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BRIEF FOR CONSULTANCY:

Prototype sound insulation testing of timber floor in timber frame construction with Icynene® products installed inner leaves of external walls.

TESTING OF TIMBER FLOOR STRUCTURE WITH ICYNENE PRODUCTS AT BPAC FACILITY

Technical Report No. P/4950H/09
2 November 2009

PREPARED FOR:

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CANADA

For the attention of Jeff Hood

Contents

1.0 Introduction

1.1 The measurements of Icynene insulation system were conducted at the BPAC test facility, Glenrothes, Fife.

1.2 Within a restricted-access enclosed test facility, Hanger 17 at BPAC Ltd. (Glenrothes, Fife), a two-storey building was constructed. The building consisted of two apartment rooms on the ground floor and two rooms at the first floor. A schematic representation of the core test structure can be seen in Figure 1.

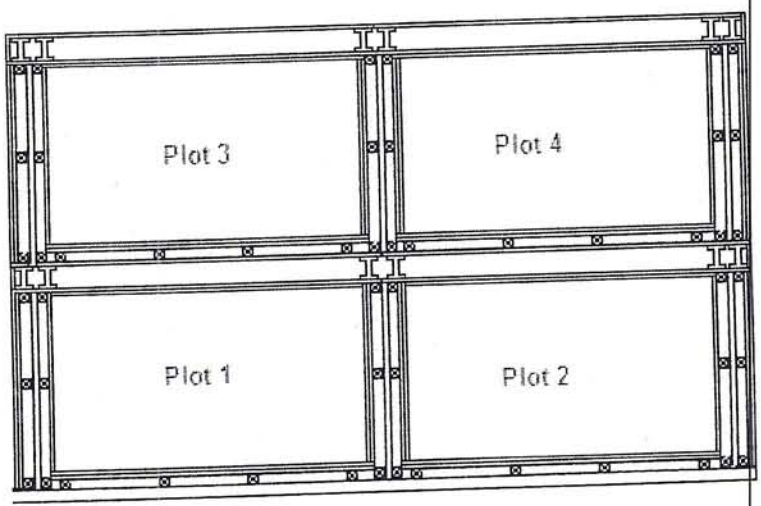

Figure 1. Test structure.

1.3 Sound insulation measurements were carried out on 18th of September, 2009 by Dr. Elena Prokofieva BSc, MSc, PhD, MIOA.

2.0 Sound Insulation Criteria

2.1 Sound insulation measurements have been performed in full compliance with procedures outlined in Approved Document Part E (ADE, applicable to England and Wales, E&W), the Building (Scotland) Regulations 2004, and BS EN ISO 140, as outlined in Section 5.0.

2.2 The test results are reported to in-situ (field) performance ratings as full flanking conditions were present. The minimum criteria recommended in the Scottish Technical Handbooks and ADE are reproduced in Tables 1a and 1b.

Table 1a. Recommended minimum sound insulation performance values for separating walls and floors given in the current Scottish Technical Handbook 5.0 'Noise', and Approved Document Part E (E&W).

	Scottish: Airborne Sound Insulation, $D_{nT,w}$ (dB)	England & Wales: Airborne Sound Insulation, $D_{nT,w}$ +Ctr (dB)
Separating Walls	53 (mean)	45
Party Floors	52 (mean)	45

Table 1b. Recommended maximum sound insulation performance values for separating floors given in the current Scottish Technical Handbook 5.0 'Noise', and Approved Document Part E (E&W).

	Scottish: Impact Sound Insulation, $L'_{nT,w}$ (dB)	England & Wales: Impact Sound Insulation, $L'_{nT,w}$ (dB)
Party Floors	61 (mean)	62

2.3 The airborne sound insulation rating is specified in terms of the weighted standardised level difference, $D_{nT,w}$. The correction weighting C_{tr} is added to the $D_{nT,w}$ result in the ADE (E&W) primarily to account for low frequency acoustic transmission. Both ratings provide an indication of the noise reduction achieved by a residential partition; a numerically higher rating indicates better airborne sound insulation.

2.4 The impact sound insulation rating is specified in terms of the weighted standardised level, $L'_{nT,w}$. A numerically lower rating indicates better impact sound insulation.

3.0 Test Programme

Floor construction

3.1 The sound insulation of the floor construction between the ground and first floor was measured. Details of the locations and room characteristics are outlined in Table 2.

Table 2. Details of tested partition (floor)

Source Room*			Receiving Room*		
Room	Room Volume (m^3)	Floor Area (m^2)	Room	Room Volume (m^3)	Floor Area (m^2)
Plot 1	43.4	18.0	Plot 3	43.4	18.0

* for impact sound insulation measurements source and receiver room were opposite

3.2 The floor construction as tested was Robust Details E-FT-1 (only with 235 mm I-joists instead of 240 mm joists) and consisted of: 18 mm flooring board, gypsum based board, FFT-1 resilient battens with 25 mm mineral wool between battens, 15 mm floor decking board on top of 235 mm I-joists with 100 mm mineral wool quilt insulation between joists, finished with two layers of plasterboard on 16 mm resilient bars.

