Daidalos Peutz bouwfysisch ingenieursbureau

Vital Decosterstraat 67A - bus 1

B-3000 Leuven Belgium

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NOISE LAB REPORT Number A-2019LAB-024-H163-42591_E

Customer: BSW Berleburger Schaumstoffwerk GmbH

Am Hilgenacker 24 57319 Bad Berleburg

Germany

Contacts : Client : Enrico Eppner

Noise lab : Volker Spessart

Tests: Laboratory measurement of the reduction of impact noise by a floating floor system

on a heavyweight standard floor.

Product name : REGUPOL sonus curve, 17mm

Normative references:

NBN EN ISO 10140-3 Acoustics - Laboratory measurement of sound insulation of building elements

- Part 3: Measurements of impact sound insulation

Various other related norms:

NBN EN ISO 10140-1 Acoustics - Laboratory measurement of sound insulation of building elements

- Part 1: Application rules for specific products

NBN EN ISO 10140-4 Acoustics - Laboratory measurement of sound insulation of building elements

- Part 4: Measurement procedures and requirements

NBN EN ISO 10140-5 Acoustics - Laboratory measurement of sound insulation of building elements

- Part 5: Requirements for test facilities and equipment

NBN EN ISO 12999-1 Acoustics - Determination and application of measurement uncertainties in building acoustics

- Part 1: Sound insulation

NBN EN ISO 717-2 Acoustics - Rating of sound insulation in buildings and of building elements

- Part 2: Impact sound insulation

To perform the above measurements, the laboratory of Daidalos Peutz is accredited by BELAC "The Belgian Accreditation Body"
BELAC is a signatory of all existing MLAs (multilateral agreements) and MRAs (multilateral recognition agreements) of EA (European co-operation for Accreditation), ILAC (International Laboratory Accreditation Cooperation) and IAF (International Accreditation Forum).
In this way, reports and certificates issued by BELAC accredited bodies are internationally accredited.

 Date and reference of the request:
 01/08/2016
 2019LAB-024

 Date of receipt of the specimen (s):
 09/08/2016
 SONH163

Date of preparation of the report: 18/04/2019

This test report together with its annexes contains: 13 pages and must be multiplied only in its entirety.

Technical Manager, Laboratory Engineer,

Volker Spessart Karolien Benoit

Belgium

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MEASURING EQUIPMENT

Source signal

Brüel & Kjaer - 4292 : Omni Power Sound Source

Brüel & Kjear - 2716 : Power amplifier

Norsonic Nor277: Tapping machine conform ISO 10140-5 Annex E

Microphone and data acquisition system:

Brüel & Kjaer - 4189 : 1/2" free field microphone, 6Hz to 20kHz, prepolarized

Brüel & Kjaer - ZC-0032 : 1/2" microphone preamplifier

Brüel & Kjaer - 4231 : Sound calibrator 94&114dB SPL-1000Hz, Fulfils IEC 60942(2003)Class1

Brüel & Kjaer - JP 1041 : dual 10-pole adaptor JP-1041

Brüel & Kjaer - 2270 : Sound level meter - dual channel instrument (measuring both channels simultaneously)

Conforms with IEC 61672-1 (2002-05) Class 1

Brüel & Kjaer - 3923: rotating microphone boom

One rotating microphone system in the receiving room

4 Number of tapping machine positions:

> Minimum 0,7m between the different source positions Distances to the board of the floor at least 0.5 m Random positions and orientation of the tapping machine.

2 Number of microphone positions for each tapping machine position:

Microphone position with a rotating microphone

3 Number of rotations: 16 s/tr Rotation speed: 30 s Minimum rotation time:

Just not a rotation angle <10 ° to the chamber surfaces

Data processing

Brüel & Kjaer - BZ-5503 : utility software for hand-held analyzers Brüel & Kjaer - BZ-7229: dual-channel building acoustics software Brüel & Kjaer - 7830 : Qualifier Software for reporting results

A computer with proprietary software

48 s Averaging Time per measurement: 27 Number of reverberation time measurements (with graphic control):

Test chambers

51,4 m³ Volume receiving room: Reference floor area: 12,00 m² Surface test floor: 12,00 m²

There are diffusers and absorption material applied in the receiving room.

