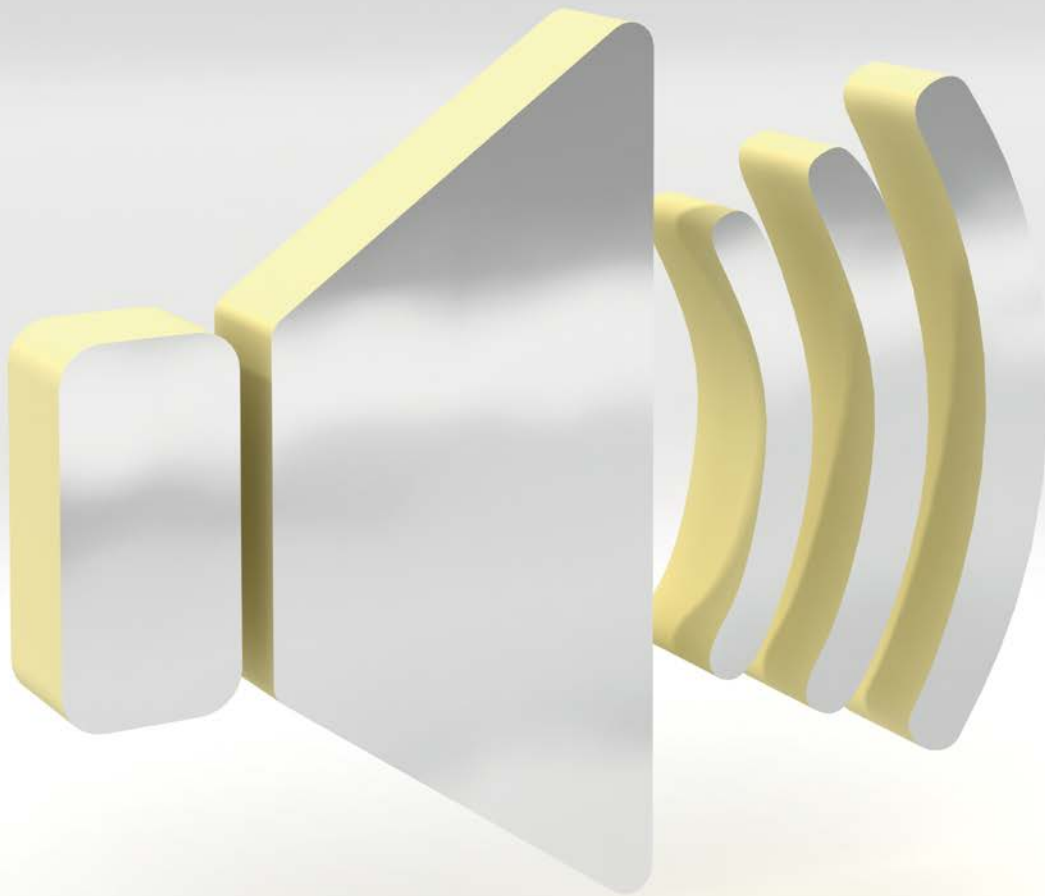




Acoustics: Airborne Sound Transmission



Introduction

This Technical Bulletin is designed to demonstrate that the effect of airborne sound transmission in both steel and plywood deck flat roofs, and steel frame walls, can be successfully mitigated by the specification of Kingspan Insulation products. It also demonstrates that the introduction of a 24 mm mineral fibre ceiling tile can significantly improve the acoustic performance in a *Kingspan Thermaroof*[®] build-up.

The installation of ceiling tiles is also likely to further reduce airborne sound transmission in the tested *Kingspan OPTIM-R*[®] configuration, but any additional layers and subsequent benefit would need to be determined by a qualified acoustician.

As the specification of ceiling tiles does not normally form part of the roof build-up, the acoustic benefits may not be accounted for at the design stage.

This data is particularly useful in relation to the design of both school and healthcare buildings to help ensure acceptable indoor noise levels. The performance standards for school buildings are set out in Building Bulletin 93 and for healthcare buildings in Healthcare Technical Memorandum 08-01.

A series of tests with *Kingspan Thermaroof*[®] insulation products were conducted in accordance with BS EN ISO 140-3:1995, BS 2750:Part 3:1995 and BS EN ISO 140-6:1998. Another series of tests with *Kingspan OPTIM-R*[®] Vacuum Insulation Panels were conducted in accordance with BS EN ISO 10140-2:2010 and BS EN ISO 717-1:2013. All tests were carried out at SRL's laboratory at Holbrook House, Sudbury, Suffolk, to determine the airborne sound transmission of various roof build-ups. Assessments were then made based on *Kingspan Thermaroof*[®] results with the addition of mineral fibre ceiling tiles.

A series of tests with *Kingspan Kooltherm*[®] K15 Rainscreen Board and *Kingspan Kooltherm*[®] K5 External Wall Board were conducted in accordance with BS EN ISO 140-3:1995 and BS EN ISO 717-1:1997 at the BRE in Garston, Watford, Hertfordshire, to determine the airborne sound transmission of various steel frame wall build-ups.

The results from these tests can be used by acoustic consultants to calculate acoustic conditions to meet the LAeq performance standards and criteria set out in the performance standard documents referred to above. These calculations are complex and consider variables including room volumes, surfaces and finishes, roof / ceiling area, and reverberation data.

Definitions used in this Technical Bulletin

Airborne Sound Transmission Sound waves travel through the air and reach a building element, causing vibration. These vibrations travel through the element and are radiated out the other side.

dB – Decibels Logarithmic ratio unit of measure used in acoustics to measure sound power, pressure, intensity, and many other concepts.

R_w – Weighted Sound Reduction Index (dB) A single number quantity, which characterises the airborne sound insulation of a material or building element over a range of frequencies.

L_{Aeq} – Equivalent A-weighted Sound Pressure (indoor ambient noise) Level (dB) Sound pressure is the fluctuation in air pressure from steady atmospheric pressure due to sound. It is measured in Pascals (Pa).

