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

# DETERMINATION OF ACOUSTIC ABSORPTION COEFFICIENT IN LABORATORY CONDITIONS

## 1 CLIENT

Ewona Finland Oy, Jarmo Palomaa. Tender February 28, 2023. Order February 28, 2023.

## 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 $\alpha_w$ 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 $\alpha_w$ and the sound absorption class.

| Specimen | $\alpha_w$ | Absorption class |
|---|---|---|
| Ewona 20 mm, uncoated (2200 g)<br>Type E200 mounting (180 mm airgap behind the specimen) | 0.95 | A |
| Ewona 20 mm, coated (2200 g)<br>Type E200 mounting (180 mm airgap behind the specimen) | 0.95 | A |

## 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 (2 pages)

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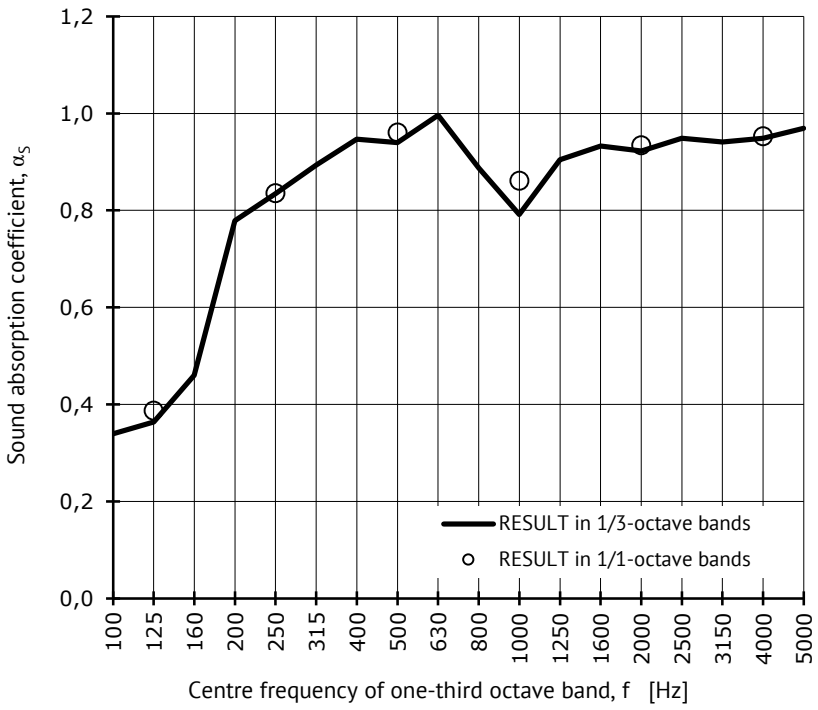
## Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

| | |
|---|---|
| **Specimen id:** | **Ewona 20 mm, uncoated (2200 g)** |
| | Type E200 mounting (180 mm airgap behind the specimen) |
| **Manufacturer:** | Ewona Finland Oy |
| **Client:** | Ewona Finland Oy |
| **Contact person:** | Jarmo Palomaa |
| **Mounting by:** | Jarkko Hakala |
| **Test laboratory:** | Turku University of Applied Sciences, Acoustics Laboratory |
| | Joukahaisenkatu 7, 20520 Turku, Finland |

| | | | | | |
|---|---|---|---|---|---|
| Specimen area: | | 10,6 $m^2$ | | Test room volume: | 201 $m^3$ |
| Temperature of test room: | 20 | 20 °C | (without / with specimen) | Room boundary area: | 224 $m^2$ |
| Relative humidity: | 66 | 77 % | (without / with specimen) | Test date: | 28.11.2022 |
| Atmospheric pressure: | 103 | 103 kPa | (without / with specimen) | Test file identification: | T281122a |

| | 1/3 | 1/1 | 1/1 |
|---|---|---|---|
| **f** (Hz) | $\alpha_S$ | $\alpha_S$ | $\alpha_p$ |
| 100 | 0,34 | | |
| 125 | 0,36 | 0,39 | 0,40 |
| 160 | 0,46 | | |
| 200 | 0,78 | | |
| 250 | 0,83 | 0,84 | 0,85 |
| 315 | 0,89 | | |
| 400 | 0,95 | | |
| 500 | 0,94 | 0,96 | 0,95 |
| 630 | 1,00 | | |
| 800 | 0,89 | | |
| 1000 | 0,79 | 0,86 | 0,85 |
| 1250 | 0,90 | | |
| 1600 | 0,93 | | |
| 2000 | 0,92 | 0,93 | 0,95 |
| 2500 | 0,95 | | |
| 3150 | 0,94 | | |
| 4000 | 0,95 | 0,95 | 0,95 |
| 5000 | 0,97 | | |



