TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES

Yeseco Oy
Ari Heikkinen
Paljekatu 6
38200 Sastamala
ari.heikkinen@yeseco.fi

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

DETERMINATION OF ACOUSTIC ABSORPTION COEFFICIENT IN LABORATORY CONDITIONS

1 CLIENT

Yeseco Oy, Ari Heikkinen. Tender September 28, 2021. Order October 4, 2021.

2 DESCRIPTION OF THE COMMISSION

Sound absorption coefficient α_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 α_w and the sound absorption class for the specimen is described in table 1. Detailed results are presented in Annex 1.

Table 1. The weighted sound absorption coefficient α_w and the sound absorption class.

Specimen	α_w	Absorption class
Yeseco Aallokko thickness: 32–45 mm	0.90	A

4 SIGNATURES

Valtteri Hongisto
Research Group Leader

Reijo Alakoivu
Research Engineer

Turku University of Applied Sciences
Acoustics laboratory

ANNEXES

Annex 1 – Test results (1 page)
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Annex 3 – Mounting of specimen (1 page)
Annex 4 – Measurement arrangements (2 pages)

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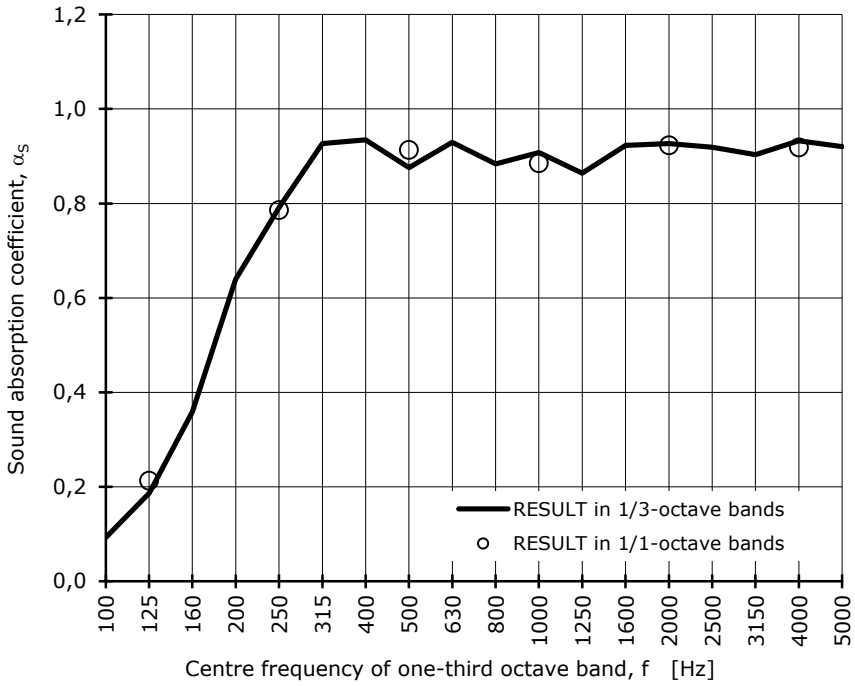
Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

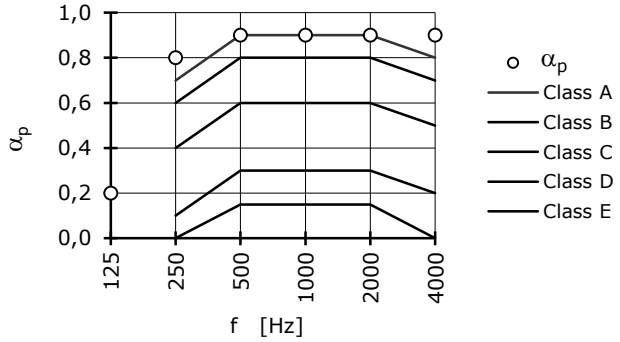
Specimen id: **Yeseco Aallokko**
thickness: 32 - 45 mm
Manufacturer: Yeseco Oy
Client: Yeseco Oy
Contact person: Ari Heikkinen
Mounting by: Alakoivu
Test laboratory: Turku University of Applied Sciences, Acoustics Laboratory
Joukahaisenkatu 7, 20520 Turku, Finland

