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MA 39 – 21-04706

Vienna, 12. Juli 2021  
Total number of pages: 13

## Test Report (second execution)

### Measurement of the airborne sound insulation characteristics of sound absorbing panels for noise barriers, types "Whisper® NBO-40" and "Whisper® NBO-40-A3" (grooved in post-processing) with and without supports

Commissioned by	Sealed Air Verpackungen GmbH, Ernst-Diegel Straße 2, 36304 Alsfeld, Germany
Date of commission	31. Mai 2021 (through Mr. Ingo Lublow, Sealed Air Verpackungen GmbH)
Test date(s)	15. April 2019 and 27. May 2019
Test object(s)	Sound absorbing panels for noise barriers with smooth or grooved surfaces, with or without supports (simulated by a cover panel)  12 elements of 100 cm x 100 cm x 4.5 cm each (NBO-40)  12 elements of 100 cm x 100 cm x 4.5 cm each (NBO-40-A3)  The test material was delivered by the company commissioning the test.
Place of testing	Acoustics Laboratory, Reverberation Chamber 4 – Absorption, Research Centre, Laboratory and Certification Services of the City of Vienna, MA 39, Building Physics Labs
Testing programme	Determination of the sound absorption coefficient according to ÖNORM EN ISO 354:2003 and calculation of the single integer specification $DL_{\alpha}$ according to ÖNORM EN 1793-1:2013 (accr. range) and according to ÖNORM EN 16272-1:2012.





## 1 Commission

Based on your commission of 31 May 2021 (through Mr. Ingo Lublow, Sealed Air Verpackungen GmbH, Ernst-Diegel Straße 2, 36304 Alsfeld), the sound absorption coefficient of sound absorbing panels for noise barriers was to be measured in a specified set-up. The frequency-dependent sound absorption coefficient  $\alpha_s$  was established (through the determination of sound absorption in the reverberation chamber) and on this basis, the single integer noise reduction specification  $DL_\alpha$  (describing noise reduction in situations where noise from vehicle or rail traffic is reflected by a noise absorbing surface) was calculated.

## 2 Structure, installation and testing conditions

### 2.1 Structure of the noise barrier

Material:	Sound absorbing panels for noise barriers (12 panels, 100 cm x 100 cm) with a smooth surface and (12 panels, 100 cm x 100 cm) with a grooved surface, with and without supports (HEA 160, simulated by a cover panel)  Complete arrangement: pages 12 and 13
Dimensions:	100 cm x 100 cm x 4.5 cm (= size of individual element)
Mass:	appr. 1.1 kg (100 cm x 100 cm) per element (equivalent to appr. 1.1 kg/m <sup>2</sup> ), established by weighing a subset of elements individually

### 2.2 Type of installation

Type of installation:	Type A
Installation frame:	No lateral cover

### 2.3 Testing conditions

#### 2.3.1 Whisper® NBO-40:

Testing area:	total of 12.63 m <sup>2</sup> (= 12.00 m <sup>2</sup> base + 0.63 m <sup>2</sup> rim)
Air temperature:	20.3 / 20.4 / 20.4 °C                      No / Measurement 1 / Measurement 2
Air humidity:	46.8 / 44.8 / 44.8 % rel. humidity
Air pressure:	100.4 / 100.4 / 100.4 kPa

#### 2.3.2 Whisper® NBO-40-A3:

Testing area:	total of 12.66 m <sup>2</sup> (= 12.03 m <sup>2</sup> base + 0.63 m <sup>2</sup> rim)
Air temperature:	21.3 / 20.8 / 20.8 °C                      No / Measurement 3 / Measurement 4
Air humidity:	51.7 / 53.4 / 53.4 % rel. humidity
Air pressure:	99.4 / 99.4 / 99.4 kPa

The material delivered was placed on the floor of the reverberation chamber in accordance with ÖNORM EN ISO 354 as a closed surface (installation type A). Moreover, the surface on the face of the test material was not covered.

No mechanical fastenings were used in the test arrangement.



