



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:
AC210-07-1

Report for: Decor Systems
6 Millenium Court, Silverwater, NSW 2128

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: 3.6 x 3.0 m = 10.8 m²]

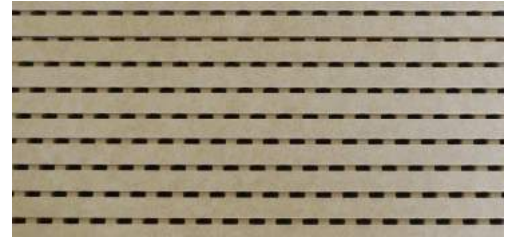
Description: DecorLini DL20 - 416 acoustic room lining slats, backed with acoustic backing fabric and 50 mm thick 32 kg/m³ polyester sound absorbing blanket, with an air cavity behind. Test configuration type E-415.

Material Details:

- a) DecorLini DL20 - 416 Slats. 16 mm thick MDF slats with a grooved front face (4 mm wide x 4 mm deep grooves at 16 mm pitch), meeting an array of 10 mm holes behind, backed with Sonus 2.0 fabric. Slats with a tongue and groove edge profile (128 mm coverage width per slat). Open area of perforated face approx 15.2 %.
- b) Polyester sound absorbing blanket, 50 mm thick, 32 kg/m³.

Installation:

- The test specimen was installed on the floor of the laboratory with the exposed face on top.
- A 400 mm high perimeter enclosure of 32 mm thick MDF board (approx 23 kg/m²) was constructed and placed on the concrete floor of the chamber, not parallel to the walls.
- An arrangement of internal support members was set up in the perimeter enclosure and the cavity enclosed by it, to enable the test specimen materials to be laid on top in an arrangement acoustically equivalent to a normal installation. The supporting members were kept to a minimum; not dividing the cavity into multiple sections.
- A combination of solid supports and tensioned strings was used to suspend the blanket, item b) immediately behind the DecorLini slats, item a), which were placed on top and mated together with their tongue and groove edge profiles.
- The face of the DecorLini finished approximately 15 mm proud of the MDF enclosure; the laboratory inspected the installation and concluded that the perforations exposed at the edges, resting on a solid ledge underneath, should not significantly affect absorption.
- The test fixture enclosure was provided by the laboratory; additional support fixtures were provided by the client, who also carried out installation of the test specimen.



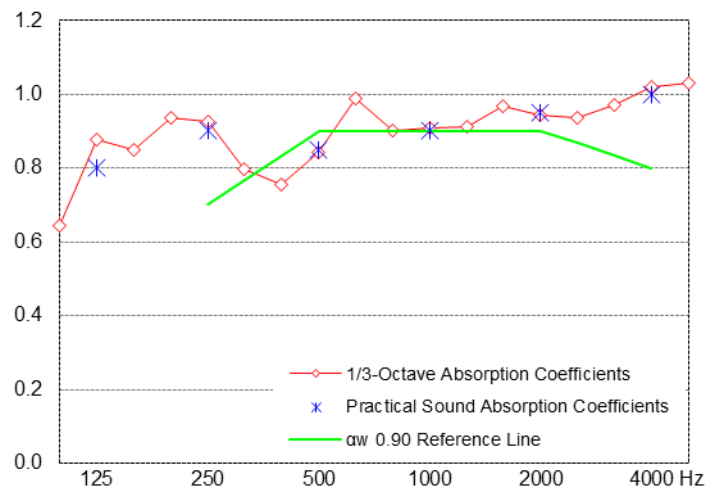
Perforated face of test specimen



Test specimen arranged for test

Measurement Details & Results

Freq Hz	Absorption coefficient		Reverberation times, T ₆₀ (sec)	
	α_s	α_p	Empty room	with Specimen
100	0.64		6.49	2.70
125	0.88	0.80	7.32	2.32
160	0.85		7.51	2.39
200	0.94		7.17	2.21
250	0.93	0.90	6.67	2.17
315	0.80		7.02	2.44
400	0.75		6.60	2.47
500	0.84	0.85	6.13	2.24
630	0.99		6.12	2.02
800	0.90		5.78	2.10
1000	0.91	0.90	5.43	2.04
1250	0.91		4.92	1.96
1600	0.97		4.56	1.84
2000	0.94	0.95	4.01	1.77
2500	0.94		3.50	1.66
3150	0.97		3.05	1.52
4000	1.02	1.00	2.54	1.36
5000	1.03		2.01	1.18



Performance Indices^{2,3}

$\alpha_w = 0.90$
SAA = 0.90
NRC = 0.90

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	4 Oct 2016	4 Oct 2016
Temperature & humidity:	13 °C, 66 % R.H.	14 °C, 60 % R.H.
Atmospheric pressure:	992 mBar	990 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 may be as per client or supplier's advice; not necessarily verified by CSIRO.
5. Temperature in the chamber, being below 15 °C during testing, is a deviation from AS ISO 354 requirements.
6. This report describes the same test as AC203-07-1; test specimen being identified by another trade designation.

