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DETERMINATION OF ACOUSTIC ABSORPTION COEFFICIENT IN LABORATORY CONDITIONS

1 CLIENT

Hifiturku, Risto Anttila. Tender October 13, 2021. Order October 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 50–80 Hz applying the principles to ISO 354:2003. The results within 50–80 Hz involve large and unknown uncertainty.

The object was Bassan120. 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

A_{obj} describes the absorption area per single resonator. Detailed results are presented in Annex 1.

4 SIGNATURES

Valtteri Hongisto
Research Group Leader

Jarkko Hakala
Research Engineer

Turku University of Applied Sciences
Acoustic laboratory

ANNEXES

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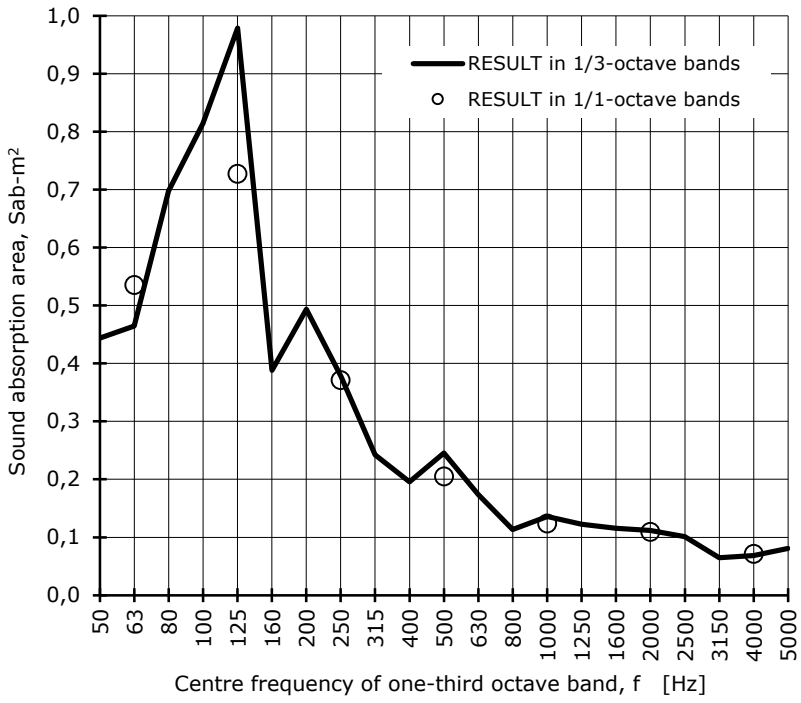
Determination of sound absorption area according to ISO 354:2003 in laboratory conditions

Specimen id: **Bassan120**
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 m^3
Temperature of test room:	20	20 °C	(without / with specimen)	Room boundary area:	224 m^2
Relative humidity:	56	60 %	(without / with specimen)	Test date:	30.11.2021
Atmospheric pressure:	98	98 kPa	(without / with specimen)	Test file identification:	t301121a

	1/3	1/1
f	**A_{obj}**	**A_{obj}**
(Hz)	(m^2)	(m^2)
50	0,44	
63	0,46	0,54
80	0,70	
100	0,81	
125	0,98	0,73
160	0,39	
200	0,49	
250	0,38	0,37
315	0,24	
400	0,20	
500	0,25	0,20
630	0,17	
800	0,11	
1000	0,14	0,12
1250	0,12	
1600	0,12	
2000	0,11	0,11
2500	0,10	
3150	0,06	
4000	0,07	0,07
5000	0,08	



Jarkko Hakala
Research Engineer
test performer

ANNEX 2 – STRUCTURE DRAWINGS

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

Bassan120 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 Bassan120 mounted to the reverberation room corners.

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.

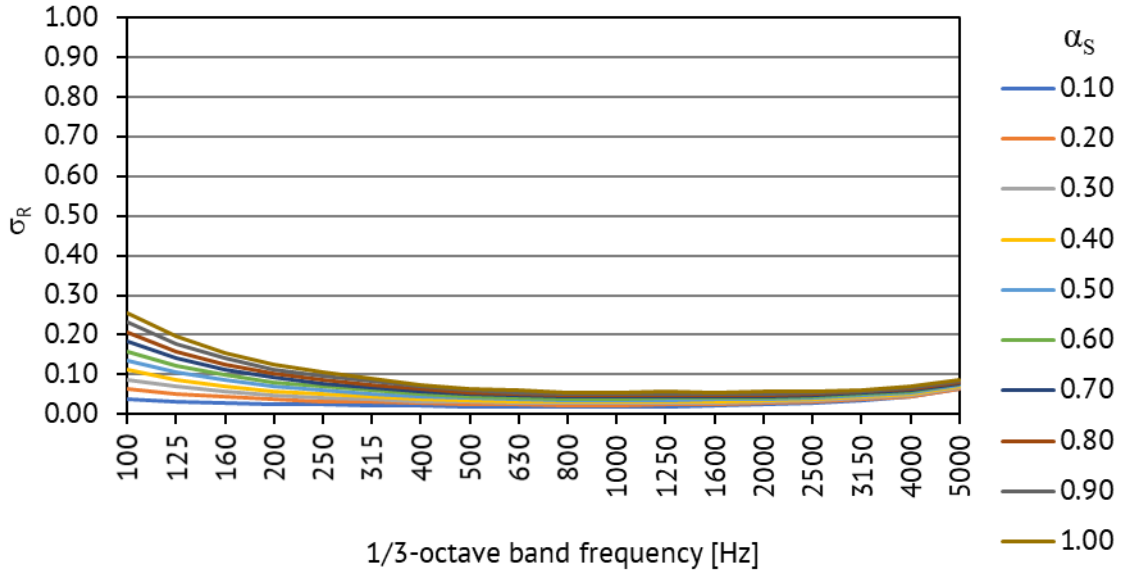


Figure. The reproducibility standard deviation, σ_R, of sound absorption coefficient, α_S, according to ISO 12999-2:2020.

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.