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2018-05-15
M102794/29 RFD/STY

Fabric of Création Baumann

Measurement of the airborne sound insulation of curtain constructions according to DIN EN ISO 15186-1/-3

Test report No. M102794/29

Client:	Création Baumann AG Bern-Zürich-Strasse 23 4901 Langenthal SWITZERLAND
Consultant:	Dipl.-Ing. (FH) Dominik Reif
Date of report:	2018-05-15
Delivery date of the test objects:	2017-07-15
Dates of tests:	2017-08-21 / 2017-08-22 / 2017-08-29 and 2017-08-30 as well as 2017-09-01
Total number of pages:	In total 29 pages, thereof 8 pages of text, 13 pages of Appendix A, 2 pages of Appendix B and 6 pages of Appendix C.

Table of contents

1 Task

On behalf of Création Baumann AG, Bern-Zürich-Strasse 23, 4901 Langenthal, Switzerland, the intensity sound reduction index of curtain constructions was to be determined in the window test facility according to DIN EN ISO 15186-1/-3 [6] [7].

2 References

This test report is based on the following documents:

[1] DIN EN ISO 12999-1: Acoustics – Determination and application of measurement uncertainties in building acoustics – Part 1: Sound insulation. German version September 2014

[2] DIN EN ISO 10140-1: Acoustics – Laboratory measurement of sound insulation of building elements – Part 1: Application rules for specific products. German version December 2016

[3] DIN EN ISO 10140-2: Acoustics – Laboratory measurement of sound insulation of building elements – Part 2. Measurement of airborne sound insulation, German version December 2010

[4] DIN EN ISO 10140-4: Acoustics – Laboratory measurement of sound insulation of building elements – Part 4: Measurement procedures and requirements. German version December 2010

[5] DIN EN ISO 10140-5: Acoustics – Laboratory measurement of sound insulation of building elements – Part 5: Requirements for test facilities and equipment. German version September 2014 (DIN EN ISO 10140-5:2010 + A1:2014)

[6] DIN EN ISO 15186-1: Acoustics – Measurement of sound insulation in buildings and of building elements using sound intensity measurements – Part 1: Laboratory measurements. German version December 2003

[7] DIN EN ISO 15186-3: Acoustics – Measurement of sound insulation in buildings and of building elements using sound intensity – Part 3: Laboratory measurements at low frequencies. German version December 2010

[8] DIN EN ISO 717-1: Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation. German version June 2013

[9] DIN EN 29053: Acoustics – Materials for acoustical applications; determination of airflow resistance. German version May 1993

3 Test setup and test objects

3.1 Test objects

The test objects were composed of combinations of different fabric and film layers. The individual materials can be described as follows:

Fabric Alex

- fabric: Alex
- material: 100 % PLF CS
- thickness: d = 1.60 mm
- specific airflow resistance according to DIN EN 29053 [9]: R_s = 310 Pa · s/m
- mass per unit area: m' = 369 g/m^2

Fabric Phantom Plus

- fabric: Phantom Plus
- material: 100 % PLF
- specific airflow resistance according to DIN EN 29053 [9] R_s = 665 Pa · s/m
- mass per unit area: m' = 202 g/m^2

Fabric Sport

- fabric: Sport
- material: 70 % PLF, 30 % PE
- thickness: d = 0.40 mm
- specific airflow resistance according to DIN EN 29053 [9]: R_s = 808 Pa · s/m
- mass per unit area: m' = 256 g/m^2

Fabric Secret

- fabric: Secret
- material: 100 % PLF
- thickness: d = 0.75 mm
- specific airflow resistance according to DIN EN 29053 [9]: R_s = 606 Pa · s/m
- mass per unit area: m' = 308 g/m^2

Fabric Arno

- fabric: Arno
- material: 100 % PLF CS
- thickness: d = 1.00 mm
- specific airflow resistance according to DIN EN 29053 [9]: R_s = 1421 Pa · s/m
- mass per unit area: m' = 315 g/m^2

Fabric molton/film

- fabric: Molton 1655, film-laminated on one side
- thickness: d = 1.50 mm
- specific airflow resistance according to DIN EN 29053 [9]: R_s > 40000 Pa · s/m
- mass per unit area: m' = 377 g/m^2

Fabric Silent

- fabric: Silent
- material: 100 % PLF CS
- thickness: d = 0.90 mm
- specific airflow resistance according to DIN EN 29053 [9]: R_s = 594 Pa · s/m
- mass per unit area: m' = 315 g/m^2

The information regarding the above mentioned fabrics were taken from the documents submitted by the manufacturer Création Baumann. The data regarding the thickness of the fabric, the mass per unit area as well as the specific airflow resistance were determined by the test laboratory.

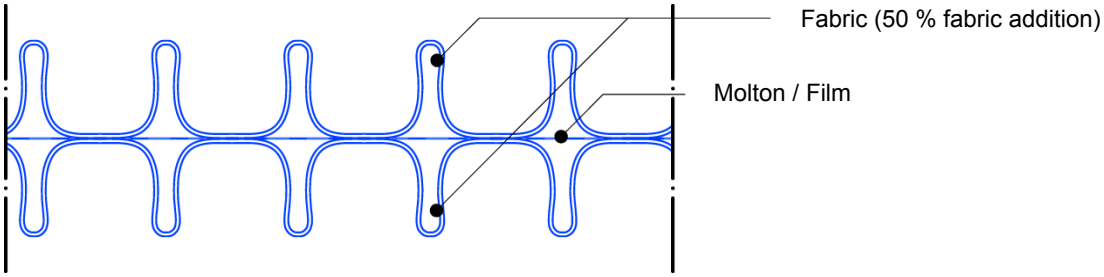
3.2 Test setup

The setup of the test objects in the test facility was carried out by employees of the test laboratory.

In order to obtain the commonly used drapery and to mount the curtain fabrics in the opening of the test facility, a two-piece frame of a coated derived timber product (MDF, 19 mm) was built. In each half of the frame the fabric was inserted in prefabricated grooves (width: approx. 5 mm, depth: 25 mm; centre distance between grooves: 80 mm) and fixed by means of tacker staples. The fabric width per frame half was 1.90 m, the installation width corresponding to the frame width was 1.24 m (resulting in approx. 50 % fabric addition).

By assembling the two frame halves, a double drapery was obtained. Depending on the test setup, a flat intermediate layer of film-laminated molton was fixed between the two frame halves. The intermediate layer of molton/film was inserted in different versions with one and two layers. For the two-layered arrangement of the intermediate layer, the individual layers were placed loosely without space with the film faces on top of one another.

The following figure shows a schematic sketch of the setups tested (sketch not drawn to scale):



The test opening had the dimensions width x height = 1.25 m x 1.50 m. The frames had the exterior dimensions width x height = 1.24 m x 1.49 m and were made of a coated derived timber product (MDF, thickness: 19 mm). The test surface (clear opening span within the frame) had the dimensions width x height = 1.202 m x 1.452 m = 1.75 m².

The frame was installed with a 5 mm circumferential air gap between the frame and the boundary surfaces of the test stand opening. The installation joint was sealed on both sides by a permanently elastic sealing compound.

The test certificates in Appendix A contain further information on the test objects and the test setups. Appendix B shows exemplary photos of the test setups.

4 Test method

The tests of the airborne sound insulation were carried out according to DIN EN ISO 15186-1/-3 [6] [7]. The test method, test facility and the test equipment used are described in Appendix C.

5 Evaluation

The intensity sound reduction index R_I was determined in one-third octave bands between 100 Hz and 5000 Hz according to DIN EN ISO 15186-1/-3 [6] [7].

The determination of the single values was carried out according to DIN EN ISO 717-1 [8].

