



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:
AC275-01-1

Client: Woven Image Pty Ltd
37-39 Chard Road, Brookvale, NSW 2766 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 area: 3.720 x 2.802 m (10.423 m²)]

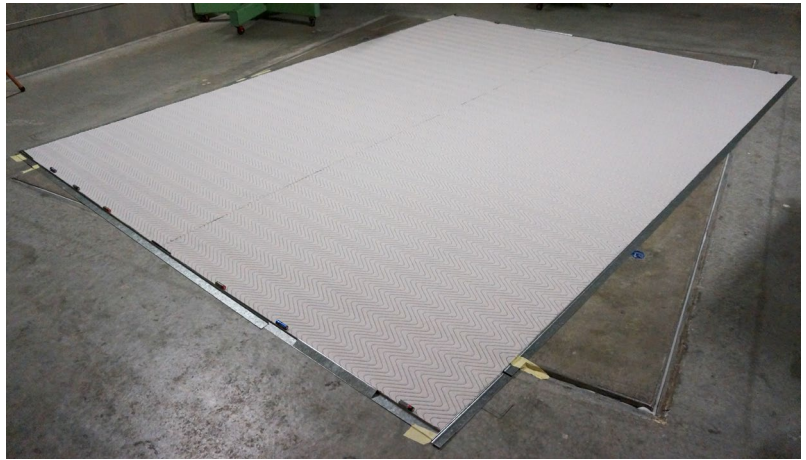
Description: Woven Image 'Focus Wave' quilted upholstery fabric, installed directly against the room surface.

Focus Wave Details³

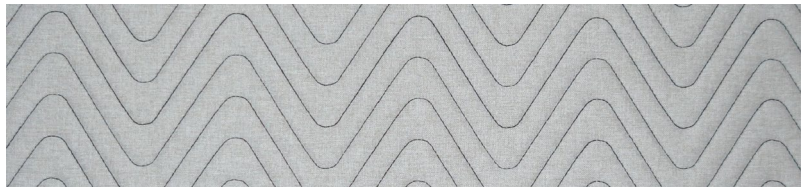
- Product designation: Focus Wave
- Woven Image Colour number: 909
- Composition: triple layer with polyester fabric face and backing layers enclosing a polyurethane inner foam layer; 91 % polyester, 9 % polyurethane overall
- Physical characteristics: Delivered for testing as a roll – 1370 mm wide, Thickness: 5 mm; Weight: 800 g/lin.m, 584 g/m², Pattern repeat - vertical: 11cm; horizontal: 2.5cm.

Installation

- The reverberation chamber was swept and vacuumed.
- The roll of 1370 mm wide test specimen was cut down to 2 pieces of length 3720 mm and were laid directly on the concrete floor of the chamber, arranged in a rectangle at an angle of 11° from the nearest chamber wall (not parallel, as per AS ISO 354 cl 6.2.1.2).
- The 2 lengths of fabric were carefully aligned with each other and pushed together. Small weights were required to hold the cut ends of the fabric down against the floor of the test chamber.
- A skirt of folded steel angle (1 mm thick, 10 mm high) was arranged around the perimeter of the installed fabric to mask the edges.
- Specimen installation was carried out by laboratory staff.



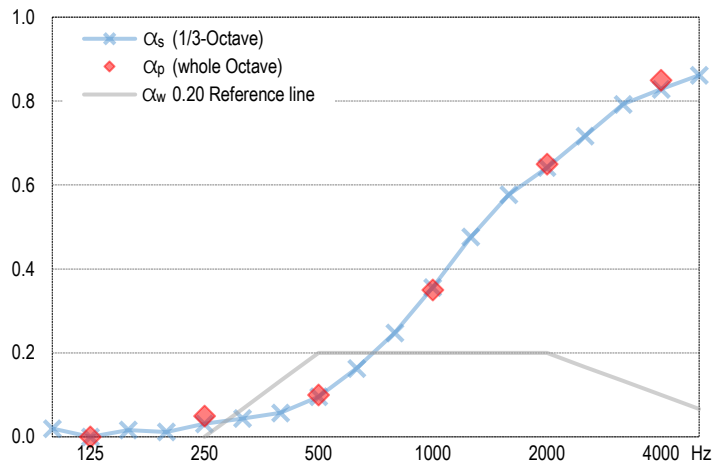
Test specimen installed for testing



Detail of quilting pattern

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	0.02		0.06	5.74	5.54
125	0.00	0.00	0.03	6.06	6.21
160	0.02		0.03	6.12	5.93
200	0.01		0.04	5.53	5.42
250	0.03	0.05	0.03	4.98	4.75
315	0.04		0.03	5.83	5.39
400	0.06		0.02	5.81	5.25
500	0.10	0.10	0.03	5.40	4.64
630	0.16		0.03	5.22	4.10
800	0.25		0.03	5.02	3.59
1000	0.36	0.35	0.04	4.91	3.15
1250	0.48		0.03	4.32	2.61
1600	0.58		0.03	3.90	2.27
2000	0.64	0.65	0.04	3.48	2.03
2500	0.72		0.04	3.14	1.83
3150	0.79		0.04	2.81	1.64
4000	0.83	0.85	0.04	2.31	1.44
5000	0.86		0.05	1.89	1.25



Performance Indices^{1,2}

α_w = 0.20 (H)

SAA = 0.29

NRC = 0.30

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: 9 Jul 2020	9 Jul 2020
Temperature & humidity: 20 °C, 50 % R.H.	20 °C, 50 % R.H.
Atmospheric pressure: 1013 mBar	1014 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. Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.

Issuing Authority

Signed:

John Watson

Date:

30 July 2020

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • 4 x GRAS microphones (types 40AR & 40AP, 2 ea) on GRAS & B&K preamplifiers, in 4 fixed positions as per AS ISO 354
Noise source: • Room populated with three dodecahedron loudspeakers; (2 x Norsonic NOR276 & 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 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 otherwise