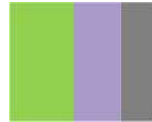


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N° 451-TEST



NBN EN ISO 17025:2017

EA MLA signatory

NOISE LAB
TEST REPORT Number A-2022LAB-111a-I628-44943_E

Customer :
Mulcol International
PO Box 93
4330 AB Middelburg
The Netherlands

Contacts :
 Client : Wiebe Scheffer-Geuze
 Noise lab : Els Meulemans

Tests : Laboratory measurement of airborne joint sound reduction of filling material
Product name : **Mulcol®Multisealant GR**

Reference norm :
 NBN EN ISO 10140-2:2021 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 2: Measurement of airborne sound insulation
 NBN EN ISO 10140-1:2021 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 1: Application rules for specific products
 Annex J Guidelines for the determination of sound reduction index of joints filled with fillers and/or seals
Various other related norms:
 NBN EN ISO 10140-4:2021 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 4: Measurement procedures and requirements
 NBN EN ISO 10140-5:2021 Acoustics - Laboratory measurement of sound insulation of building elements
 - Part 5: Requirements for test facilities and equipment
 NBN EN ISO 12999-1:2020 Acoustics - Determination and application of measurement uncertainties in building acoustics -
 - Part 1: Sound insulation (ISO 12999-1:2020)
 NBN EN ISO 717-1: 2021 Acoustics - Rating of sound insulation in buildings and of building elements
 - Part 1: Airborne sound insulation (ISO 717-1:2021)

To perform the above measurements, the laboratory of Daidalos Peutz is accredited by BELAC, "The Belgian Accreditation Body", under the certificate nr N°451-TEST. The activities covered by this accreditation certificate are covered by the EA MLA.
 BELAC is a signatory of all existing multilateral agreements and recognition agreements of International Laboratory Accreditation Cooperation (ILAC).
 In this way, reports issued by BELAC accredited bodies are internationally accredited.

Date and reference of the request:	25/10/2022	2022LAB-111a
Date of receipt of the specimen (s):	11/01/2023	SONI628
Date of tests:	17/01/2023	
Date of preparation of the test report:	1/03/2023	

The measurements were carried out at Daidalos Peutz Laboratory for Acoustics at Hoogdele, see appendix 1
 This test report together with its annexes contains : 12 pages and must be multiplied only in its entirety

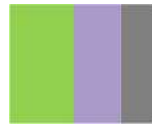
Technical Manager,

Paul Mees

Laboratory Engineer,

Els Meulemans

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MEASURING EQUIPMENT

Sound Sources

Brüel & Kjaer - 4292 : Omni Power Sound Source (+ Brüel & Kjaer - 2716 : Power amplifier)

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 - JP 1041 : dual 10-pole adaptor JP-1041

Brüel & Kjaer - 3923 : rotating microphone boom

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

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

Conforms with IEC 61672-1 Class 1

Two rotating microphone systems, one in the receiving room, one in the source room

Number of source positions: 3

Minimum 3m between the different source positions

Number of microphone positions for each source position: 3

Microphone position with a rotating microphone

Number of rotations: 3

Rotation speed: 16 s/tr

Minimum rotation time: 30 s

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 of results

A computer with proprietary software

Averaging Time per measurement: 48 s

Number of reverberation time measurements (with graphic control): 27 measurements

Test chambers

Volume source room: 65,48 m³

Volume receiving room: 52,77 m³

Total partition wall area: 1,88 m²

Dimension of the joint and joint element, see technical drawings in annex:

l, length of joint: 1000 mm

d, depth of joint: 27 mm (depth of joint 12 mm + backer 15 mm)

b, width of joint: 30 mm

D, depth of the joint cassette 150 mm

h, height of joint cassette and filler: 106 mm

There is absorption material applied in the test rooms

Partition wall

A convenient way to carry out tests of the sound insulation of penetration seals is to use the specific small-sized test opening in accordance with ISO 10140-5:2021,4.3.4. For this purpose, a highly sound insulating element is prepared, leaving a small opening, for the cassette with the sealing filler.