Hereby the following definitions apply:

- $R_{I,w}$ weighted intensity sound reduction index
- C spectrum adaption value for airborne sound with spectrum 1
- C_{tr} spectrum adaption value for airborne sound with spectrum 2

6 Results

The determined weighted sound reduction indices together with the spectrum adaption values of the setups tested are summarized in the following Table 1.

Table 1. Setups in the window test facility.

No.	Fabric (upper layer with drapery)	Intermediate layer molton film-laminated	Intensity sound reduction index R_I (C; C_{tr}) [dB]	Test certificate Appendix A, page
1	Alex, double-sided	single layer	11 (-1; -3)	1
2		two layers	14 (-1; -4)	2
3	Phantom Plus, double-sided	single layer	13 (-1; -4)	3
4		two layers	15 (-1; -4)	4
5	Sport, double-sided	single layer	13 (-1; -3)	5
6		two layers	15 (-1; -3)	6
7	Secret, double-sided	single layer	13 (-1; -3)	7
8		two layers	16 (-2; -4)	8
9	Arno, double-sided	single layer	14 (-1; -3)	9
10		two layers	16 (-1; -4)	10
11	without	single layer	8 (0; -1)	11
12		two layers	12 (-1; -3)	12
13	Silent, one-sided	without intermediate layer	5 (0; -1)	13

The complete measurement results are given in the test certificates in Appendix A.

7 Remarks

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

M.Eng. Philipp Meistring
(Responsible for technical content)

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

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Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Alex (draped), intermediate layer of molton/film (single layer)

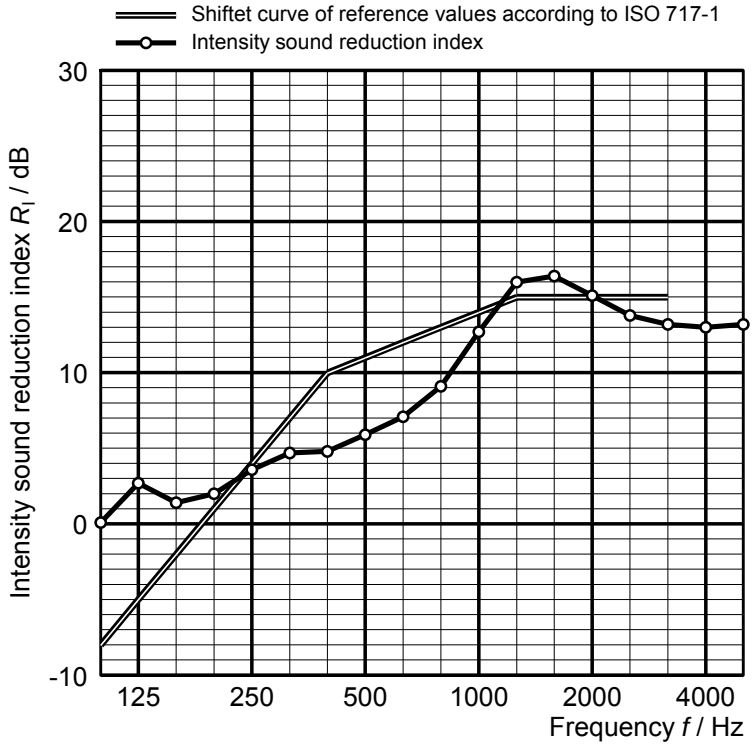
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Alex (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.60 mm, m'' = 369 g/m^2, specific airflow resistance R_s > 40,000 Pa s/m, material: 100 % PLF CS
- 1.5 mm Molton/Film (flat)
- 25 mm Fabric Alex (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.60 mm, m'' = 369 g/m^2, specific airflow resistance R_s > 40,000 Pa s/m, material: 100 % PLF CS

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m^2 (clear opening span of the frame).

Date of test: 2017-08-21
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	0.1	3.3
125	2.7	2.8
160	1.4	2.5
200	2.0	1.9
250	3.6	2.0
315	4.7	2.3
400	4.8	2.6
500	5.9	2.8
630	7.1	2.9
800	9.1	3.0
1000	12.7	3.5
1250	16.0	3.8
1600	16.4	3.5
2000	15.1	3.2
2500	13.8	2.8
3150	13.2	2.6
4000	13.0	2.7
5000	13.2	2.4



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 11 (-1; -3) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	0 dB
C_{tr}	-3 dB	-3 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1

Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Alex (draped), intermediate layer of molton/film (two layers)

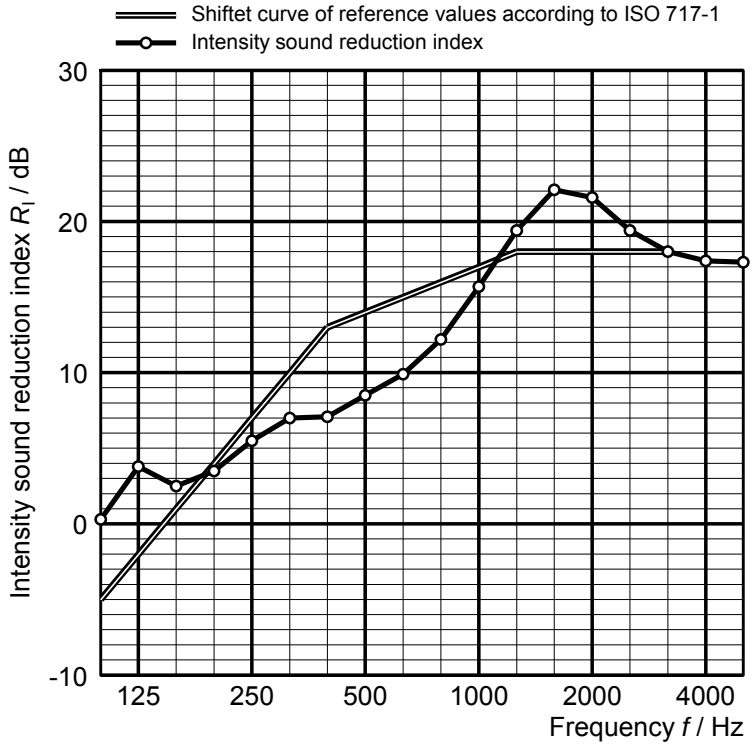
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Alex (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.60 mm, m'' = 369 g/m², specific airflow resistance R_s > 40,000 Pa s/m, material: 100 % PLF CS
- 1.5 mm Molton/Film (flat)
- 1.5 mm Film/Molton (flat)
- 25 mm Fabric Alex (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.60 mm, m'' = 369 g/m², specific airflow resistance R_s > 40,000 Pa s/m, material: 100 % PLF CS

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m² (clear opening span of the frame).

Date of test: 2017-08-21
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	0.3	2.7
125	3.8	2.9
160	2.5	2.5
200	3.5	2.0
250	5.5	2.2
315	7.0	2.4
400	7.1	2.6
500	8.5	2.9
630	9.9	3.3
800	12.2	3.3
1000	15.7	3.7
1250	19.4	3.8
1600	22.1	3.8
2000	21.6	3.6
2500	19.4	3.1
3150	18.0	2.8
4000	17.4	2.8
5000	17.3	2.5



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 14 (-1; -4) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	0 dB
C_{tr}	-4 dB	-4 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Phantom Plus (draped), intermediate layer of molton/film (single layer)

