Proceedings of the Institute of Acoustics

COMPARISON OF THE NEW TEST PROCEDURE PROPOSED BY HEVAC FOR ACOUSTIC LOUVRES WITH IN-DUCT SILENCER STATIC INSERTION LOSS MEASUREMENTS

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ABSTRACT

The British Standard for testing in-duct silencers, BS4718, specifically excludes acoustic louvres and states that they should be considered as a partition which should be tested between two reverberant rooms using BS2750. It is considered more appropriate by some manufacturers to test louvres as though they were in-duct silencers, pending publication of any new standards. The Heating, Ventilating and Air Conditioning Manufacturers Association, HEVAC, Acoustic Group 1990, have proposed a method of testing which attempts to simulate industrial installations by comparing the noise emission from an aperture in the external wall of a reverberant chamber with and without the acoustic louvre installed. This method also produces additional information on directivity. This paper compares these test methods and also the results obtained from sound pressure and intensity measurements.

1. INTRODUCTION

The method of test for silencers (attenuators) for air distribution systems is specificed in the British Standard BS4718:1971(1) and the section defining the scope of this standard contains the following:

"the results obtained from tests carried out using the standard should not be used to determine the performance of: ..... silencers designed to be installed to increase the sound insulation of a partition having a ventilation opening. The sound insulation provided by such silencers can be assessed by tests carried out in accordance with BS2750". Thus the appropriate current standard for testing acoustic louvres is BS2750. Recommendations for field and laboratory measurement of airborne and impact sound transmissions in buildings (2) which states that the acoustic louvres shall be tested as a partition between two reverberant rooms. This procedure is not generally considered an appropriate measurement for predicting the performance of many installed acoustic louvres, and the Heating, Ventilating and Air Conditioning Manufacturers Association, HEVAC, are currently preparing their own test standard. This investigation compares the static insertion loss of two examples of acoustic louvres using the following methods:

Method (i)

A diffuse sound field is generated in a reverberant room, Figure 1, which has a 1m square aperture in one wall. The external sound pressure level at nine

stations 3m from the centre of the aperture, figure 2, is measured with an open aperture and with the acoustic louvre fitted. The static insertion loss is given by the difference between the sound pressure level averaged over the nine positions with and without the louvre.

Method (ii)

As above, but measuring acoustic intensity.

Method (iii)

This method (3) closely follows BS4718 in that the acoustic louvre is placed between the long inlet and outlet duct, the outlet duct protruding into the reverberant chamber. The deviations from the full procedure are as follows:

(a) no substitution duct is used, for the "silencer out" test the inlet and outlet duct being directly coupled.

(b) a rotary microphone method as specified in BS4196 (4) is used as this is quick and is in close agreement with the six position method (5).

Method (iv)

This is a modified BS4718 in that the acoustic louvre is mounted in the wall of the reverberant chamber, the bird screen being flush with the inner face of the chamber wall, and the inlet duct connected to the louvre, the outlet duct is discarded. For the "silencer out" test the end of the inlet duct is positioned to be flush with the inner face of the chamber wall.

Instrumentation: Sound pressure levels were measured using Nortronic 823 system and intensity using Bruel & Kjaer 4433 system.

The proposed HEVAC procedure, method (i) and the intensity method was used for two louvres:

1m wide, 1m high, 270mm deep	30% open area
1m wide, 1m high, 540mm deep	30% open area

The BS4718 based procedure, method (iii) and (iv) was used on the same type of louvres but reduced to 500mm x 800mm cross section. These reduced area louvres were also fitted with a birdscreen.

NEW TEST HEVAC PROCEDURES

Results for Insertion Loss

Comparison of the various methods, normalising to the HEVAC method (i)

270mm deep louvre

OCTAVE BAND CENTRE FREQUENCY, Hz

	63	125	250	500	1K	2K	4K	8K	16K
Method (ii) dB	--	-0.7	-0.7	-0.2	-1.0	-1.6	-0.4	-0.8	--
Method (iii) dB	-2.6*	+0.9	+1.5	+1.0	+0.1	+1.4	+2.8	+2.1	+2.8
Method (iv) dB	-1.0*	+1.4	-0.9	-0.5	-0.7	-1.8	-1.3	-2.3	--

540mm deep louvre

OCTAVE BAND CENTRE FREQUENCY, Hz

	63	125	250	500	1K	2K	4K	8K	16K
Method (iii) dB	-3.3*	+0.4	0	+0.7	+2.0	+3.9	+1.8	-0.9	+0.5
Method (iv) dB	-0.8*	+0.3	-1.8	-0.3	+0.4	+1.2	-0.6	-2.4	-1.6