Conclusions

- Airborne sound transmission can be mitigated by simple roof build-ups insulated with *Kingspan Thermaroof*[®] and *Kingspan OPTIM-R*[®] flat roof insulation products.
- The addition of a 24 mm mineral fibre ceiling tile in a *Kingspan Thermaroof*[®] build-up, (which is often not specified in a roof build-up as it is part of the internal fit-out), results in significantly improved performance.
- Airborne sound transmission can be mitigated by steel frame wall build-ups insulated with *Kingspan Kooltherm*[®] K15 Rainscreen Board and *Kingspan Kooltherm*[®] K5 External Wall Board.

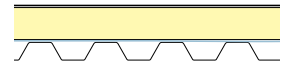
If you would like more information or to discuss anything you have read in this Technical Bulletin, please contact us by e-mailing: acoustics@kingspaninsulation.co.uk

Appendix - Airborne Sound Transmission Data

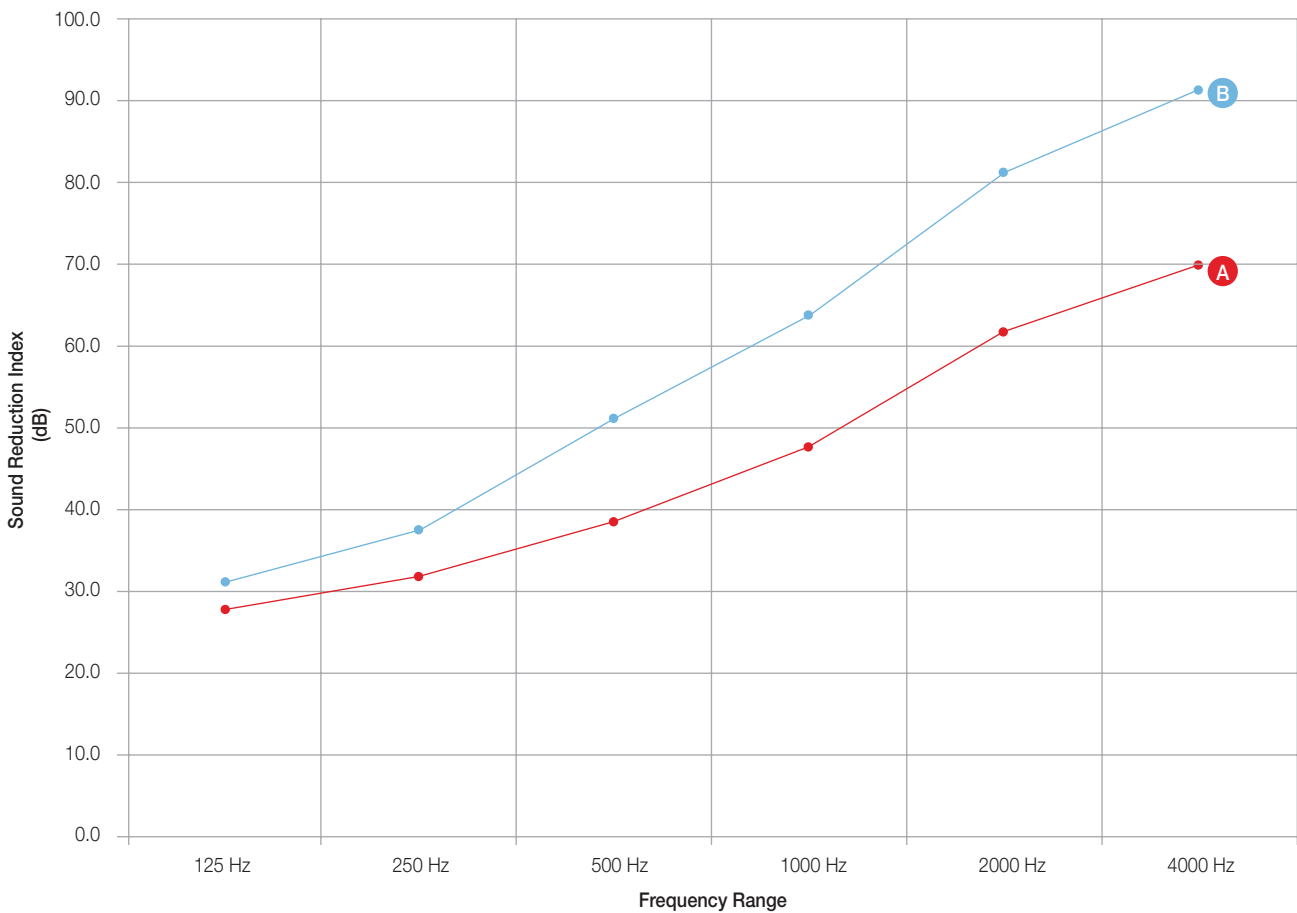
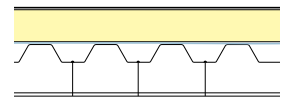
Test 1

Construction Tested and Assessed

A Single ply membrane, 2 x 10 Kg/m² acoustic sheets, 80 mm *Kingspan Thermaroof*[®] TR26 LPC/FM, 2 x 10 Kg/m² acoustic sheets and a galvanized metal deck



B Same as above with correction for 24 mm mineral fibre ceiling tile (8.23 Kg/m²) with a 300 mm ceiling void



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	28.4	31.2	39.8	48.5	61.2	70	(SRL Test 36 Report No. C/00/5L/7950/1)
B	31	38	51	65	81	91	(Predicted – SRL Report No. C/40269)

*Assessment carried out by Sound Research Laboratories.