Separating wall

3.3 The separating wall construction in the tested room was Robust Details E-WT-2 and consisted of two leaves of 95 mm timber frame wall with 60 mm mineral wool between the studs and 9 mm sheeting board across 50 mm clear cavity, finished with two layers of 15 mm plasterboard with staggered joints each side.

External wall

3.4 The external wall construction in the tested rooms consisted of two leaves of 95 mm timber frame wall with blown-in Icynene insulation between the 140 mm studs of inner leaf, 9 mm sheeting, finished with one layer of plasterboard on the room side.

4.0 Measurement Procedure

4.1 The measurement procedure conformed to the requirements of the Building (Scotland) Regulations 2004 and Approved Document E – Resistance to the Passage of Sound – 2003 (England and Wales).

4.2 The equipment and criteria used conformed to the requirements of Parts 4 (airborne) and 7 (impact) of BS EN ISO 140, "Measurement of sound insulation in buildings and of building elements".

4.3 The following items of equipment were used during the measurement:

Equipment	Serial No.
Brüel & Kjær Modular Precision Sound Level Meter Type 2260 running Building Acoustics Module Type BZ7204	2399619
Brüel & Kjær Prepolarised Condenser Microphone Cartridge Type 4189	2386220
Brüel & Kjær Sound Level Calibrator Type 4231	2393980
JBL EON10 G2 Sound Source	15033
JBL EON10 G2 Sound Source	13150
Norsonic Tapping machine NOR-211A	31113

4.4 The sound level meter was calibrated before and after the measurements at the calibration level of 93.9 dB re 2 x 10^{-5} Pa at 1000 Hz; the recorded deviation in meter sensitivity was less than 0.1 dB.

4.5 The following airborne sound insulation measurement procedures were followed:

- L_1 1 spatially averaged 30 second source room SPL measurement
- L_2 1 spatially averaged 30 second receiver room SPL measurement
- T_2 6 receiver room reverberation time measurements (2 speaker positions)
- B_2 1 spatially averaged 30 second receiver room measurements

4.6 The following impact sound insulation measurement procedures were followed:

- L_2 4 spatially averaged 30 second receiver room SPL measurements
- T_2 6 receiver room reverberation time measurements (2 speaker positions)
- B_2 1 spatially averaged 30 second receiver room measurements

5.0 Results

5.1 The full sound insulation results of the party floor construction are given in Figure 1 (airborne) and Figure 2 (impact) respectively. The single figure sound insulation ratings calculated in accordance with BS EN ISO 717: 1997 are shown in Table 3.

Table 3. Results of floor sound insulation testing

Test Room 1	Test Room 2	Airborne $D_{nT,w}$ (+C_{tr}) (dB)		Impact $L'_{nT,w}$ (dB)
		Building (Scotland) Regulations 2004,	Part E of Building Regulations 2003, E&W	
Plot 1, Gnd floor	Plot 3, 1st floor	59 (-10)	59(-10)	47

5.2 The results indicate that the sound insulation of the party floor construction has complied with current regulatory standards outlined in Approved Document Part E (applicable to England and Wales) and in Building (Scotland) Regulations 2004. It would also comply with the proposed Section 5 for Scotland Standards in 2010, which requires min 56 dB $D_{nT,w}$ and max 56 dB $L'_{nT,w}$.

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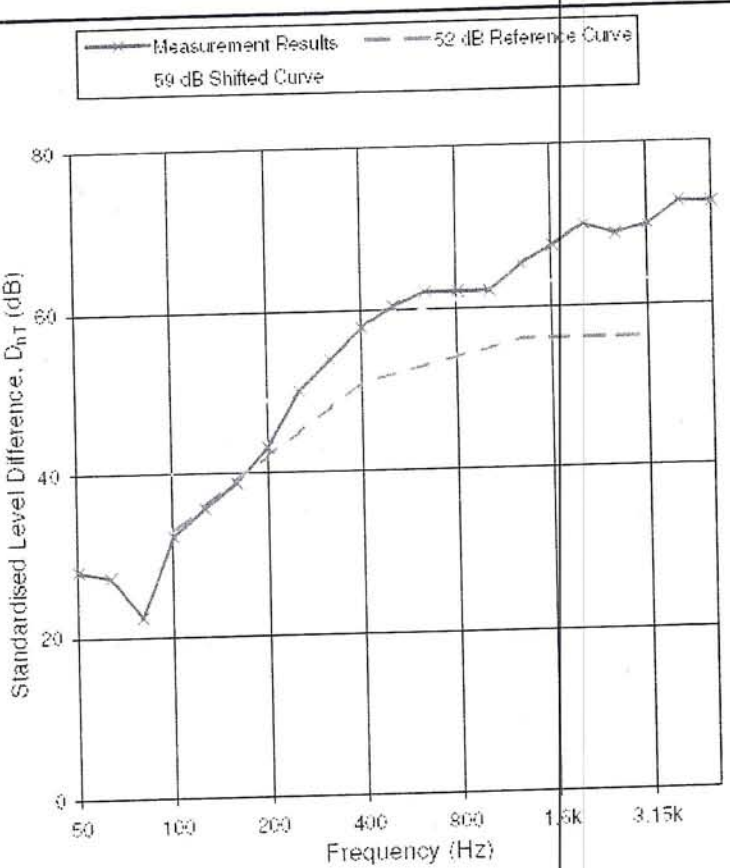
Figure 1. Airborne Sound Insulation Measurement