### 3 Measuring process

#### 3.1 Measuring equipment and test devices

Measuring system:	Norsonic Nor850 (2x)	S/N 8501147, 8501148
Calibrator:	Norsonic 1251	S/N 22781
Loudspeaker:	Norsonic dodecahedron loudspeaker 276	S/N 2765873
Amplifier:	PA – 260	S/N 22655
Microphones:	Norsonic 1225	S/N 215370, 215379, 215377, 48123, 103193, 112865
Preamplifier:	Norsonic 1209	S/N 20380 bis 20385

#### 3.2 Measuring reverberation time

Basically, two procedures for the measurement of decay curves have been presented, the interrupted noise method and the integrated impulse response method. The method used here was the interrupted noise method. Microphones and microphone positions, sound source and sound source position as well as the number of microphone and loudspeaker positions can be found in item 7.1, the interrupted noise measuring procedure and averaging are described in item 7.2 of ÖNORM EN ISO 354.

### 4 Definitions

The single integer specification for the assessment of the absorption properties of sound absorbing elements is the frequency-dependent sound absorption coefficient  $\alpha_{s,i}$  and the single integer specification  $DL_\alpha$  derived from it. The standards ÖNORM EN ISO 354:2003 and ÖNORM EN 1793-1:2013 as well as 1793-3:1998 and ÖNORM EN 16272-1:2013 as well as 16272-3-1:2012, respectively, provide the following calculation rules and definitions (applying mutatis mutandis):

#### 4.1 Sound absorption coefficient $\alpha_s$

The change in the equivalent sound absorption surface after the test object has been placed in the reverberation chamber, in comparison with the equivalent sound absorption surface of the empty test chamber, divided by the surface of the test object. This is defined for flat test objects and is designated as  $\alpha_s$  or  $\alpha_{s,i}$  (measured at  $i$  times the third octave band).

#### 4.2 Single integer specification $DL_\alpha$ according to ÖNORM EN 1793-1

To describe the effectiveness of the sound absorbing elements, the single integer specification  $DL_\alpha$  has to be derived. The individual sound absorption coefficients have to be weighted according to the standardised traffic noise spectrum defined in ÖNORM EN 1793-3 and to be calculated on the basis of the formula stated in item 5.2 of ÖNORM EN 1793-1. The rating is expressed in decibel (dB). This single integer specification is primarily suited to describe the sound absorption properties in situations in which traffic noise is reflected by the sound absorbing surfaces and reaches the recipient without being reflected from other surfaces or deflected by obstacles.



### 4.3 Single integer specification $DL_\alpha$ according to ÖNORM EN 16272-1

To describe the effectiveness of the sound absorbing elements alongside railway track, the single integer specification  $DL_\alpha$  has to be derived. The individual sound absorption coefficients have to be weighted according to the standardised rail traffic noise spectrum defined in ÖNORM EN 16272-3-1 and to be calculated on the basis of the formula stated in item 5 of ÖNORM EN 16272-3-1. The rating is expressed in decibel (dB). This single integer specification serves to compare the overall quality of noise barriers and related structures without considering the location, rail traffic composition and track type.

## 5 Results

The measurements produced the following levels:

Noise barrier	Mass per unit area	Type of installation	Single integer specification $DL_\alpha$	
			EN 1793-1	EN 16272-1
Sound absorbing panels for noise barriers (Whisper® NBO-40) "with supports" (Measurement 1)	1.1 kg/m <sup>2</sup>	Type A	<b>7 (7,35) dB</b>	<b>8 (8,24) dB</b>
Sound absorbing panels for noise barriers (Whisper® NBO-40) "without supports" (Measurement 2)	1.1 kg/m <sup>2</sup>	Type A	<b>8 (7,73) dB</b>	<b>9 (8,92) dB</b>
Sound absorbing panels for noise barriers (Whisper® NBO-40-A3) "without supports" (Measurement 3)	1.1 kg/m <sup>2</sup>	Type A	<b>9 (8,70) dB</b>	<b>12 (11,80) dB</b>
Sound absorbing panels for noise barriers (Whisper® NBO-40-A3) "with supports" (Measurement 4)	1.1 kg/m <sup>2</sup>	Type A	<b>9 (8,51) dB</b>	<b>11 (10,91) dB</b>

On pages 8 to 11, the measured curves (thick line) of the sound absorption coefficient  $\alpha_s$  are shown in relation to the respective frequencies (from 100 Hz to 5000 Hz) and numerical values are given for the individual sound absorption coefficients.



