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

**NOISE LAB**  
**REPORT Number A-2021LAB-017-1-2-44273\_E**

**Customer :** Indetex  
 Rue du Mont Gallois 58  
 7700 Mouscron  
 Belgium

**Contacts :** Client : Dhr. Cun Cornelis  
 Noise lab : Els Meulemans

**Tests :** Measurement of sound absorption in the reverberation room

**Product / series name :** DEVIL Curtain - 200% pleated

**Reference norm :**  
**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 -

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.

<b>Date and reference of the request:</b>	4/02/2021	2021LAB-017
<b>Date of receipt of the specimen (s):</b>	18/03/2021	DEVIL Curtain - 200% pleated
<b>Date of construction:</b>	18/03/2021	until 18/03/2021
<b>Date of tests:</b>	18/03/2021	until 18/03/2021
<b>Date of preparation of the report:</b>	18/03/2021	

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 REPORT Number A-2021LAB-017-1-2-44273\_E

### MEASURING EQUIPMENT

#### Sound Sources

Brüel & Kjaer - 4292 : Omni Power Sound Source (+ Behringer iNuke NU3000DSP power amplifier)

#### Microphones and recording

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, Fulfills 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

A PC with all necessary software

#### Reverberation room

Dimensions of the room:	Volume :	298,31 m <sup>3</sup>
	Length:	9,99 m
	Width:	4,97 m
	Height:	5,98 m
	Total area:	278 m <sup>2</sup>
	$l_{max} = 12,65 \text{ m} < 1,9 V^{1/3}$	

In order to improve the diffusivity, the use of diffusers is necessary

The test specimen shall have a maximum area of 15,62 m<sup>2</sup>, which depends on the room volume

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**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 can be found in the standard.

The measurement method can be simply described as follows:

The reverberation time of the room is determined in 2 situations:

- an empty reflecting room
- a reflecting room with the test sample inside, which is mounted following the different prescriptions specified in the standard

By adding the test sample inside the room, the reverberation time will be shorter. The reduction of reverberation time is a reference for the amount of added absorption.

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,  $A_1$ , in square metres, shall be calculated using the formula (1) :

$$A_1 = 55,3 V / (c_1 T_1) - 4V m_1 \quad [m^2] \quad (1)$$

The equivalent sound absorption area of the reverberation room containing a test specimen,  $A_2$ , in square metres, shall be calculated using the formula (2) :

$$A_2 = 55,3 V / (c_2 T_2) - 4V m_2 \quad [m^2] \quad (2)$$

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

$$A_T = A_2 - A_1 = 55,3 V (1/c_2 T_2 - 1/c_1 T_1) - 4V(m_2 - m_1) \quad [m^2] \quad (3)$$

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

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

whereas: $A_2, A_1$	=	<i>the equivalent sound absorption area of respectively the empty reverberation room and the room containing a test specimen [m<sup>2</sup>]</i>
$V$	=	<i>volume, in cubic metres, of the empty reverberation room [m<sup>3</sup>]</i>
$c_1, c_2$	=	<i>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)</i> $c = 331 + 0,6 t$ with $t =$ <i>the air temperature in degrees Celsius for temperatures in the range of 15°C to 30°C</i>
$T_1, T_2$	=	<i>the reverberation time, in seconds, of the empty reverberation room resp. with test specimen in [s]</i>
$m_1, m_2$	=	<i>the power attenuation coefficient, in reciprocal metres, calculated according to ISO 9613-1:1993</i>
$A_T$	=	<i>The equivalent sound absorption area of the test specimen in square metres</i>
$S$	=	<i>the area, in square metres, covered by the test specimen</i>
$\alpha_s$	=	<i>the sound absorption coefficient</i>

**SPECIAL MEASUREMENT CONDITIONS**

-  
-  
-  
-  
-

n/a

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**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,  $\alpha_{pi}$ , 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  $\alpha_{pi}$  exceeds the value of the shifted reference curve by 0,25 or more, one or more shape indicators shall be added, in parentheses, to the  $\alpha_w$  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 C423-09a. 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  $k=2$

$$U = u \cdot k \quad \text{with} \quad \begin{array}{l} u = \text{uncertainty under reproducibility conditions} \\ k = \text{coverage factor (} k=2 \text{ for a confidence level of 95\%)} \\ U = \text{expanded uncertainty under reproducibility conditions} \end{array}$$

This standard specifies how to calculate :

- the uncertainty of sound absorption 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 from inter-laboratory measurements with different types of test specimens including suspended ceilings, mineral wool, foams.