Standard floor

The base floor used is a 140 mm thick solid reinforced concrete slab. According to ISO 10140-5 Annex C this is the "heavyweight standard floor".

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STANDARD METHOD

The normalised impact sound pressure level Ln and the reduction of sound pressure level (improvement of impact sound insulation) ΔL were measured according to the standard NBN EN ISO 10140-3:2010. A detailed description of the test set up has been given in the figures of annex 1 of this report.

The tests were measured as follows:

- The test sample is mounted onto a heavyweight standard floor, in accordance with the descriptions in the standard NBN EN ISO 10140-1 and 10140-3.
- The standardized (see NBN EN ISO 10140-5:2010 Annex E) tapping machine is positioned in 3 or 4 positions on the test floor (depending on the sample). The impact sound pressure levels are measured in the receiving room below the test floor using a moving microphone A one-third octave band analyser measured the averaged sound levels in the third octave bands from 100 to 5000 Hz. If required, the levels are corrected to account for the background noise. The individual measurements are then averaged energetically for each one-third octave band and converted with the reverberation time measurements to the normalized impact sound pressure level Ln for a receiving room having 10m2 of equivalent sound absorption area.
- The normalized impact sound pressure level of the heavyweight standard floor Ln,0 is measured using the identical procedure.
- The normalized impact sound pressure level is calculated according to the following equation:

normalized impact sound pressure level of the bare floor with floor covering

- The temperature, relative humidity and static pressure is also measured in the test rooms.
- The improvement ΔL of the impact sound insulation is calculated from the difference between the weighted impact sound levels of the bare floor without and with the floor covering:

$$\Delta \, \, \textbf{L} = \, \, \textbf{L}_{\textbf{n},\textbf{0}} - \textbf{L}_{\textbf{n}} \qquad \qquad \textbf{[dB]}$$
 met
$$\Delta \, \, \textbf{L} = \qquad \text{The improvement of the impact sound insulation}$$

$$\textbf{L}_{\textbf{n},\textbf{0}} = \qquad \text{normalized impact sound pressure level of the bare floor}$$

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STANDARD METHOD

Single rating numbers

Evaluation according to EN ISO 717-2 defines single-number quantities, $L_{n,w}(C_i)$ for the impact sound insulation of floors and $\Delta L_w(C_{i,\Delta})$ for the impact sound reduction of floor coverings and floating floors from the results of measurements carried out in accordance with NBN EN ISO 10140-3. The values obtained in accordance with ISO 10140-3 are compared with reference values at the frequencies of measurement within the range 100Hz

The values obtained in accordance with ISO 10140-3 are compared with reference values at the frequencies of measurement within the range 100Hz to 3150 Hz for measurements in one-third octave bands. The calculation of the single-value indicator can not be summarised in a few lines. See standard NBN EN ISO 717-2 for details.

-n,w = weighted normalized impact sound pressure level

 $L_{n,w}$ + C_i = weighted normalized impact sound pressure level corrected with the adaptation term Ci

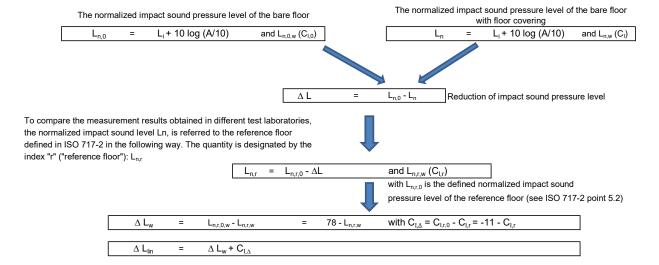
C_i = L_{n,sum} - 15 - L_{n,w} With L_{n,sum} the summation on an energetic basis for the one-third octave bands in the frequency range 100Hz to 2,5kHz

$$L_{n,sum} = 10 \log \sum_{i=1}^{\kappa} 10^{\frac{L_i}{10}}$$

Calculations of the spectrum adaptation term may additionally be carried out for an enlarged frequency range.

