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TURKU UNIVERSITY OF APPLIED SCIENCES

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

DETERMINATION OF ACOUSTIC ABSORPTION COEFFICIENT IN LABORATORY CONDITIONS

1 CLIENT

P.Rotola-Pukkila Oy, Pauli Rotola-Pukkila. Tender May 14, 2024. Order May 20, 2024.

2 DESCRIPTION OF THE COMMISSION

Sound absorption coefficient α_S was measured for the slatted panels 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 slatted panels 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.

Slatted Panel	α_w	Absorption class
Slatted Panel 19.8 mm - ISO 354 Type A mounting	0.20	E
Slatted Panel 19.8 mm - ISO 354 Type E65 mounting (45 mm airgap behind the acoustic panel)	0.15	E

4 SIGNATURES

Valtteri Hongisto
Research Group Leader

Reijo Alakoivu
Research Engineer

Turku University of Applied Sciences
Acoustics laboratory

ANNEXES

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

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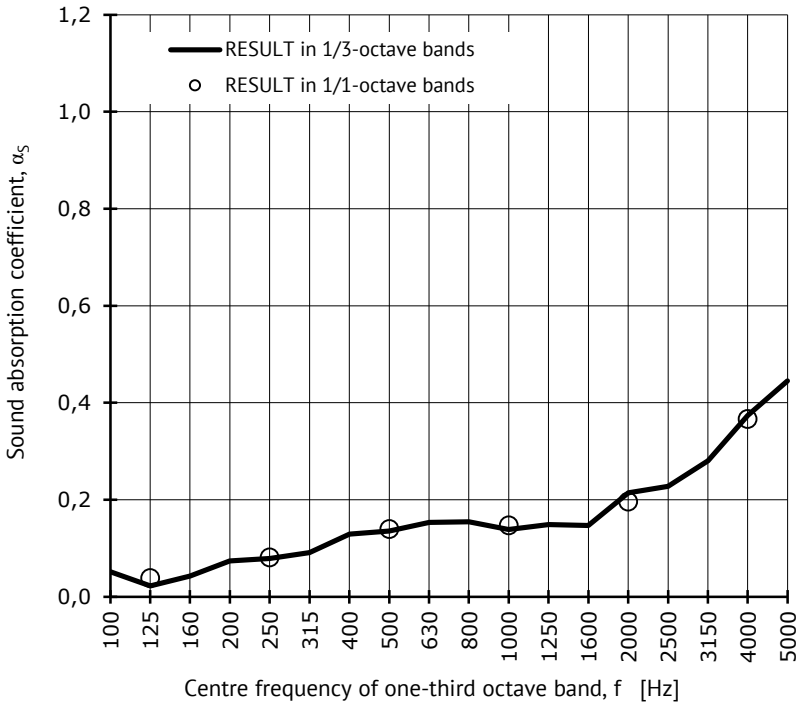
Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

Specimen id: **Slatted Panel 19.8 mm - ISO 354 Type A mounting**

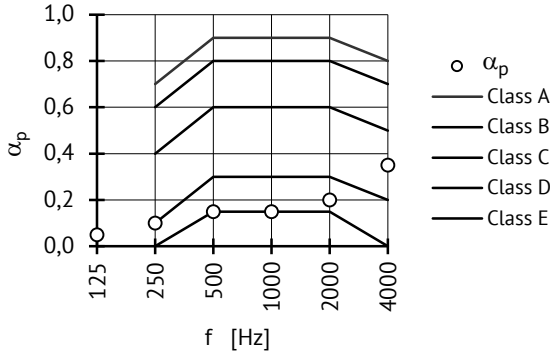
Manufacturer: P.Rotola-Pukkila Oy
Client: P.Rotola-Pukkila Oy
Contact person: Pauli Rotola-Pukkila
Mounting by: Tuomo Koivisto-Kokko
Test laboratory: Turku University of Applied Sciences, Acoustics Laboratory
Joukahaisenkatu 7, 20520 Turku, Finland

Specimen area:		10,5 m^2		Test room volume:	201 m^3
Temperature of test room:	22	22 °C	(without / with specimen)	Room boundary area:	224 m^2
Relative humidity:	67	62 %	(without / with specimen)	Test date:	20.5.2024
Atmospheric pressure:	102	102 kPa	(without / with specimen)	Test file identification:	T200524d

	1/3	1/1	1/1
f (Hz)	**α_S**	**α_S**	**α_p**
100	0,05		
125	0,02	0,04	0,05
160	0,04		
200	0,07		
250	0,08	0,08	0,10
315	0,09		
400	0,13		
500	0,14	0,14	0,15
630	0,15		
800	0,15		
1000	0,14	0,15	0,15
1250	0,15		
1600	0,15		
2000	0,21	0,20	0,20
2500	0,23		
3150	0,28		
4000	0,37	0,37	0,35
5000	0,45		



