

S R L



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Technical Report

Report Number C/06/5L/3541/1

Date 25 August 2006

Project

**The Laboratory Determination of
Random Incidence Sound Absorption
Coefficient of various Foam Samples**

Prepared for

**Comfortex Ltd
Anchor Works
Rochdale Road
Oldham
OL1 2HP**

By

Gareth Young

Sound Research Laboratories Limited

Consultants in Noise & Vibration

Head Office & Laboratory: Holbrook House, Little Waldingfield

Sudbury, Suffolk CO10 0TH

Telephone (01787) 247595 Fax (01787) 248420

e-mail: srl@soundresearch.co.uk

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1.0 Summary

Tests have been done in SRL's Laboratory at Holbrook House, Sudbury, Suffolk, to determine the random incidence sound absorption of various foam samples generally in accordance with BS EN ISO 354:2003.

From these measurements the required results have been derived and are presented in both tabular and graphic form in Data Sheets 1 to 11.

The results are given in 1/3rd octave bands over the frequency range 50 Hz to 10 KHz, which is beyond that required by the test standard.



.....
Gareth Young
Laboratory Engineer

For and on behalf of
Sound Research Laboratories Ltd



.....
Allen Smalls
Laboratory Manager
Quality Manager



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1.0 Summary

2.0 Details of Measurements

3.0 Description of Test

4.0 Results

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Appendix 1: Test Procedure

Appendix 2: Measurement Uncertainty

2.0 Details of Measurements

2.1 Location

Sound Research Laboratories Ltd
Holbrook House
Little Waldingfield
Sudbury
Suffolk
CO10 0TH

2.2 Test Dates

24 July, 4 & 16 August 2006

2.3 Instrumentation and Apparatus Used

Make	Description	Type
E D I	Microphone Multiplexer Microphone Power Supply Unit	
Brüel & Kjaer	12mm Condenser Microphones Windshields Pre Amplifiers Microphone Calibrator Omnipower Sound Source	4166 UA0237 2639, 2669C 4231 4296
Larson Davis	12mm Condenser Microphone	2560
SRL	Power Amplifiers	
Celestion	Loudspeakers	100w
Darton	Fortin Barometer	P411
Thermo Hygro	Temperature & Humidity Probe	
TOA	Graphic Equalizer Power Amplifier	E-1231 DPA-800

2.4 References

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

2.5 Personnel Present

None

3.0 Description of Test

3.1 Description of Sample

Five different types of flat backed foam tile and two different types of corner tile were tested in our laboratory.

The flat tiles were all 425 mm x 425 mm. Tile description is as follows:-

AFW45	-	45mm deep "Wedge" profile
AFW100	-	100mm deep "Wedge" profile
AFP45	-	45mm deep "Pyramid" profile
AFP100	-	100mm deep "Pyramid" profile
PFW45	-	45mm deep "Wedge" profile

Both corner tiles were 315 mm x 315 mm.

AFBT02	-	Corner Bass Trap
AFBT03	-	Corner Bass Trap

Photographs showing some of the tiles and mounting arrangements are included as Photographs 1 to 4.

The flat tiles were laid directly onto the test room floor giving an area of 11.56m².

The corner tiles were tested in various different wall/floor junction configurations in an attempt to replicate real life mounting conditions.

The first test was performed with the tile against two wall/floor junctions. This was replicated on the opposite test wall giving an area of 7.47m² which is below that required in the test standard. See photograph 1 for mounting arrangement.

The second test was performed as above but using three of the test room wall/floor junctions. This gave a U shape on the floor of the test room. Two square shaped corner tiles were used in the two corners of the room to join the samples together. This gave an area of 10.19m². See photograph 2 for mounting arrangement.

For both of these tests the samples were laid into the corners of the room. No fixings were used.

The third test was performed as above but with the addition of uprights onto the corner pieces. These uprights were fixed directly to the wall with contact adhesive. See photograph 3 for mounting arrangement.

Flat mounting arrangement is shown in photograph 4.

The stated area on the Data Sheets is the flat face area of the tile and not the actual face area. Due to the profile of the tiles / wedges, the true face area is considerably greater than the flat face area. This has the effect that the absorption coefficient calculated on the data sheets is greater than one.

Sampling plan: All materials supplied

Sample condition: New

Details supplied by: Comfortex Ltd

Sample installed by: SRL

3.2 Sample Delivery date

24 July 2006

3.3 Test Procedures

The sample was mounted/located and tested generally in accordance with the relevant standard. The method and procedure is described in Appendix 1.

4.0 Results

The results of the measurements and subsequent analysis are given in Data Sheets 1 to 11.

Results relate only to the items tested.

————— *End of Text* —————

[Data Sheet 1](#)

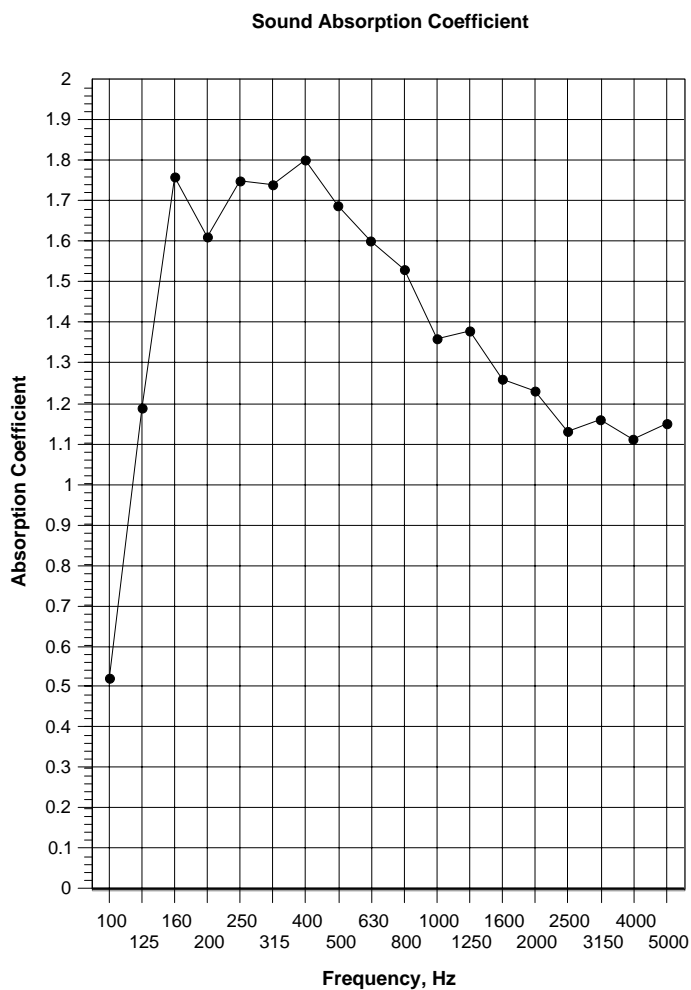
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption generally to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: 24/07/2006
 Empty Room: Temperature: 24.8 °C Humidity: 56 %RH Pressure: 1004 mbar
 Room with Sample: Temperature: 25.5 °C Humidity: 55 %RH Pressure: 1004 mbar
 Sample: **AFBT02 Base trap**
 Description: **One corner only**
 Sample Area: 7.47 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 3

Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	8.87	3.83	0.95	
63*	4.21	3.28	0.43	n/a
80*	5.22	4.19	0.30	
100	7.57	4.68	0.52	
125	7.17	3.07	1.19	1.00
160	7.01	2.40	1.76	
200	7.39	2.59	1.61	
250	7.42	2.45	1.75	1.00
315	7.28	2.45	1.74	
400	6.60	2.31	1.80	
500	5.52	2.25	1.69	1.00
630	5.09	2.24	1.60	
800	5.18	2.31	1.53	
1000	5.51	2.53	1.36	1.00
1250	5.45	2.50	1.38	
1600	5.09	2.54	1.26	
2000	4.67	2.46	1.23	1.00
2500	4.11	2.38	1.13	
3150	3.58	2.17	1.16	
4000	3.07	2.00	1.11	1.00
5000	2.57	1.76	1.15	
6300*	1.98	1.47	1.13	
8000*	1.49	1.20	1.06	n/a
10000*	1.09	0.92	1.12	



A_w 1.00

Class A

Calculated to EN ISO 11654:1997

NRC 1.50

Calculated to ASTM C 423-01

* Denotes frequencies outside the range covered by BS EN ISO 354:2003

T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

[Data Sheet 2](#)

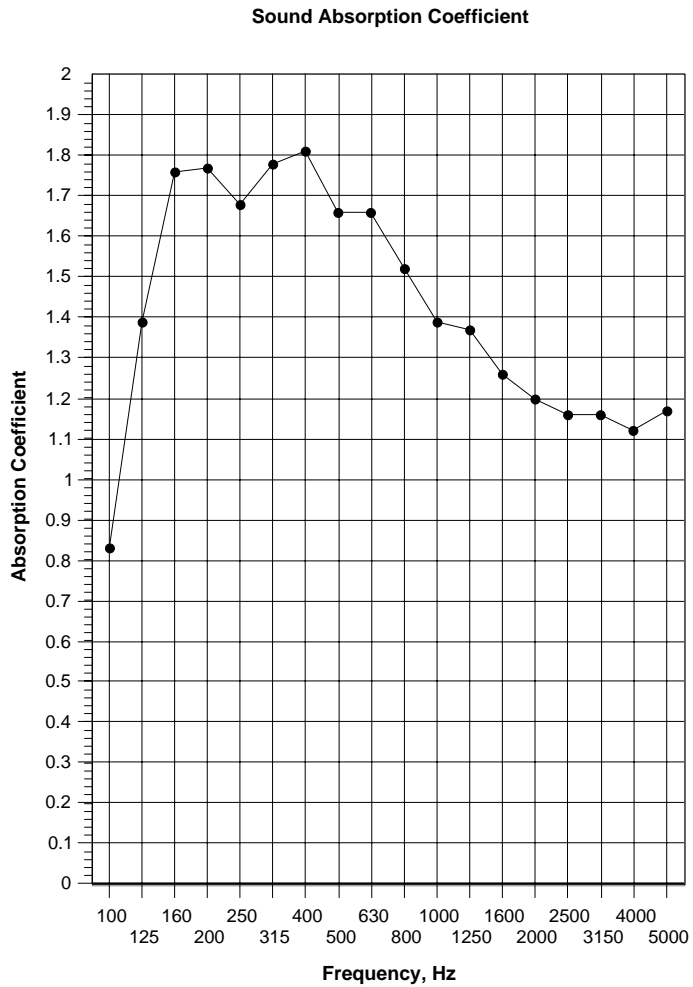
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: [Comfortex Ltd](#)
 Test Date: 24/07/2006
 Empty Room: Temperature: 24.8 °C Humidity: 56 %RH Pressure: 1004 mbar
 Room with Sample: Temperature: 25.5 °C Humidity: 55 %RH Pressure: 1004 mbar
 Sample: [AFBT02 Base trap](#)
 Description: [With 2 corner pieces](#)
 Sample Area: 10.19 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 4

Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	8.87	3.69	0.74	
63*	4.21	3.00	0.45	n/a
80*	5.22	3.10	0.61	
100	7.57	3.24	0.83	
125	7.17	2.30	1.39	1.00
160	7.01	1.93	1.76	
200	7.39	1.95	1.77	
250	7.42	2.03	1.68	1.00
315	7.28	1.94	1.78	
400	6.60	1.86	1.81	
500	5.52	1.87	1.66	1.00
630	5.09	1.82	1.66	
800	5.18	1.93	1.52	
1000	5.51	2.09	1.39	1.00
1250	5.45	2.10	1.37	
1600	5.09	2.15	1.26	
2000	4.67	2.12	1.20	1.00
2500	4.11	2.04	1.16	
3150	3.58	1.90	1.16	
4000	3.07	1.77	1.12	1.00
5000	2.57	1.57	1.17	
6300*	1.98	1.35	1.11	
8000*	1.49	1.11	1.09	n/a
10000*	1.09	0.85	1.24	



A_w 1.00

Class A

Calculated to EN ISO 11654:1997

NRC 1.50

Calculated to ASTM C 423-01

* Denotes frequencies outside the range covered by BS EN ISO 354:2003

T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

[Data Sheet 3](#)

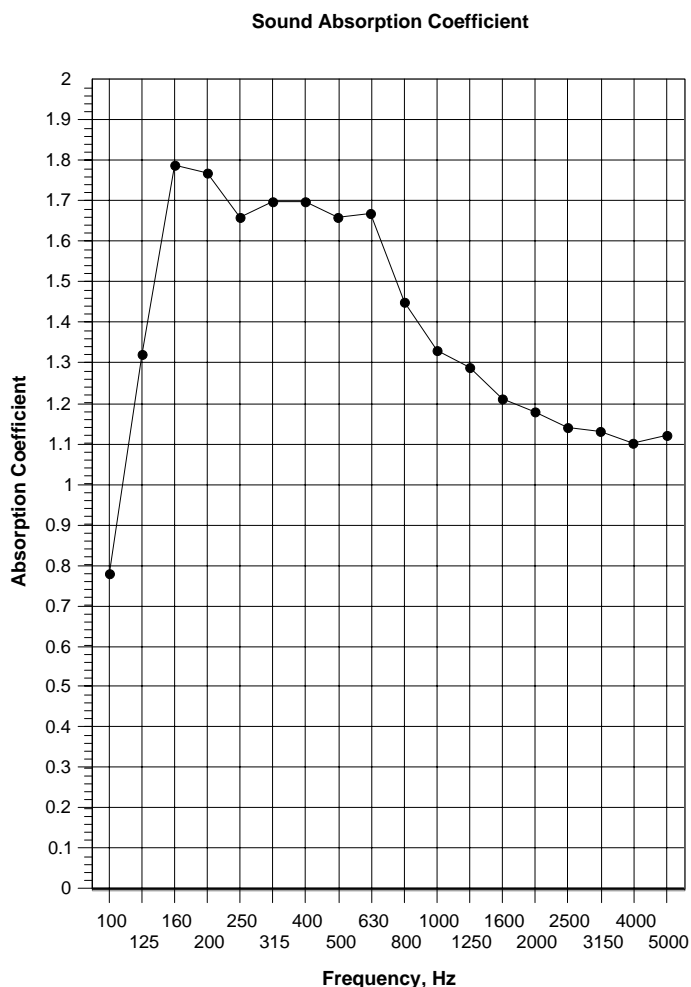
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: **24/07/2006**
 Empty Room: **Temperature: 24.8 °C Humidity: 56 %RH Pressure: 1004 mbar**
 Room with Sample: **Temperature: 25.5 °C Humidity: 55 %RH Pressure: 1004 mbar**
 Sample: **AFBT02 base trap with 2 corner pieces 3 walls**
 Description: **With 2 corner pieces**
 Sample Area: **11.855 m2**
 Cavity Depth: **0 mm**
 Chamber Volume: **300 m3**

