Efficiency Matrix Pty Ltd

Downlight Mitts

"Basic Mitt" Acoustic Test Report

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1. INTRODUCTION

Vipac Engineers & Scientists Ltd (VIPAC) has been engaged by *Efficiency Matrix* to test the acoustic performance of the Basic Mitt. All tests were conducted using a *Galaxy* ∅90mm low voltage downlight kit supplied by *Efficiency Matrix*. The test certifies the acoustic Insertion Loss (dB) of the specimen and composite Transmission Loss of plasterboard, light and mitt, which may be deemed useful when comparing to a homogenous plasterboard finish.

2. TESTING STANDARD & PROCEDURE

We note that no specific standard exists for testing the performance of downlight covers, however procedures that determine the acoustic Insertion Loss (dB) and Transmission Loss (dB) of the product have been deemed by the engineer as appropriate performance measures. The testing is derived from the general and technical requirements of International Standards ISO 140-10 *Acoustics -- Measurement of sound insulation in buildings and of building elements -- Part 10: Laboratory measurement of airborne sound insulation of small building elements* and ISO 11691 *Acoustics -- Measurement of insertion loss of ducted silencers without flow -- Laboratory survey method*.

While the first provides the background and requirement for sound insulation requirements including Sound Transmission Loss, the latter documents the Insertion Loss, which is a useful index for describing the performance of the specimen alone.

All tests were carried out in Vipac's Reverberation Chambers. The ∅90mm downlight specimen was installed in 16mm Fire-rated plasterboard (13kg/m^2). The plasterboard panel was installed in a 1.2m x 1.2m aperture between the two chambers. The mitt was installed following the recommendations of the manufacturer within the source chamber. A pink noise signal was generated in the source chamber and 1/3 Octave Band sound level measurements were conducted in the receiving chamber at six (6) diffuse points, which were then averaged. Frequency analysis was conducted between 100Hz and 10,000Hz.

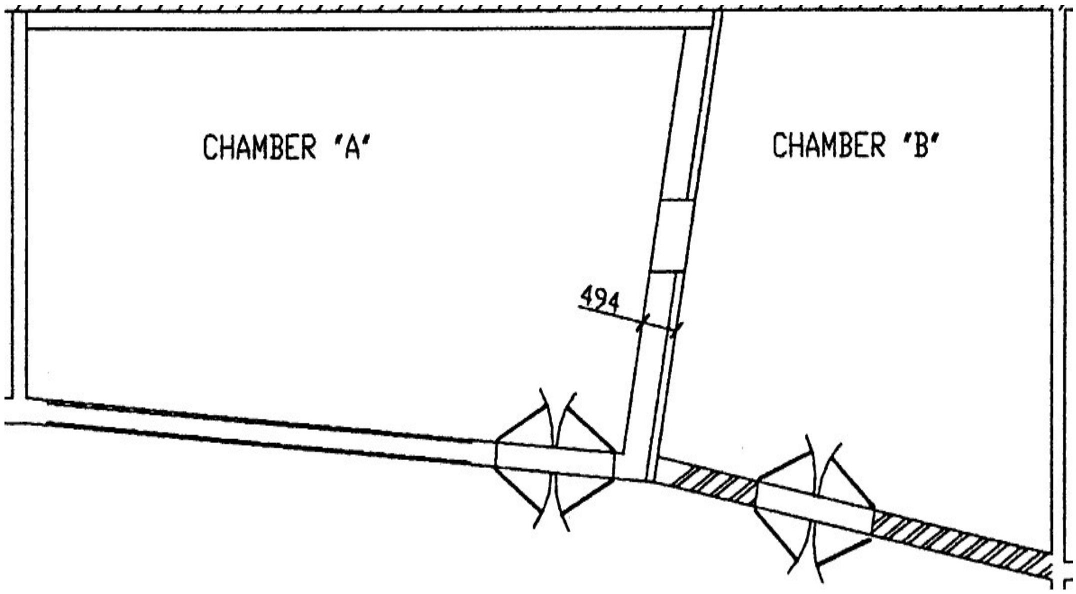

Figure 2.1: Vipac's Reverberation Chambers

The following measurements were conducted:

