

Acoustic Test Report

Fabric: Embrace

J&C Joel 
Inspiration in every performance



Acoustic Test Laboratory
The University of Salford
Salford, Greater Manchester
M5 4WT, United Kingdom

T: +44 (0) 161 295 4615
E: d.j.mccaul@salford.ac.uk

TEST REPORT No : 4785

DATE OF ISSUE : 05 January 2021

Page 1 of 11

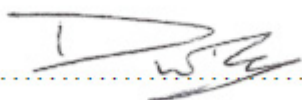
BS EN ISO 354:2003

Acoustics – Measurement of Sound Absorption in a Reverberation Room

Job Number: ACOUS/04785

Sample Reference:

Date(s) of Test: 28 October 2020

Signed:  D Wong-McSweeney
Laboratory Manager

Approved:  S M Furlong
Specialist Acoustics Technician

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Acoustic Test Report

Fabric: Embrace

Contents

1. Test Samples	3
1.1. Description of Test Samples	3
1.2. Test Reference: 4785-4364	3
1.3. Photographs	4
2. Description of Test Procedure	5
2.1. Description of Test Facility	5
2.2. Test Procedure	5
2.3. Calculation	6
3. Equipment	7
4. Results	8

Manufacturer:	Client
Mounting Type:	Type G-100 Mounting
Date Order Received:	16 October 2020

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



United Kingdom



+44 1422 833835



uksales@jcjoel.com



United Arab Emirates



+971 4 884 7801



menasales@jcjoel.com

www.jcjoel.com

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.

1.1. Description of Test Samples

1.2. Test Reference: 4785-4364

Sample Reference:

Sample Description: Fabric - Type G-100 Mounting

A sample of fabric (4980 × 3000 mm) was received from the client. Small clamps and magnets were used to fix one long edge of the fabric to a solid bar to a width of 4000 mm. The excess material was allowed to form pleats between the clamps. The bar was raised on tripods to 3000 mm which allowed the fabric to just reach the floor. It was positioned so that there was a 100 mm air gap between the curtain and the wall, as measured at the top of the curtain.

The tripod and bar were included in the empty room measurements.

Sample area: 4000 × 3000 mm

Thickness: 1.0 mm

Mass per unit area: 0.5 kg/m²

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



United Kingdom



+44 1422 833835



uksales@jcjoel.com



United Arab Emirates



+971 4 884 7801



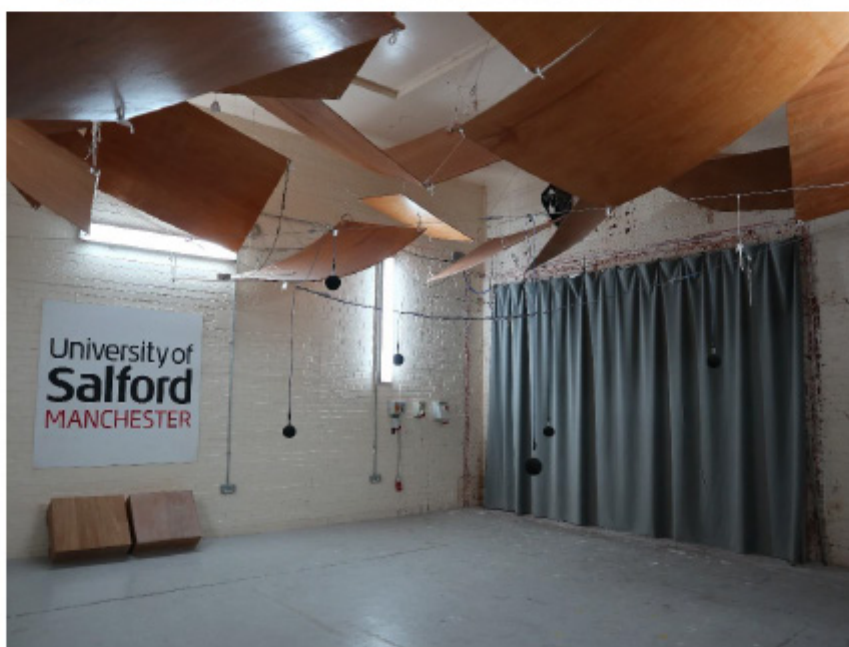
menasales@jcjoel.com

www.jcjoel.com

Acoustic Test Report

Fabric: Embrace

1.3. Photographs



This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

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 220 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.

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



United Kingdom



+44 1422 833835



uksales@jcjoel.com



United Arab Emirates



+971 4 884 7801



menasales@jcjoel.com

www.jcjoel.com

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, HG1, HG2, BM2
Toshiba TECRA R850 119 laptop computer and related peripheral equipment (network switch, printer, monitor etc.)	RTA3-00
Yamaha GQ1031BII graphic equalizer	GEQ1

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



United Kingdom



+44 1422 833835



uksales@jcjoel.com



United Arab Emirates



+971 4 884 7801



menasales@jcjoel.com

www.jcjoel.com

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.

