**Daidalos Peutz** bouwfysisch ingenieursbureau
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VAT: BE 0454.276.239
www.daidalospeutz.be

daidalos peutz
laboratory of acoustics

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

# NOISE LAB
# TEST REPORT Number A-2022LAB-106-10-45050_E

| | | |
|---|---|---|
| **Customer :** | Texdecor<br>Rue d'Hem, 2<br>59780 Willems<br>France | |
| **Contacts :** | **Client :** | Max Olivier Loubert |
| | **Noise lab :** | Els Meulemans |
| **Tests :** | Measurement of sound absorption in the reverberation room | |
| **Product name :** | **SlimUp ceiling (1200 x 300 x 9 mm) - 200 mm between the parallel rows - air cavity 220 mm** | |

**Normative references:**

| | |
|---|---|
| **NBN EN ISO 354:2003** | **Acoustics - Measurement of sound absorption in a reverberation room** |
| NBN EN ISO 11654:1997 | Acoustics - Sound absorbers for use in buildings - Rating of sound absorption |
| NBN ISO 9613-1:1996 | Acoustics - Attenuation of sound during propagation outdoors - part 1 : Calculation of the absorption of sound by the atmosphere |
| ISO 12999-2:2020 | Acoustics - Determination and application of measurement uncertainties in building acoustics Part 2: Sound absorption |

**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:** | 8/10/2022 | 2022LAB-106 |
| **Date of receipt of the specimen(s):** | 4/05/2023 | 10 |
| **Date of construction:** | 4/05/2023 | |
| **Date of tests:** | 4/05/2023 | |
| **Date of preparation of the test report:** | 25/09/2023 | |

The measurements were carried out at Daidalos Peutz Laboratory for Acoustics at Hooglede, see appendix 1
This test report together with its annexes contains : 9 pages and must be multiplied only in its entirety

Technical Manager,

Paul Mees

Laboratory Engineer,

Els Meulemans

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-10-45050_E

## MEASURING EQUIPMENT

**Signal**
Brüel & Kjaer - 4292 : Omni Power Sound Source

**Microphone system:**
Brüel & Kjaer - 4189-L-001 : 1/2" free field microphone prepolarized, inclusive 2669L TEDS
Brüel & Kjaer - 4189 : 1/2" free field microphone, 6Hz to 20kHz, prepolarized
Brüel & Kjaer - 2669 : 1/2" microphone preamplifier
Brüel & Kjaer - 4231 : Sound calibrator 94&114dB SPL-1000Hz, Fulfils IEC 60942(2003)Class1

| | | |
|---|---|---|
| Number of source positions: | 2 | (Different sound source positions at least 3m apart. |
| Number of microphone positions for each source position: | 8 | The measurements shall be made with different microphone positions |
| Number of measured decays curves: | 3 | which are at least 1,5m apart, 2m from any sound source and 1m from |
| Total number of measurements with different positions for microphone & source: | 16 | any room surface and the test specimen.) |

**Signal processing**
Brüel & Kjaer - 2716C : Power amplifier
Brüel & Kjaer - 3050-A-6/0: Signal generator, 6-ch. Inputmodule LAN-XI
Brüel & Kjaer - 3160-A-042: Signal generator, 4/2-ch. Input/output module LAN-XI
Brüel & Kjaer : PULSE Labshop Version 13.5
A PC with all necessary software

**Reverberation room**

| | | |
|---|---|---|
| Dimensions of the room: | Total volume : | 298,3 m³ |
| | Length: | 9,99 m |
| | Width | 4,97 m |
| | Height | 5,98 m |
| | Volume door opening : | 1,32 m³ |
| | Total area: | 279,9 m² |
| | $l_{max}$ = 12,65 m < 1,9 $V^{⅓}$ | |

In order to improve the diffusivity, the use of diffusers is necessary
The test specimen shall have a maximum area of 15,62 m², which depends on the room volume

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-10-45050_E

## TEST METHOD

The tests were conducted in accordance with the provisions of the test method EN ISO354:2003. A detailed description of the test set up has been given in the figures of annex 1 of this report.
The measurement method can be simply descibed as follows:

Essence of the test is in measuring of the reverberation time in the empty reflecting room and in the same room with the test sample inside it. The sound-absorption properties of a material depend on how the material is mounted during the test. Annex B of ISO 354:2003 specifies several different standard mountings that shall be used during a test for sound absorption. Normally a test specimen is tested using only one of the specified mountings.

From these reverberation times, the equivalent sound absorption area of the test specimen, is calculated by using Sabine's equation. Measurement is carried out in ranges of 1/3 octave and interval from 100Hz to 5000Hz.

The equivalent sound absorption area of the empty reverberation room, A1, in square metres, shall be calculated using the formula (1) :

$A_1 = 55{,}3\ V / (c_1 T_1) - 4Vm_1$ [m²] (1)

The equivalent sound absorption area of the reverberation room containing a test specimen, A2, in square metres, shall be calculated using the formula (2) :

$A_2 = 55{,}3\ V / (c_2 T_2) - 4Vm_2$ [m²] (2)

The equivalent sound absorption area of the test specimen, AT, in square metres, shall be calculated using the formula (3) :

$A_T = A_2 - A_1 = 55{,}3\ V\ (1/c_2T_2 - 1/c_1T_1) - 4V(m_2 - m_1)$ [m²] (3)

The sound absorption coefficient of a plane absorber or a specified array of test objects shall be calculated using the formula (4):

$\alpha_S = A_T / S$ (4)

whereas:
- $A_1$ = *The equivalent sound absorption area of the empty reverberation room in square metres*
- $A_2$ = *The equivalent sound absorption area of the reverberation room containing a test specimen in square metres*
- $V$ = volume , in cubic metres, of the empty reverberation room [m³]
- $c_1, c_2$ = the propagation speed of sound in air, in [m/s], calculated using the formula (in function of the temperature in the room during the test)
  c=331 + 0,6 t with t= the air temperature in degrees Celsius for temperatures in the range of 15°C to 30°C
- $T_1$ = *the reverberation time, in seconds, of the empty reverberation room*
- $T_2$ = *the reverberation time, in seconds, of the reverberation room after the test specimen has been introduced*
- $m_1, m_2$ = *the power attenuation coefficient, in reciprocal metres, calculated according to ISO 9613-1:1993*
- $A_T$ = *The equivalent sound absorption area of the test specimen in square metres*
- $S$ = *the area, in square metres, covered by the test specimen*
- $\alpha_s$ = *the sound absorption coefficient*