EN ISO 11654:
Weighted sound absorption coefficient α_w
0,20
Absorption class (EN ISO 11654)
E



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Reijo Alakoivu
Research Engineer
test performer

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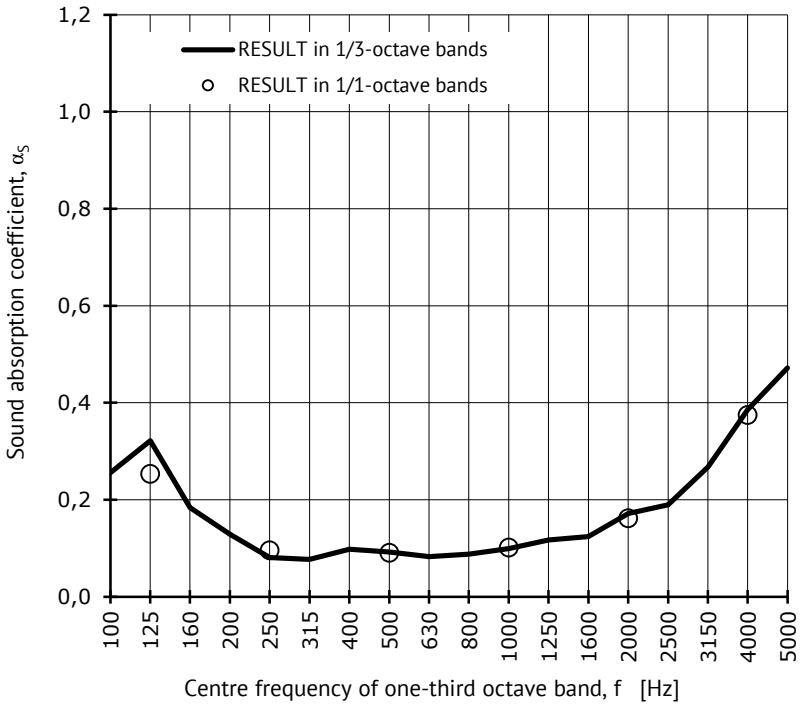
Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

Specimen id: **Slatted Panel 19.8 mm - ISO 354 Type E65 mounting**

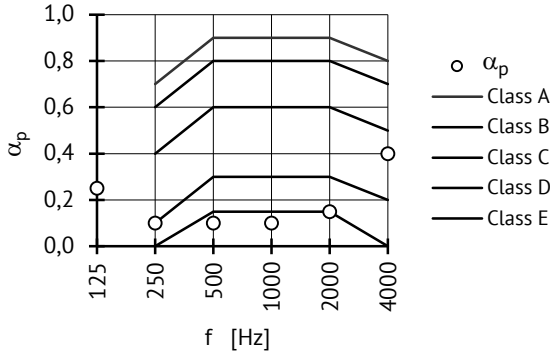
Manufacturer: P.Rotola-Pukkila Oy
Client: P.Rotola-Pukkila Oy
Contact person: Pauli Rotola-Pukkila
Mounting by: Tuomo Koivisto-Kokko
Test laboratory: Turku University of Applied Sciences, Acoustics Laboratory
Joukahaisenkatu 7, 20520 Turku, Finland

Specimen area:		10,5 m^2		Test room volume:	201 m^3
Temperature of test room:	22	22 °C	(without / with specimen)	Room boundary area:	224 m^2
Relative humidity:	67	62 %	(without / with specimen)	Test date:	20.5.2024
Atmospheric pressure:	102	102 kPa	(without / with specimen)	Test file identification:	T200524C

	1/3	1/1	1/1
f (Hz)	α_S	α_S	α_p
100	0,26		
125	0,32	0,25	0,25
160	0,18		
200	0,13		
250	0,08	0,10	0,10
315	0,08		
400	0,10		
500	0,09	0,09	0,10
630	0,08		
800	0,09		
1000	0,10	0,10	0,10
1250	0,12		
1600	0,12		
2000	0,17	0,16	0,15
2500	0,19		
3150	0,27		
4000	0,39	0,38	0,40
5000	0,47		



EN ISO 11654:
Weighted sound absorption coefficient α_w
0,15
Absorption class (EN ISO 11654)
E



