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## **DETERMINATION OF ACOUSTIC ABSORPTION COEFFICIENT IN LABORATORY CONDITIONS**

### **1 CLIENT**

Soften Oy, Sami Helle. Tender January 14, 2025. Order January 23, 2025.

### **2 DESCRIPTION OF THE COMMISSION**

Sound absorption coefficient  $\alpha_s$  was measured for the specimen within 100–5000 Hz according to ISO 354:2003. Sound absorption class was determined according to EN ISO 11654:1997.

### **3 RESULTS**

The weighted sound absorption coefficient  $\alpha_w$  was 0.90 and the sound absorption class for the specimen was **A**. Detailed results are presented in Annex 1.

## 4 SIGNATURES



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Research Group Leader



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## ANNEXES

- Annex 1 – Test results (1 pages)
- Annex 2 – Mounting of specimen (1 page)
- Annex 3 – Measurement arrangements (1 page)

## Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

**Specimen id:** Soften Kotelopaneeli  
30mm polyester wool inside, edges covered

**Manufacturer:** Soften Oy

**Client:** Soften Oy

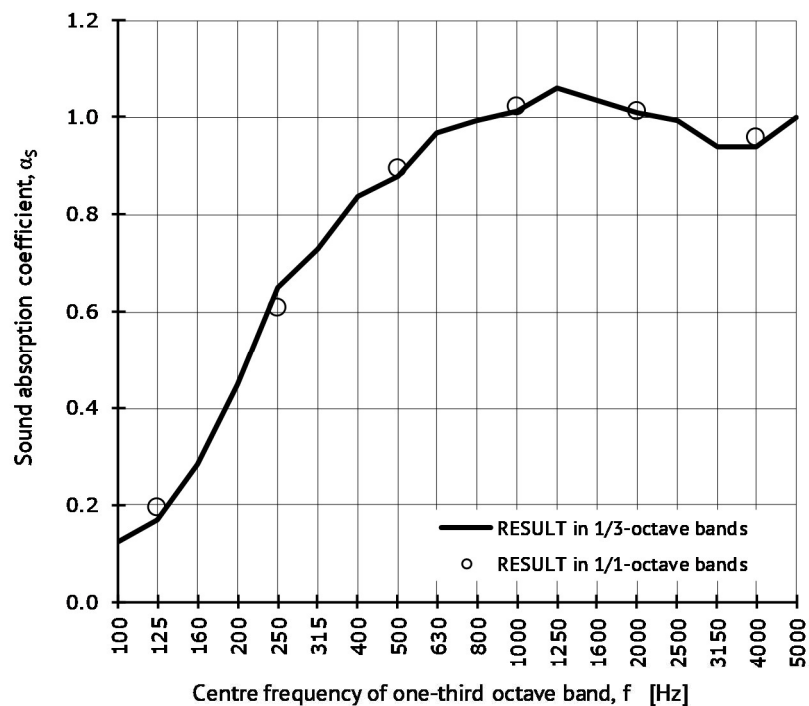
**Contact person:** Sami Helle

**Mounting by:** Sami Helle, Joonas Viljanen

**Test laboratory:** Turku University of Applied Sciences, Acoustics Laboratory  
Joukahaisenkatu 7, 20520 Turku, Finland

Specimen area: 10.9 m<sup>2</sup> Test room volume: 201 m<sup>3</sup>  
Temperature of test room: 21 21 °C (without / with specimen) Room boundary area: 224 m<sup>2</sup>  
Relative humidity: 54 61 % (without / with specimen) Test date: 24.1.2025  
Atmospheric pressure: 101 100 kPa (without / with specimen) Test file identification: t240125b

f (Hz)	1/3 $\alpha_s$	1/1 $\alpha_s$	1/1 $\alpha_p$
100	0.13		
125	0.17	0.19	0.20
160	0.29		
200	0.45		
250	0.65	0.61	0.60
315	0.73		
400	0.84		
500	0.88	0.89	0.90
630	0.97		
800	0.99		
1000	1.01	1.02	1.00
1250	1.06		
1600	1.03		
2000	1.01	1.01	1.00
2500	0.99		
3150	0.94		
4000	0.94	0.96	0.95
5000	1.00		



EN ISO 11654:

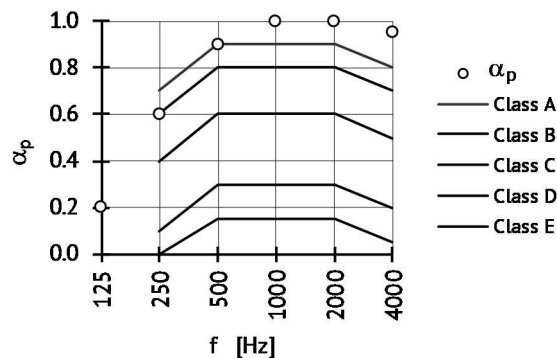
Weighted sound absorption coefficient  $\alpha_w$

**0.90**

Absorption class (EN ISO 11654)

**A**

**FINAS**  
Finnish Accreditation Service  
T293 (EN ISO/IEC 17025)



*Jarkko Hakala*

Jarkko Hakala  
Research Engineer  
test performer

### ANNEX 3 – MOUNTING OF SPECIMEN

The acoustic panels were mounted on the floor of the reverberation room in conformance with **ISO 354:2003 Annex B, Type A mounting**. The edges of the specimen were covered with 28x45 mm wood lath and sealed with duct tape to the floor. Edges were not included to the physical specimen area reported in Annex 1.



