

**REPORT ON THE DETERMINATION OF AIRBORNE SOUND  
TRANSMISSION LOSS IN ONE-THIRD OCTAVE BANDS AND WEIGHTED  
SOUND REDUCTION INDEX ( $R_w$ ) OF A TIMBER STUD WALL WITH 10  
MM PLASTERBOARD WITH SELECTION 500 CAVITY INSULATION.**

Testing Procedure: AS 1191-2002

Testing Laboratory: Applied Acoustics Laboratory  
RMIT University, Applied Physics  
Melbourne, Victoria 3000, Australia  
NATA Accreditation Number 1421

Client: Insulfoam Solutions  
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Peter Dale  
Approved NATA Signatory



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# **REPORT ON THE DETERMINATION OF AIRBORNE SOUND TRANSMISSION LOSS IN ONE-THIRD OCTAVE BANDS AND WEIGHTED SOUND REDUCTION INDEX ( $R_w$ ) OF A TIMBER STUD WALL WITH 10 MM PLASTERBOARD WITH SELECTION 500 CAVITY INSULATION.**

## **1. INTRODUCTION**

The test described in this report was carried out at the request of Insulfoam Solutions on to determine the airborne sound transmission loss and the weighted sound transmission index of a timber stud wall system with Selection 500 cavity insulation..

The test has been carried out using the pair of sound transmission rooms of the Applied Physics Discipline, RMIT University. The sample under test is mounted in the vertical aperture between a reverberant source room and a reverberant receiving room.

The sound pressure level difference resulting between these two rooms when a sound source operates in the source room is used in conjunction with the surface area of the sample and the equivalent absorption area of the receiving room to determine the airborne sound transmission loss of the sample.

Testing has been carried out in accordance with Australian Standard 1191:2002 - Acoustics: Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions. The weighted sound transmission index ( $R_w$ ) has been determined as specified in AS/NZS ISO 717.1:2004 - Acoustics: Rating of sound insulation in buildings and of building elements, Part I: Airborne Sound Insulation.

The measuring facilities and method have been accredited by the National Association of Testing Authorities, Australia (NATA) Accreditation No. 1421, and testing has been conducted fully in accordance with those terms of accreditation.

## **2. TEST FACILITIES**

The sound transmission suite consists of a reverberant source room volume of 115.82 cubic metres and a reverberant receiving room of volume 114.73 cubic metres. Both rooms have an irregular geometry featuring a pentagonal floor plan with no two walls parallel, and with non-parallel floors and ceilings. The rooms are constructed of 305mm reinforced concrete, supported on laminated-rubber isolators, and acoustically de-coupled from one another by a 50mm closed cell polyurethane gasket.

The irregular room shape has been chosen to assist in the production of diffuse sound fields. Such diffuseness is further enhanced:

(a) In the receiving room by the inclusion of nine fixed non-rectangular panels, suspended in the room with random orientation. Six panels each have an area of 1.44 square metres and three each have an area of 1.67 square metres. The total one-sided area of these panel diffusers is 13.65 square metres, being 55.7% of that of the largest single boundary surface (the ceiling).

(b) In the source room by inclusion of nine fixed non-rectangular polyvinyl chloride panels suspended in the room with random orientation. Four panels each have an area 1.86 square metres, the other five each have an area 1.24 square metres. The total one-sided area of these panel diffusers is 13.64 square metres, being 56.5% of that of the largest single boundary surfaces (the ceiling).

The average sound absorption coefficient of the diffusers and the internal surfaces of the rooms is below 0.06 in each test frequency band.

### 3. EQUIPMENT

The equipment used in performing this test is listed below.

|                                   |  |
|-----------------------------------|--|
| Lap Top Computer                  | Manuf. By Dell: 1.6GHz Intel Pentium, 591MHz - 1.00GB RAM S/N: X10-60264 |
| Pulse LabShop Version 10 Software | Bruel & Kjaer  |
| Pulse Hardware Interface          | Bruel & Kjaer Type 3560B-030 S/N: 2463302                                |
| Measuring Amplifier               | Bruel & Kjaer Type 2610 S/N 1646952                                      |
| Microphone 1                      | Bruel & Kjaer Type 4192 S/N 2114482                                      |
| Microphone 2                      | Bruel & Kjaer Type 4192 S/N 2114481                                      |
| Microphone 3                      | Bruel & Kjaer Type 4192 S/N 2493521                                      |
| Microphone 4                      | Bruel & Kjaer Type 4192 S/N 2493522                                      |
| Microphone Preamplifier 1         | GRAS Type 26AK S/N 21137   |
| Microphone Preamplifier 2         | GRAS Type 26AK S/N 44523   |
| Microphone Preamplifier 3         | GRAS Type 26AK S/N 19528   |
| Microphone Preamplifier 4         | GRAS Type 26AK S/N 19529   |
| Microphone Power Supply 1         | Bruel & Kjaer Type 2804 S/N 619032                                       |
| Microphone Power Supply 2         | Bruel & Kjaer Type 2804 S/N 684339                                       |
| Band-pass Filter Set              | Rockland Wavetek Type 852  |
| Amplifier                         | Yamaha Type AX-500 S/N M48342910   |
| Speakers                          | Lorantz Audio  |

### 4. PROCEDURES

Testing has been conducted in accordance with the methods of AS1191:2002 – Acoustics: Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

Random noise is fed to a single loudspeaker placed in a corner of the source room. In each one-third octave band of centre frequency 100Hz to 5000Hz, the mean sound pressure level in each room is found by the use of microphones connected to a Bruel & Kjaer Pulse Analyser. Eight independent locations of the microphone are used in each room, with the signals temporally averaged for the sampling time of 64 seconds.