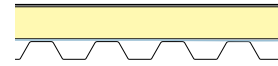
A – weighted Sound Reduction Index (R_W)

Test	R _W (dB)
A	44
B	51

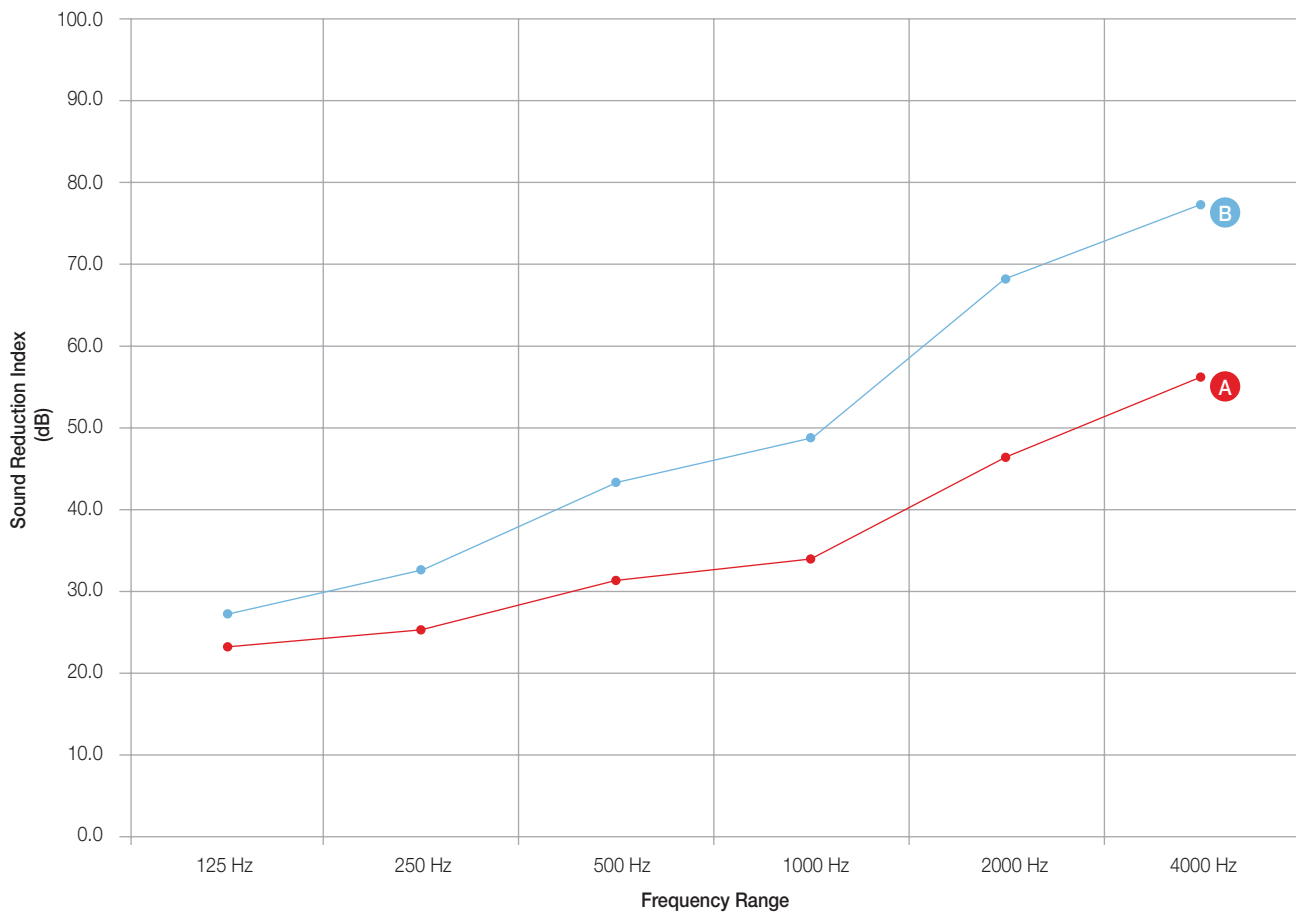
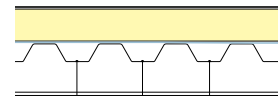
Test 2

Construction Tested and Assessed

A Single ply membrane, 85 mm *Kingspan Thermaroof*® TR26 LPC/FM, 10 mm Rubbertech R10 and a galvanized metal deck



B Same as above with correction for 24 mm mineral fibre ceiling tile (8.23 Kg/m²) with a 300 mm ceiling void



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	23.7	25.2	31.8	33.3	47.7	56.1	(SRL Test 4 Report No. C/03/5L/0830/2)
B	27	32	43	49	68	77	(Predicted – SRL Report No. C/40269)

*Assessment carried out by Sound Research Laboratories.

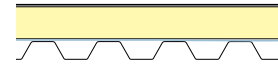
A – weighted Sound Reduction Index (R_w)