## 6 Technical standards

- Measuring and test pad standard: ÖNORM EN ISO 354: 1 November 2003
- Terms and units as well as analysis standards:
  - ÖNORM EN 1793-1 and -3: 1 January 2013 and 1 March 1998, respectively
  - ÖNORM EN 16272-1: 15 May 2013
  - ÖNORM EN 16272-3-1: 1 December 2012
  - ÖNORM B 8115-1: 1 June 2011

## 7 Comparison of measured levels for single integer specification $DL_\alpha$

### 7.1 according to ÖNORM EN 1793-1

Annex A of ÖNORM EN 1793-1:2013, Table A.1, groups sound absorption properties according to single integer specifications  $DL_\alpha$ :

Group	$DL_\alpha$ in dB
A 0	Not determined
A 1	$DL_\alpha < 4$
A 2	4 to 7
A 3	8 to 11
A 4	12 to 15
A 5	> 15

Please note: Rating according to ÖNORM EN 1793-1:2013 is identical with DIN EN 1793-1:2013.

### 7.2 according to ÖNORM EN 16272-1

No comparison within the meaning of ÖNORM EN 1793 can be made for the rating of noise barriers alongside railway tracks by calculating the single integer specification  $DL_\alpha$  according to the traffic spectrum in ÖNORM EN 16272-3-1. In this case, the single integer specification is calculated only.



## 8 Classification of the test object(s)

### 8.1 according to ÖNORM / DIN EN 1793-1

Based on the measured levels of sound absorption coefficient  $\alpha_s$  in the individual third-octave bands and the single integer specification  $DL_\alpha$  derived from these, the airborne sound insulation groups for the test objects (noise barriers – structures as described in 2.1 and 2.2 above) are as follows:

Noise barrier	Sound absorption single integer specification $DL_\alpha$	Sound absorption group
Sound absorbing panels for noise barriers (Whisper® NBO-40) with supports	7 dB	A 2
Sound absorbing panels for noise barriers (Whisper® NBO-40) without supports	8 dB	A 3
Sound absorbing panels for noise barriers (Whisper® NBO-40-A3) without supports	9 dB	A 3
Sound absorbing panels for noise barriers (Whisper® NBO-40-A3) with supports	9 dB	A 3

### 8.2 according to ÖNORM EN 16272-1

The classification of the test objects based on the measured levels of sound absorption coefficient  $\alpha_s$  in the individual third-octave bands resulted in a derived single integer specification  $DL_\alpha$

Noise barrier - Type	Sound absorption single integer specification $DL_\alpha$
Sound absorbing panels for noise barriers (Whisper® NBO-40) with supports	8 dB
Sound absorbing panels for noise barriers (Whisper® NBO-40) without supports	9 dB
Sound absorbing panels for noise barriers (Whisper® NBO-40-A3) without supports	12 dB
Sound absorbing panels for noise barriers (Whisper® NBO-40-A3) with supports	11 dB

### 8.3 according to ZTV-Lsw 06

The table in 7 above also conforms to ZTV-Lsw 6 (Additional Specifications and Guidelines for Building Noise Barriers along Roads, FGSV Verlag GmbH, 50999 Cologne, see 2.2, Table 1 of the Guidelines).

Thus, the noise barrier tested is classified as follows within the meaning of ZTV-Lsw 06: **"absorbent"** in the "Whisper® NBO-40" version and **"highly absorbent"** in the "Whisper® NBO-40-A3" version.

Please note:

- In case of doubt, the German test report is valid.



The Case Manager  
Dipl.-Ing. Roman Mottinger



The Head of the  
Building Physics Laboratory  
Dipl.-Ing. Dieter Werner, MSc



The Head of the Research Centre,  
Laboratory and Certification  
Dipl.-Ing. Georg Pommer



