IMPROVING SOUND INSULATION BY LININGS

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Linings applied to walls with a deficient sound insulation are known to be a measure for improving the sound insulation in existing buildings. But more and more such linings are applied not for acoustical reasons but with the intention to improve the thermal insulation. It is known that some types of linings may decrease the sound insulation between rooms.

Fig. 1 shows a typical example of the sound insulation between rooms having a brick wall as flanking wall which in case (a) was lined by a plasterboard-polystyrene compound board. The sound insulation without lining should be in the range of (b). Another very instructive example is shown in Fig. 2. Here, the wall is built up by a stack of polystyrene foam moulds whereof the cavity is filled by chuted conrete. The outer sides of the mould have a thin prime coat layer made out of chipped bloated clay. The frequency response curve of the direct (transversal) sound insulation R reveals a deep depression at about 1.4 kHz. This will reduce the weighted sound insulation index down to I_W = 40 dB albeit the wall has a surface density of about 490 kg/m². This depression is the result of a strong compressional resonance of the polystyrene layers together with a strong coupling to the concrete wall. If, in a next step, the wall is rendered and plastered as in Fig. 3, the situation becomes even worse. The resonances are down-tuned by the added masses of the coating.

We have found in earlier measurements that the unfavourable effect upon the lateral sound transmission of compound board linings with foams as insulating material can be reduced if the full surface contact to the wall and/or to the cover plate is replaced by punctual connections (see Fig. 4 and Fig. 5). The improvement of transversal sound insulation by a plasterboard lining attached by plaster dabs to the wall described above is visible in Fig. 6; it is not yet satisfying, however.

Real and important improvements of the flanking sound insulation are obtained by using mineral fibre boards as insulating material in wall linings. Fig. 7 shows two examples thereof. Such a plasterboard-mineral-fibre compound board in connection with the above wall will increase the transmission loss even in combination with a rendering at the other side, which itself is known to decrease the sound insulation; see Fig. 8. A satisfactory transversal sound insulation of the cited wall is obtained by a combination of a plasterboard-mineral-fibre compound board on one side with a plasterboard cover on the other side; see Fig. 9.

We have tested with about 30 different linings the influence of several parameters of linings on the flanking transmission loss R_L and - with the same test object - on the transversal transmission loss R. The parameters which were changed and the range of variation are indicated in Table 1.

Parameter	Variation	Dimensions
Cover Plate:	gas concrete, mineral fibre boards	
• material	chipboard, plasterboard, wood panels	-
• thickness	9.5 - 56	mm
• m"	8.4 - 33	kg/m²
Mineral Fibre:		
• thickness	0 - 80	mm
• thickness ratio	0 - 100	%
Mounting:	plaster dabs, glued, wood frame free, - dowelled	-
Distance d	40 - 110	mm
Results:		
ΔR_W	6 - 19	dB
ΔR_{LW}	7 - 20	dB

The improvements of the weighted transversal transmission loss ΔR_W are represented in Fig. 10 over the product of $m'' \cdot d$ as abscissa. Fig. 11 shows the corresponding improvements ΔR_{LW} of the weighted flanking transmission loss.

The improvement of R_W reveals some systematic dependence on $m'' \cdot d$. The scatter of the points in this case is relatively weak (in contrast to ΔR_{LW}); it is mainly caused by different mountings and degrees of mineral fibre infill. An improvement of $\Delta R_W = 15$ dB is a representative value. The lateral transmission seems to react more sensitively to the individual way of mounting; the scatter is larger, therefore. A typical value of possible improvement is $\Delta R_{LW} = 18$ dB.