Test	R _w (dB)
A	35
B	45

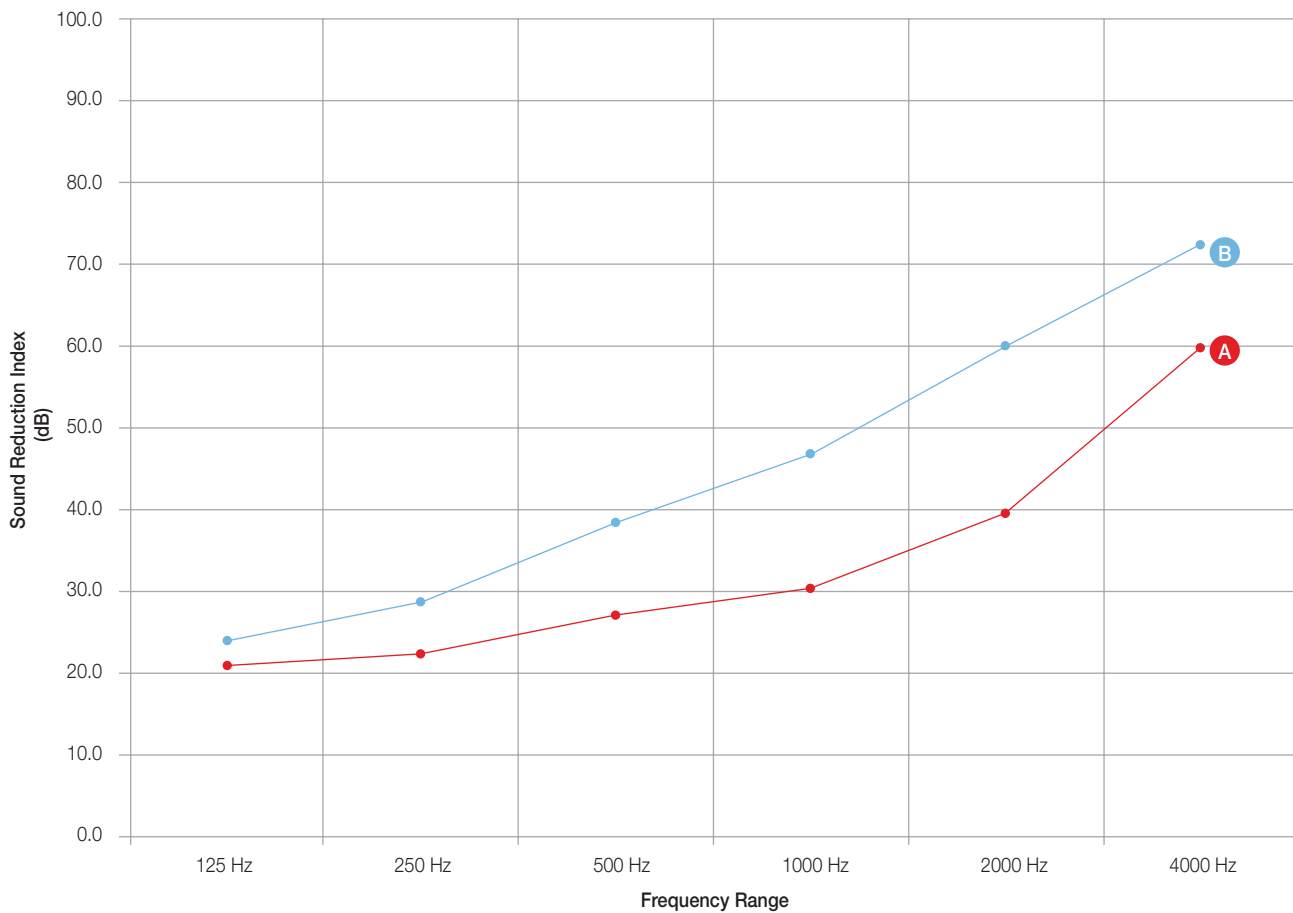
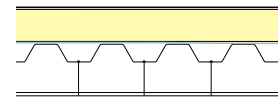
Test 3

Construction Tested and Assessed

A Single ply membrane, 80 mm *Kingspan Thermaroof*® TR26 LPC/FM, 5 Kg/m² acoustic sheet and a galvanized metal deck



B Same as above with correction for 24 mm mineral fibre ceiling tile (8.23 Kg/m²) with a 300 mm ceiling void



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	21.4	22.4	26.9	30.6	39.9	50.9	(SRL Test 39 Report No. C/00/5L/7950/1)
B	24	29	38	47	60	72	(Predicted – SRL Report No. C/40269)

*Assessment carried out by Sound Research Laboratories.

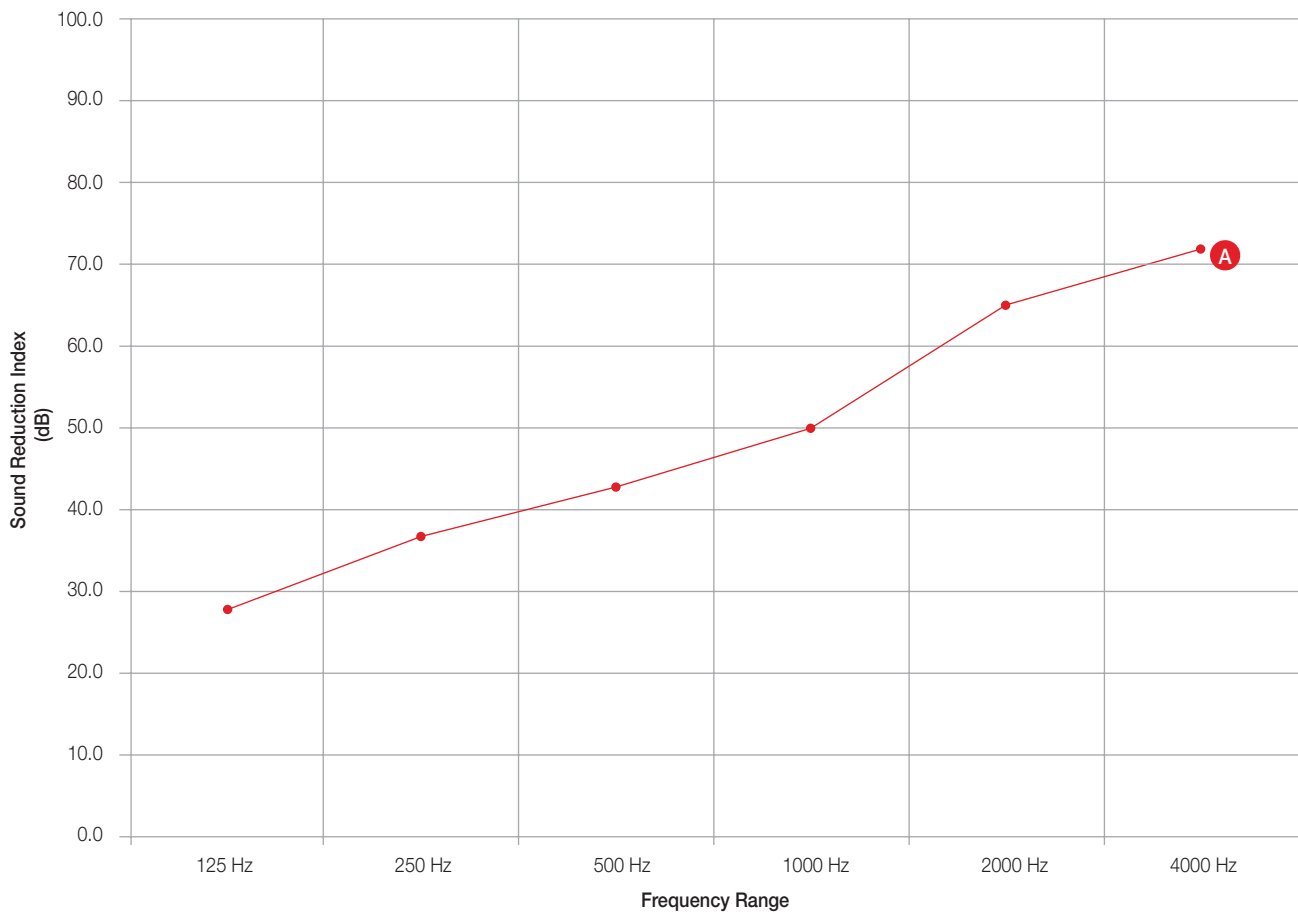
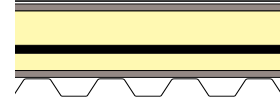
A – weighted Sound Reduction Index (R_W)

