



REPORT

issued by an Accredited Testing Laboratory

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Determination of sound absorption area of chairs according to EN ISO 354 and SS 25269

Client

Skandiform AB

Test object

Chairs of type: *deciBel*, with and without a sound absorbing pad on the underside.

Pictures of the chairs can be seen in the report.

The largest dimensions of the chairs were, height: 0,82, width: 0,475 and depth: 0,485 m

Arrival of test objects

Just before the test

Date of test

December 16, 2016

Results

The equivalent sound absorption area is given per object, A_{obj} , in 1/3 octave band in table 1.

The sound absorption area per object in octave band according to SS 25269 is given in table 2.

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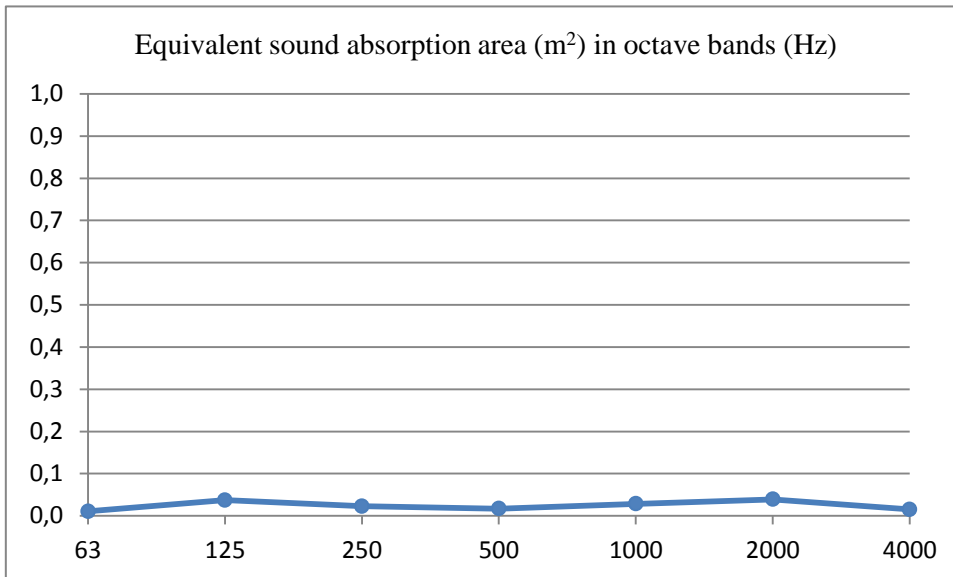
Table 1 – The equivalent sound absorption area A_{obj} in m^2 per single object.

1/3-octave band	One chair without sound absorbing pad.	One chair with a sound absorbing pad.
50	0,01	0,00
63	-0,01	0,01
80	0,03	0,04
100	0,04	0,11
125	0,04	0,09
160	0,03	0,06
200	-0,01	0,04
250	0,06	0,10
315	0,01	0,05
400	0,01	0,07
500	0,02	0,12
630	0,02	0,13
800	0,01	0,17
1000	0,03	0,18
1250	0,04	0,18
1600	0,04	0,18
2000	0,04	0,19
2500	0,03	0,18
3150	0,02	0,17
4000	0,01	0,15
5000	0,01	0,13
6300	0,01	0,13
8000	-0,02	0,09
10000	-0,01	0,09

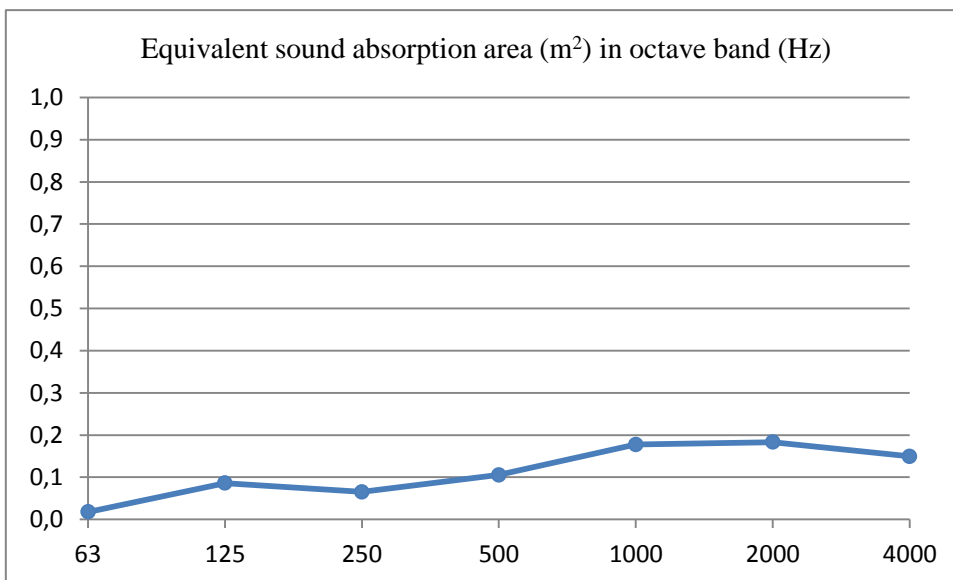
Table 2 – The equivalent sound absorption area in m^2 per single object.