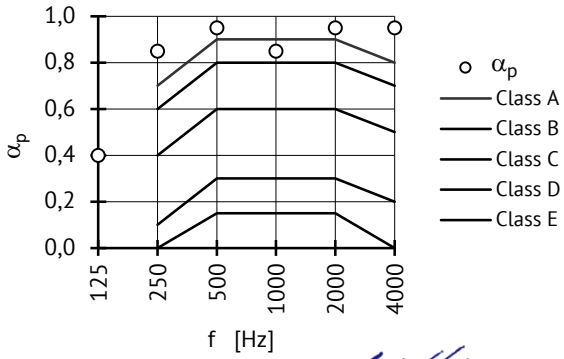

EN ISO 11654:

Weighted sound absorption coefficient $\alpha_w$

**0,95**

Absorption class (EN ISO 11654)

**A**

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Jarkko Hakala
Research Engineer
test performer

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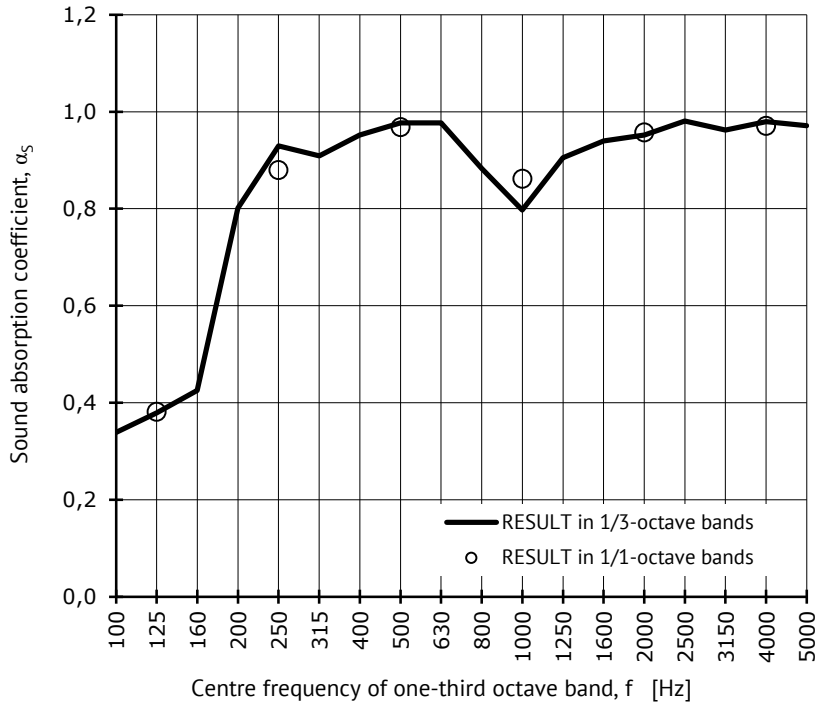
## Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

| | |
|---|---|
| **Specimen id:** | **Ewona 20 mm, coated (2200 g)** |
| | Type E200 mounting (180 mm airgap behind the specimen) |
| **Manufacturer:** | Ewona Finland Oy |
| **Client:** | Ewona Finland Oy |
| **Contact person:** | Jarmo Palomaa |
| **Mounting by:** | Jarkko Hakala |
| **Test laboratory:** | Turku University of Applied Sciences, Acoustics Laboratory |
| | Joukahaisenkatu 7, 20520 Turku, Finland |

| | | | | | |
|---|---|---|---|---|---|
| Specimen area: | | 10,6 $m^2$ | | Test room volume: | 201 $m^3$ |
| Temperature of test room: | 20 | 20 °C | (without / with specimen) | Room boundary area: | 224 $m^2$ |
| Relative humidity: | 66 | 72 % | (without / with specimen) | Test date: | 28.11.2022 |
| Atmospheric pressure: | 103 | 103 kPa | (without / with specimen) | Test file identification: | T281122b |

