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TECHNICAL REPORT

THE LABORATORY DETERMINATION OF THE AIRBORNE SOUND TRANSMISSION CHARACTERISTICS OF A SERIES OF VARIOUS THICKNESS OF INTUMESCENT 106

Prepared for

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By

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1. BRIEF FOR COMMISSION

To undertake laboratory measurements to determine the airborne sound transmission characteristics of a series of various thickness of Intumescent 106 in accordance with BS EN ISO 140-3:1995, BS 2750:Part 3:1995

The tests to be carried out over the 1/3rd octave band frequency range 50 Hz to 10 000 Hz.

The frequency range is beyond that required by the test Standard.

2. SUMMARY

Test in accordance with the brief have been undertaken in the transmission suite of SRL's Laboratory at Holbrook House, Sudbury, Suffolk.

From these measurements the required results have been derived and are presented in both tabular and graphic form in Tables 1 and 2 and Graph 1.

P. K. Bradstock
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Laboratory Engineer

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3. DETAILS OF MEASUREMENTS

3.1 Location

Sound Research Laboratories Ltd
Holbrook House
Little Waldingfield
Sudbury
Suffolk
CO10 OTH

3.2 Test Dates 10th October 1997

3.3 Instrumentation and Apparatus Used

Make	Description	Type
E D I	Microphone Multiplexer	
	Microphone Power Supply Unit	
Norwegian Electronics	Real Time Analyser	830
	Power Amplifier	215
	Dodecahedron Speaker	223
Olivetti	Computer	M290S
Bruel & Kjaer	12mm Condenser Microphones	4166
	Windshields	UA0237
	Pre Amplifiers	2639
	Microphone Calibrator	4230
Larson Davis	12mm Condenser Microphone	2560
SRL	Power Amplifiers	
Celestion	Loudspeakers	100w
Gallenkamp	Thermometer	
Norsonic	Rotating Microphone Boom	NOR-231
Douglas Curtis	Rotating Microphone Boom	
Solomat Mfs	Multimeter	MPM500e
	226 RH Probe	PT100

3.4 References

BS 5821:Part 1:1984	Method for rating the airborne sound insulation in buildings and of interior building elements
BS EN ISO 140-3:1995 BS 2750:Part 3:1995	Laboratory measurement of airborne sound insulation of building elements.

4. DESCRIPTION OF TEST

4.1 Description of Sample

Test 1	Intumescent 106, 200mm thick with a density of $200kg/m^3$
Test 2	Intumescent 106, 70mm thick with a density of $200kg/m^3$
Test 3	Intumescent 106, 40mm thick with a density of $200kg/m^3$
Test 4	Intumescent 106, 15mm thick with a density of $200kg/m^3$

Area of test sample = 1.0m x 0.6m

Temperature = 17°C

4.2 Sample Delivery date

8th October 1997

4.3 Test Procedures

The sample was mounted and tested in accordance with the relevant standard. The method and procedure is described more fully in Appendix 1.

5. RESULTS

The results of the measurements and subsequent analysis is given in Tables 1 and 2 and Graph 1.

Table 1 Sound Reduction Index Measurements - dB

Third Octave Band Centre Frequency Hz	Test Number 1		Test Number 2	
	1/3 Oct	1/1 Oct	1/3 Oct	1/1 Oct
50 *	22.0		20.6	
63 *	21.2	20.4	19.7	20.0
80 *	18.7		19.6	
100	14.7		17.3	
125	19.4	17.6	14.4	16.1
160	21.4		17.2	
200	22.1		15.5	
250	25.0	23.9	15.1	16.1
315	25.3		18.3	
400	28.0		20.2	
500	35.1	31.7	23.4	23.0
630	39.6		29.3	
800	42.4		37.8	
1000	44.5	44.0	43.4	40.9
1250	45.8		45.1	
1600	46.8		47.6	
2000	47.8	47.6	48.8	48.5
2500	48.4		49.1	
3150	50.5		50.5	
4000	53.5	52.7	51.6	51.1
5000	55.8		51.4	
6300 *	57.7		54.0	
8000 *	52.7	49.8	51.8	48.4
10000 *	46.1		44.8	
Average SRI (100-3150 Hz)	34.8		30.8	
Weighted Sound Reduction Index Rw (BS 5821:Part 1)	36		29	

* Denotes frequencies outside the range covered by BS EN ISO 140-3 : 1995, BS 2750 : Part 3 : 1995