- Average Sound Pressure Level in the source chamber (L_s)
- Average Sound Pressure Level in the receiving chamber with downlight (no mitt) installed (L_{R1})
- Average Sound Pressure Level in the receiving chamber with downlight and *Basic Mitt* installed (L_{Rn})
- Average Sound Pressure Level in the receiving chamber with plasterboard fill installed (L_{Rn})

Insertion Loss was determined by the following equation:

$$IL = L_{R1} - L_{Rn} \text{ (dB)}$$

Transmission Loss was determined by the following equation:

$$TL = L_s - L_R + 10\log_{10}(S/A) \text{ (dB)}$$

where

S = Area of the test specimen, here S = 1.44m^2

A = Equivalent absorption area in the receiving room, determined by reverberation time measurements

All tests were performed with a NATA calibrated *Bruel & Kjaer 2250* Type-1 Precision Sound Level Meter and Frequency Analyser. Instrumentation was also checked for calibration with a *Bruel & Kjaer 4230* calibrator before and after the measurements. No significant drift was observed.

Background noise measurements were also made within the reverberation laboratory during testing. Levels were found to be at least 15 dB below the measured noise signal levels demonstrating that background noise did not affect the measurements.

The testing environment was also monitored for temperature, humidity and atmospheric pressure deviations over the course of the measurements and no significant drift was noted.

The test installation is illustrated in Figures 2.2 and 2.4.

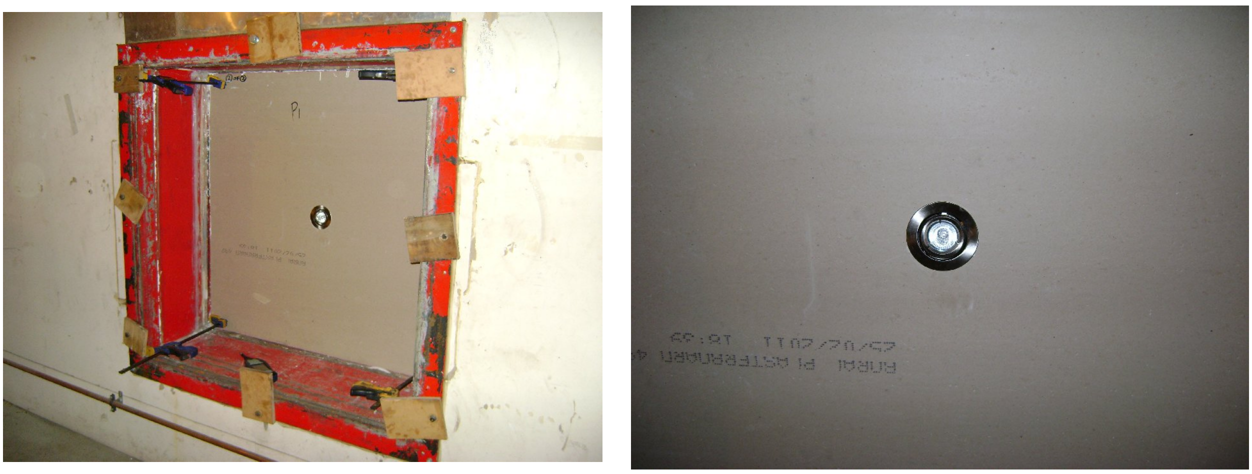

Figure 2.2: Downlight installation in plasterboard (from receiving chamber)

Figure 2.3: Basic Mitt (covering downlight) installation on plasterboard (from source chamber)

Figure 2.4: 16mm plasterboard fill installation, from receiving and source rooms respectively

3. TEST RESULTS

3.1. Sound Pressure Levels

Figure 3.1.1 shows the average receiving chamber Sound Pressure Levels. In comparison to the 90mm light and plasterboard composite installation, the average *Noise Reduction* (defined here as the Pink Noise SPL reduction with reference to plasterboard with light fitting only) for the 16mm Plasterboard, 90mm downlight and *Basic Mitt* was 1.5dB(A). The average *Noise Reduction* for the 16mm Plasterboard fill was 3dB(A).