Test	R _W (dB)
A	31
B	41

Test 4

Construction Tested

- A** Fleece-backed single ply membrane, 2 x 10 mm cement particle board, 100mm *Kingspan Thermaroof*® TR26/27 LPC/FM, 25mm open cell synthetic rubber, 50 mm *Kingspan Thermaroof*® TR26 LPC/FM, 2 x 10mm cement particle board and a galvanized metal deck



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	28.6	37.3	42.1	50.1	65.3	72.5	(SRL Test 12 Report No. C/07/5L/20025/R01)

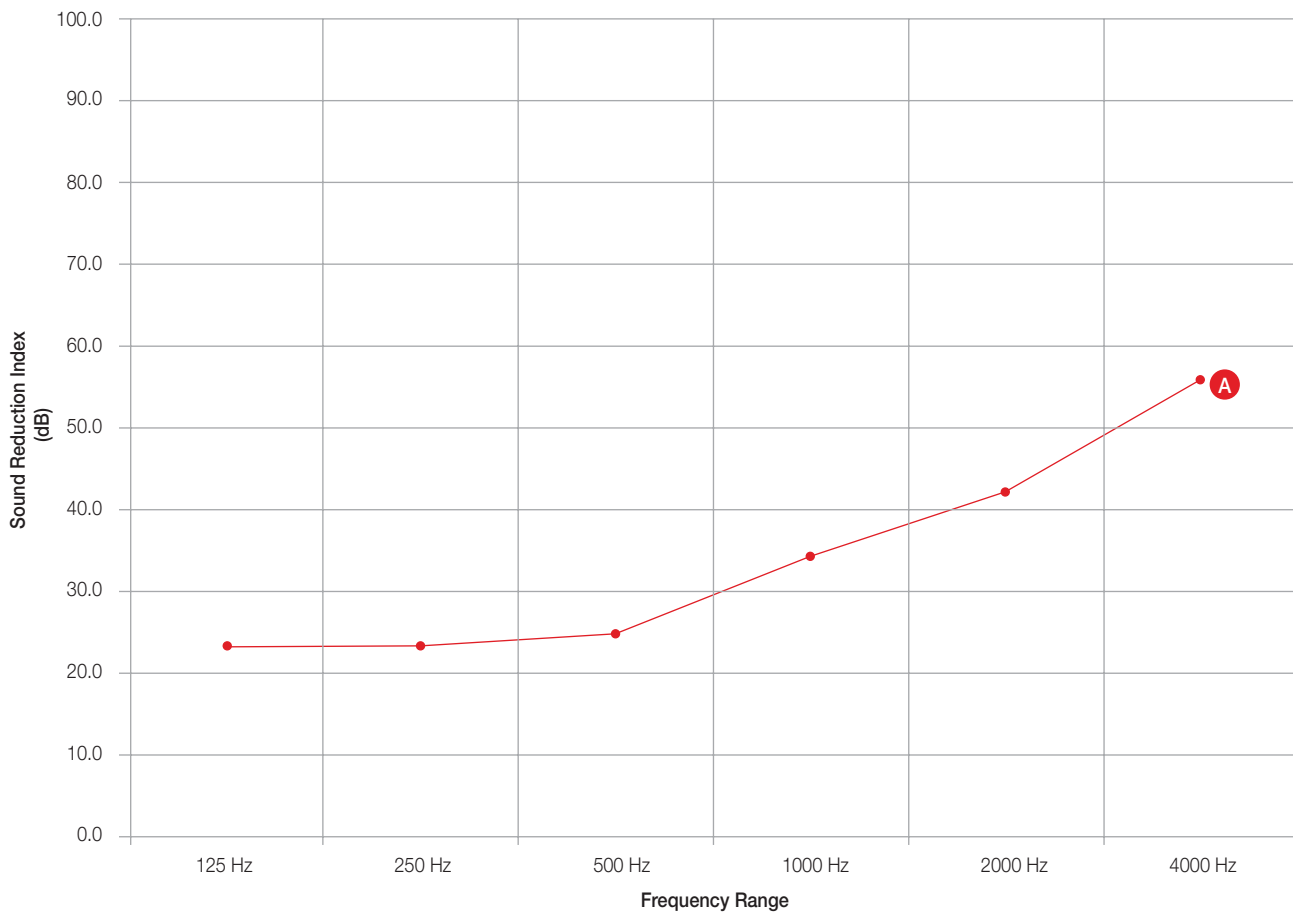
A – weighted Sound Reduction Index (R_w)

Test	R_w (dB)
A	47

Test 5

Construction Tested

- A** Single ply membrane, 25 mm *Kingspan Thermaroof*® TR27 LPC/FM overlay, 50 mm *Kingspan OPTIM-R*®, 3 mm rubber crumb, polyethylene foil vapour control layer and an 18 mm plywood deck



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	23.4	23.3	25.4	34	41.9	56.5	(SRL Test 2 Report No. C/23250/T03)

