

Curtain fabrics of the company Tüchler GmbH

**Measurement of sound absorption according to
DIN EN ISO 354
Stage velour Brahms**

Report No. B300007-01/TB09 Index A
24 February 2026

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Due to an IT system change, our internal project number has changed. The previous project number B77692 has been replaced by B300007-01.

ATTENTION

The assignment of goods to the certificate must be ensured beyond doubt. The use of the certificate for goods other than those purchased from TÜCHLER is inadmissible and will be reported.

Christoph Lach
managing director

1 Task

On behalf of the company TÜCHLER Bühnen- & Textiltechnik GmbH, AT-1220 Vienna, the sound absorption of the stage velour Brahms was to be measured according to DIN EN ISO 354 [1] in the reverberation room. The fabric was tested as a curtain in various test arrangements.

2 Basis

This test report is based on the following documents:

- [1] DIN EN ISO 354:2003-12, Acoustics – Measurement of sound absorption in a reverberation room (ISO 354:2003); German version EN ISO 354:2003
- [2] DIN EN ISO 11654:1997-07, Acoustics – Sound absorbers for use in buildings - Rating of sound absorption (ISO 11654:1997); German version EN ISO 11654:1997
- [3] ASTM C 423-23e1:2024-08, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method. Revision: 23e1
- [4] ISO 9613-1:1993-06, Acoustics – Attenuation of sound during propagation outdoors; part 1: calculation of the absorption of sound by the atmosphere
- [5] DIN EN ISO 5084:1996-10, Textiles – Determination of thickness of textiles and textile products (ISO 5084:1996); German version EN ISO 5084:1996
- [6] DIN EN ISO 9053-1: 2019-03, Acoustics - Determination of airflow resistance - Part 1: Static airflow method (ISO 9053-1:2018); German version EN ISO 9053-1:2018
- [7] DIN EN ISO 12999-2:2020-11, Acoustics – Determination and application of measurement uncertainties in building acoustics – Part 2: Sound absorption (ISO 12999-2:2020); German version EN ISO 12999-2:2020

3 Test object and test assembly

3.1 Test object

The tested material is described by the client as follows:

- manufacturer: TÜCHLER
- fabric: stage velour Brahms
- material: 100 % polyester

The testing laboratory has measured as follows at three random A4-sized samples from testing material:

- thickness acc. DIN EN ISO 5084 [5]
(3 positions, pressure 1.00 kPa, pressure-foot 2000 mm²): $t = 1.43 \text{ mm}$
- area specific mass: $m'' = 420 \text{ g/m}^2$
- specific air flow resistance acc.
to DIN EN ISO 9053-1 [6]: $R_s = 2614 \text{ Pa}\cdot\text{s/m}$

3.2 Test assembly

The test material was delivered on 13th February 2026. The installation of the test objects was carried out at the reverberation room by employees of the test laboratory on the day of test.

The test assemblies were made following mounting type G according to DIN EN ISO 354 [1]. The mounting details of the test set-ups are as follows:

- curtain webs fixed to a metal rail that was placed directly at the ceiling of the reverberation room, the height of the rail was 90 mm, the fabric was fixed at the rail with 60 mm overlap
- manufactured as a ready-made curtain, with 100% fullness in two webs with 20 mm overlap at the vertical joint
- test set-up with free curtain edges at sides and at bottom (no enclosing frame)

Testing was done in two different test assemblies, which are described in Table 1.

Table 1. Overview of the tested assemblies.

Test arrangement	Distance to the reflective wall	Drapery	Fabric dimensions $W \times H$	Dimensions of test surface (from lower border of the rail) $W \times H = S$
1	100 mm	flat-hanging	1 web 3.60 m x 3.00 m	3.60 m x 2.94 m = 10.58 m ²
2	100 mm	pleated-hanging, 100 % fullness	2 webs, 3.60 m x 3.00 m each	

The test certificates in Appendix A and the photographs in Appendix B show further details of the test assemblies.

4 Execution of the measurements

The measurements were executed according to DIN EN ISO 354 [1].

The test procedure, the test stand and the test equipment used for the measurements are described in Appendix C.

5 Evaluation

The sound absorption coefficient α_s was determined in one-third octave bands between 100 Hz and 5000 Hz according to DIN EN ISO 354 [1].

In addition, the following characteristic values were determined according to DIN EN ISO 11654 [2].

- Practical sound absorption coefficient α_p in octave bands
- Weighted sound absorption coefficient α_w as single value

The weighted sound absorption coefficient α_w is determined from the practical sound absorption coefficients α_p in the octave bands of 250 Hz to 4000 Hz.

