



CSIRO ACOUSTIC MEASUREMENT REPORT

Commonwealth Scientific and Industrial Research Organisation, Infrastructure Technologies
Acoustics Testing Laboratory, Gate 5, 2 Normanby Road, Clayton, Vic 3168 Australia

Report No:
AC253-02A-1

Client: Woven Image Pty. Ltd.
37-39 Chard Road, Brookvale, NSW 2766 Australia

Measurement Type: Sound Absorption

AS ISO 354-2006 "Acoustics-Measurement of sound absorption in a reverberation room"

Test Specimen

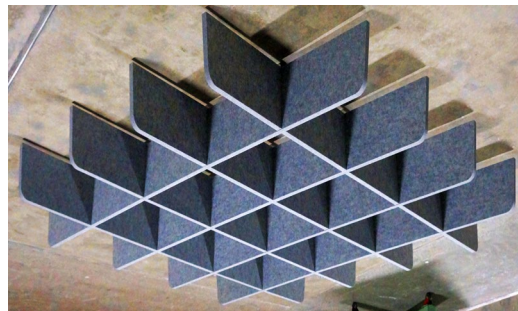
Name: Woven Image 'EchoPanel® Element' Ceiling Absorber – spaced approx 30 mm from room surface using mounting clips from supplied kit; Absorption area calculated of single 'standard' absorber (8 blades assembled).

Test Specimen Details:¹

- 'EchoPanel® Element' specimen composition:
 - 'EchoPanel® Element' blades: composed of Woven Image EchoPanel® - 100% polymer fibre (PET, 60% recycled), 24 mm thick $\pm 7\%$, area density: 3000 gsm; individual blade dimensions: 2350 x 215 x 24 mm (slightly trapezoidal in shape, with two rounded corners); each blade was made with four half-depth slots cut from one or other long edge to enable them to be assembled together into a grid formation in accordance with manufacturer's instructions; the assembled object forming a single unit.
 - Woven Image Ceiling/Wall Clips (see adjacent illustration): proprietary plastic (ABS) clips designed to grip a 24 mm thick 'EchoPanel® Element' blade and clip to a standard ceiling Tee above, with a swivelling connection between the two.
- Supplied for testing unassembled as a standard 'EchoPanel® Element' kit with contents: 8 x pre-cut blades (4 of each slotting variant), 16 x ceiling/wall clips and an installation guide (version updated subsequent to test): '24 MM SUSPENSION KIT_Installation Guide_26-03-2019.pdf'

Installation:

- The reverberation chamber was swept and vacuumed prior to testing to remove dust and debris.
- Due to test-laboratory constraints, this product was tested upside-down, resting on clips (installed to ceiling side of test specimen) on the floor of the test chamber in a manner acoustically equivalent to being suspended below the ceiling of a normal room.
- The test specimen was placed directly on the concrete floor of the test chamber not parallel with the walls of the chamber (12° angle), with no enclosure surrounding the test specimen.
- The test specimen was assembled as per manufacturer's instructions and installed with its mounting clips attached but resting on the floor of the chamber; placing the absorber unit approx 30 mm from the room surface. No ceiling grid was used in the installation of the specimen for testing.
- Specimen assembly and installation was carried out by laboratory staff.



Specimen as tested (image flipped upside down)

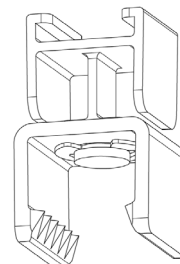
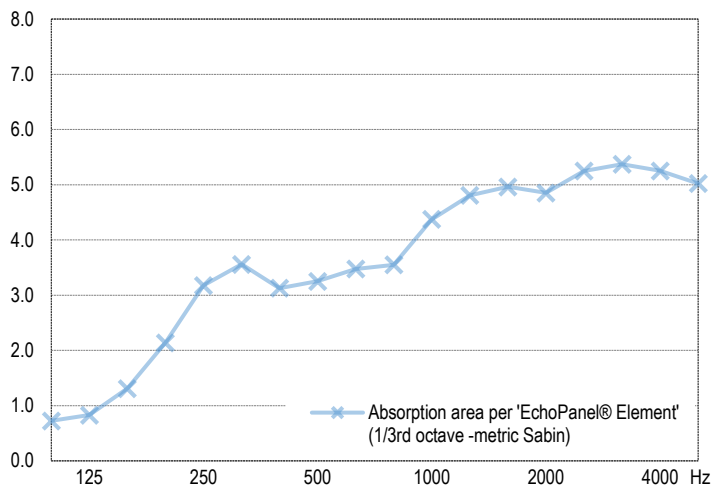


Diagram of Woven Image ceiling/wall clips

Measurement Details & Results

Freq Hz	Absorption Area (per object ²)		Reverberation times, T_{60} (sec)	
	(m ² Sabin)	95% Conf (δ)	Empty room	with Specimen
100	0.73	0.57	6.23	5.46
125	0.83	0.26	7.68	6.41
160	1.31	0.31	6.96	5.43
200	2.14	0.50	6.38	4.48
250	3.18	0.37	5.76	3.68
315	3.56	0.45	6.53	3.80
400	3.13	0.29	6.35	3.93
500	3.25	0.30	5.79	3.65
630	3.48	0.24	5.60	3.49
800	3.55	0.24	5.21	3.31
1000	4.37	0.23	5.12	3.02
1250	4.81	0.23	4.63	2.74
1600	4.96	0.23	4.02	2.49
2000	4.85	0.30	3.45	2.27
2500	5.25	0.26	3.12	2.07
3150	5.37	0.35	2.75	1.89
4000	5.25	0.29	2.29	1.67
5000	5.02	0.28	1.82	1.42



The required 12 spatially independent decay curves came from ensemble averaging 10 successive decays with each of 3 different source loudspeaker positions, all sampled by 4 fixed microphones, using linear averaging.

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	17 Apr 2019	17 Apr 2019
Temperature & humidity:	25 °C, 34 % R.H.	25 °C, 34 % R.H.
Atmospheric pressure:	1005 mBar	1005 mBar

Notes, Deviations etc

- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- AS ISO 354 allows test specimens to be defined as 'objects' and the measured equivalent absorption area to be reported 'per object'; in this instance the 'object' is defined as the assembled set of 8 blades with the mounting clips attached.

Issuing Authority

Signed:

Date:

John Watson
26 July 2019

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • 2 x GRAS type 40AP and 2 x Brüel & Kjær type 4134 microphones, on B&K type 2669 preamps, in 4 fixed positions as per AS ISO 354
Noise source: • 1 x Brüel & Kjær Type 4296 Dodecahedron loudspeakers driven by a Norsonic NOR280 power amplifier

Calibration: • Analyser: Jul 2018 (NATA cal)

Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by a composite wall with plasterboard face)
• parallelepiped with dimensional proportions 1:1.3:1.6 for distribution of room modes • approx 202 m³ total room volume • approx 225 m² surface area excluding diffusers
Diffusers: • 20 stationary diffusers, approx 40 m² total surface area
Absorption area: • in accordance with AS ISO 354, unless noted otherwise