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REPORT ON THE DETERMINATION OF SOUND ABSORPTION COEFFICIENTS OF WOVEN IMAGE ECHO PANEL 24MM TESTED WITH A 50MM AIR GAP MEASURED IN A REVERBERATION ROOM.

Testing Procedure:	AS ISO 354 - 2006
Testing Laboratory:	Applied Acoustics Laboratory RMIT University, School of Electrical and Computer Engineering Melbourne, Victoria 3000, Australia NATA Accreditation Number 1421
Client:	Woven Image Pty. Limited 37- 39 Chard Road Brookvale, N.S.W. 2100 Australia
Date of Test:	8th October 2013
Date of Report:	9th October 2013
Report Number:	13-121/PD,JW
Testing Officer:	Peter Dale

Peter Dale
Approved NATA Signatory

Accredited for compliance with ISO/IEC 17025

REPORT ON THE DETERMINATION OF SOUND ABSORPTION COEFFICIENTS OF WOVEN IMAGE ECHO PANEL 24MM TESTED WITH A 50MM AIR GAP MEASURED IN A REVERBERATION ROOM.

1. INTRODUCTION

The tests described in this report were carried out at the request of Woven Image Pty. Limited to determine the sound absorption coefficients of a sample of Echo Panel 24mm tested with a 50mm air gap. The tests were carried out using the Reverberation Room of the School of Electrical and Computer Engineering, The Royal Melbourne Institute of Technology Limited.

Testing has been carried out in accordance with AS ISO 354–2006 "Acoustics: Measurement of sound absorption in a reverberation room" with the exception that the surface area of the sample was 12.32m^2 instead of the maximum sample surface area of 12.00m^2 specified in the AS ISO 354–2006 standard. This was due to the pre-cut size of the panels.

At the request of the client the weighted sound absorption coefficient α_w has been determined in accordance with AS ISO 11654-1997 "Acoustics: Sound Absorbers for Use in Buildings - Rating of sound absorption".

The equipment used to perform these tests has been calibrated at an accredited laboratory and is in current calibration.

2. TEST FACILITIES AND PROCEDURES

2.1 Facilities: The Reverberation Room is of pentagonal plan with the ceiling inclined with respect to the floor. No two room dimensions are equal or in the ratio of small whole numbers. The volume of the room is 200.0 cubic metres. A sufficiently diffuse sound field is established by the inclusion of 17 stationary diffusing boards of panelboard, each of one-sided area approximately one square metre and suspended with random orientation. The total two-sided area of the diffusing elements is 0.16 of the total boundary surface area of the room. Previous tests carried out in the room have established that diffusivity of the room sound field is acceptable.

The total surface area of the room boundaries and diffusing elements is 235.6 square metres.

2.2 Generation of Sound-field: The test signals is random noise, band limited to a frequency range of 40Hz to 6300Hz. Three individual loudspeaker positions are used to excite the sound field in the reverberation chamber. The signal is fed to each loudspeaker in turn.

2.3 Receipt of Signals: Four microphones each mounted in statistically independent locations in the Reverberation Room are used to measure the sound field decays in the room. Ten sound decays are obtained at each of the twelve loudspeaker/microphone combinations, thus representing 120 decays for each frequency band.

The microphone signal is relayed via a microphone amplifier, to a Bruel & Kjaer 3560 Pulse Multi Analyser System. The Pulse analyser is interfaced to a personal computer. A program running on the personal computer allows the determination of the reverberation time from the sound decays in accordance with the standard. The measuring equipment has been calibrated by an external laboratory, and is in current calibration.

