17025 · HAA 1043

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RN 72160821 Zagreb, 2015-12-21

TEST REPORT No. EN-2160/060/15-104/15

Building product:	Quadsorber 8 – sound-absorption cladding
Client:	Sonitus d.o.o. Tina Ujevića 26 HR-48000 Koprivnica Croatia
Contract/order:	offer 2160-0-0747/15 dated 2015-06-17
Manufacturer:	Sonitus d.o.o. Tina Ujevića 26 HR-48000 Koprivnica Croatia
Date of sample delivery:	on 2015-08-17 client delivered samples of sound-absorption claddings to Laboratory
Laboratory sample No.:	LGF 120/15
Testing laboratory:	Institut IGH d.d. Materials and Structures Department Laboratory IGH Building Physics Laboratory Janka Rakuše 1 HR-10000 Zagreb Croatia
Tested property:	Sound absorption Test method: HRN EN ISO 354:2004 Acoustics - Measurement of sound absorption in a reverberation room (ISO 354:2003; EN ISO 354:2003) *(test method accredited by the Croatian Accreditation Agency (HAA))*

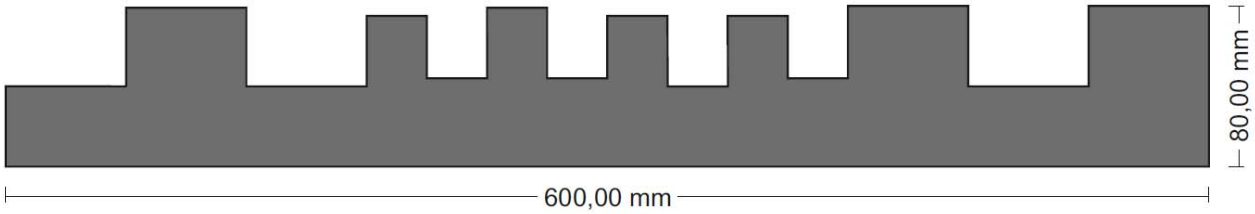
Test overseer: Head of Laboratory:

Tomislav Vuić, B.S.c (Occ. Safety & Health) Dr Ivica Kušević, mag.phys.

Laboratory for Building Physics is accredited by the Croatian Accreditation Agency (HAA) according to the standard HRN EN ISO/IEC 17025 requirements for testing of thermal-insulation building products, selected testing of: building materials and products regarding thermal, hygric and acoustic properties, thermal characteristics of buildings, windows and doors properties, paints and varnishes, and fire-behavior of building materials and elements, according to the Annex of Accreditation Certificate No. 1043.

Description of test sample:

Quadsorber 8 sound-absorption claddings were tested. Nominal dimensions of sound-absorption claddings were 600 mm x 600 mm and maximum thickness 80 mm (Pictures 1-3).
According to the data supplied by the client, base material of sound-absorption Quadsorber 8 cladding is polyester based acoustic foam FMVSS 302 of nominal density 25 kg/m^3.
The average value of sound-absorption Quadsorber 8 cladding samples weight was 561 g.



Picture 1: schematic drawing of the Quadsorber 8 sound-absorption cladding.

Picture 2

Picture 3

Testing and evaluation standard:

HRN EN ISO 354:2004 Acoustics - Measurement of sound absorption in a reverberation room (ISO 354:2003; EN ISO 354:2003),
HRN EN ISO 11654:1998 – Acoustics - Sound absorbers for use in buildings - Rating of sound absorption (ISO 11654:1997; EN ISO 11654:1997).

Dimensions and arrangement of test samples:

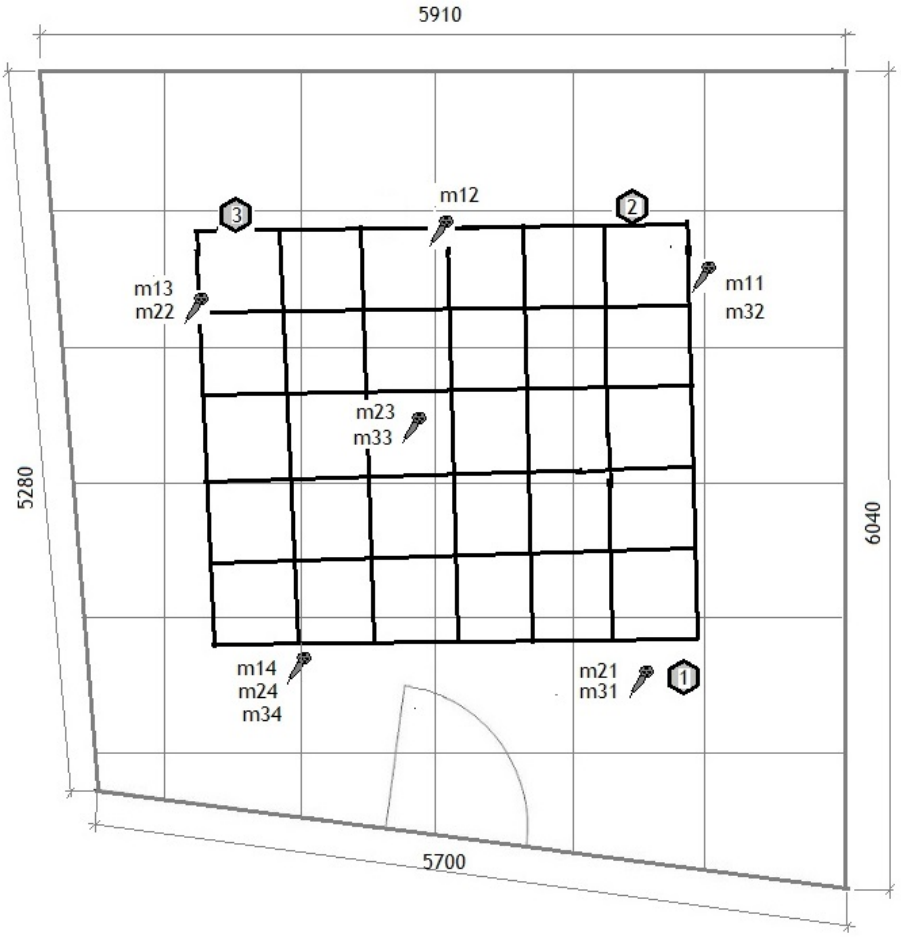
For determination of sound absorption of sound-absorption Quadsorber 8 cladding, 30 pieces, with dimensions 600 mm x 600 mm each, were laid without fixation on the floor of the reverberation room. Overall dimensions of the rectangle-area of laid claddings were 3600 mm x 3000 mm, with surface area of 10,8 m^2 (Picture 4 and 5). The perimeter edge of laid claddings were not covered, so edge surface also contributes to the sound absorption with additional area of 0,79 m^2 (Picture 6).

Date of test:

test was performed on 2015-08-17.

Description of reverberation room:
- volume: 194,8 m^3,
- area: floor 32,65 m^2, ceiling: 32,65 m^2, walls: 136,77 m^2,
- diffusers: 8 pieces, with total area 30,17 m^2.

Test conditions:
- number of microphone positions: 4,
- number of sound-source positions: 3,
- number of averaging at each microphone/sound-source position: 3.



Picture 4: drawing of the test sample position in the reverberation room with the sound-source positions (1, 2 and 3) and microphone positions (m11, m12 … m34).

Picture 5: test samples in the reverberation room.

Picture 6: exposed perimeter edge of test samples.

Measurement and testing equipment:

- modular sound analyzer, type 2260 Investigator, Bruel & Kjær, serial number: 2418322,
- sound pressure calibrator, type 4231, Bruel & Kjær, serial number: 2094668,
- condenser microphone, type 4189, Bruel & Kjær, serial number: 2417824,
- preamplifier, type ZC 0026, Bruel & Kjær, serial number: 2877,
- power amplifier, type 2716, Bruel & Kjær, serial number: 2486522,
- sound source, type 4296, Bruel & Kjær, serial number: 2485310,
- thermohygrometer, ROTRONIC, type Hygroclip S, laboratory mark 1679, serial number: 23535 012,
- barometer, serial number: 225558.

Presentation of test results:

The sound absorption coefficient (a_S) and the practical sound absorption coefficient (a_p) of test samples are shown as functions of frequency in a table and diagram. In presenting the results, the following symbols are used:

f – centre frequency of the one-third-octave band (Hz),
a_S – sound absorption coefficient at a centre frequency of the one-third-octave band,
a_p- practical sound absorption coefficient at a centre frequency of octave band,
T_1 – reverberation time of the empty reverberation room (s),
T_2 – reverberation time of the reverberation room with test samples(s) (s),
a_W – weighted sound absorption coefficient.

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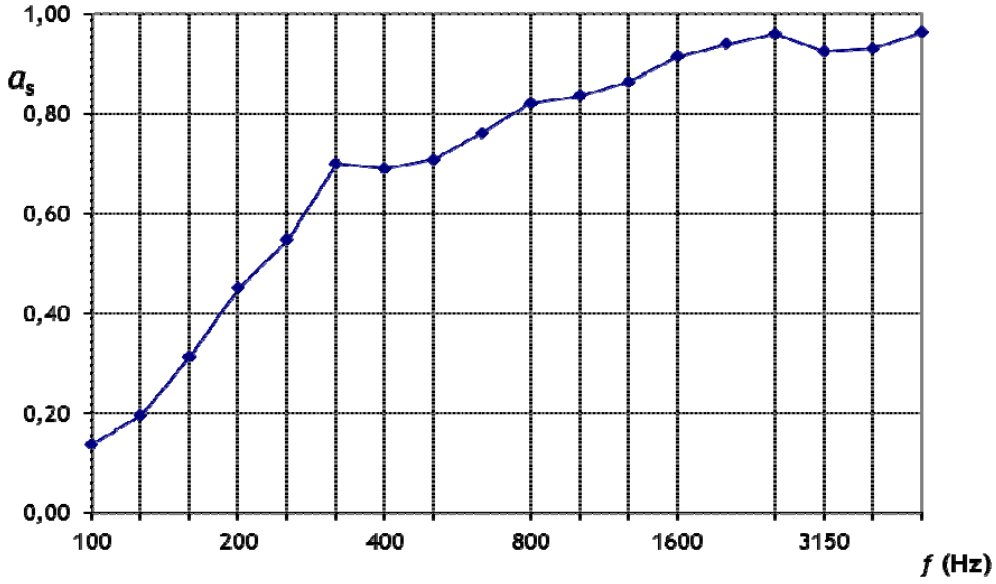
Results of sound-absorption test of sound-absorption Quadsorber 8 claddings in the reverberation room