The equivalent absorption area of the receiving room is determined by measurement of the reverberation time in each one-third octave band. A loudspeaker is placed in one corner of the receiving room and 10 decays are obtained at each of the eight microphone positions, between 100Hz and 5000Hz. The microphone signal is relayed via a microphone amplifier, to the Bruel & Kjaer Pulse Analyser. The analyser is interfaced to a personal computer. A program running on the personal computer allows the determination of the reverberation time from the sound decays in accordance with AS ISO 354:2006 - Acoustics: Measurements of Sound Absorption in a Room.

The measuring equipment has been calibrated by an external accredited calibration laboratory, and is in current calibration.

## 5. SAMPLE DESCRIPTION

The sample tested comprised of a 90mm x 35mm timber frame comprising timber top and bottom plate with timber studs at 450mm centres. The frame was secured with nails. One side of the wall was sheeted with 10mm standard plasterboard and screw fixed to the timber frame.

The insulation material is a semi-rigid foam with the trade name of Selection 500. This product is manufactured by Demilec USA.

Selection 500 was then applied to the cavity of the wall. The thickness of the foam was between 65mm and 90mm. A second sheet of 10mm standard core plasterboard was then installed on the second face of the wall. The plasterboard was installed horizontally and the joints were staggered on either side of the wall. The plasterboard junctions were stopped with jointing compound and the perimeter on both faces of the wall were sealed with a flexible mastic.

The estimated surface density of the sample (excluding framing) is 13kg/m<sup>2</sup>.

The sample was tested mounted into the vertical aperture of the RMIT Transmission Suite giving a total area of sample of 10.69m<sup>2</sup>.

## 6. RESULTS

The measured airborne sound transmission loss, R dB, at each one-third octave bandwidth of centre frequencies between 100Hz – 5000Hz is given in tabular form to the nearest decibel. The Weighted Sound Reduction Index (R<sub>w</sub>) reference curve, in each one-third octave bandwidth of centre frequencies between 100Hz and 3150Hz are expressed in tabular form and are also represented graphically for the sample tested. There are no significant errors in transmission loss values due to flanking transmission, filler wall or background noise. The Weighted Sound Reduction Index of the sample is determined in accordance with AS/NZS ISO 717.1-2004.

The precision in the results is expressed as the 95% confidence interval in the determined sound transmission loss. The K value used to determine the 95% confidence interval is 2.361. This interval is estimated from the 95% confidence interval in each of the average source room level, the average receiving room level and the receiving room absorption/surface area of sample. These values are included in the table of results.

### 6.1 Sample - Test Conditions

|                      |   |
|----------------------|---|
| Temperature:         | Receive Room : 24.0 <sup>0</sup> C.<br>Send Room : 24.0 <sup>0</sup> C.         |
| Humidity:            | Receive Room : 40%.<br>Send Room : 40%.   |
| Room Volumes:        | Receive room : 116.17 m <sup>3</sup> .<br>Source room : 120.01 m <sup>3</sup> . |
| Sample Surface Area: | 10.69 m <sup>2</sup>  |

## 6.2 Sound Transmission Loss Results and Weighted Sound Reduction Index $R_w$ :

The Weighted Sound Reduction Index of the test sample is:  $R_w (C;C_{tr}) = 39(-2;-7 \text{ dB})$ .

Based on laboratory measurements. Rating determined in accordance with AS/NZS ISO 717.1-2004

**Table I:** Table of results for 10mm plasterboard wall with a 90mm timber stud frame and Selection 500 cavity insulation.

| 1/3 Octave Centre Frequency Hz | Sound Transmission Loss : R dB | $R_w$ 39 Reference Curve | 95% Confidence levels, dB. |
|--------------------------------|--------------------------------|--------------------------|----------------------------|
| 100                            | 19.7                           | 20                       | 3.0                        |
| 125                            | 19.5                           | 23                       | 1.8                        |
| 160                            | 20.0                           | 26                       | 1.9                        |
| 200                            | 23.0                           | 29                       | 2.0                        |
| 250                            | 26.0                           | 32                       | 1.3                        |
| 315                            | 30.9                           | 35                       | 1.1                        |
| 400                            | 34.2                           | 38                       | 0.8                        |
| 500                            | 36.8                           | 39                       | 0.8                        |
| 630                            | 40.1                           | 40                       | 0.6                        |
| 800                            | 43.1                           | 41                       | 0.5                        |
| 1000                           | 46.1                           | 42                       | 0.5                        |
| 1250                           | 48.7                           | 43                       | 0.5                        |
| 1600                           | 50.8                           | 43                       | 0.5                        |
| 2000                           | 50.9                           | 43                       | 0.4                        |
| 2500                           | 52.0                           | 43                       | 0.5                        |
| 3150                           | 46.8                           | 43                       | 0.5                        |
| 4000                           | 43.6                           | -                        | 0.6                        |
| 5000                           | 48.9                           | -                        | 0.5                        |

**Chart I:** Graph of results for 10mm plasterboard wall with a 90mm timber stud frame and Selection 500 cavity insulation.