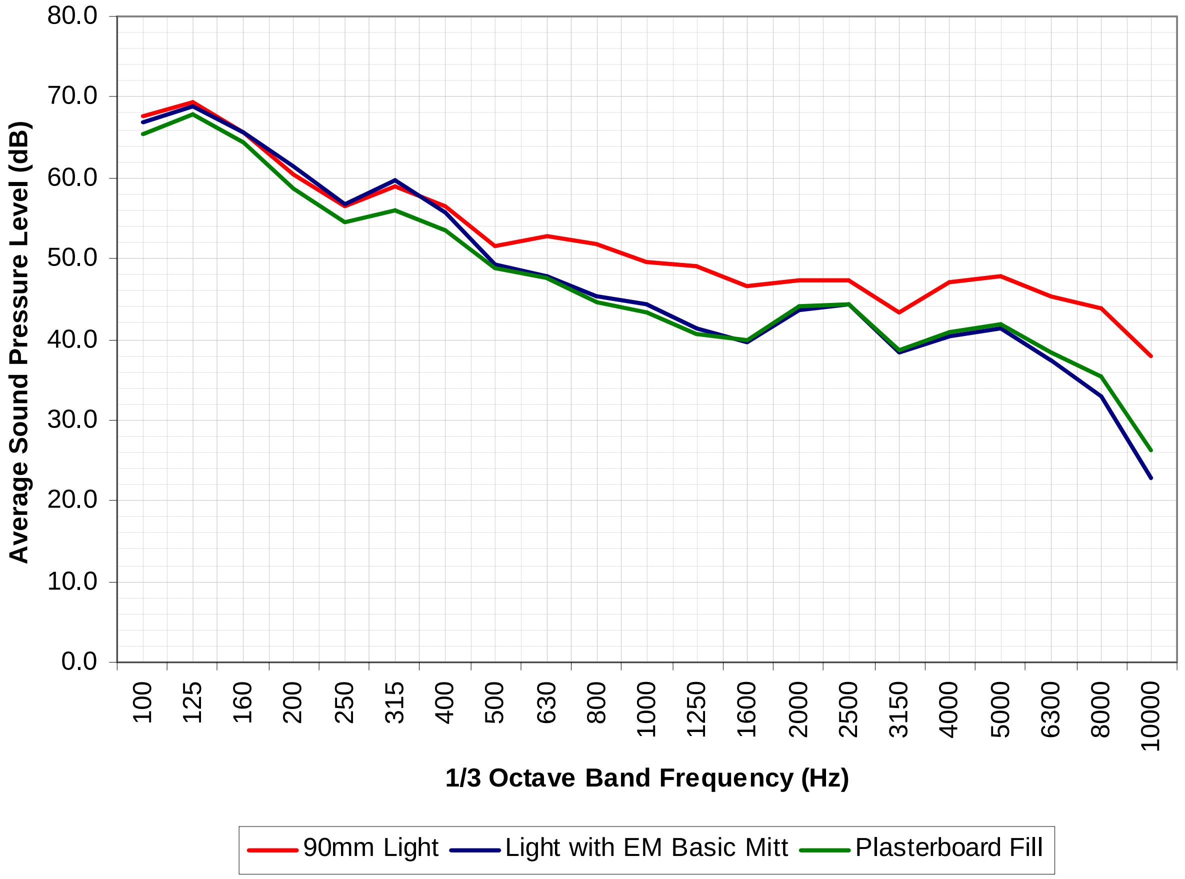

Figure 3.1.1: Average SPL difference of measurements

3.2. Insertion Loss

Figure 3.2.1 shows the Insertion Loss (dB) for the specimen and plasterboard fill, compared with the 90mm light and plasterboard composite installation.

