



**Airborne sound insulation of a noise barriers in accordance with German
technical provision ZTV-Lsw 88 and according to DIN EN 1793-2: 1997**

Client: Röhm GmbH Chemische Fabrik
Kirschenallee
D-64293 Darmstadt

1. Place and date of the measurements

The measurements were performed between November 19th, 1998 and
November 25th, 1998 in the test facilities of the Fraunhofer-Institut für
Bauphysik in Stuttgart.

2. Test specimens

Noise barrier consisting of PMMA panels, manufacturer's designation:
PLEXIGLAS® and PLEXIGLAS SOUNDSTOP® (test objects S 8732-1,
S 8731-2, S 8731-3, S 8731-4, S 8731-5, S 8731-6 and S 8731-7), see Fig. 1
and
Fig. 2.

Plates of different thicknesses were inserted into a supporting frame
constructed from carrying channels and H-sections, plate edges were sealed
with perimeter gaskets. The frame construction was adapted to the various
plate depths by way of displaceable contact angles. The following panel
thicknesses were tested:

Test specimen	Plate thickness [mm]	Designation	mass per unit area [kg/m ²]
8731-5	12	PLEXIGLAS®	14.1
8731-3	15	PLEXIGLAS SOUNDSTOP®	17.6
8731-2	16	PLEXIGLAS SOUNDSTOP®	18.7
8731-1	18	PLEXIGLAS SOUNDSTOP®	21.9
8731-4	20	PLEXIGLAS SOUNDSTOP®	23.5
8731-6	22	PLEXIGLAS SOUNDSTOP®	26.6
8731-7	25	PLEXIGLAS SOUNDSTOP®	29.9

Dimensions of test specimens were 3.71 m (W) x 2.95 m (H),
visible panel surfaces were 1.91 m (W) x 2.85 m (H) and
1.495 m (W) x 2.85 m (H).

At the top and at the bottom, the gaskets were sealed with a permanent sealant; to the left and to the right side, U-sections were backed with mineral fibres, with a permanent seal towards the test facility.

3. Sampling procedure

The test material was delivered by the client in June 1998. The panels were mounted in November 1998.

4. Test procedure

The test specimens were mounted on the test facility following the instructions specified in ZTV-Lsw 88. Due to the wall construction, the wall's overlapping by the centre post was approx. 45 mm instead of 20 mm. This is however in accordance with the mounting conditions as specified in the standard DIN EN 1793-2: 1997.

According to the "Additional technical rules and directions for the construction of noise barriers along roads" (ZTV-Lsw 88) the test procedure laid down in German standard DIN 52 210 has to be applied. The tests were performed in a test facility with suppressed flanking transmission acc. to German standard DIN 52 210-2:1984; measurements were performed according to German standards DIN 52 210-1: 1984 and DIN 52 210-3: 1987. The test sound was pink noise, which was filtered by one-third octave band filters in an analyser. The sound reduction index was determined according to the following relation

$$R = L_1 - L_2 + 10 \lg (S/A) \text{ dB.}$$

where:

- R sound reduction index
- L_1 average sound pressure level in the source room
- L_2 average sound pressure level in the receiving room
- S area of test specimen
- A equivalent absorption area in the receiving room
evaluated by measurements of the reverberation
time

The sound reduction index relevant for noise barriers along roads $\Delta L_{A,R,Str}$ was computed acc. to the instructions specified in ZTV-Lsw 88. The single number rating for the airborne sound insulation was determined acc. to the standard DIN EN 1793-2: 1997.

5. Test equipment and test conditions

Dimensions of test rooms:

Source room (L x W x H): 4.79 m x 3.56 m x 3.02 m; V = 51.5 m³

Receiving room (L x W x H): 5.90 m x 3.56 m x 3.01 m; V = 63.2 m³

Test opening (W x H): 3.71 m x 2.95 m; S = 10.9 m²

Air temperature: 19 °C to 22 °C

Relative air humidity: 36 % to 45%

Measuring equipment:

Microphones: B&K 4165

Preamplifier: B&K 2639

Analyser: Norsonic 840-2

Amplifier: Klein & Hummel AK 120

Loudspeaker: MLS Lanny 03/93

6. Measurement results

The measured sound reduction indices are indicated in Tables 1 to 7 and plotted versus frequency in Figs. 3 to 9. The relevant values for sound insulation acc. to ZTV-Lsw 88 and the single number ratings for the airborne sound reduction acc. to DIN EN 1793-2: 1997 are

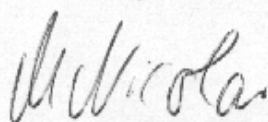
Panel thickness [mm]	$\Delta L_{A,R,Str}$ [dB]	DL_R [dB]
12	29	29
15	30	30
16	30	31
18	31	31
20	32	32
22	32	32
25	33	33

All systems under test meet the requirements specified in clause 7.2.1 of ZTV-Lsw 88. The airborne sound insulation properties of the systems under test are to be classified in group B3 according to the standard DIN EN 1793-2. The adaptation of the noise barrier units to the test facility did not cause any degradation of the measured results.

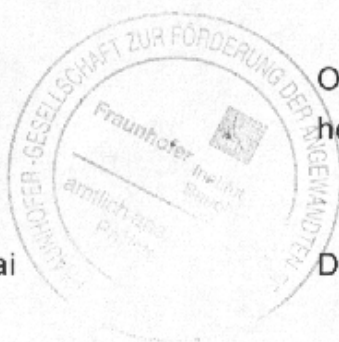
The present test report comprises 5 pages, 7 tables and 8 figures. The measured results contained therein are only valid for the specimens under test. The publication of excerpts of this test report is subject to written authorisation by the Fraunhofer Institut für Bauphysik.

