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MEMORANDUM

Attention:	Michael Acraman	Date:	3 Apr 2008
Company:	Thermotec Australia Pty Ltd	Pages:	1 of 13
Email:	Michael@thermotec.com.au	Document No:	50B-07-0174-TRP-420335-0
From:	William Dawson	Reviewed By:	Elizabeth Cheng
Subject:	Thermotec Impact Foam - Impact Noise Isolation Test		

CC:	Name:	Company:	Facsimile:
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This Facsimile is Commercial-in-Confidence. If this Facsimile does not reach the intended recipient, please telephone the number above (reverse charges). Thank you

Dear Sir,

Re: Thermotec Impact Foam - Impact Noise Isolation Test

VIPAC Engineers & Scientists were engaged to undertake Floor Impact Noise Isolation testing of Thermotec Impact Foam of varying thicknesses. This report documents our results from the measurements conducted on 27th March 2008 as well as assessment of the test results against BCA 2007 requirements for impact noise isolation.

1. REFERENCES

- [1] Building Code of Australia 2007.
- [2] DIN 52 210-1: August 1984 "Testing of acoustics in buildings; airborne and impact sound insulation; measurement procedures", 1984.
- [3] International Standard ISO 140-7:1998 "Acoustics – Measurement of sound isolation in buildings and of building elements" Part 7: Field measurements of impact noise insulation of floors, 1998.
- [4] International Standard ISO 717-2:1996 "Acoustics – Rating of sound insulation in buildings and of building elements" Part 2: Impact sound isolation, 1996.

2. METHODOLOGY

The impact noise isolation tests were conducted using the following equipment:

- A Bruel and Kjaer Hand-held Analyser Type 2250 Sound Level Meter (Serial Number: 2590542), due for calibration 26th July 2008. The calibration of the analyser was checked before and after the measurements using a Larson Davis Pistonphone Calibrator (LD CA 250, Serial Number: 2386), and was found to be consistent. An approved windshield was fitted at all times.
- A Bruel and Kjaer Tapping Machine Type 3207.
- A cap gun.



The tests were conducted at the Octagon Apartment Complex development site, located at 88 Hindley Street, Adelaide. The test set up consisted of a source room on Level 4 (Apartment 404) and a receiving room on Level 3 (Apartment 304). Note that the floor / ceiling arrangement between the stacked apartments as per Table 2-1. For each test sample, the Thermotec Impact Foam was laid flat on the source room slab, and the concrete plinth rested on the foam (refer to Appendix B for test setup images). Note that the foam was not adhered to the concrete slab, however we consider that laying the foam flat on the concrete slab would not significantly affect the results of the testing. The receiving room was completely enclosed (with the door shut).

Testing of the samples was conducted using a Bruel and Kjaer Tapping machine. For each of the test samples (outlined below), the tapping machine was turned on and noise levels were recorded at 5 positions within the receiving room. Reverberation times and background noise levels within the receiving room were then measured without the tapping machine active, and the weighted standardised impact sound pressure level corresponding to each test sample was calculated based on ISO 140-7 [3], DIN 52 210-1 [2] and ISO 717-2 [4]. A glossary of acoustic terminology used in this document is included in Appendix A.

Table 2-1 displays the floor samples which were tested using the method outlined above.

Table 2-1: Source room floor test conditions / test samples.

Test Sample	Floor Covering System	Base Floor / Ceiling System
Concrete Plinth (no underlay)	Tiled 40mm concrete plinth placed directly onto concrete slab	150mm concrete slab with a suspended 13mm plasterboard ceiling (100mm cavity) and ceiling overlay of 50mm, 32kg/m ³ fibreglass.
5mm Thermotec Impact Foam	Tiled 40mm concrete plinth on 5mm Thermotec Impact Foam placed onto concrete slab.	
10mm Thermotec Impact Foam	Tiled 40mm concrete plinth on 10mm Thermotec Impact Foam placed onto concrete slab.	
15mm Thermotec Impact Foam	Tiled 40mm concrete plinth on 15mm Thermotec Impact Foam placed onto concrete slab.	