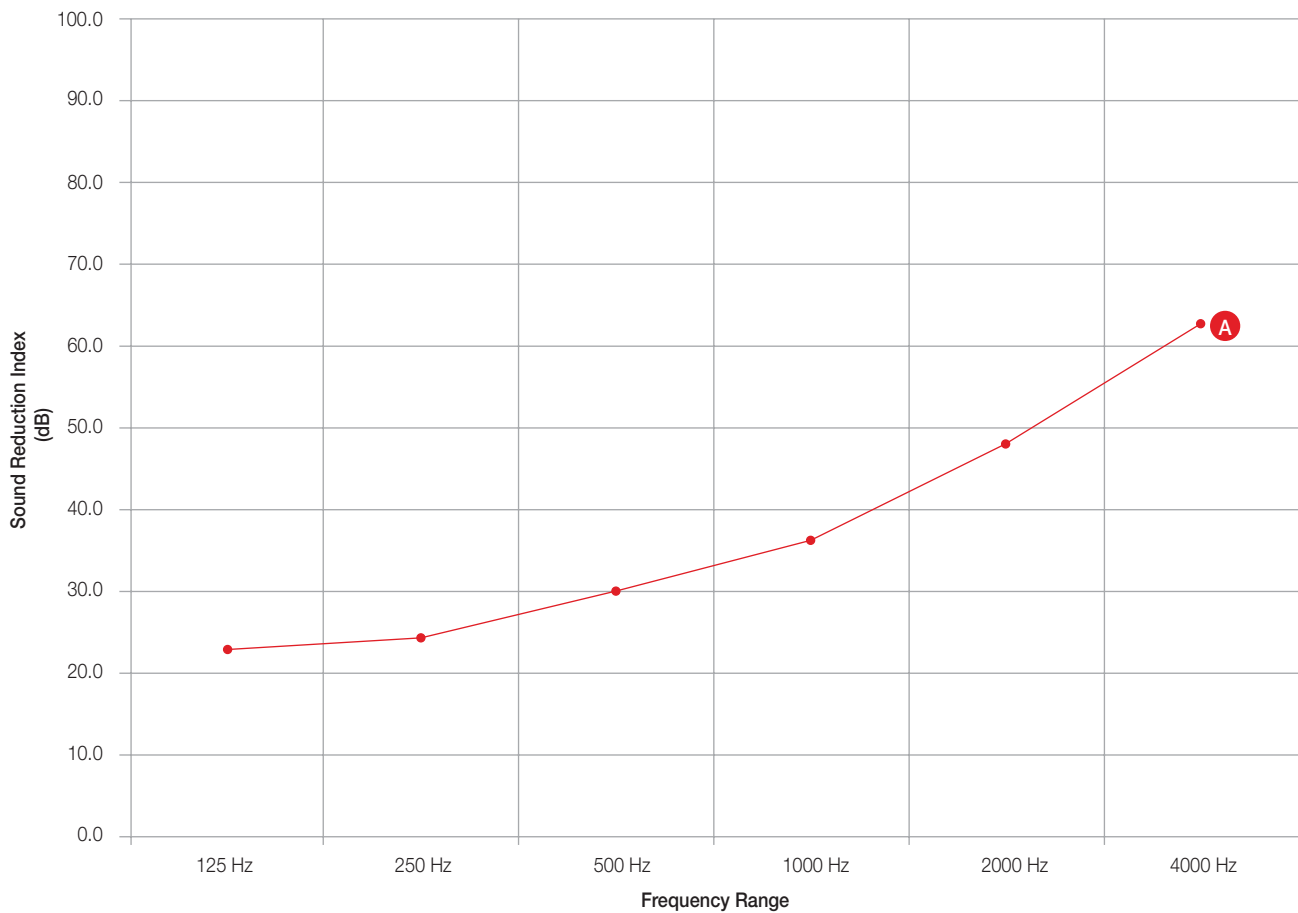
A – weighted Sound Reduction Index (R_w)

Test	R_w (dB)
A	32

Test 6

Construction Tested

A Single ply membrane, 25 mm *Kingspan Thermaroof*® TR27 LPC/FM overlay, 50 mm *Kingspan OPTIM-R*, 10 mm Rubbertech R10, polyethylene foil vapour control layer and an 18 mm plywood deck



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	23.9	24.2	30.8	37.9	48.1	62.6	(SRL Test 5 Report No. C/23250/T03)

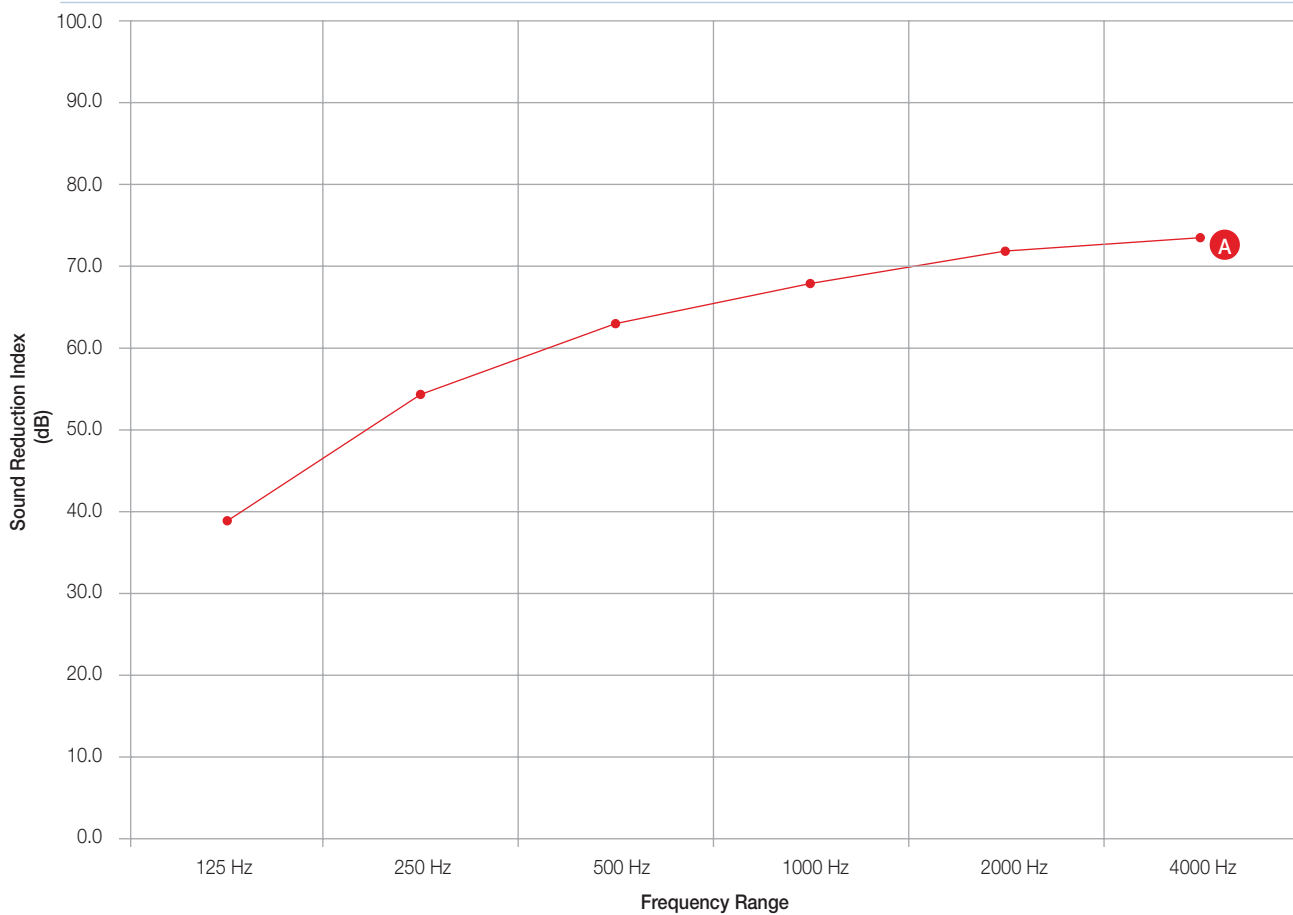
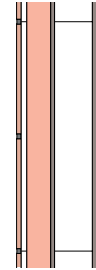
A – weighted Sound Reduction Index (R_W)

