

TEST REPORT No : 1772-2102

DATE OF ISSUE : 6 January 2016

Page 1 of 10

BS EN ISO 354:2003

ACOUSTICS – MEASUREMENT OF SOUND ABSORPTION IN A  
REVERBERATION ROOM

Equivalent Sound Absorption Area

**CLIENT:** GIK Acoustics Europe  
Unit A  
Perseverance Mills  
Giles Street  
Wibsey  
BD6 3HS

**JOB NUMBER:** ACOUS/01772

**MANUFACTURER:** Client

**MODEL:** “Alpha 2A” Panel

**TYPE:** Non-standard, corner mounted panels

**DATE RECEIVED:** 6 May 2014

**DATE OF TEST:** 2 December 2015

Signed:.....

C Lomax

Quality Manager

Approved:.....

D J M<sup>c</sup>Caul

Technical Manager



## **1 TEST SAMPLES**

### **1.1 Description of Test Samples**

**Test Reference:** 1772-2102

**Sample Reference:** “Alpha 2A” Panel

**Sample Description:** Acoustic panels. Each with dimensions of; 1208 mm long x 598 mm wide x 57 mm deep, with a measured weight of 4.6 kg. Each panel consisted of an 18 mm plywood frame containing a Rockwool core. The face, back and edges of the panel were covered with cloth. The front of each panel was faced with a perforated sheet of 3 mm thick MDF. Ten panels (of the sixteen supplied) were arranged at random, by the client, at the corners of the floor and wall of the reverberation room.

At the client’s request, the additional frequencies 50 Hz, 63 Hz, 80 Hz, 6.3 kHz, 8 kHz and 10 kHz were measured.

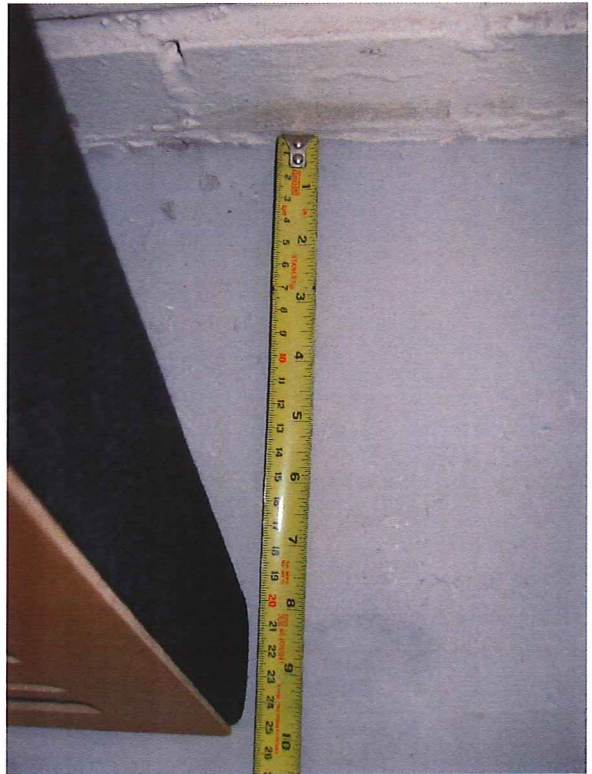
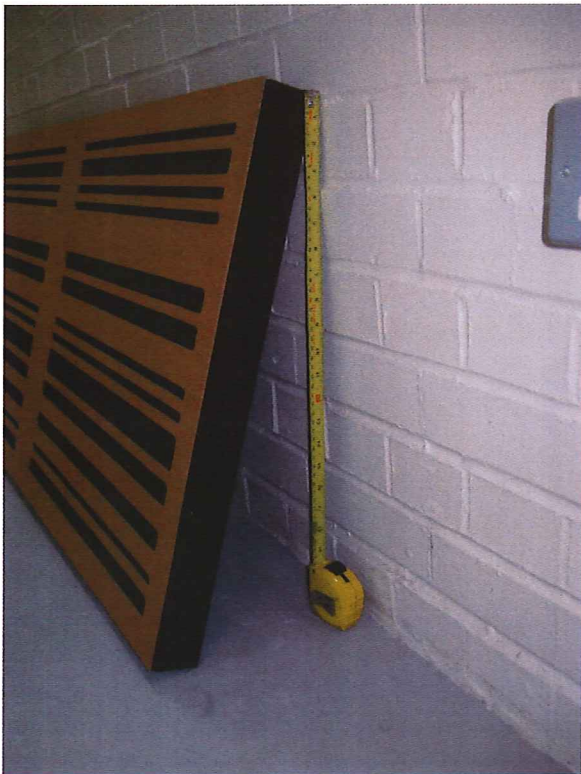
Tabulated data for these additional frequencies can be found in Appendix A.

### **1.2 Photographs**





## 1.2 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 11 plywood panels, each panel 1.22m × 2.44m, 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 a loudspeaker system mounted in a cabinet facing a corner. The sound was monitored at each of 6 microphone positions. The room is 7.4m long × ~6.6m wide × 4.5m high with a volume of 220m<sup>3</sup> and a total surface area of 224m<sup>2</sup>. The volume of the room permits a maximum sample size of 12.79m<sup>2</sup> 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 100Hz to 5000Hz<sup>1</sup> 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 20dB is measured and tripled 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.

---

<sup>1</sup> At the client's request, the measured frequency response was 50 Hz – 10,000Hz





## 2.3 Calculation

At the request of the client, the equivalent sound absorption area,  $A_T$  of the test specimen were determined from the measured data by means of the equations below:

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

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

Where:

$A_1$  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**

	<b>Departmental Record No</b>
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
2 of broadband loudspeakers (receiving room)	LS3-LS4
4 x Brüel & Kjær random incidence condenser microphone type 4166 in the receiving room	M8, M9 M18, M19
2 x G.R.A.S. random incidence condenser microphones type 40AP in the receiving room	M20, M31
Environmental sensor data logger, hygrometers and barometer	HL1, HG1, HG2, BM1
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 equivalent sound absorption area is given in the table(s) overleaf.