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# 1. $\alpha_s$

## SOUND ABSORPTION COEFFICIENT

EN ISO 354:2003  
 EN ISO 11654:1997  
 ISO 12999-2:2020

Acoustics - Measurement of sound absorption in a reverberation room  
 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:** 1  
**Reverberation room:** V = 298,3 m<sup>3</sup> Test date: 18/03/2021  
**Room conditions during measurements:** Empty space With testelement  
**Temperature:** T = 18,9 °C  
**Atmospheric pressure:** p = 102,38 kPa  
**Relative humidity :** h<sub>r</sub> = 49,5 %

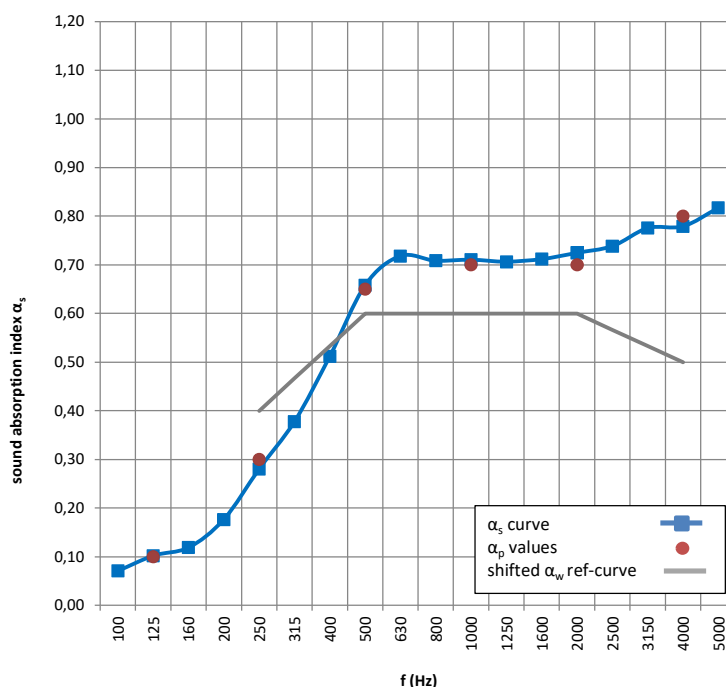
**Type of test element:** Plane absorber

**Construction characteristics:**

\* using plane absorber:

Area of test element: 11,92 m<sup>2</sup>  
 Total thickness: 100 mm  
 Number of layers, including air spaces: 2  
 Connection of layers: The curtain is hung parallel to the room surface .

f(Hz)	T <sub>1</sub> (s)	T <sub>2</sub> (s)	$\alpha_s$	$\pm U$ (k=2)
50				
63				
80				
100	10,80	9,08	0,07	$\pm 0,06$
125	9,12	7,41	0,10	$\pm 0,07$
160	9,91	7,67	0,12	$\pm 0,06$
200	10,31	7,11	0,18	$\pm 0,07$
250	9,37	5,67	0,28	$\pm 0,08$
315	9,77	5,11	0,38	$\pm 0,09$
400	9,18	4,25	0,51	$\pm 0,09$
500	9,07	3,66	0,66	$\pm 0,10$
630	9,59	3,54	0,72	$\pm 0,09$
800	9,42	3,55	0,71	$\pm 0,09$
1000	9,34	3,54	0,71	$\pm 0,09$
1250	8,52	3,42	0,71	$\pm 0,09$
1600	7,40	3,21	0,71	$\pm 0,08$
2000	6,42	2,99	0,72	$\pm 0,08$
2500	5,35	2,71	0,74	$\pm 0,07$
3150	4,38	2,38	0,78	$\pm 0,08$
4000	3,33	2,03	0,78	$\pm 0,08$
5000	2,61	1,71	0,82	$\pm 0,07$



f(Hz)	$\alpha_p$	$\pm U$ (k=2)
125	0,10	
250	0,30	$\pm 0,07$
500	0,65	$\pm 0,08$
1000	0,70	$\pm 0,08$
2000	0,70	$\pm 0,08$
4000	0,80	$\pm 0,10$