3. BUILDING CODE OF AUSTRALIA

The Building Code of Australia 2007 (BCA) [1] stipulates the required Weighted Normalised Impact Sound Pressure Level with spectrum adaptation term ($L_{n,w} + C_1$) for floors between sole-occupancy units. We note the following criterion is applicable for floors in a Class 2 or 3 building (e.g. residential buildings containing 2 or more sole-occupancy units, or residential buildings including boarding houses, residential parts of a school, hotel or motel, or accommodations for the aged or people with disabilities):

- A floor in a Class 2 or 3 building must have an $L_{n,w} + C_1$ (impact) not more than 62 if it separates:
 - Sole-occupancy units, or
 - A sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.



4. TEST RESULTS

The impact test results of 4 different floor and ceiling systems are displayed in Table 4-1.

Table 4-1: Calculated impact noise, isolation class and assessment against BCA 2007 [1] requirements.

Test Sample	$L'_{nT,w}$	$L'_{nT,w} + C_I $	FIIC	BCA 2007 requirements $L'_{nT,w} + C_I \leq 62$
Bare Slab (no sample)	71	82	32	Does not comply.
Concrete Plinth (no underlay)	61	62	46	Marginally complies.
5mm Thermotec Impact Foam	51	53	54	BCA 2007 compliant.
10mm Thermotec Impact Foam	50	51	56	BCA 2007 compliant.
15mm Thermotec Impact Foam	47	47	59	BCA 2007 compliant.

Note: FIIC rating calculated using American Standard ASTM E989.

5. DISCUSSION

Based on the results summarised in Table 4-1, we comment as follows:

- The bare concrete floor slab (on which the test samples were placed) and plasterboard ceiling arrangement do not achieve the BCA requirements for $L'_{nT,w} + C_1$ not more than 62.
- The tiled concrete plinth when placed on the concrete slab will marginally achieve the BCA requirements for $L'_{nT,w} + C_1$ not more than 62.
- The 5mm, 10mm and 15mm Thermotec Impact Foam underlay samples all achieved the BCA requirements for $L'_{nT,w} + C_1$ not more than 62, and display better impact isolation performance with increased foam thickness. We therefore consider the use of Thermotec Impact Foam beneath 40mm mortar / screed will achieve a suitable level of impact vibration isolation (i.e. from footsteps, jumping) when used in kitchens, bathroom and other non-habitable areas located above a lounge room, bedroom, or otherwise habitable area of a separate apartment.

We trust that the information provided is satisfactory. However, if you have any queries or require further information, please do not hesitate to contact us.

Yours sincerely

VIPAC ENGINEERS & SCIENTISTS LTD –

William Dawson
Project Engineer



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Attachments:

Appendix A: Acoustic Terminology

Appendix B: Test Setup Images

Appendix C: Test Certificates



Appendix A: Acoustic Terminology

$L_{n,w}$	The Weighted Normalised Impact Sound Level is derived from laboratory measurements which are adjusted relative to the area of sound absorption within the receiving room. The lower the Weighted Normalised Impact Sound Level the better the impact insulation achieved.
$L'_{n,w}$	Similar to $L_{n,w}$ but derived from measurements carried out under site conditions.
$L'_{nT,w}$	Weighted, standardized impact sound pressure level, which is a single number rating of the sound level in a floor/ceiling assembly in terms of its ability to control structure-borne sound in the receiving when excited by a standard impact testing machine under field conditions. The lower the $L'_{nT,w}$ the better the acoustic performance.
C_1	Spectrum adaptation term. Note: The lower the $L'_{n,w} + C_1$ of a floor, the better the impact sound performance.
IIC	Impact Isolation Class is a single number rating that provides a means for comparing the acoustical performance of floor/ceiling assemblies when excited by impacts.
FIIC	Similar to IIC but derived from measurements carried out onsite.