Test 5

Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	8.87	3.48	0.71	
63*	4.21	2.76	0.50	n/a
80*	5.22	2.85	0.64	
100	7.57	3.07	0.78	
125	7.17	2.15	1.32	1.00
160	7.01	1.71	1.79	
200	7.39	1.74	1.77	
250	7.42	1.83	1.66	1.00
315	7.28	1.79	1.70	
400	6.60	1.75	1.70	
500	5.52	1.69	1.66	1.00
630	5.09	1.64	1.67	
800	5.18	1.81	1.45	
1000	5.51	1.95	1.33	1.00
1250	5.45	1.98	1.29	
1600	5.09	2.01	1.21	
2000	4.67	1.97	1.18	1.00
2500	4.11	1.90	1.14	
3150	3.58	1.79	1.13	
4000	3.07	1.67	1.10	1.00
5000	2.57	1.50	1.12	
6300*	1.98	1.28	1.12	
8000*	1.49	1.07	1.08	n/a
10000*	1.09	0.83	1.18	



A_w 1.00

Class A

Calculated to EN ISO 11654:1997

NRC 1.45

Calculated to ASTM C 423-01

* Denotes frequencies outside the range covered by BS EN ISO 354:2003

T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

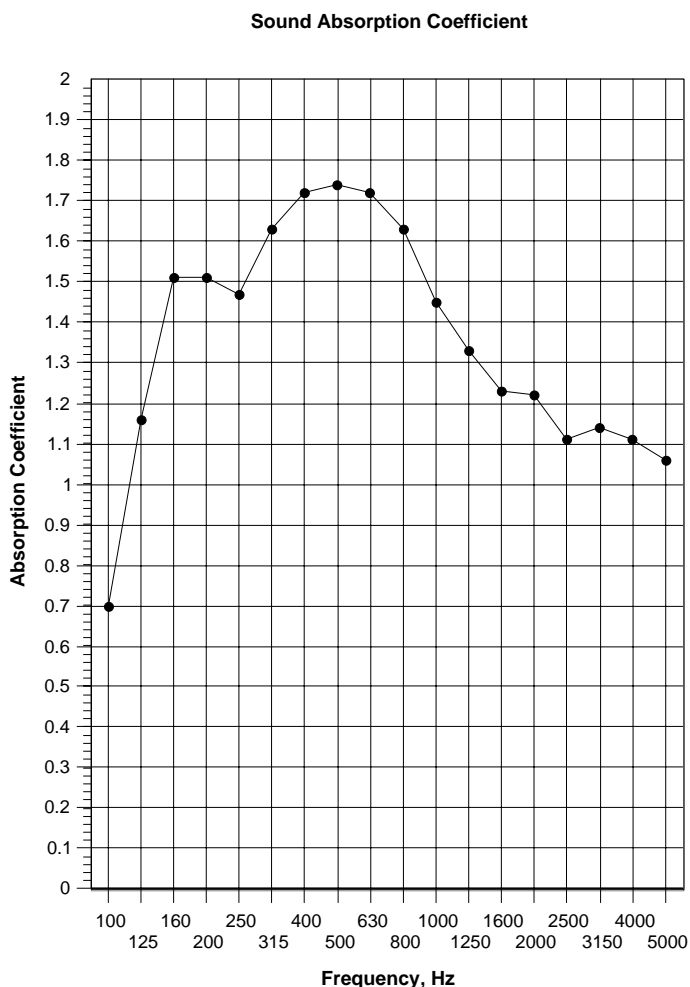
[Data Sheet 4](#)

[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption generally to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: 24/07/2006
 Empty Room: Temperature: 24.8 °C Humidity: 56 %RH Pressure: 1004 mbar
 Room with Sample: Temperature: 25.6 °C Humidity: 53 %RH Pressure: 1004 mbar
 Sample: **AFBT03**
 Description: **With 2 corner pieces**
 Sample Area: 7.47 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 6				
Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	8.87	4.57	0.68	
63*	4.21	2.99	0.62	n/a
80*	5.22	3.54	0.58	
100	7.57	4.14	0.70	
125	7.17	3.12	1.16	1.00
160	7.01	2.64	1.51	
200	7.39	2.70	1.51	
250	7.42	2.74	1.47	1.00
315	7.28	2.55	1.63	
400	6.60	2.38	1.72	
500	5.52	2.21	1.74	1.00
630	5.09	2.15	1.72	
800	5.18	2.23	1.63	
1000	5.51	2.45	1.45	1.00
1250	5.45	2.55	1.33	
1600	5.09	2.57	1.23	
2000	4.67	2.46	1.22	1.00
2500	4.11	2.39	1.11	
3150	3.58	2.18	1.14	
4000	3.07	1.99	1.11	1.00
5000	2.57	1.79	1.06	
6300*	1.98	1.47	1.08	
8000*	1.49	1.17	1.12	n/a
10000*	1.09	0.90	1.15	
A_w			1.00	
Class A				
Calculated to EN ISO 11654:1997				
NRC			1.45	
Calculated to ASTM C 423-01				
* Denotes frequencies outside the range covered by BS EN ISO 354:2003				
T1, empty room reverberation time				
T2, room reverberation time with sample				



Practical absorption coefficient, BS EN ISO 11654:1997

v1

[Data Sheet 5](#)