Stuttgart, December 17 th, 1999
Nic/Hy/Ec

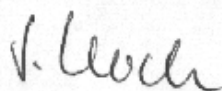
Test engineer:



Dipl.-Ing. M. Nicolai



On behalf of the
head of the laboratory



Dipl.-Ing. S. Koch

Table 1 Noise barrier with 12 mm thick panel

Single values for sound pressure levels L_1 in the source room and L_2 in receiving room, reverberation times T in the receiving room, sound insulation R_i and total sound reduction index

$\Delta L_{A,R,Str}$

acc. to ZTV-Lsw 88, Table 7 and single figure rating for the airborne sound insulation acc. to the standard DIN EN 1793-2

f [Hz]	L_1 [dB]	L_2 [dB]	T [s]	R_i [dB]
100	82,8	62,7	1,1	20,6
125	86,2	69,6	1,4	18,4
160	97,0	77,8	1,8	22,1
200	104,0	83,0	1,7	23,6
250	105,2	85,2	1,6	22,4
315	101,0	79,4	1,7	24,3
400	98,5	74,3	1,7	26,8
500	96,4	70,5	1,7	28,5
630	95,8	67,6	1,6	30,7
800	95,1	64,6	1,6	33,0
1000	94,8	62,4	1,5	34,6
1250	92,2	58,5	1,4	35,8
1600	92,1	58,2	1,3	35,6
2000	91,7	59,3	1,2	33,5
2500	88,3	60,6	1,1	28,5
3150	88,6	58,3	1,0	30,8
4000	87,0	52,7	1,0	34,6
5000	76,1	37,8	0,9	38,1

$$\Delta L_{A,R,Str} = 29 \text{ dB}$$

$$DL_R = 29 \text{ dB}$$



**Sound reduction in accordance with ZTV-Lsw 88 and
acc.to DIN EN 1793-2**

Client: PARA-CHEMIE GmbH
A - 2440 Gramatneusiedl

P-BA 376/2002e
Fig. 3

Test specimen:

Noise barrier consisting of PMMA panels, manufacturers designation: PARAGLAS®
(test object S 8731-5). Thickness of panels 12 mm, mass per unit area: 14,1 kg/m².
Construction see Fig. 1 and Fig. 2.

Test area: 10,9 m²

Test rooms:

Volumes: $V_S = 52 \text{ m}^3$

$V_E = 63 \text{ m}^3$

Type: laboratory

Condition: empty

Upper limit:

$R'_{\max, w} = 75 \text{ dB}$.

Test sound: pink noise

Test method:

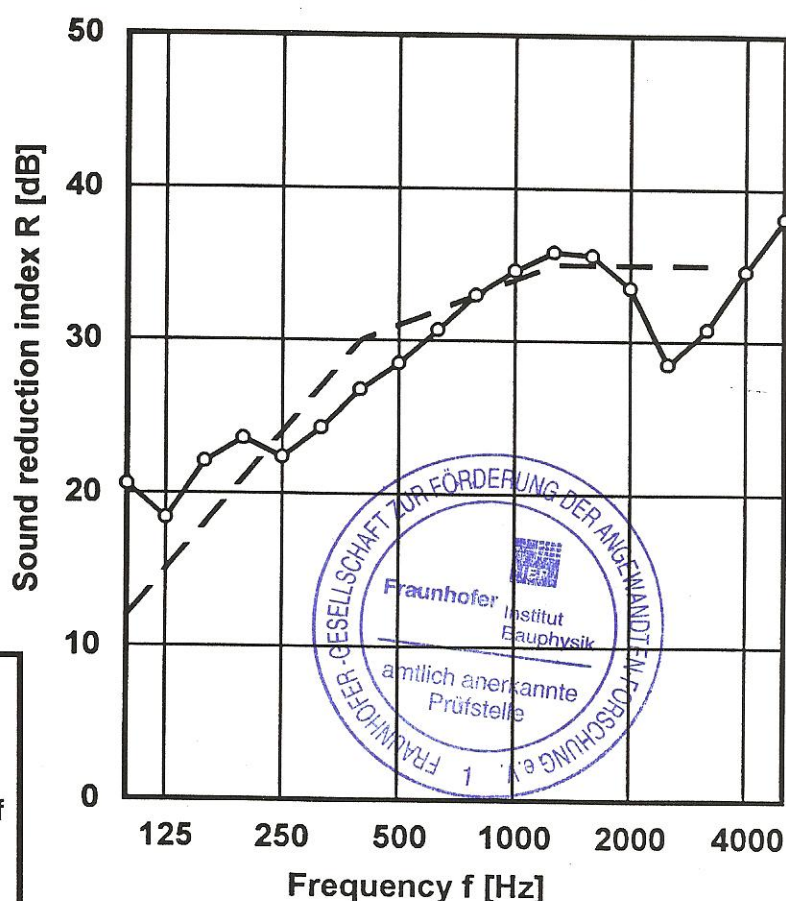
DIN 52 210-03-M-L-P-W

Date of measurement:

November 24 th, 1998

Test conditions:

Test temperature: 19 °C



Rating acc. to ZTV-Lsw 88

$\Delta L_{A,R, Str} = 29 \text{ dB}$.

The system under test meets the
requirements specified in clause 7.2.1 of
ZTV-Lsw 88.

Rating acc. to DIN EN 1793-2:1997

$DL_R = 29 \text{ dB}$.

The airborne sound insulation
properties of the system under test are
to be classified in group B3.



Fraunhofer
Institut
Bauphysik

Stuttgart, July 4 th, 2003

On behalf of the head of the laboratory: