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TEST REPORT No : 06199-6023 **DATE OF ISSUE : 01 August 2023**

BS EN ISO 354:2003

Acoustics – Measurement of Sound Absorption in a Reverberation Room

Client:	GIK Acoustics Europe
Job Number:	06199
Sample Reference:	Slat Fusor - Corner
Date(s) of Test:	24 May 2023

Signed: . . . . . L Cambidge
Specialist Acoustics Technician

Approved: . . . . . D Wong-McSweeney
Laboratory Manager

Contents

Client Details:	GIK Acoustics Europe
	Unit F
	Perseverance Mills
	Giles Street, Wibsey
	BD06 3HS
Manufacturer:	Client
Mounting Type:	Discrete Object Mounting
Date Order Received:	30 March 2023

1. Test Samples

The following sample was installed in the large reverberation room of the University of Salford Acoustic Test Laboratory. It was **NOT** 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.

Absorption measurements include 50 Hz, 63 Hz and 80 Hz which are outside of the scope of the standard. This is a NOT UKAS accredited test or report.

1.1. Description of Test Samples

1.2. Test Reference: **06199-6023**

Sample Reference *cs*: Slat Fusor - Corner

Sample Description: Corner absorption boxes

Eight absorption boxes were installed around the edge of the floor of the reverberation chamber. Each box was a right-angle prism with dimensions 420 × 420 × 1000 mm. The exposed face was covered with 20 × 25 mm slats evenly spaced.

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 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 × ~6.6 m wide × 4.5 m high with a volume of 220 m^3 and a total surface area of 224 m^2. The volume of the room permits a maximum sample size of 12.79 m^2 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 50 Hz to 5000 Hz was covered in one-third octave bands (50, 63 and 80 Hz are not included in BS EN ISO 354 and are not UKAS accredited). 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. 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 equivalent sound absorption per object, A_{Obj}, was determined from the measured data by means of the equations below:

$$A_{Obj} = \frac{A_T}{N_{Obj}}$$

Where

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.

(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 per object, α_{obj}, are given in the tables over leaf. Results at frequencies between 100 Hz and 5000 Hz are included in the standard, BS EN ISO 354:2003. Results at frequencies 50 Hz, 63 Hz and 80 Hz are also presented but these are not within the scope of the BS EN ISO 354:2003.

The results here presented relate only to the items received, tested and described in this report. This is not a UKAS accredited report.

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

Client:	**GIK Acoustics Europe**
	Unit F, Perseverance Mills, Giles Street, Wibsey,
	BD06 3HS
Sample Reference:	**Slat Fusor - Corner**
Description of Sample:	Corner absorption boxes
	Frequencies, 50, 63 and 80Hz not accredited

Room Volume:	220 m³	Location:	Acoustic Transmission Suite
No. of Samples:	8	Test Room	Large reverberation Room
		Condition:	Clean

Sample Out		***Sample In***	
Temperature	20.9 °C	Temperature	20.9 °C
Relative Humidity	50.2 %	Relative Humidity	50.6 %
Static Pressure	102.4 kPa	Static Pressure	102.4 kPa

Random Incidence Equivalent Absorption Area

Frequency [Hz]	T_1 [s]	T_2 [s]	A_{obj}
50	7.53	6.02	0.1
63	5.79	3.75	0.4
80	5.95	3.13	0.7
100	5.09	2.40	1.0
125	4.56	2.41	0.9
160	5.13	2.53	0.9
200	5.89	2.86	0.8
250	6.85	2.85	0.9
315	6.43	2.91	0.8
400	6.24	2.99	0.8
500	6.31	3.10	0.7
630	6.16	3.14	0.7
800	5.96	3.07	0.7
1000	5.46	2.94	0.7
1250	5.01	2.80	0.7
1600	4.56	2.61	0.7
2000	4.09	2.42	0.7
2500	3.46	2.21	0.7
3150	2.93	2.01	0.7
4000	2.27	1.73	0.6
5000	1.95	1.59	0.5

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University of Salford, School of Computing Science & Engineering

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No. of Samples:	8	Test Room	Large reverberation Room
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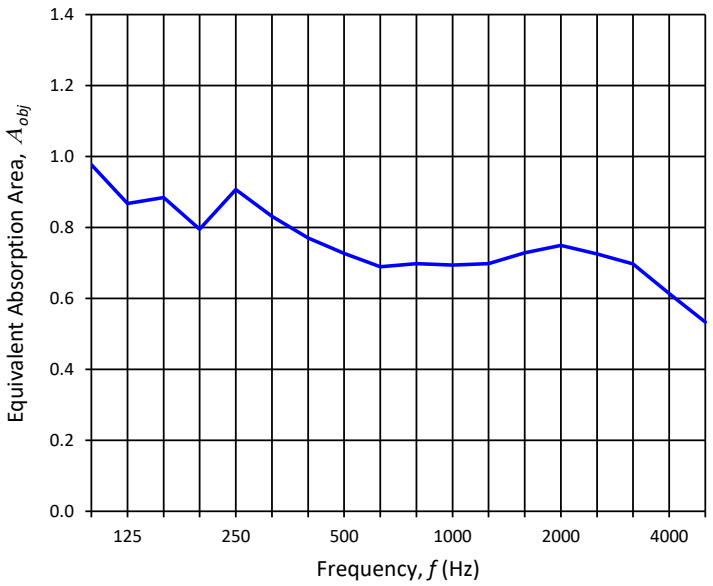
Sample Out		***Sample In***	
Temperature	20.9 °C	Temperature	20.9 °C
Relative Humidity	50.2 %	Relative Humidity	50.6 %
Static Pressure	102.4 kPa	Static Pressure	102.4 kPa

Random Incidence Equivalent Absorption Area

Frequency [Hz]	A_{obj}
50	0.1
63	0.4
80	0.7
100	1.0
125	0.9
160	0.9
200	0.8
250	0.9
315	0.8
400	0.8
500	0.7
630	0.7
800	0.7
1000	0.7
1250	0.7
1600	0.7
2000	0.7
2500	0.7
3150	0.7
4000	0.6
5000	0.5



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