| | 1/3 | 1/1 | 1/1 |
|---|---|---|---|
| f (Hz) | $\alpha_S$ | $\alpha_S$ | $\alpha_p$ |
| 100 | 0,34 | | |
| 125 | 0,38 | 0,38 | 0,40 |
| 160 | 0,43 | | |
| 200 | 0,80 | | |
| 250 | 0,93 | 0,88 | 0,90 |
| 315 | 0,91 | | |
| 400 | 0,95 | | |
| 500 | 0,98 | 0,97 | 0,95 |
| 630 | 0,98 | | |
| 800 | 0,88 | | |
| 1000 | 0,80 | 0,86 | 0,85 |
| 1250 | 0,91 | | |
| 1600 | 0,94 | | |
| 2000 | 0,95 | 0,96 | 0,95 |
| 2500 | 0,98 | | |
| 3150 | 0,96 | | |
| 4000 | 0,98 | 0,97 | 0,95 |
| 5000 | 0,97 | | |



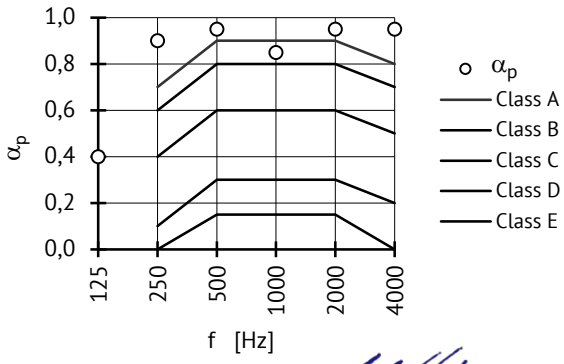

EN ISO 11654:

Weighted sound absorption coefficient $\alpha_w$

**0,95**

Absorption class (EN ISO 11654)

**A**

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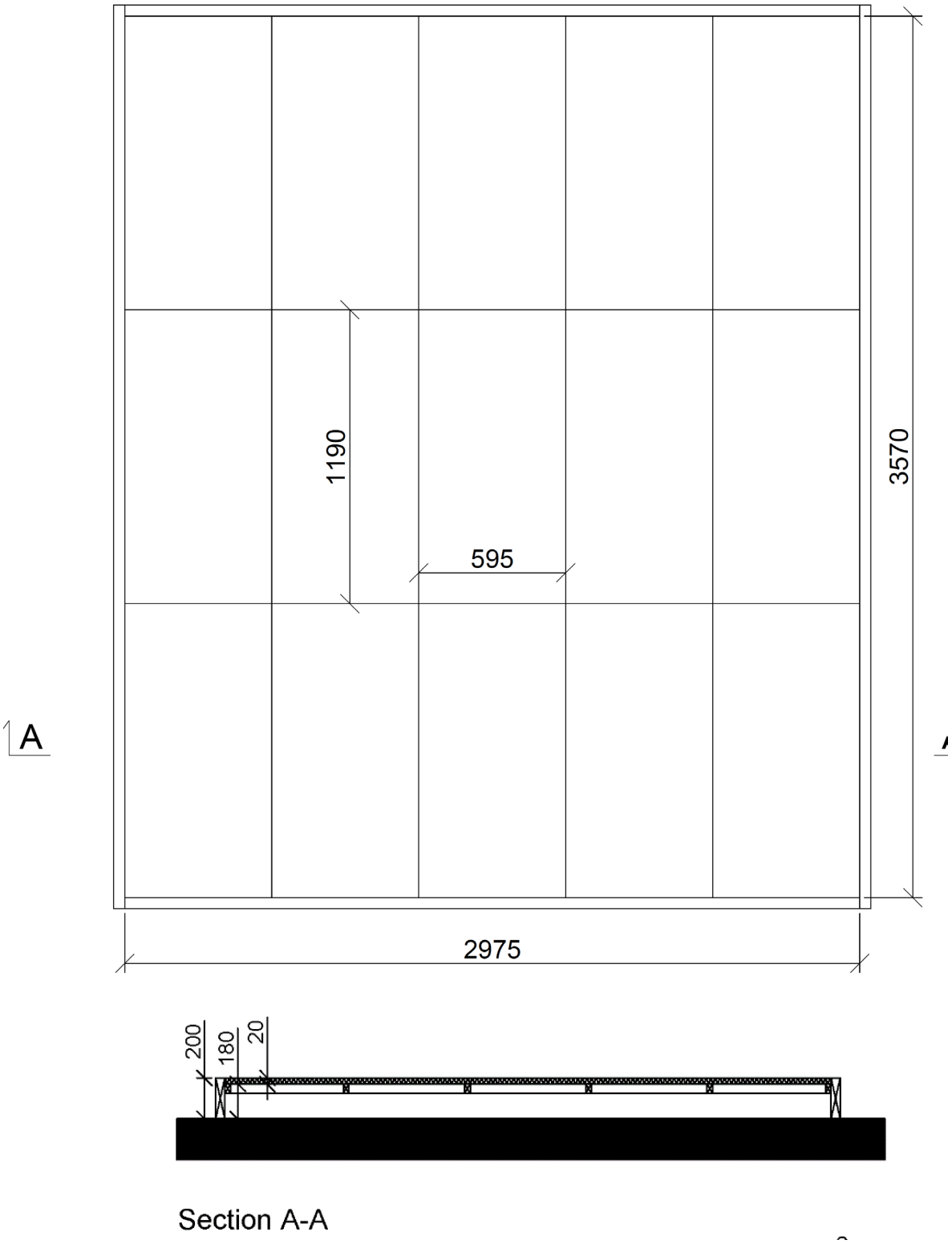
## ANNEX 2 – STRUCTURE DRAWINGS