## SPECIAL MEASUREMENT CONDITIONS

-
-
-
-
-

n/a

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-10-45050_E

## RATING OF SOUND ABSORPTION

### $\alpha_p$ PRACTICAL SOUND ABSORPTION COEFFICIENT

Frequency-dependent value of the sound absorption coefficient which is based on measurements on one-third-octave bands in accordance with ISO 354 and which is calculated in octave bands in accordance with the standard ISO 11654:1997.
The practical sound absorption coefficient, api, for each octave band i, is calculated from the arithmetic mean value of the three one-third octave sound absorption coefficients within the octave. The mean value is calculated to the second decimal and rounded in steps of 0,05 and maximized to 1,00 for rounded mean values > 1,00

### $\alpha_w$ WEIGHTED SOUND ABSORPTION COEFFICIENT

The weighted sound absorption coefficient is determined as a single number value from the practical sound absorption coefficients from 250 Hz to 4000 Hz. The practical sound absorption coefficient is calculated according to ISO 11654:1997.
Single-number frequency-independent value which equals the value of the reference curve at 500 Hz after shifting is as specified in the standard ISO 11654:1997.

### SHAPE INDICATORS, L,M,H

Whenever a practical sound absorption coefficient api exceeds the value of the shifted reference curve by 0,25 or more, one or more shape indicators shall be added, in parantheses, to the aw value.
If the excess absorption occurs at 250 Hz, use the notation L.
If the excess absorption occurs at 500 Hz or 1000 Hz, use the notation M.
If the excess absorption occurs at 2000 Hz or 4000 Hz, use the notation H.

### NRC NOISE REDUCTION COEFFICIENT

The NRC is a single-number index determined in a lab test and used for rating how absorptive a particular material is. This industry standard ranges from zero (perfectly reflective) to 1 (perfectly absorptive). It is simply the average of the mid-frequency sound absorption coefficients (250, 500, 1000 and 2000 Hertz) rounded to the nearest 5%.

### SAA SOUND ABSORPTION AVERAGE

NRC is being replaced by the Sound Absorption Average (SAA), which is described in the current ASTM C423-17. The SAA is a single-number rating of sound absorption properties of a material similar to NRC, except that the sound absorption values employed in the averaging are taken at the twelve one-third octave bands from 200 Hz to 2500 Hz, inclusive, and rounding is to the nearest multiple of 0.01.

**The NRC and SAA results are not within the scope of the accreditation.**

Test results related to tested object only. The test results should not be considered as material constants, the absorption depends not only on the material itself. The method of construction, the size of the material surface and its place in the room, affect the sound absorption characteristics of the test element.

## ACCURACY

The accuracy of the absorption coefficients as calculated can be expressed in terms of repeatability of measured reverberation times (tests within one laboratory) and reproducibility (between various laboratories)

The expanded uncertainty under reproducibility conditions, U, is calculated in accordance to the standard ISO 12999-2 for the confidence level of 95%, used the coverage factor k=2

$U = u*k$ met

u = uncertainty under reproducibility conditions
k = coverage factor (k=2 for a confidence level of 95%)
U = expanded uncertainty under reproducibility conditions

This standard specifies how to calculate :
- the uncertainty of sound absoption coefficients and equivalent sound absorption areas measured according to ISO 354
- the uncertainty of the practical and weighted sound absorption coefficients determined according to ISO 11654

The numbers given are derived form inter-laboratory measurements with different types of test specimens including suspended ceilings, mineral wool, foams.

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-10-45050_E

## $\alpha_s$ SOUND ABSORPTION COEFFICIENT

| | |
|---|---|
| EN ISO 354:2003 | Acoustics - Measurement of sound absorption in a reverberation room |
| EN ISO 11654:1997 | Acoustics - Sound absorbers for use in buildings - Rating of sound absorption |
| ISO 12999-2:2020 | Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 2: sound absorption |

**Identification number of test element:** **10** **Test date:** 4/05/2023
**Name of test institute :** Daidalos Peutz Laboratory of Acoustics, Hooglede, Belgium

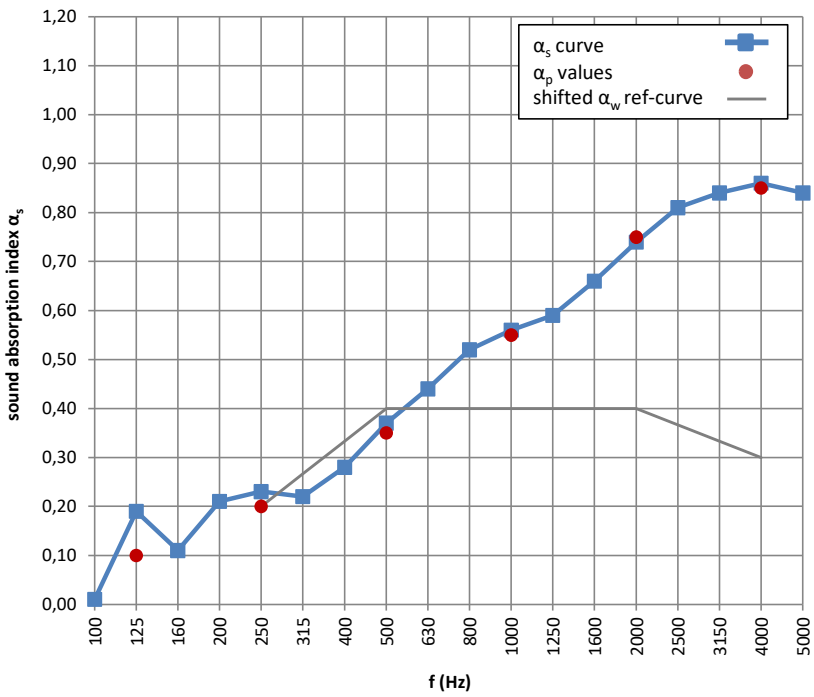
**Reverberation room:** V = 298,3 m³ $S_{tot}$ = 279,9 m²

| **Room conditions during measurements:** | | Empty room | With testelement | |
|---|---|---|---|---|
| **Temperature:** | T = | 17,4 | 17,1 | °C |
| **Atmospheric pressure:** | p = | 102,1 | 101,0 | kPa |
| **Relative humidity :** | $h_r$ = | 60 | 65 | % |

**Type of test element:** **Plane absorber**
**Construction characteristics:** Mounting type in line with ISO354 Annex B: Type J mounting (array of baffles or pads)
Area of test element: 10,5 m²
Total thickness: 520 mm
Number of layers,including air spaces: 2
Connection of layers: The grilles were arranged in 15 parallel rows at a spacing of 200 mm and there was no airspace between the single grilles in a row.
There was an airspace of 220 mm between the grilles and the floor of the reverberation room.