Issuing Authority

Signed:
Date: 18 November 2016

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • Brüel & Kjær, 2 x 4166 & 2 x 4134 microphones on 2669 preamps, positioned in the room as per AS ISO 354
Noise source: • Rola 12UX on flat 1m² baffle (up to 1.8 KHz)
• Brüel & Kjær type HP 1000 dodecahedron (from 1.8 KHz)
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 plasterboard faced 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



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:
AC210-01-1

Report for: Decor Systems
6 Millenium Court, Silverwater, NSW 2128

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: 3.6 x 3.0 m = 10.8 m²]

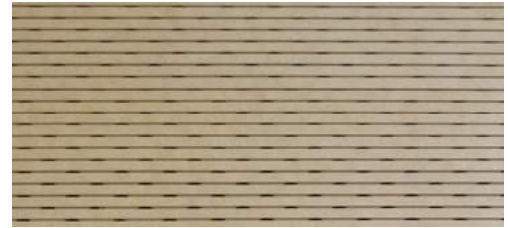
Description: DecorLini DL10 - 280 acoustic room lining slats, backed with acoustic backing fabric, with an air cavity behind. Test configuration type E-105.

Material Details:

- DecorLini DL10 - 280 Slats. 16 mm thick MDF slats with a grooved front face (2 mm wide x 4 mm deep grooves at 8 mm pitch), meeting an array of 10 mm holes behind, backed with Sonus 2.0 fabric. Slats with a tongue and groove edge profile (128 mm coverage width per slat). Open area of perforated face approx 7.7 %.

Installation:

- The test specimen was installed on the floor of the laboratory with the exposed face on top.
- A 100 mm high perimeter enclosure of 32 mm thick MDF board (approx 23 kg/m²) was constructed and placed on the concrete floor of the chamber, not parallel to the walls.
- An arrangement of internal support members was set up in the perimeter enclosure and the cavity enclosed by it, to enable the test specimen material to be laid on top in an arrangement acoustically equivalent to a normal installation. The supporting members were kept to a minimum; not dividing the cavity into multiple sections.
- The DecorLini slats were placed on top of the supports and mated together with their tongue and groove edge profiles.
- The face of the DecorLini finished approximately 5 mm proud of the MDF enclosure; the laboratory inspected the installation and concluded that the perforations exposed at the edges, resting on a solid ledge underneath, should not significantly affect absorption.
- The text fixture enclosure was provided by the laboratory; additional support fixtures were provided by the client, who also carried out installation of the test specimen.



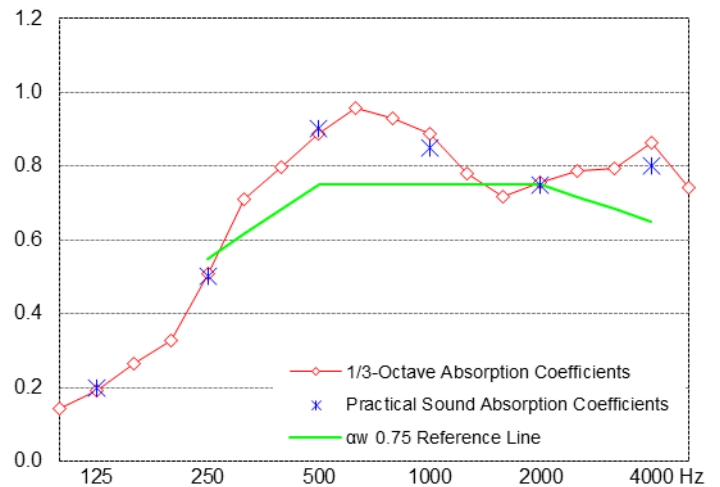
Perforated face of test specimen



Test specimen arranged for test

Measurement Details & Results

Freq Hz	Absorption coefficient		Reverberation times, T ₆₀ (sec)	
	α _s	α _p	Empty room	with Specimen
100	0.14		6.49	4.97
125	0.19	0.20	7.32	5.01
160	0.26		7.51	4.54
200	0.33		7.17	4.04
250	0.51	0.50	6.67	3.15
315	0.71		7.02	2.66
400	0.80		6.60	2.42
500	0.89	0.90	6.13	2.20
630	0.96		6.12	2.09
800	0.93		5.78	2.09
1000	0.89	0.85	5.43	2.10
1250	0.78		4.92	2.17
1600	0.72		4.56	2.19
2000	0.76	0.75	4.01	2.01
2500	0.79		3.50	1.83
3150	0.79		3.05	1.69
4000	0.86	0.80	2.54	1.47
5000	0.74		2.01	1.34