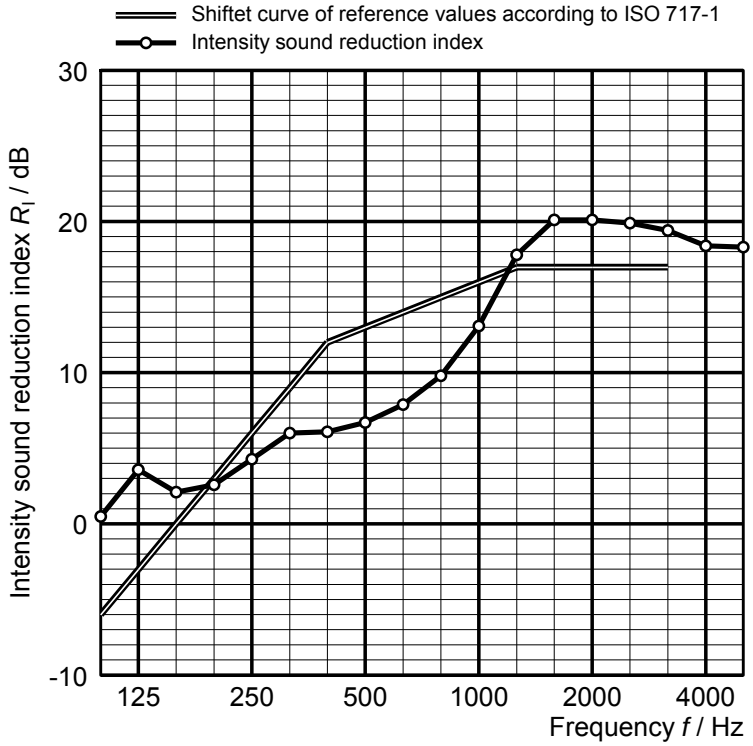
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Phantom Plus (draped, approx. 50 % fabric addition), manufacturer Création Baumann, m'' = 202 g/m^2, specific airflow resistance R_s = 665 Pa s/m, material: 100 % PLF
- 1.5 mm Molton/Film (flat)
- 25 mm Fabric Phantom Plus (draped, approx. 50 % fabric addition), manufacturer Création Baumann, m'' = 202 g/m^2, specific airflow resistance R_s = 665 Pa s/m, material: 100 % PLF

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m^2 (clear opening span of the frame).

Date of test: 2017-08-22
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	0.5	4.1
125	3.6	2.8
160	2.1	2.7
200	2.6	2.5
250	4.3	2.4
315	6.0	2.5
400	6.1	2.8
500	6.7	3.2
630	7.9	3.5
800	9.8	3.8
1000	13.1	4.0
1250	17.8	4.7
1600	20.1	5.0
2000	20.1	4.7
2500	19.9	4.4
3150	19.4	3.7
4000	18.4	3.3
5000	18.3	2.9



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 13 (-1; -4) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	-1 dB
C_{tr}	-4 dB	-4 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1

Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Phantom Plus (draped), intermediate layer of molton/film (two layers)

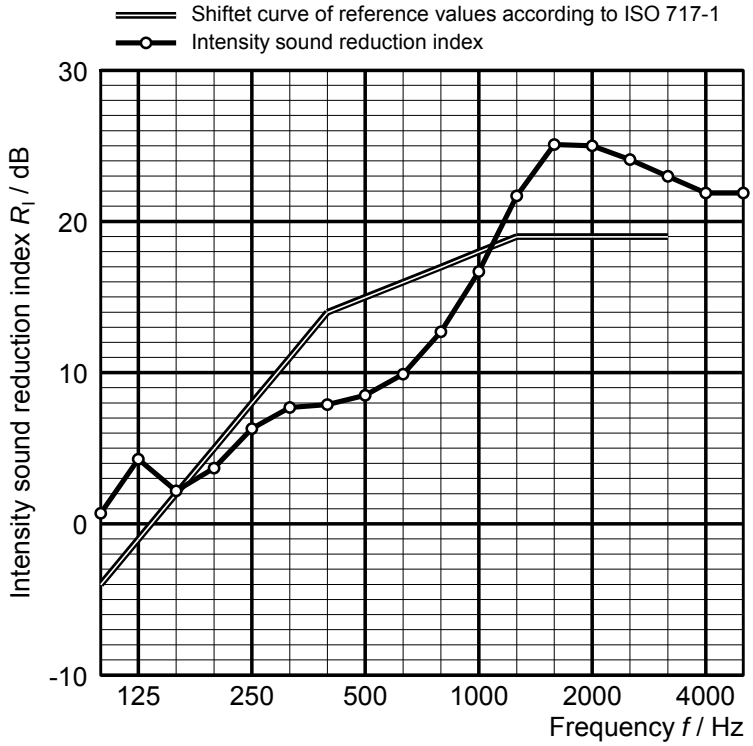
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Phantom Plus (draped, approx. 50 % fabric addition), manufacturer Création Baumann, m'' = 202 g/m^2, specific airflow resistance R_s = 665 Pa s/m, material: 100 % PLF
- 1.5 mm Molton/Film (flat)
- 1.5 mm Film/Molton (flat)
- 25 mm Fabric Phantom Plus (draped, approx. 50 % fabric addition), manufacturer Création Baumann, m'' = 202 g/m^2, specific airflow resistance R_s = 665 Pa s/m, material: 100 % PLF

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m^2 (clear opening span of the frame).

Date of test: 2017-08-22
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_I 1/3 octave [dB]	$F_{p,I}$ 1/3 octave [dB]
100	0.7	3.7
125	4.3	2.8
160	2.2	2.7
200	3.7	2.5
250	6.3	2.9
315	7.7	3.1
400	7.9	3.1
500	8.5	3.1
630	9.9	3.7
800	12.7	4.4
1000	16.7	4.4
1250	21.7	4.9
1600	25.1	5.2
2000	25.0	4.9
2500	24.1	4.3
3150	23.0	3.7
4000	21.9	3.2
5000	21.9	2.9



Weighted intensity sound reduction index $R_{I,w}(C; C_{tr})$ = 15 (-1; -4) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	0 dB
C_{tr}	-4 dB	-4 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Sport (draped), intermediate layer of molton/film (single layer)

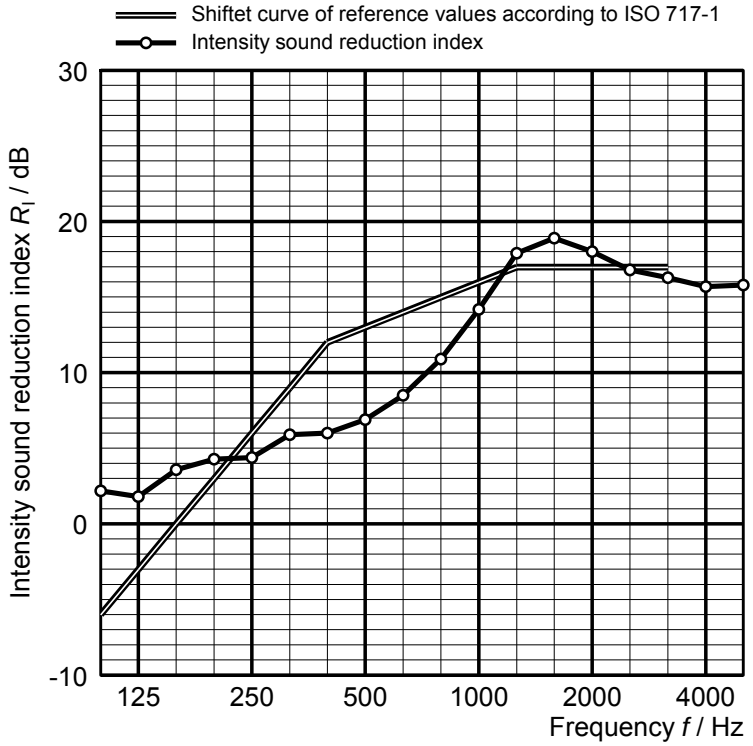
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Sport (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.40 mm, m'' = 256 g/m^2, specific airflow resistance R_s = 808 Pa s/m, material: 70 % PLF 30 % PE
- 1.5 mm Molton/Film (flat)
- 25 mm Fabric Sport (draped, approx. 50 % fabric addition) manufacturer Création Baumann, thickness d = 0.40 mm, m'' = 256 g/m^2, specific airflow resistance R_s = 808 Pa s/m, material: 70 % PLF 30 % PE

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m^2 (clear opening span of the frame).