Specimen area:		10,8	m^2		Test room volume:	200,7 m^3
Temperature of test room:	21	21	°C	(without / with specimen)	Room boundary area:	223,7 m^2
Relative humidity:	71	70	%	(without / with specimen)	Test date:	12.10.2021
Atmospheric pressure:	100	100	kPa	(without / with specimen)	Test file identification:	T121021a

	1/3	1/1	1/1
f (Hz)	α_S	α_S	α_p
100	0,09		
125	0,19	0,21	0,20
160	0,36		
200	0,64		
250	0,79	0,79	0,80
315	0,93		
400	0,93		
500	0,88	0,91	0,90
630	0,93		
800	0,88		
1000	0,91	0,89	0,90
1250	0,86		
1600	0,92		
2000	0,93	0,92	0,90
2500	0,92		
3150	0,90		
4000	0,93	0,92	0,90
5000	0,92		



EN ISO 11654:
Weighted sound absorption coefficient α_w
0,90
Absorption class (EN ISO 11654)
A



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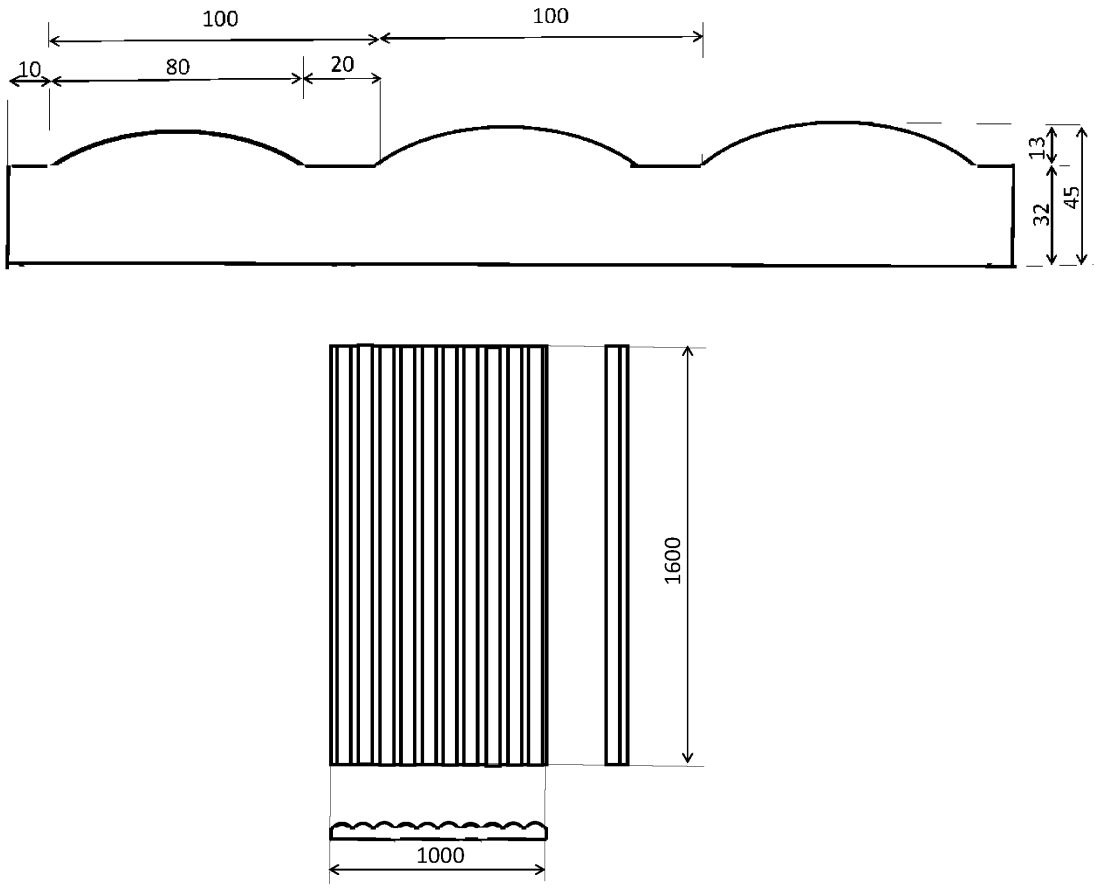
Reijo Alakoivu
Research Engineer
test performer