Appendix B: Test Setup Images



Figure 5-1: 40mm concrete plinth on 5mm Thermotec Impact Foam sample.



Figure 5-2: 40mm concrete plinth on 10mm Thermotec Impact Foam sample.



Figure 5-3: 40mm concrete plinth on 15mm Thermotec Impact Foam sample.



Figure 5-4: Some cracking of the tiles on the concrete plinth was evident after a number of tapping tests. The tapping machine position was adjusted to not impact upon the fracture lines for subsequent tests. We do not consider the small amount of cracking to significantly affect the measurement results.



Thermotec Australia Pty Ltd

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Appendix C: Test Certificates



Standardised Impact Sound Pressure Level to ISO 140-7
Field measurements of impact sound insulation of floors

Client: Thermotec
Job Name: Thermotec Impact Foam
Job Number: 50B-07-0174

Test Sample:

40mm concrete plinth: Tiled 40mm concrete plinth placed on 150mm concrete slab with a suspended 13mm plasterboard ceiling with 100mm cavity and ceiling overlay of 50mm, 32kg/m3 fibreglass insulation.

Decription:

Conducted in testing room at Octagon Apartments, Adelaide.

Reciever room was fully enclosed.

A B&K 3207 tapping machine was placed on the test floor outlined above.

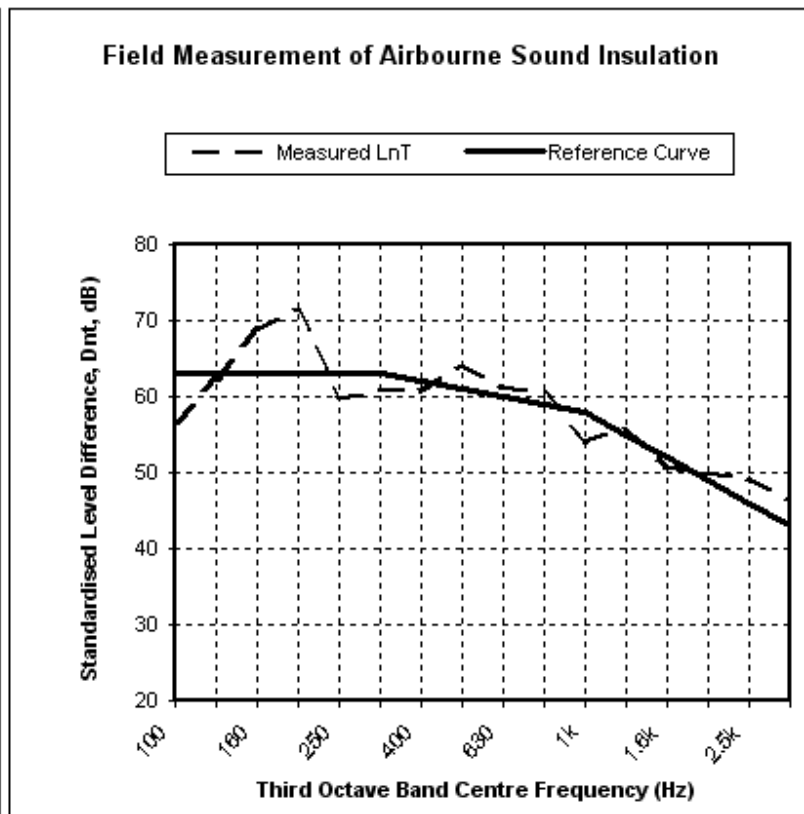
Receiving room volume: 57.3 m³

Rating according to ISO 717-2

$L_{nT,w}$: 61

C_i : -1

Centre Frequency	Measured LnT	Reference Curve	Deficiencies
Hz	dB	dB	dB
100	56.7	63.0	0.0
125	62.3	63.0	0.0
160	68.7	63.0	-5.7
200	71.7	63.0	-8.7
250	59.8	63.0	0.0
315	60.8	63.0	0.0
400	60.7	62.0	0.0
500	64.1	61.0	-3.1
630	61.4	60.0	-1.4
800	60.3	59.0	-1.3
1k	54.1	58.0	0.0
1.25k	55.8	55.0	-0.8
1.6k	50.7	52.0	0.0
2k	50.0	49.0	-1.0
2.5k	49.2	46.0	-3.2
3.15k	46.3	43.0	-3.3