Date of test: 2017-08-29
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	2.2	3.0
125	1.8	2.9
160	3.6	2.9
200	4.3	2.7
250	4.4	2.6
315	5.9	2.6
400	6.0	3.0
500	6.9	3.5
630	8.5	3.4
800	10.9	3.7
1000	14.2	3.9
1250	17.9	4.0
1600	18.9	4.0
2000	18.0	3.9
2500	16.8	3.5
3150	16.3	3.1
4000	15.7	3.0
5000	15.8	2.8



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 13 (-1; -3) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	-1 dB
C_{tr}	-3 dB	-3 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Sport (draped), intermediate layer of molton/film (two layers)

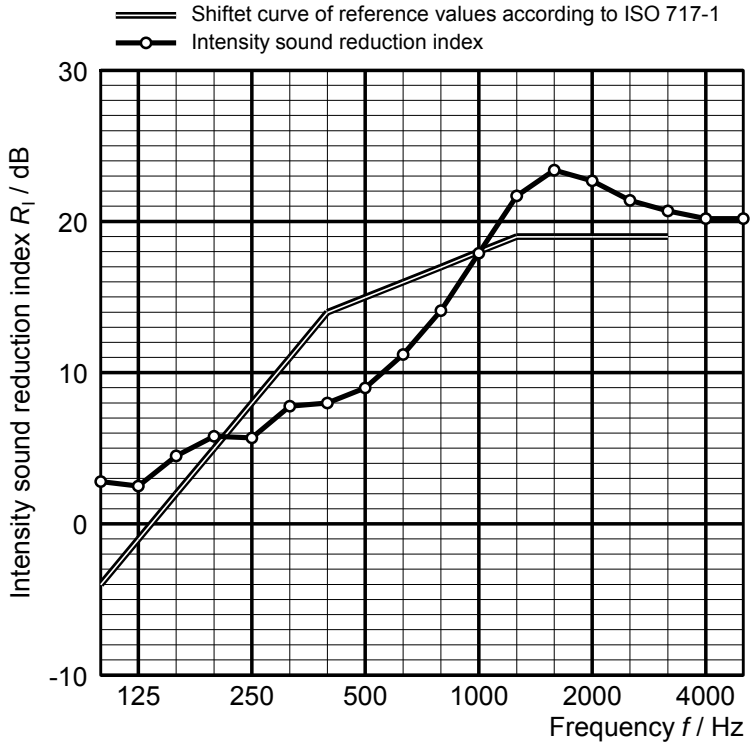
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Sport (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.40 mm, m' = 256 g/m², specific airflow resistance R_s = 808 Pa s/m, material: 70 % PLF 30 % PE
- 1.5 mm Molton/Film (flat)
- 1.5 mm Film/Molton (flat)
- 25 mm Fabric Sport (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.40 mm, m' = 256 g/m², specific airflow resistance R_s = 808 Pa s/m, material: 70 % PLF 30 % PE

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m² (clear opening span of the frame).

Date of test: 2017-08-29
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	2.8	2.6
125	2.5	2.7
160	4.5	2.8
200	5.8	2.8
250	5.7	2.7
315	7.8	2.6
400	8.0	2.9
500	9.0	3.1
630	11.2	3.6
800	14.1	3.9
1000	17.9	4.0
1250	21.7	4.2
1600	23.4	4.2
2000	22.7	4.1
2500	21.4	3.6
3150	20.7	3.2
4000	20.2	3.2
5000	20.2	2.9



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 15 (-1; -3) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	0 dB
C_{tr}	-3 dB	-3 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Secret (draped), intermediate layer of molton/film (single layer)

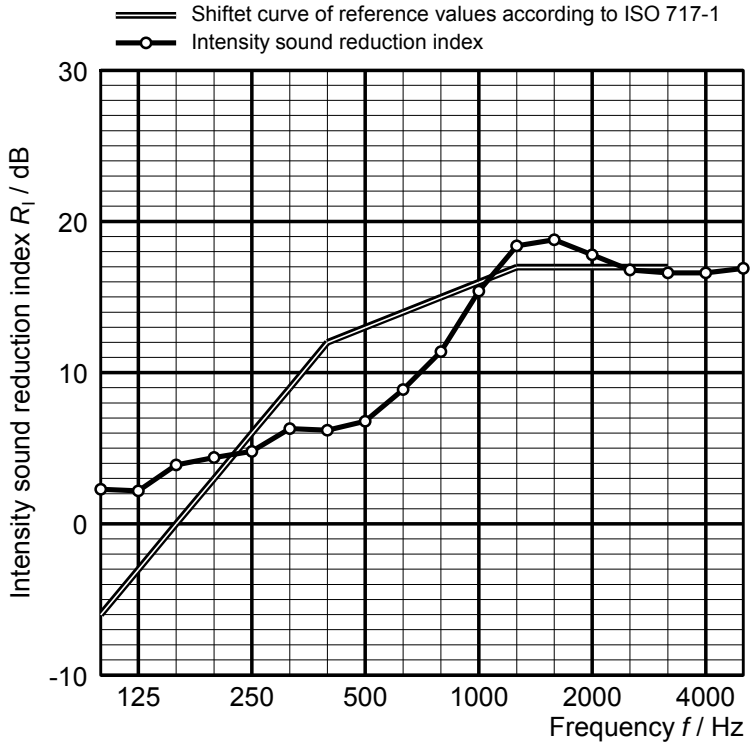
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Secret (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.75 mm, m'' = 308 g/m^2, specific airflow resistance R_s = 606 Pa s/m, material: 100 % PLF
- 1.5 mm Molton/Film (flat)
- 25 mm Fabric Secret (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.75 mm, m'' = 308 g/m^2, specific airflow resistance R_s = 606 Pa s/m, material: 100 % PLF

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m^2 (clear opening span of the frame).

Date of test: 2017-08-30
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_I 1/3 octave [dB]	$F_{p,I}$ 1/3 octave [dB]
100	2.3	3.0
125	2.2	2.7
160	3.9	2.8
200	4.4	2.6
250	4.8	2.7
315	6.3	2.8
400	6.2	2.8
500	6.8	3.2
630	8.9	3.5
800	11.4	3.7
1000	15.4	4.0
1250	18.4	4.0
1600	18.8	3.9
2000	17.8	3.7
2500	16.8	3.3
3150	16.6	3.0
4000	16.6	3.1
5000	16.9	2.9



Weighted intensity sound reduction index $R_{I,w}(C; C_{tr})$ = 13 (-1; -3) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	0 dB
C_{tr}	-3 dB	-3 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Secret (draped), intermediate layer of molton/film (two layers)

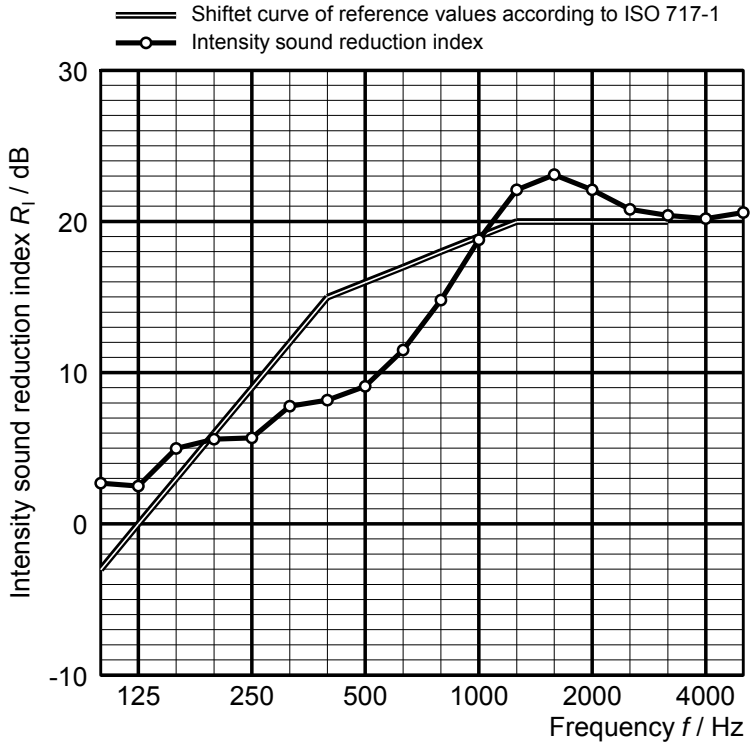
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Secret (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.75 mm, m'' = 308 g/m², specific airflow resistance R_s = 606 Pa s/m, material: 100 % PLF
- 1.5 mm Molton/Film (flat)
- 1.5 mm Film/Molton (flat)
- 25 mm Fabric Secret (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.75 mm, m'' = 308 g/m², specific airflow resistance R_s = 606 Pa s/m, material: 100 % PLF

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m² (clear opening span of the frame).