Standardised Level Difference: Field Method BS EN ISO 140-4:1998

Client :	Date of Test: 18 September 2009 Test Partition: Separating Floor
Site Address : BPAC, Hangar 17	Test Locations : S : Plot 1, Grd floor R : Plot 2, 1st floor ANC Test reference nbr:

Construction Details: floor: E-FT-1 235 mm I-joists party wall: E-WT-2 external wall: E-WT-2 Isoprene insulation in inner leaf no insulation in outer leaf 1 layer of plasterboard on room side

Third Octave Frequency (Hz)	Standardised Level Difference D_{nT} (dB)
50	28.2
63	27.4
80	22.3
100	32.4
125	35.7
160	38.6
200	42.1
250	50.1
315	52.9
400	57.8
500	60.3
630	62.0
800	62.0
1k	62.0
1.25k	65.1
1.6k	67.3
2k	69.6
2.5k	69.4
3.15k	69.5
4k	72.4
5k	72.2
$D_{nT,w}$ (C; C_{tr})	59 (-4; -10)



Source Room Volume: ~43.4 m³
Receiver Room Volume: ~43.4 m³

Single Figure Rating Calculated According to BS EN ISO 717-1:1997

$D_{nTw} + C_{tr}$ = 49 dB

Evaluation based on field measurement results.

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Date : 18-9-2009

Signature :

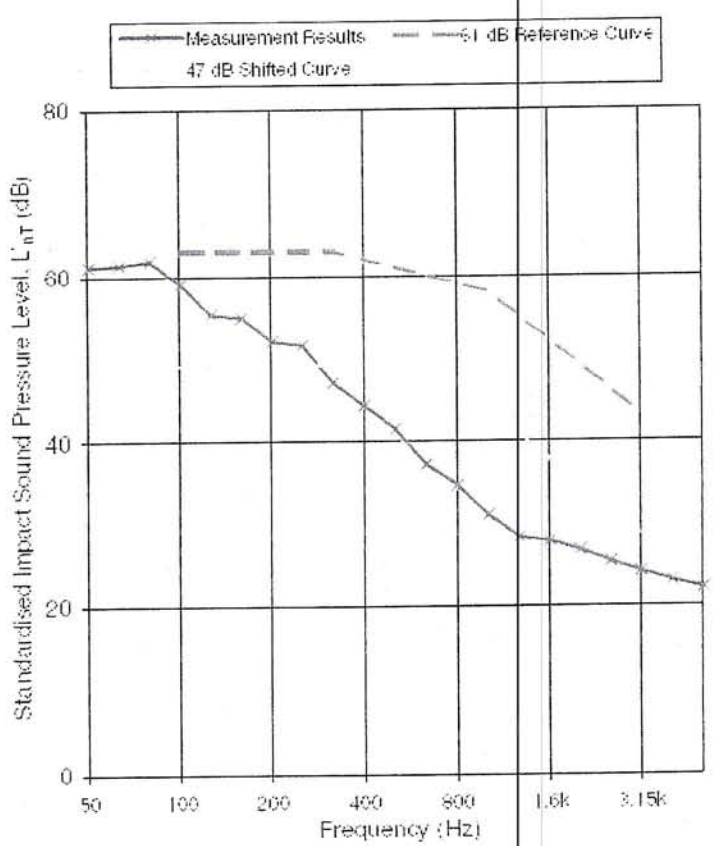
Figure 2. Impact Sound Insulation Measurement

Standardised Impact Sound Pressure Level: Field Method BS EN ISO 140-7:1998

Client :	Date of Test: 18 September 2009 Test Partition: Separating Floor
Site Address : BPAC Hangar 17	Test Locations : S : Plot 2, 1st floor R : Plot 1, Gnd floor ANC Registration nb:

Construction Details: floor: E-FT-1, 235 mm I-joists party wall: E-WT-2 external wall: E-WT-2 rockwool insulation in inner leaf no insulation in outer leaf 1 layer of plasterboard on room side

Third Octave Frequency (Hz)	Standardised Impact SPL L'_{nT} (dB)
50	61.1
63	61.3
80	61.8
100	59.0
125	55.3
160	54.9
200	52.0
250	51.5
315	46.9
400	44.2
500	41.4
630	37.3
800	34.8
1k	31.2
1.25k	28.5
1.6k	28.0
2k	26.9
2.5k	25.4
3.15k	24.2
4k	23.0
5k	22.1
$L'_{nT,w}$ (Ci)	47 (1)



Source Room Volume: ~42.7 m³
Receiver Room Volume: ~42.7 m³

Single Figure Rating Calculated According to BS EN ISO 717-2:1997

$L'_{nT,w}$ = 47 dB

Evaluation based on field measurement results.

Test Report No.: P/4950H/09 Name of Test Institute : Robin Mackenzie Partnership

Date : 18-9-2009 Signature :