ANNEX 2 – STRUCTURE DRAWINGS

Yeseco Aallokko, poikkileikkaus



The structure drawing was provided by the client. Turku University of Applied Sciences has not verified the structure.

The weight of one 400 × 1000 mm element was 1.85 kg so the surface mass was approximately 4.6 kg/m^2. The surface material was natural fiber/recycled plastic composite. The core was recycled paper/recycled plastic composite.

ANNEX 3 – MOUNTING OF SPECIMEN

The specimens were mounted on the floor of the reverberation room in conformance with **ISO 354:2003 Annex B, Type A mounting**.

The acoustic elements were placed directly on the floor. The total area of the acoustic elements was 10.8 m^2. The side edges of the specimen were covered with 12 mm thick wood lath. The edges of the specimen were covered with adhesive tape. Figure A3.1 shows view of acoustic elements.

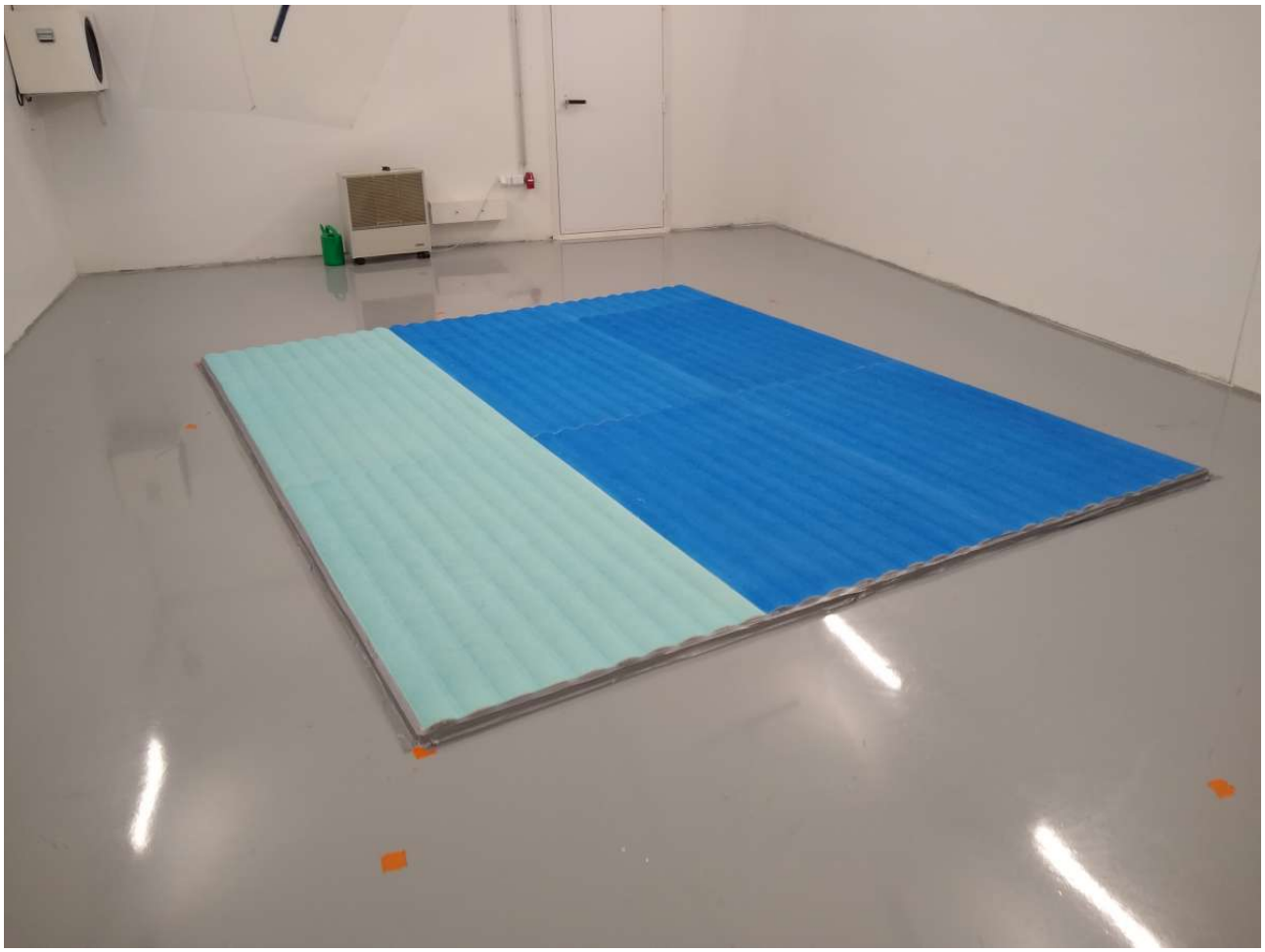


Figure A3.1. The specimen mounted on the floor of the reverberation room.

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

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^3 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 α_w is 0.035.

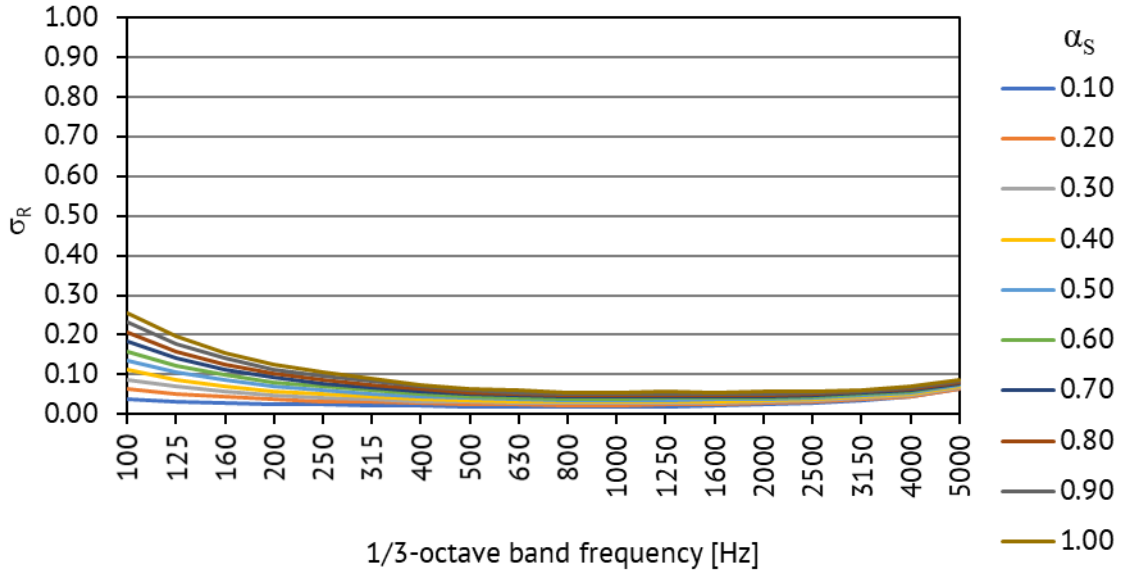


Figure. The reproducibility standard deviation, σ_R, of sound absorption coefficient, α_S, according to ISO 12999-2:2020.

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.