ACOUSTICS
NOISE CONTROL
BUILDING PHYSICS
ENVIRONMENTAL TECHNOLOGY

ADVIESBUREAU PEUTZ & ASSOCIES

Report

Laboratory for Acoustics
Determination of the sound insulation of a
relocatable system partition type Style Line Variant manufactured by Maars

Report number A 1070-3E dd. 8 April 2003

Principal:	Maars Holding BV PO Box 1000 NL-3840 BA HARDERWIJK Netherlands
Report number:	A 1070-3E
Date:	8 April 2003
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ISO-9001 certified

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1. INTRODUCTION

At the request of Maars Holding BV at Harderwijk (Netherlands) sound insulation measurements have been carried out on

various designs of a relocatable system partition type Style Line Variant (SLV) manufactured by Maars (Netherlands)

in the Laboratory for Acoustics of "Adviesbureau Peutz & Associés B.V.", at Mook, The Netherlands (see figure 1)

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For this type of measurements the Laboratory for Acoustics has been accredited by the Dutch “Stichting Raad voor Accreditatie”. The accreditation has been registered in the “STERLAB” register for testing laboratories.

2. NORMS AND GUIDELINES

The measurements have been carried out according to the Quality Manual of the Laboratory for Acoustics and to:

ISO 140-3:1995 Acoustics - Measurements of sound insulation in buildings and of building elements: Part 3: Laboratory measurements of airborne sound insulation of building elements

NOTE: this international standard has been accepted within all EU-countries as European Norm EN ISO 140-3:1995

Various other related norms:

ISO 140-1:1997 Acoustics - Measurement of sound insulation of building elements - Part 1: Requirements for laboratory test facilities with suppressed flanking transmission

NOTE: this international standard has been accepted within all EU-countries as European Norm EN ISO 140-1:1997

ISO 140-2:1991 Acoustics - Measurement of sound insulation of building elements - Part 2: Determination, verification and application of precision data

NOTE: this international standard has been accepted within all EU-countries as European Norm EN 20140-2:1993

ISO 717-1:1996 Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

NOTE: this international standard has been accepted within all EU-countries as European Norm EN ISO 717-1:1996

3. TESTED CONSTRUCTIONS

The measurements have been carried out on a relocatable system partition type Style Line Variant (SLV), dimensions width x height x thickness 4297 x 2796 x 99 mm. The partition exists of a frame covered on both sides with wallpanels

Within the perimeter of the test opening a frame has been constructed existing of:

- a steel recessed ceiling track, 82 or 107mm
- a steel recessed floor track, 82 or 107mm
- two steel wall tracks 82 or 107 mm
- four steel vertical studs 56 or 81mm,

The tracks have been mounted to the perimeter of the test opening using PVC foamtape 3x9mm between the tracks and the perimeter.

This wallframe was covered with wallpanels. Three different types of wallpanels have been tested. (see below). By means of screwed U-profile connectors the panels have been fixed to the frame. The distance between the screws was 300 mm. The channel in the U-profile connectors has been filled up with a PVC infill

Tested panels:

- **Glazed panels**: (see figure 2 and 3) existing of a aluminium frame into which the two panes were mounted.
- **Gypsum board panels**: (see figure 4): each panel existing of a 12,5mm thick gypsum board panel with a 25 mm thick layer of Rockwool, 45 kg/m^3 glued to each panel
- **Melamine chipboard panels**: (see figure 5 and 6): each wallpanel exists of a veneered 12 mm thick melamine chipboard panel, mass 11,6 kg/m^2, density about 646 kg/m^3

Several variants of the partition have been tested as mentioned in chapter 4.4

The results as presented here relate only to the tested items and laboratory conditions as described in this report. The laboratory can make no judgement about the representativity of the tested samples.

4. MEASUREMENTS

4.1. Method

The tests were conducted in accordance with the provisions of the test method ISO 140-3 in the Laboratory for Acoustics of Adviesbureau Peutz & Associés BV in Mook. A detailed description of the test set up has been given in the figure 7 of this report.

