

Silent Gliss

Silente



Acoustic Certificate
Zertifikat Akustik

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Materials Science & Technology

Silent Gliss Fabrics & Component GmbH
Rebgartenweg 5
D-79576 Weil am Rhein

Test Report No 5214001072.1

internal No. 666.5949

Test assignment

Sound absorption coefficient α_s

Test object:

Curtain SILENTE

Client:

Silent Gliss Fabrics & Component GmbH

Order dated of:

March 5, 2013

Test performed:

March 25, 2013

Number of pages:

11

Empa, Swiss Federal Laboratories for Materials Science and Technology, Laboratory of Acoustics
Dübendorf, 6. Dezember 2013§

Expert:
M. Würzer

Head of Laboratory
K. Eggenschwiler

A blue ink signature of M. Würzer, consisting of a stylized, cursive script.

A blue ink signature of K. Eggenschwiler, consisting of a stylized, cursive script.



Note: The test results are valid solely for the tested object. The use of the test report for advertizing purposes, any reference to it or the publication of excerpts require the approval of the Empa (see Information Sheet). Test reports and supporting documents are retained for 10 years.

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1 Assignment

The firm Silent Gliss Fabrics & Component GmbH, contracted Empa, Laboratory of Acoustics, by e-mail to perform sound absorption measurements in the reverberation room according to EN ISO 354.

2 Information on the measurement procedures

The measurement of the sound absorption of absorbing materials as well as the data analysis and determination of the sound absorption coefficient α_s is described in Standard EN ISO 354 (2003). Details of the measurement procedure, the test layout, installation and dimensions of the reverberation room, a list of the measurement equipment and the respective calibration dates are to be found in the internal Quality Assurance Document SOP-177-6 (Nr. 1059).

The description of the object and mounting conditions are indicated in section 3, and the results are presented starting in section 5. The numerical data represent the official values. These values are limited to the objects actually measured in the EMPA facility; they cannot necessarily be applied to a series.

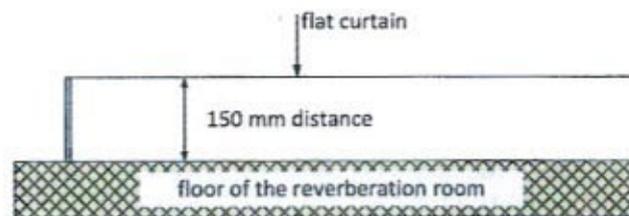
The measurement accuracy for α_s is given as the standard deviation as a function of frequency in accordance with previous experience for the equipment employed:

Low frequency range 100 - 250 Hz: +/- 0.1; Middle frequency range 315 - 800 Hz: +/- 0.05;
High frequency range 1000 - 5000 Hz: +/- 0.02.

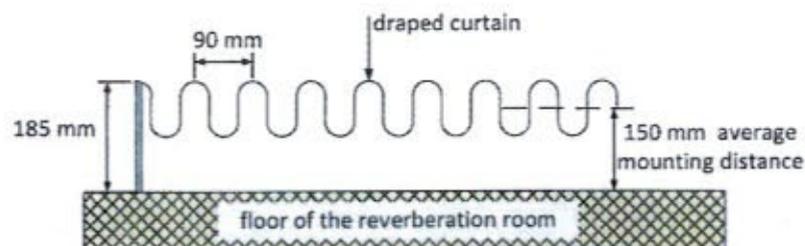
3 Measurements performed

Client Reference:	Mr. Markus Brugger		
Receipt of test object:	18. march 2013	EMPA reference:	5949nn
Installation of test object:	25. march 2013	Performed by:	Customer
Execution of test:	25. march 2013	Performed by:	M. Würzer

