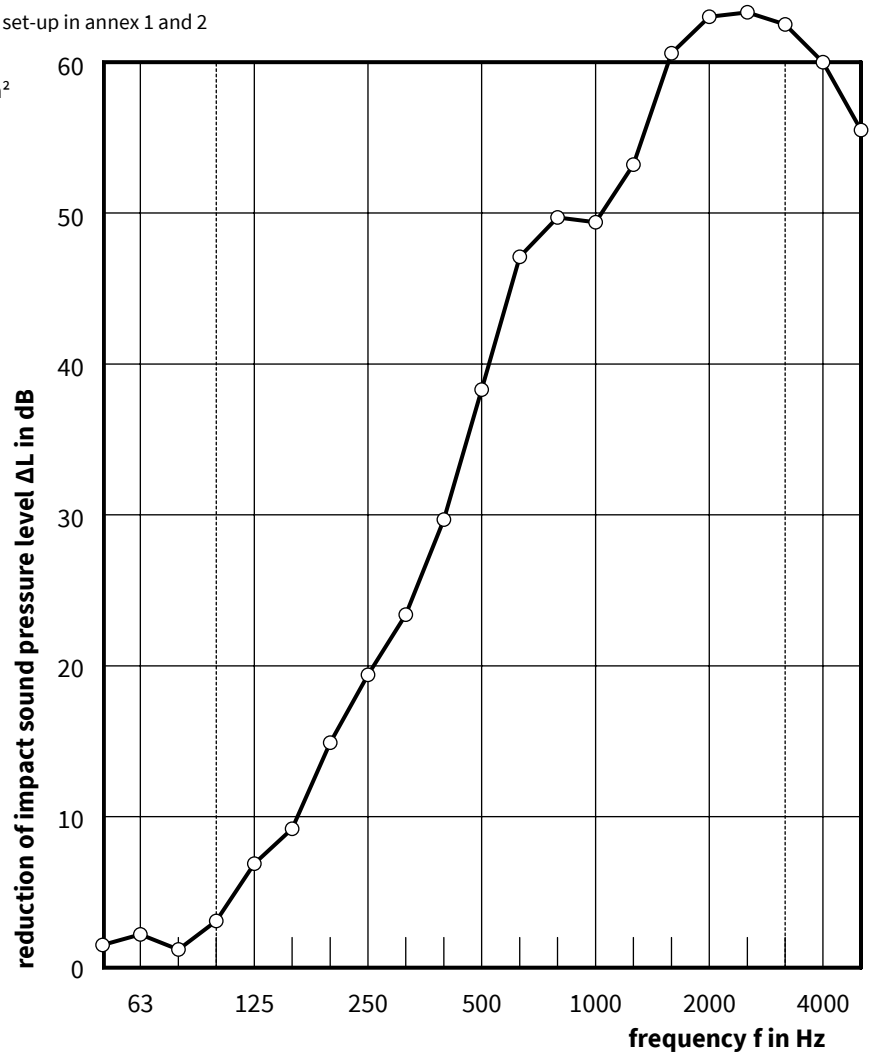
Structure of the reference floor/reinforced concrete slab:
150 mm Reinforced concrete slab (heavyweight reference floor in accordance with DIN EN ISO 10 140 [1])

Installation and construction details of the Test set-up in annex 1 and 2

mass per unit area:	18,9	kg/m²
air temp. in source room:	14	°C
relative humidity:	72	%
static air pressure:	1004	hPa
receiving room volume:	51,1	m³
Date of test:	10.10.2022	

Frequency f Hz	$L_{n,0}$ 1/3 octav dB	ΔL 1/3 octav dB
50	61,0	1,5
63	62,0	2,2
80	63,1	1,2
100	58,2	3,1
125	63,9	6,9
160	62,2	9,2
200	63,8	14,9
250	65,6	19,4
315	63,5	23,4
400	64,9	29,7
500	65,2	38,3
630	66,0	47,1
800	66,9	49,7
1000	66,4	49,4
1250	67,0	53,2
1600	66,8	* ≥ 60,6
2000	66,9	* ≥ 63,0
2500	66,6	* ≥ 63,3
3150	65,9	* ≥ 62,5
4000	64,3	* ≥ 60,0
5000	60,5	* ≥ 55,5

* Measurement limit reached/exceeded



---------- frequency range for the rating in accordance with ISO 717-2

Rating according to ISO 717-2: Results of tests with an artificial source under laboratory conditions with a fixed reference floor

ΔL_w = 28 dB **$C_{I,\Delta}$ = -13 dB** **ΔL_{lin} = 15 dB**

$\Delta L_w \pm \sigma_R$ = 28,3 dB ± 1,1 dB (Informative specification with one decimal place and measurement uncertainties)

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Reduction of impact sound pressure level in according to ISO 10140 (all parts)

Laboratory measurements of the reduction of transmitted impact sound by floor coverings on a heavyweight or lightweight reference floor

Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm

Client: REGUPOL Germany GmbH & Co. KG
Am Hilgenacker 24, 57319 Bad Berleburg - Germany

Test specimen: Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm
Test element mounted by: client
Test room identification: ceiling test stand P-D1 in accordance with DIN EN ISO 10 140
Description of test specimen and test arrangement:

Structure of the floor support (from top to bottom):
48 mm Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm
Mass per unit area m' = 18,9 kg/m²
(The exact structure is known to the test laboratory)

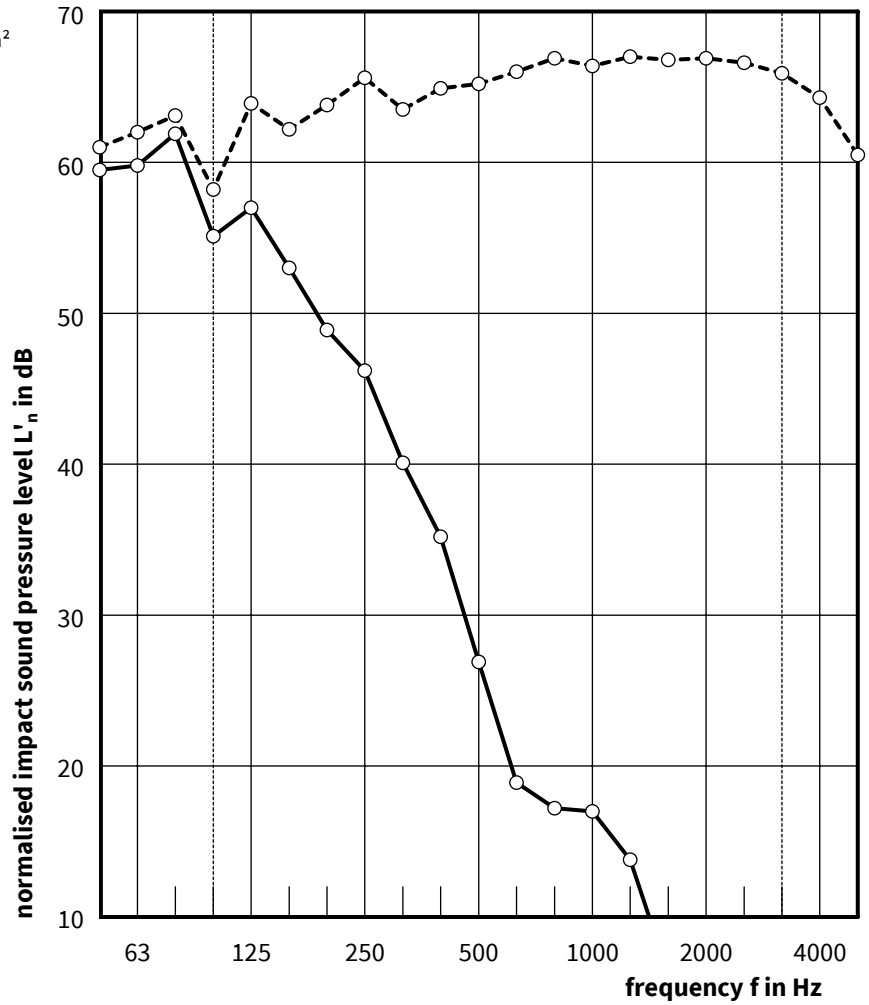
Structure of the reference floor/reinforced concrete slab:
150 mm Reinforced concrete slab (heavyweight reference floor in accordance with DIN EN ISO 10 140 [1])

Installation and construction details of the Test set-up in annex 1 and 2

mass per unit area:	18,9	kg/m²
air temp. in source room:	14	°C
relative humidity:	72	%
static air pressure:	1004	hPa
receiving room volume:	51,1	m³
Date of test:	10.10.2022	

Frequency f Hz	L_n 1/3 octav dB	$L_{n,0}$ 1/3 octav dB
50	59,5	61,0
63	59,8	62,0
80	61,9	63,1
100	55,1	58,2
125	57,0	63,9
160	53,0	62,2
200	48,9	63,8
250	46,2	65,6
315	40,1	63,5
400	35,2	64,9
500	26,9	65,2
630	18,9	66,0
800	17,2	66,9
1000	17,0	66,4
1250	13,8	67,0
1600	* ≥ 6,2	66,8
2000	* ≥ 3,9	66,9
2500	* ≥ 3,3	66,6
3150	* ≥ 3,4	65,9
4000	* ≥ 4,3	64,3
5000	* ≥ 5,0	60,5

* Measurement limit reached/exceeded



---------- frequency range for the rating in accordance with ISO 717-2

—○— reference floor with floor covering
L_n (C_I; $C_{I,50\text{-}2500}$) = 44 (2;) dB (43,7 dB)