$\alpha_w = 0,60$  (H)\*  $\pm 0,07$  (k=2)  
 Sound absorption class: C

NRC = 0,6 \*\*  
 SAA = 0,59 \*\*

\* 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:** Indetex, Rue du Mont Gallois 58,7700 Mouscron

**TESTELEMANT:**

(short description by the manufacturer, details: see Annex 1)

**DEVIL curtain - 200% pleated - G100 mounting**

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## 2. $\alpha_s$

### SOUND ABSORPTION COEFFICIENT

EN ISO 354:2003  
 EN ISO 11654:1997  
 ISO 12999-2:2020

Acoustics - Measurement of sound absorption in a reverberation room  
 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:** 2  
**Reverberation room:** V = 298,3 m<sup>3</sup>  
**Test date:** 18/03/2021  
 S<sub>tot</sub> = 279,9 m<sup>2</sup>  
**Room conditions during measurements:**  
 Empty space With testelement  
**Temperature:** T = 18,9 18,7 °C  
**Atmospheric pressure:** p = 102,38 102,32 kPa  
**Relative humidity :** h<sub>r</sub> = 49,5 50,7 %

**Type of test element:** Plane absorber

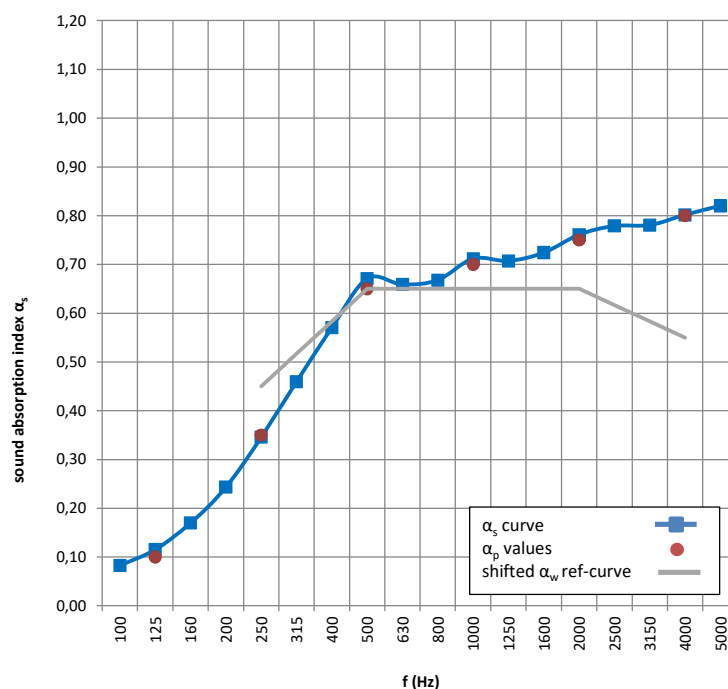
**Construction characteristics:**

\* using plane absorber:

Area of test element: 11,92 m<sup>2</sup>  
 Total thickness: 200 mm  
 Number of layers, including air spaces: 2  
 Connection of layers: The curtain is hung parallel to the room surface .