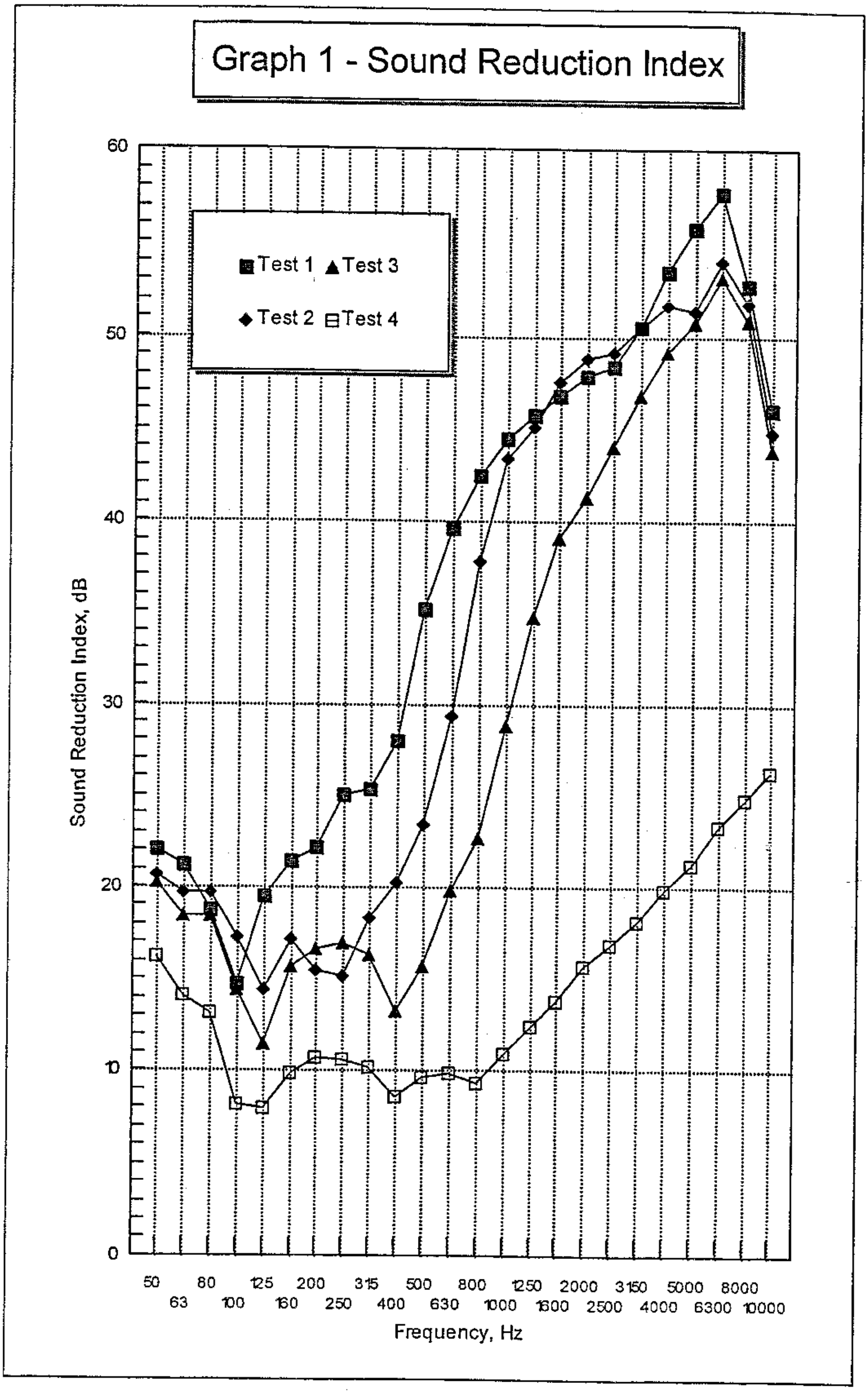
Test Number	Description
1	Intumescent 106, 200mm thick with a density of 200kg/m3
2	Intumescent 106, 70mm thick with a density of 200kg/m3