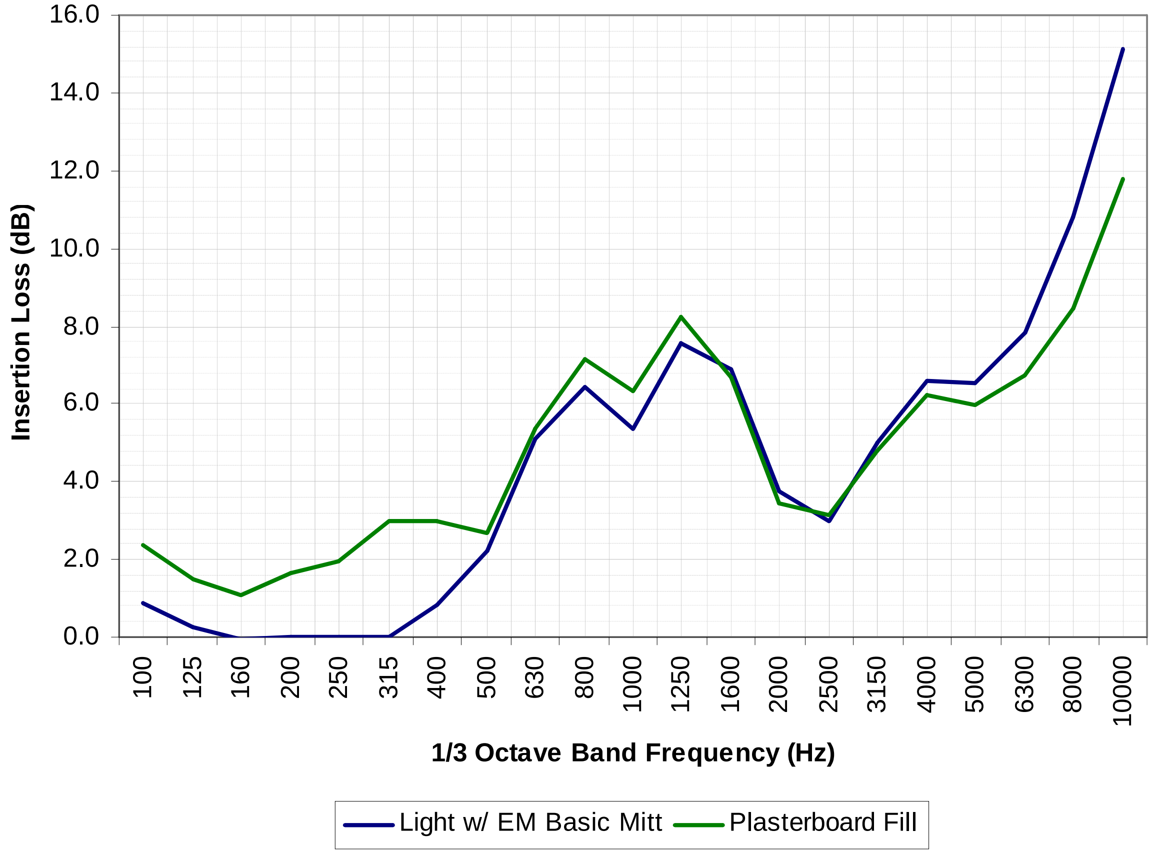

Figure 3.2.1: Insertion Loss values

3.3. Transmission Loss

Figure 3.2.1 shows the Transmission Loss (dB) for the specimen. The composite *Weighted Sound Reduction Index* as determined in accordance with ISO 717.1 and considered relevant for the 16mm Plasterboard, 90mm downlight and *Basic Mitt* was R_w = 33dB. The *Weighted Sound Reduction Index* for the 16mm Plasterboard alone was R_w = 34dB.

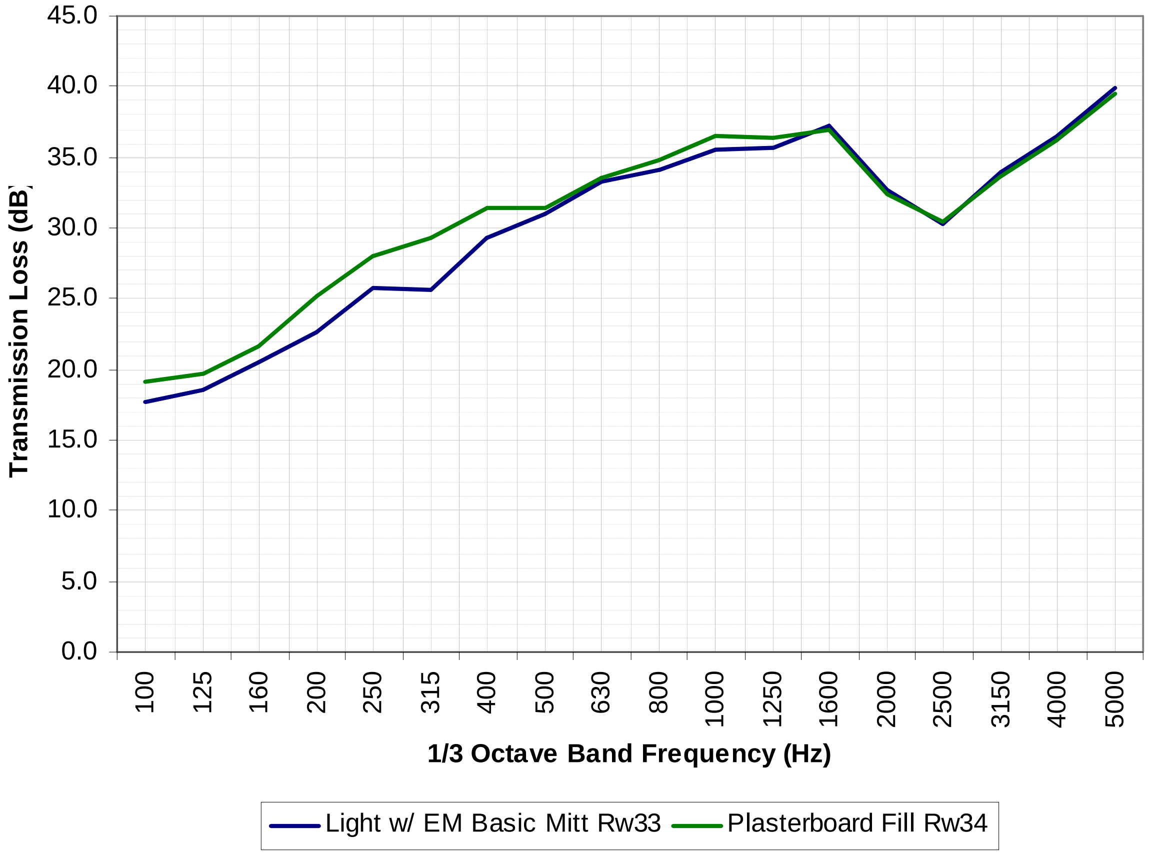

Figure 3.3.1: Transmission Loss values

3.4. Tabulated Data

The tabulated Insertion Loss (dB) and Transmission Loss (dB) values are:

	Basic Mitt w/ 90mm downlight		Plasterboard Fill	
1/3 Octave Band Frequency	Insertion Loss dB	Transmission Loss dB	Insertion Loss dB	Transmission Loss dB
100Hz	*0.8*	*17.6*	*2.3*	*19.1*
125Hz	*0.3*	*18.5*	*1.5*	*19.7*
160Hz	*0.0*	*20.5*	*1.1*	*21.6*
200Hz	*0.0*	*22.6*	*1.6*	*25.1*
250Hz	*0.0*	*25.8*	*1.9*	*28.1*
315Hz	*0.0*	*25.7*	*3.0*	*29.4*
400Hz	*0.8*	*29.3*	*3.0*	*31.5*
500Hz	*2.2*	*31.0*	*2.7*	*31.5*
630Hz	*5.1*	*33.3*	*5.4*	*33.5*
800Hz	*6.4*	*34.1*	*7.2*	*34.8*
1000Hz	*5.4*	*35.5*	*6.4*	*36.5*
1250Hz	*7.5*	*35.7*	*8.3*	*36.4*
1600Hz	*6.9*	*37.2*	*6.7*	*37.0*
2000Hz	*3.8*	*32.7*	*3.4*	*32.4*
2500Hz	*3.0*	*30.3*	*3.2*	*30.5*
3150Hz	*5.0*	*33.9*	*4.8*	*33.7*
4000Hz	*6.6*	*36.6*	*6.2*	*36.2*
5000Hz	*6.5*	*40.0*	*6.0*	*39.4*
6300Hz	*7.8*	R_w = 33dB	*6.7*	R_w = 34dB
8000Hz	*10.8*		*8.4*	
10000Hz	*15.1*		*11.8*	

4. CONCLUSION

Under the test conditions documented in this report, the *Basic Mitt* with 90mm downlight performs approximately equal to 16mm Fire-rated plasterboard at frequencies above 500Hz. The difference in Weighted Sound Reduction Index between the plasterboard panel with plasterboard fill and plasterboard panel with *Basic Mitt* with 90mm downlight is found to be 1dB.