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: **AC260-01-1**

Client: Milliken (Australia) Pty Ltd
171 Briens Road, Northmead, NSW 2152

Measurement Type: Sound Absorption

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

Test Specimen

[Specimen area: 3.5 x 3.0 m (10.5 m²), Test configuration: Type A]

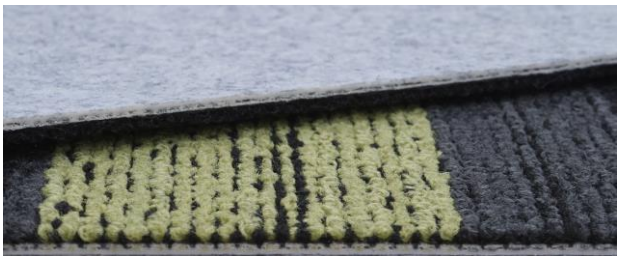
Description: Milliken *'WellBAC Function'* carpet tiles

Carpet Tile Details[3]

- Product designation: WellBAC Function
- Construction: nylon loop pile carpet on a primary backing, precoated and bonded to a fibreglass layer with hotmelt, on top of a polyester felt backing layer.
- Tile size: 500 x 500 mm, x 5.84 mm thick (average thickness, nominal)
- Overall weight: 3.4 kg/m² (nom).

Installation

- The reverberation chamber was swept and vacuumed to remove debris and dust.
- The carpet tiles (as described above) were laid directly on the concrete floor of the chamber; no adhesives or underlay materials.
- Carpet tiles (7 tiles x 6) were arranged in a rectangular area, 8 degrees off parallel with the walls of the chamber. Tile were carefully arranged and pushed tight against each other.
- A skirt of folded steel angle (1 mm thick, 15 mm high) was arranged around the perimeter of the installed carpet to mask the edges.
- Specimen installation was carried out by laboratory staff.



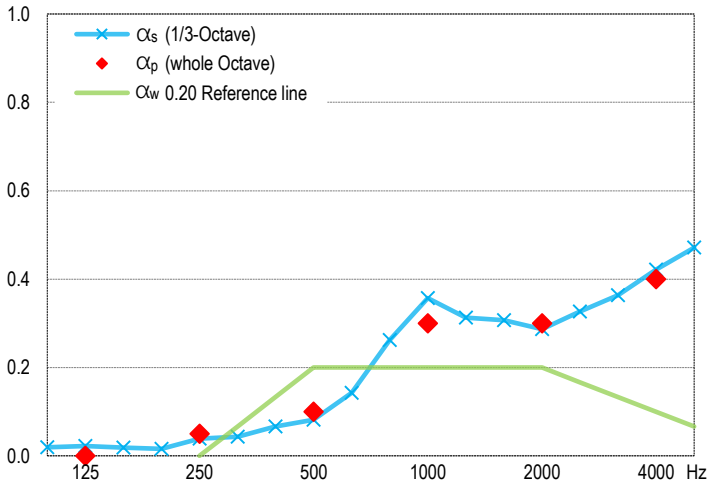
Close up of carpet tiles, showing face, edge and backing.



Test specimen installed in laboratory for test.

Measurement Details & Results

Freq	Absorption coefficients			Reverberation times, T_{60} (sec)	
Hz	α_s	α_p	95% Conf (δ)	Empty room	with Specimen
100	0.02		0.07	6.13	5.91
125	0.02	0.00	0.04	6.66	6.36
160	0.02		0.02	6.72	6.46
200	0.02		0.03	6.24	6.05
250	0.04	0.05	0.03	5.98	5.57
315	0.04		0.02	6.63	6.08
400	0.07		0.02	6.80	5.95
500	0.08	0.10	0.02	6.49	5.56
630	0.14		0.02	6.01	4.73
800	0.26		0.02	5.57	3.80
1000	0.36	0.30	0.03	5.41	3.35
1250	0.31		0.02	4.80	3.25
1600	0.31		0.02	4.19	2.97
2000	0.29	0.30	0.03	3.67	2.75
2500	0.33		0.02	3.28	2.45
3150	0.36		0.03	2.83	2.13
4000	0.42	0.40	0.03	2.32	1.77
5000	0.47		0.06	1.86	1.46



Performance Indices[1,2]
α_w = 0.20 (H)
SAA = 0.19
NRC = 0.20

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:	18 Aug 2019	18 Aug 2019
Temperature & humidity:	14 °C, 60 % R.H.	14 °C, 60 % R.H.
Atmospheric pressure:	993 mBar	993 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: .....
David Truett
Date: 22 November 2019

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • 2 x GRAS type 40AP and 2 x B&K type 4134 microphones, all on B&K type 2669 preamps, in 4 fixed positions as per AS ISO 354
Noise source: • Room populated with three decahedron loudspeakers; 2 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

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