Client: Sonitus d.o.o., Koprivnica
Manufacturer: Sonitus d.o.o., Koprivnica
Product: sound-absorption cladding Quadsorber 8
Laboratory sample No.: LGF 120/15
Product installed by: client and Laboratory personnel
Test date: 2015-08-17
Area of tested samples: S = 11,6 m^2
Volume of the reverberation room: V = 194,8 m^3

Test conditions:
- empty reverberation room (2015-08-17): air temperature 25,3 °C, relative air humidity 57,9 %, atmospheric pressure: 99,1 kPa,
- reverberation room with sample (2015-08-17): air temperature 25,2 °C, relative air humidity 60,9 %, atmospheric pressure: 99,1 kPa.

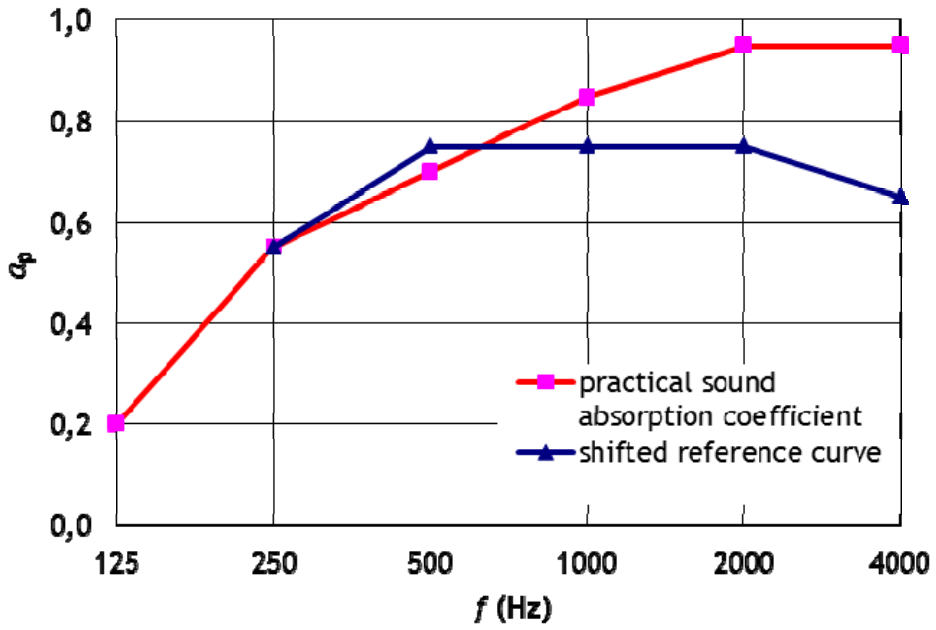
frequency f (Hz)	reverberation time of empty reverberation room T_1 (s)	reverberation time of reverberation room with test samples T_2 (s)	sound absorption coefficient a_S
100	10,71	6,91	0,14
125	9,23	5,53	0,19
160	9,24	4,45	0,31
200	7,71	3,36	0,45
250	7,86	3,02	0,55
315	7,59	2,55	0,70
400	7,64	2,58	0,69
500	7,24	2,49	0,71
630	6,97	2,34	0,76
800	6,46	2,17	0,82
1000	6,34	2,13	0,84
1250	5,79	2,02	0,86
1600	5,32	1,89	0,91
2000	5,10	1,83	0,94
2500	4,68	1,75	0,96
3150	4,09	1,70	0,93
4000	3,42	1,57	0,93
5000	2,82	1,41	0,96

sound absorption coefficient:



Rating of sound-absorption test results of sound-absorption Quadsorber 8 claddings in the reverberation room according to HRN EN ISO 11654:1998

frequency	shifted reference curve	practical sound absorption coefficient
f (Hz)		a_p
125		0,20
250	0,55	0,55
500	0,75	0,70
1000	0,75	0,85
2000	0,75	0,95
4000	0,65	0,95



sound-absorption Quadsorber 8 cladding manufactured by Sonitus d.o.o. from Koprivnica (Croatia)	
weighted sound absorption coefficient	sound absorption class according to HRN EN ISO 11654:1998
a_w = 0,75 (H)	C