For the purpose of this measurement a twin leaf wall construction has been build into the test opening between the measuring rooms. (see Annex 1)

The wall construction exists out of separated frames, covered on the transmission side with : 6mm MDF + 2 layers of 1mm lead + 8mm plywood + 2 mass layers of 1mm lead and on the receiving side with : 12,5 mm plywood + 2 mass layers of 1 mm lead + 12,5 mm plywood

On the receiving side, the plating is funnel-shaped, with the narrow part on the cassette side and the wide side on the top and bottom edges in accordance with the prescriptions of ISO 10140-1 Annex E.

The twin leaf partition was mounted accros the acoustic break of the laboratory. The wall cavity was filled with rock wool.

There is no mechanical coupling between both parts of the filler wall. In addition, the filler wall does not make contact with the concrete wall of the laboratory.

An opening was provided in this filling wall for the installation of the cassette with the sealing fillers, which was filled with PE wool for the measurement of the closed filling wall, and sealed along both sides with the same laminated lead plates as described above.

With the completely closed filling wall we measured the maximum measurable sound reduction index with this set-up.

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STANDARD METHOD

Airborne sound insulation measurement

The tests were conducted in accordance with the provisions of the test method ISO 10140-2. A detailed description of the test set up has been given in the figures of annex 1 of this report.

The construction to be tested is placed into a test opening between two measuring rooms. In one of the rooms (the so-called sending room) broad band noise is generated by loud-speakers. 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.

In this sending room as well as in the adjacent room (the "receiving room") the resulting sound pressure level is measured by means of a continuous rotating boom, so the (time- and space-) averaged sound pressure level is determined.

The reverberation time of the receiving room is also measured. The measurement of the reverberation time in the receiving room allows to determine the sound absorption per octave band using Sabine's formula as in the ISO 10140-4 standard and in accordance with ISO 354

The equivalent sound absorption (m^2) in the receiving room is calculated as : $A = 0,16 V/T$ in which :

V = volume of the receiving room in cubic meter
 T = reverberation time in the receiving room in sec

In ISO 10140-1:2010 Annex J the sound reduction index of joints filled with fillers and/or seals is defined as the "sound reduction index of joints, R_s , per meter of a sealed gap or joint" to be evaluated according to the formula

$$R_s = L_1 - L_2 + 10 \lg \left(\frac{S_n l}{A l_n} \right)$$

where

L_1	=	the energy average sound pressure level in the source room, in dB (ref 20 μ Pa)
L_2	=	the energy average sound pressure level in the receiving room, in dB (ref 20 μ Pa)
l	=	the length of the joint in the used measurement set up, in metre
l_n	=	reference length ($l_n = 1$ m)
S_n	=	reference area ($S_n = 1$ m ²)
A	=	equivalent sound absorption in the receiving room, in square metre

The above parameters are determined at least in the 1/3 octave bands 100 Hz to 5000 Hz

The environmental conditions in the test rooms (temperature, relative humidity) are measured during the tests

The maximum measurable sound reduction index of joints with this set-up, related to l in this test set-up, $R_{s,max}$ is measured

Single-number quantity : $R_{s,w}$ (C;C_v)

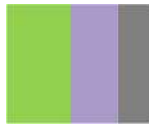
The values of the measured sound reduction index R_s of the joint are drawn-up in the diagram of the annexed data sheet as a function of the frequency (in 1/3 octave bands) and are given in a table.

According to EN ISO 717-1 the weighted sound reduction index $R_{s,w}$ and the spectrum adaptation terms C and C_v for the frequency range from 100 Hz to 3150 Hz can be calculated.

Optionally, these two terms are supplemented by additional adjustment terms (if necessary and measured data are available) on a wider frequency range between 50 Hz and 5000 Hz

Optionally and according other international standards, other single-number quantities have been calculated and stated.

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SPECIAL MEASUREMENT CONDITIONS

n/a

ACCURACY

The accuracy of the airborne sound insulation as calculated can be expressed in terms of repeatability (tests within one laboratory) and reproducibility (between various laboratories).

Repeatability [r]

When: - two tests are performed on identical test material - within a short period of time - by the same person or team - using the same instrumentation - under unchanged environmental conditions - the probability will be 95% that the difference between the two test results will be less than or equal to r.