The single-number quantities of impact sound insulation properties of floors, presented as $L_{n,w}(C_i)$

The single-number quantities of the weighted reduction in impact sound pressure level for floorcoverings, is presented as ΔL_w ($C_{i,\Delta}$) and ΔL_{lin}



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SPECIAL MEASUREMENT CONDITIONS				
n/a				
ACCURACY				
the course of the import cound including accelerated can be conversed in terms of respect	tability (tooto within	one laboratory)		
The accuracy of the impact sound insulation as calculated can be expressed in terms of repeat and reproducibility (between various laboratories)	tability (tests within	one laboratory)		
Repeatability [r] When: - two tests are performed on identical test material - within a short period of time - by the inder unchanged environmental conditions - the probability will be 95% that the difference bether.				
Reproducibility [R]				
Vhen: - two tests are performed on identical test material - in different laboratories - by differe ne probability will be 95% that the difference between the two test results will be less than or or		different environm	ental conditions -	
n NBN EN ISO 12999-1 there is a statement on the reproducibility R to be expected, based or the reproducibility of the single figure rating Lw, Δ Lw is about 3 dB.	n the results of vario	us inter-laboratory	tests.	
he specific value of uncertainty is available on request				
ENVIRONMENTAL CONDITIONS during the tests				
	So	urce room	Receiving room	
emperature : Atmospheric pressure :	T = p =	21,9 °C 1025 hPa	20,9 °C 1025 hPa	
Relative humidity :	h _r =	64,0 %	77,0 %	

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MEASUREMENT AND CALCULATION DETAILS

The results as presented here relate only to the tested items and laboratory conditions as described in this report.

The results of the measurements are presented on the next pages (6 till 9)

- on page 7 : the measurement results for the normalized impact sound level for the bare floor (the naked laboratory floor)
- on page 8: the measurement results for the normalized impact sound level for the bare floor with floor covering, composition of the test element in annex 2
- on page 9: the calculation of the reduction of impact sound pressure

The results are given at all frequencies of measurement, both in tabular form and in the form of a graph.

The next table present an overview of the measurements and calculations

	Ln,0	Ln	ΔL	L _{n,r,0}	$L_{n,r}$	
f	bare floor	bare floor	L _{n,0} - L _n	reference floor	reference floor	
'	1 1	+ floor covering	'	according ISO 717-2 / 5.2	+ floor covering	
'	1 1	1	'	1	L _{n,r,0} - ∆L	
(Hz)	(dB)	(dB)	(dB)	(dB)	(dB)	
50	54,7	49,4	5,3			1
63	54,5	53,1	1,4	1	1	
80	63,7	59,1	4,6	1		
100	59,5	55,6	3,9	67,0	63,1	
125	59,2	53,6	5,6	67,5	61,9	
160	62,7	51,5	11,2	68,0	56,8	
200	64,2	52,0	12,2	68,5	56,3	
250	71,0	52,1	18,9	69,0	50,1	
315	71,3	48,2	23,1	69,5	46,4	
400	71,2	45,6	25,6	70,0	44,4	
500	71,0	40,1	30,9	70,5	39,6	
630	72,2	37,9	34,3	71,0	36,7	
800	72,7	35,8	36,9	71,5	34,6	
1000	73,5	33,4	40,1	72,0	31,9	
1250	73,9	29,7	44,2	72,0	27,8	
1600	73,7	27,4	46,3	72,0	25,7	
2000	73,1	21,0	52,1	72,0	19,9	
2500	72,8	18,3	54,5	72,0	17,5	
3150	71,8	15,6	56,2	72,0	15,8	
4000	70,2	12,6	57,6	/	1	
5000	67,6	13,9	53,7		1	
ISO	L _{n,0,w}	L _{n,w}		$L_{n,r,0,w}$	L _{n,r,w}	ΔL _w = 78 - Ln,r,w
717-2	79	45	<u>'</u>	78	50	28 dB
	C _{I,0}	C _I	4 '	C _{I,r,0}	C _{I,r}	C _{I,Δ} = CI,r,0 - CI,r
	-11	1	<u> </u>	-11	2	-13 dB