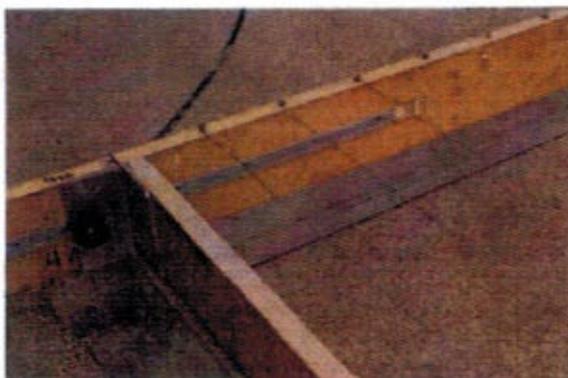
The curtains were mounted on top of a cavity, placed on the floor of the reverberation room. The frames were provided by Empa. The dimensions are 3.0 m times 4.0 m (12 m²). Wires were installed on top of the frame with a span of 3 m and with a distance of 90 mm between wires. For flat mounting of the curtain, the height of the frame was 150 mm. For draped mounting, the height of the frame was 185 mm, such that the average mounting distance of the curtain to the floor was 150 mm. The curtains were installed by the customer.



Sketch of flat mounting



Sketch of draped mounting



Frame with wires



example of draped curtain

3.1 Curtain SILENTE 10 D – article EA00, draped

The curtain was draped (8 m curtain mounted on 4 m) with an average mounting distance of 150 mm.

Empa-Reference: 594901. Results are found in section 5.

3.2 Curtain SILENTE 20 D – article EA07, draped

The curtain was draped (8 m curtain mounted on 4 m) with an average mounting distance of 150 mm.

Empa-Reference: 594902. Results are found in section 6.

3.3 Curtain SILENTE 20 P – article T033, flat mounted

The flat curtain was mounted on the wires with a distance to the floor of 150 mm.

Empa-Reference: 594903. Results are found in section 7.

3.4 Curtain SILENTE 10 P – article EA00, flat mounted

The flat curtain was mounted on the wires with a distance to the floor of 150 mm.

Empa-Reference: 594904. Results are found in section 8.

4 Measurement of the Sound Absorption Coefficient in the Reverberation Room

This section provides background information on the measurement procedures.

References

Standard EN ISO 354 (2003) "Acoustics – Measurement of sound absorption in a reverberation room" with measurement procedures adopted according to: EN ISO 18233 (2006) "Acoustics – Application of new measurement methods in building and room acoustics"

Procedure

The material under test is prepared as a single test surface having an area of approx. 12 m², which is placed on the floor of the reverberation room. The reverberation times required for the absorption measurement are determined with the Norsonic "Real Time Analyser 840" using the MLS method.

For practical reasons, the MLS measurements are made in two frequency ranges of one-third octave bands: 100 Hz to 2'500 Hz (MLS-sequence length: 16 seconds) and 3'150 to 5'000 Hz (MLS-sequence length: 4 seconds). The measurements are performed with 6 different microphone positions and 3 different loudspeaker positions. Thus in each third-octave band the resulting reverberation time T_{20} is calculated from the arithmetic mean value of 18 measurements.

Complete measurements are performed for the conditions **with** and **without** the test material. Both measurements are made at the same temperature and humidity. All requirements of Standard EN ISO 354 are fulfilled.

Calculation of Sound Absorption Coefficient α_s

With the aid of the measured reverberation times the frequency-dependent sound absorption of the test samples are determined:

Equivalent sound absorption area:
$$A = \frac{55,3 \cdot V}{c} \left(\frac{1}{T_2} - \frac{1}{T_1} \right) \text{ [m}^2\text{]}$$

With	V	Volume of the reverberation room [m ³]
	c	speed of sound [m/s]
	T ₁	Reverberation time without test material [s]
	T ₂	Reverberation time with test material [s]

The sound absorption coefficient α_s describes the amount of effective sound absorption area A contributed by one square meter of the sample, i.e.

$$\alpha_s = A/S$$

with S Surface area of the test material [m²]

The sound absorption coefficient α_s is determined separately for each third octave band.

