

ABSORPTION MEASUREMENTS FOR BOW SOUND ABSORBER FROM DECIBEL BY JOHANSON

CONCLUSIONS

The sound absorption for Bow from Decibel by Johanson has been measured according to the reverberation room method SS-EN ISO 354:2003. The measurements have been evaluated according to SS-EN ISO 11654:1997 and ISO 20189:2018. The results as weighted sound absorption coefficient and sound absorption class are presented in the table below. The results for sound absorption area according to ISO 20189:2018 are presented in the separate measurement protocol M2.

Measurement protocol	Test object	α_w	Absorption class
M1	Bow	1.00	A

1. CLIENT

Decibel by Johansson, Anders Anderssons väg 7, 285 35 Markaryd, Sweden
Contact: Per Kentner, +46 (0) 704 551 790, per@decibelab.se

2. ASSIGNMENT

To measure the sound absorption coefficient and sound absorption area for sound absorber Bow from Decibel by Johanson according to SS-EN ISO 354:2003. The measurements shall be evaluated according to SS-EN ISO 11654:1997 and ISO 20189:2018 where applicable. Akustikverkstan is accredited for these standards.

3. TEST OBJECTS

Bow is a square sound absorbing wall panel made of a MDF base plate with soundabsorbing filling and a metal structure stretching the panel fabric to create a three dimensional shape.

The base plate is 595 x 595 mm and the maximum height when mounted on the wall is 120 mm. The backside is fitted with 12 mm distances to hang the panels (figure 3).

Bow was tested as a surface as seen in figure 1 and as an object of 3x2 panels (2.1 m²) as seen in figure 2.



Figure 1. Bow as surface, 10 m² (type A mounting)

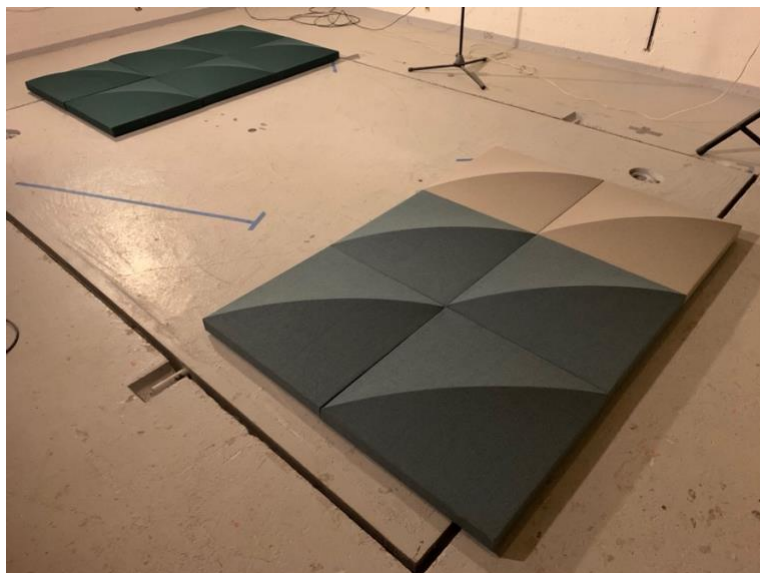


Figure 2. Bow as object of 6 panels, 2.1 m²



Figure 3. View of backside with distances

4. MEASUREMENT PROCEDURE

The absorption measurements were performed according to the standard SS-EN ISO 354:2003. The measurements were made with three speaker positions and four microphone positions. The results for sound absorption area were evaluated according to ISO 20189:2018. The results for sound absorption coefficient were evaluated according to SS-EN ISO 11654:1997.

The measurements were performed by Joachim Schubert 2021-01-05 in Akustikverkstan's reverberation room in Skultorp, Skövde, Sweden. More information on the test facilities can be found in Appendix 2.

5. MEASUREMENT EQUIPMENT

Table 1 lists the equipment used during the measurements. The equipment fulfils class 1 according to SS-EN 61672-1, 60942 and 61260. Date for the latest calibration is available in the instrument journal of Akustikverkstan.