| f(Hz) | $T_1$ (s) | $T_2$ (s) | $\alpha_s$ | ±U (k=2) |
|---|---|---|---|---|
| 50 | | | | |
| **63** | | | | |
| 80 | | | | |
| 100 | 9,86 | 9,64 | 0,01 | ± 0,03 |
| **125** | **8,02** | **5,99** | **0,19** | ± 0,10 |
| 160 | 7,58 | 6,46 | 0,11 | ± 0,06 |
| 200 | 7,92 | 5,80 | 0,21 | ± 0,08 |
| **250** | **8,55** | **6,00** | **0,23** | ± 0,07 |
| 315 | 8,76 | 6,20 | 0,22 | ± 0,06 |
| 400 | 8,01 | 5,40 | 0,28 | ± 0,06 |
| **500** | **7,87** | **4,81** | **0,37** | ± 0,07 |
| 630 | 8,00 | 4,56 | 0,44 | ± 0,07 |
| 800 | 7,85 | 4,18 | 0,52 | ± 0,07 |
| **1000** | **7,86** | **4,01** | **0,56** | ± 0,07 |
| 1250 | 7,39 | 3,82 | 0,59 | ± 0,08 |
| 1600 | 6,50 | 3,38 | 0,66 | ± 0,08 |
| **2000** | **5,75** | **3,00** | **0,74** | ± 0,08 |
| 2500 | 4,77 | 2,61 | 0,81 | ± 0,08 |
| 3150 | 3,96 | 2,32 | 0,84 | ± 0,08 |
| **4000** | **3,19** | **2,03** | **0,86** | ± 0,08 |
| 5000 | 2,55 | 1,77 | 0,84 | ± 0,07 |

| f(Hz) | $\alpha_p$ | ±U (k=2) |
|---|---|---|
| 125 | 0,10 | |
| 250 | 0,20 | ± 0,06 |
| 500 | 0,35 | ± 0,08 |
| 1000 | 0,55 | ± 0,08 |
| 2000 | 0,75 | ± 0,08 |
| 4000 | 0,85 | ± 0,10 |




$\alpha_w$ = **0,40** **(H)*** **± 0,07 (k=2)**
Sound absorption class: D

**NRC =** 0,45 **
**SAA =** 0,47 **

* It is strongly recommended to use this single-number rating in combination with the complete sound absorption coefficient curve
** These results are not within the scope of the accreditation

**Requested by:** Texdecor,Rue d'Hem, 2,59780 Willems
**TESTELEMENT:** (product name, for details see Annex 2)

***SlimUp ceiling (1200 x 300 x 9 mm) - 200 mm between the parallel rows - air cavity 220 mm***

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**N° 451-TEST**
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## NOISE LAB
## TEST REPORT Number A-2022LAB-106-10-45050_E

### ANNEX 1: 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

Texdecor - SlimUp ceiling
manufacturer: Texdecor
Type : acoustic grilles
application : ceiling
composition: les grilles SlimUp ceiling are made of PET, 50% coming from recycled plastic bottles

The blades are made from Slimpanel (recycled polyester fiber felt, PET, thickness 9mm)
Slimpanel : the compact felt of SlimPanel contains 50% polyester fibers from recycled plastic bottles.

Row spacing was 200 mm
Suspencion height : 220 mm from the floor of the reverberation room and the bottom edge of the panels
dimensions : 1200 x 300 x 9 mm

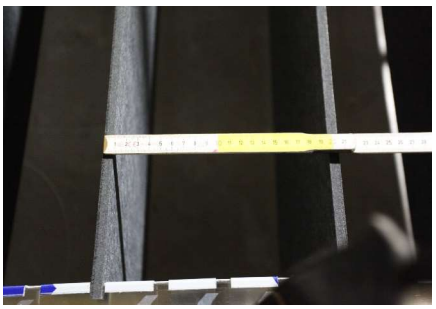
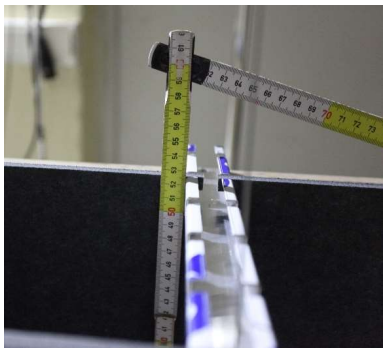


*photo : 200 mm distance between rows of SlimUp panel*



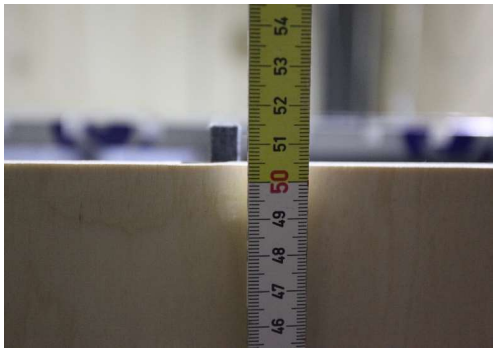


*photo: detail of the wooden frame (height 500) and the total height of the test set-up (300+220 = 520mm)*

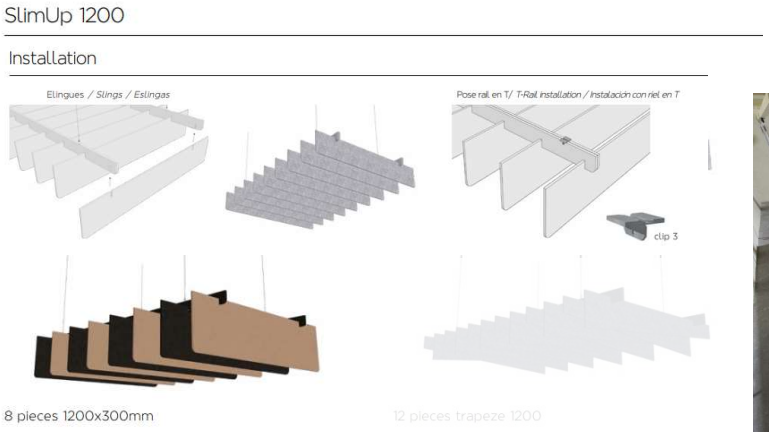



*photo : test set-up*

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## NOISE LAB
## TEST REPORT Number A-2022LAB-106-10-45050_E

**ANNEX 2: Technical datasheet**

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 directly from the manufacturer.**

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-10-45050_E

## ANNEX 3: photographs of the test element or the test arrangement

*Description of the assembly or drawing or photo*

The SlimUp panels (1120 x 260 x 40 mm) were aranged in 15 parallel rows. Each row contains three panels and there was no airspace between the single panels in a row.
The distance, "d", between each row was 200 mm. There was an airspace of 220 mm between the panels and the floor of the reverberation room.
The array of baffles was surrounded by a non-absorptive wooden frame, with a height of 500 mm, in line with the "well approach - type J mounting" of the standard ISO354.
The part of the wooden frame perpendicular to the rows of baffles flush with the ends of the baffles.
The part of the wooden frame parrallel to the absorptive area of the baffles was 100 mm (d/2) from the centreline of the nearest row of panels, where d is the distance between the parallel rows.