Significance

The sound absorption coefficient α_s is a standardised quantity. The higher the sound absorption coefficient of a material, the higher is its sound absorption capability. With the reverberation room method, absorption coefficients greater than 1 can occur. It is therefore important to differentiate between this

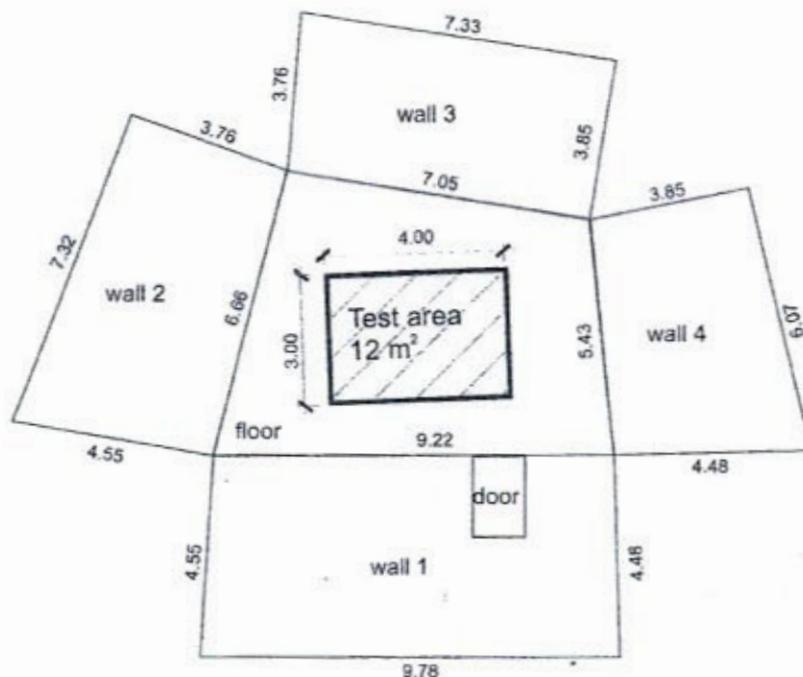
index, designated with an s (s denoting statistical sound incidence), and other indices, which are obtained from reflection measurements (for example in an impedance tube) and can attain a maximum value of 1.

Further Calculations

Standard **EN ISO 11'654** (1997) "Acoustics - Sound absorbers for use in buildings - Rating of sound absorbers" describes an evaluation procedure to obtain single values per octave: the "practical sound absorption coefficient" α_p as well as the global single value: the "weighted sound absorption coefficient" α_w .

Standard **EN 1793-1** (1997) "Road traffic noise reducing devices" defines classes for noise barriers.

Lay out of the Empa reverberation room



Dimensions

Smallest linear dimension	3.76 m	Floor:	48.2 m ²
Largest room diagonal	11.50 m	Ceiling:	56.2 m ²
Door opening	1.20 x 2.00 m	Wall 1:	42.8 m ²

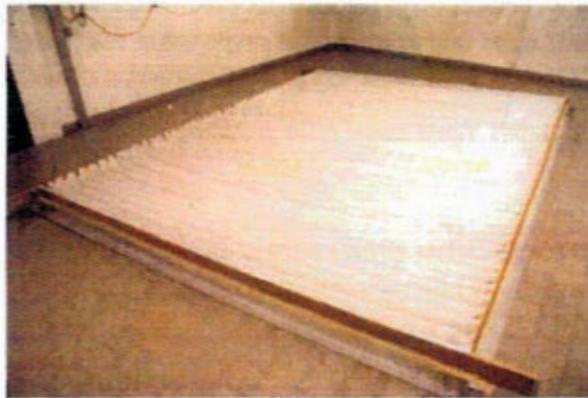
Volume of the reverberation room: 215 m³ **Total area of inner surfaces: 227 m²**

Plexiglas reflectors:	sum of all surfaces (one-sided): 31 m ²
Loudspeakers:	4 units, distributed in the room
Microphones:	6 units, irregularly distributed in the room