Date of test: 2017-08-30
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	2.7	3.0
125	2.5	2.8
160	5.0	2.8
200	5.6	2.8
250	5.7	2.7
315	7.8	2.9
400	8.2	3.0
500	9.1	3.2
630	11.5	3.8
800	14.8	4.2
1000	18.8	4.3
1250	22.1	4.4
1600	23.1	4.3
2000	22.1	4.0
2500	20.8	3.5
3150	20.4	3.0
4000	20.2	3.1
5000	20.6	2.8



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 16 (-2; -4) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-2 dB	-1 dB
C_{tr}	-4 dB	-4 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Arno (draped), intermediate layer of molton/film (single layer)

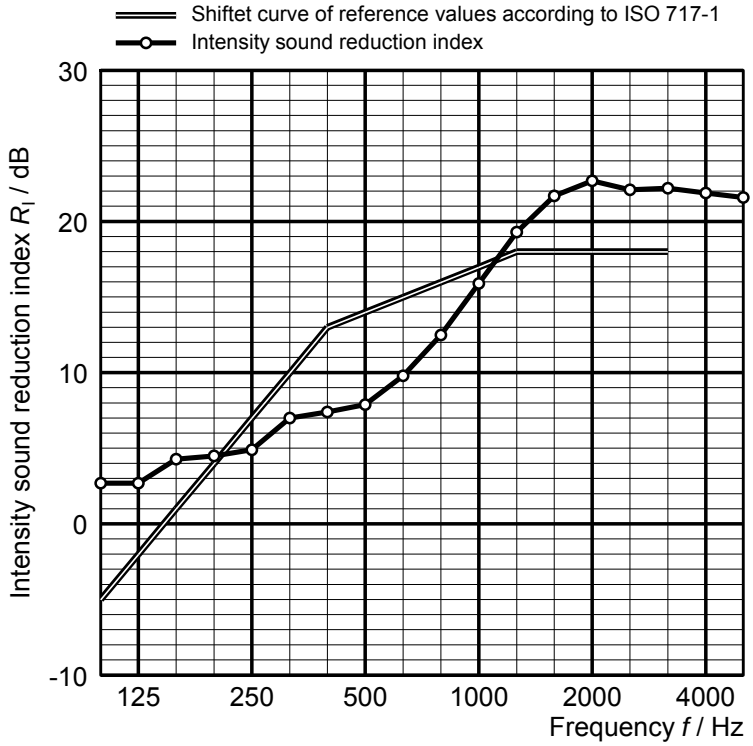
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Arno (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.00 mm, m'' = 315 g/m^2, specific airflow resistance R_s = 1421 Pa s/m, material: 100 % PLF CS
- 1.5 mm Molton/Film (flat)
- 25 mm Fabric Arno (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.00 mm, m'' = 315 g/m^2, specific airflow resistance R_s = 1421 Pa s/m, material: 100 % PLF CS

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m^2 (clear opening span of the frame).

Date of test: 2017-09-01
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	2.7	3.0
125	2.7	2.8
160	4.3	3.0
200	4.5	2.9
250	4.9	2.7
315	7.0	3.0
400	7.4	3.1
500	7.9	3.0
630	9.8	3.7
800	12.5	4.1
1000	15.9	4.4
1250	19.3	4.7
1600	21.7	5.0
2000	22.7	5.2
2500	22.1	4.4
3150	22.2	3.7
4000	21.9	3.3
5000	21.6	2.9



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 14 (-1; -3) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	0 dB
C_{tr}	-3 dB	-3 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Arno (draped), intermediate layer of molton/film (two layers)

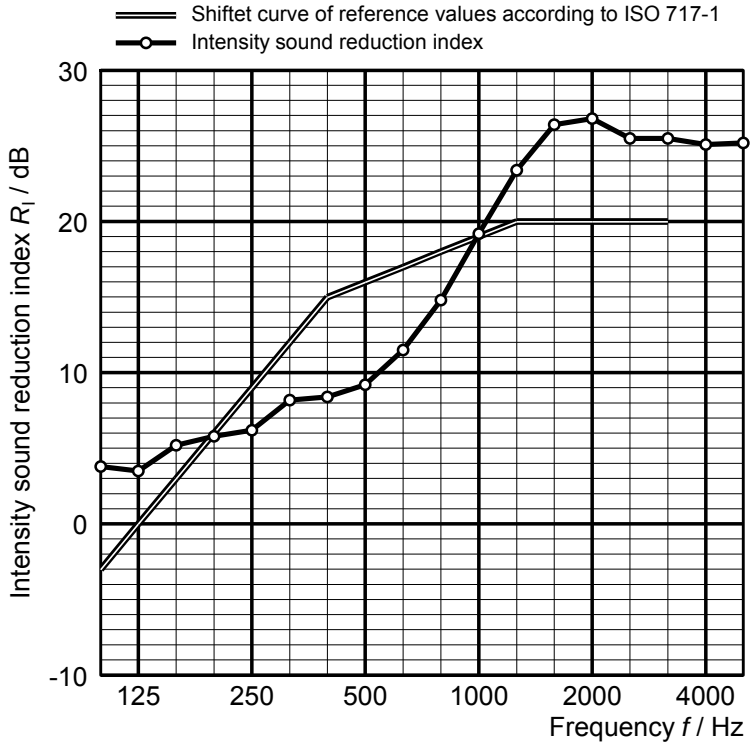
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Arno (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.00 mm, m'' = 315 g/m², specific airflow resistance R_s = 1421 Pa s/m, material: 100 % PLF CS
- 1.5 mm Molton/Film (flat)
- 1.5 mm Film/Molton (flat)
- 25 mm Fabric Arno (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 1.00 mm, m'' = 315 g/m², specific airflow resistance R_s = 1421 Pa s/m, material: 100 % PLF CS

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m² (clear opening span of the frame).