f(Hz)	T <sub>1</sub> (s)	T <sub>2</sub> (s)	$\alpha_s$	$\pm U$ (k=2)
50				
63				
80				
100	10,80	8,86	0,08	$\pm 0,07$
125	9,12	7,24	0,12	$\pm 0,07$
160	9,91	7,01	0,17	$\pm 0,08$
200	10,31	6,37	0,24	$\pm 0,08$
250	9,37	5,21	0,35	$\pm 0,09$
315	9,77	4,64	0,46	$\pm 0,10$
400	9,18	4,00	0,57	$\pm 0,10$
500	9,07	3,62	0,67	$\pm 0,10$
630	9,59	3,74	0,66	$\pm 0,09$
800	9,42	3,69	0,67	$\pm 0,08$
1000	9,34	3,54	0,71	$\pm 0,09$
1250	8,52	3,43	0,71	$\pm 0,09$
1600	7,40	3,19	0,72	$\pm 0,08$
2000	6,42	2,91	0,76	$\pm 0,08$
2500	5,35	2,64	0,78	$\pm 0,08$
3150	4,38	2,38	0,78	$\pm 0,08$
4000	3,33	2,02	0,80	$\pm 0,08$
5000	2,61	1,72	0,82	$\pm 0,07$

f(Hz)	$\alpha_p$	$\pm U$ (k=2)
125	0,10	
250	0,35	$\pm 0,07$
500	0,65	$\pm 0,08$
1000	0,70	$\pm 0,08$
2000	0,75	$\pm 0,08$
4000	0,80	$\pm 0,10$



$\alpha_w = 0,65$  (H)\*  $\pm 0,07$  (k=2)  
 Sound absorption class: C

NRC = 0,6 \*\*  
 SAA = 0,61 \*\*

\* 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:** Indetex, Rue du Mont Gallois 58, 7700 Mouscron

**TESTELEMANT:**

(short description by the manufacturer, details: see Annex 1)

**DEVIL curtain - 200% pleated - G200 mounting**

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**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*

DEVIL Curtain - 200% pleated  
  
end use : drapery / curtains  
type of product : light filtering  
design type : plains  
composition : 100% polyester FR  
weight : 125 g/m<sup>2</sup>



*photo : detail of the front side of the curtain*

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**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*

n.v. **INDETEX** s.a.

[WWW.BLACKOUTCURTAINS.EU](http://WWW.BLACKOUTCURTAINS.EU)

TECHNICAL SHEET

**Design** DEVIL



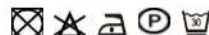
**General Information**

End Use	Drapery / Curtains
Type of Product	Lining
Design Type	Plains
Composition	100 % polyester FR
Width	300 cm
Net Weight (g/m <sup>2</sup> )	125
Colour	White

**Fire Retardancy Level**

M1

**Washing Instructions**



**Fysical properties**

Density warp per inch	-
Density weft per inch	-
Yarn type warp	-
Yarn type weft	-
Martindale (ISO 12947-2) in rubs	-
Dimensional Stability in %	1 - 2
Light Fastness (ISO 105 B02)	4 - 5
Wash fastness (ISO 105 C06)	3 - 4
Shrinkage % by washing (30°C) - Warp	1 - 2
Shrinkage % by washing (30°C) - Weft	1 - 2
Shrinkage by washing (60°C) - Warp	1 - 2
Shrinkage by washing (60°C) - Weft	1 - 2

**Acoustical properties**

Sound absorption alpha w (EN ISO 354/EN ISO 11654) -

**Environmental features**

Oekotex certificaaf is available

**Energetic**

g_value (NBN EN 13363 -1)	-
Solar reflectance pE in % (EN410)	-
Visual reflectance pV in % (EN 410)	-



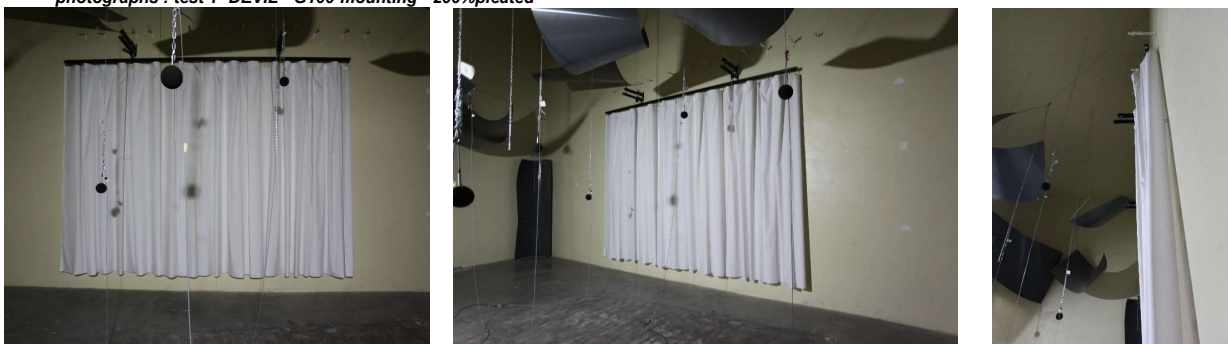
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**ANNEX 3: Photographs of the test elements and/or the test arrangements**