5 Sound absorption coefficient α_s (measured in the reverberation room)

Curtain SILENTE 10 D – article EA00, draped

Average mounting distance: 150 mm



Frequency f [Hz]	α_s [-]
100	0.05
125	0.09
160	0.16
200	0.24
250	0.39
315	0.46
400	0.58
500	0.65
630	0.66
800	0.66
1000	0.66
1250	0.64
1600	0.66
2000	0.69
2500	0.70
3150	0.73
4000	0.75
5000	0.75
6300	0.78
8000	0.76

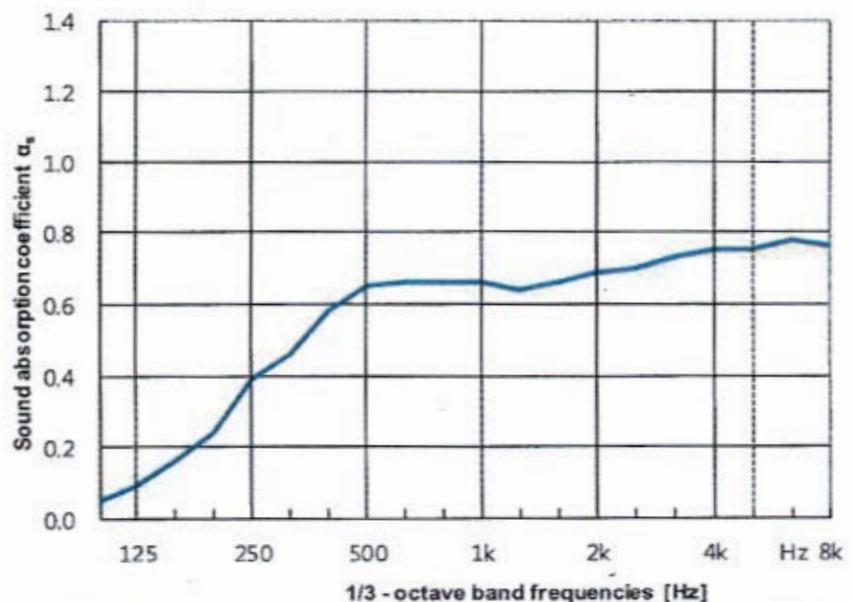
Test

Reverberation room Empa, Volume V: 215 m³

Date: 25.03.2013

Temperature: 21°C, relative humidity: 58 %

Sample size: 3000 x 4000 mm Area S: 12.0 m²



Evaluation according to EN ISO 11'654 (1997): α_w : 0.65

α_p : 250 Hz: 0.35 500 Hz: 0.65 1000 Hz: 0.65 2000 Hz: 0.70 4000 Hz: 0.75

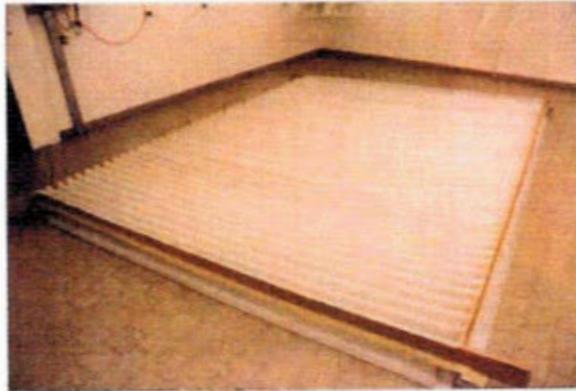
Method of measurement: EN ISO 354 (2003)

MLS-based measurement; 1/3 octave band filters, T20 based upon the integrated impulse response

6 Sound absorption coefficient α_s (measured in the reverberation room)

Curtain SILENTE 20 D – article EA07, draped

Average mounting distance: 150 mm



Frequency f [Hz]	α_s [-]
100	0.05
125	0.07
160	0.14
200	0.19
250	0.34
315	0.40
400	0.58
500	0.69
630	0.79
800	0.85
1000	0.89
1250	0.92
1600	0.91
2000	0.84
2500	0.82
3150	0.88
4000	0.89
5000	0.90
6300	0.89
8000	0.94