Annex: Measured curves and photo documentation



## Sound absorption coefficient according to ISO 354

Measurement of sound absorption coefficient in a reverberation room

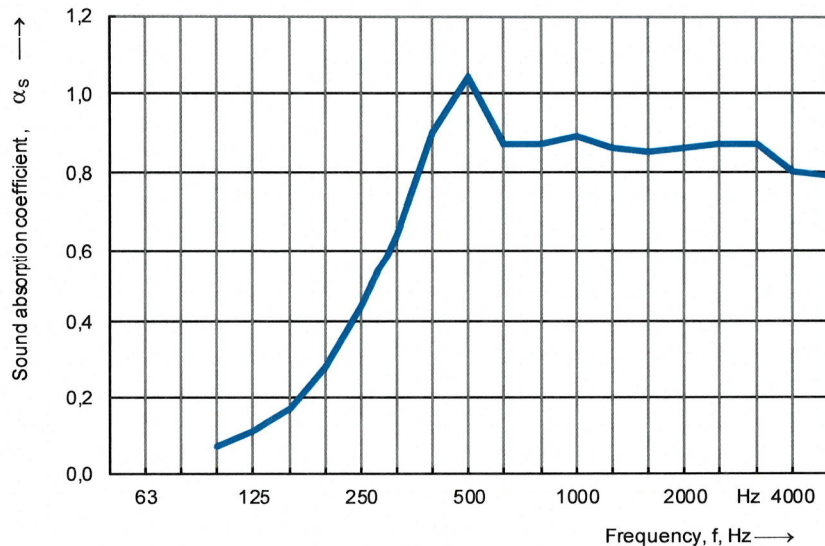
Client: Sealed Air Verpackungen GmbH, Ernst-Diegel Str. 2, 36304 Alsfeld, DE Date of test: 15.04.2019  
 Description: sound-absorbing panels for noise barriers 3,00m x 4,00m with supports consisting of  
 Absorber plates Typ "Whisper® NBO-40", 100cm x 100cm x 4,5cm (12 panels)  
 Complete arrangement: See page 12

Object:

Empty reverberation room:		Reverberation room with object	
Relative humidity:	46,8 %	Relative humidity:	44,8 %
Temperature:	20,3 °C	Temperature:	20,4 °C
Barometric pressure:	100,4 kPa	Barometric pressure:	100,4 kPa

Surface area: 12,63 m<sup>2</sup>  
 Room volume: 203,5 m<sup>3</sup>  
 Total room area St: 219,1 m<sup>2</sup>

Frequency f [Hz]	$\alpha_s$ 1/3 octave
50	
63	
80	
100	0,07
125	0,11
160	0,17
200	0,28
250	0,44
315	0,64
400	0,90
500	1,04
630	0,87
800	0,87
1000	0,89
1250	0,86
1600	0,85
2000	0,86
2500	0,87
3150	0,87
4000	0,80
5000	0,79



Name of test institute: MA 39 - Testing and Inspection Center and Certification Body of the City of Vienna  
 No. of test report: MA 39 - 21-04706

Date: 12.07.2021

Signature: 



## Sound absorption coefficient according to ISO 354

Measurement of sound absorption coefficient in a reverberation room

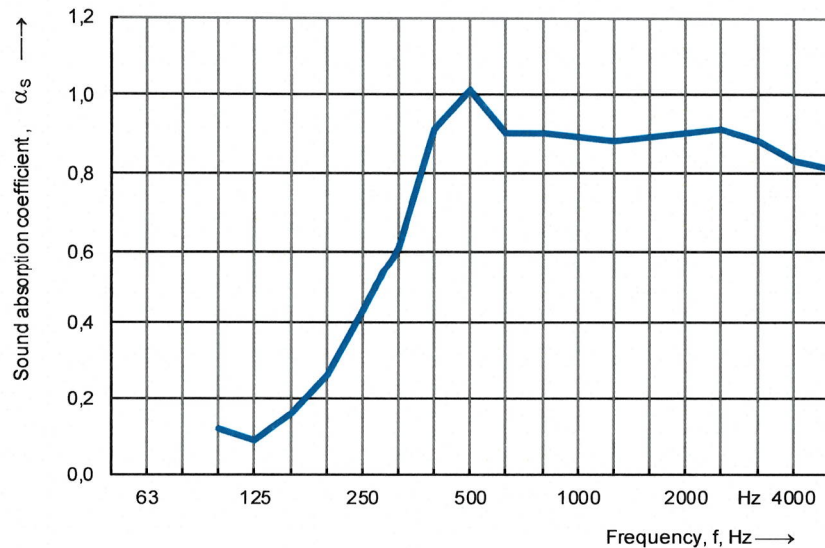
Client: Sealed Air Verpackungen GmbH, Ernst-Diegel Str. 2, 36304 Alsfeld, DE Date of test: 15.04.2019  
 Description: sound-absorbing panels for noise barriers 3,00m x 4,00m without supports consisting of Absorber plates Typ "Whisper® NBO-40", 100cm x 100cm x 4,5cm (12 panels)  
 Complete arrangement: See page 12

Object:

Empty reverberation room:		Reverberation room with object	
Relative humidity:	46,8 %	Relative humidity:	44,8 %
Temperature:	20,3 °C	Temperature:	20,4 °C
Barometric pressure:	100,4 kPa	Barometric pressure:	100,4 kPa

Surface area: 12,63 m<sup>2</sup>  
 Room volume: 203,5 m<sup>3</sup>  
 Total room area St: 219,1 m<sup>2</sup>

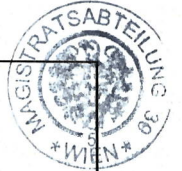
Frequency f [Hz]	$\alpha_s$ 1/3 octave
50	
63	
80	
100	0,12
125	0,09
160	0,16
200	0,26
250	0,43
315	0,61
400	0,91
500	1,01
630	0,90
800	0,90
1000	0,89
1250	0,88
1600	0,89
2000	0,90
2500	0,91
3150	0,88
4000	0,83
5000	0,81



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Signature: 



## Sound absorption coefficient according to ISO 354

Measurement of sound absorption coefficient in a reverberation room

Client: Sealed Air Verpackungen GmbH, Ernst-Diegel Str. 2, 36304 Alsfeld, DE Date of test: 27.05.2019  
 Description: sound-absorbing panels for noise barriers 3,00m x 4,00m without supports consisting of  
 Absorber plates Typ "Whisper® NBO-40-A3", 100cm x 100cm x 4,5cm (12 panels)  
 Complete arrangement: See page 13

Object:

Empty reverberation room:

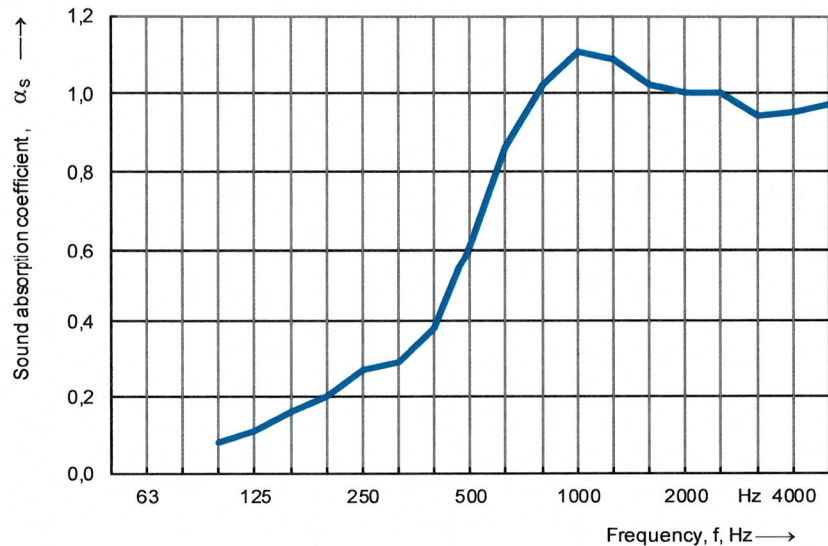
Relative humidity: 51,7 %  
 Temperature: 21,3 °C  
 Barometric pressure: 99,4 kPa

Reverberation room with object

Relative humidity: 53,4 %  
 Temperature: 20,8 °C  
 Barometric pressure: 99,4 kPa

Surface area: 12,66 m<sup>2</sup>  
 Room volume: 203,5 m<sup>3</sup>  
 Total room area St: 219 m<sup>2</sup>

Frequency f [Hz]	$\alpha_s$ 1/3 octave
50	
63	
80	
100	0,08
125	0,11
160	0,16
200	0,20
250	0,27
315	0,29
400	0,38
500	0,61
630	0,86
800	1,02
1000	1,11
1250	1,09
1600	1,02
2000	1,00
2500	1,00
3150	0,94
4000	0,95
5000	0,97



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 No. of test report: MA 39 - 21-04706

Date: 12.07.2021

Signature: 