Performance Indices^{2,3}

α_w = 0.75
SAA = 0.76
NRC = 0.75

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	4 Oct 2016	4 Oct 2016
Temperature & humidity:	13 °C, 66 % R.H.	14 °C, 66 % R.H.
Atmospheric pressure:	992 mBar	987 mBar

Notes, Deviations etc

- 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.
- 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.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- Temperature in the chamber, being below 15 °C during testing, is a deviation from AS ISO 354 requirements.
- This report describes the same test as AC203-01-1; test specimen being identified by another trade designation.

Issuing Authority

Signed:
Date: 18 November 2016

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
 Microphones/preamps: • Brüel & Kjær, 2 x 4166 & 2 x 4134 microphones on 2669 preamps, positioned in the room as per AS ISO 354
 Noise source: • Rola 12UX on flat 1m² baffle (up to 1.8 KHz)
 • Brüel & Kjær type HP 1000 dodecahedron (from 1.8 KHz)
 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 plasterboard faced 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



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:
AC210-02-1

Report for: Decor Systems
6 Millenium Court, Silverwater, NSW 2128

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: 3.6 x 3.0 m = 10.8 m²]

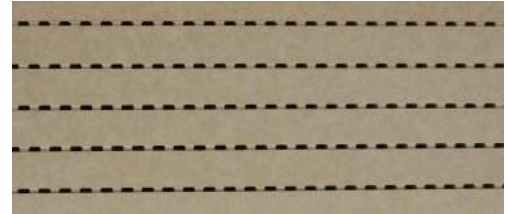
Description: DecorLini DL36 - 432 acoustic room lining slats, backed with acoustic backing fabric, with an air cavity behind. Test configuration type E-105.

Material Details:

- DecorLini DL36 - 432 Slats. 16 mm thick MDF slats with a grooved front face (4 mm wide x 4 mm deep grooves at 32 mm pitch), meeting an array of 10 mm holes behind, backed with Sonus 2.0 fabric. Slats with a tongue and groove edge profile (128 mm coverage width per slat). Open area of perforated face approx 7.6 %.

Installation:

- The test specimen was installed on the floor of the laboratory with the exposed face on top.
- A 100 mm high perimeter enclosure of 32 mm thick MDF board (approx 23 kg/m²) was constructed and placed on the concrete floor of the chamber, not parallel to the walls.
- An arrangement of internal support members was set up in the perimeter enclosure and the cavity enclosed by it, to enable the test specimen material to be laid on top in an arrangement acoustically equivalent to a normal installation. The supporting members were kept to a minimum; not dividing the cavity into multiple sections.
- The DecorLini slats were placed on top of the supports and mated together with their tongue and groove edge profiles.
- The face of the DecorLini finished approximately 5 mm proud of the MDF enclosure; the laboratory inspected the installation and concluded that the perforations exposed at the edges, resting on a solid ledge underneath, should not significantly affect absorption.
- The test fixture enclosure was provided by the laboratory; additional support fixtures were provided by the client, who also carried out installation of the test specimen.



