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DETERMINATION OF ACOUSTIC ABSORPTION AREA PER OBJECT IN LABORATORY CONDITIONS

1 CLIENT

Hifiturku, Risto Anttila. Tender September 3, 2021. Order September 16, 2021.

2 DESCRIPTION OF THE COMMISSION

Sound absorption area per object, A_{obj} , was determined within 100–5000 Hz according to ISO 354 and within 25–80 Hz applying the principles to ISO 354:2003. The results within 20–80 Hz involve large and unknown uncertainty.

The object was Bassan60. Four objects were installed to the room during the test. The objects were placed on the floor to the corners of the room (distance to from wall was under 10 mm).

3 RESULTS

Detailed results are presented in Annex 1.

4 SIGNATURES



Valtteri Hongisto
Research Group Leader



Jarkko Hakala
Research Engineer

Turku University of Applied Sciences
Acoustics laboratory

ANNEXES

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

Determination of sound absorption area according to ISO 354:2003 in laboratory conditions

Specimen id: Bassan60
4 pcs, placed in corner of the reverberation room.

Manufacturer: Hifiturku

Client: Hifiturku

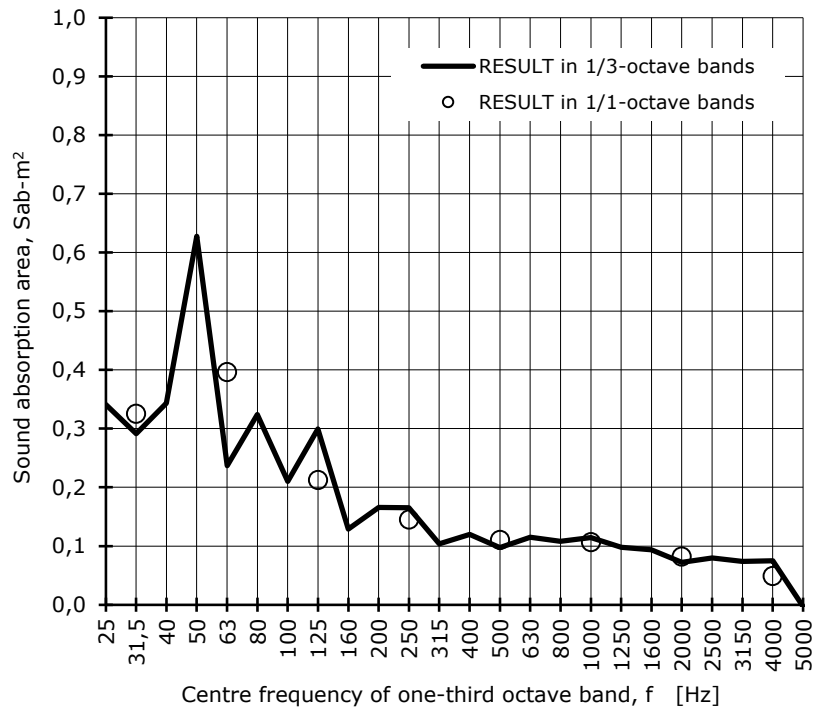
Contact person: Risto Anttila

Mounting by: Jarkko Hakala

Test laboratory: Turku University of Applied Sciences, Indoor environment, acoustics
Joukahaisenkatu 7, 20520 Turku, Finland. www.turkuamk.fi

Number of objects, N : 4 Test room volume: 201 m³
 Temperature of test room: 21 21 °C (without / with specimen) Room boundary area: 224 m²
 Relative humidity: 71 67 % (without / with specimen) Test date: 8.10.2021
 Atmospheric pressure: 103 103 kPa (without / with specimen) Test file identification: t081021a

| f (Hz) | 1/3 | 1/1 |
|-----------|---------------------------------------|---------------------------------------|
| | A _{obj} (m ²) | A _{obj} (m ²) |
| 25 | 0,34 | |
| 31,5 | 0,29 | 0,33 |
| 40 | 0,34 | |
| 50 | 0,63 | |
| 63 | 0,24 | 0,40 |
| 80 | 0,32 | |
| 100 | 0,21 | |
| 125 | 0,30 | 0,21 |
| 160 | 0,13 | |
| 200 | 0,17 | |
| 250 | 0,17 | 0,14 |
| 315 | 0,10 | |
| 400 | 0,12 | |
| 500 | 0,10 | 0,11 |
| 630 | 0,12 | |
| 800 | 0,11 | |
| 1000 | 0,11 | 0,11 |
| 1250 | 0,10 | |
| 1600 | 0,09 | |
| 2000 | 0,07 | 0,08 |
| 2500 | 0,08 | |
| 3150 | 0,07 | |
| 4000 | 0,07 | 0,05 |
| 5000 | 0,00 | |