Reverberant room volume	220 m <sup>2</sup>		
Number of Samples	10		
Sample dimensions	1208 x 598 x 57 mm		
Atm. pressure	100.2 kPa		
		Sample out	Sample in
Temperature [°C ± 0.3]		19.52	19.50
Rel. humidity [% ± 3.0]		46.01	46.92

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



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

<b>Client:</b>	<b>GIK Acoustics Europe</b>		
	Unit A, Perseverance Mills, Giles Street, Wibsey BD6 3HS		
Product Identification:	Alpha 2A Panel		
Description of Sample:	Acoustic Panel		
	<i>Please note that the surface area of the sample is outside the required range specified, as defined in BS EN ISO 354:2003.</i>		
Room Volume:	220 m <sup>3</sup>	Location:	Acoustic Transmission Suite
No. of Samples:	10.00		Test Room Large reverberation Room
			Condition: Clean
<b>Sample Out</b>		<b>Sample In</b>	
Temperature	19.5 °C	Temperature	19.5 °C
Relative Humidity	46.0 %	Relative Humidity	46.9 %
Static Pressure	100.2 kPa	Static Pressure	100.2 kPa

### Random Incidence Equivalent Absorption Area

Frequency [Hz]	$T_1$ [s]	$T_2$ [s]	$A_T$
100	4.10	2.93	3.50
125	3.86	2.31	6.20
160	3.52	2.07	7.10
200	3.51	1.75	10.20
250	3.70	1.89	9.20
315	3.99	1.77	11.20
400	4.18	1.87	10.50
500	4.42	1.95	10.20
630	4.47	1.95	10.30
800	4.38	2.03	9.40
1000	4.28	2.11	8.50
1250	4.04	2.16	7.70
1600	3.82	2.14	7.40
2000	3.53	2.10	6.80
2500	3.14	2.00	6.40
3150	2.74	1.88	6.00
4000	2.24	1.63	6.00
5000	1.71	1.35	5.70

Test reference: 1772-2102

Date: 02 December 2015

University of Salford, School of Computing Science & Engineering





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

**Client:** **GIK Acoustics Europe**  
 Unit A, Perseverance Mills, Giles Street, Wibsey  
 BD6 3HS

**Product Identification:** Alpha 2A Panel  
**Description of Sample:** Acoustic Panel

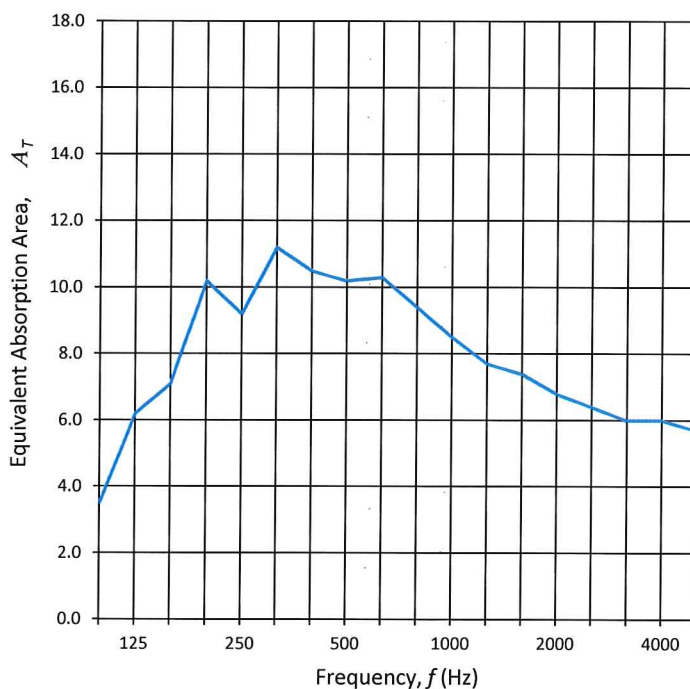
*Please note that the surface area of the sample is outside the required range specified, as defined in BS EN ISO 354:2003.*

**Room Volume:** 220 m<sup>3</sup>      **Location:** Acoustic Transmission Suite  
**No. of Samples:** 10.00      **Test Room Large reverberation Room**  
**Condition:** Clean

<b>Sample Out</b>		<b>Sample In</b>	
Temperature	19.5 °C	Temperature	19.5 °C
Relative Humidity	46.0 %	Relative Humidity	46.9 %
Static Pressure	100.2 kPa	Static Pressure	100.2 kPa

**Random Incidence Equivalent Absorption Area**

Frequency [Hz]	$A_T$
100	3.50
125	6.20
160	7.10
200	10.20
250	9.20
315	11.20
400	10.50
500	10.20
630	10.30
800	9.40
1000	8.50
1250	7.70
1600	7.40
2000	6.80
2500	6.40
3150	6.00
4000	6.00
5000	5.70



Signed: *G. M. Kurling*

**Test reference: 1772-2102**

**Date: 02 December 2015**

University of Salford, School of Computing Science & Engineering



**APPENDIX A**

At the client's request, the following additional frequencies were measured.

Frequency [Hz]	$A_T$	$T_1$ [s]	$T_2$ [s]
50	0.70	9.72	8.23
63	0.90	6.11	5.26
80	1.50	4.79	3.97
6,300	5.50	1.47	1.20
8,000	5.60	1.10	0.94
10,000	5.00	0.76	0.69