 $\Delta L_{lin} = \Delta L_w + C_{l,\Delta}$ 15 dB

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$L_{n,0}$

NORMALIZED IMPACT SOUND PRESSURE LEVEL (of standard floor) in accordance with ISO 10140-3:2010

BSW Berleburger Schaumstoffwerk GmbH Date of test: 09/08/2016 Client: Description of the test setup: The base floor used is a 140 mm thick solid reinforced concrete slab. According to ISO 10140-5 Annex C this is the "heavyweight standard floor". 51,4 m³ Receiving room volume V: Reference floor area: 12,0 m² reference values (according ISO 717-2) Tested floor area: 12,0 m² shifted reference values (according ISO 717-2) Signal: Standard tapping machine with steel-headed hammers. f $L_{n,0}$ (*) 80 (dB) (Hz) 1/3 octave bands 54,7 70 63 54,5 63,7 100 59,5 125 59,2 60 62,7 200 64 2 250 71,0 71,3 315 400 71.2 500 71,0 40 72,2 630 72,7 1000 73,5 30 1250 73,9 73,7 73,1 2500 72,8 20 3150 71.8 70,2 5000 67,6 10 octave bands : 63 56.1 125 60,2 1125 1250 1250 1315 1500 1000 1250 250 67,5 500 71.4 f [Hz] 1000 73,3 2000 73.2 69,5 B: Ln=< value shown (*) b : background noise correction used B : Maximum background noise correction used Rating according to ISO 717-2 Ln,0,w (Ci,0) = 79 (-11) dΒ Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method No.of test report: SONH159 Name of test institute: Daidalos Peutz Date: 09/08/2016 Signature: Volker Spessart

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NORMALIZED IMPACT SOUND PRESSURE LEVEL in accordance with ISO 10140-3:2010

Ln Client: **BSW Berleburger Schaumstoffwerk GmbH** Date of test: 09/08/2016 Description of the test setup: 45 mm prefab anhydrite screed slab 17 mm REGUPOL sonus curve, 17mm heavyweight standard floor = solid reinforced concrete slab 140 mm 51,4 m³ Receiving room volume V: Reference floor area: 12,0 m² reference values (according ISO 717-2) 12,0 m² Tested floor area : shifted reference values (according ISO 717-2) Signal: Standard tapping machine with steel-headed hammers. 80 f (*) (dB) (Hz) 70 1/3 octave bands : 50 49,4 53,1 80 59,1 60 55,6 100 125 53,6 160 51,5 Ln [dB] 50 200 52,0 52,1 315 48.2 400 45,6 40 500 40,1 630 37,9 800 35,8 30 1000 33.4 1250 29,7 27,4 2000 21,0 b 20 18,3 b 15,6 b 12,6 В 10 5000 13,9 octave bands : 63 125 53,2 250 50,4 500 40.2 f [Hz] 1000 32,2 20,9 13.9 B: Ln=< value shown (*) b : background noise correction used B: Maximum background noise correction used Rating according to ISO 717-2 dΒ Ln,w (Ci) 45 (1) Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method SONH163 Daidalos Peutz No.of test report: Name of test institute: Date: 09/08/2016 Signature: Volker Spessart

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ΛL

REDUCTION OF IMPACT SOUND PRESSURE LEVEL BY FLOOR COVERINGS in accordance with ISO 10140-3