*photo : Empty reverberation room with non-absorbent frame for measurement setup*

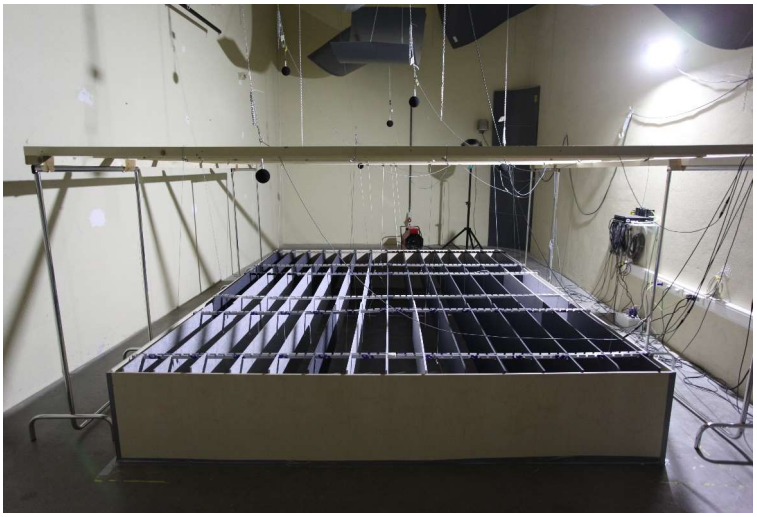

*photo : total measurement setup*

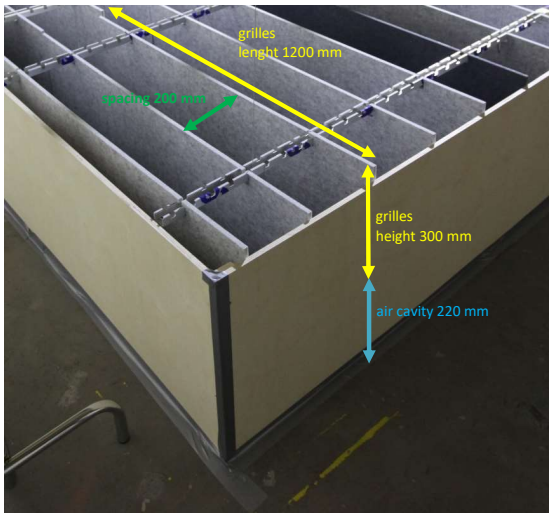


*photo : detail of the measurement setup*

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## NOISE LAB
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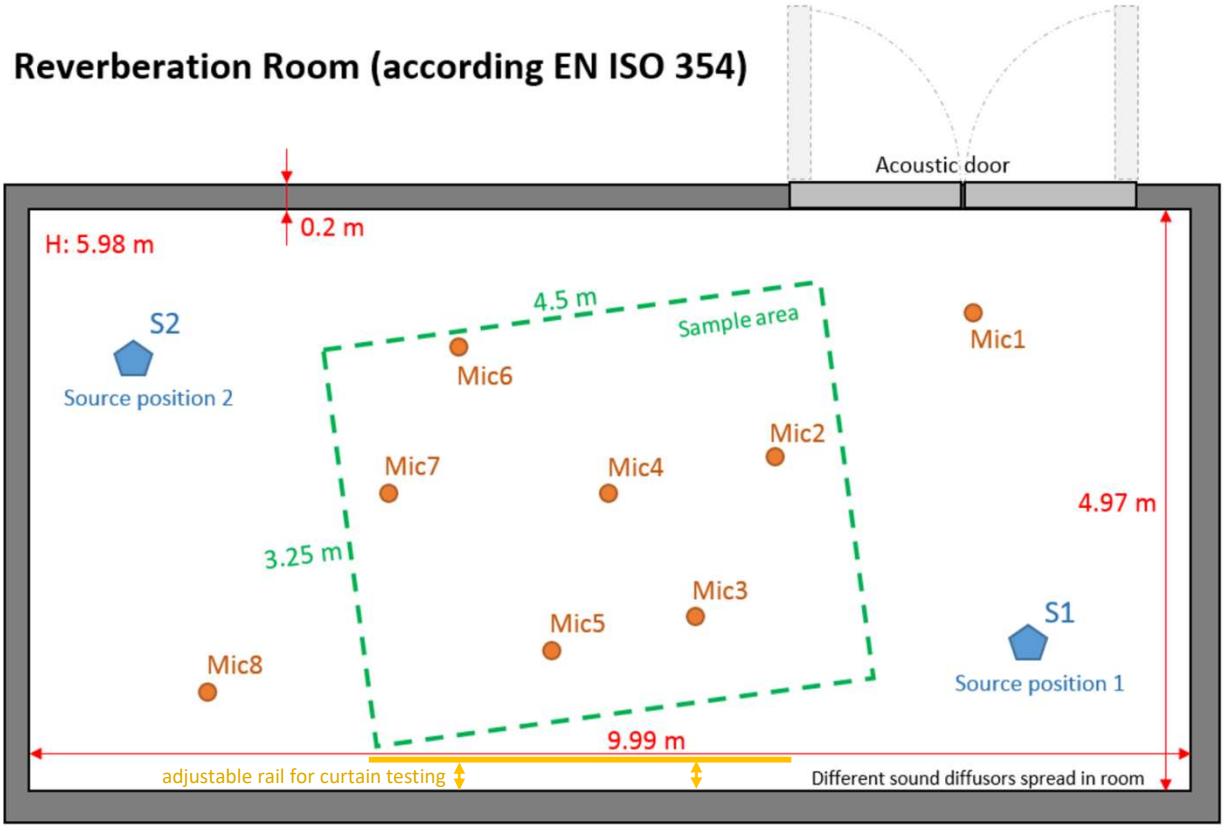
### ANNEX 4: Sketch of the test room

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

The test room was built and finished according ISO 354.