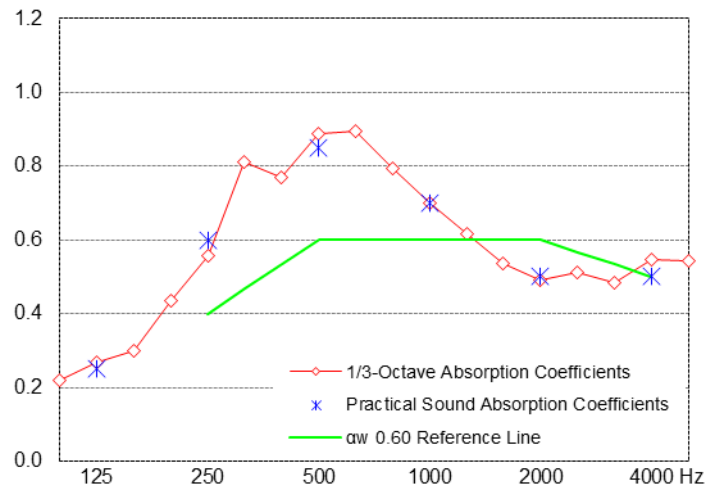
Perforated face of test specimen



Test specimen arranged for test

Measurement Details & Results

Freq Hz	Absorption coefficient		Reverberation times, T ₆₀ (sec)	
	α _s	α _p	Empty room	with Specimen
100	0.22		6.49	4.42
125	0.27	0.25	7.32	4.44
160	0.30		7.51	4.32
200	0.43		7.17	3.54
250	0.56	0.60	6.67	3.00
315	0.81		7.02	2.44
400	0.77		6.60	2.47
500	0.89	0.85	6.13	2.19
630	0.89		6.12	2.18
800	0.79		5.78	2.31
1000	0.70	0.70	5.43	2.41
1250	0.62		4.92	2.46
1600	0.54		4.56	2.53
2000	0.49	0.50	4.01	2.43
2500	0.51		3.50	2.20
3150	0.48		3.05	2.05
4000	0.55	0.50	2.54	1.74
5000	0.54		2.01	1.47



Performance Indices^{2,3}

α_w = 0.60 (M)
SAA = 0.67
NRC = 0.65

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	4 Oct 2016	4 Oct 2016
Temperature & humidity:	13 °C, 66 % R.H.	14 °C, 71 % R.H.
Atmospheric pressure:	992 mBar	987 mBar

Notes, Deviations etc

- 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.
- 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.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- Temperature in the chamber, being below 15 °C during testing, is a deviation from AS ISO 354 requirements.
- This report describes the same test as AC203-02-1; specimen being identified by another trade designation.

Issuing Authority

Signed:
Date: 18 November 2016

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
 Microphones/preamps: • Brüel & Kjær, 2 x 4166 & 2 x 4134 microphones on 2669 preamps, positioned in the room as per AS ISO 354
 Noise source: • Rola 12UX on flat 1m² baffle (up to 1.8 KHz)
 • Brüel & Kjær type HP 1000 dodecahedron (from 1.8 KHz)
 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 plasterboard faced 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

Report for: Decor Systems
6 Millenium Court, Silverwater, NSW 2128

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: 3.6 x 3.0 m = 10.8 m²]

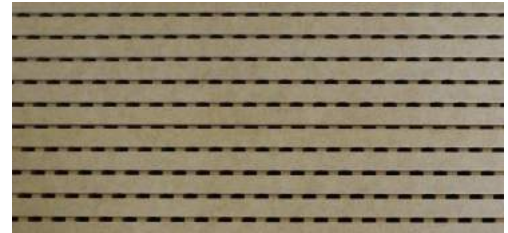
Description: DecorLini DL20 - 416 acoustic room lining slats, backed with acoustic backing fabric, with an air cavity behind. Test configuration type E-105.

Material Details:

- DecorLini DL20 - 416 Slats. 16 mm thick MDF slats with a grooved front face (4 mm wide x 4 mm deep grooves at 16 mm pitch), meeting an array of 10 mm holes behind, backed with Sonus 2.0 fabric. Slats with a tongue and groove edge profile (128 mm coverage width per slat). Open area of perforated face approx 15.2 %.

Installation:

- The test specimen was installed on the floor of the laboratory with the exposed face on top.
- A 100 mm high perimeter enclosure of 32 mm thick MDF board (approx 23 kg/m²) was constructed and placed on the concrete floor of the chamber, not parallel to the walls.
- An arrangement of internal support members was set up in the perimeter enclosure and the cavity enclosed by it, to enable the test specimen material to be laid on top in an arrangement acoustically equivalent to a normal installation. The supporting members were kept to a minimum; not dividing the cavity into multiple sections.
- The DecorLini slats were placed on top of the supports and mated together with their tongue and groove edge profiles.
- The face of the DecorLini finished approximately 5 mm proud of the MDF enclosure; the laboratory inspected the installation and concluded that the perforations exposed at the edges, resting on a solid ledge underneath, should not significantly affect absorption.
- The text fixture enclosure was provided by the laboratory; additional support fixtures were provided by the client, who also carried out installation of the test specimen.