Test	R_W (dB)
A	36

Test 7

Construction Tested

- A** Brick slip cladding system supported on galvanised zed profiles at 600 mm centres, 60 mm *Kingspan Kooltherm*® K15 Rainscreen Board, 9mm cement particle board, 100 mm galvanised steel frame with 2 x 12.5 mm plasterboard, taped and skimmed



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	39	54	63.2	68.5	71.7	73.6	(BRE Test L107-076 Report No. 236234)

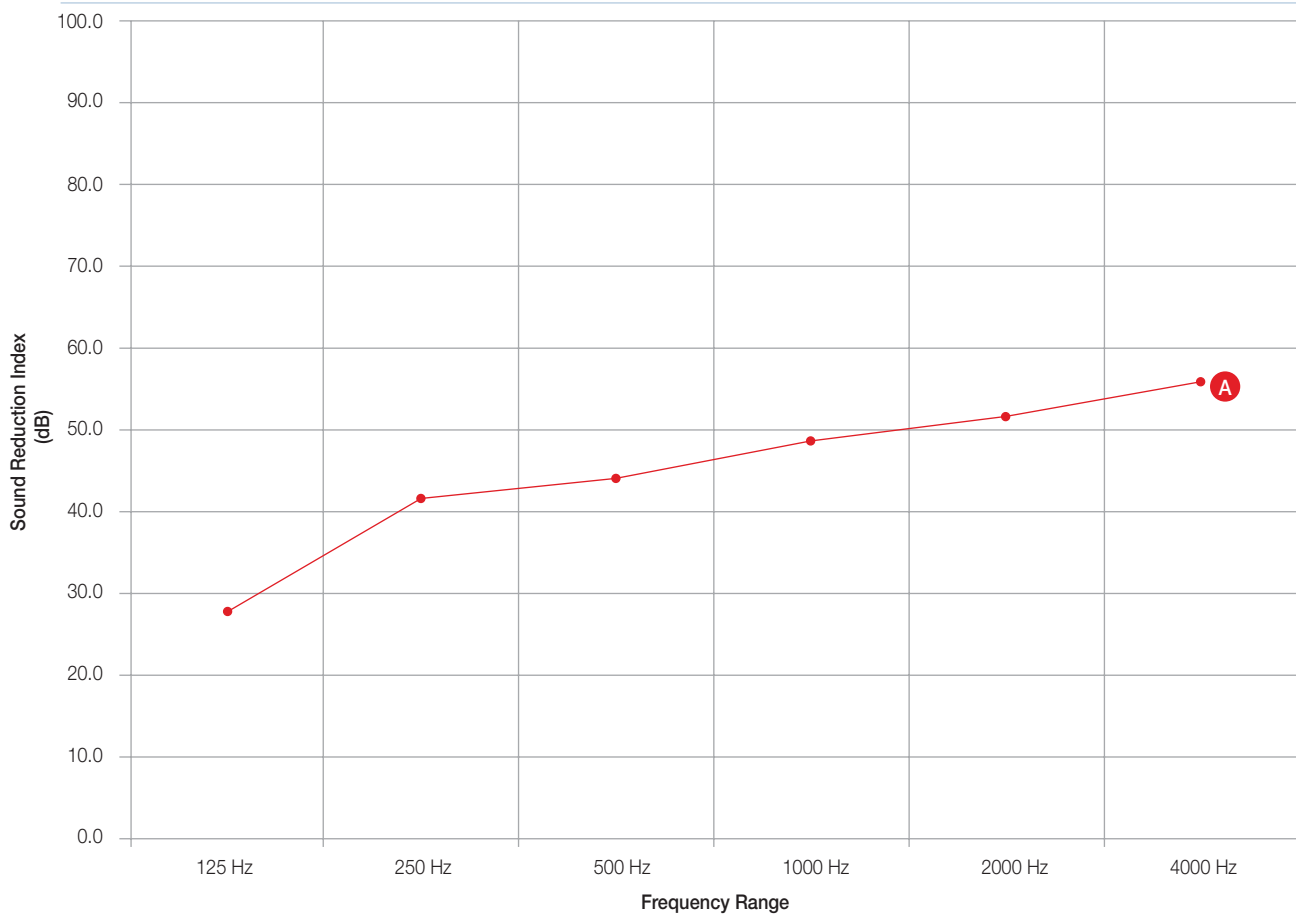
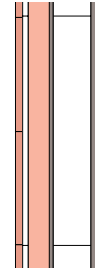
A – weighted Sound Reduction Index (R_w)