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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-11-45050_E

| | |
|---|---|
| **Customer :** | Texdecor<br>Rue d'Hem, 2<br>59780 Willems<br>France |
| **Contacts :** | **Client :** Max Olivier Loubert<br>**Noise lab :** Els Meulemans |
| **Tests :** | Measurement of sound absorption in the reverberation room |
| **Product name :** | **SlimUp ceiling - grille with 8 panels (1200 x 300 x 9 mm) - spacing of 200 mm - suspension height 200 mm** |

**Normative references:**

| | |
|---|---|
| **NBN EN ISO 354:2003** | **Acoustics - Measurement of sound absorption in a reverberation room** |
| NBN EN ISO 11654:1997 | Acoustics - Sound absorbers for use in buildings - Rating of sound absorption |
| NBN ISO 9613-1:1996 | Acoustics - Attenuation of sound during propagation outdoors - part 1 : Calculation of the absorption of sound by the atmosphere |
| ISO 12999-2:2020 | Acoustics - Determination and application of measurement uncertainties in building acoustics Part 2: Sound absorption |

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**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:** | 8/10/2022 | 2022LAB-106 |
| **Date of receipt of the specimen(s):** | 3/05/2023 | 11 |
| **Date of construction:** | 4/05/2023 | |
| **Date of tests:** | 4/05/2023 | |
| **Date of preparation of the test report:** | 25/09/2023 | |

The measurements were carried out at Daidalos Peutz Laboratory for Acoustics at Hooglede, see appendix 1
This test report together with its annexes contains : 10 pages and must be multiplied only in its entirety

Technical Manager,

Paul Mees

Laboratory Engineer,

Els Meulemans

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-11-45050_E

## MEASURING EQUIPMENT

**Signal**
Brüel & Kjaer - 4292 : Omni Power Sound Source

**Microphone system:**
Brüel & Kjaer - 4189-L-001 : 1/2" free field microphone prepolarized, inclusive 2669L TEDS
Brüel & Kjaer - 4189 : 1/2" free field microphone, 6Hz to 20kHz, prepolarized
Brüel & Kjaer - 2669 : 1/2" microphone preamplifier
Brüel & Kjaer - 4231 : Sound calibrator 94&114dB SPL-1000Hz, Fulfils IEC 60942(2003)Class1

| | | |
|---|---|---|
| Number of source positions: | 2 | (Different sound source positions at least 3m apart. |
| Number of microphone positions for each source position: | 8 | The measurements shall be made with different microphone positions |
| Number of measured decays curves: | 3 | which are at least 1,5m apart, 2m from any sound source and 1m from |
| Total number of measurements with different positions for microphone & source: | 16 | any room surface and the test specimen.) |

**Signal processing**
Brüel & Kjaer - 2716C : Power amplifier
Brüel & Kjaer - 3050-A-6/0: Signal generator, 6-ch. Inputmodule LAN-XI
Brüel & Kjaer - 3160-A-042: Signal generator, 4/2-ch. Input/output module LAN-XI
Brüel & Kjaer : PULSE Labshop Version 13.5
A PC with all necessary software

**Reverberation room**

| | | |
|---|---|---|
| Dimensions of the room: | Total volume : | 298,3 m³ |
| | Length: | 9,99 m |
| | Width | 4,97 m |
| | Height | 5,98 m |
| | Volume door opening : | 1,32 m³ |
| | Total area: | 279,9 m² |
| | $l_{max}$ = 12,65 m < 1,9 $V^{⅓}$ | |

In order to improve the diffusivity, the use of diffusers is necessary
The test specimen shall have a maximum area of 15,62 m², which depends on the room volume

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-11-45050_E

## TEST METHOD

The tests were conducted in accordance with the provisions of the test method EN ISO354:2003. A detailed description of the test set up has been given in the figures of annex 1 of this report.
The measurement method can be simply descibed as follows:

Essence of the test is in measuring of the reverberation time in the empty reflecting room and in the same room with the test sample inside it. The sound-absorption properties of a material depend on how the material is mounted during the test. Annex B of ISO 354:2003 specifies several different standard mountings that shall be used during a test for sound absorption. Normally a test specimen is tested using only one of the specified mountings.

From these reverberation times, the equivalent sound absorption area of the test specimen, is calculated by using Sabine's equation. Measurement is carried out in ranges of 1/3 octave and interval from 100Hz to 5000Hz.

The equivalent sound absorption area of the empty reverberation room, A1, in square metres, shall be calculated using the formula (1) :

$$A_1 = 55{,}3\ V / (c_1 T_1) - 4Vm_1 \quad [m^2] \quad (1)$$

The equivalent sound absorption area of the reverberation room containing a test specimen, A2, in square metres, shall be calculated using the formula (2) :

$$A_2 = 55{,}3\ V / (c_2 T_2) - 4Vm_2 \quad [m^2] \quad (2)$$

The equivalent sound absorption area of the test specimen, AT, in square metres, shall be calculated using the formula (3) :

$$A_T = A_2 - A_1 = 55{,}3\ V\ (1/c_2T_2 - 1/c_1T_1) - 4V(m_2 - m_1) \quad [m^2] \quad (3)$$

The sound absorption coefficient of a plane absorber or a specified array of test objects shall be calculated using the formula (4):

$$\alpha_S = A_T / S \quad (4)$$

***NOTE*** *For discrete objects $A_{obj}$ is used instead of $\alpha_s$*
*For a specific array of objects the result is given as $\alpha_s$*

The equivalent sound absorption area of discrete absorbers or individual objects shall be calculated using the formula (5):

$$A_{obj} = A_T / n$$ *where n is the number of tested objects* (5)

whereas:

| | | |
|---|---|---|
| $A_1$ | = | *The equivalent sound absorption area of the empty reverberation room in square metres* |
| $A_2$ | = | *The equivalent sound absorption area of the reverberation room containing a test specimen in square metres* |
| V | = | *volume , in cubic metres, of the empty reverberation room [m³]* |
| $c_1, c_2$ | = | *the propagation speed of sound in air, in [m/s], calculated using the formula (in function of the temperature in the room during the test)* c=331 + 0,6 t with t = the air temperature in degrees Celsius for temperatures in the range of 15°C to 30°C |
| $T_1$ | = | *the reverberation time, in seconds, of the empty reverberation room* |
| $T_2$ | = | *the reverberation time, in seconds, of the reverberation room after the test specimen has been introduced* |
| $m_1, m_2$ | = | *the power attenuation coefficient, in reciprocal metres, calculated according to ISO 9613-1:1993* |
| $A_T$ | = | *The equivalent sound absorption area of the test specimen in square metres* |
| S | = | *the area, in square metres, covered by the test specimen* |
| $\alpha_s$ | = | *the sound absorption coefficient* |
| $A_{obj}$ | = | *the equivalent sound absorption area per object* |
| n | = | *the number of tested discrete or individual objects* |

## SPECIAL MEASUREMENT CONDITIONS

-
-
-
-
-

The measured objects were not completely indientic : the customer mounted 1 grille with 7 panels and 1 grille with 8 panels.
This was, both by the customer and the lab, only noticed during processing of the results when the test setup was already aborted.
Client wanted a report anyway, so in the calculations of Aobj, the number of objects was calculated with 1,9 objects instead of 2 objects.