*Reverberant room too small for 63Hz band

Results for Directivity

Open Aperture

Octave Band Centre Frequency Hz

		63	125	250	500	1K	2K	4K	8K	16K
Sound Pressure level (dB)	Max-Min	3.4	1.5	2.2	4.0	4.4	6.0	5.1	6.5	7.4
	Max-Mean	1.3	0.5	1.4	0.9	1.7	3.3	2.2	2.6	2.8
	Position	60°	90°	105°	105°	120°	45°	90°	90°	120°
Sound Intensity (dB)	Max-Min	-	1.8	3.4	3.6	5.0	5.0	3.2	2.1	-
	Max-Mean	-	0.8	1.3	1.4	1.8	1.5	0.9	1.6	-
	Position	-	90°	105°	90°	105°	75°	105°	75°	-

NEW TEST HEVAC PROCEDURES

270mm deep louvre

		Octave Band Centre Frequency Hz								
		63	125	250	500	1K	2K	4K	8K	16K
Sound Pressure level (dB)	Max-Min	5.1	2.0	1.6	4.2	5.6	7.0	9.5	6.4	4.5
	Max-Mean	1.8	0.8	0.7	1.3	1.2	2.8	3.1	3.2	2.1
	Position	45°	120°	105°	90°	90°	90°	90°	90°	90°
Sound Intensity (dB)	Max-Min	-	4.5	3.9	4.5	5.4	9.0	8.5	2.7	-
	Max-Mean	-	1.8	1.1	1.6	1.9	2.8	2.6	1.4	-
	Position	-	60°	150°	90°	135°	90°	90°	135°	-

540mm deep louvre

		Octave Band Centre Frequency Hz								
		63	125	250	500	1K	2K	4K	8K	16K
Sound Pressure level (dB)	Max-Min	4.4	2.6	4.5	2.7	4.1	4.5	2.1	4.4	4.0
	Max-Mean	1.7	1.0	1.5	1.2	1.8	2.0	1.4	2.1	1.6
	Position	75°	30°	90°	105°	90°	75°	90°	90°	90°

CONCLUSIONS

Insertion loss: BS4718 section 1.10. "Accuracy of measurement" states that the tolerances for insertion loss can be expected to be ± 3dB in the 125Hz band and ± 2dB in bands up to 8kHz. Only two readings in 35 results showed a variation greater than this tolerance so it is concluded that all the methods used were in reasonable agreement.

Directivity: An advantage of the HEVAC procedure is that information on directivity may be obtained. This is defined in the procedure as maximum minus mean level and ranged from 1 to 3dB. This was somewhat less than expected, possibly due to reflections from neighbouring buildings, however these values were confirmed by intensity measurements which should reduce this error.

Acknowledgement

The support of Acoustic Engineering Services Ltd., Byfleet, Surrey is acknowledged.

References

(1) BS4718: 1971 Method of Test for Silencers for Air Distribution Systems. British Standards Institution, London.

(2) BS2750: 1956 Recommendations for field and laboratory measurements of airborne and impact sound transmissions in building (now in 9 parts 1980 to 1987) British Standards Institution, London.

(3) N J Pittams and S Simpson. Static Insertion Loss of Acoustic Weather Louvres, Bristol Polytechnic Acoustics Testing Section, Report No.1042A 1990.

(4) BS4196 1981 Sound Power Levels of Noise Sources, British Standards Institution, London.

(5) N J Pittams and S Simpson. The Effect of Variation of Method of Generation of the incident sound field on static insertion loss for air-conditioning silencers. Bristol Polytechnic Acoustics Testing Section, Report No. 1065 1990.