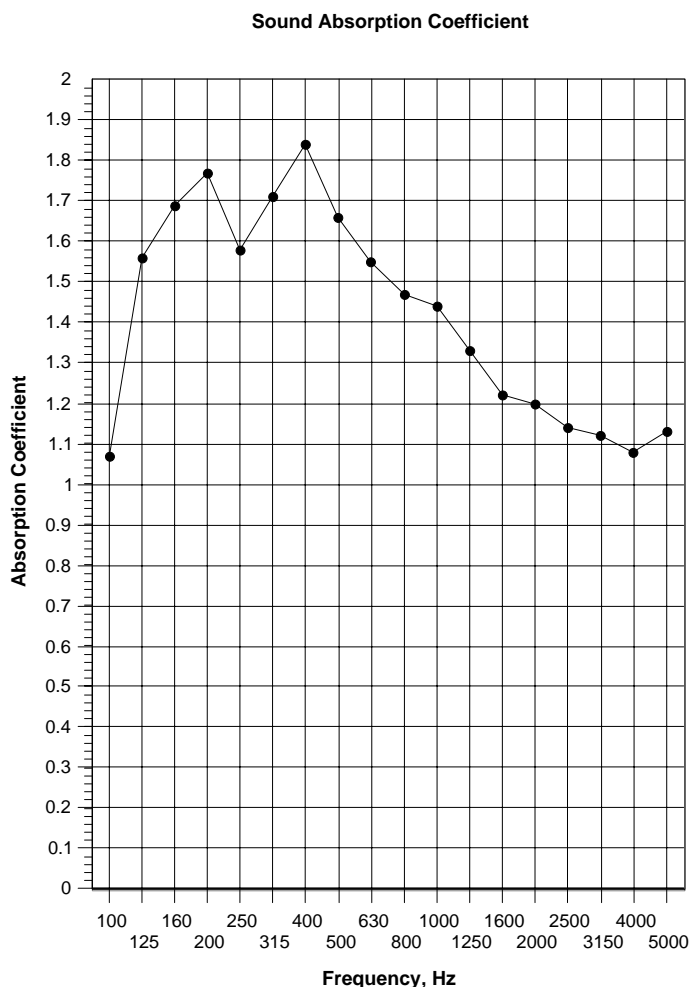
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: [Comfortex Ltd](#)
 Test Date: 24/07/2006
 Empty Room: Temperature: 24.8 °C Humidity: 56 %RH Pressure: 1004 mbar
 Room with Sample: Temperature: 25.6 °C Humidity: 53 %RH Pressure: 1004 mbar
 Sample: [AFBT03 as test 4](#)
 Description: [With 2 corner pieces](#)
 Sample Area: 10.19 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 7

Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	8.87	4.11	0.61	
63*	4.21	2.63	0.67	n/a
80*	5.22	2.62	0.89	
100	7.57	2.77	1.07	
125	7.17	2.12	1.56	1.00
160	7.01	1.99	1.69	
200	7.39	1.95	1.77	
250	7.42	2.12	1.58	1.00
315	7.28	1.99	1.71	
400	6.60	1.84	1.84	
500	5.52	1.87	1.66	1.00
630	5.09	1.90	1.55	
800	5.18	1.97	1.47	
1000	5.51	2.05	1.44	1.00
1250	5.45	2.14	1.33	
1600	5.09	2.19	1.22	
2000	4.67	2.12	1.20	1.00
2500	4.11	2.05	1.14	
3150	3.58	1.92	1.12	
4000	3.07	1.79	1.08	1.00
5000	2.57	1.58	1.13	
6300*	1.98	1.34	1.10	
8000*	1.49	1.10	1.07	n/a
10000*	1.09	0.84	1.22	



α_w 1.00

Class A

Calculated to EN ISO 11654:1997

NRC 1.45

Calculated to ASTM C 423-01

* Denotes frequencies outside the range covered by BS EN ISO 354:2003

T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

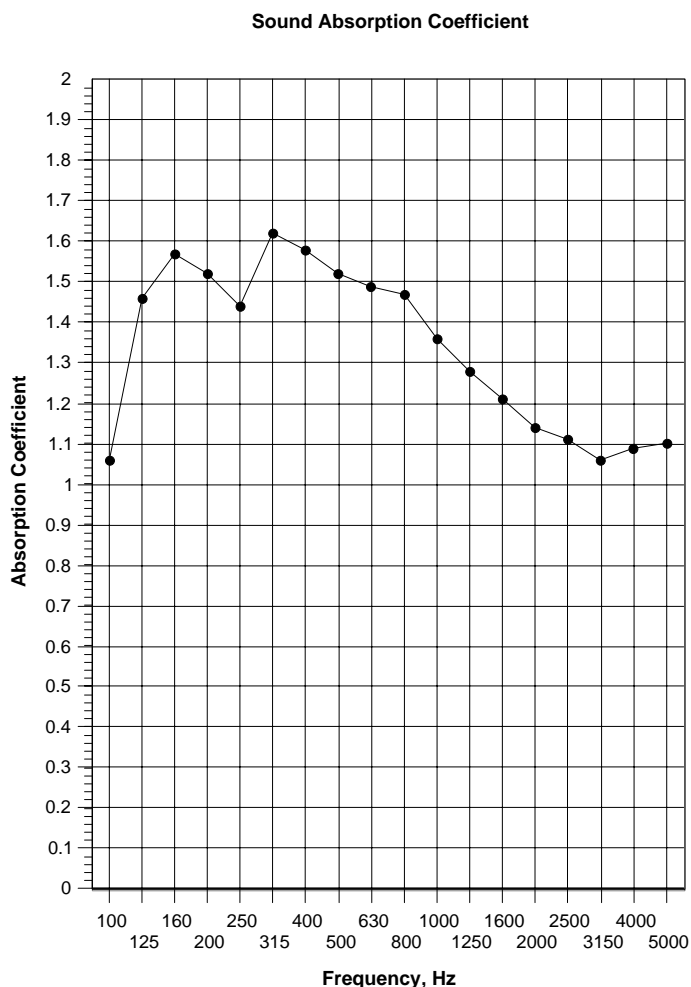
[Data Sheet 6](#)

[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: [Comfortex Ltd](#)
 Test Date: 24/07/2006
 Empty Room: Temperature: 24.8 °C Humidity: 56 %RH Pressure: 1004 mbar
 Room with Sample: Temperature: 25.6 °C Humidity: 53 %RH Pressure: 1004 mbar
 Sample: [AFBT03 as test 5](#)
 Description: [With 2 corner pieces](#)
 Sample Area: 11.855 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 8				
Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	8.87	3.33	0.76	
63*	4.21	2.53	0.64	n/a
80*	5.22	2.47	0.86	
100	7.57	2.53	1.06	
125	7.17	2.00	1.46	1.00
160	7.01	1.88	1.57	
200	7.39	1.95	1.52	
250	7.42	2.03	1.44	1.00
315	7.28	1.86	1.62	
400	6.60	1.84	1.58	
500	5.52	1.79	1.52	1.00
630	5.09	1.77	1.49	
800	5.18	1.79	1.47	
1000	5.51	1.93	1.36	1.00
1250	5.45	1.99	1.28	
1600	5.09	2.01	1.21	
2000	4.67	2.01	1.14	1.00
2500	4.11	1.92	1.11	
3150	3.58	1.84	1.06	
4000	3.07	1.67	1.09	1.00
5000	2.57	1.50	1.10	
6300*	1.98	1.28	1.09	
8000*	1.49	1.05	1.10	n/a
10000*	1.09	0.85	0.99	