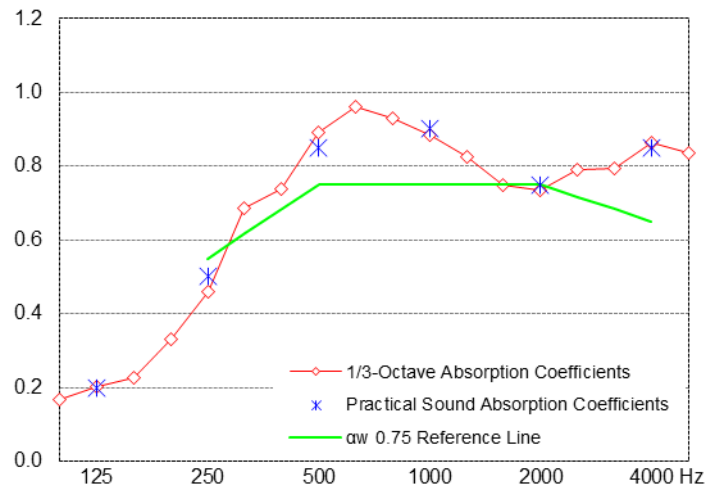
Perforated face of test specimen



Test specimen arranged for test

Measurement Details & Results

Freq Hz	Absorption coefficient		Reverberation times, T ₆₀ (sec)	
	α _s	α _p	Empty room	with Specimen
100	0.17		6.49	4.79
125	0.20	0.20	7.32	4.91
160	0.23		7.51	4.82
200	0.33		7.17	4.03
250	0.46	0.50	6.67	3.33
315	0.69		7.02	2.72
400	0.74		6.60	2.54
500	0.89	0.85	6.13	2.19
630	0.96		6.12	2.09
800	0.93		5.78	2.09
1000	0.88	0.90	5.43	2.10
1250	0.83		4.92	2.11
1600	0.75		4.56	2.15
2000	0.73	0.75	4.01	2.04
2500	0.79		3.50	1.83
3150	0.79		3.05	1.69
4000	0.86	0.85	2.54	1.47
5000	0.83		2.01	1.29



Performance Indices^{2,3}

α_w = 0.75
SAA = 0.75
NRC = 0.75

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	4 Oct 2016	4 Oct 2016
Temperature & humidity:	13 °C, 66 % R.H.	14 °C, 66 % R.H.
Atmospheric pressure:	992 mBar	987 mBar

Notes, Deviations etc

- 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.
- 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.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- Temperature in the chamber, being below 15 °C during testing, is a deviation from AS ISO 354 requirements.
- This report describes the same test as AC203-03-1; test specimen being identified by another trade designation.

Issuing Authority

Signed:
Date: 18 November 2016

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • Brüel & Kjær, 2 x 4166 & 2 x 4134 microphones on 2669 preamps, positioned in the room as per AS ISO 354
Noise source: • Rola 12UX on flat 1m² baffle (up to 1.8 KHz)
• Brüel & Kjær type HP 1000 dodecahedron (from 1.8 KHz)
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 plasterboard faced 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



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:
AC210-04-1

Report for: Decor Systems
6 Millenium Court, Silverwater, NSW 2128

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: 3.6 x 3.0 m = 10.8 m²]

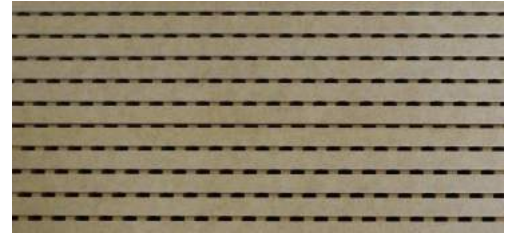
Description: DecorLini DL10 - 280 acoustic room lining slats, backed with acoustic backing fabric and 50 mm thick 32 kg/m³ polyester sound absorbing blanket, with an air cavity behind. Test configuration type E-105.

Material Details:

- a) DecorLini DL10 - 280 Slats. 16 mm thick MDF slats with a grooved front face (2 mm wide x 4 mm deep grooves at 8 mm pitch), meeting an array of 10 mm holes behind, backed with Sonus 2.0 fabric. Slats with a tongue and groove edge profile (128 mm coverage width per slat). Open area of perforated face approx 7.7 %.
- b) Polyester sound absorbing blanket, 50 mm thick, 32 kg/m³.

Installation:

- The test specimen was installed on the floor of the laboratory with the exposed face on top.
- A 100 mm high perimeter enclosure of 32 mm thick MDF board (approx 23 kg/m²) was constructed and placed on the concrete floor of the chamber, not parallel to the walls.
- An arrangement of internal support members was set up in the perimeter enclosure and the cavity enclosed by it, to enable the test specimen materials to be laid on top in an arrangement acoustically equivalent to a normal installation. The supporting members were kept to a minimum; not dividing the cavity into multiple sections.
- A combination of solid supports and tensioned strings was used to suspend the blanket, item b) immediately behind the DecorLini slats, item a), which were placed on top and mated together with their tongue and groove edge profiles.
- The face of the DecorLini finished approximately 5 mm proud of the MDF enclosure; the laboratory inspected the installation and concluded that the perforations exposed at the edges, resting on a solid ledge underneath, should not significantly affect absorption.
- The test fixture enclosure was provided by the laboratory; additional support fixtures were provided by the client, who also carried out installation of the test specimen.



