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daidalos peutz
laboratory of acoustics

N° 451-TEST
NBN EN ISO 17025:2017
EA MLA signatory

NOISE LAB
TEST REPORT Number A-2022LAB-111a-I627-44943_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 sound insulation of building elements
Product name :	**Mulcol®Multimortar**

Reference norm :

NBN EN ISO 10140-2:2021	Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation
Various other related norms:	
NBN EN ISO 10140-1:2021	Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products
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	SONI627
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 Hooglede, see appendix 1
This test report together with its annexes contains : 11 pages and must be multiplies 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 & Kjear - 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
Surface test opening:	0,03	m²

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 separeted 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 (m²) 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 10140-2 the airborne sound insulation of an object is defined as the "sound reduction index R" to be evaluated according to the formula (the formula (J.1) in ISO 10140-1:2020 is therefore not applied)

$$R = L_1 - L_2 + 10 \log (S/A) \quad [dB]$$

with
L_1 = sound pressure level in the sending room, in dB (ref 20µPa)
L_2 = sound pressure level in the receiving room, in dB (ref 20µPa)
S = area of the object to be tested, in square metre
A = equivalent sound absorption in the receiving room, in square metre

In this report, the area S is the actual frontal surface of the test specimen: the joint filler: 30 mm x 1000 mm
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

Single-number quantity : R_w ($C;C_{tr}$)

The values of the measured airborne sound reduction index of the tested element 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_w and the spectrum adaptation terms C and C_{tr} for the frequency range from 100 Hz to 3150 Hz can be calculated.

R_w = the 'weighted sound reduction index'
$R_w + C$ = characterize in one number the insulation of the test element against pink noise
$R_w + C_{tr}$ = characterize in one number the insulation of the test element against urban traffic noise

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.

situation A: reproducibility (same test samples, measured in different laboratories)	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 = σ_R * k, k=1,65, 90% confidence level (two-sided)	2,0 dB	2,1 dB	2,5 dB
expanded uncertainty U = σ_R * 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 ± 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 $R_w + C_{100\text{-}5000}$, the σ_{R95}, from table D2 of Annex D of the standard ISO 12999-1:2020 is 2,1 dB.
For $R_w + C_{tr100\text{-}5000}$, 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 =	19,1 °C	18,6 °C
Atmospheric pressure :	p =	984,5 hPa	984,2 hPa
Relative humidity :	h_r =	51,9 %	54,9 %

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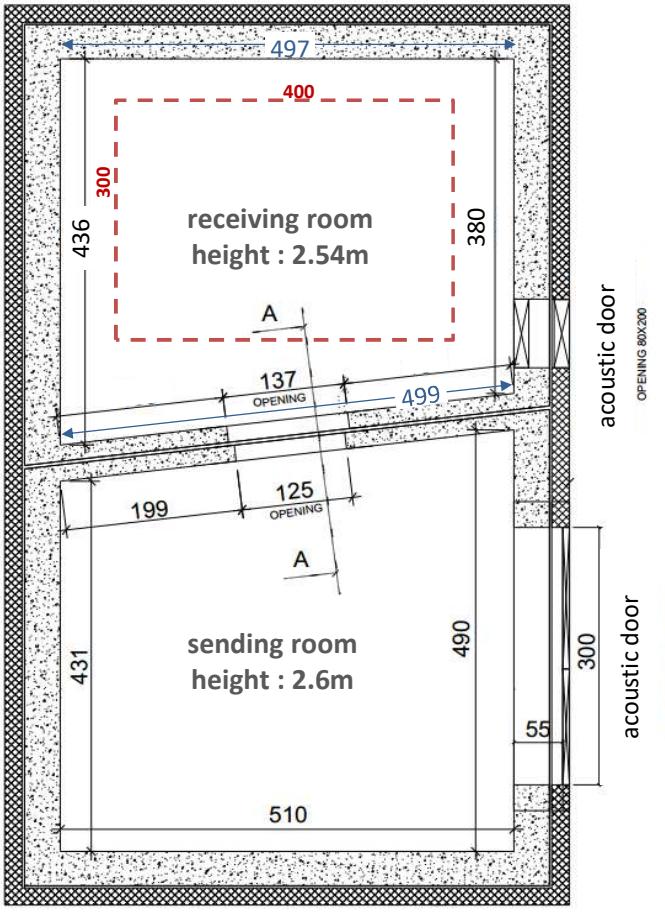
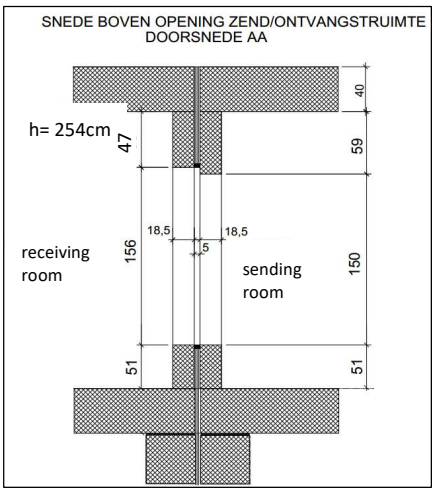
ANNEX 1 : Sound insulation test facilities at Daidalos Peutz Laboratory of Acoustics

Daidalos Peutz Laboratory of Acoustics, Diksmuidesteenweg 17B/1, B-8830 Hooglede, 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:

Penetration sealing product for fire stopping :
name : Mulcol®Multimortar
density :
Size of the test specimen :
lenght l : 1000 mm
depht d : 50 mm
width b : 30 mm