The construction to be tested is placed into a test opening between two measuring rooms. In one of the rooms (the so-called sending room) loudspeakers generate broadband noise.

In this sending room as well as in the adjacent room (the "receiving room") the resulting sound pressure level is measured by means of a continuous rotating boom, so the (time- and space-) averaged sound pressure level is determined.

The reverberation time of the receiving room is also measured.

The instruments and the method used meet the requirements of ISO 140-3

As allowed by the test method the test procedure is repeated reversing the sending and receiving rooms. The reported value of each sound insulation is the arithmetic average of the two results.

In ISO 140-3 the airborne sound insulation of an object is defined as the "sound reduction index R" to be evaluated according to formula 1 and expressed in dB:

$$R = L_1 - L_2 + 10 \lg\left(\frac{S}{A}\right) \qquad (1)$$

in which:

L_1	=	sound pressure level in the sending room	[dB]
L_2	=	sound pressure level in the receiving room	[dB]
S	=	area of the object to be tested	[m^2]
A	=	equivalent sound absorption [m^2] in the receiving room according to:	

$$A = \frac{0.16 \cdot V}{T} \qquad (2)$$

in which :

V	=	volume of the receiving room	[m^3]
T	=	reverberation time in the receiving room	[s]

4.2. Accuracy

The accuracy of the airborne sound insulation as calculated can be expressed in terms of repeatability (tests within one laboratory) and reproducibility (between various laboratories).

4.2.1. Repeatability r

When: - two tests are performed on identical test material - within a short period of time - by the same person or team - using the same instrumentation - under unchanged environmental conditions - the probability will be 95% that the difference between the two test results will be less than or equal to r.

In order to evaluate the repeatability r for the sound insulation measurements performed in the laboratories of "Adviesbureau Peutz & Associés" in Mook eight series of measurements have been carried out according to ISO 140-2. From the results of those measurements the repeatability r has been calculated. It was found that for the frequency range from 100 to 250 Hz the repeatability r is 2.0 dB as a maximum. For the frequency range 315 to 3150 Hz the repeatability r is 1.3 dB as a maximum.

The repeatability r regarding the single-figure rating R_w is 0.7 dB as a maximum. As ISO 717-1 prescribes rounding of the R_w-values to the nearest dB repeatability r of 1 dB is applicable for the R_w-value.

From these results it may be concluded that the repeatability r as found satisfies the demands of ISO 140-2.

4.2.2. Reproducibility R

When: - two tests are performed on identical test material - in different laboratories - by different person(s) - under different environmental conditions - the probability will be 95% that the difference between the two test results will be less than or equal to R

In ISO 140-2 there is a statement on the reproducibility R to be expected, based on the results of various inter-laboratory tests. The reproducibility of the single figure rating R_w is about 3 dB.