According to ASTM C 423 [3] the following characteristic values were determined:

- Noise reduction coefficient *NRC* as single value
Arithmetical mean value of the sound absorption coefficients in the four one-third octave bands 250 Hz, 500 Hz, 1000 Hz and 2000 Hz; mean value rounded to 0.05.
- Sound absorption average *SAA* as single value
Arithmetical mean value of the sound absorption coefficients in the twelve one-third octave bands between 250 Hz and 2500 Hz; mean value rounded to 0.01.

6 Measurement results

The sound absorption coefficients α_s in one-third octave bands, the practical sound absorption coefficients α_p in octave bands and the single values (α_w , *NRC* und *SAA*) are indicated in the test certificate in Appendix A.

Information on the uncertainty of measurement is given in Appendix C. When assigning the absorption group, the measurement uncertainty was not taken into account in accordance with DIN EN ISO 11654 [2].

7 Remarks

The test results exclusively relate to the investigated subjects and conditions described.



Dipl.-Ing. (FH) Dominik Reif
(Project Manager)



Maximilian Klameth
(Responsible)

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The publishing of excerpts is only possible with prior consent of Müller-BBM.



Testing laboratory accredited by DAkkS according to
DIN EN ISO/EC 17025:2018.
The accreditation is valid only for scope listed in the annex
of the accreditation certificate.

Appendix A – Test certificates

Sound absorption coefficient ISO 354

Measurement of sound absorption in reverberation rooms

Client: TÜCHLER Bühnen- und Textiltechnik GmbH,
Rennbahnweg 78, 1220 Vienna

Test specimen: Stage velour Brahms, mounting type G-100, single-layer, flat arrangement

Information on the test object:

Information provided by the client:

- designation: stage velour Brahms
- material: 100 % polyester

Properties determined by the testing laboratory

- area specific mass $m'' = 420 \text{ g/m}^2$
- airflow resistance acc. to DIN EN ISO 9053-1 $R_S = 2614 \text{ Pa s/m}$
- fabric thickness $d = 1.43 \text{ mm}$

Information on the test arrangement (mounting type G-100 acc. to DIN EN ISO 354):

- flat-hanging curtain in front of the wall of the reverberation room
- suspended from a 90 mm high metal rail on the ceiling of the reverberation room (60 mm overlap), 100 mm distance to the reflective wall
- single-layer arrangement
- test set-up without enclosing frame
- manufactured as ready-made curtain 360 cm x 300 cm, upper edge with metal eyelets (every 10 cm)
- test surface width x height = 3.60 m x 2.94 m (starting at lower edge of the metal rail)

Room: E

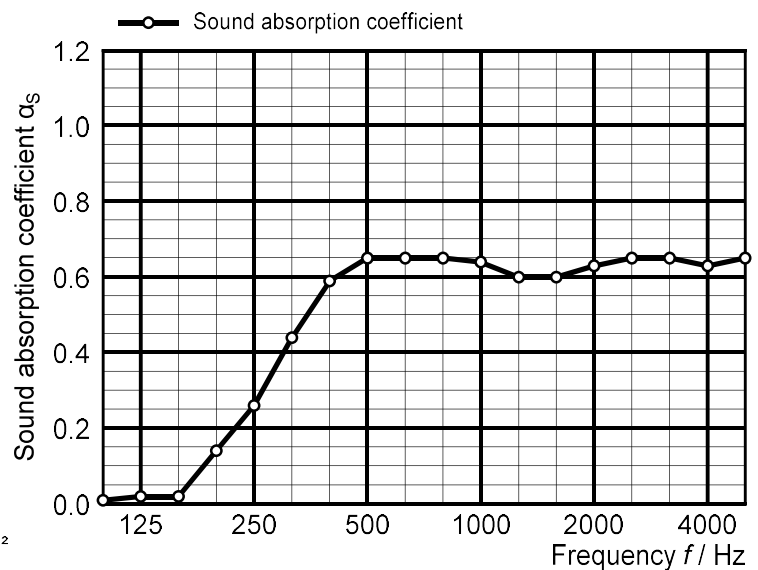
Volume: 199.60 m³

Size: 10.58 m²

Date of test: 2026-02-17

	θ [°C]	$r. h.$ [%]	B [kPa]
without specimen	18.4	37.4	94.0
with specimen	18.5	36.6	94.0