### Sound absorption coefficient according to ISO 354

Measurement of sound absorption coefficient in a reverberation room

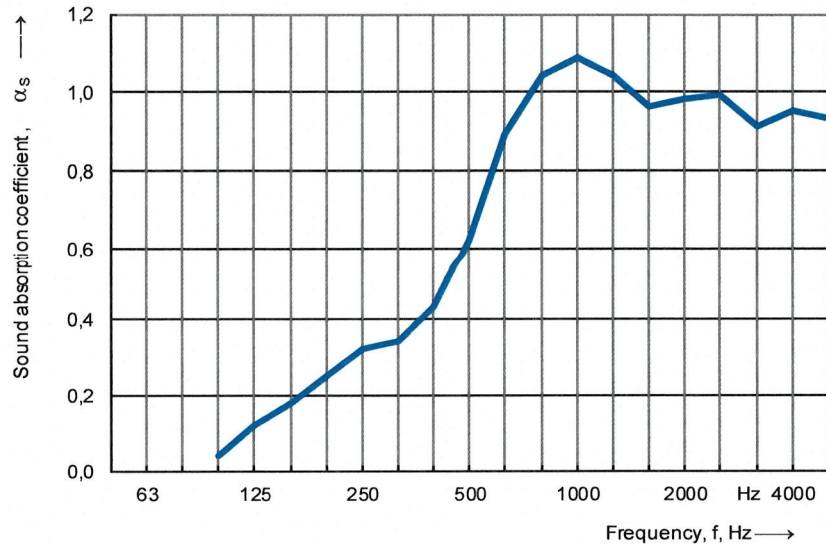
**Client:** Sealed Air Verpackungen GmbH, Ernst-Diegel Str. 2, 36304 Alsfeld, DE      **Date of test:** 27.05.2019  
**Description:** sound-absorbing panels for noise barriers 3,00m x 4,00m with supports consisting of  
 Absorber plates Typ "Whisper® NBO-40-A3", 100cm x 100cm x 4,5cm (12 panels)  
 Complete arrangement: See page 13

**Object:**

<b>Empty reverberation room:</b>		<b>Reverberation room with object</b>	
Relative humidity:	51,7 %	Relative humidity:	53,4 %
Temperature:	21,3 °C	Temperature:	20,8 °C
Barometric pressure:	99,4 kPa	Barometric pressure:	99,4 kPa

Surface area: 12,66 m<sup>2</sup>  
 Room volume: 203,5 m<sup>3</sup>  
 Total room area St: 219 m<sup>2</sup>

Frequency f [Hz]	$\alpha_s$ 1/3 octave
50	
63	
80	
100	0,04
125	0,12
160	0,18
200	0,25
250	0,32
315	0,34
400	0,43
500	0,62
630	0,89
800	1,04
1000	1,09
1250	1,04
1600	0,96
2000	0,98
2500	0,99
3150	0,91
4000	0,95
5000	0,93



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**Date:** 12.07.2021

**Signature:**

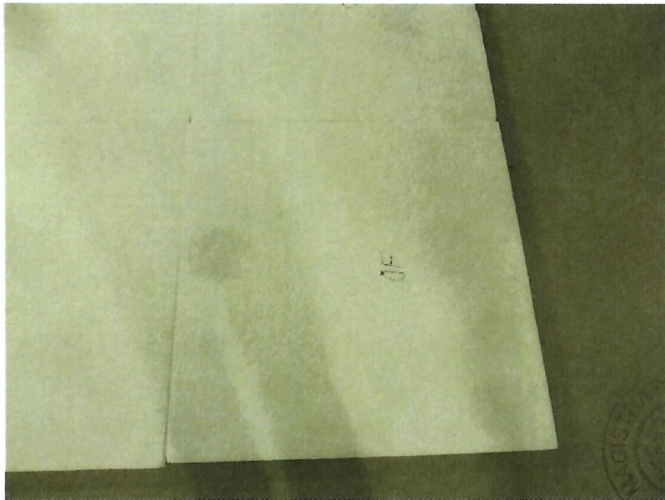


Illustration no. 1  
Individual elements  
(Whisper® NBO-40)  
100 cm x 100 cm  
4.5 cm thick

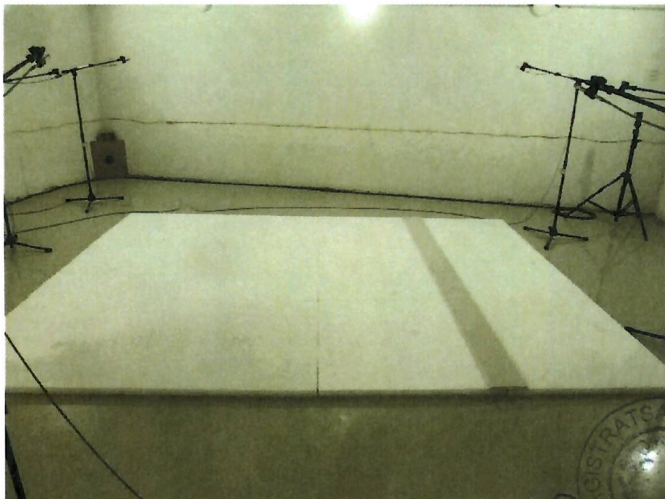


Illustration no. 2  
Arrangement on chamber floor  
Whisper® NBO-40 with support  
(simulated by a cover panel)