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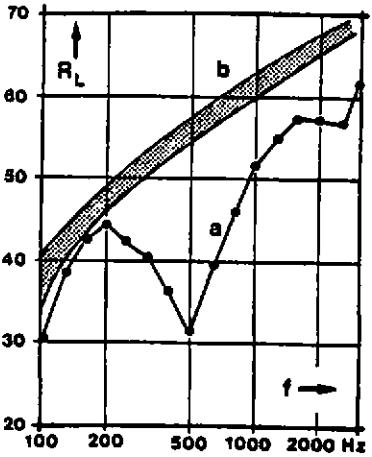
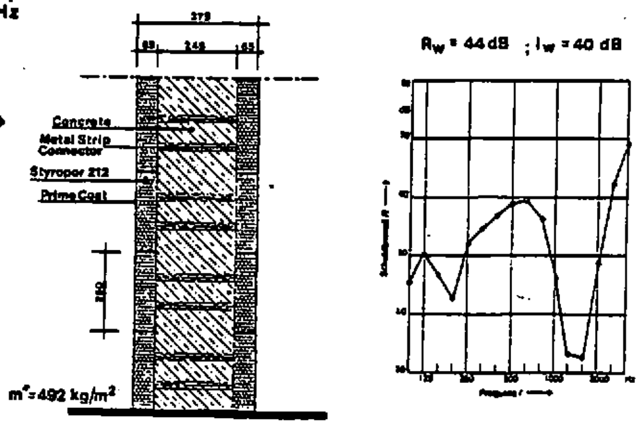


Fig. 1

Fig. 2



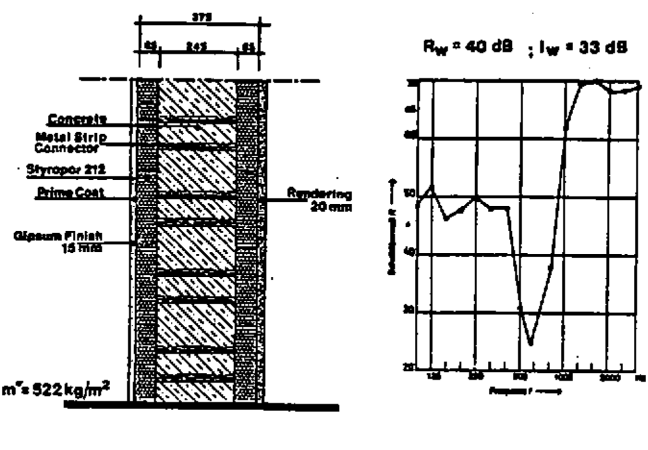


Fig. 3

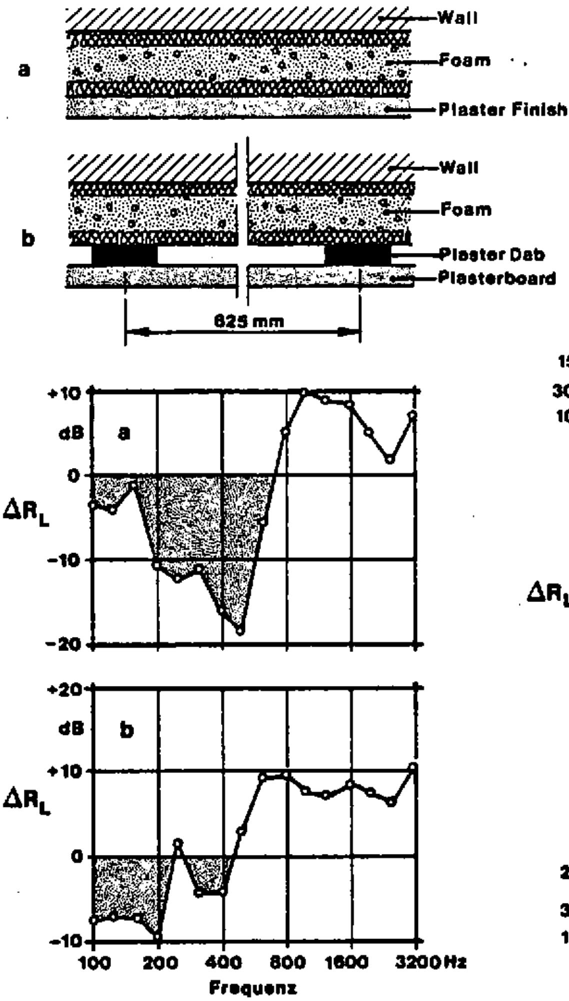

a
Wall
Foam
Plaster Finish
b
Wall
Foam
Plaster Dab
Plasterboard
625 mm
+10
dB
a
0
ΔR_L
-10
-20
+20
dB
b
+10
ΔR_L
0
-10
100
200
400
800
1600
3200 Hz
Frequenz