Reproducibility [R]

When: - two tests are performed on identical test material - in different laboratories - by different person(s) - under different environmental conditions - the probability will be 95% that the difference between the two test results will be less than or equal to R.

In the standard ISO 12999-1:2020 there is a statement on the reproducibility R to be expected, based on the results of various interlaboratory tests.

The table below gives the reproducibility of the single-number values of the airborne sound insulation according to ISO 717-1, as specified in Table 3 of ISO 12999-1:2020

<i>situation A: reproducibility (same test samples, measured in different laboratories)</i>	R_w	$R_w + C$	$R_w + C_{tr}$
standard deviation under reproducibility conditions σ_R according to ISO 12999-1:2020 table 3	1,2 dB	1,3 dB	1,5 dB
expanded uncertainty $U = \sigma_R \cdot k$, $k=1,65$, 90% confidence level (two-sided)	2,0 dB	2,1 dB	2,5 dB
expanded uncertainty $U = \sigma_R \cdot k$, $k=1,96$, 95% confidence level (two-sided)	2,4 dB	2,5 dB	2,9 dB

A measurand, Y, shall then be stated as : $Y = u \pm U$

The standard also contains a quantity, σ_{R95} . It is derived from the same round robins as σ_R for airborne sound insulation represents an average of the upper interval limits for the standard deviation of reproducibility with a coverage probability of 95%.

For R_w , the σ_{R95} , from table D2 of Annex D in the standard ISO 12999-1:2020 is 2,0 dB.

For $R_w + C_{100-5000}$, the σ_{R95} , from table D2 of Annex D of the standard ISO 12999-1:2020 is 2,1 dB.

For $R_w + C_{tr100-5000}$, the σ_{R95} , from table D2 of Annex D of the standard ISO 12999-1:2020 is 2,4 dB.

The specific value of uncertainty is available on request

ENVIRONMENTAL CONDITIONS during the tests

	Source room	Receiving room
Temperature :	T = 19 °C	18,6 °C
Atmospheric pressure :	p = 984,9 hPa	984,5 hPa
Relative humidity :	h_r = 52,3 %	54,4 %

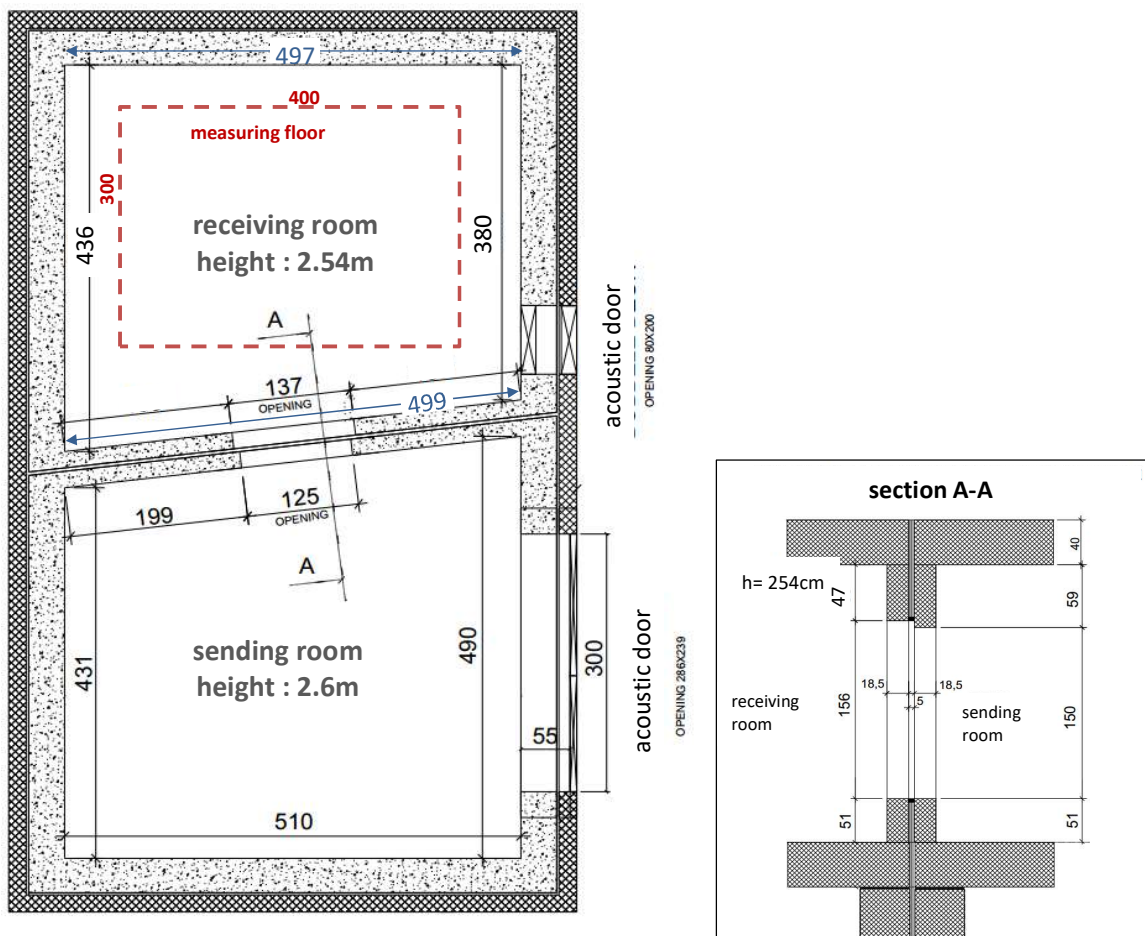
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ANNEX 1 : Sound insulation test facilities at Daidalos Peutz Laboratory of Acoustics

