



CSIRO ACOUSTIC MEASUREMENT REPORT

Commonwealth Scientific and Industrial Research Organisation, Infrastructure Technologies
Acoustics Testing Laboratory, Research Way, Clayton, Vic 3168 Australia

Report No:
AC388-02-1

Client: Woven Image Pty Ltd
37-39 Chard Road, Brookvale, NSW 2100

Measurement Type: Sound Absorption

AS ISO 354-2006 [R2016]: *Acoustics-Measurement of sound absorption in a reverberation room*
AS ISO 11654-2002 [R2016] (ISO 11654:1997): *Acoustics-Rating of sound absorption-Materials and systems*

Test Specimen [Specimen area⁶: 4.135 x 2.800 m (11.578 m²)]

Description: • Woven Image 'Column Mura Epsilon' Acoustic Panel
• Installed directly against the surface of the room

Panel Details³:

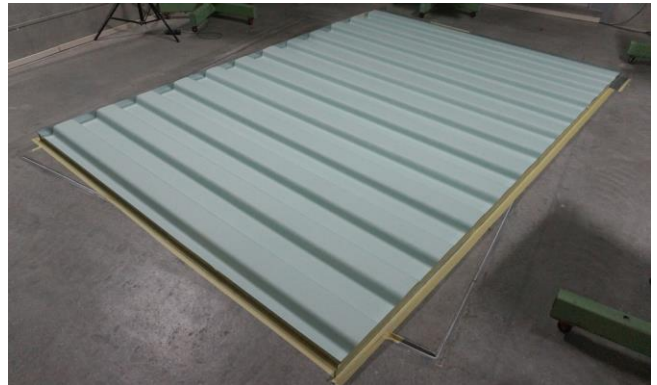
- Dual layer compressed polyester fibre panel with corrugated profile
- 9 mm 'Epsilon' substrate with 1 mm pigmented 'Mura' facing (colour 573, Mint)
- Formed with a corrugated profile; overall thickness 70 mm
- Panel size 2800 x 1040 mm (approx)

Installation: (installation by laboratory staff)

- The reverberation chamber was swept and vacuumed.
- The test specimen panels were laid horizontally on the floor of the chamber.
- Four panels were used, assembled butted against each other to form a continuous rectangular area.
- Double sided adhesive tape of minimal thickness was used where required to keep the rear face of the panels against the floor.
- The rectangular installation was oriented at a 10° angle to the walls of the chamber (not parallel, as per AS ISO 354 Cl 6.2.1.2).
- The perimeter of the test specimen was enclosed by a skirt of 1 mm thick folded steel angle, 70 mm high.
- The junction of the skirt with the concrete floor of the chamber was sealed with tape.



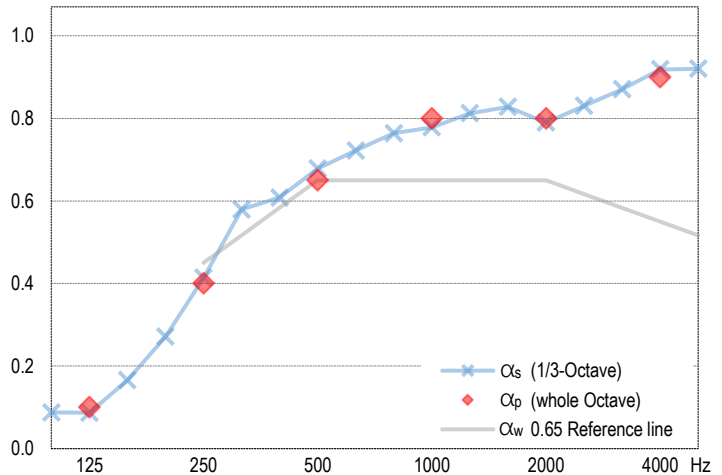
Closeup view of test specimen material showing face, edge and corrugated profile



Test specimen installed in laboratory for test

Measurement Details & Results

Freq Hz	Absorption coefficients			Reverberation times, T ₆₀ (sec)	
	α_s	α_p	95% Conf (δ)	Empty room ⁴	with Specimen
100	0.09		0.04	5.30	4.55
125	0.09	0.10	0.03	5.95	5.03
160	0.17		0.03	6.51	4.71
200	0.27		0.05	5.49	3.60
250	0.41	0.40	0.06	4.50	2.71
315	0.58		0.04	5.45	2.57
400	0.61		0.06	5.34	2.49
500	0.68	0.65	0.05	5.00	2.27
630	0.72		0.05	4.55	2.11
800	0.76		0.03	4.41	2.01
1000	0.78	0.80	0.05	4.40	1.99
1250	0.81		0.04	3.94	1.85
1600	0.83		0.03	3.36	1.69
2000	0.79	0.80	0.04	3.09	1.66
2500	0.83		0.03	2.84	1.55
3150	0.87		0.03	2.53	1.42
4000	0.92	0.90	0.04	2.09	1.25
5000	0.92		0.06	1.71	1.10



Performance Indices^{1,2}

$\alpha_w = 0.65$ (H)

SAA = 0.67

NRC = 0.65

Sound Absorption Class = C

The required 12 spatially independent decay curves came from ensemble averaging 10 successive decay sets, 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:	10 Sep 2024	10 Sep 2024
Temperature & humidity:	17 °C, 53 % R.H.	17 °C, 53 % R.H.
Atmospheric pressure:	1010 mBar	1010 mBar

Notes, Deviations etc

1. Shape indicators (L, M, and H), if any, following the α_w index, indicate α_p values above the reference contour by ≥ 0.25 in the Low, Medium or High frequency ranges respectively; it is strongly recommended to use this single number rating in combination with the complete sound absorption coefficient curve.
2. SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
3. Material details stated are as per client advice; unless identified as (meas), indicating measured by CSIRO.

4. Empty room absorption in the 250, 630, 800 & 1600 Hz bands did not meet all AS ISO 354 requirements; a non-compliance unrelated to the product/material under test.
5. Specimen area used in calculations (11.578 m²) was the area inside the steel angle enclosing the installed panels.

Issuing Authority

Signed:

David Truett

Date:

15 October 2024

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-042
Microphones/preamps: • 4 x GRAS 46AQ microphone/preamps sets, in fixed positions as per AS ISO 354
Noise source: • Room populated with three Norsonic NOR276 dodecahedron loudspeakers, driven in turn by a Norsonic NOR280 power amplifier.
Calibration: • Analyser: February 2024 (DANAK cal, ilac-MRA recognised)

Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by an MDF wall) • parallelepiped with dimensional proportions 1:1.3:1.6 for distribution of room modes • approx 202 m³ total room volume • approx 215 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 otherwise⁴