Fig.4

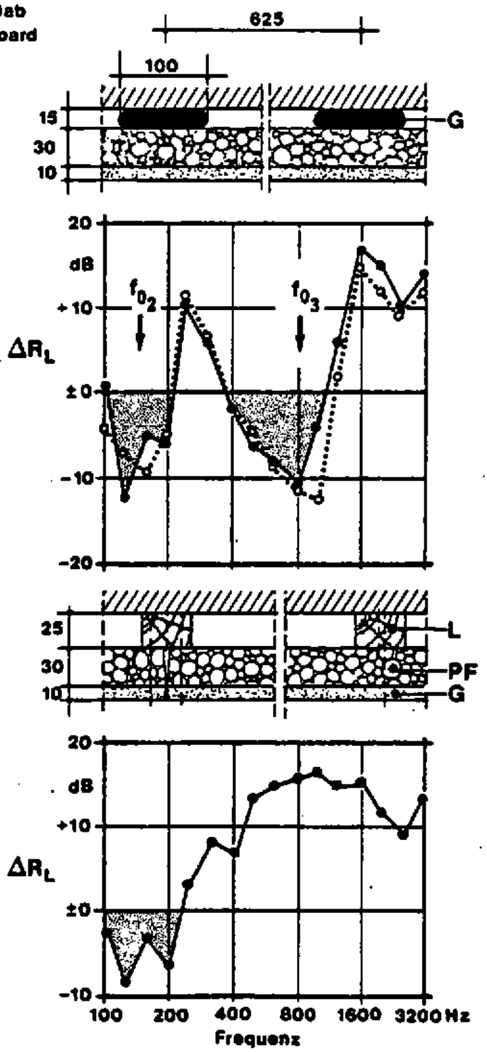

625
100
15
30
10
G
20
dB
f02
f03
+10
ΔR_L
±0
-10
-20
25
30
10
L
PF
G
20
dB
+10
ΔR_L
±0
-10
100
200
400
800
1600
3200 Hz
Frequenz

Fig.5

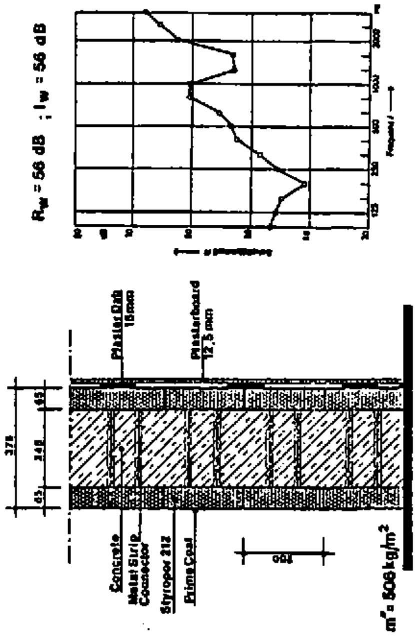
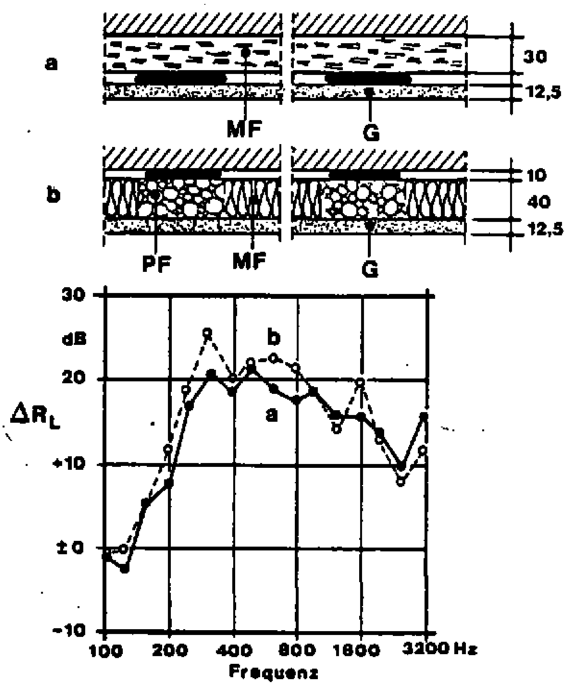