Frequency [Hz]	α_s 1/3 octave	α_p octave
100	0.01	
125	0.02	0.00
160	0.02	
200	0.14	
250	0.26	0.30
315	0.44	
400	0.59	
500	0.65	0.65
630	0.65	
800	0.65	
1000	0.64	0.65
1250	0.60	
1600	0.60	
2000	0.63	0.65
2500	0.65	
3150	0.65	
4000	0.63	0.65
5000	0.65	



◦ Equivalent sound absorption area less than 1.0 m²

α_s Sound absorption coefficient according to ISO 354

α_p Practical sound absorption coefficient according to ISO 11654

<p>Rating according to ISO 11654: Weighted sound absorption coefficient $\alpha_w = 0,60$ Sound absorption class: C</p>	<p>Rating according to ASTM C423: Noise Reduction Coefficient $NRC = 0.55$ Sound Absorption Average $SAA = 0.54$</p>
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Sound absorption coefficient ISO 354

Measurement of sound absorption in reverberation rooms

Client: TÜCHLER Bühnen- und Textiltechnik GmbH,
Rennbahnweg 78, 1220 Vienna

Test specimen: Stage velour Brahms, mounting type G-100,
pleated with 100 % fullness

Information on the test object:

Information provided by the client:

- designation: stage velour Brahms
- material: 100 % polyester

Properties determined by the testing laboratory

- area specific mass $m'' = 420 \text{ g/m}^2$
- airflow resistance acc. to DIN EN ISO 9053-1 $R_S = 2614 \text{ Pa s/m}$
- fabric thickness $d = 1.43 \text{ mm}$

Information on the test arrangement (mounting type G-100 acc. to DIN EN ISO 354):

- pleated hanging curtain in front of the wall of the reverberation room with 100 % fullness
- suspended from a 90 mm high metal rail on the ceiling of the reverberation room (60 mm overlap), 100 mm distance to the reflective wall
- single-layer arrangement
- test set-up without enclosing frame
- manufactured as two ready-made curtains 360 cm x 300 cm, 20 mm overlap at the joint upper edge with metal eyelets (every 10 cm)
- test surface width x height = 3.60 m x 2.94 m (starting at lower edge of the metal rail)

Room: E

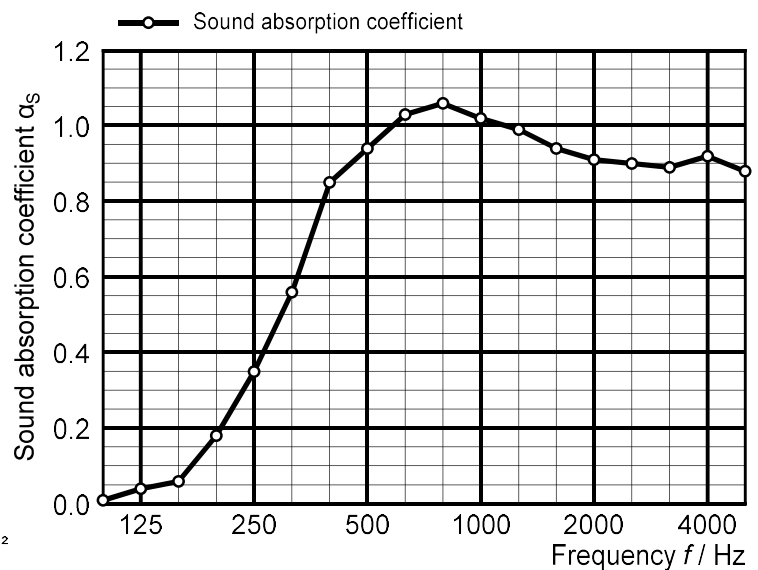
Volume: 199.60 m³

Size: 10.58 m²

Date of test: 2026-02-17

	θ [°C]	<i>r. h.</i> [%]	<i>B</i> [kPa]
without specimen	18.4	37.4	94.0
with specimen	18.5	36.5	94.0

Frequency [Hz]	α_s 1/3 octave	α_p octave
100	0.01	
125	0.04	0.05
160	0.06	
200	0.18	
250	0.35	0.35
315	0.56	
400	0.85	
500	0.94	0.95
630	1.03	
800	1.06	
1000	1.02	1.00
1250	0.99	
1600	0.94	
2000	0.91	0.90
2500	0.90	
3150	0.89	
4000	0.92	0.90
5000	0.88	



◦ Equivalent sound absorption area less than 1.0 m²

α_s Sound absorption coefficient according to ISO 354

α_p Practical sound absorption coefficient according to ISO 11654

<p>Rating according to ISO 11654: Weighted sound absorption coefficient $\alpha_w = 0,65$ (MH) Sound absorption class: C</p>	<p>Rating according to ASTM C423: Noise Reduction Coefficient NRC = 0.80 Sound Absorption Average SAA = 0.81</p>
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Appendix B – Photos



Figure B.1. Flat test arrangement in the reverberation room (frontal view).