Date of test: 2017-09-01
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	3.8	3.2
125	3.5	3.0
160	5.2	3.0
200	5.8	2.7
250	6.2	2.9
315	8.2	2.9
400	8.4	3.1
500	9.2	3.2
630	11.5	3.8
800	14.8	4.4
1000	19.2	4.9
1250	23.4	5.2
1600	26.4	5.3
2000	26.8	5.3
2500	25.5	4.3
3150	25.5	3.6
4000	25.1	3.2
5000	25.2	2.8



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 16 (-1; -4) dB

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	0 dB
C_{tr}	-4 dB	-4 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Molton/Film (single layer)

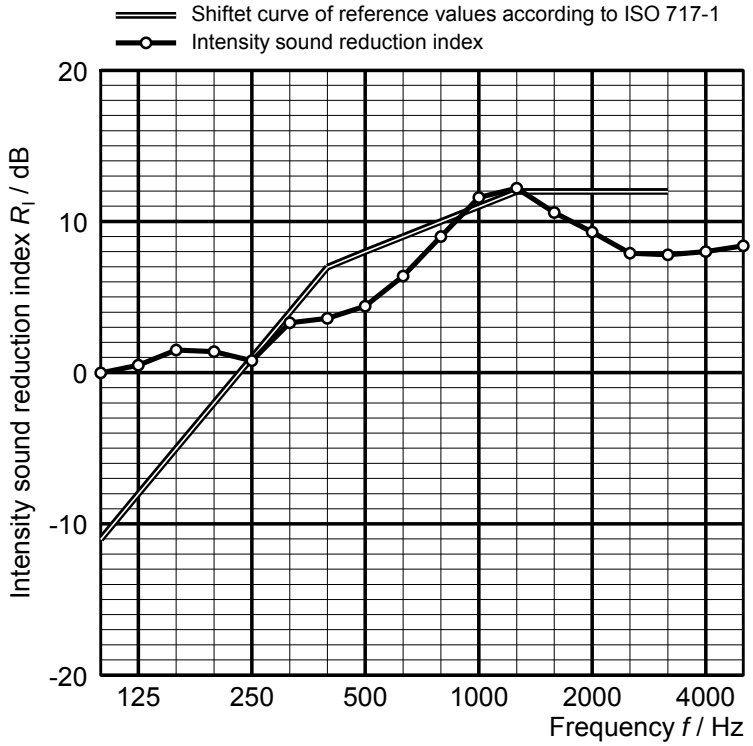
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 1.5 mm Molton/Film (flat)
  m'' = 377 g/m², specific airflow resistance R_s ≥ 40000 Pa s/m

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m² (clear opening span of the frame).

Date of test: 2017-09-01
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_I 1/3 octave [dB]	$F_{p,I}$ 1/3 octave [dB]
100	0.0	2.7
125	0.5	2.7
160	1.5	2.9
200	1.4	2.9
250	0.8	2.4
315	3.3	2.7
400	3.6	3.2
500	4.4	3.1
630	6.4	3.6
800	9.0	4.0
1000	11.6	4.3
1250	12.2	4.5
1600	10.6	4.3
2000	9.3	4.1
2500	7.9	3.9
3150	7.8	3.7
4000	8.0	3.9
5000	8.4	3.9



Weighted intensity sound reduction index $R_{I,w}(C; C_{tr})$ = 8 (0; -1) dB

Evaluation based on laboratory measurement results obtained by an engineering method.

	100 - 3150 Hz	100 - 5000 Hz
C	0 dB	0 dB
C_{tr}	-1 dB	-2 dB

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Molton/film (two layers)

Details of the test setup:
Setup of the test object (from the source room to the receiving room):

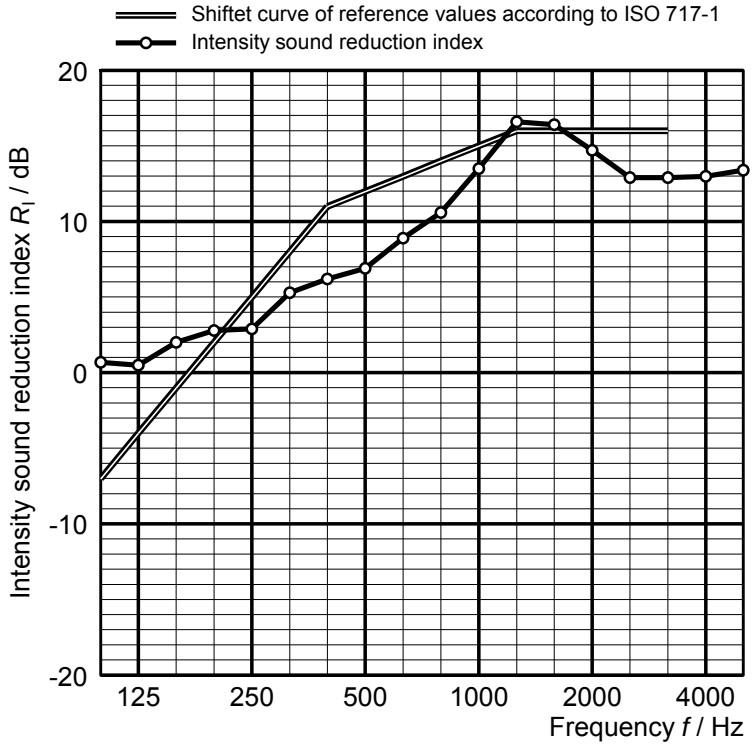
- 1.5 mm Molton/Film (flat)
  m'' = 377 g/m², specific airflow resistance R_s ≥ 40000 Pa s/m

- 1.5 mm Film/molton (flat)
  m'' = 377 g/m², specific airflow resistance R_s ≥ 40000 Pa s/m

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m² (clear opening span of the frame).

Date of test: 2017-09-01
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_l 1/3 octave [dB]	$F_{p,l}$ 1/3 octave [dB]
100	0.7	2.8
125	0.5	2.8
160	2.0	2.8
200	2.8	2.6
250	2.9	2.6
315	5.3	2.7
400	6.2	3.1
500	6.9	3.3
630	8.9	3.7
800	10.6	3.8
1000	13.5	4.1
1250	16.6	4.6
1600	16.4	4.6
2000	14.7	4.5
2500	12.9	4.4
3150	12.9	4.1
4000	13.0	4.2
5000	13.4	4.1



Weighted intensity sound reduction index $R_{l,w}(C; C_{tr})$ = 12 (-1; -3) dB

Evaluation based on laboratory measurement results obtained by an engineering method.

	100 - 3150 Hz	100 - 5000 Hz
C	-1 dB	-1 dB
C_{tr}	-3 dB	-3 dB

Intensity sound reduction index ISO 15186-1
Laboratory measurements of airborne sound insulation between rooms

Client: Création Baumann AG
Bern-Zürich-Strasse 23, CH - 4901 Langenthal

Test specimen: Fabric Silent (draped, single layer without intermediate layer)

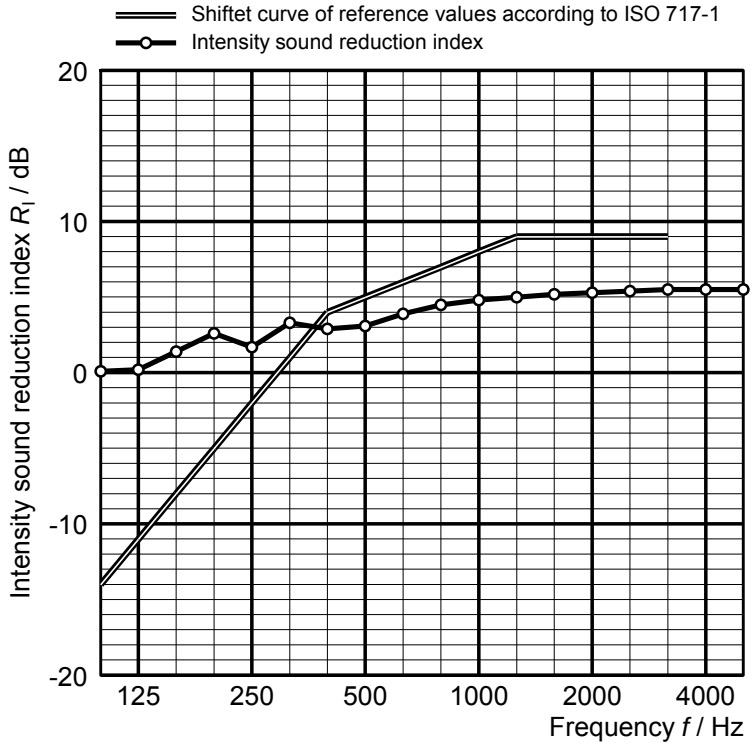
Details of the test setup:
Setup of the test object (from the source room to the receiving room):

- 25 mm Fabric Silent (draped, approx. 50 % fabric addition), manufacturer Création Baumann, thickness d = 0.90 mm, m'' = 315 g/m², specific airflow resistance R_s = 594 Pa s/m, material: 100 % PLF CS

A frame made of derived timber product was installed into the test stand opening. The test object was fixed in the frame with a commonly used drapery. The air gap between the frame and the boundary surfaces of the test opening was sealed with a permanently elastic sealant. Dimensions of the test surface width x height = 1.202 m x 1.452 m = 1.75 m² (clear opening span of the frame)..