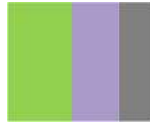
Daidalos Peutz Laboratory of Acoustics, Diksmuidesteeweg 17B/1, B-8830 Hoogdele, Belgium

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 of the 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:

Joint product :

name : Mulcol®Multisealant GR

density :

Size of joint :

length l: 1000 mm
 depth d: 27 mm (depth of joint 12 mm + backer 15 mm)
 width b: 30 mm

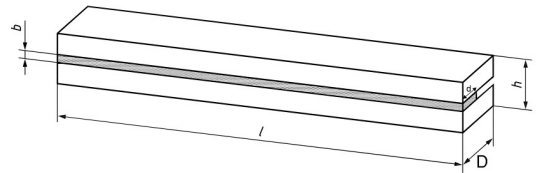


figure 1 : slide-in cassettes (drawing not in scale)

Size of joint element :

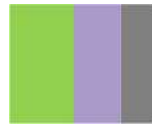
length l: 1000 mm
 depth D: 150 mm
 height h: 106 mm

Mulcol®Multisealant GR, firestop Intumescent Graphite

Mulcol®Multisealant GR is graphite-based sealant that foams and insulates when heated to for the fire-resistant sealing of gaps around services like cable and pipe penetrations. In the event of fire, this sealant prevents fire and smoke from spreading through fire-resistant walls and floors.

As mentioned in the EAD 350141-00-1106 from september 2017, the assesment method for the airborne sound insulation EN ISO 10140 shall be used for the determination of the sound reduction index of Joints Rs. In particular annex J of EN ISO 10140-1 shall be considered. This EAD 350141-00-1106 from september 2017 deals with the product group of 'linear joint and gap seals' for fire stopping and fire sealing products.

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ANNEX 3: Technical sheet

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

Further information can be obtained from the producer

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

The laboratory can make no judgement about the representativity of the tested samples.

The test report ahead is valid as long as the tested constructions and/or materials are unchanged.

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R_s

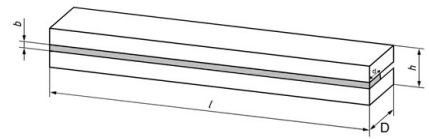
SOUND REDUCTION INDEX OF JOINTS according to ISO 10140-1
Laboratory measurement of the sound reduction index of joints

Client: Mulcol International

Date of test: 17/01/2023

Description of the test setup:

Mulcol®Multisealant GR, firestop Intumescent Graphite, 12 mm depth + 15 mm backer