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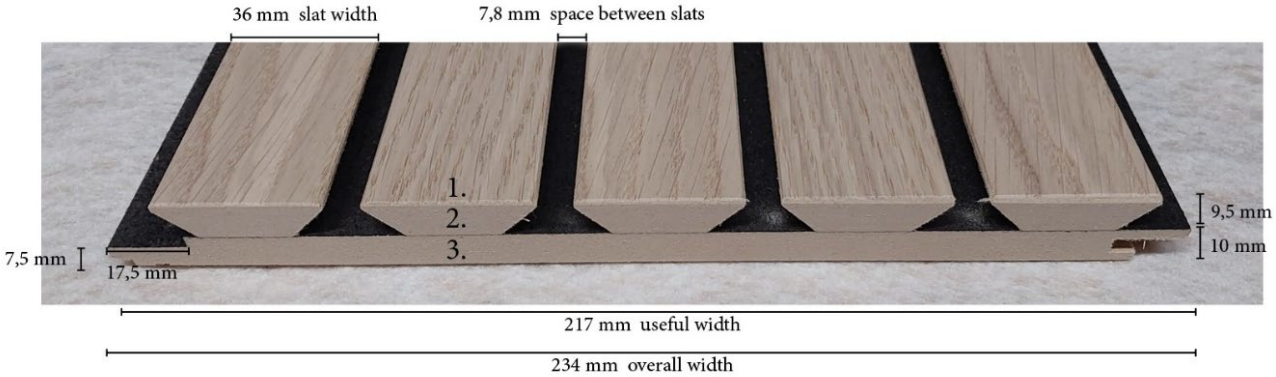
ANNEX 2 – STRUCTURE DRAWINGS

The structure of the Slatted Panel, total thickness 19.8 mm.



Structure

1. Oak veneer 0,5 mm
2. Unilin Fibralux MDF 9 mm, 750 kg/m3
3. Unilin Fibrabel MDF 10 mm, 630 kg/m3

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

ANNEX 3 – MOUNTING OF SPECIMEN

Type A mounting

The Panels were placed directly against the floor surface. The panels were surrounded on the edges by a wooden vertical frame (20 × 20 mm). The seam between floor and wood frame was sealed with adhesive tape. The area of the sides was not included in the calculation of the test specimen area.

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

Type E65 mounting

The panels were installed on top of 45 mm air cavity.

The specimen was surrounded on the edges by a wooden vertical frame (45 × 45 mm). The seam between floor and wood frame was sealed with adhesive tape. The panels were screwed onto the rack. The area of the sides was not included in the calculation of the test specimen area.

Figure A3.2. The Slatted Panels 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.

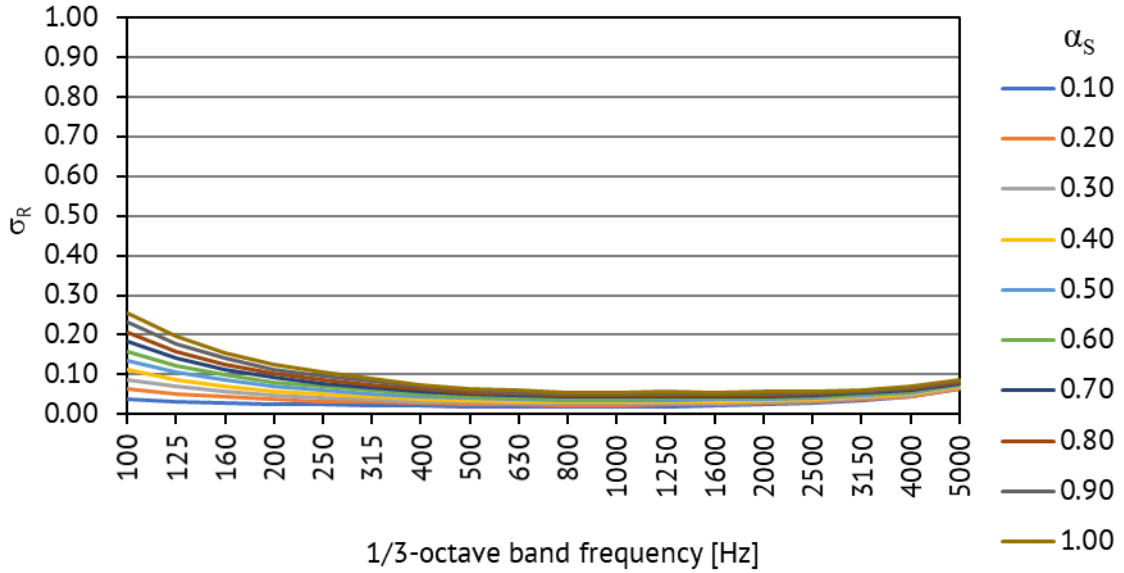


Figure. The reproducibility standard deviation, σ_R, of sound absorption coefficient, α_S, according to ISO 12999-2:2020.

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.