Date of test: 2017-09-01
Size: 1.75 m²
Source room: F/G
Vol.: V = 150.60 m³
Receiving room: H
Vol.: V = 57.80 m³
θ = 24°C r.h. = 36 %

Frequency [Hz]	R_I 1/3 octave [dB]	$F_{p,I}$ 1/3 octave [dB]
100	0.1	2.8
125	0.2	2.7
160	1.4	2.7
200	2.6	2.9
250	1.7	2.5
315	3.3	2.6
400	2.9	2.7
500	3.1	2.9
630	3.9	3.3
800	4.5	3.3
1000	4.8	2.9
1250	5.0	2.9
1600	5.2	2.8
2000	5.3	2.6
2500	5.4	2.4
3150	5.5	2.5
4000	5.5	2.8
5000	5.5	2.5



Weighted intensity sound reduction index $R_{I,w}(C; C_{tr})$ = 5 (0; -1) dB

Evaluation based on laboratory measurement results obtained by an engineering method.

	100 - 3150 Hz	100 - 5000 Hz
C	0 dB	0 dB
C_{tr}	-1 dB	-1 dB

Photos

Figure B.1. Exemplary picture of a specimen in the window test stand (reception room side).

Figure B.2. Exemplary picture of a specimen in the window test stand (source room side).

Figure B.3. Exemplary picture of a setup with one layer of molton/film in the window test stand (test setup opened).

Figure B.4. Exemplary picture of a setup with two layers of molton/film in the window test stand (test setup opened).

Description of the test procedure for the determination of the airborne sound insulation

1 Measurand

The intensity sound reduction index R_I was determined assuming a sufficiently diffuse sound field in the source room. The calculation of the intensity sound reduction index was effected according to the following equations:

$$R_I = L_{ps,1} - 9 - [L_{In} + 10 \log(S_m/S)] \text{ dB} \qquad \text{for } f \leq 160 \text{ Hz}$$

$$R_I = L_{p,1} - 6 - [L_{In} + 10 \log(S_m/S)] \text{ dB} \qquad \text{for } f \geq 200 \text{ Hz}$$

With:

R_I Intensity sound reduction index in dB

$L_{ps,1}$ Average sound pressure level on the surface of the test specimen in the source room in dB

$L_{p,1}$ Average sound pressure level in the source room in dB

L_{In} Average normal sound intensity level over the measurement surface in the receiving room in dB

S_m Total surface area of the measurement surface(s) in m^2

S Surface area of the test specimen in m^2

The surface area of the free test opening on the receiving room side was used in terms of surface area of the test specimen S. The total surface area of the scanned measurement surfaces S_m is identical with the surface area of the test specimen S.

Indications concerning the precision of the laboratory procedures regarding the determination of the airborne sound insulation are given in DIN EN ISO 12999-1 [1]. Indications regarding the reproducibility of the results of the intensity procedure using the method according to DIN EN ISO 10140-2 [3] are described in DIN EN ISO 15186-1 [6]

For the determination of the intensity sound reduction index the measurement results of one measurement direction were used.

2 Description of the test facility

The window test stand complies with the requirements according to DIN EN ISO 10140-5 [5], whereby the height of the test opening was adapted to the dimensions of the test object.

In order to increase the diffusivity of the sound field and to adjust the reverberation time in the source room, two absorber boxes (dimensions each l x w x h = 0.6 m x 0.6 m x 1.3 m) were placed on the floor.

Figure C.1 and Figure C.2 show drawings of the window test facility.

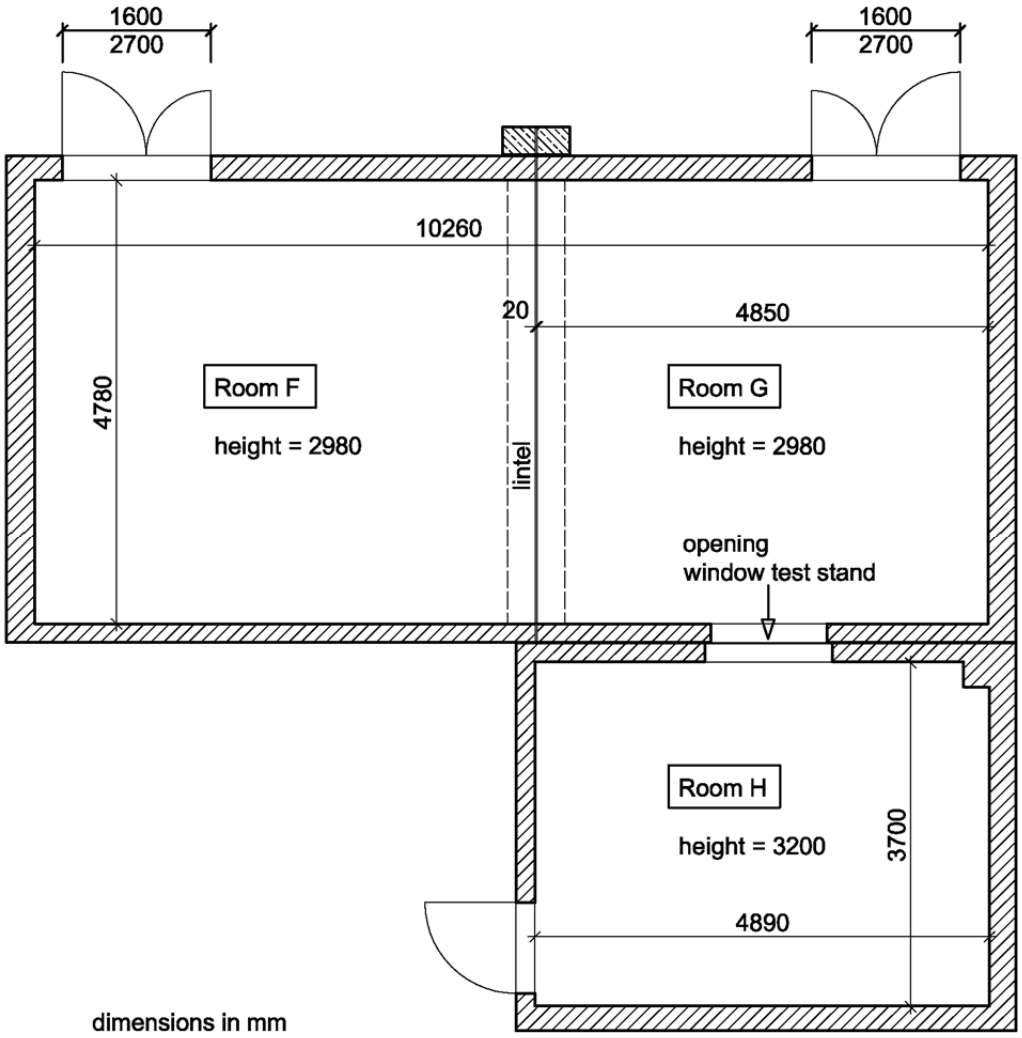


Figure C.1. Floor plan of the window test facility.