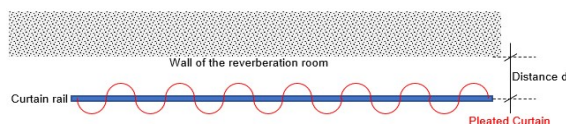
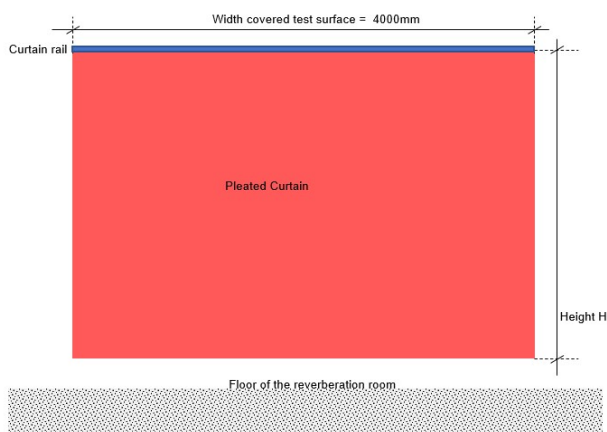
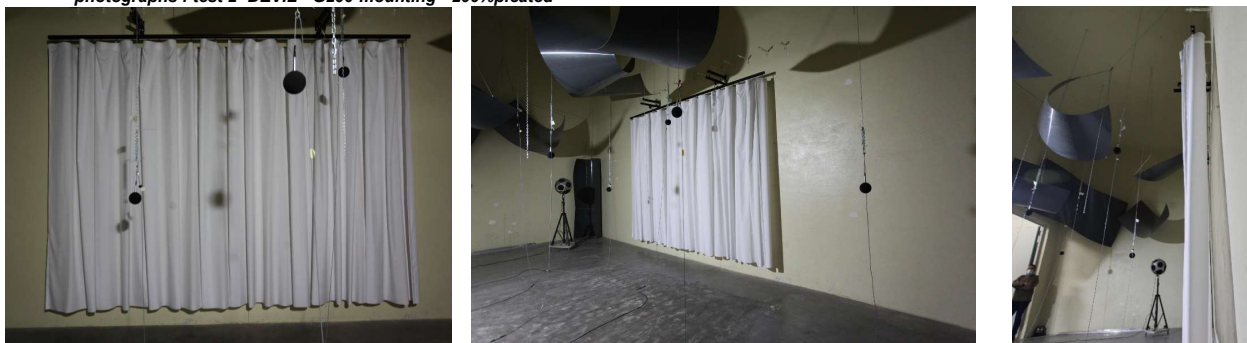
*Description of the assembly and/or drawing and/or image*

The curtain was hung draped parallel to one room wall surface on a curtain rail with 30 curtain hooks.  
 For the draping 2 times more fabric was used than the finished width of the curtain (flow = 200%)  
 The distance from curtain rail to the room surface was 100 and 200mm, respectively for the type G-100 en type G-200 mounting

**photographs : test 1- DEVIL - G100-mounting - 200%pleated**



**photographs : test 2- DEVIL - G200-mounting - 200%pleated**



Distance d = 100mm (G100-mounting)  
 Distance d = 200mm (G200-mounting)  
 Height [H] = 2980 mm  
 Width covered surface = 4000 mm  
 pleated curtain 200%, total width of the fabric=8000mm

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**ANNEX 4: Sketch of the test room**

The test room was built and finished according ISO 354.