Test	R_w (dB)
A	62

Test 8

Construction Tested

- A** Rainscreen cladding system supported on brackets at 600 mm centres, 60 mm *Kingspan Kooltherm® K15 Rainscreen Board*, 9mm cement particle board, 100 mm galvanised steel frame with 2 x 15 mm plasterboard, taped and skimmed



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	28.8	42.9	44.5	49.7	52.3	56.3	(BRE Test L107-066 Report No. 236234)

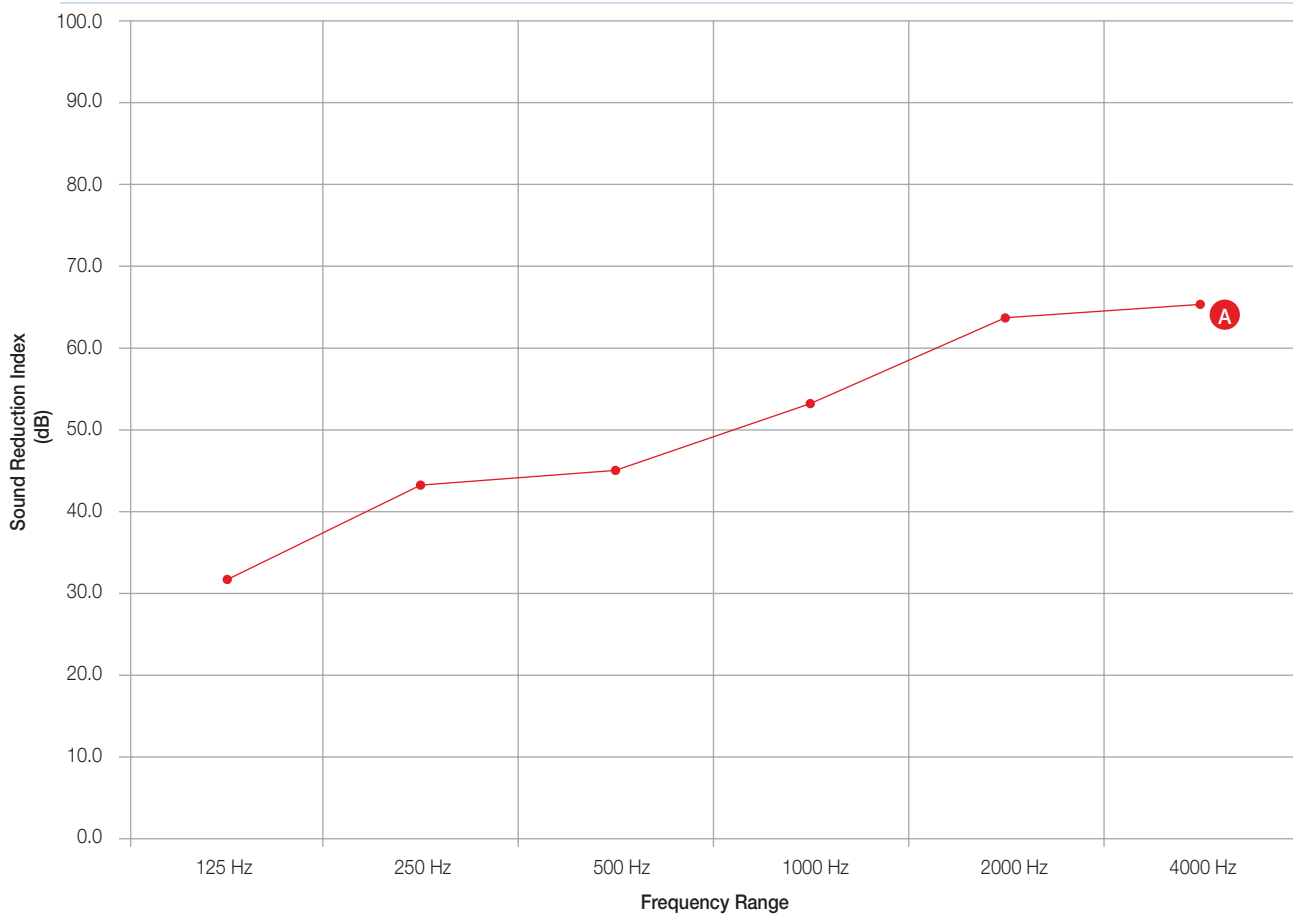
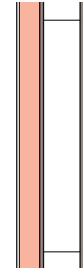
A – weighted Sound Reduction Index (R_W)

Test	R _W (dB)
A	46

Test 9

Construction Tested

- A** 6 mm polymer render, 60 mm *Kingspan Kooltherm*® K5 External Wall Board
8mm cement particle board, 100 mm galvanised steel frame with 2 x 12.5 mm
plasterboard, taped and skimmed



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	32.4	43	45.5	53.4	63.8	66.9	(BRE Test L107-049 Report No. 236234)

A – weighted Sound Reduction Index (R_w)

Test	R_w (dB)
A	50

Contact Details

Customer Service

For quotations, order placement and details of despatches please contact the Kingspan Insulation Customer Service Department on the numbers below:

UK – Tel: +44 (0) 1544 388 601
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 – www.kingspaninsulation.co.uk/literature

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For technical guidance, quotations, order placement and details of despatches please contact the Kingspan Insulation Tapered Roofing Department on the numbers below:

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Technical Advice / Design

Kingspan Insulation supports all of its products with a comprehensive Technical Advisory Service. Calculations can be carried out to provide U-values, condensation / dew point risk, required insulation thicknesses etc...

U-value calculations can also be carried out on the Kingspan Insulation U-value Calculator, available for free online at www.uvalue-calculator.co.uk or downloaded as an App.



The Kingspan Insulation Technical Service Department can also give general application advice and advice on design detailing and fixing etc... Site surveys are also undertaken as appropriate.

The Kingspan Insulation British Technical Service Department operates under a management system certified to the BBA Scheme for Assessing the Competency of Persons to Undertake U-value and Condensation Risk Calculations.



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