



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:
AC283-01-1

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

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 area⁴: 3.6 x 3.3 m (11.88 m²)]

Description: Woven Image 'Array - 12 mm Beam' Acoustic Baffle System – baffles installed at 300 mm centres with no gap between the specimen and the room surface using mounting elements from supplied mounting kit; absorption coefficients calculated based on effective specimen area of 11.88 m² – see diagram (below right)

Test Specimen Details:¹

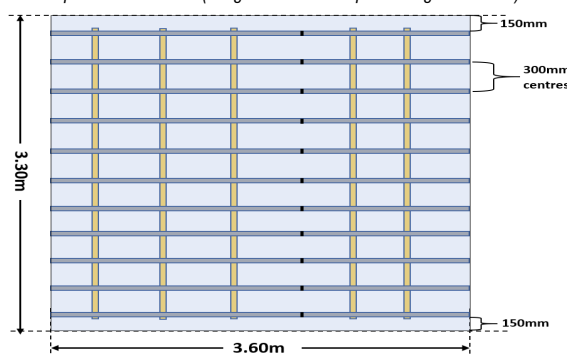
- Baffles: EchoPanel® - non-woven polymer fibre panel 100% PET (60% recycled), 12 mm thick \pm 7%, area density: 2400 gsm; individual baffle height: 300 mm (rectangular in shape); 2 lengths: 1200 and 2400 mm; each baffle was made with cuts matching the cross-section of the Aluminium mounting extrusions included in the standard kit.
- Supplied for testing unassembled in standard kits with the installation components comprising:
 - Mounting Rails: 2.5 m long aluminium extrusions of a proprietary profile designed to be directly fixed or suspended from the ceiling above and engage with matching cut-outs in the baffles for mounting.
 - Ancillary Components: plastic joiners for longitudinal joining of mounting rails (or cut-down lengths), and end caps to cover the mounting rail ends, and aluminium snap covers to be cut to size and snapped into the open mouth of the mounting extrusion between adjacent baffles.

Installation:

- The reverberation chamber was swept and vacuumed prior to testing to remove dust and debris.
- The test specimen was supplied as two standard kits, one in each of the two sizes (1200 and 2400 mm) plus some additional components as required to extend the mounting rails to accommodate eleven baffles at 300 mm centres.
- An array of each size (1200 and 2400 mm) was assembled, and then the two arrays were placed directly against each other to form a single array of 3600 mm baffles (x 11 rows at 300 mm centres).
- To replicate an in-situ direct-fix suspended ceiling installation within the constraints of the Laboratory, the test specimen was placed directly on the concrete floor of the test chamber not parallel with the walls of the chamber (11° angle), with no enclosure surrounding the test specimen.
- Apart from the upside down orientation⁵, installation was carried out as per manufacturer's instructions (Ref: ARRAY DIRECT FIX INSTALL GUIDE_MAR20.pdf).
- Specimen assembly and installation was carried out by laboratory staff.

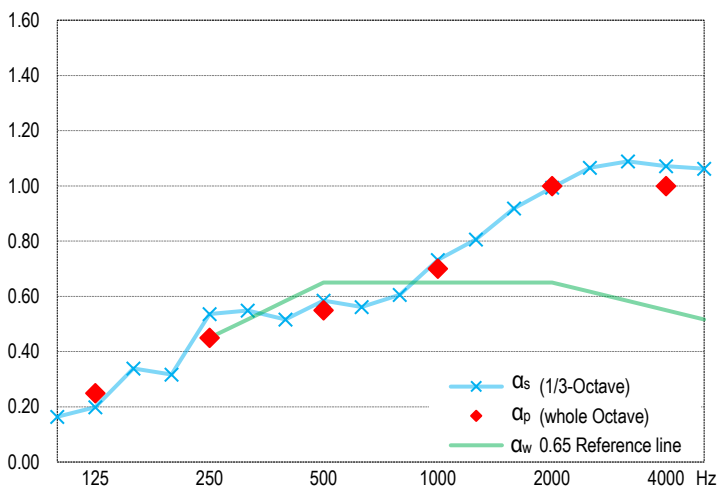


Specimen as tested (image inverted to depict ceiling installation)



Measurement Details & Results

Freq Hz	Absorption coefficients ⁴			Reverberation times, T ₆₀ (sec)	
	α_s	α_p	95% Conf (δ)	Empty room	with Specimen
100	0.16		0.04	5.30	4.02
125	0.20	0.25	0.05	6.09	4.23
160	0.34		0.06	6.49	3.60
200	0.32		0.05	5.73	3.45
250	0.54	0.45	0.07	4.99	2.53
315	0.55		0.04	6.05	2.74
400	0.52		0.04	5.95	2.81
500	0.58	0.55	0.03	5.75	2.58
630	0.56		0.04	5.36	2.55
800	0.61		0.04	5.07	2.39
1000	0.73	0.70	0.04	5.04	2.15
1250	0.81		0.04	4.55	1.94
1600	0.92		0.05	4.13	1.73
2000	0.99	1.00	0.04	3.70	1.58
2500	1.07		0.04	3.33	1.45
3150	1.09		0.04	2.98	1.37
4000	1.07	1.00	0.04	2.46	1.26
5000	1.06		0.04	2.00	1.14



Performance Indices^{2,3}

$\alpha_w = 0.65$ (H)
SAA = 0.68
NRC = 0.70
Sound Absorption Class = C

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:	21 Dec 2020	21 Dec 2020
Temperature & humidity:	19 °C, 59 % R.H.	19 °C, 61 % R.H.
Atmospheric pressure:	996 mBar	992 mBar

Notes, Deviations etc

- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- 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.
- Absorption coefficients reported are based on 11.88 m² of room area being 'treated' by the test specimen – see diagram above.
- The product would usually be directly fixed or suspended from the ceiling of a room. The test specimen was installed upside-down on the floor due to laboratory constraints but done so as to be acoustically equivalent to normal ceiling installation.

Issuing Authority

Signed:
Date: 3 March 2021

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • 4 microphones (1 x B&K 4134, 1 x B&K 4166, and 2 x GRAS 40AR) on B&K and GRAS preamps, in fixed positions as per AS ISO 354
Noise source: • Room populated with three dodecahedron loudspeakers; (2 x Norsonic NOR276 and 1 x B&K 4296), driven in turn by a Norsonic NOR280 power amplifier.
Calibration: • Analyser: July 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