Figure B.2. Flat test arrangement in the reverberation room (diagonal view).



Figure B.3. Pleated test arrangement in the reverberation room (frontal view).



Figure B.4. Pleated test arrangement in the reverberation room (diagonal view).

Appendix C – Description of the test procedure for the determination of the sound absorption in a reverberation room

C.1 Measurand sound absorption coefficient

The sound absorption coefficient α of the test object was determined. For this purpose the mean value of the reverberation time in the reverberation room with and without the test object was measured. The sound absorption coefficient was calculated using the following equation:

$$\alpha_S = \frac{A_T}{S}$$

$$A_T = 55.3 V \left(\frac{1}{c_2 T_2} - \frac{1}{c_1 T_1} \right) - 4 V (m_2 - m_1)$$

With:

- α_S sound absorption coefficient;
- A_T equivalent sound absorption area of the test object in m^2 ;
- S area covered by the test object in m^2 ;
- V volume of the reverberation room in m^3 ;
- c_1 propagation speed of sound in air in the reverberation room without test object in m/s;
- c_2 propagation speed of sound in air in the reverberation room with test object in m/s;
- T_1 reverberation time in the reverberation room without test object in s;
- T_2 reverberation time in the reverberation room with test object in s;
- m_1 power attenuation coefficient in the reverberation room without test object in m^{-1} ;
- m_2 power attenuation coefficient in the reverberation room with test object in m^{-1} .

The area covered by the test object was used as the surface area of the test object.

The different dissipation during the sound propagation in the air was taken into account according to paragraph 8.1.2 of DIN EN ISO 354 [1]. The calculation of the power attenuation coefficients was effected according to ISO 9613-1 [4]. The climatic conditions during the measurements are indicated in the test certificates.

Information on the repeatability and reproducibility of the test procedure are given in DIN EN ISO 354 [1] and DIN EN ISO 12999-2 [7]. In [7] for the single-number α_w a standard deviation of reproducibility of $\sigma_R = 0.035$ is indicated. This value was determined from reproducibility data of the test method based on round robin tests and describes the reproducibility of test results that was determined in test laboratories for similar constructions. An aspired confidence level of 95 % results in a coverage factor of $k = 2.0$ and an expanded uncertainty of $U = \pm 0.07$ for the weighted sound absorption coefficient α_w .

C.2 Test procedure

C.2.1 Description of the reverberation room

The reverberation room complies with the requirements according to DIN EN ISO 354 [1].

The reverberation room has a volume of $V = 199.6 \text{ m}^3$ and a surface of $S = 216 \text{ m}^2$.

Six omni-directional microphones and four loudspeakers were installed in the reverberation room.

In order to improve the diffusivity, six composite sheet metal boards dimensioned 1.2 m x 2.4 m and six composite sheet metal boards dimensioned 1.2 m x 1.2 m were suspended curved and irregularly.

Figure C.1 shows the drawings of the reverberation room.