Figure A3.1. The specimen mounted on the floor of the reverberation room.

## ANNEX 4 – MEASUREMENT ARRANGEMENTS

### 1 Acoustical measurements

The test signal was produced to the test room using three fixed omnidirectional loudspeakers (6 x Seas W12CY001). The test signal (pink noise) was produced by a real time analyzer (Norsonic 121, serialnr. 31416) and amplified with terminal amplifier (QSC 1300 W USA). The sound pressure level in the reverberation room was measured with the condenser microphone (Bruel&Kjær 4190, serialnr. 2322537) and the pre-amplifier (Bruel&Kjær 2669, serialnr. 2298180).

The reverberation time at third-octave bands was measured with the real time analyzer (Norsonic 121, serialnr. 31416) using 20 dB decay range. All frequency bands were measured using 3 fixed source positions and 4 microphone positions. In every position 3 decays were measured. The total number of reverberation time measurements was 36.

The acoustical measurement equipment fulfilled the following IEC standards and grades of accuracy:

IEC 60651	Sound level meters (replaced by IEC 61672)	<b>type 1</b>
IEC 60804	Integrating sound level meters (replaced by IEC 61672)	<b>type 1</b>
IEC 61260	Octave-band and fractional-octave-band filters	<b>class 1</b>
IEC 60942	Sound level calibrators	<b>class 1</b>

The test laboratory operates in conformance with EN/ISO/IEC 17025.

### 2 Other measurements

The temperature, the ambient atmospheric pressure and the relative humidity of the measurement room were measured using an environmental measurement device (Thermo Recorder TR-73U, serialnr. E00009). The specimen was weighed with a weighing machine (Vetek TI-500 SL, serialnr. 47359). The dimensions of the specimen were measured with a roll meter (Stanley FatMax).

### 3 The test room

The reverberation room was equipped with five fixed diffuser panels. The positions were selected randomly in respect with altitude, angle and position. The amount of diffusers and their arrangement fulfills the requirements of Annex A in ISO 354. The reverberation time of the empty reverberation room fulfills the requirements of ISO 354 for 200 m<sup>3</sup> test room.

### 4 The uncertainty of sound absorption coefficient

The uncertainty of reproducibility expresses the differences between the laboratories. The procedure to determine uncertainty of sound absorption coefficient in laboratory tests is defined in standard ISO 12999-2:2020. According to the standard, the reproducibility standard deviation varies within the measured frequency range and depends on the value of sound absorption coefficient (Figure below). The reproducibility standard deviation of the weighted sound absorption coefficient  $\alpha_w$  is 0.035.

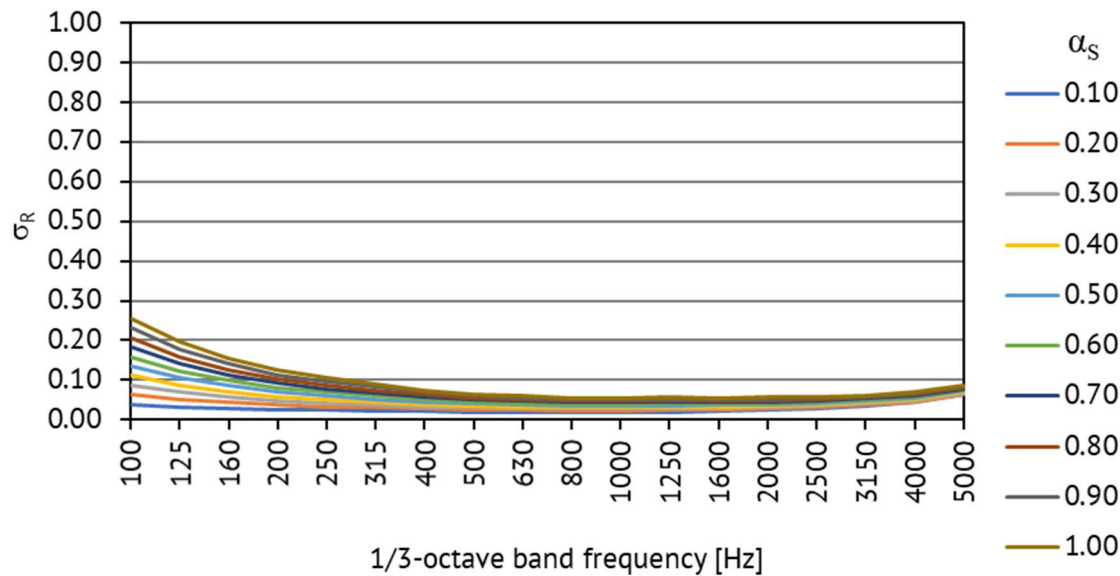


Figure. The reproducibility standard deviation,  $\sigma_R$ , of sound absorption coefficient,  $\alpha_s$ , according to ISO 12999-2:2020.

## 5 References to the ISO standards

Test: ISO 354:2003 (E) Acoustics - Measurement of sound absorption in a reverberation room, International Organization for Standardization, 2003, Genève, Switzerland.

SFS-EN ISO 11654:1997 (E) Acoustics - Sound absorbers for use in buildings - Rating of sound absorption, International Organization for Standardization, 1997, Genève, Switzerland.

SFS-EN ISO 12999-2:2020 (E) Acoustics – Determination and application of measurement uncertainties in building acoustics. Part 2: Sound absorption, International Organization for Standardization, 2020, Genève, Switzerland.