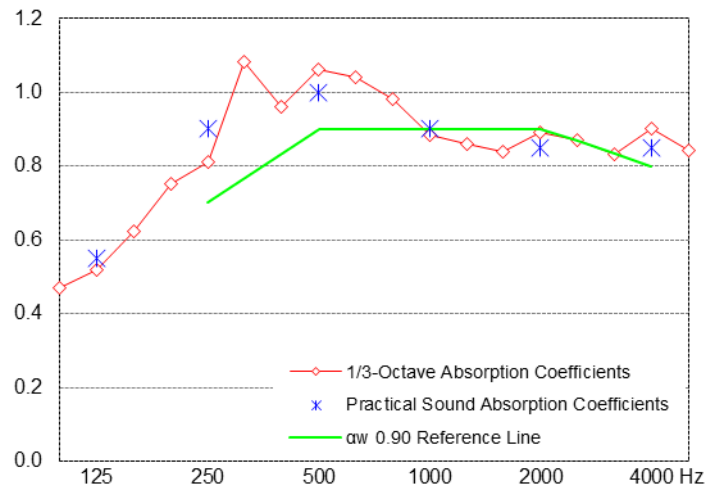
Perforated face of test specimen



Test specimen arranged for test

Measurement Details & Results

Freq Hz	Absorption coefficient		Reverberation times, T ₆₀ (sec)	
	α _s	α _p	Empty room	with Specimen
100	0.47		6.49	3.23
125	0.52	0.55	7.32	3.25
160	0.62		7.51	2.95
200	0.75		7.17	2.58
250	0.81	0.90	6.67	2.40
315	1.08		7.02	2.01
400	0.96		6.60	2.14
500	1.06	1.00	6.13	1.95
630	1.04		6.12	1.98
800	0.98		5.78	2.02
1000	0.88	0.90	5.43	2.10
1250	0.86		4.92	2.06
1600	0.84		4.56	2.02
2000	0.89	0.85	4.01	1.84
2500	0.87		3.50	1.75
3150	0.83		3.05	1.66
4000	0.90	0.85	2.54	1.44
5000	0.84		2.01	1.28



Performance Indices^{2,3}

α_w = 0.90
SAA = 0.92
NRC = 0.90

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	4 Oct 2016	4 Oct 2016
Temperature & humidity:	13 °C, 66 % R.H.	14 °C, 66 % R.H.
Atmospheric pressure:	992 mBar	987 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 may be as per client or supplier's advice; not necessarily verified by CSIRO.
5. Temperature in the chamber, being below 15 °C during testing, is a deviation from AS ISO 354 requirements.
6. This report describes the same test as AC203-04-1; test specimen being identified by another trade designation.

Issuing Authority

Signed:
Date: 18 November 2016

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
 Microphones/preamps: • Brüel & Kjær, 2 x 4166 & 2 x 4134 microphones on 2669 preamps, positioned in the room as per AS ISO 354
 Noise source: • Rola 12UX on flat 1m² baffle (up to 1.8 KHz)
 • Brüel & Kjær type HP 1000 dodecahedron (from 1.8 KHz)
 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 plasterboard faced 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



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:
AC210-05-1

Report for: Decor Systems
6 Millenium Court, Silverwater, NSW 2128

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: 3.6 x 3.0 m = 10.8 m²]

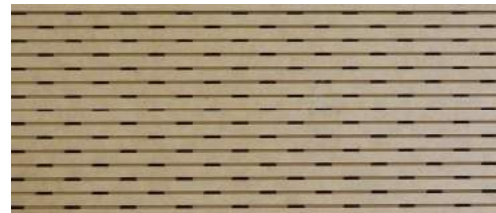
Description: DecorLini DL10 - 280 acoustic room lining slats, backed with acoustic backing fabric, with an air cavity behind. Test configuration type E-415.

Material Details:

- DecorLini DL10 - 280 Slats. 16 mm thick MDF slats with a grooved front face (2 mm wide x 4 mm deep grooves at 8 mm pitch), meeting an array of 10 mm holes behind, backed with Sonus 2.0 fabric. Slats with a tongue and groove edge profile (128 mm coverage width per slat). Open area of perforated face approx 7.7 %.