Size of the cassette:
length l: 1000 mm
depth D: 150 mm
height h: 106 mm

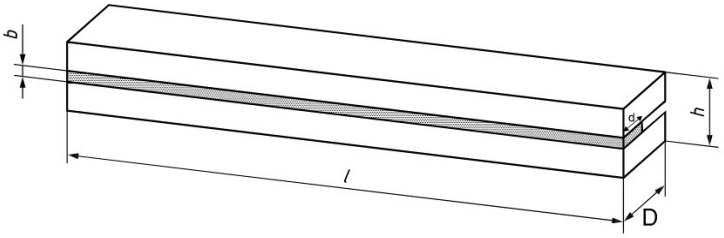

figure 1 : slide-in cassettes (drawing not in scale)

Mulcol®Multimortar, a firestop Mortar

Mulcol®Multimortar is a dry white powder consisting of non-organic compounds and perlite. When these are mixed with water, the compounds form a strongly thermal and insulating fire-resistant mass. In the event of fire, this mortar prevents fire and smoke from spreading through fire-resistant walls and floors. After having sealed openings with Mulcol®Multimortar, the wall or floor will retain its excellent acoustic properties

As mentioned in the EAD 350454-00-1104 from september 2017, the assesment method for the airborne sound insulation EN ISO 10140 parts 1,2,4 and 5 shall be used for the determination of the sound reduction index R and shall be expressed as a single number rating Rw(C;Ctr) in accordance with EN ISO 717-1.
The test shall be carried out without services passing through the specimen, using the "specific small sized opening" in accordance with ISO 10140-5, clause 3.3.3
This EAD 350454-00-1104 from september 2017 deals with the product group of 'penetration 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 decribed 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

SOUND REDUCTION INDEX according to ISO 10140-2
Laboratory measurement of airborne sound insulation between rooms

Client: **Mulcol International** Date of test: 17/01/2023

Description of the test setup:
Mulcol®Multimortar, a firestop Mortar

Area S of separating element: 0,03 m²

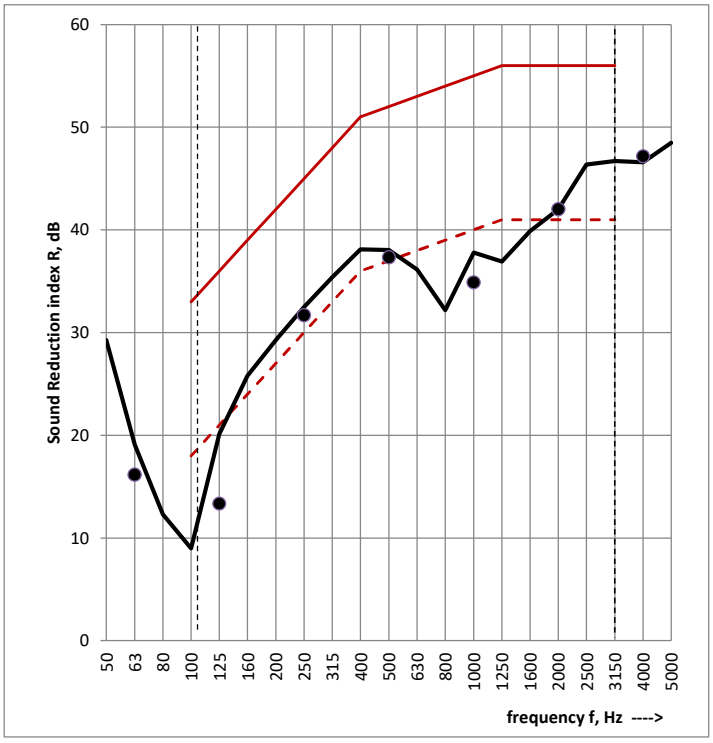
Receiving room volume: 52,77 m³
Source room volume: 65,48 m³

	source room	receiving room	
Temperature:	19,1	18,6	°C
Atmospheric pressure:	984,5	984,2	hPa
Relative humidity:	51,9	54,9	%

1/3 oct. ——— Shifted reference values (according ISO 717-1)
1/1 oct. ● ——— reference values (according ISO 717-1)

frequency Hz	R 1/3 octave dB	R 1/1 octave dB	(*)	(**)
50	29,3			M
63	**19,1**	**16,2**		M
80	12,3			M
100	9,0			M
125	**20,1**	**13,4**		**M**
160	25,8			M
200	29,3			M
250	**32,5**	**31,7**		**M**
315	35,4			M
400	38,1			M
500	**38,0**	**37,3**		**m**
630	36,2			m
800	32,2			
1000	**37,8**	**34,9**		**m**
1250	36,9			
1600	39,9			
2000	**42,0**	**42,0**		**m**
2500	46,4			m
3150	46,7			M
4000	**46,6**	**47,2**		**M**
5000	48,5			M

B or M : R >= value shown
(*) b : background noise correction used
B : Maximum background noise correction used
(**) m : flanking transmission correction used
M : Maximum flanking transmission correction used



Rating in accordance with ISO 717-1: *Evaluation based on laboratory measurement results obtained by an engineering method:*

R_w (C;C_{tr}) = 37 (-4 ; -10) dB

$C_{50\text{-}3150}$= -4 dB; $C_{50\text{-}5000}$= -3 dB; $C_{100\text{-}5000}$= -3 dB

Measurement uncertainty according to ISO12999-1:2020

R_w = 37,8 ± 2,4 dB
R_w+C = 34,4 ± 2,5 dB
R_w+C_{tr} = 27,9 ± 2,9 dB

$C_{tr,50\text{-}3150}$= -11 dB; $C_{tr,50\text{-}5000}$= -11 dB; $C_{tr,100\text{-}5000}$= -10 dB

Measurement no.: SONI627
Date of test report: 1/03/2023

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