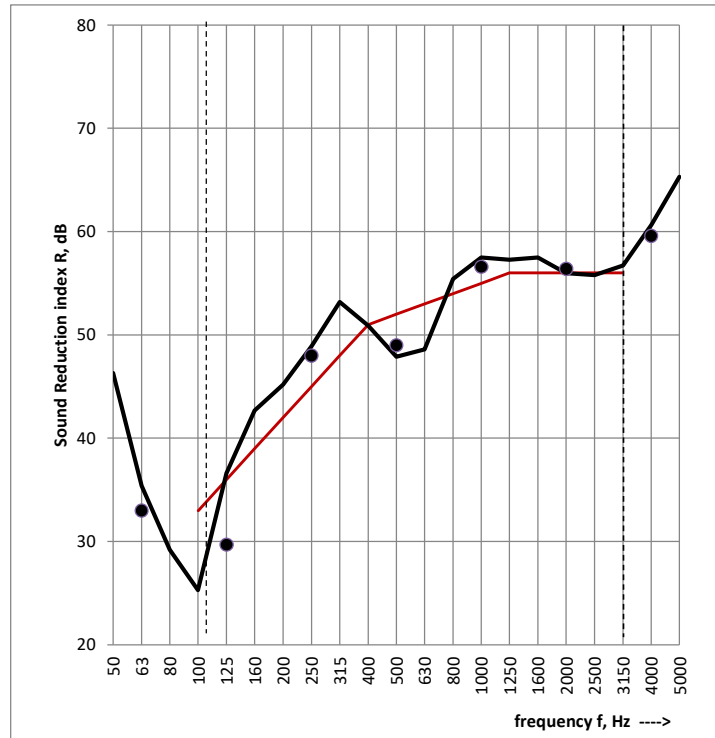
Length of joint, l: 1000 mm
Depth of joint, d: 27 mm (depth of joint 12 mm + 15 mm backer)
Width of joint, b: 30 mm
Depth of joint cassette, D : 150 mm

source room receiving room

Temperature: 19 18,6 °C
Atmospheric pressure: 984,9 984,5 hPa
Relative humidity: 52,3 54,4 %
— 1/3 oct. - - - - - Shifted reference values (according ISO 717-1)
● 1/1 oct. — reference values (according ISO 717-1)

Receiving room volume: 52,77 m³
Source room volume: 65,48 m³

frequency Hz	R_s 1/3 octave dB	R_s 1/1 octave dB	(*)
50	(≥ 46.3)		
63	(≥ 35.4)	33,0	
80	(≥ 29.2)		
100	(≥ 25.3)		
125	(≥ 36.6)	29,7	
160	(≥ 42.7)		
200	(≥ 45.2)		
250	(≥ 48.9)	48,0	
315	(≥ 53.2)		
400	50,9		
500	47,9	49,0	
630	48,6		
800	55,4		
1000	57,5	56,6	
1250	57,3		
1600	57,5		
2000	56,0	56,4	
2500	55,8		
3150	56,7		
4000	60,6	59,6	
5000	65,3		



(*) b : background noise correction used
B : Maximum background noise correction used
(≥ minimum value)

Rating in accordance with ISO 717-1:

Evaluation based on laboratory measurement results obtained by an engineering method:

$R_{s,w}$ ($C; C_{tr}$) = (≥ 55) (-2 ; -9) dB

$C_{50-3150}$ = -3 dB; $C_{50-5000}$ = -2 dB; $C_{100-5000}$ = -1 dB

Measurement uncertainty according to ISO12999-1:2020

$C_{tr,50-3150}$ = -10 dB; $C_{tr,50-5000}$ = -10 dB; $C_{tr,100-5000}$ = -9 dB

$R_{s,w}$ = 53,9 ± 2,4 dB

$R_{s,w}+C$ = 50,6 ± 2,5 dB

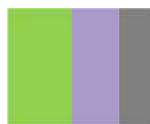
$R_{s,w}+C_{tr}$ = 44,2 ± 2,9 dB

Maximum sound reduction index of joints (related to test length) : $R_{s,max,w}$ = 58 dB

Measurement no.: SONI628
Date of test report: 1/03/2023

Test institute: Daidalos Peutz Laboratory of Acoustics, Hooglede, Belgium
Lab-engineer: Els Meulemans

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TEST REPORT Number A-2022LAB-111a-I628-44943_E