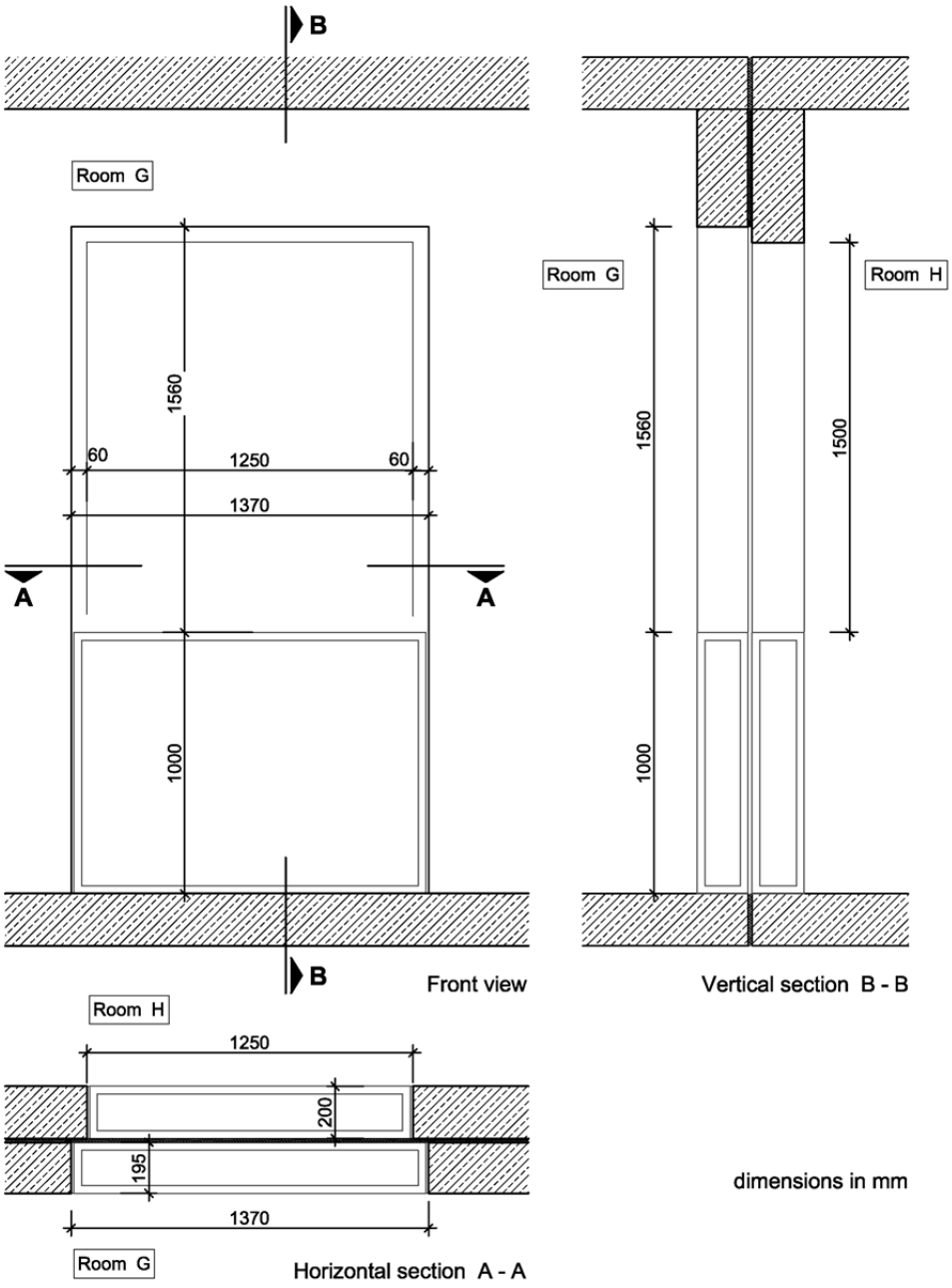


Figure C.2. Front view and sections of the window test facility.

3 Test procedure

3.1 Determination of the source room level

In order to increase the diffusivity of the sound field and to adjust the reverberation time, two absorber boxes (dimensions each *l* x *w* x *h* = 0.6 m x 0.6 m x 1.3 m) were placed on the floor in the source room.

Pink Noise was used as a test signal. The sound pressure level difference between adjacent one-third octave bands in the source room was < 6 dB.

Two dodecahedrons were used as sound sources. The excitation of the dodecahedrons was effected simultaneously at two sound source positions in the room. The room with the larger volume was determined as source room. The sound sources were arranged in such a way that a most diffuse sound field was created. For this purpose the excitation was done in the corner positions of the rear wall of the test facility. The distance between the positions of the sound source and the test object was at least 2 m, so that the share of the direct radiation of the sound source onto the test object was negligible compared to the diffuse sound. Furthermore a distance of at least 0.7 m to all room boundaries was kept.

The measurement of the averaged sound pressure level in the source room was executed in the frequency range ≥ 200 Hz by continuous scanning with a moving microphone. The sweep radius of the microphone was 1.0 m. The traverse plane of the microphone was inclined by approx. 10° compared to the ceiling. The microphone traverses were distributed equally in the permitted room volume. Three microphone traverses were registered. The averaging time of 60 seconds corresponded to the duration of two traverses of the movable microphones.

The average sound pressure level in the frequency range ≤ 160 Hz was registered at ten fixed microphone positions on the surface of the specimen at a distance of 1.0 mm. The averaging time was 15 s.

The rms-average of the sound pressure levels was determined at the different microphone positions. The following minimum distances of the microphone positions were considered:

- 1.2 m between each microphone position and the room boundaries
- 2.0 m between each microphone position and the sound source
- 1.2 m between each moving microphone position and test specimen

Measurement of the sound pressure level was effected in one third octave bands.

3.2 Measurement of the averaged normal sound intensity level on the receiving room side

In the receiving room, the level of the intensity normal component radiated by the test object was determined by continuous scanning of the measurement surface using an intensity probe.

The scanning was done with the intensity probe oriented perpendicular to the test object, moving on meandering traverses at a distance of 0.2 m in front of the test object. For the measurement, the test surface was subdivided into 3 partial measurement areas. Each field was scanned in horizontal and vertical directions.

By using sound absorbing material, the receiving room was adjusted before executing the measurements so that the pressure-intensity-indicator $F_{pI} = L_p - L_{In}$ was ≤ 5 dB in all one-third octave bands.

3.3 Background noise

The averaged sound pressure level and the sound intensity level during excitation in the receiving room exceeded the background noise level by at least 10 dB in all one-third octave bands. This was examined by means of the procedure according to DIN EN ISO 15186-1 [6], section 6.5.

3.4 List of test equipment

The test equipment used for the measurements and evaluations is indicated in the following list:

Table C.1. Test equipment.

Name	Manufacturer	Type	Serial-No.	Calibration valid until
Building acoustics measurement system	Norsonic	121	26342	2019-12
Amplifier	QSC	GXD8	GGF0M0495	
Dodecahedron	Müller-BBM	DOD360A	372838	2018-08
Dodecahedron	Müller-BBM	DOD360A	372839	2018-08
Loudspeaker moving facility	Müller-BBM	LSV	354501	
Microphone swivel facility	Norsonic	212	12986	
Pre-amplifier microphone with free-field microphone	Norsonic Norsonic	1201 1220	26145 25160	2018-12
Pre-amplifier microphone with free-field microphone	Norsonic Norsonic	1201 1220	30588 26071	2018-12
Pistonphone	Brüel & Kjaer	4228	1651956	2018-12
Intensity measurement system	Brüel & Kjaer	2270	3009304	2018-11
Intensity probe kit: Microphone pair Pre-amplifier	 Brüel & Kjaer Brüel & Kjaer	 4197 2683	 2984593-1/ 2984593-2 3038462	 2018-11 2018-11
Measurement and evaluation software	Müller-BBM	Bau4	Version 1.11	