NEW TEST HEVAC PROCEDURES

Figure 1

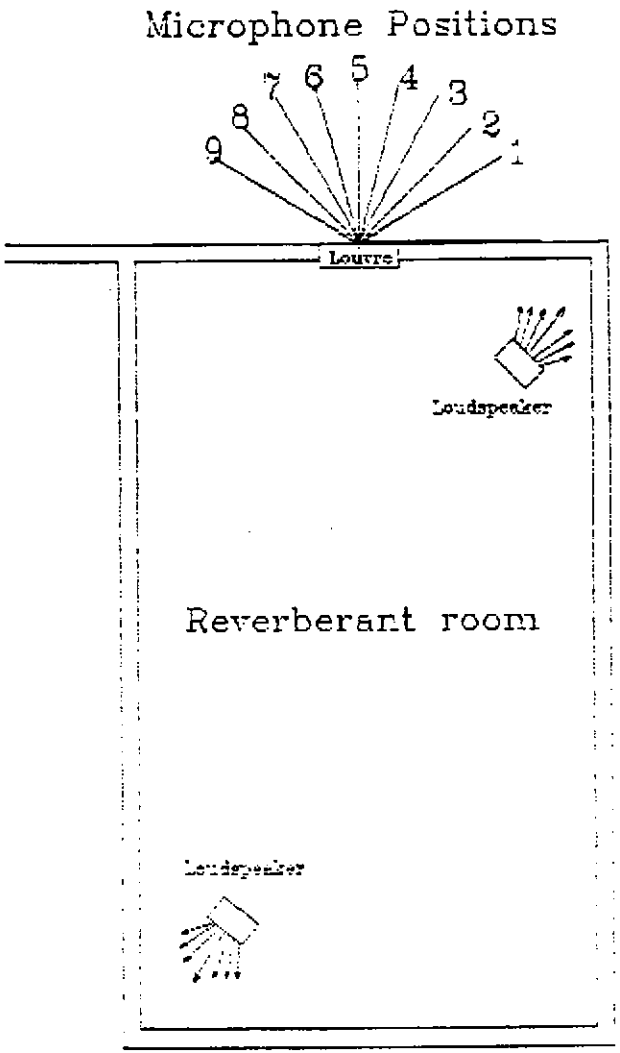
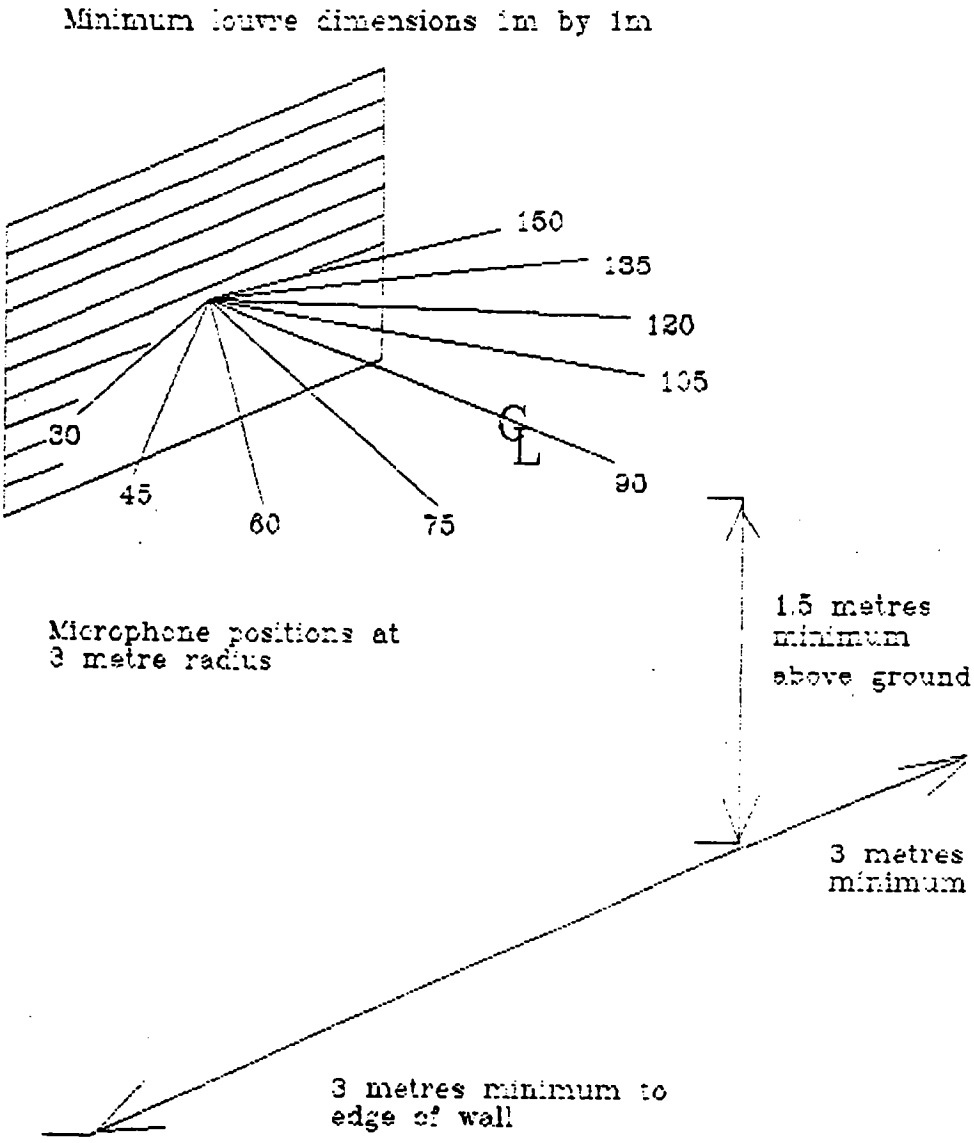


Figure 2


Minimum louvre dimensions 1m by 1m
150
135
120
105
90
75
60
45
30
CL
Microphone positions at
3 metre radius
1.5 metres
minimum
above ground
3 metres
minimum
3 metres minimum to
edge of wall