## 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 E200 mounting (180 mm airgap behind the acoustic panel).**

The specimens were surrounded on the edges by a wooden vertical frame. The height of the frame was 200 mm. The side edges of the specimen were covered with adhesive tape. The wooden frame was ignored when calculating the total size of specimen area. Figure A3.1 shows view of the installation.

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 $\alpha_w$ is 0.035.

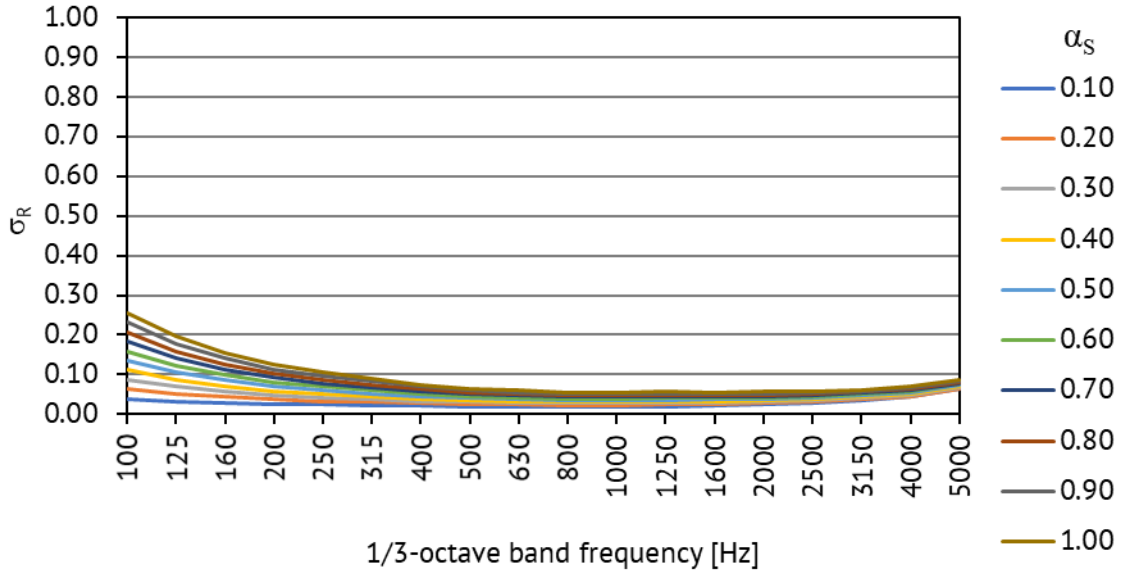



Figure. The reproducibility standard deviation, $\sigma_R$, of sound absorption coefficient, $\alpha_S$, according to ISO 12999-2:2020.

## 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.