4.3. Environmental conditions during the tests

room	Temperature [°C]	relative humidity [%]
1	15	66
2	15	61

4.4. Results

The results of the measurements are given in table 1 and in figures 8 to 12

Table 1: results of the **Style Line Variant** partitions

	SOUND REDUCTION INDEX R [dB]									
Variant	SLV 82		SLV 107		SLV 107E		SLV 82		SLV 82	
panels	4 en 6 mm clear glass		4 en 6 mm clear glass		12,5 mm gypsum board		melamine chipboard 12mm		melamine chipboard 12mm	
mineral wool ca 35 kg/m^3					80 mm		40 mm		60 mm	
extra					gypsum straps in ceiling and floor tracks					
figure	8		9		10		11		12	
frequency [Hz]	1/3 oct.	1/1 oct.	1/3 oct.	1/1 oct.	1/3 oct.	1/1 oct.	1/3 oct.	1/1 oct.	1/3 oct.	1/1 oct.
100	19.6		25.8		19.6		16.2		16.6	
125	19.3	19.9	22.5	23.8	24.1	22.7	13.1	15.6	14.7	16.8
160	20.8		23.8		29.1		20.0		21.3	
200	23.0		28.2		34.4		27.6		29.2	
250	25.8	24.9	29.5	29.4	38.3	36.9	33.1	30.9	34.3	32.4
315	26.8		31.0		39.7		36.4		38.1	
400	31.1		36.5		40.4		38.1		41.2	
500	35.1	33.8	38.8	38.2	43.5	42.8	40.9	40.3	43.1	42.7
630	38.0		40.2		46.6		43.5		44.6	
800	40.0		42.3		48.3		44.7		46.2	
1000	41.4	41.0	43.8	43.4	49.5	49.5	46.6	46.0	47.9	47.4
1250	41.8		44.2		51.0		47.0		48.6	
1600	40.4		43.1		52.1		44.2		46.1	
2000	37.8	38.9	39.6	41.1	52.8	49.2	42.4	41.8	43.9	44.4
2500	38.8		41.2		46.1		39.8		43.5	
3150	35.3		38.2		43.5		40.8		44.3	
4000	39.2	38.1	41.3	40.7	46.1	45.6	45.2	43.6	47.2	46.4
5000	42.9		45.3		48.8		47.8		49.0	
$R_w(C;C_{tr})$	36(-2;-5) dB		39(-1;-4) dB		45(-2;-8) dB		39(-3;-9) dB		41(-4;-10) dB	
category	IVa		IVa		IIIa		IVa		IVa	
R_{rose}	35 dB(A)		38 dB(A)		43 dB(A)		36 dB(A)		38 dB(A)	

In the table and graphs the values of the insulation found are presented in 1/3 octave bands. From these values the weighted sound reduction index R_w according to ISO 717-1 including the spectrum adaptation terms C and C_{tr} have been calculated and stated.

Mook,

Th. Scheers
Leader of the Laboratory

ir. M.L.S Vercammen
manager

This report contains: 8 page(s) and 12 figures

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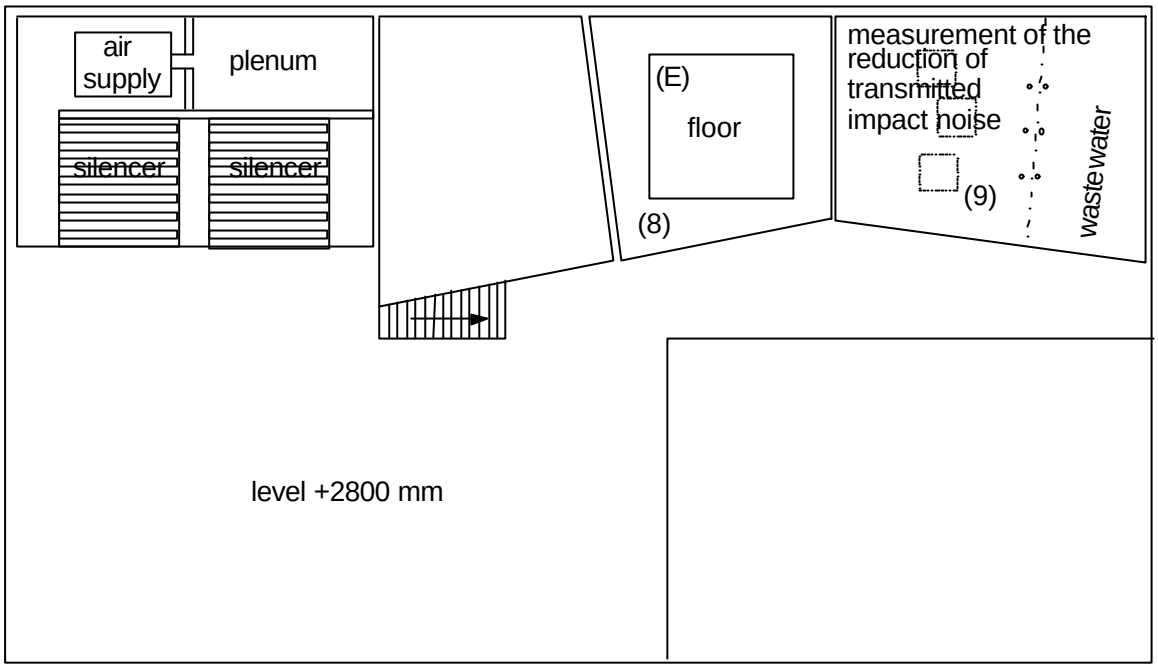
OVERVIEW