Instrument	Manufacture and type	Serial number	Internal designation
Measurement computer	HP Zbook		DA02
Front end	National Instruments NI 9234	1918620/190DB0B	AN05
Microphone	Roga MI-17	592	MI04
Microphone	Roga MI-17	593	MI05
Microphone	Roga MI-17	594	MI06
Microphone	Roga MI-17	595	MI07
Speaker	IMA Kub 1	8	HÖ7
Speaker	IMA Kub 1	9	HÖ8
Speaker	IMA Kub 1	10	HÖ9
Equalizer	Monacor MEQ-2152	-	Lab
Amplifier	Denon POA-2200	-	Lab

Table 1: Equipment used during the measurements.

6. RESULTS

Detailed measurement results for all test specimens are available in the measurement protocols given in table 2 below and is attached as appendices to this report. Result for weighted sound absorption coefficient α_w is given in table 3. The result is only valid for the tested samples.

Measurement protocol	Test object	Tested area/ no of objects
M1	Bow	10 m ²
M2	Bow as object of 3x2 panels (1785x1190)	2 objects

Table 2: List of measurement protocols.

Measurement protocol	Test object	α_w	Absorption Class
M1	Bow	1.00	A

Table 3: Results evaluated according to SS-EN ISO 11654:1997

7. COMMENTS AND INTERPRETATIONS

Kammarkollegiet, the Swedish authority dealing with public purchasing, has published advice regarding purchasing of sound absorbers.

They define the value N_{10} according to the formula:

$$N_{10} = \frac{10}{A_{500}}$$

A_{500} is the sound absorption area at the 500 Hz octave band for the sound absorber. The N_{10} value is developed to be a single value metric for speech sound absorption and describes how many objects are needed to obtain 10 m² of sound absorption area in the 500 Hz octave band. If the sound absorption is lower in any octave above 500 Hz, the lower value will be used instead.

Measurement protocol	Test object	N_{10}
M2	Bow as object of 3x2 panels (1785x1190)	3.8

Table 4: N_{10} -values for the measured products.

8. MEASUREMENT UNCERTAINTY

The uncertainties in the measured sound absorption coefficients have been estimated to the values in table 5. The uncertainty corresponds to one standard deviation. The uncertainties for the sound absorption area measurement are concluded from the same values multiplied with the test specimen area.

50 Hz ± 0.10	63 Hz ± 0.08	80 Hz ± 0.07	100 Hz ± 0.06	125 Hz ± 0.05	160 Hz ± 0.04	200 Hz ± 0.03
250 Hz ± 0.03	315 Hz ± 0.03	400 Hz ± 0.03	500 Hz ± 0.03	630 Hz ± 0.03	800 Hz ± 0.03	1 kHz ± 0.03
1.25 kHz ± 0.03	1.6 kHz ± 0.03	2 kHz ± 0.03	2.5 kHz ± 0.03	3.15 kHz ± 0.03	4 kHz ± 0.03	5 kHz ± 0.03

Table 5: Measurement uncertainty for each third octave.

This report should always be used in its complete context, though the measurement protocols may be used independently.

Joachim Schubert

Reviewed by Carl Nyqvist, 2020-01-08

APPENDIX 1: MEASURED REVERBERATION TIMES

f(Hz)	Empty 2021-01-05	Bow, 10 m ²	Bow 3x2 panels, 2 objects, 4,2 m ²
50	8.30	7.32	8.19
63	8.44	7.07	7.87
80	7.97	6.29	7.05
100	7.34	5.27	6.04
125	6.49	4.51	5.46
160	5.64	3.28	4.26
200	5.61	2.81	3.93
250	5.39	2.38	3.47
315	5.41	2.16	3.15
400	5.34	2.07	2.98
500	4.72	1.83	2.57
630	4.29	1.70	2.40
800	4.70	1.75	2.57
1000	4.50	1.76	2.59
1250	3.91	1.69	2.42
1600	3.54	1.58	2.28
2000	3.09	1.50	2.08
2500	2.73	1.39	1.90
3150	2.24	1.24	1.64
4000	1.82	1.11	1.40
5000	1.47	0.95	1.15

Number of test objects / test area	0	10	2
Temperature (°C)	15	15	15
RH (%)	42	42	42

APPENDIX 2: INFORMATION ABOUT THE REVERBERATION ROOM

The reverberation room is rectangular, measuring Length x Width x Height = 5.85 x 4.65 x 7.35 m. The room volume is 200 m³ and the total area of the walls, ceiling and floor is 209 m². There are 22 diffusors (size 0.775 x 1.25 m) randomly installed in the room. The reverberation time between 50 and 200 Hz is controlled with membrane absorbers on the walls.