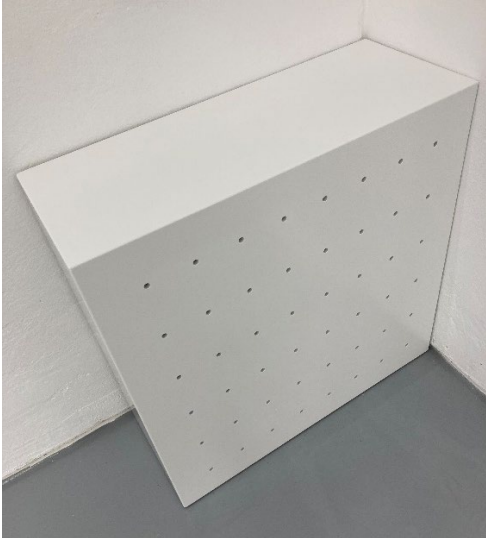


Jarkko Hakala

Jarkko Hakala
Research Engineer
test performer

ANNEX 2 – STRUCTURE DRAWINGS

The client did not provide specific structure drawings for the product.



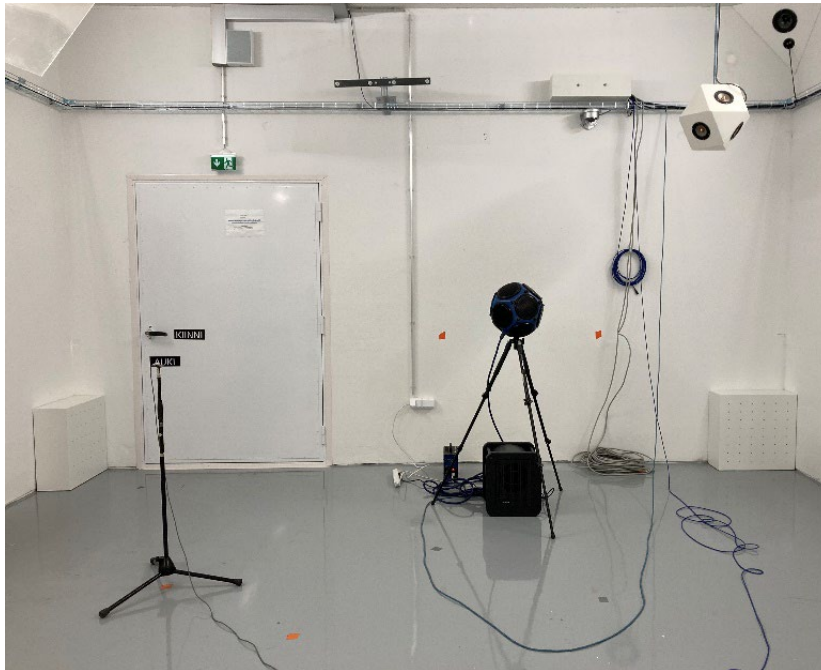
Bassan60 is a box made of MDF board. One side is perforated so that the box acts as a resonator absorber.

Dimension of the product is about (H) 600 x (W)600 x (D)240 mm.

ANNEX 3 – MOUNTING OF SPECIMEN

The specimen was mounted on the four corners on floor of the reverberation room in conformance with **ISO 354:2003 Annex B, Type A mounting**.

Corner of the floor is typical placement for the product, and therefore this placement was applied during the measurements. The distance from the walls was under 10 mm. The perforations were towards the room as shown in the photograph.



In picture two of the specimens mounted to the reverberation room corners.

ANNEX 4 – MEASUREMENT ARRANGEMENTS

1 Acoustical measurements

The test signal was produced to the test room using omnidirectional loudspeaker Norsonic 276 with amplifier Norssonor Nor 280, and Genelec 7050B active subwoofer. The test signal (sweep) was produced by a real time analyzer (Sinus Soundbook MK2). 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 (Sinus Soundbook MK21) using 20 dB decay range. All frequency bands were measured using 3 source positions and 4 microphone positions. In every position one decay were measured. The total number of reverberation time measurements was 12.

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 m³ test room.

4 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.