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TEST REPORT No : 05899-5645

DATE OF ISSUE : 03 November 2022

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BS EN ISO 354:2003

Acoustics – Measurement of Sound Absorption in a Reverberation Room

Client: Bowiq benelux BV

Job Number: 05899

Sample Reference: Bowiq BOSPRAY

Date of Test: 17 October 2022

Signed: 

E Kalavsky
Laboratory Assistant

Approved: 

D Wong-McSweeney
Laboratory Manager

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Client Details:	Bowiq benelux BV
	Hullenberg 278
	1101 BV Amsterdam
	The Netherlands
Manufacturer:	Client
Mounting Type:	Type A Mounting
Date Order Received:	31 August 2022

1. Test Samples

The following sample was installed in the large reverberation room of the University of Salford Acoustic Test Laboratory. It was installed in accordance with Annex B of BS EN ISO 354:2003. All information regarding the samples comes from laboratory measurements unless marked with “cs” or otherwise stated.

1.1. Description of Test Samples

- 1.2. Test Reference:** 05899-5645
Sample Reference^{cs}: Bowiq BOSPRAY
Sample Description: Acoustic Panels - Type A Mounting

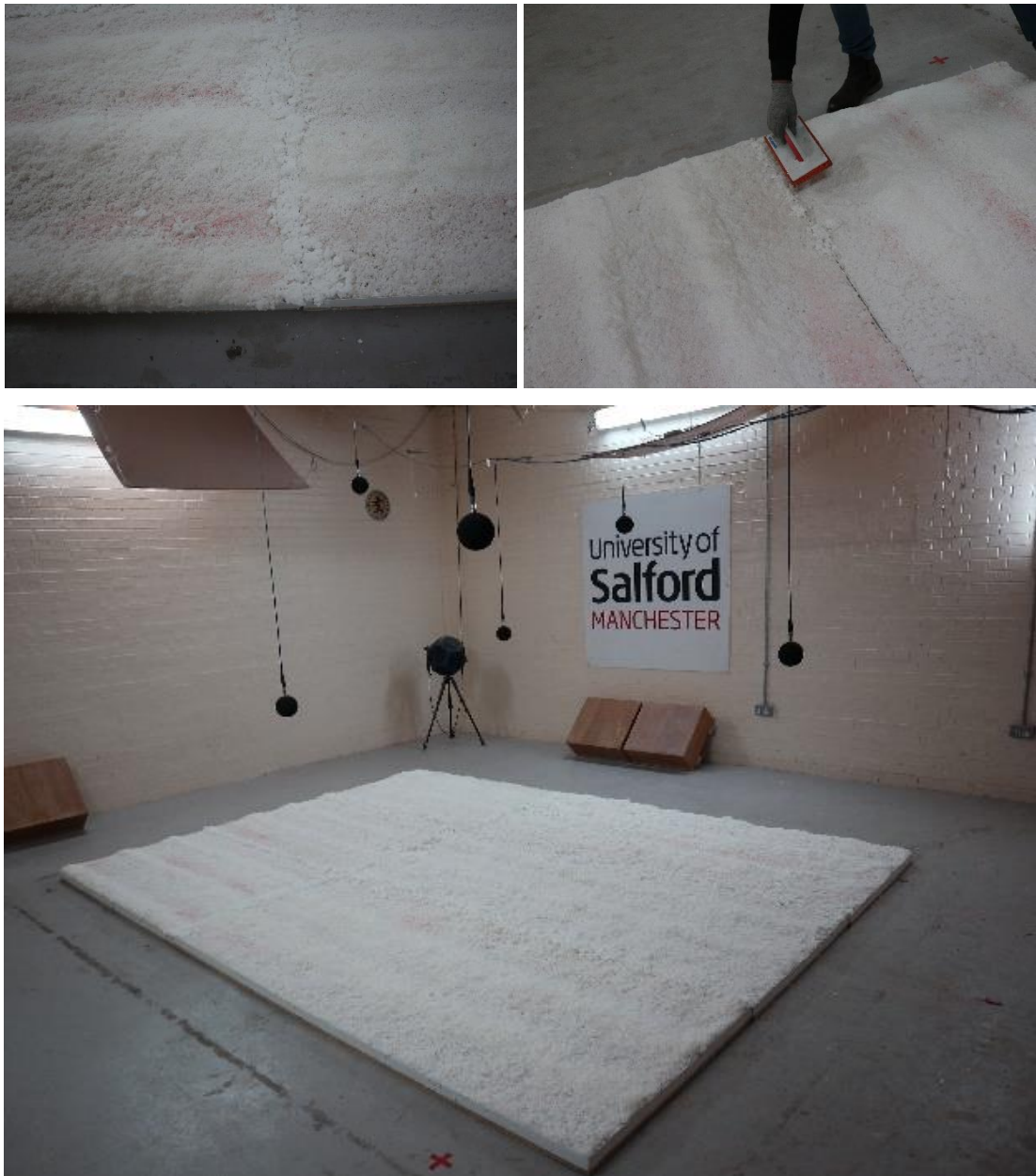
Six absorption panels, as received from the client, were laid directly onto the concrete floor of the reverberation room. The panels consisted of a 20 mm OSB backing, a thin sheet of metal and a layer of shredded paper. They were of variable thickness due to compaction and shedding. Each panel was edged with a strip of plastic. The joins between panels were patched with extra material in situ.

Sample area: 4005 × 3010 mm

Thickness (nominal): 80.0 mm

1.3. Photographs





2. Description of Test Procedure

2.1. Description of Test Facility

The tests were carried out in the large reverberation room at the University of Salford. The room has been designed with hard surfaces and non-parallel walls to give long empty room reverberation times with uniform decays. It has the shape of a truncated wedge. In addition, 18 plywood panels, of various sizes, were hung in the room to improve the diffusivity of the sound field. The test sample was placed in the centre of the floor. The excitation signal comprised wide band random noise played into the room via two dodecahedron, omnidirectional loudspeakers mounted in room corners. The sound was monitored at each of 6 microphone positions. The room is 7.4 m long $\times$ ~6.6 m wide $\times$ 4.5 m high with a volume of 221 m³ and a total surface area of 224 m². The volume of the room permits a maximum sample size of 12.79 m² to be tested, in accordance with Clause 6.2.1.1 in BS EN ISO 354: 2003, "Acoustics - Measurement of sound absorption in a reverberation room".

2.2. Test Procedure

The procedure followed that detailed in BS EN ISO 354. Measurements were made on the rate of decay of sound in the test chamber with and without the sample in place. The frequency range from 100 Hz to 5000 Hz was covered in one-third octave bands. An average reverberation time was taken from five decays at each of six microphone positions for each of two loudspeaker positions (i.e. 60 decays per third octave band). The decays were produced by exciting the room with amplified wide band random noise and stopping the excitation once the chamber became saturated. The time taken for the sound to decay by a given amount is measured and extrapolated to give the reverberation time. In practice this was determined by sampling the decaying sound field on a one-third octave band frequency analyser and storing the spectrum in a computer every 32 milliseconds. The reverberation time was obtained from the arithmetically averaged decays at each frequency. The measurements with and without the sample in the room were carried out consecutively to avoid significant changes in relative humidity and temperature that influence air absorption at higher frequencies.

2.3. Calculation

The random incidence sound absorption coefficients were determined from the measured data by means of the equations below:

$$\alpha_s = \frac{A_T}{S}$$

Where

α_s is the absorption coefficient of the sample

S is the area covered by the test specimen (m^2)

A_T is the equivalent sound absorption area of the test specimen (m^2)

$$A_T = A_2 - A_1 = 55.3V \left(\frac{1}{c_2 T_2} - \frac{1}{c_1 T_1} \right) - 4V(m_2 - m_1)$$

A_1 is the equivalent sound absorption area of the empty reverberation room (m^2).

A_2 is the equivalent sound absorption area of the room reverberation containing the test specimen (m^2).

V is the volume, in cubic metres, of the empty reverberation room:

c_1 is the propagation speed of sound at air temperature t_1 ;

c_2 is the propagation speed of sound at air temperature t_2 ;

T_1 is the mean reverberation times of the empty reverberation room in each frequency band (sec).

T_2 is the mean reverberation times of the reverberation room containing the test specimen in each frequency band (sec)

m_1 is the power attenuation, in reciprocal metres, using the climatic conditions that have been presented in the empty reverberation room.

m_2 is the power attenuation, in reciprocal metres, using the climatic conditions that have been presented in the reverberation room containing the test specimen.