The test specimen is put on the floor on the mounting area (10 m², 2.6 x 3.85 m) according to figure B2.1. The mounting area consists of a concrete slab that can be lowered up to 700 mm below the floor.

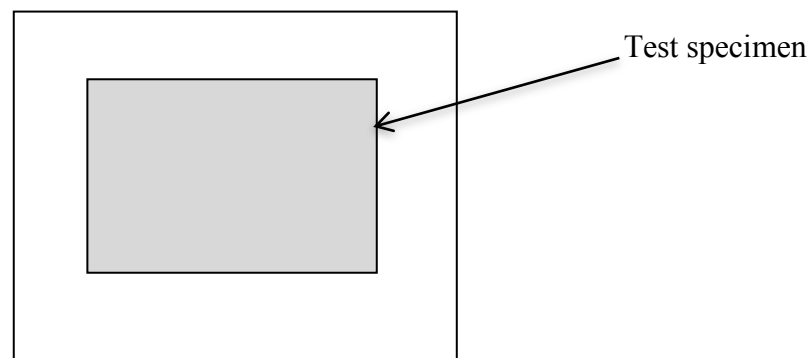


Figure B2.1: Plane drawing of the reverberation room with the test specimen put on the mounting area.

Bow

SOUND ABSORPTION COEFFICIENT ACCORDING TO SS-EN ISO 354:2003 AND SS-EN ISO 11654:1997

Measurement of sound absorption coefficient in a reverberation room



Report number:
20-759-M1
Date
2021-01-07

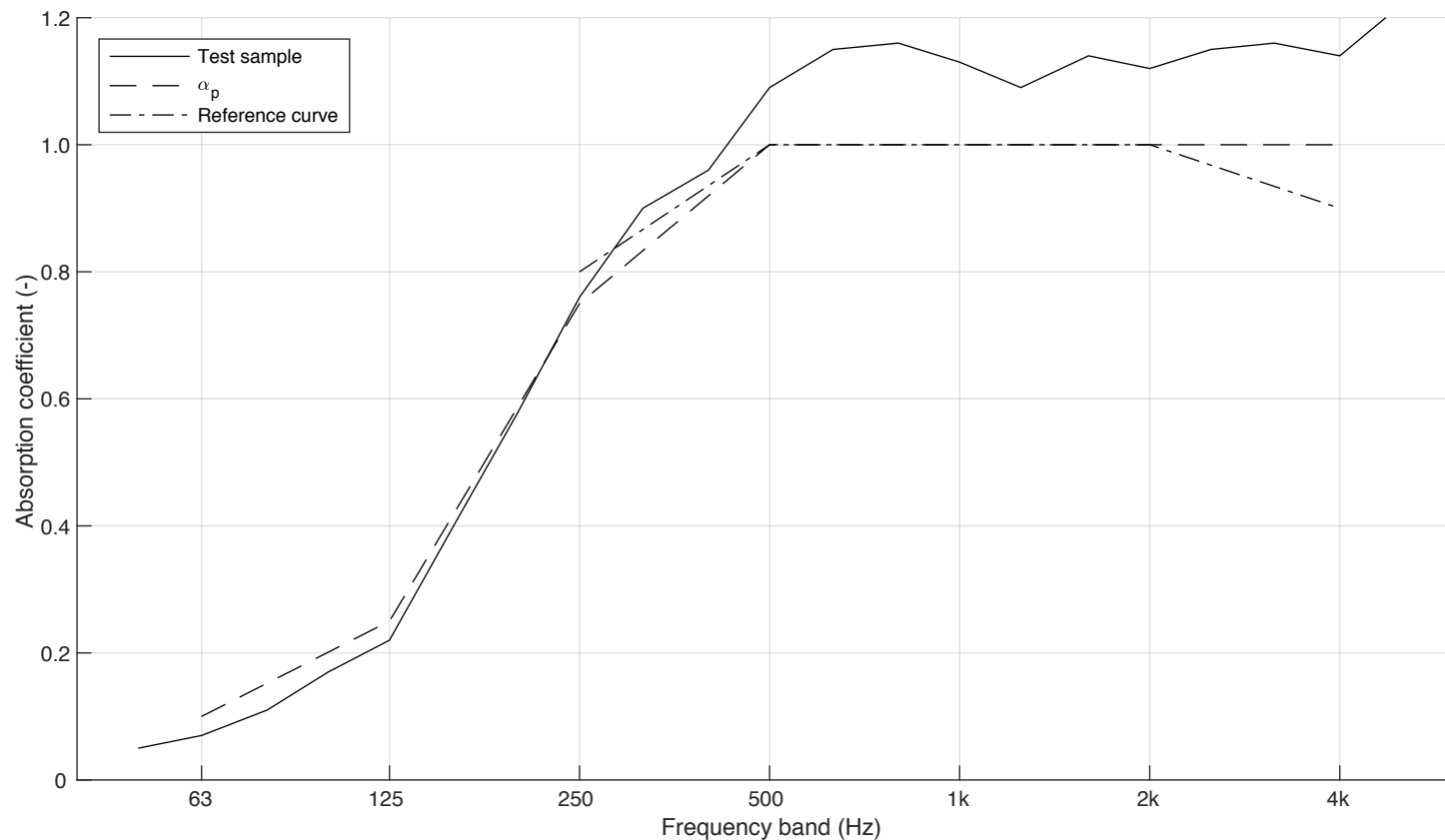
Frequency f [Hz]	Sound absorption coefficient	
	α_s	α_p
50	0.05	
63	0.07	0.10
80	0.11	
100	0.17	
125	0.22	0.25
160	0.41	
200	0.58	
250	0.76	0.75
315	0.90	
400	0.96	
500	1.09	1.00
630	1.15	
800	1.16	
1000	1.13	1.00
1250	1.09	
1600	1.14	
2000	1.12	1.00
2500	1.15	
3150	1.16	
4000	1.14	1.00
5000	1.22	