Fig.6

Fig.7



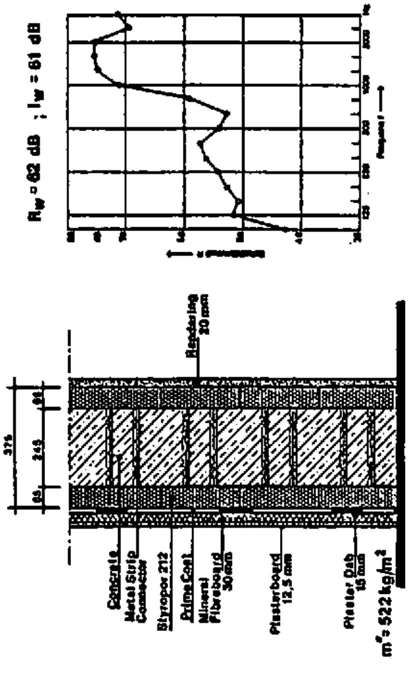


Fig.8

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Fig.10

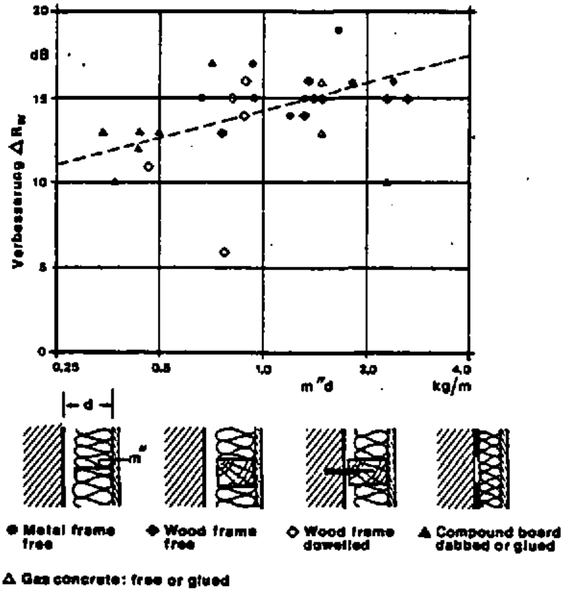
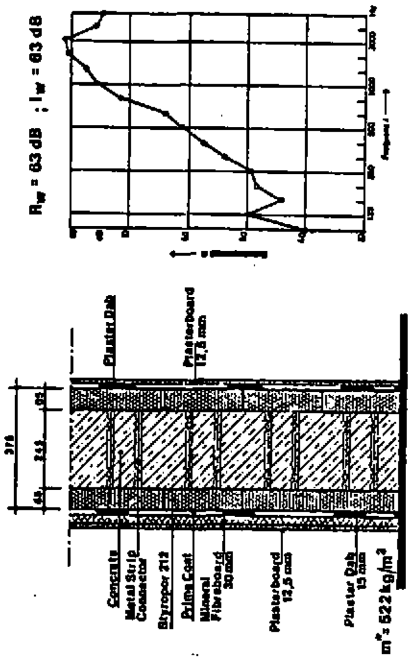


Fig.9



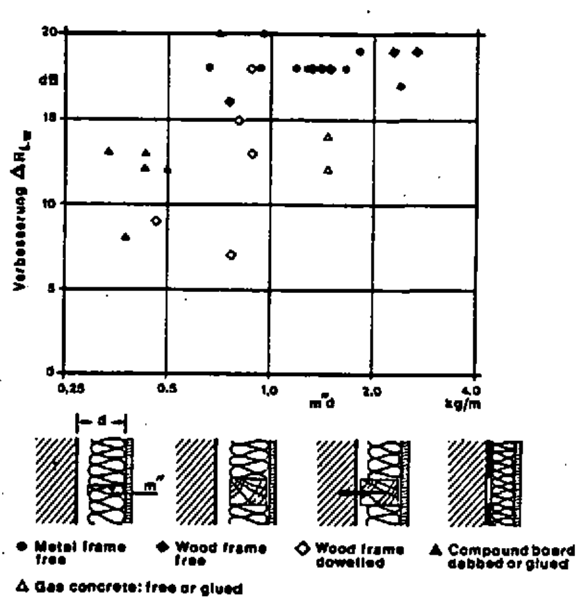


Fig.11