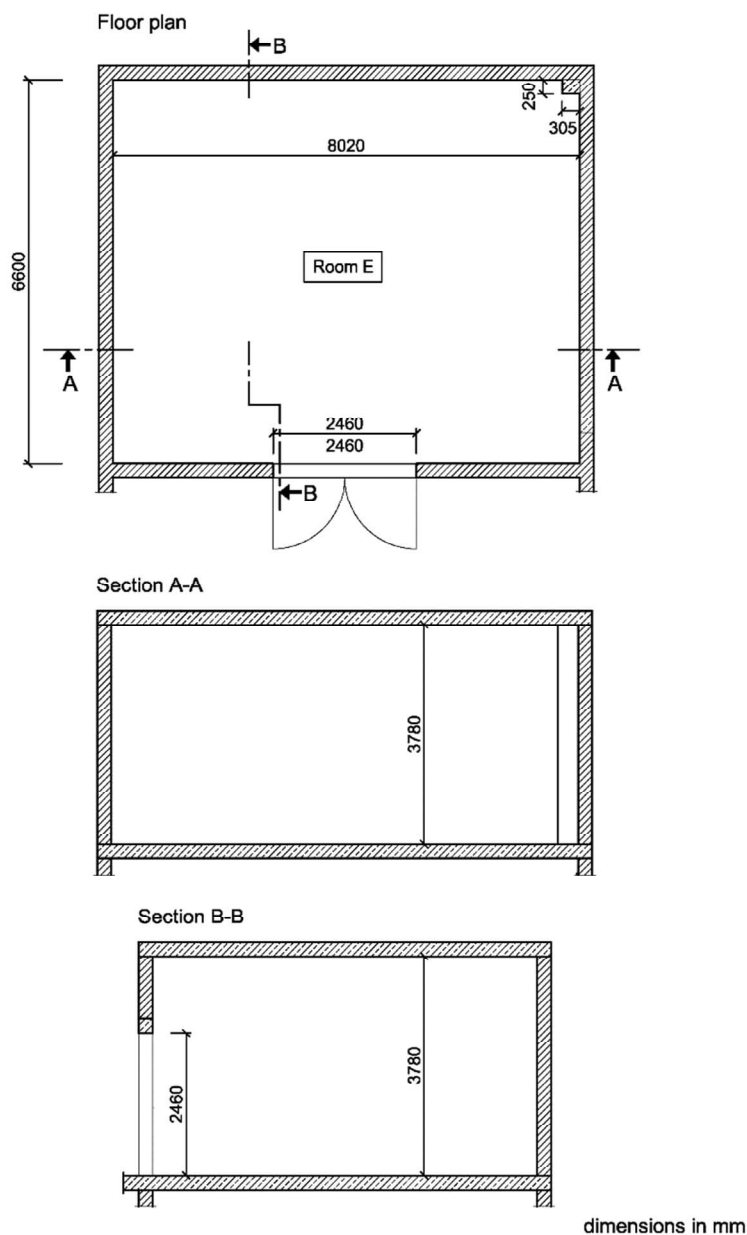


Figure C.1. Plan view and sections of the reverberation room.

C.2.2 Measurement of reverberation time

The determination of the impulse responses were carried out according to the indirect method. In all tests, a sinusoidal sweep with pink noise spectrum was used as test signal. In the reverberation room with and without test objects each 24 independent combinations of loudspeakers and microphones were measured. The reverberation time was evaluated according to DIN EN ISO 354 [1], using a linear regression for the calculation of the reverberation time T_{20} from the level of a backward integrated impulse response.

The determined reverberation times in the reverberation room with and without test object are indicated in table C.1.

Table C.1. Reverberation times without and with test objects.

Frequency f in Hz	Reverberation time T in s		
	T_1 (without test object)	T_2 (with test object)	
		Test arrangement 1	Test arrangement 2
100	5.48	5.43	5.35
125	5.71	5.49	5.29
160	5.64	5.39	5.09
200	5.19	4.18	3.99
250	5.69	3.83	3.45
315	5.41	3.05	2.71
400	5.40	2.63	2.16
500	5.43	2.52	2.03
630	5.19	2.47	1.89
800	4.94	2.40	1.82
1000	5.04	2.45	1.88
1250	4.97	2.51	1.90
1600	4.82	2.47	1.94
2000	4.44	2.32	1.90
2500	3.67	2.05	1.76
3150	2.91	1.79	1.56
4000	2.22	1.51	1.32
5000	1.72	1.25	1.14

C.2.3 List of test equipment

The test equipment used is listed in Table C.2

Table C.2. Test equipment.

Designation	Manufacturer	Type	Serial-No.
AD-/DA-converter	RME	Fireface 802	23811470
Amplifier	APart	Champ 2	17120171
Dodecahedron	Müller-BBM	DOD360A	372828
Dodecahedron	Müller-BBM	DOD360A	372829
Dodecahedron	Müller-BBM	DOD360A	372830
Dodecahedron	Müller-BBM	DOD360A	372831
Microphone	Microtech Gefell	M370	1355
Microphone	Microtech Gefell	M370	1356
Microphone	Microtech Gefell	M360	1786
Microphone	Microtech Gefell	M360	1787
Microphone	Microtech Gefell	M360	1788
Microphone	Microtech Gefell	M360	1789
Microphone power supply	MFA	IV80F	330364
Hygro-/Thermometer	Testo	Saveris H1E	01554624
Barometer	Lufft	Opus 10	057.0410.0003.9.4.1.30
Thickness gauge	Hans Schmidt & Co. GmbH	D-2000-C0913	2985
Electronic balance	Kern	KB1200-2N	W1402353
Measuring system for airflow resistance	Müller-BBM	M89319-00	315003
Software for measurement and evaluation	Müller-BBM	m ars	Version 1.25.8546.27331
Software for measurement and evaluation	Müller-BBM	Bau 4	Version 1.12