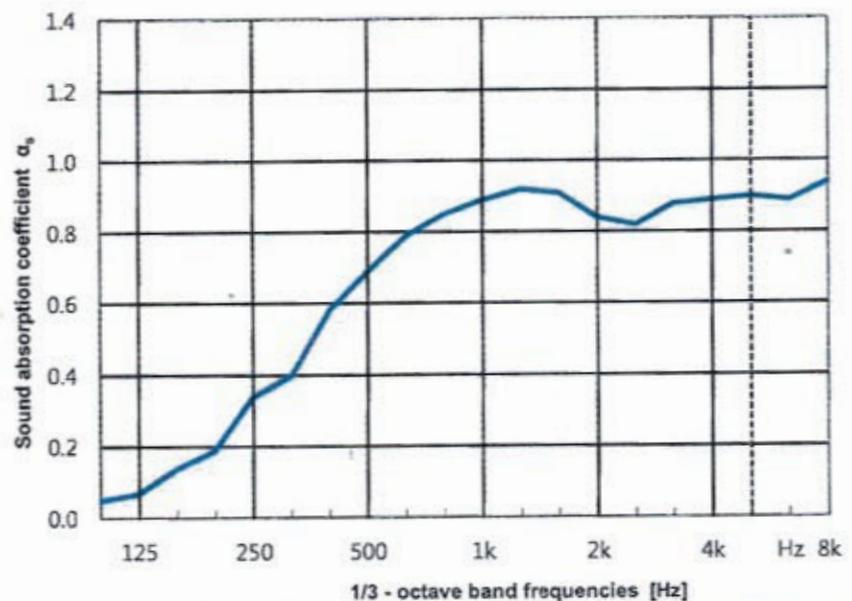
Test

Reverberation room Empa, Volume V: 215 m³

Date: 25.03.2013

Temperature: 21°C, relative humidity: 57 %

Sample size: 3000 x 4000 mm Area S: 12.0 m²



Evaluation according to EN ISO 11'654 (1997): α_{av} : 0.60 (MH)

α_p : 250 Hz: 0.30 500 Hz: 0.90 1000Hz: 0.70 2000Hz: 0.85 4000Hz: 0.90

Method of measurement: EN ISO 354 (2003)

MLS-based measurement: 1/3 octave band filters, T20 based upon the integrated impulse response

7 Sound absorption coefficient α_s (measured in the reverberation room)

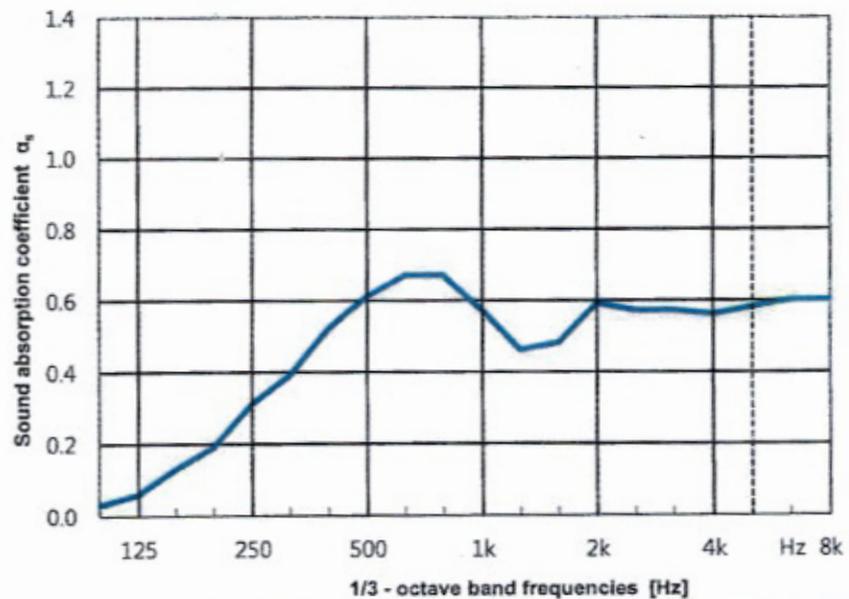
Curtain SILENTE 20 P – article T033, flat mounted