- -○- - reference floor
$L_{n,0}$ (C_I; $C_{I,50\text{-}2500}$) = 73 (-11; -10) dB (72,3 dB)

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Sound pressure level with drop weight excitation

Test stand measurements of the normalised maximum sound pressure level

Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm

Client: REGUPOL Germany GmbH & Co. KG
Am Hilgenacker 24, 57319 Bad Berleburg - Germany

Test specimen: Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm
Test element mounted by: client
Test room identification: ceiling test stand P-D1 in accordance with DIN EN ISO 10 140
Description of test specimen and test arrangement:

Structure of the floor support (from top to bottom):
48 mm Sports floor - REGUPOL sonusfit m 517 (AUS), 48 mm
Mass per unit area m' = 18,9 kg/m²
(The exact structure is known to the test laboratory)

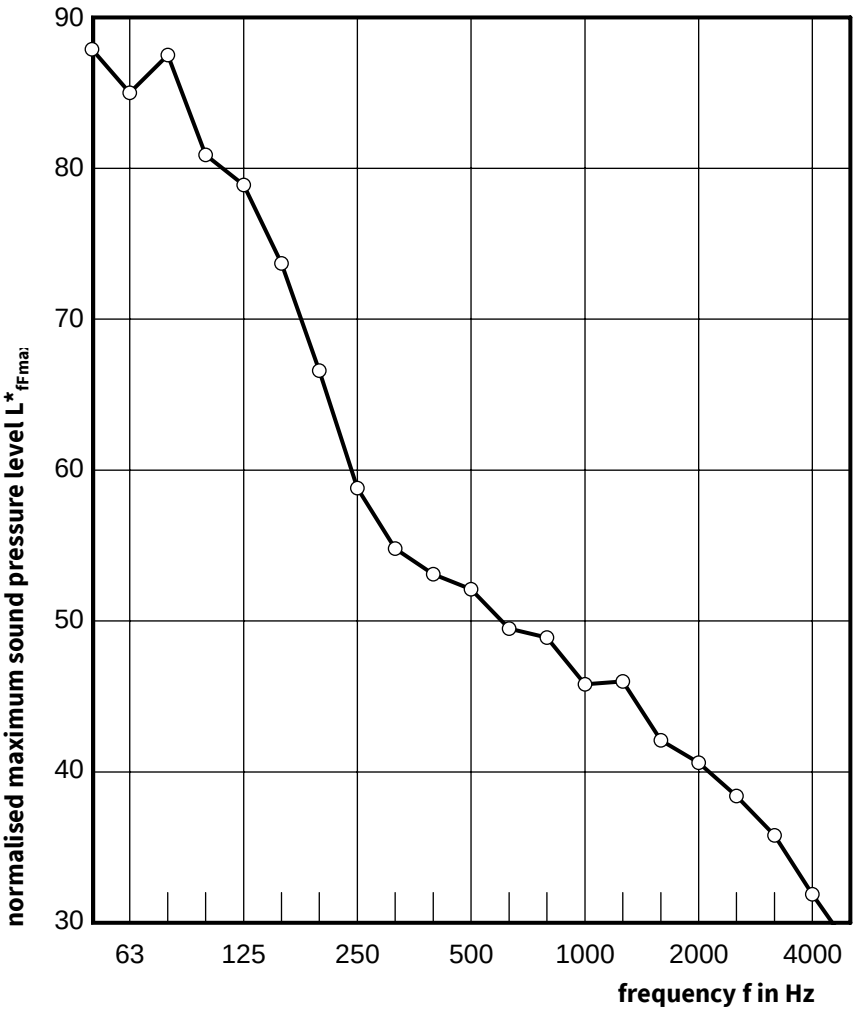
Structure of the reference floor/reinforced concrete slab:
150 mm Reinforced concrete slab (heavyweight reference floor in accordance with DIN EN ISO 10 140 [1])

Drop weight excitation with steel ball
weight: 30 kg
drop height: 40 cm
Excitation at 5 positions / 3 repetitions per position / energy-equivalent averaging of 15 measurement series (1 microphone position)

Installation and construction details of the Test set-up in annex 1 and 2

mass per unit area:	18,9	kg/m²
air temp. in source room:	14	°C
relative humidity:	72	%
static air pressure:	1004	hPa
source room volume:	--	m³
receiving room volume:	51	m³
Date of test:	10.10.2022	

Frequency f Hz	L^*_{fFmax} 1/3-octav dB
50	87,9
63	85,0
80	87,5
100	80,9
125	78,9
160	73,7
200	66,6
250	58,8
315	54,8
400	53,1
500	52,1
630	49,5
800	48,9
1000	45,8
1250	46,0
1600	42,1
2000	40,6
2500	38,4
3150	35,8
4000	31,9
5000	28,3



A-weighted normalised maximum sound pressure level

L^*_{AFmax} = 68,5 dB

Energy-equivalent average value from 15 measurement series / normalised to the reverberation time in the receiving room

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