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## DETERMINATION OF ACOUSTIC ABSORPTION COEFFICIENT IN LABORATORY CONDITIONS

### 1 CLIENT

Areco Profiles Oy, Kasper Siintola. Tender November 13, 2024. Order November 13, 2024.

### 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

Table 1. The weighted sound absorption coefficient  $\alpha_w$  and the sound absorption class. All products were installed against rigid floor (type A installation). Detailed results are presented in Annex 1.

Specimen id	Weighted sound absorption coefficient $\alpha_w$	sound absorption class
<b>ASP150-T perforated sandwich panel</b> , perforated side against the floor 0.5 mm steel sheet, Mineral wool with a density of 85 kg/m <sup>3</sup> , 0.5 mm perforated steel sheet	<b>0.10</b>	<b>Not classified</b>
<b>ASP150-T perforated sandwich panel</b> , perforated side up 0.5 mm perforated steel sheet Mineral wool with a density of 85 kg/m <sup>3</sup> , 0.5 mm steel sheet	<b>0.10</b>	<b>Not classified</b>

## 4 SIGNATURES



Valtteri Hongisto  
Research Group Leader



Johann Laukka  
Researcher

Turku University of Applied Sciences  
Acoustics laboratory

## ANNEXES

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

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

**Specimen id:** ASP150-T perforated sandwich panel, perforated side against the floor  
0.5 mm steel sheet, Mineral wool with a density of 85 kg/m<sup>3</sup>, 0.5 mm perforated steel sheet

**Manufacturer:** Areco Profiles Oy

**Client:** Areco Profiles Oy

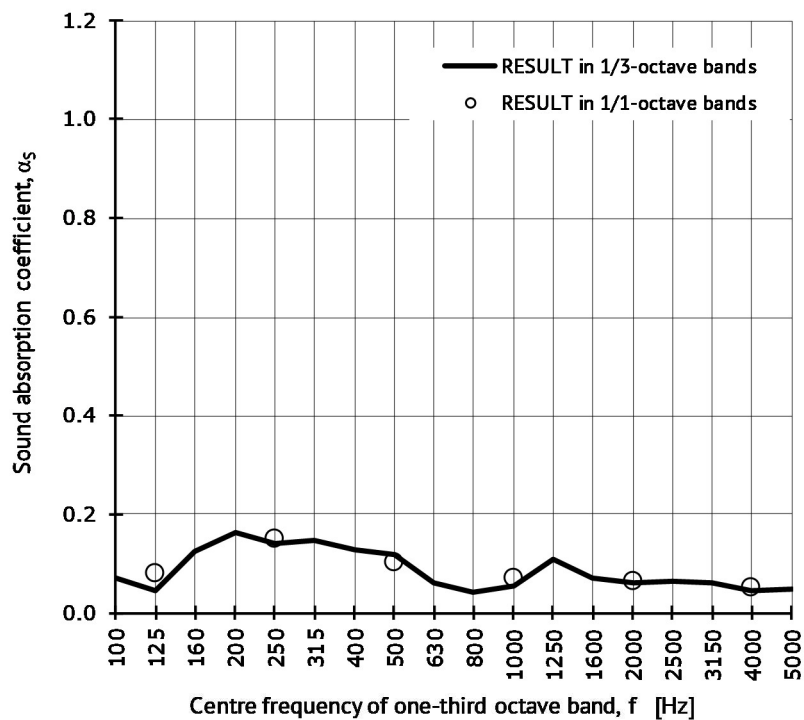
**Contact person:** Kasper Siintola

**Mounting by:** Aurabo Oy

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

Specimen area: 10.3 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: 69.1 70.5 % (without / with specimen) Test date: 26.11.2024  
Atmospheric pressure: 100 100 kPa (without / with specimen) Test file identification: T261124b

f (Hz)	1/3	1/1	1/1
	$\alpha_s$	$\alpha_s$	$\alpha_p$
100	0.07		
125	0.05	0.08	0.10
160	0.13		
200	0.16		
250	0.14	0.15	0.15
315	0.15		
400	0.13		
500	0.12	0.10	0.10
630	0.06		
800	0.04		
1000	0.06	0.07	0.05
1250	0.11		
1600	0.07		
2000	0.06	0.07	0.05
2500	0.07		
3150	0.06		
4000	0.05	0.05	0.05
5000	0.05		



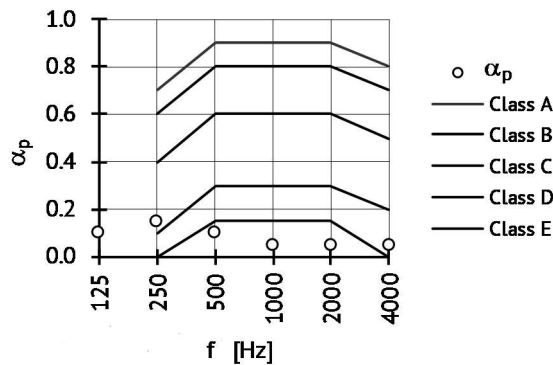
EN ISO 11654:

Weighted sound absorption coefficient  $\alpha_w$

**0.10**

Absorption class (EN ISO 11654)

**Not classified**



*Johann Laukka*

Johann Laukka  
Researcher  
test performer

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

**Specimen id:** ASP150-T perforated sandwich panel, perforated side up  
0.5 mm perforated steel sheet, Mineral wool with a density of 85 kg/m<sup>3</sup>, 0.5 mm steel sheet

**Manufacturer:** Areco Profiles Oy

**Client:** Areco Profiles Oy

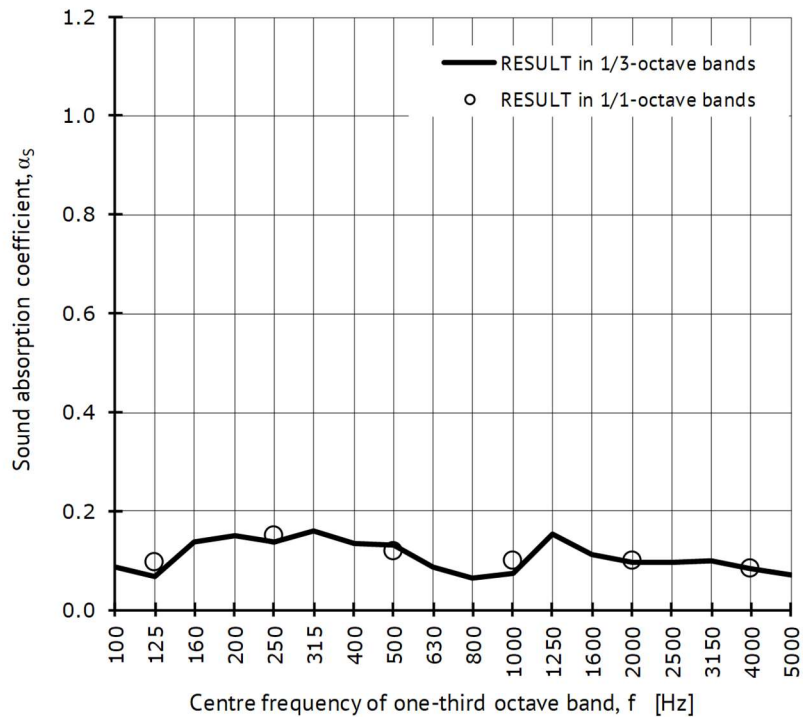
**Contact person:** Kasper Siintola

**Mounting by:** Aurabo Oy

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

Specimen area: 10.3 m<sup>2</sup> Test room volume: 201 m<sup>3</sup>  
Temperature of test room: 21 22 °C (without / with specimen) Room boundary area: 224 m<sup>2</sup>  
Relative humidity: 69.1 70.5 % (without / with specimen) Test date: 26.11.2024  
Atmospheric pressure: 100 100 kPa (without / with specimen) Test file identification: T261124c

f (Hz)	1/3	1/1	1/1
	$\alpha_s$	$\alpha_s$	$\alpha_p$
100	0.09		
125	0.07	0.10	0.10
160	0.14		
200	0.15		
250	0.14	0.15	0.15
315	0.16		
400	0.13		
500	0.13	0.12	0.10
630	0.09		
800	0.07		
1000	0.07	0.10	0.10
1250	0.15		
1600	0.11		
2000	0.10	0.10	0.10
2500	0.10		
3150	0.10		
4000	0.09	0.08	0.10
5000	0.07		