Client: Decibel by Johansson Design
 Manufacturer: Decibel by Johansson Design
 Product identification: Bow

Reverberation room volume: 200 m³
 Temperature: 15.0 °C (empty: 15.0 °C)
 Air humidity: 42 % (empty: 42 %)
 Air pressure: 100.5 kPa (empty: 100.5 kPa)
 Size of specimen: 10 m²

Description of test specimen: Bow is a square sound absorbing wall panel made of a MDF base plate with soundabsorbing filling and a metal structure stretching the panel fabric to create a three dimensional shape. The base plate is 595 x 595 mm and the maximum height when mounted on the wall is 120 mm.

Measurement date: 2021-01-05
 Measured by: Joachim Schubert



$\alpha_w = 1.00$

Absorption class = A

Bow 3x2 panels

SOUND ABSORPTION AREA ACCORDING TO SS-EN ISO 354:2003, SS 25269:2013 and ISO 20189:2018

Measurement of sound absorption area in a reverberation room



Report number:
20-759-M2
Date
2021-01-07

Frequency f [Hz]	Sound absorption area per object [m ² Sabine]	
50	0.03	
63	0.14	0.15
80	0.27	
100	0.48	
125	0.47	0.63
160	0.93	
200	1.24	
250	1.67	1.7
315	2.16	
400	2.42	
500	2.88	2.8
630	2.98	
800	2.88	
1000	2.66	2.7
1250	2.57	
1600	2.55	
2000	2.57	2.6
2500	2.57	
3150	2.70	
4000	2.69	2.8
5000	3.10	

Client: Decibel by Johansson
 Manufacturer: Decibel by Johansson
 Product identification: Bow 3x2 panels

Description of test specimen: Bow is a square sound absorbing wall panel made of a MDF base plate with soundabsorbing filling and a metal structure stretching the panel fabric to create a three dimensional shape. Measurements of one object of 6 panels is 1785 x 1190 mm. The maximum height is 120 mm

Reverberation room volume: 200 m³
 Temperature: 15.0 °C (empty: 15.0 °C)
 Air humidity: 42 % (empty: 42 %)
 Air pressure: 100.5 kPa (empty: 100.5 kPa)
 Number of objects: 2
 Measurement date: 2021-01-05
 Measured by: Joachim Schubert

$$N_{10} = 3.8$$