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Standardised Impact Sound Pressure Level to ISO 140-7
Field measurements of impact sound insulation of floors

Client: Thermotec
Job Name: Thermotec Impact Foam
Job Number: 50B-07-0174

Test Sample:

5mm Thermotec Impact Foam: Tiled 40mm concrete plinth with 5mm Thermotec Impact Foam underlay, placed on 150mm concrete slab with a suspended 13mm plasterboard ceiling with 100mm cavity and ceiling overlay of 50mm, 32kg/m³ fibreglass insulation.

Description:

Conducted in testing room at Octagon Apartments, Adelaide.

Receiver room was fully enclosed.

A B&K 3207 tapping machine was placed on the test floor outlined above.

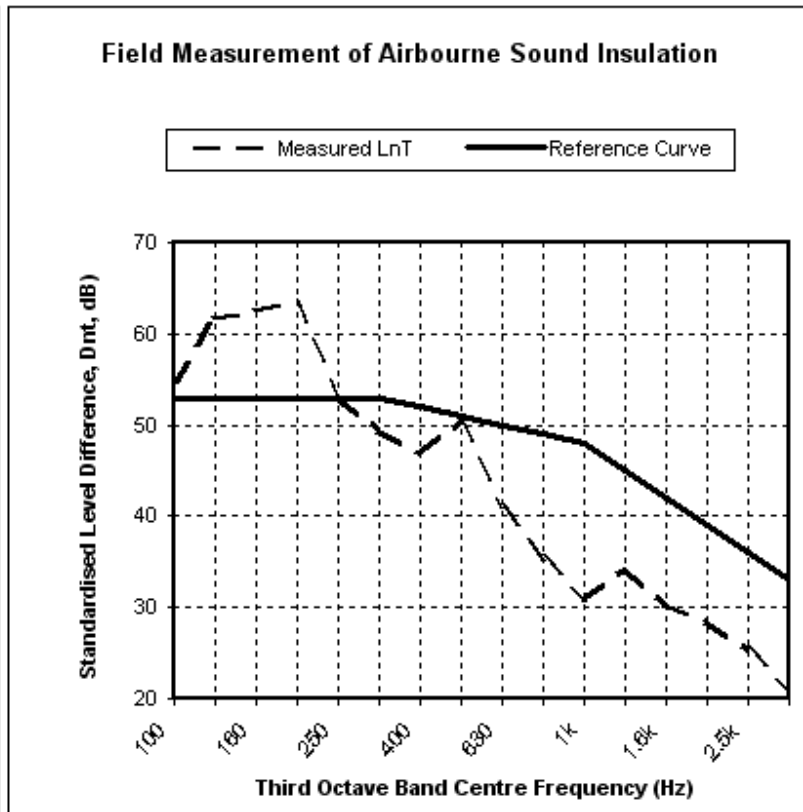
Receiving room volume: 57.3 m³

Rating according to ISO 717-2

$L_{nT,w}$: 51

C_i : 2

Centre Frequency	Measured LnT	Reference Curve	Deficiencies
Hz	dB	dB	dB
100	54.9	53.0	-1.9
125	61.6	53.0	-8.6
160	62.6	53.0	-9.6
200	63.7	53.0	-10.7
250	53.2	53.0	-0.2
315	49.5	53.0	0.0
400	47.0	52.0	0.0
500	50.5	51.0	0.0
630	40.9	50.0	0.0
800	35.4	49.0	0.0
1k	31.0	48.0	0.0
1.25k	34.2	45.0	0.0
1.6k	30.3	42.0	0.0
2k	28.6	39.0	0.0
2.5k	25.4	36.0	0.0
3.15k	20.8	33.0	0.0