Illustration no. 3  
Arrangement on chamber floor  
Whisper® NBO-40  
without support



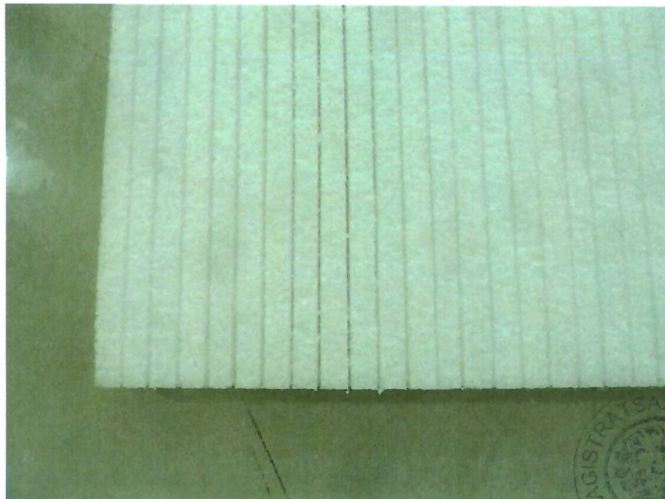


Illustration no. 4  
Individual elements  
(Whisper® NBO-40-A3)  
100 cm x 100 cm  
4.5 cm thick

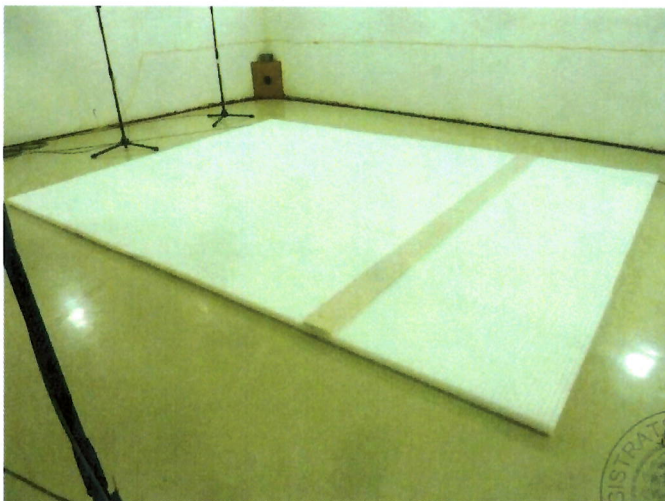


Illustration no. 5  
Arrangement on chamber floor  
Whisper® NBO-40-A3  
with support  
(simulated by a cover panel)

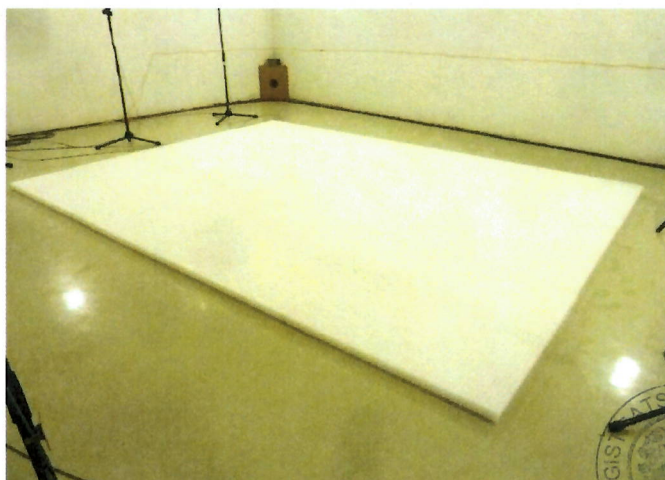


Illustration no. 6  
Arrangement on chamber floor  
Whisper® NBO-40-A3  
without support