Client: BSW Berleburger Schaumstoffwerk GmbH Date of test: 09/08/2016 Description of the test setup: prefab anhydrite screed slab 45 mm REGUPOL sonus curve, 17mm 17 mm 140 mm heavyweight standard floor = solid reinforced concrete slab Receiving room volume V: 51,4 m³ 12,0 m² Reference floor area: 12,0 m² Tested floor area: Signal: Standard tapping machine with steel-headed hammers. f ΔL =L_{n,0}- L_n (dB) (Hz) 1/3 octave bands : 60 50 5,3 80 4,6 3,9 50 125 5,6 160 11,2 200 12,2 250 18,9 23,1 400 25,6 500 30,9 630 34,3 30 800 36,9 1000 40,1 1250 44,2 46,3 20 52,1 2500 54,5 3150 56,2 57,6 10 5000 53,7 octave bands : 125 6,0 160 250 315 315 500 630 630 1250 1250 2500 2500 4000 250 15.8 500 28,8 f [Hz] 1000 39.5 2000 49,6 55,5 Rating according to ISO 717-2 $\Delta L_w (C_{i,\Delta})$ (-13) dB 28 dΒ ΔL_{lin} 15 Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method No.of test report: SONH163 Name of test institute: Daidalos Peutz Date: 09/08/2016 Signature: Volker Spessart

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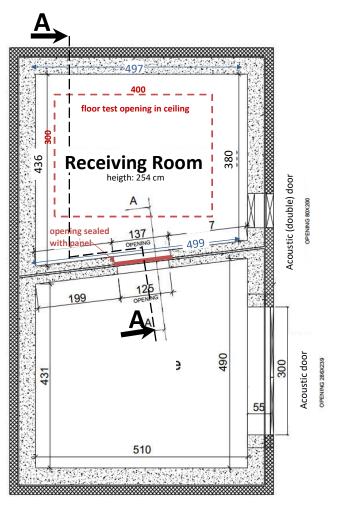


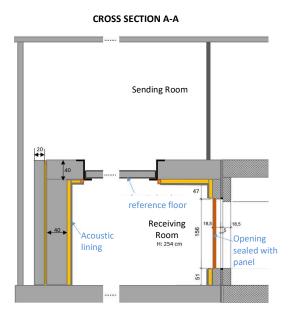


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ANNEX 1 : Sound insulation test facilities

The test rooms meet the requirements of ISO 10140-5
Both rooms are isolated for vibrations by using a so called room-in-room construction.





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ANNEX 2: Description test items by manufacturer

The test sample description given by manufacturer is checked visually as good as possible by the laboratory.

 $The \ correspondence \ between \ the \ test \ element \ and \ the \ commercialized \ product \ is \ the \ sole \ responsibility \ of \ the \ manufacturer$

Description of the test element as a layered structure

	Thickness			
	(mm)	ρ (kg/m³)	m" (kg/m²)	Description of the layer
1	45		±90	prefab anhydrite screed slab
2	17			REGUPOL sonus curve, 17mm
3	140	2300	322	heavyweight standard floor = solid reinforced concrete slab
4				
5				
6				
7				
8				
9				
10				

Total thickness = 202 mm

REGUPOL sonus curve, 17mm
It is a floating floor underlayer product for impact sound isolation.
The resilient layer is made from recycled rubber materials.





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ANNEX 3: Technical sheet

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The test sample description given by manufacturer is checked visually as good as possible by the laboratory.

The correspondence between the test element and the commercialized product is the sole responsibility of the manufacturer

On request at supplier.







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ANNEX 4: photographs of the test element or the test arrangement

Description of the assembly or drawing or photo

The floating floor underlayer product was placed on the standard concrete floor.

Then a prefab anhydrite screed slab was placed on top.

The topfloor had no rigid contact with the test opening construction. Gaps between the topfloor and the test opening were filled-up with sound-absorbing material.

To improve the acoustical sealing of the perimeter edge around the topfloor, additional sandbags were placed onto the gap. Remark: the sound-absorbing material and sandbags are not part of the floating floor product.