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## RATING OF SOUND ABSORPTION

### $A_{obj}$ EQUIVALENT SOUND ABSORPTION AREA PER OBJECT

Frequency-dependent value of the sound absorption coefficient which is based on measurements on one-third-octave bands in accordance with ISO 354 and which is calculated in octave bands in accordance with the standard ISO 11654:1997.
The equivalent sound absorption area for each octave band i, is calculated from the arithmetic mean value of the three one-third octave sound absorption coefficients within the octave. In line with the standard ISO 354, the mean value is calculated to the first decimal.

### $\alpha_w$ WEIGHTED SOUND ABSORPTION COEFFICIENT

The weighted sound absorption coefficient is determined as a single number value from the practical sound absorption coefficients from 250 Hz to 4000 Hz. The practical sound absorption coefficient is calculated according to ISO 11654:1997.
Single-number frequency-independent value which equals the value of the reference curve at 500 Hz after shifting is as specified in the standard ISO 11654:1997.

But an individual object is NOT evaluated with the standard ISO 11654, both in terms of the single-number value and the absorption class.

Test results related to tested object only. The test results should not be considered as material constants, the absorption depends not only on the material itself. The method of construction, the size of the material surface and its place in the room, affect the sound absorption characteristics of the test element.

## ACCURACY

The accuracy of the absorption coefficients as calculated can be expressed in terms of repeatability of measured reverberation times (tests within one laboratory) and reproducibility (between various laboratories)

The relative standard deviation of the reverberation time T20, evaluated over a 20dB decay range, can be estimated by the following formula (see 8.2.2. van ISO 354:2003)
These relative standard deviations of the reverberation time T20 were calculated and illustrated in annex 1.

The reproducibility of absorption coefficient measurement is still under investigation

The specific value of uncertainty is available on request

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# NOISE LAB
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## $A_{obj}$ EQUIVALENT SOUND ABSORPTION AREA PER OBJECT

EN ISO 354:2003 Acoustics - Measurement of sound absorption in a reverberation room
EN ISO 11654:1997 Acoustics - Sound absorbers for use in buildings - Rating of sound absorption
Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 2: sound absorption

**Identification number of test element:** **11** **Test date:** 4/05/2023
**Name of test institute :** Daidalos Peutz Laboratory of Acoustics, Hooglede, Belgium

| | | | | | |
|---|---|---|---|---|---|
| **Reverberation room:** | V = | 298,3 m³ | $S_{tot}$ = | 279,9 m² | |
| **Room conditions during measurements:** | | Empty room | With testelement | | |
| **Temperature:** | T = | 18,4 | 18,4 | °C | |
| **Atmospheric pressure:** | p = | 102,4 | 101,0 | kPa | |
| **Relative humidity :** | $h_r$ = | 58 | 61 | % | |

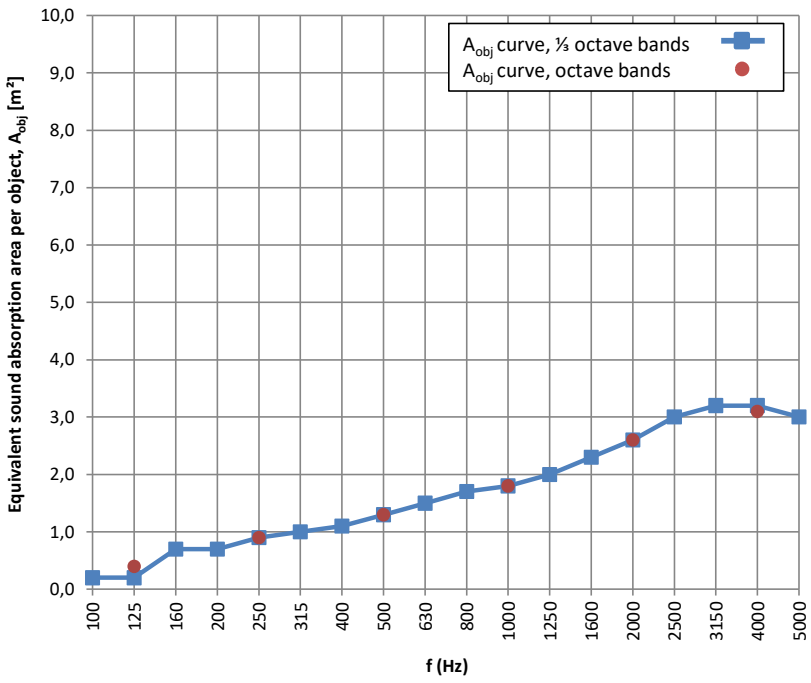
**Type of test element:** **Discrete object**
**Construction characteristics:**

Number of tested objects 1,9
Number of location setups in the reverberation room 2

Test setup: Two SlimUp ceiling grids (one with 8 and an other one with 7 panels) were freely installed in the reverberation room, with a suspension height of 200 mm
One object = 1 grid element with 8 panels (1200 x 300 x 9 mm) - spacing of 200 mm

| f(Hz) | $T_1$ (s) | $T_2$ (s) | $A_{obj}$ [m²] |
|---|---|---|---|
| 50 | | | |
| **63** | | | |
| 80 | | | |
| 100 | 9,97 | 9,16 | 0,2 |
| **125** | **8,48** | **7,98** | **0,2** |
| 160 | 8,36 | 6,90 | 0,7 |
| 200 | 8,97 | 7,13 | 0,7 |
| **250** | **9,41** | **7,06** | **0,9** |
| 315 | 9,52 | 7,01 | 1,0 |
| 400 | 8,79 | 6,41 | 1,1 |
| **500** | **8,75** | **6,10** | **1,3** |
| 630 | 8,90 | 5,82 | 1,5 |
| 800 | 8,62 | 5,51 | 1,7 |
| **1000** | **8,75** | **5,43** | **1,8** |
| 1250 | 8,30 | 5,09 | 2,0 |
| 1600 | 7,31 | 4,44 | 2,3 |
| **2000** | **6,46** | **3,95** | **2,6** |
| 2500 | 5,45 | 3,37 | 3,0 |
| 3150 | 4,44 | 2,90 | 3,2 |
| **4000** | **3,50** | **2,47** | **3,2** |
| 5000 | 2,75 | 2,10 | 3,0 |

| f(Hz) | $A_{obj}$ [m²] |
|---|---|
| 125 | 0,4 |
| 250 | 0,9 |
| 500 | 1,3 |
| 1000 | 1,8 |
| 2000 | 2,6 |
| 4000 | 3,1 |