A_w 1.00
Class A
 Calculated to EN ISO 11654:1997
NRC 1.35
 Calculated to ASTM C 423-01
 * Denotes frequencies outside the range covered by BS EN ISO 354:2003
 T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

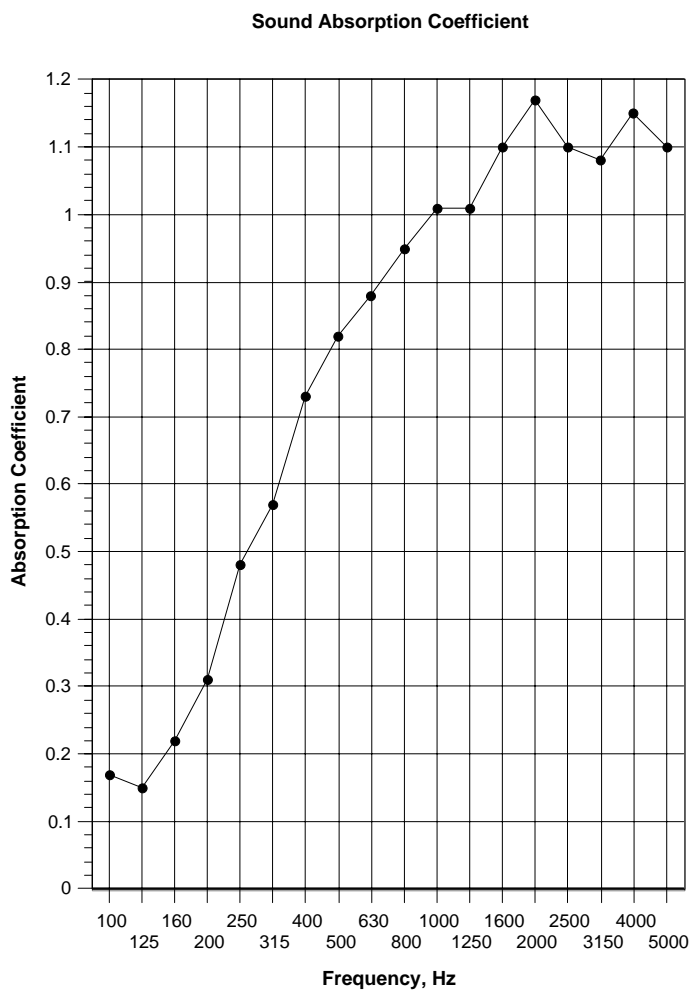
[Data Sheet 7](#)

[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: 04/08/2006
 Empty Room: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Room with Sample: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Sample: **AFP100**
 Description:
 Sample Area: 11.56 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 11				
Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	4.16	3.85	0.08	
63*	4.04	3.68	0.10	n/a
80*	5.39	4.57	0.14	
100	8.56	6.37	0.17	
125	7.33	5.79	0.15	0.20
160	6.88	5.06	0.22	
200	7.23	4.70	0.31	
250	7.77	4.10	0.48	0.45
315	7.34	3.68	0.57	
400	6.41	3.03	0.73	
500	5.52	2.65	0.82	0.80
630	5.07	2.45	0.88	
800	5.36	2.42	0.95	
1000	5.75	2.41	1.01	1.00
1250	5.64	2.38	1.01	
1600	5.21	2.20	1.10	
2000	4.80	2.05	1.17	1.00
2500	4.22	2.00	1.10	
3150	3.58	1.86	1.08	
4000	3.05	1.66	1.15	1.00
5000	2.45	1.49	1.10	
6300*	1.87	1.21	1.22	
8000*	1.37	1.01	1.09	n/a
10000*	0.99	0.79	1.07	



A_ω 0.75(MH)
 Class C
 Calculated to EN ISO 11654:1997
 NRC 0.85
 Calculated to ASTM C 423-01
 * Denotes frequencies outside the range covered by BS EN ISO 354:2003
 T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

[Data Sheet 8](#)

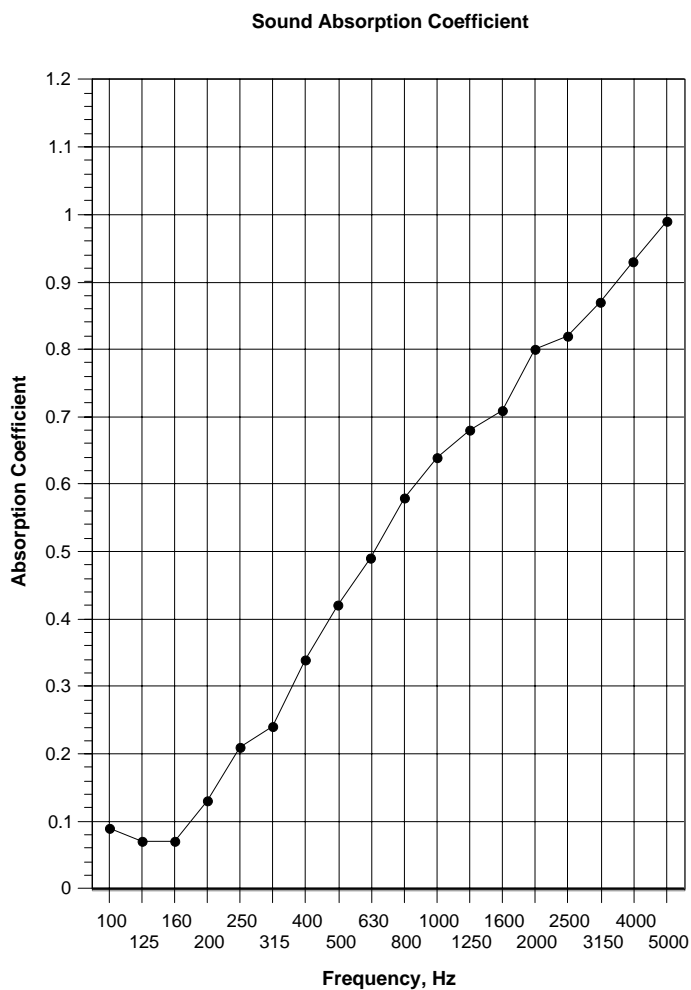
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: 04/08/2006
 Empty Room: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Room with Sample: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Sample: **AFP45**
 Description:
 Sample Area: 11.56 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 12

Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	4.16	3.92	0.06	
63*	4.04	3.82	0.06	n/a
80*	5.39	4.96	0.07	
100	8.56	7.17	0.09	
125	7.33	6.49	0.07	0.10
160	6.88	6.15	0.07	
200	7.23	5.92	0.13	
250	7.77	5.58	0.21	0.20
315	7.34	5.19	0.24	
400	6.41	4.22	0.34	
500	5.52	3.56	0.42	0.40
630	5.07	3.19	0.49	
800	5.36	3.08	0.58	
1000	5.75	3.06	0.64	0.65
1250	5.64	2.95	0.68	
1600	5.21	2.76	0.71	
2000	4.80	2.50	0.80	0.80
2500	4.22	2.31	0.82	
3150	3.58	2.05	0.87	
4000	3.05	1.82	0.93	0.95
5000	2.45	1.55	0.99	
6300*	1.87	1.26	1.08	
8000*	1.37	1.04	0.97	n/a
10000*	0.99	0.80	1.00	



A_w 0.45(H)

Class D

Calculated to EN ISO 11654:1997

NRC 0.50

Calculated to ASTM C 423-01

* Denotes frequencies outside the range covered by BS EN ISO 354:2003

T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

[Data Sheet 9](#)

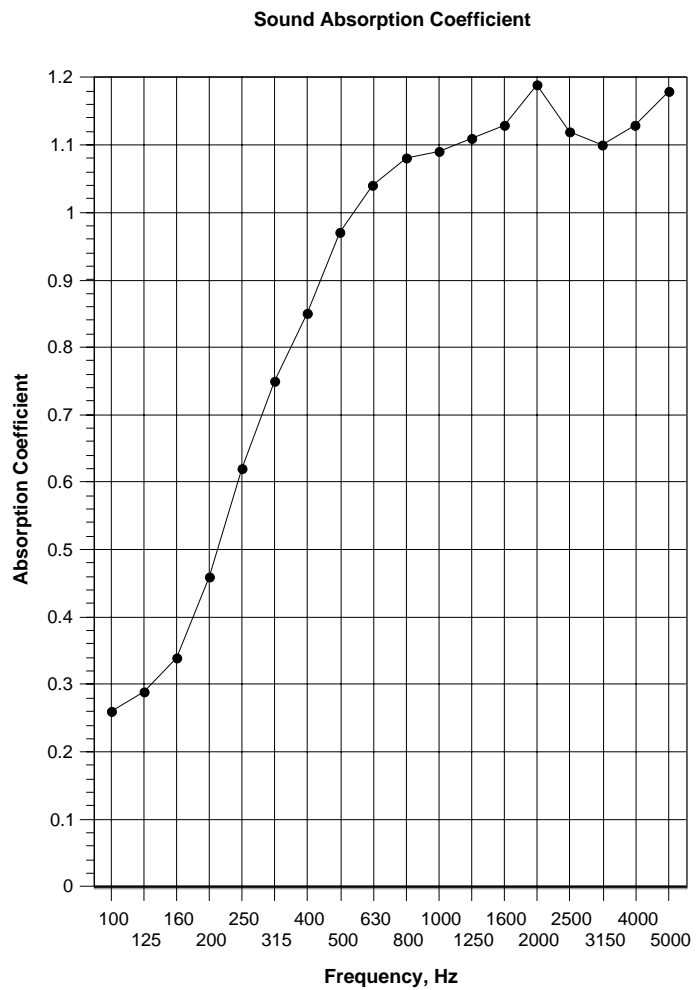
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: 04/08/2006
 Empty Room: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Room with Sample: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Sample: **AFW100**
 Description:
 Sample Area: 11.56 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 13

Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	4.16	3.63	0.15	
63*	4.04	3.47	0.17	n/a
80*	5.39	4.29	0.20	
100	8.56	5.58	0.26	
125	7.33	4.83	0.29	0.30
160	6.88	4.40	0.34	
200	7.23	4.02	0.46	
250	7.77	3.60	0.62	0.60
315	7.34	3.16	0.75	
400	6.41	2.78	0.85	
500	5.52	2.42	0.97	0.95
630	5.07	2.24	1.04	
800	5.36	2.25	1.08	
1000	5.75	2.30	1.09	1.00
1250	5.64	2.26	1.11	
1600	5.21	2.16	1.13	
2000	4.80	2.03	1.19	1.00
2500	4.22	1.98	1.12	
3150	3.58	1.84	1.10	
4000	3.05	1.67	1.13	1.00
5000	2.45	1.45	1.18	
6300*	1.87	1.23	1.16	
8000*	1.37	1.00	1.13	n/a
10000*	0.99	0.78	1.14	



α_w 0.90

Class A

Calculated to EN ISO 11654:1997

NRC 0.95

Calculated to ASTM C 423-01

* Denotes frequencies outside the range covered by BS EN ISO 354:2003

T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

[Data Sheet 10](#)

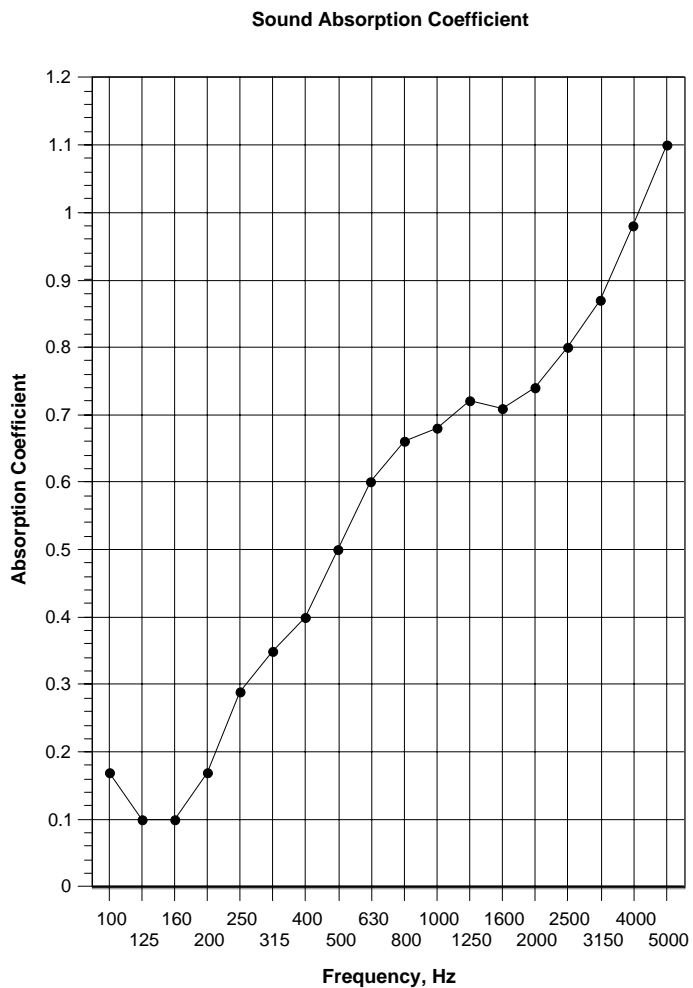
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: 04/08/2006
 Empty Room: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Room with Sample: Temperature: 21.1 °C Humidity: 67 %RH Pressure: 1003 mbar
 Sample: **AFW45**
 Description:
 Sample Area: 11.56 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 14

Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	4.16	3.91	0.06	
63*	4.04	3.97	0.02	n/a
80*	5.39	4.62	0.13	
100	8.56	6.35	0.17	
125	7.33	6.19	0.10	0.10
160	6.88	5.90	0.10	
200	7.23	5.57	0.17	
250	7.77	5.06	0.29	0.25
315	7.34	4.55	0.35	
400	6.41	3.96	0.40	
500	5.52	3.32	0.50	0.50
630	5.07	2.93	0.60	
800	5.36	2.91	0.66	
1000	5.75	2.96	0.68	0.70
1250	5.64	2.85	0.72	
1600	5.21	2.77	0.71	
2000	4.80	2.60	0.74	0.75
2500	4.22	2.33	0.80	
3150	3.58	2.05	0.87	
4000	3.05	1.78	0.98	1.00
5000	2.45	1.49	1.10	
6300*	1.87	1.26	1.08	
8000*	1.37	1.02	1.05	n/a
10000*	0.99	0.78	1.14	



α_w 0.50(H)

Class D

Calculated to EN ISO 11654:1997

NRC 0.55

Calculated to ASTM C 423-01

* Denotes frequencies outside the range covered by BS EN ISO 354:2003

T1, empty room reverberation time
 T2, room reverberation time with sample

Practical absorption coefficient, BS EN ISO 11654:1997

v1

[Data Sheet 11](#)

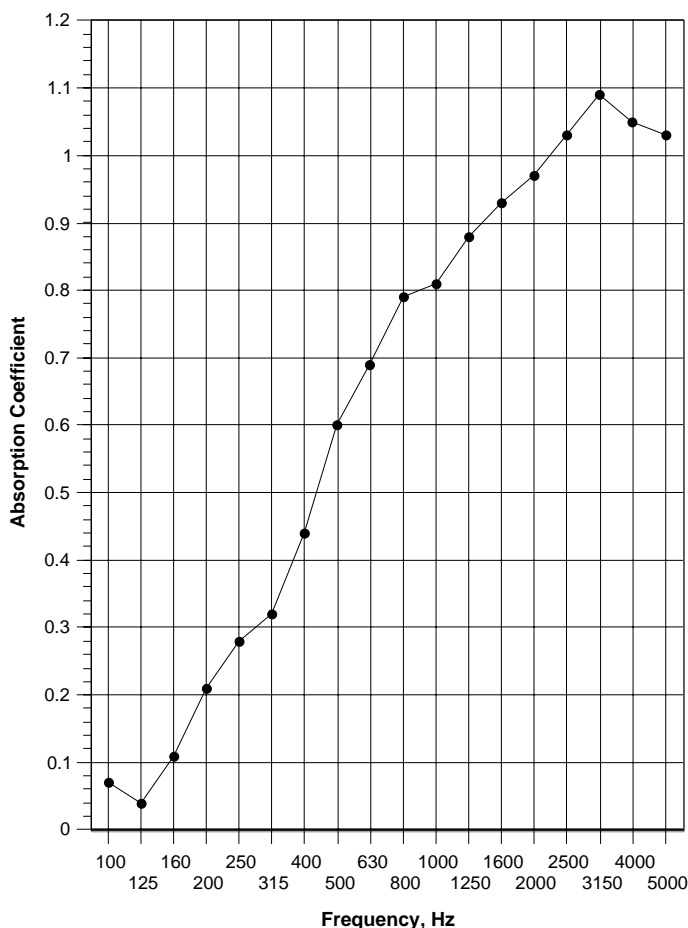
[See SRL report C/06/5L/3541/1 for full details](#)

The Laboratory Measurement of Random Incidence Sound Absorption to BS EN ISO 354:2003

Client: **Comfortex Ltd**
 Test Date: 16/08/2006
 Empty Room: Temperature: 19.1 °C Humidity: 60 %RH Pressure: 1003 mbar
 Room with Sample: Temperature: 19.0 °C Humidity: 60 %RH Pressure: 1003 mbar
 Sample: **PFW 45**
 Description:
 Sample Area: 11.56 m²
 Cavity Depth: 0 mm
 Chamber Volume: 300 m³

Test 16				
Freq Hz	T1 sec	T2 sec	Absorp Coeff	Practical Absorp Coeff #
50*	5.64	5.33	0.04	
63*	4.45	3.92	0.13	n/a
80*	5.71	5.04	0.10	
100	7.40	6.56	0.07	
125	7.33	6.83	0.04	0.05
160	6.96	5.87	0.11	
200	7.00	5.20	0.21	
250	7.54	4.99	0.28	0.25
315	7.21	4.65	0.32	
400	6.55	3.88	0.44	
500	5.50	3.07	0.60	0.60
630	5.04	2.75	0.69	
800	5.39	2.67	0.79	
1000	5.63	2.70	0.81	0.85
1250	5.52	2.56	0.88	
1600	5.15	2.41	0.93	
2000	4.80	2.28	0.97	1.00
2500	4.25	2.08	1.03	
3150	3.60	1.86	1.09	
4000	2.99	1.71	1.05	1.00
5000	2.48	1.54	1.03	
6300*	1.87	1.22	1.19	
8000*	1.42	1.02	1.15	n/a
10000*	1.01	0.77	1.28	
<i>A_w</i> 0.55(MH)				
Class D				
Calculated to EN ISO 11654:1997				
NRC 0.65				
Calculated to ASTM C 423-01				
* Denotes frequencies outside the range covered by BS EN ISO 354:2003				
T1, empty room reverberation time				
T2, room reverberation time with sample				

