



CSIRO ACOUSTIC MEASUREMENT REPORT

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

Report No:
AC404-04-1

Client: CSR Pty Ltd / Woven Image
376 Victoria Street, Wetherill Park, NSW, 2164

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 area⁵: 3.610 x 3.055 m (11.029 m²)]

Description: • Woven Image Embossed Panel IX 9 mm laid with 18 mm Zeta panel behind
(no air gap)

Materials³:

- a) Embossed Panel IX 9 mm
- Composition: 100 % PET (50 % recycled)
 - Panel dimensions: 2800 mm x 1130 mm
 - Thickness: 9 mm \pm 7 %
 - Profile: corrugated with 49 mm pitch, 5 mm thick at valleys, 9 mm thick at peaks
 - Area density: 2385 g/m² \pm 10 %
- b) Zeta 18 mm
- Composition: 100 % PET (50 % recycled)
 - Panel dimensions: 2800 mm x 1200 mm
 - Thickness: 18 mm \pm 7 %
 - Profile: Rectangular
 - Area density: 2000 g/m² \pm 10 %

Installation:

- The reverberation chamber was swept and vacuumed in preparation for specimen installation.
- The specimen consisted of an 18 mm layer of Zeta (item a) laid directly on the chamber floor.
- On top of this was laid a 9 mm layer of Embossed Panel IX (item b) comprising: 2 uncut panels, 1 full-length panel cut to 0.74 m width, 2 full-width panels cut to 0.8 m length and 1 panel cut to 0.74 x 0.8 m.
- These were arranged in a rectangle at an angle of 8° from the nearest chamber wall (not parallel, as per AS ISO 354 cl 6.2.1.2). All corrugations were aligned in the same direction.
- The exposed perimeter edges of the specimen were covered with a skirt of 1 mm thick folded steel angle, 40 mm high. The installation minimised panel-panel and panel-skirt gaps.
- The perimeter of the skirt was taped to the chamber floor.
- Specimen installation was carried out by laboratory staff.



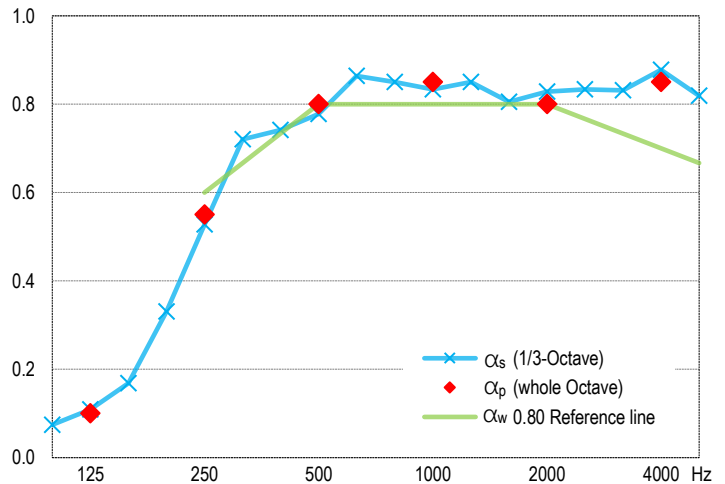
Test specimen installed in laboratory for test



Side view of specimen prior to skirt installation

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	0.07		0.05	4.87	4.34
125	0.11	0.10	0.05	5.69	4.71
160	0.17		0.04	5.98	4.46
200	0.33		0.05	5.35	3.35
250	0.53	0.55	0.07	4.67	2.55
315	0.72		0.06	5.75	2.40
400	0.74		0.07	5.72	2.35
500	0.78	0.80	0.05	5.14	2.19
630	0.86		0.06	4.75	1.99
800	0.85		0.03	4.55	1.97
1000	0.83	0.85	0.04	4.48	1.98
1250	0.85		0.03	4.11	1.89
1600	0.81		0.03	3.61	1.82
2000	0.83	0.80	0.03	3.26	1.71
2500	0.83		0.04	2.83	1.58
3150	0.83		0.05	2.52	1.48
4000	0.88	0.85	0.06	2.04	1.28
5000	0.82		0.03	1.61	1.12



Performance Indices^{1,2}

$\alpha_w = 0.80$
SAA = 0.75
NRC = 0.75
Sound Absorption Class = B

The required 12 spatially independent decay curves came from ensemble averaging 10 successive decays 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:	5 Sep 2025	5 Sep 2025
Temperature & humidity:	17 °C, 45 % R.H.	17 °C, 46 % R.H.
Atmospheric pressure:	1016 mbar	1016 mbar

Notes, Deviations etc

- 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.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Material details stated are as per client advice; unless identified as (meas), indicating measured by CSIRO.
- Empty room absorption in the 100, 250 and 800 Hz bands did not meet all AS ISO 354 requirements; a non-compliance unrelated to the product/material under test.
- Specimen area used in calculations (11.029 m²) was the area inside the steel angle enclosing the installed panels.

Issuing Authority

Signed: 
Jim Payne
Date: 7 October 2025

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: Feb 2025 (DANAK cal, ilac-MRA recognised)

Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by a composite 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