Story



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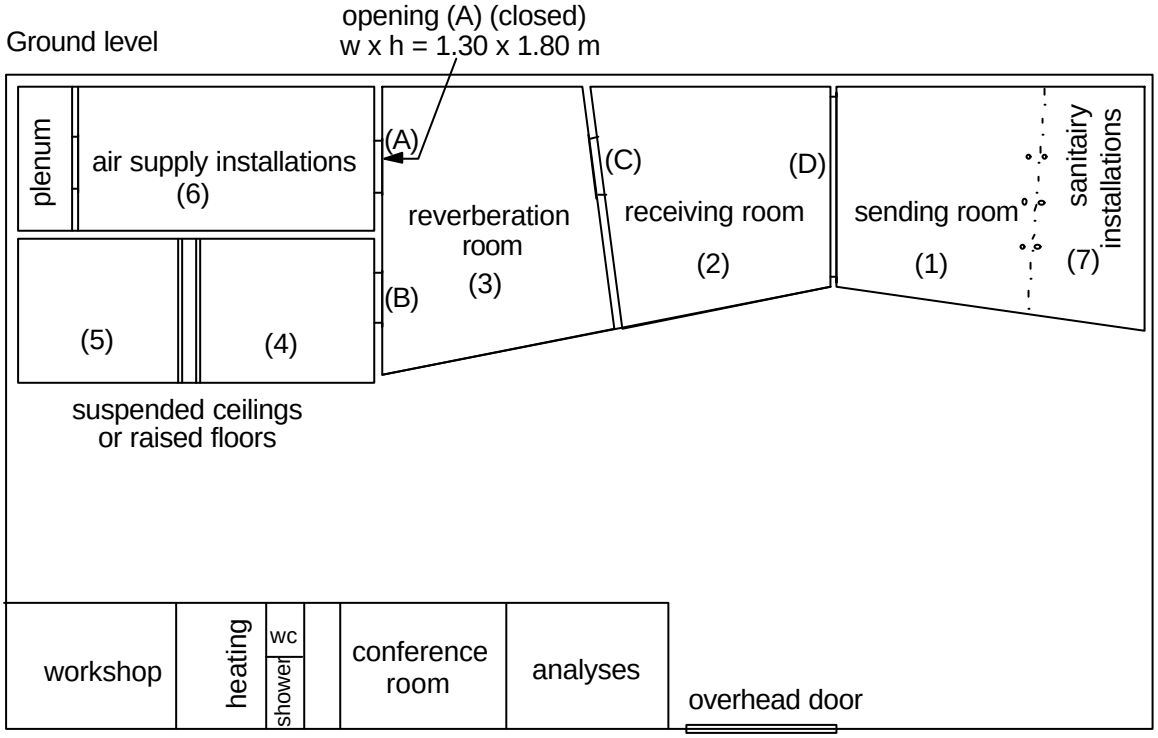
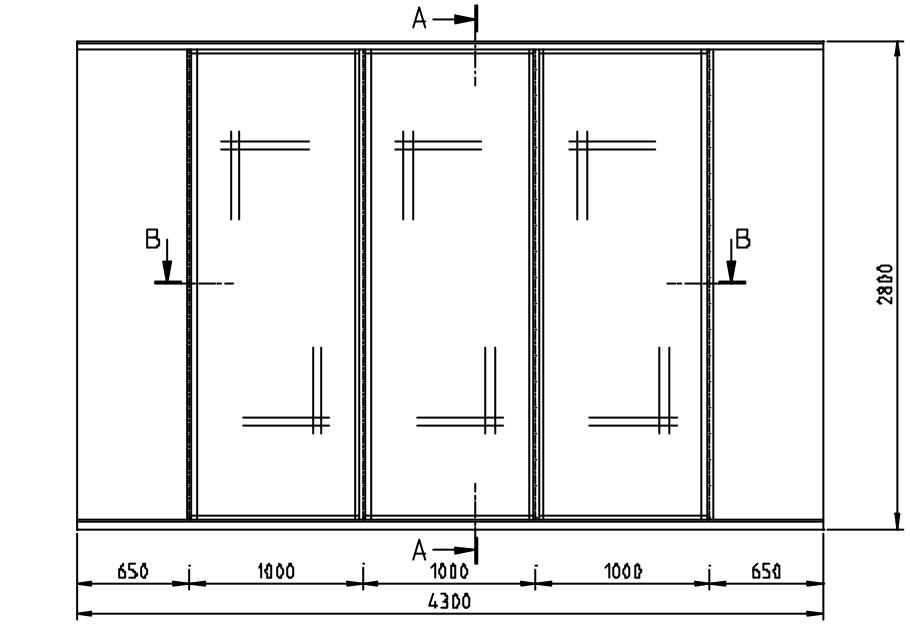