Mounting distance: 150 mm



Frequency f [Hz]	α_s [-]
100	0.03
125	0.06
160	0.13
200	0.19
250	0.31
315	0.39
400	0.52
500	0.61
630	0.67
800	0.67
1000	0.57
1250	0.46
1600	0.48
2000	0.59
2500	0.57
3150	0.57
4000	0.56
5000	0.58
6300	0.60
8000	0.60

Test Reverberation room Empa, Volume V: 215 m³ **Date:** 25.03.2013
 Temperature: 21°C, relative humidity: 59 %
 Sample size: 3000 x 4000 mm Area S: 12.0 m²



Evaluation according to EN ISO 11'654 (1997): α_w : **0.55**
 α_p : 250 Hz: 0.30 500 Hz: 0.55 1000Hz: 0.60 2000Hz: 0.55 4000Hz: 0.55

Methode of measurement: EN ISO 354 (2003)

MLS-based measurement; 1/3 octave band filters, T20 based upon the integrated impulse response

8 Sound absorption coefficient α_s (measured in the reverberation room)

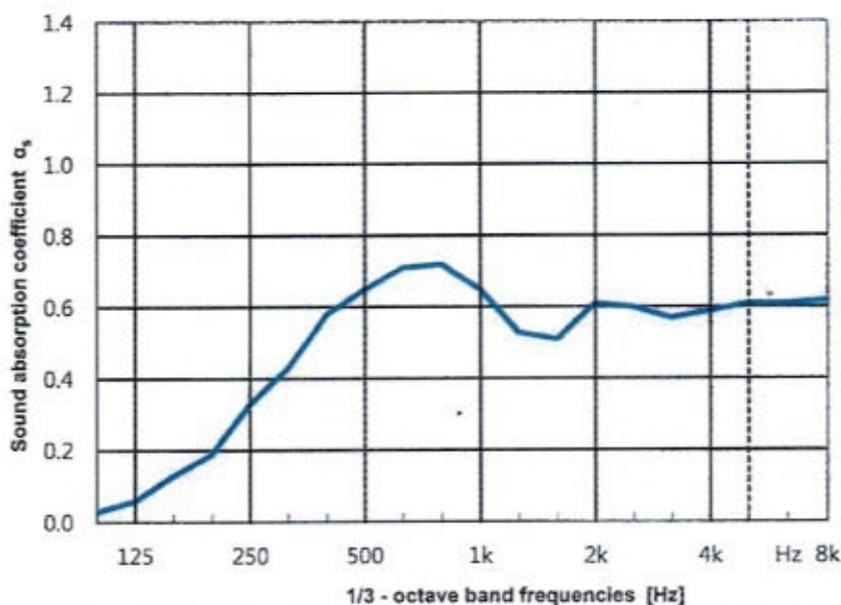
Curtain SILENTE 10 P – article EA00, flat mounted

Mounting distance: 150 mm



Frequency f [Hz]	α_s [-]
100	0.03
125	0.06
160	0.13
200	0.19
250	0.33
315	0.43
400	0.58
500	0.65
630	0.71
800	0.72
1000	0.65
1250	0.53
1600	0.51
2000	0.61
2500	0.60
3150	0.57
4000	0.59
5000	0.61
6300	0.61
8000	0.62

Test Reverberation room Empa, Volume V: 215 m³ **Date:** 25.03.2013
 Temperature: 21°C, relative humidity: 60 %
 Sample size: 3000 x 4000 mm Area S: 12.0 m²



Evaluation according to EN ISO 11'654 (1997): α_w : 0.55

α_p : 250 Hz: 0.30 500 Hz: 0.65 1000Hz: 0.65 2000Hz: 0.55 4000Hz: 0.60

Methode of measurement: EN ISO 354 (2003)

MLS-based measurement; 1/3 octave band filters; T20 based upon the integrated impulse response