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



United Kingdom



+44 1422 833835



uksales@jcjoel.com



United Arab Emirates



+971 4 884 7801



menasales@jcjoel.com

www.jcjoel.com

BS EN ISO 354:2003

Acoustics - Measurement of absorption in a reverberation room

Sample Reference:

Description of Sample: Fabric - Type G-100 Mounting

Room Volume: 220 m³ Location: Acoustic Transmission Suite
Sample Size: 12.00 m² Test Room Large reverberation Room
Sample Thickness: 1.0 mm Condition: Clean

Sample Out

Temperature 19.8 °C
Relative Humidity 43.1 %
Static Pressure 99.2 kPa

Sample In

Temperature 19.9 °C
Relative Humidity 45.4 %
Static Pressure 99.2 kPa

Random Incidence Sound Absorption Coefficient

Frequency [Hz]	T_1 [s]	T_2 [s]	α_s
100	5.50	5.41	0.01
125	6.37	6.30	0.01
160	5.87	5.84	0.00
200	6.34	5.38	0.08
250	7.21	5.50	0.13
315	6.90	4.30	0.26
400	6.52	3.65	0.36
500	6.56	3.43	0.41
630	6.39	3.57	0.36
800	6.19	3.60	0.34
1000	5.66	3.64	0.29
1250	5.25	3.57	0.27
1600	4.77	3.51	0.23
2000	4.26	3.26	0.22
2500	3.54	2.89	0.20
3150	2.95	2.50	0.20
4000	2.21	1.91	0.24
5000	1.86	1.63	0.27

Test reference: 4785-4364

Date: 28 October 2020

University of Salford, School of Computing Science & Engineering

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



United Kingdom



+44 1422 833835



uksales@jcjoel.com



United Arab Emirates



+971 4 884 7801



menasales@jcjoel.com

www.jcjoel.com

Acoustic Test Report

Fabric: Embrace

BS EN ISO 354:2003

Acoustics - Measurement of absorption in a reverberation room

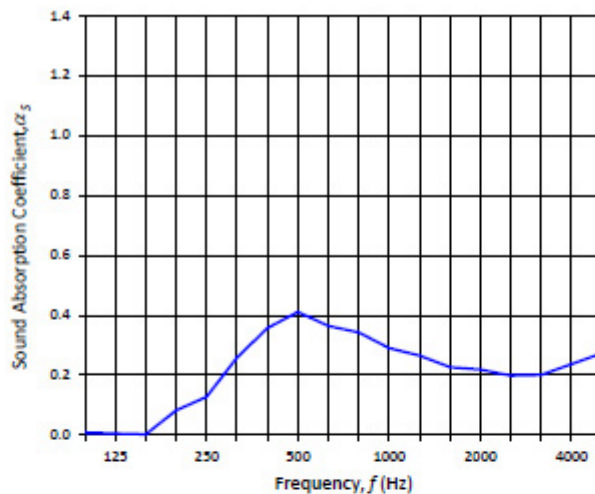
Sample Reference:

Description of Sample: Fabric - Type G-100 Mounting

Room Volume:	220 m ³	Location:	Acoustic Transmission Suite
Sample Size:	12.00 m ²	Test Room:	Large reverberation Room
Sample Thickness:	1.0 mm	Condition:	Clean
Sample Out		Sample In	
Temperature	19.8 °C	Temperature	19.9 °C
Relative Humidity	43.1 %	Relative Humidity	45.4 %
Static Pressure	99.2 kPa	Static Pressure	99.2 kPa

Random Incidence Sound Absorption Coefficient

Frequency [Hz]	α_s
100	0.01
125	0.01
160	0.00
200	0.08
250	0.13
315	0.26
400	0.36
500	0.41
630	0.36
800	0.34
1000	0.29
1250	0.27
1600	0.23
2000	0.22
2500	0.20
3150	0.20
4000	0.24
5000	0.27



Signed: 

Test reference: 4785-4364

Date: 28 October 2020

University of Salford, School of Computing Science & Engineering

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

BS EN ISO 11654:1997
Acoustics - Sound absorbers for use in buildings

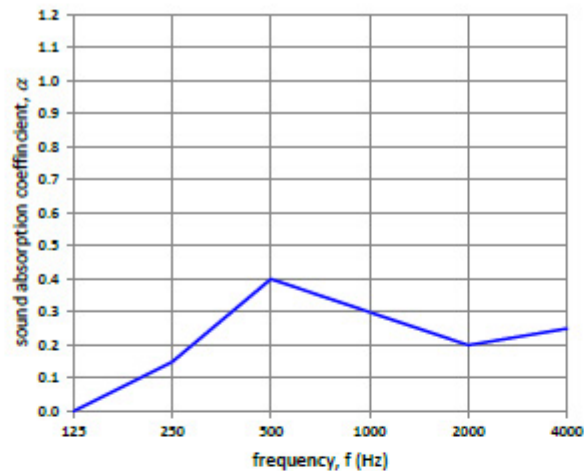
Sample Reference:
Description of Sample: Fabric - Type G-100 Mounting

Room Volume: 220 m³ Location: Acoustic Transmission Suite
Sample Size: 12.00 m² Test Room Large reverberation Room
Sample Thickness: 1.0 mm Condition: Clean

Sample Out		Sample In	
Temperature	19.8 °C	Temperature	19.9 °C
Relative Humidity	43.1 %	Relative Humidity	45.4 %
Static Pressure	99.2 kPa	Static Pressure	99.2 kPa

Random Incidence Sound Absorption Coefficient

Frequency [Hz]	α_{pl}
125	0.00
250	0.15
500	0.40
1000	0.30
2000	0.20
4000	0.25



$\alpha_w = 0.30$

Classification: D

Signed: 

Test reference: 4785-4364

Date: 28 October 2020

University of Salford, School of Computing Science & Engineering

This report is issued by the University of Salford Acoustic Test Laboratory, UKAS accredited Test Laboratory No. 1262, and may not be reproduced other than in full except with the prior written approval of the issuing laboratory.