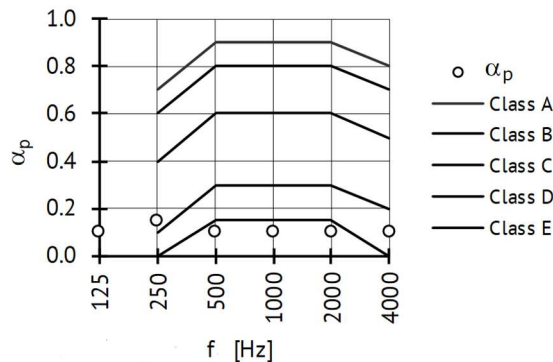
EN ISO 11654:

Weighted sound absorption coefficient  $\alpha_w$

**0.10**

Absorption class (EN ISO 11654)

**Not classified**

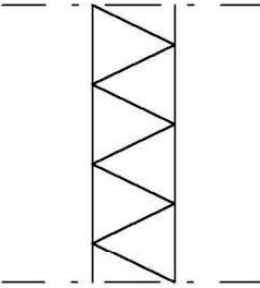


*Johann Laukka*


Johann Laukka  
Researcher  
test performer

## ANNEX 2 – STRUCTURE DRAWINGS

ASP150-T  
perforoitu

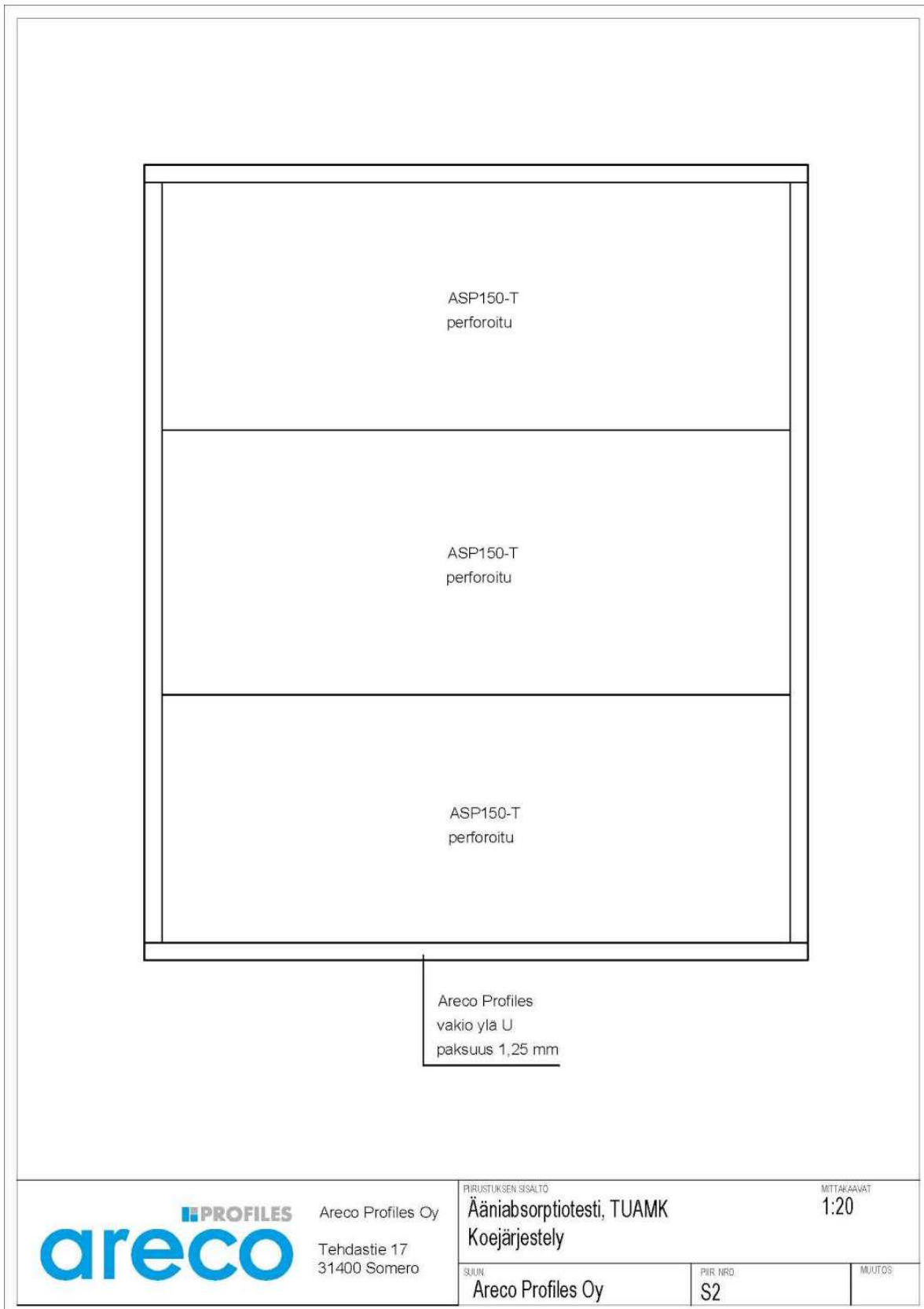


Pelti-villa-peltielementti 150 mm  
pintalevy 0,5 mm ulkopuoli  
ydin kivivilla 85 kg/m<sup>3</sup>  
pintalevy perforoitu 0,5 mm sisäpuoli

 <b>areco</b>	PIRUSTUKSEN SISÄLTÖ	MITTAKAAVAT
	Ääniabsorptiotesti, TUAMK Rakennetyyppi	1:10
Areco Profiles Oy Tehdastie 17 31400 Somero	SUUNNITTELU Areco Profiles Oy	PIIR. NRO. S1
		MUUTOS:

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

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

### ANNEX 3 – MOUNTING OF SPECIMEN

The specimen was mounted on the floor of the reverberation room in conformance with **ISO 354:2003 Annex B, Type A mounting** perforated side against the floor and perforated side up.

The side edges of the specimen were covered with U-steel profile (thickness 1.25 mm) and adhesive tape. The area covered by U-steel profile were not included in the calculation of the test specimen area.



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





Figure A3.2. The specimen mounted on the floor of the reverberation room perforated side up.



## 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.

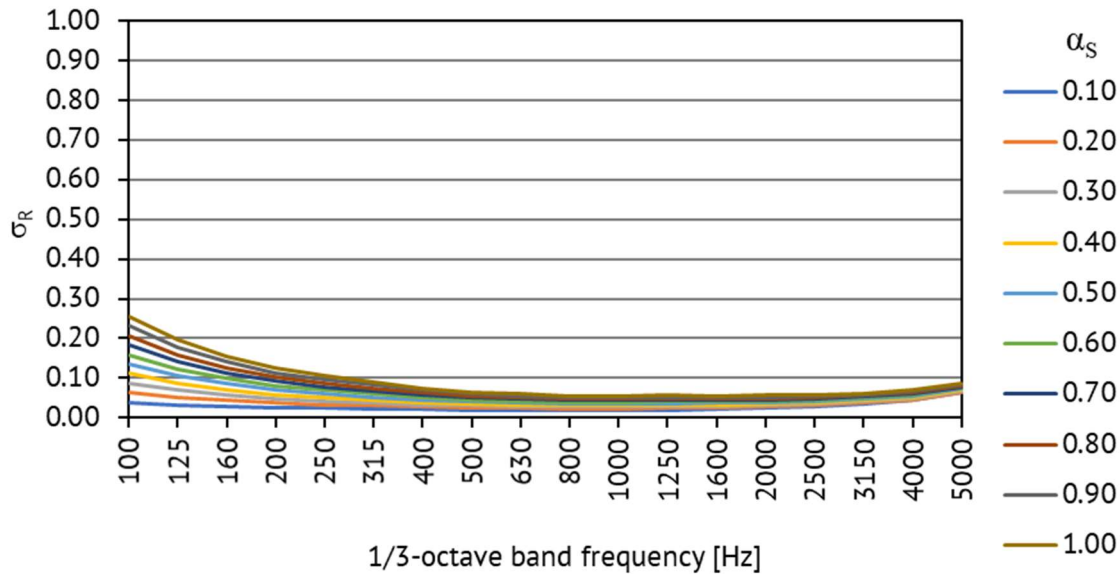


Figure. The reproducibility standard deviation,  $\sigma_R$ , of sound absorption coefficient,  $\alpha_s$ , according to ISO 12999-2:2020.

### 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.