**Note:** an individual object is not evaluated according to ISO 11654 ($\alpha_w$ and class)

**Requested by:** Texdecor,Rue d'Hem, 2,59780 Willems
**TESTELEMENT:** (product name, for details see Annex 2)

***SlimUp ceiling - grille with 8 panels (1200 x 300 x 9 mm) - spacing of 200 mm - suspension height 200 mm***

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-11-45050_E

## ANNEX 1 : PRECISION

The relative standard deviation of the reverberation time T20

| f | $T_1$ (s) | $\varepsilon_{20}$ (s) | $T_2$ (s) | $\varepsilon_{20}$ (s) |
|---|---|---|---|---|
| 50 | | | | |
| **63** | | | | |
| 80 | | | | |
| 100 | 9,97 | 0,51 | 9,16 | 0,49 |
| **125** | 8,48 | 0,42 | 7,98 | 0,41 |
| 160 | 8,36 | 0,37 | 6,90 | 0,34 |
| 200 | 8,97 | 0,34 | 7,13 | 0,31 |
| **250** | 9,41 | 0,32 | 7,06 | 0,27 |
| 315 | 9,52 | 0,28 | 7,01 | 0,24 |
| 400 | 8,79 | 0,24 | 6,41 | 0,21 |
| **500** | 8,75 | 0,22 | 6,10 | 0,18 |
| 630 | 8,90 | 0,19 | 5,82 | 0,16 |
| 800 | 8,62 | 0,17 | 5,51 | 0,13 |
| **1000** | 8,75 | 0,15 | 5,43 | 0,12 |
| 1250 | 8,30 | 0,13 | 5,09 | 0,10 |
| 1600 | 7,31 | 0,11 | 4,44 | 0,09 |
| **2000** | 6,46 | 0,09 | 3,95 | 0,07 |
| 2500 | 5,45 | 0,08 | 3,37 | 0,06 |
| 3150 | 4,44 | 0,06 | 2,90 | 0,05 |
| **4000** | 3,50 | 0,05 | 2,47 | 0,04 |
| 5000 | 2,75 | 0,04 | 2,10 | 0,03 |

$\varepsilon_{20}$ = The relative standard deviation of the reverberation time T20, evaluated over a 20dB decay range, can be estimated by the following formula (see 8.2.2. van ISO 354:2003)

$$\varepsilon_{20}(T) = T\sqrt{\frac{2{,}42 + {}^{3{,}59}/_{N}}{f\,T}}$$

$T_1$ (s) = reverberation time of the empty room
$T_2$ (s) = reverberation time of the reverberation room after with the test specimen
f (Hz) = centre frequency of the one-third-octave band
N = number of decay curves evaluated

The relative standard deviation of the sound absorption coefficient

| f | $A_{obj}$ (m²) | $\varepsilon_{Aobj}$ | $\delta_{95}$ ($A_{obj}$) |
|---|---|---|---|
| 50 | | | |
| **63** | | | |
| 80 | | | |
| 100 | 0,2 | 0,2 | 0,1 |
| **125** | 0,2 | 0,2 | 0,1 |
| 160 | 0,7 | 0,2 | 0,1 |
| 200 | 0,7 | 0,2 | 0,1 |
| **250** | 0,9 | 0,2 | 0,1 |
| 315 | 1,0 | 0,2 | 0,1 |
| 400 | 1,1 | 0,2 | 0,1 |
| **500** | 1,3 | 0,1 | 0,1 |
| 630 | 1,5 | 0,1 | 0,1 |
| 800 | 1,7 | 0,1 | 0,1 |
| **1000** | 1,8 | 0,1 | 0,1 |
| 1250 | 2,0 | 0,1 | 0,1 |
| 1600 | 2,3 | 0,1 | 0,1 |
| **2000** | 2,6 | 0,1 | 0,1 |
| 2500 | 3,0 | 0,2 | 0,1 |
| 3150 | 3,2 | 0,2 | 0,1 |
| **4000** | 3,2 | 0,2 | 0,1 |
| 5000 | 3,0 | 0,2 | 0,1 |

$\varepsilon(A_{obj})$ = The relative standard deviation of the sound absorption coefficient

$$\varepsilon(A_{obj}) = \frac{55{,}3\,V}{c\,S}\sqrt{\left(\frac{\varepsilon_{20}(T_2)}{T_2^2}\right)^2 + \left(\frac{\varepsilon_{20}(T_1)}{T_1^2}\right)^2}$$

$\delta_{95}$ ($A_{obj}$) = 95% confidence interval

$$\delta_{95}(A_{obj}) = \frac{1{,}96\,\varepsilon(\alpha)}{\sqrt{N}}$$

$T_1$ (s) = reverberation time of the empty room
$T_2$ (s) = reverberation time of the reverberation room after with the test specimen
V = Volume of the reverberation room
c = the propagation speed of sound in air

N = number of decay curves evaluated
S = the area, in square metres, covered by the test specimen

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-11-45050_E

## 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

Texdecor - SlimUp ceiling
manufacturer: Texdecor
Type : acoustic grilles
application : ceiling
composition: les grilles SlimUp ceiling are made of PET, 50% coming from recycled plastic bottles

The blades are made from Slimpanel (recycled polyester fiber felt, PET, thickness 9mm)
Slimpanel : the compact felt of SlimPanel contains 50% polyester fibers from recycled plastic bottles.