Installation:

- The test specimen was installed on the floor of the laboratory with the exposed face on top.
- A 400 mm high perimeter enclosure of 32 mm thick MDF board (approx 23 kg/m²) was constructed and placed on the concrete floor of the chamber, not parallel to the walls.
- An arrangement of internal support members was set up in the perimeter enclosure and the cavity enclosed by it, to enable the test specimen material to be laid on top in an arrangement acoustically equivalent to a normal installation. The supporting members were kept to a minimum; not dividing the cavity into multiple sections.
- The DecorLini slats were placed on top of the supports and mated together with their tongue and groove edge profiles.
- The face of the DecorLini finished approximately 15 mm proud of the MDF enclosure; the laboratory inspected the installation and concluded that the perforations exposed at the edges, resting on a solid ledge underneath, should not significantly affect absorption.
- The test fixture enclosure was provided by the laboratory; additional support fixtures were provided by the client, who also carried out installation of the test specimen.



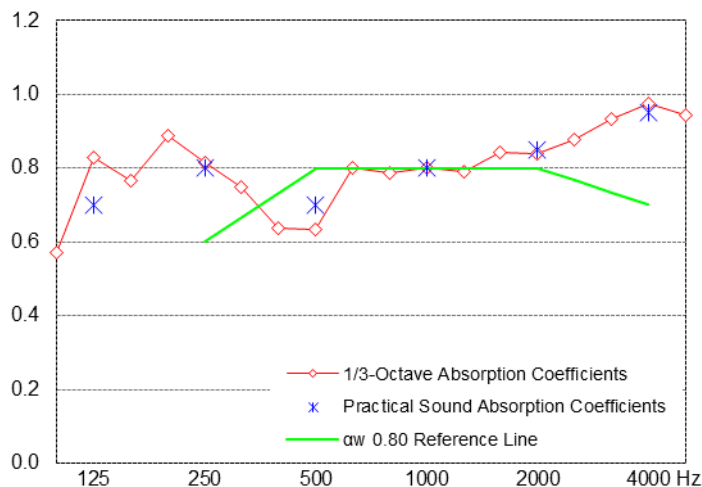
Perforated face of test specimen



Test specimen arranged for test

Measurement Details & Results

Freq Hz	Absorption coefficient		Reverberation times, T ₆₀ (sec)	
	α_s	α_p	Empty room	with Specimen
100	0.57		6.49	2.89
125	0.83	0.70	7.32	2.41
160	0.77		7.51	2.56
200	0.89		7.17	2.28
250	0.81	0.80	6.67	2.36
315	0.75		7.02	2.54
400	0.64		6.60	2.74
500	0.64	0.70	6.13	2.65
630	0.80		6.12	2.31
800	0.79		5.78	2.29
1000	0.80	0.80	5.43	2.20
1250	0.79		4.92	2.13
1600	0.84		4.56	1.98
2000	0.84	0.85	4.01	1.88
2500	0.88		3.50	1.71
3150	0.93		3.05	1.55
4000	0.97	0.95	2.54	1.38
5000	0.94		2.01	1.21



Performance Indices^{2,3}

$\alpha_w = 0.80$ (H)
SAA = 0.79
NRC = 0.75

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	4 Oct 2016	4 Oct 2016
Temperature & humidity:	13 °C, 66 % R.H.	15 °C, 55 % R.H.
Atmospheric pressure:	992 mBar	988 mBar

Notes, Deviations etc

- 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.
- 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.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- Temperature in the chamber, being below 15 °C during testing, is a deviation from AS ISO 354 requirements.
- This report describes the same test as AC203-05-1; test specimen being identified by another trade designation.

Issuing Authority

Signed:
Date: 18 November 2016

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
 Microphones/preamps: • Brüel & Kjær, 2 x 4166 & 2 x 4134 microphones on 2669 preamps, positioned in the room as per AS ISO 354
 Noise source: • Rola 12UX on flat 1m² baffle (up to 1.8 KHz)
 • Brüel & Kjær type HP 1000 dodecahedron (from 1.8 KHz)
 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 plasterboard faced 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

Report for: Decor Systems
6 Millenium Court, Silverwater, NSW 2128

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: 3.6 x 3.0 m = 10.8 m²]

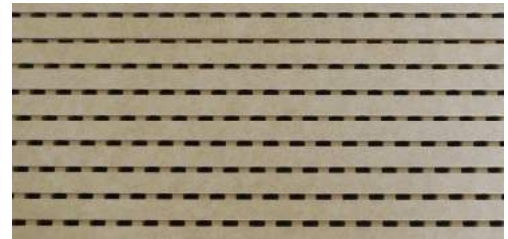
Description: DecorLini DL20 - 416 acoustic room lining slats, backed with acoustic backing fabric, with an air cavity behind. Test configuration type E-415.