3. SAMPLE FOR TESTING

3.1 Description: Woven - Image Echo Panel 24mm tested with a 50mm air gap:

Woven Image – Echo Panel 24mm

- As provided by Client

Product name: Echo Panel 24mm
Material: 100% Pet (60% recycled)
Thickness: 24mm
Surface Density: 2800gsm
Panel Size: 2200mm x 1200mm
Primary Use: Workstation panel/divider
Air Gap: 50mm

Sample Mount Details:

The sample tested comprised of a 2 x 2 array of the panels (individual panel dimensions of 2200mm x 1200mm x 24mm) arranged to form a 2803mm x 4395mm rectangle. The panels were placed on 50mm spacers on the floor of the chamber to achieve a 50mm air gap on the underside of the panels under test. Figure 1 shows the surface detail of the sample and Figure 2 shows the sample installed in the chamber for testing. The sample was tested with the perimeter edges enclosed by metal edges in accordance with the recommendations contained in AS ISO 354.

The total surface area of the sample was 12.32m^2 instead of the maximum sample surface area of 12.00m^2 specified in the AS ISO 354–2006 standard. This was due to the pre-cut size of the panels under test.

Figure 1: Surface detail of the Echo Panel 24mm.

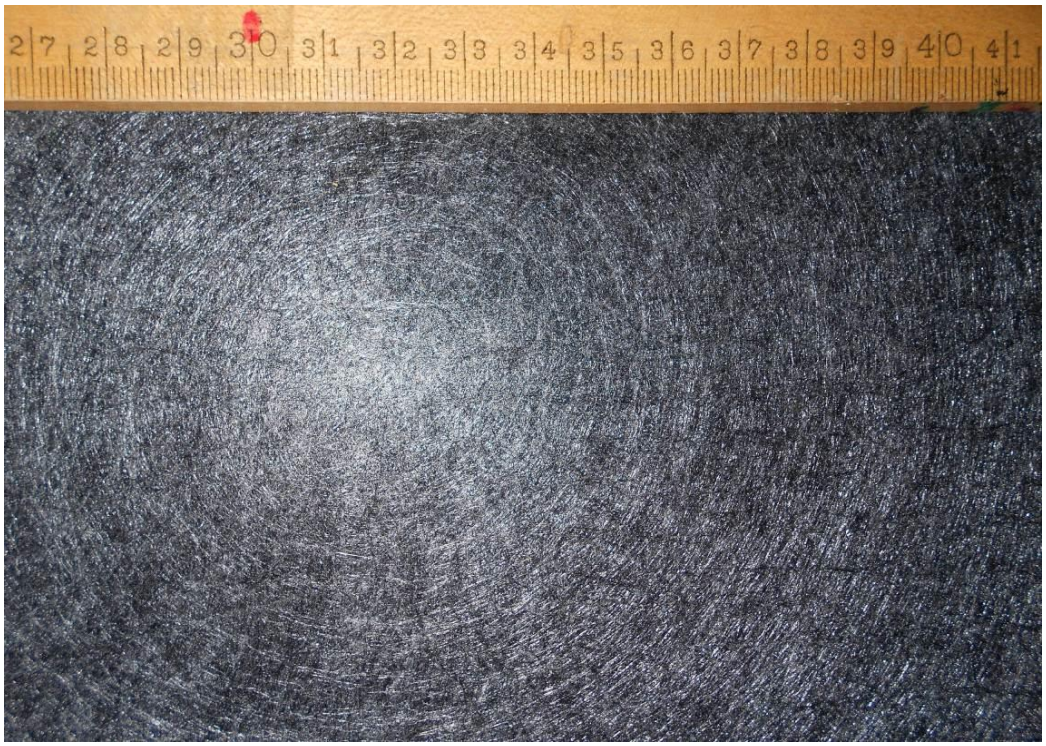

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Figure 2: Echo Panel 24mm tested with a 50mm air gap installed in Reverberation Chamber