Table 2 Sound Reduction Index Measurements - dB

Third Octave Band Centre Frequency Hz	Test Number 3		Test Number 4	
	1/3 Oct	1/1 Oct	1/3 Oct	1/1 Oct
50 *	20.2		16.2	
63 *	18.4	18.9	14.0	14.3
80 *	18.5		13.1	
100	14.3		8.2	
125	11.4	13.4	7.9	8.6
160	15.7		9.9	
200	16.7		10.7	
250	16.9	16.6	10.6	10.5
315	16.3		10.1	
400	13.2		8.6	
500	15.7	15.5	9.6	9.3
630	19.8		9.8	
800	22.6		9.4	
1000	28.8	26.2	10.9	10.7
1250	34.8		12.3	
1600	39.0		13.8	
2000	41.3	41.0	15.7	15.2
2500	44.0		16.8	
3150	46.8		18.1	
4000	49.1	48.6	19.8	19.5
5000	50.8		21.2	
6300 *	53.1		23.2	
8000 *	50.9	47.4	24.8	24.6
10000 *	43.8		26.3	
Average SRI (100-3150 Hz)	24.8		11.4	
Weighted Sound Reduction Index Rw (BS 5821:Part 1)	24		13	

* Denotes frequencies outside the range covered by BS EN ISO 140-3 : 1995, BS 2750 : Part 3 : 1995

Test Number	Description
3	Intumescent 106, 40mm thick with a density of 200kg/m3
4	Intumescent 106, 15mm thick with a density of 200kg/m3



Graph 1 - Sound Reduction Index
Test 1 Test 3
Test 2 Test 4
Sound Reduction Index, dB
60
50
40
30
20
10
0
50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000 10000
Frequency, Hz

APPENDIX 1

Measurement of Sound Transmission in accordance with BS EN ISO 140-3 : 1995

The Laboratory determination of airborne sound transmission is characterised by the difference in corrected sound pressure levels measured across the test sample installed between the reverberant rooms. The test is intended to be conducted under conditions which restrict the transmission of sound by paths other than that directly through the sample and where the source field is randomly incident on the sample.

The test sample is located and sealed in an aperture within the brick dividing wall between the two rectangular reverberant or acoustically "live" rooms, both of which are constructed from 215mm brick with reinforced concrete floors and roofs. The brick wall has dimensions of 4.8m wide x 3.1m high and 550mm nominal thickness and forms the whole of the common area between the two rooms. One of the rooms termed the receiving room has a volume of 300 cubic metres and is isolated by the use of resilient mountings and seals from the surrounding structure and the adjoining room, therefore ensuring good acoustic isolation. The adjoining source room has a volume of 60 cubic metres.

Broad band noise is produced in the source room from an electronic generator, power amplifier and loudspeaker. The resulting sound pressure levels in both rooms are sampled, filtered into one third octave band widths, integrated and averaged by means of a Real Time Analyser using a spaced array of microphones. The value obtained at any particular frequency is known as the equivalent sound pressure level for either source or receiving rooms. The change in level across the test sample is termed the equivalent sound pressure level difference i.e.

$$D = L_1 - L_2$$

where

D is the equivalent Sound Pressure level difference in dB

L_1 is the equivalent Sound Pressure level in the source room in dB

L_2 is the equivalent Sound Pressure level in the receiving room in dB

The Sound Reduction Index (R) also known by the American terminology Sound Transmission Loss, is defined as the number of decibels by which sound energy randomly incident on the test sample, is reduced in transmitting through it and is given by the formula:

$$R = D + 10\log_{10} \frac{S}{A} \text{ ...... in decibels}$$

where

S is the area of the sample

A is the total absorption in the receiving room

both dimensions being in consistent units

The Sound Reduction Index is an expression of the laboratory sound transmission performance of a particular element or construction. It is a function of the mass, thickness, sealing method of mounting etc.and is independent of the overall area of the sample.

However, when a sample is installed on site and forms part of an enclosure of building, the sound insulation obtained will be dependent upon its surface area, the larger the area the greater the sound energy transmitted, as well as the absorption in the receiving area. In addition, the overall sound insulation of an enclosure is also determined by the sound transmission through other building elements, some of which may have an inferior performance to the sample. Because of this the potential Sound Reduction Index of a sample is not always fully realised in practice. A further consequence is that the Sound Reduction Index of a particular sample can only successfully be measured in a laboratory because only under such controlled conditions can the sound transmission path be limited to the sample under test.

R_w has been calculated in accordance with the relevant section of BS 5821 from the results of laboratory tests carried out in accordance with BS 2750:Part 3.