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:
AC219-03-2

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

Measurement Type: Sound Absorption

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

Test Specimen

[Specimen area: 3.855 m x 2.700 m, = 10.41 m^2]

Name: 9 mm EchoPanel 542 tested with a 50mm air gap

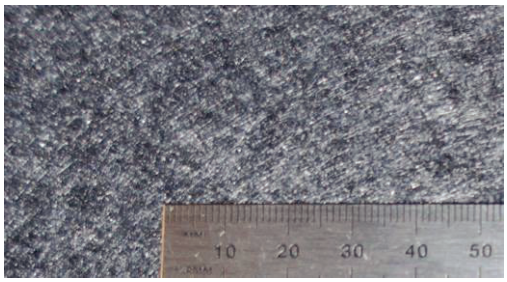
Description:

- Semi-Rigid 100% Polyethylene terephthalate (PET) – 60% recycled PET
- The 9 mm EchoPanel is homogeneous in composition and texture.
- Panel size, as supplied: 2695 mm x 1210 mm x 9 mm thick
- Nominal surface density: 1400 gsm (approx 1550 gsm as measured by Lab)

Installation:

- The floor of the laboratory was swept and vacuumed before commencement of the testing and specimen installation.
- The 9 mm EchoPanel 542 specimen was tested with a 50 mm air gap under the specimen. The air gap was set by placing an array of 50 mm MDF spacers under the test specimen; arranged to avoid dividing the enclosed space into multiple air pockets.
- The test specimen consisted of 3 full panels and a cut 4th panel, placed on the floor of the chamber, not parallel with the room walls, in a rectangle 3.855 m x 2.700 m; Total area of specimen: 10.41 m^2.
- The perimeter of the specimen under test was enclosed with 60 mm high, 1 mm thick steel slats in accordance with Annex B of ISO 354-2006.
- Installation of the test specimen into the test chamber was carried out by the laboratory.
- The Empty Room measurement was carried out as soon as practicable after removing the test specimen.
- The upper image at right depicts the 9 mm EchoPanel 542 installed for testing.
- The lower image at right depicts a close up view of the sound incident face of the 9 mm EchoPanel 542.

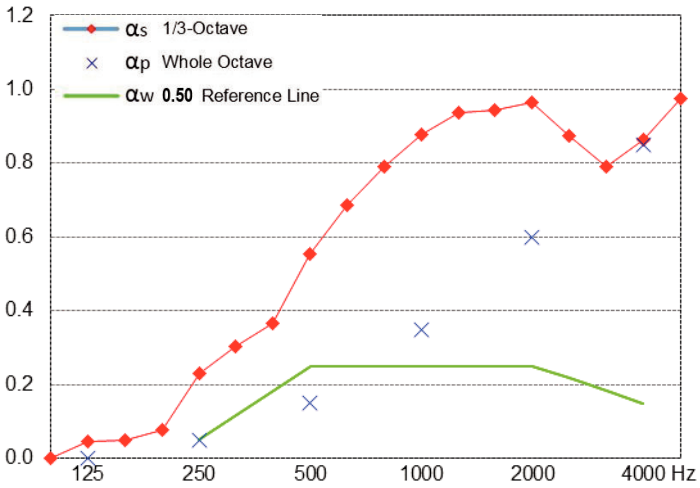
Test specimen arranged for test



Close up view of specimen face and edge

Measurement Details & Results

Freq (Hz)	Absorption coefficient α_s	α_p	Reverberation times, T_{60} (s) Empty room	with Specimen
100	0.00		5.57	5.60
125	0.05	0.05	7.12	6.43
160	0.05		6.89	6.20
200	0.08		7.41	6.26
250	0.23	0.20	6.23	4.26
315	0.30		7.25	4.25
400	0.37		6.82	3.79
500	0.55	0.55	6.34	2.99
630	0.69		6.07	2.60
800	0.79		5.58	2.31
1000	0.88	0.85	5.43	2.15
1250	0.94		4.82	1.97
1600	0.94		4.43	1.89
2000	0.96	0.95	3.84	1.76
2500	0.87		3.40	1.74
3150	0.79		3.13	1.75
4000	0.86	0.90	2.58	1.51
5000	0.96		2.16	1.30



Performance Indices[2,3]
α_w = 0.50 (MH)
SAA = 0.63
NRC = 0.65

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	17 Feb 2017	17 Feb 2017
Temperature & humidity:	21.6 °C, 55 % R.H.	21.5 °C, 56 % R.H.
Atmospheric pressure:	998 mBar	999 mBar

Notes, Deviations etc

1. 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.
2. Shape indicators (L, M, and H), if any, accompanying the α_w index, signify absorption coefficients (α_p) exceeding the α_w reference value by 0.25 or more in the Low, Medium or High frequency ranges respectively.
3. SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354
4. Physical characteristics of materials bay be as per client or supplier's advice; not necessarily verified by CSIRO.
5. Empty room absorption area in the 125 Hz and 250 Hz bands deviated from the mean for the two adjacent bands by more than 15 %; a deviation from AS ISO 354.

Issuing Authority

This report replaces previous report AC219-03-1; material details having been amended.

Signed: .....
John Watson

Date: 9th March 2017

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • 2 x GRAS 40AP & 2 x Brüel & Kjær 4134 microphones, all on Brüel & Kjær 2669 preamps, positioned in the room as per AS ISO 354
Noise source: • Norsonic Type Nor276 Dodecahedron loudspeaker
Calibration: • Brüel & Kjær type 4228 Pistonphone: Feb 2016 (NATA cal)
• Analyser: Feb 2016 (NATA cal)

Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by a wall with a medium density fibreboard face)
• parallelepiped with dimensional proportions 1:1.3:1.6 for distribution of room modes • approx 202 m^3 total room volume • approx 215 m^2 surface area excluding diffusers
Diffusers: • 20 stationary diffusers, approx. 40 m^2 total surface area
Absorption area: • in accordance with AS ISO 354 unless noted otherwise[5]