Material Details:

- DecorLini DL20 - 416 Slats. 16 mm thick MDF slats with a grooved front face (4 mm wide x 4 mm deep grooves at 16 mm pitch), meeting an array of 10 mm holes behind, backed with Sonus 2.0 fabric. Slats with a tongue and groove edge profile (128 mm coverage width per slat). Open area of perforated face approx 15.2 %.

Installation:

- The test specimen was installed on the floor of the laboratory with the exposed face on top.
- A 400 mm high perimeter enclosure of 32 mm thick MDF board (approx 23 kg/m²) was constructed and placed on the concrete floor of the chamber, not parallel to the walls.
- An arrangement of internal support members was set up in the perimeter enclosure and the cavity enclosed by it, to enable the test specimen material to be laid on top in an arrangement acoustically equivalent to a normal installation. The supporting members were kept to a minimum; not dividing the cavity into multiple sections.
- The DecorLini slats were placed on top of the supports and mated together with their tongue and groove edge profiles.
- The face of the DecorLini finished approximately 15 mm proud of the MDF enclosure; the laboratory inspected the installation and concluded that the perforations exposed at the edges, resting on a solid ledge underneath, should not significantly affect absorption.
- The text fixture enclosure was provided by the laboratory; additional support fixtures were provided by the client, who also carried out installation of the test specimen.



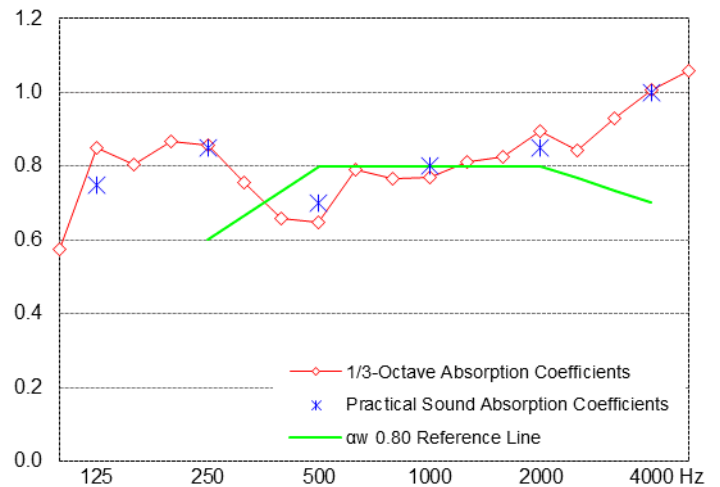
Perforated face of test specimen



Test specimen arranged for test

Measurement Details & Results

Freq Hz	Absorption coefficient		Reverberation times, T ₆₀ (sec)	
	α _s	α _p	Empty room	with Specimen
100	0.58		6.49	2.87
125	0.85	0.75	7.32	2.37
160	0.80		7.51	2.48
200	0.87		7.17	2.32
250	0.86	0.85	6.67	2.28
315	0.75		7.02	2.52
400	0.66		6.60	2.68
500	0.65	0.70	6.13	2.62
630	0.79		6.12	2.33
800	0.77		5.78	2.32
1000	0.77	0.80	5.43	2.25
1250	0.81		4.92	2.10
1600	0.82		4.56	2.01
2000	0.90	0.85	4.01	1.81
2500	0.84		3.50	1.75
3150	0.93		3.05	1.55
4000	1.01	1.00	2.54	1.36
5000	1.06		2.01	1.16



Performance Indices^{2,3}

α_w = 0.80 (L,H)
SAA = 0.79
NRC = 0.80

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	4 Oct 2016	4 Oct 2016
Temperature & humidity:	13 °C, 66 % R.H.	15 °C, 53 % R.H.
Atmospheric pressure:	992 mBar	989 mBar

Notes, Deviations etc

- 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.
- 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.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- Temperature in the chamber, being below 15 °C during testing, is a deviation from AS ISO 354 requirements.
- This report describes the same test as AC203-06-1; test specimen being identified by another trade designation.

Issuing Authority

Signed:
Date: 18 November 2016

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • Brüel & Kjær, 2 x 4166 & 2 x 4134 microphones on 2669 preamps, positioned in the room as per AS ISO 354
Noise source: • Rola 12UX on flat 1m² baffle (up to 1.8 KHz)
• Brüel & Kjær type HP 1000 dodecahedron (from 1.8 KHz)
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 plasterboard faced 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