The single-number rating, α_w , has been calculated in accordance with BS EN ISO 11654:1997, *Acoustics – Sound absorbers for use in buildings – Rating of sound absorption*.

(No correction is applied for the absorption of the surface covered by the test sample)

3. Equipment

Equipment	Laboratory Equipment Record No.
Norwegian Electronics 1/3 octave band real time analyser type 850 with in-built random noise generator	RTA3-07 to 12
Quad 510 power amplifier	PA7
Norsonic Sound Calibrator type 1251	C8
2 × Norsonic Dodecahedron Loudspeakers	LS10-LS11
2 × Bruel & Kjaer random incidence condenser microphone type 4166 in the receiving room	M9, M18
4 × G.R.A.S. random incidence condenser microphones type 40AP in the receiving room	M20, M31, M19, M32
Environmental sensor data logger, hygrometers and barometer	HL1, HG2, BM3
Toshiba TECRA R850 119 laptop computer and related peripheral equipment (network switch, printer, monitor etc.)	RTA3-00
Yamaha GQ1031BII graphic equalizer	GEQ1

4. Results

The random incidence sound absorption coefficients, α_s , are given in the tables over leaf.

Also given are the octave-band practical sound absorption coefficients, α_{pi} , and the weighted sound absorption coefficient, α_w .

The results here presented relate only to the items received, tested and described in this report.

BS EN ISO 354:2003**Acoustics - Measurement of absorption in a reverberation room**

Client: **Bowiq benelux BV**
Hullenberg 278, 1101 BV Amsterdam, The Netherlands,

Sample Reference: **Bowiq BOSPRAY**
Description of Sample: Acoustic Panels - Type A Mounting

Room Volume: 221 m³ Location: Acoustic Transmission Suite
Sample Size: 12.06 m² Test Room Large reverberation Room
Sample Thickness: 80.0 mm Condition: Clean

Sample Out

Temperature 19.9 °C
Relative Humidity 53.3 %
Static Pressure 101.0 kPa

Sample In

Temperature 20.0 °C
Relative Humidity 54.9 %
Static Pressure 100.9 kPa

Random Incidence Sound Absorption Coefficient

Frequency [Hz]	T_1 [s]	T_2 [s]	α_s
100	3.97	3.54	0.09
125	4.15	3.23	0.20
160	5.40	3.11	0.40
200	5.58	2.72	0.56
250	6.37	2.44	0.75
315	6.21	2.12	0.92
400	6.03	2.00	0.99
500	5.99	1.85	1.10
630	5.88	1.84	1.11
800	5.67	1.80	1.12
1000	5.22	1.76	1.11
1250	4.82	1.74	1.09
1600	4.46	1.70	1.08
2000	4.00	1.65	1.05
2500	3.43	1.53	1.07
3150	2.99	1.43	1.08
4000	2.28	1.26	1.06
5000	1.97	1.17	1.06

Test reference: 05899-5645

Date: 17 October 2022

University of Salford, School of Computing Science & Engineering

BS EN ISO 354:2003**Acoustics - Measurement of absorption in a reverberation room**

Client: **Bowiq benelux BV**
Hullenberg 278, 1101 BV Amsterdam, The Netherlands,

Sample Reference: **Bowiq BOSPRAY**
Description of Sample: Acoustic Panels - Type A Mounting

Room Volume: 221 m³ Location: Acoustic Transmission Suite
Sample Size: 12.06 m² Test Room Large reverberation Room
Sample Thickness: 80.0 mm Condition: Clean