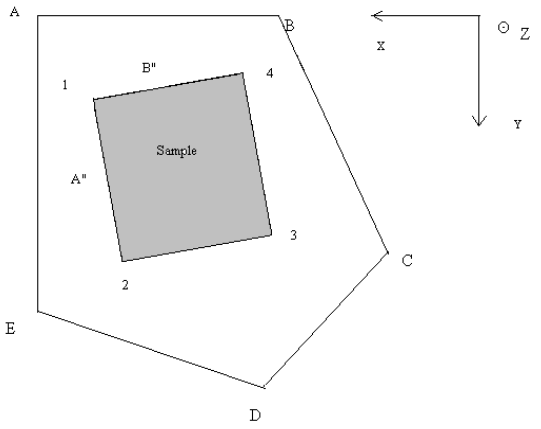
3.2 Location Of Sample In The Reverberation Room

Reverberation Chamber (Not to scale):

X and Y co-ordinates of the sample location in the Reverberation Room

Corner Ref. Number	X co-ordinate (metres)	Y co-ordinate (metres)
1	-0.82	1.73
2	-1.85	6.00
3	-4.57	5.35
4	-3.54	1.07

Descriptor	Diagram Reference	Length (m)
Sample Length 1 to 2	Diagram Ref. A”	4.395
Sample Length 1 to 4	Diagram Ref. B”	2.803



4. RESULTS

The mean reverberation times at each frequency for the empty room, $T60_e$, the room with the sample installed, $T60_{e+s}$, the sound absorption coefficient and the 95% confidence interval are provided in Table 1. The results are rounded to 0.01. The 95% confidence interval for each frequency is determined from the standard deviation of the reverberation times of the empty room and the room with the sample. The k factor used to determine the 95% Confidence interval is 2.201.

The results for the sample are detailed in Table 1, Table 2 and Graph 1 of this report.

Test conditions:

Room Empty	Air temperature	21.8^{o}C
	Relative Humidity	40%
	Barometric Pressure	0.7616 metre of mercury
Room with Sample	Air temperature	21.0^{o}C
	Relative Humidity	45%
	Barometric Pressure	0.7650 metre of mercury

Table 1: Reverberation times and Sound Absorption Coefficients for Echo Panel 24mm tested with a 50mm air gap.

Octave Centre Frequency Bands, Hz	Average RT's for empty room. $T60_e$	Average RT's for room. with sample $T60_{e+s}$	Sound Absorption Coefficient α_s	95% Confidence Interval for α_s
100	8.120	6.161	0.10	0.05
125	8.433	5.722	0.15	0.04
160	9.454	5.853	0.17	0.04
200	10.161	4.868	0.28	0.03
250	8.740	3.757	0.40	0.04
315	8.480	3.038	0.55	0.05
400	8.314	2.416	0.77	0.04
500	7.348	2.093	0.89	0.05
630	7.129	1.877	1.03	0.03
800	6.619	1.779	1.07	0.04
1000	6.041	1.748	1.06	0.03
1250	5.256	1.713	1.03	0.03
1600	4.597	1.681	0.99	0.03
2000	3.999	1.638	0.95	0.02
2500	3.386	1.554	0.92	0.02
3150	2.759	1.380	0.97	0.03
4000	2.141	1.213	0.97	0.03
5000	1.797	1.113	0.95	0.05

The weighted sound absorption coefficient α_w of the sample determined in accordance with AS ISO 11654-1997 "Acoustics: Sound Absorbers for Use in Buildings - Rating of sound absorption" is:

$$\alpha_w = 0.70(MH)$$

The Practical Sound Absorption Coefficients are detailed below in Table 2. These values have been determined in accordance with AS ISO 11654-1997 "Acoustics: Sound Absorbers for Use in Buildings - Rating of sound absorption".

Table 2: Practical Sound Absorption Coefficients for the Sample

Frequency (Hz)	**125**	**250**	**500**	**1000**	**2000**	**4000**
Practical Sound Absorption Coefficient, α_p	0.15	0.40	0.90	1.00	0.95	0.95

NRC of the sample calculated in accordance with ASTM C423-90A is: 0.85

Graph 1: Sound Absorption Coefficients of Echo Panel 24mm tested with a 50mm air gap.