Sound Absorption Coefficient



Practical absorption coefficient, BS EN ISO 11654:1997

v1

Photograph 1



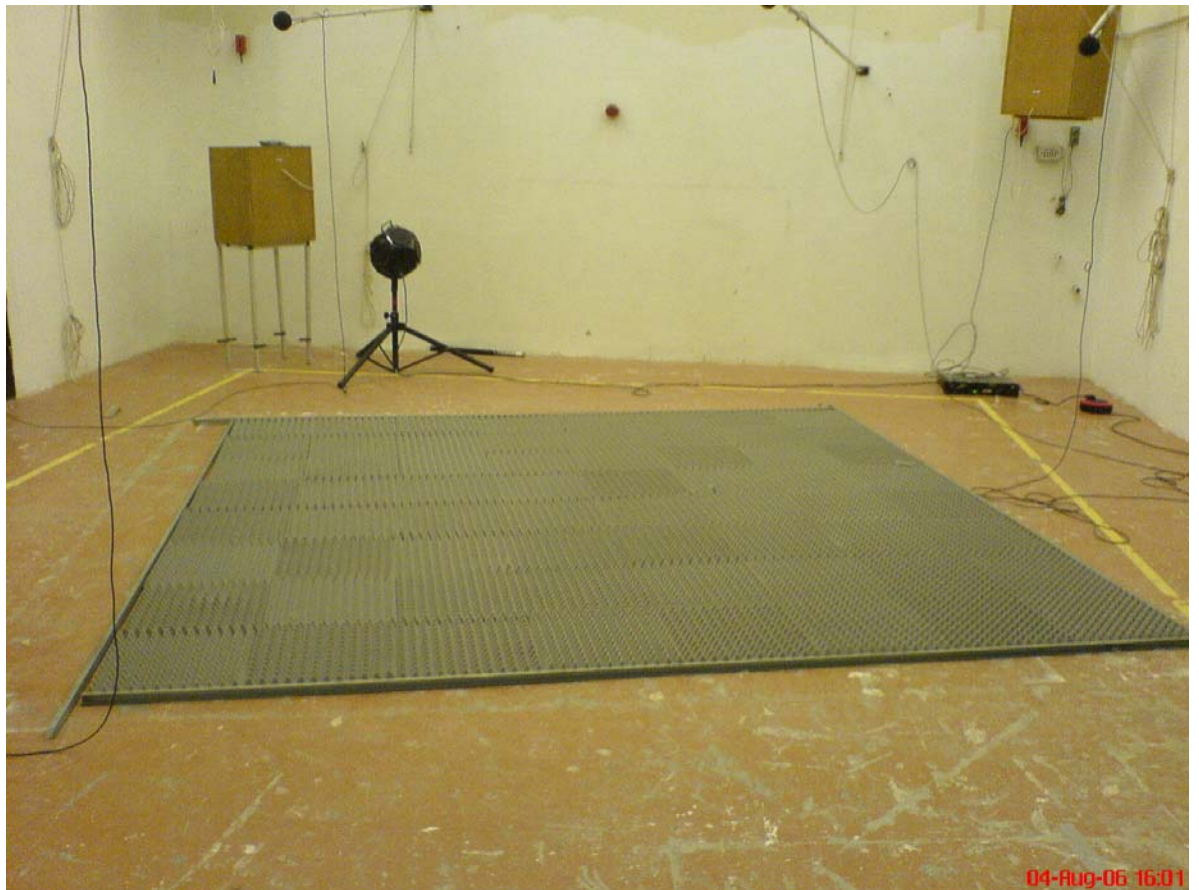
Photograph 2



Photograph 3



Photograph 4



Appendix 1

Test Procedure

Measurements of Random Incidence Sound Absorption Coefficients to BS EN ISO 354:2003 - TP14 (Plane Absorbers)

In the laboratory, random incidence sound absorption coefficients are determined from the rate of decay of a sound field in a reverberation room, with and without a test sample installed. The rate of decay is described by the time a sound field takes to decay by 60dB, known as the reverberation time.

The reverberation room is constructed from 215mm brick, which is internally plastered with a reinforced concrete roof and floor. The room is rectangular and has a volume of 300 cubic metres and a total surface area of 275m². From the ceiling hang 10 randomly positioned diffusers, each measuring 1.2m x 2.14m. The room is isolated from the surrounding structure by the use of resilient mountings and seals, ensuring good acoustic isolation.

Using at least two omnidirectional loudspeaker positions, broad band random noise is produced in the room using an electronic generator and power amplifier. When the amplification system is switched off, the decay of sound is filtered into one-third octave band widths and the reverberation times measured. This process is repeated for each of six microphone positions and the values arithmetically averaged to obtain a final value for each frequency.

The sample area should normally be between 10m² and 15.7m², this may be larger if it is suspected that the absorption properties will be low. The sample is laid on the floor of the reverberation room so that no part of it is closer than one metre from any edge of the boundaries. The procedure of measuring the reverberation times then repeated.

The sound absorption coefficients are calculated from the difference in decay rates for each frequency according to the formula:

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

where

- a_s is the random incidence absorption coefficient
- A_T is the increase in equivalent sound absorption area of the test specimen (m²)
- S is the area covered by the test specimen (m²)

The equivalent absorption area of the test specimen is further defined as:

$$A_T = 55.3V\left(\frac{1}{c_2T_2} - \frac{1}{c_1T_1}\right) - 4V(m_2 - m_1)$$

where

- V is the volume of the empty reverberation room (m^3)
- c_1 is the speed of sound in the empty room (m/sec)
- T_1 is the reverberation time in the empty room (sec)
- m_1 is the power attenuation coefficient calculated according to ISO 9613-1 using the climatic conditions that have been present in the empty rooms during the measurement.

c_2 , T_2 and m_2 have the same meanings as c_1 , T_1 and m_1 but with the test specimen in the room.

It is occasionally found that the absorption coefficient derived in this manner reaches a value greater than unity. This is impossible, by definition, and investigation has shown that this anomaly is due to diffraction of the impinging sound waves at the edges of the sample. In practical terms this is insignificant.

Appendix 2

Measurement Uncertainty BS EN ISO 354:2003 - TP14

1. Introduction

The estimated values of uncertainty are based on a standard uncertainty multiplied by a coverage factor of $K = 2$, which provides a level of confidence of approximately 95%.

Table 1: Uncertainty For Equivalent Absorption Area Measurement

Frequency, Hz	Expanded uncertainty K = 2, 95% % of A ₁ or A ₂
100	9.0
125	8.1
160	5.6
200	6.7
250	4.3
315	8.1
400	4.6
500	5.0
630	5.3
800	3.2
1000	3.5
1250	3.1
1600	2.8
2000	2.7
2500	2.2
3150	1.8
4000	1.6
5000	1.6

2. Estimation of Expanded Uncertainty For Sample Equivalent Sound Absorption Area

The expanded uncertainty, U_A, m^2 is estimated by using the following formulae:-

$$U_A = \sqrt{\left(\frac{uA_1}{100}\right)^2 + \left(\frac{uA_2}{100}\right)^2}$$

where	U_A	is the expanded uncertainty for the sample equivalent sound absorption area, for $K = 2$, 95%, m^2
	u	is the estimated expanded uncertainty for the equivalent sound absorption area, taken from Table 1 above, $K = 2$, 95%, % of A_1 or A_2
	A_1	is the equivalent sound absorption area of the empty room, m^2
	A_2	is the equivalent sound absorption area of the room with the sample, m^2

3. Estimation of expanded Uncertainty For Sound Absorption Coefficients

The expanded uncertainty for sound absorption coefficients, U_{a_s} , is estimated using the following formulae:-

$$U_{a_s} = \frac{a_s U_A}{A}$$

where	U_{a_s}	is the expanded uncertainty for sound absorption coefficients, $K=2$, 95%
	a_s	is the sound absorption coefficient
	U_A	is the expanded uncertainty for the sample equivalent sound absorption area, $K=2$, 95%, m^2
	A	is the sample equivalent sound absorption area, m^2