Sample Out

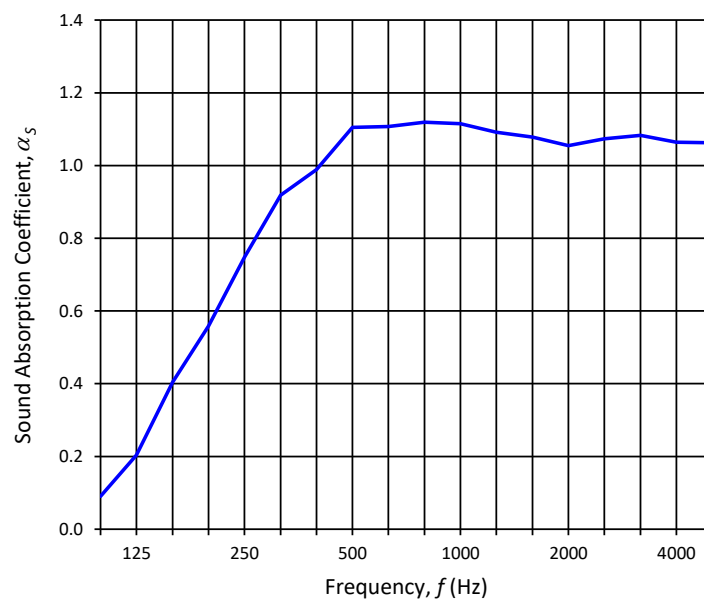
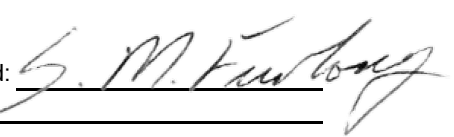
Temperature 19.9 °C
Relative Humidity 53.3 %
Static Pressure 101.0 kPa

Sample In

Temperature 20.0 °C
Relative Humidity 54.9 %
Static Pressure 100.9 kPa

Random Incidence Sound Absorption Coefficient

Frequency [Hz]	α_s
100	0.09
125	0.20
160	0.40
200	0.56
250	0.75
315	0.92
400	0.99
500	1.10
630	1.11
800	1.12
1000	1.11
1250	1.09
1600	1.08
2000	1.05
2500	1.07
3150	1.08
4000	1.06
5000	1.06

Signed: **Test reference: 05899-5645**

Date: 17 October 2022

University of Salford, School of Computing Science & Engineering

BS EN ISO 11654:1997

Acoustics - Sound absorbers for use in buildings

Client: Bowiq benelux BV
Hullenberg 278, 1101 BV Amsterdam, The Netherlands,

Sample Reference: Bowiq BOSPRAY
Description of Sample: Acoustic Panels - Type A Mounting

Room Volume: 221 m³ Location: Acoustic Transmission Suite
Sample Size: 12.06 m² Test Room Large reverberation Room
Sample Thickness: 80.0 mm Condition: Clean

Sample Out

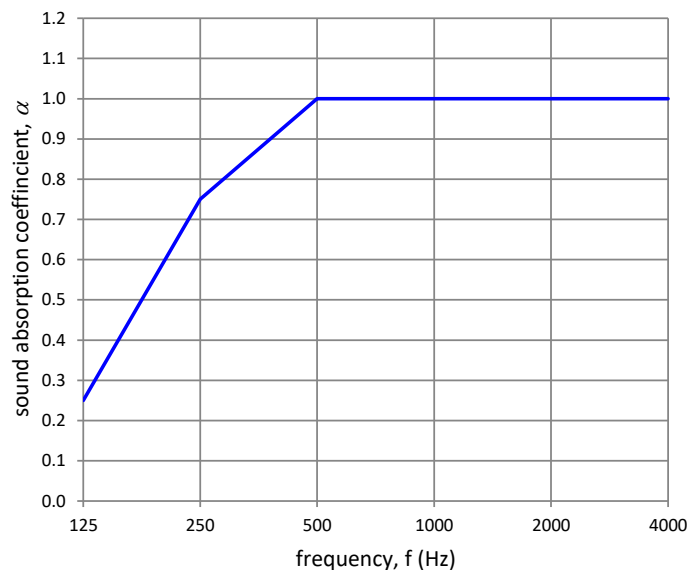
Temperature 19.9 °C
Relative Humidity 53.3 %
Static Pressure 101.0 kPa

Sample In

Temperature 20.0 °C
Relative Humidity 54.9 %
Static Pressure 100.9 kPa

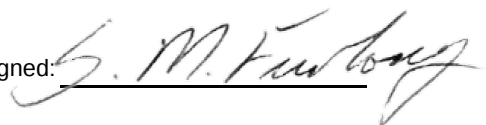
Random Incidence Sound Absorption Coefficient

Frequency [Hz]	α_{pi}
125	0.25
250	0.75
500	1.00
1000	1.00
2000	1.00
4000	1.00



$$\alpha_w = 1.00$$

Classification: A

Signed: 

Test reference: 05899-5645

Date: 17 October 2022

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