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Standardised Impact Sound Pressure Level to ISO 140-7
Field measurements of impact sound insulation of floors

Client: Thermotec
Job Name: Thermotec Impact Foam
Job Number: 50B-07-0174

Test Sample:

10mm Thermotec Impact Foam: Tiled 40mm concrete plinth with 10mm Thermotec Impact Foam underlay, placed on 150mm concrete slab with a suspended 13mm plasterboard ceiling with 100mm cavity and ceiling overlay of 50mm, 32kg/m³ fibreglass insulation.

Description:

Conducted in testing room at Octagon Apartments, Adelaide.
Receiver room was fully enclosed.
A B&K 3207 tapping machine was placed on the test floor outlined above.

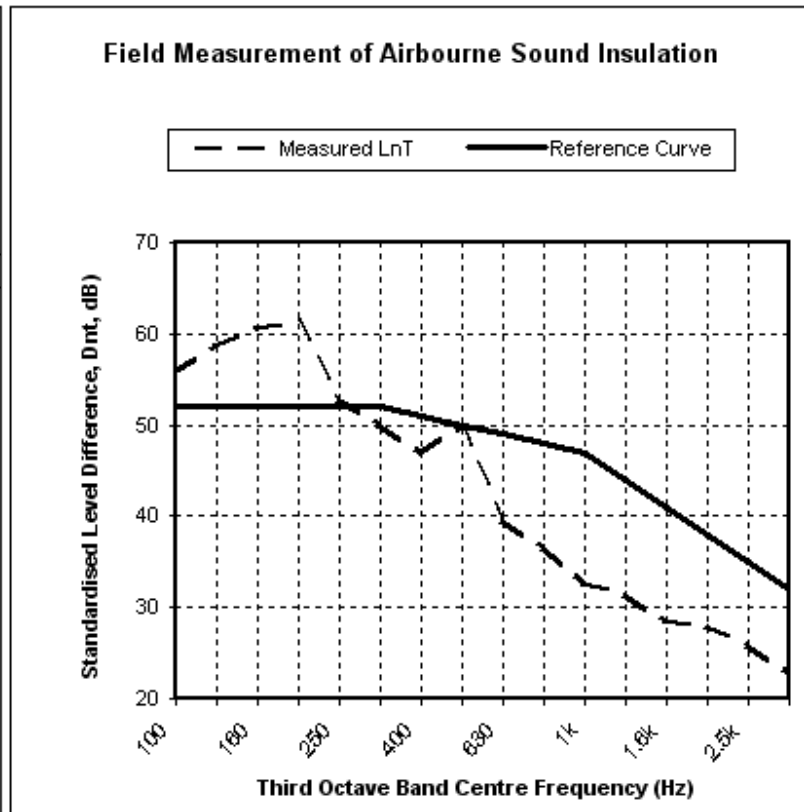
Receiving room volume: 57.3 m³

Rating according to ISO 717-2

$L_{nT,w}$: 50

C_i : 1

Centre Frequency	Measured L_{nT}	Reference Curve	Deficiencies
Hz	dB	dB	dB
100	55.8	52.0	-3.8
125	58.8	52.0	-6.8
160	60.6	52.0	-8.6
200	61.5	52.0	-9.5
250	52.8	52.0	-0.8
315	50.1	52.0	0.0
400	47.0	51.0	0.0
500	50.1	50.0	-0.1
630	39.6	49.0	0.0
800	36.7	48.0	0.0
1k	32.7	47.0	0.0
1.25k	31.6	44.0	0.0
1.6k	28.6	41.0	0.0
2k	27.9	38.0	0.0
2.5k	26.0	35.0	0.0
3.15k	22.7	32.0	0.0