Grille used in this test:
One object = 1 grid element with 8 panels (1200 x 300 x 9 mm) - spacing of 200 mm
Suspencion height : 200 mm from the floor of the reverberation room and the bottom edge of the panels
dimensions : 1200 x 300 x 9 mm

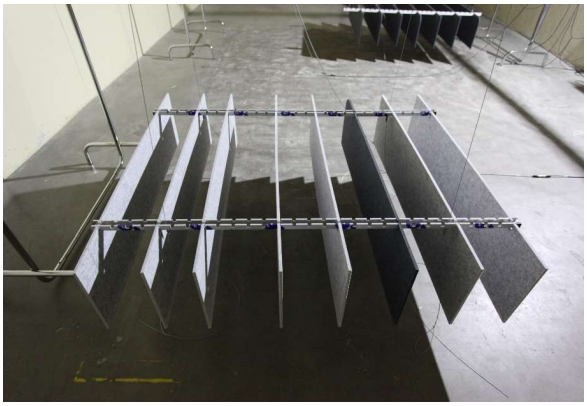

*photo: first objet = 1 grille with 8 panels (1200 x 300 x 9 mm) - pas de 200 mm*
*second objet = 1 grille with 7 panels (1200 x 300 x 9 mm) - pas de 200 mm*

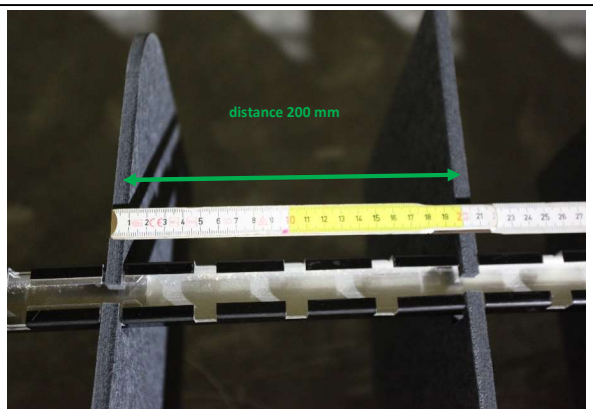


*photo : un espacement de 200 mm entre les centres (points de suspension) des lames*

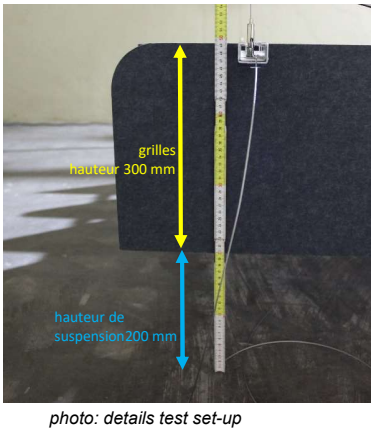


*photo: details test set-up*

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## NOISE LAB
## TEST REPORT Number A-2022LAB-106-11-45050_E

### ANNEX 3: Technical datasheet

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 directly from the manufacturer.**

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# NOISE LAB
# TEST REPORT Number A-2022LAB-106-11-45050_E

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

*Description of the assembly or drawing or photo*

Two grilles were tested as individual objects, arranged randomly in the reverberation room, spaced of at least 2m apart, in accordance with ISO 354.
In this test one object = 1 grid element with 8 panels (1200 x 300 x 9 mm) - spacing of 200 mm
Suspencion height : 200 mm from the floor of the reverberation room and the bottom edge of the panels
The test specimen comprise a sufficient number of individual objects (4 islands) to provide a measurable change in the equivalent sound absorption area of the room, AT .

For the first measurement 2 elements were randomly hung on a separate frame in the reverberation room on the first positions.
During the following measurement the 2 same elements hung on different random positions. The results were averaged.

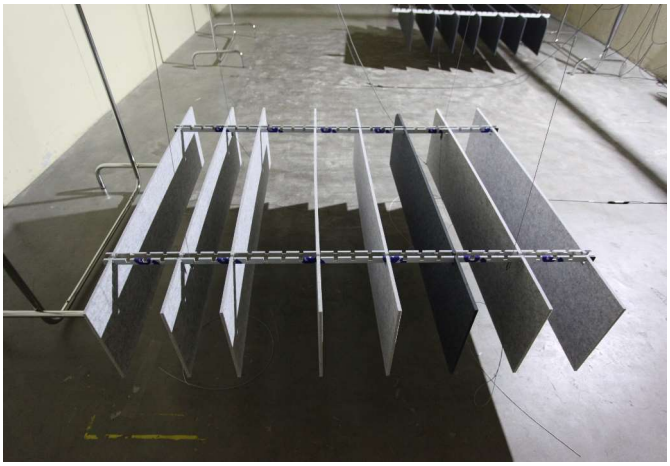

*photo: first objet = 1 grille with 8 panels (1200 x 300 x 9 mm) - pas de 200 mm*
*second objet = 1 grille with 7 panels (1200 x 300 x 9 mm) - pas de 200 mm*

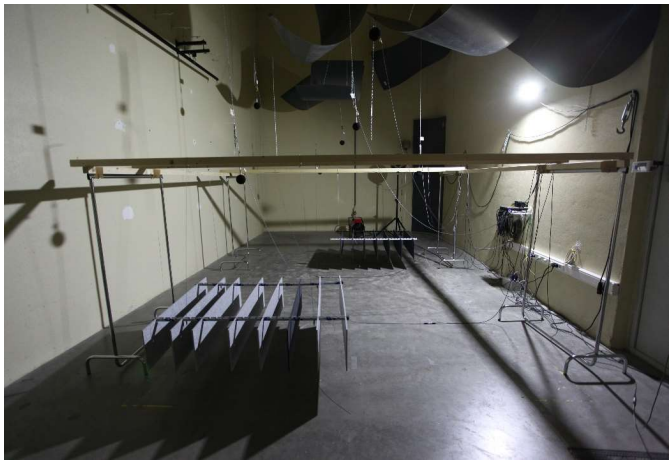

*photo: Test n° 11 : test set-up on position 1*

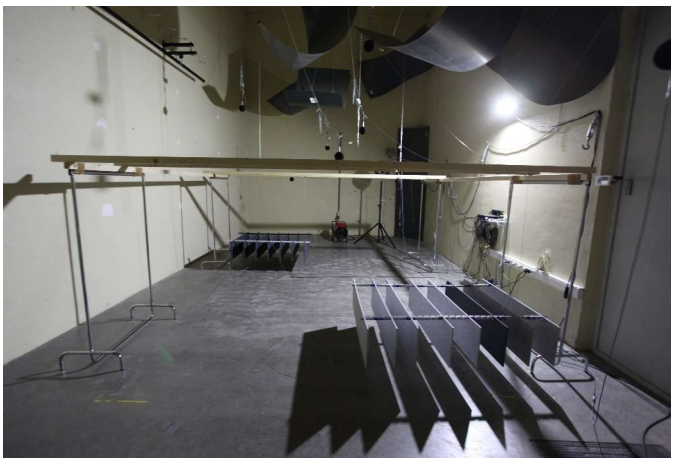

*photo : Test n° 11 : test set-up on position 2*

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## TEST REPORT Number A-2022LAB-106-11-45050_E

### ANNEX 5: Sketch of the test room

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

The test room was built and finished according ISO 354.