$R_{s,max}$

SOUND REDUCTION INDEX OF JOINTS according to ISO 10140-1

Laboratory measurement of the sound reduction index of joints

Client: Mulcol International

Date of test: 17/01/2023

Description of the test setup:

Maximal measurable sound reduction index of joints with used measurement set-up

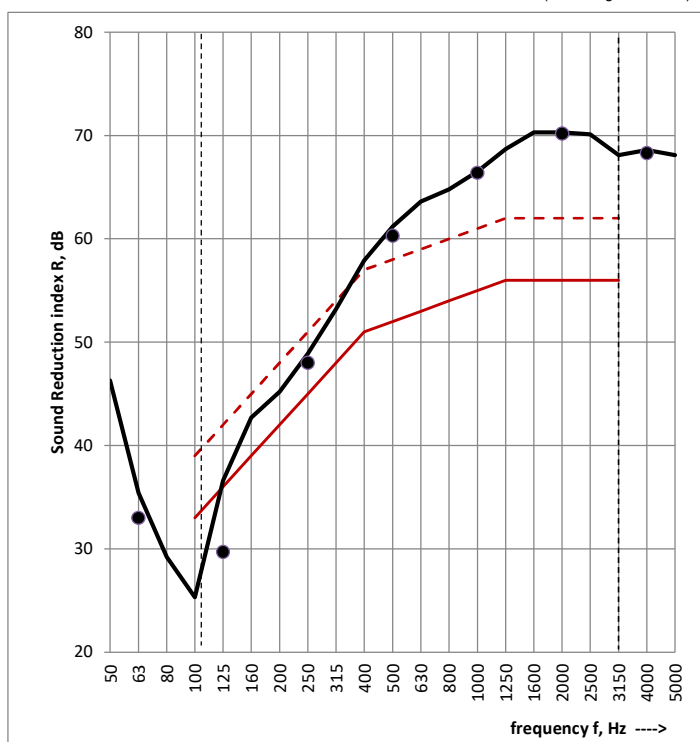
Length of joint, l: 1000 mm

Receiving room volume: 52,77 m³

Source room volume: 65,48 m³

	source room	receiving room
Temperature:	19	18,6 °C
Atmospheric pressure:	984,9	984,5 hPa
Relative humidity:	52,3	54,4 %
— 1/3 oct.	Shifted reference values (according ISO 717-1)	
● 1/1 oct.	reference values (according ISO 717-1)	

frequency Hz	$R_{s,max}$ 1/3 octave dB	$R_{s,max}$ 1/1 octave dB	(*)	(**)
50	46,3			
63	35,4	33,0		
80	29,2			
100	25,3			
125	36,6	29,7		
160	42,7			
200	45,2			
250	48,9	48,0		
315	53,2			
400	57,9			
500	61,2	60,3		
630	63,6			
800	64,8			
1000	66,5	66,4		
1250	68,7			
1600	70,3			
2000	70,3	70,2		
2500	70,1			
3150	68,1			
4000	68,6	68,3		
5000	68,1			



(*) b : background noise correction used
 B : Maximum background noise correction used
 (>= minimum value)

Rating in accordance with ISO 717-1:

Evaluation based on laboratory measurement results obtained by an engineering method:

$R_{s,max,w} (C; C_{tr}) = 58 \quad (-5 ; -13) \text{ dB}$

$C_{50-3150} = -6 \text{ dB}; \quad C_{50-5000} = -5 \text{ dB}; \quad C_{100-5000} = -4 \text{ dB}$

Measurement uncertainty according to ISO12999-1:2020

$R_{s,max,w} = 58,8 \pm \text{dB}$
 $R_{s,max,w} + C = 52,8 \pm \text{dB}$
 $R_{s,max,w} + C_{tr} = 44,7 \pm \text{dB}$

$C_{tr,50-3150} = -15 \text{ dB}; \quad C_{tr,50-5000} = -5 \text{ dB}; \quad C_{tr,100-5000} = -13 \text{ dB}$

Measurement no.: SONI631
Date of test report: 1/03/2023

Test institute: Daidalos Peutz Laboratory of Acoustics, Hooglede, Belgium
Lab-engineer: Els Meulemans