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Standardised Impact Sound Pressure Level to ISO 140-7
Field measurements of impact sound insulation of floors

Client: Thermotec
Job Name: Thermotec Impact Foam
Job Number: 50B-07-0174

Test Sample:

15mm Thermotec Impact Foam: Tiled 40mm concrete plinth with 15mm Thermotec Impact Foam underlay, placed on 150mm concrete slab with a suspended 13mm plasterboard ceiling with 100mm cavity and ceiling overlay of 50mm, 32kg/m³ fibreglass insulation.

Description:

Conducted in testing room at Octagon Apartments, Adelaide.
Receiver room was fully enclosed.
A B&K 3207 tapping machine was placed on the test floor outlined above.

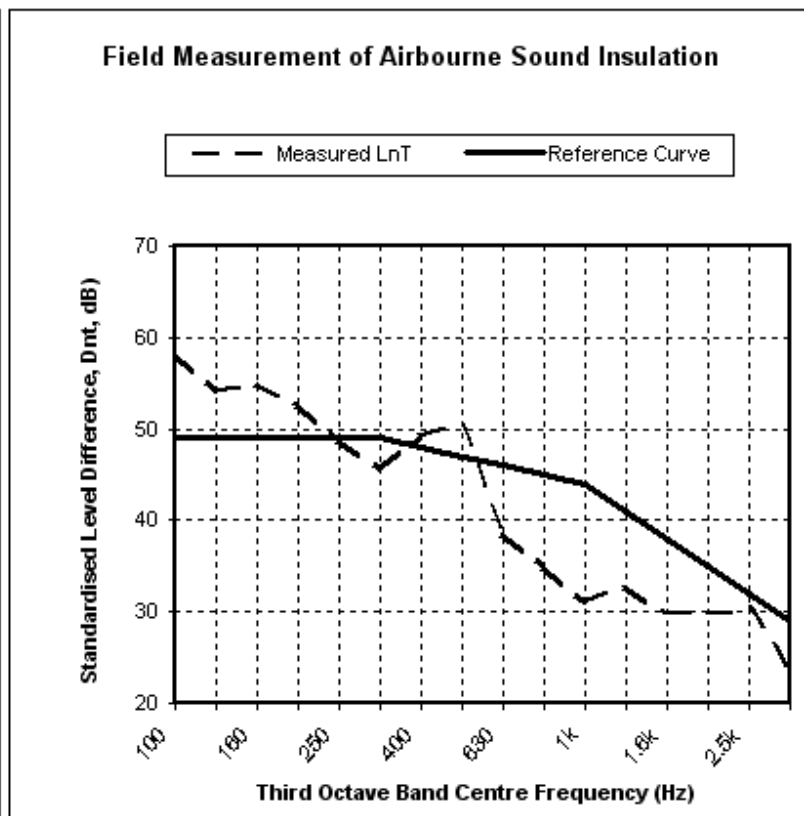
Receiving room volume: 57.3 m³

Rating according to ISO 717-2

$L_{nT,w}$: 47

C_i : 0

Centre Frequency	Measured L_{nT}	Reference Curve	Deficiencies
Hz	dB	dB	dB
100	58.3	49.0	-9.3
125	54.1	49.0	-5.1
160	54.7	49.0	-5.7
200	52.8	49.0	-3.8
250	48.8	49.0	0.0
315	45.6	49.0	0.0
400	49.3	48.0	-1.3
500	50.5	47.0	-3.5
630	38.7	46.0	0.0
800	35.0	45.0	0.0
1k	31.1	44.0	0.0
1.25k	32.8	41.0	0.0
1.6k	29.9	38.0	0.0
2k	29.8	35.0	0.0
2.5k	30.3	32.0	0.0
3.15k	23.6	29.0	0.0



Test Date March 27, 2008