Octave band	One chair without sound absorbing pad.	One chair with a sound absorbing pad.
63	0,01	0,02
125	0,04	0,09
250	0,02	0,07
500	0,02	0,11
1000	0,03	0,18
2000	0,04	0,18
4000	0,02	0,15

Graph 1 – One chair **without** a sound absorbing pad.



Graph 2 – One chair **with** a sound absorbing pad.



Pictures of the test objects



Picture 1 – The chair without sound absorbing pads.



Picture 2 – The chair without sound absorbing pads.



Picture 3 – One of the chairs with a sound absorbing pad on the underside.



Picture 4 – One of the chairs with a sound absorbing pad on the underside.

Measurement method

The measurements have been carried out according to ISO 354:2003, which is equivalent to EN ISO 354 and SS-EN ISO 354. The requirement of the standard regarding equivalent sound absorption of the test objects were not fulfilled at the 1/3-octave band 125 Hz for the “L”-shaped objects.

The evaluation has been carried out according to ISO 354 and SS25269. 4 loudspeaker positions and 6 microphone positions have been used giving 24 different combinations for the reverberation time measurements. For empty room 3 decays have been used for averaging the time and for test objects 5 decays have been used, for each combination of loudspeaker and microphone.

The equivalent sound absorption area per object A_{obj} has been evaluated from:

$$A_{obj} = \frac{55.3 V}{c \cdot n} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

where

- V = Volume of the reverberation room (m³)
- n = Number of test objects
- c = Speed of sound in air (m/s)
- c = 331 + 0.6t
- t = Temperature in the air (°C)
- T₁ = Reverberation time of the room without test object (s)
- T₂ = Reverberation time of the room with test object (s)

Measurement uncertainty

From a world wide Round Robin¹⁾, in which SP took part, with 23 participating laboratories from 11 countries, the following measurement uncertainty for the absorption coefficient has been calculated:

Frequencies (Hz)	Uncertainty
100-630	± 0,15
800-1250	± 0,10
1600-2500	± 0,15
3150-5000	± 0,20

¹⁾ The figures are calculated from twice the standard deviations, rounded to the nearest 0,05. The data from the Round Robin is documented in a letter from the ASTM to the participating laboratories.

Test room

A reverberation room with the dimensions 7,64 m x 6,16 m x 4,25 m giving the volume 200 m³ and the total surface area 211 m² was used. The suspended diffusers have been arranged according to ISO 354.

Mounting

9 chairs were placed in a reverberation room during measurement.

List of instruments

Instrument	Manufacturer	Type	Serial no/SP no.
Microphone	Larson Davis	2560	2398
Microphone	Brüel & Kjaer	4943	2206273
Microphone	Brüel & Kjaer	4943	2206274
Microphone	Brüel & Kjaer	4943	2206276
Microphone	Brüel & Kjaer	4943	2206277
Microphone	Brüel & Kjaer	4943	2206278
Microphone Preamplifier	Brüel & Kjaer	2619	726818
Microphone Preamplifier	Brüel & Kjaer	2619	726624
Microphone Preamplifier	Brüel & Kjaer	2619	469905
Microphone Preamplifier	Brüel & Kjaer	2619	726792
Microphone Preamplifier	Brüel & Kjaer	2619	970865
Microphone Preamplifier	Brüel & Kjaer	2619	970968
Microphone Multiplexer	Norsonic	834	10050
Real-Time Analyzer	Norsonic	830	11533
Sound Level Calibrator	Brüel & Kjaer	4230	1411048
Programme	SP	Absorp 960627	
Hygrometer/ Temperature meter	Testo	615	503962

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