TEST OPENINGS (w x h in mm)
(B) 1000 x 2200
(C) 1500 x 1250
(D) 4300 x 2800
(E) 4000 x 4000

0 1 2 3 4 5 m
scale



1 Foam tape 6x9mm
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5 Clear glass 6mm
6 Rec. Floor track-82
7 Rockwool infill
8 Stud 56mm
9 Infill strip PVC
10 Steel omega section
11 Wall track-82
12 Melamine chipboard ~12mm ~625kg/m3
13 Rockwool 60mm ~35kg/m3
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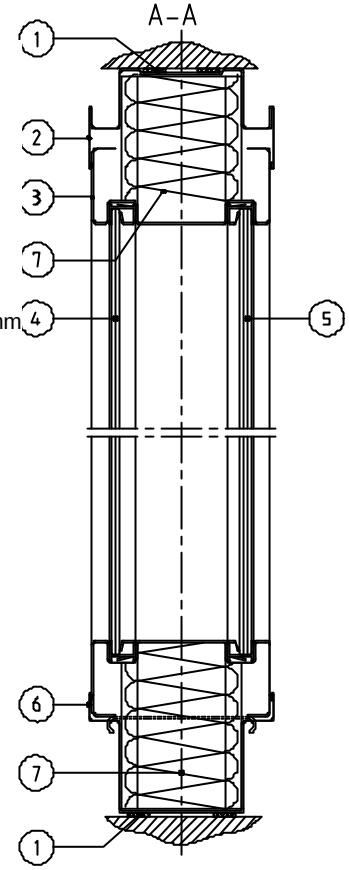
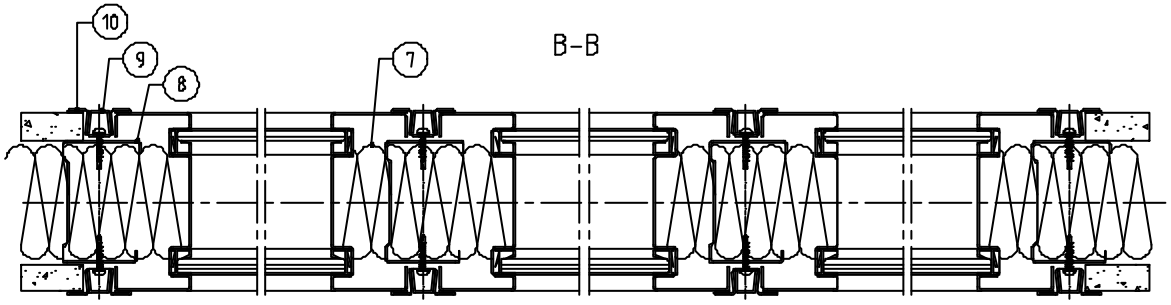
18 Gypsumboard 12,5mm





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PROJEKTIE:
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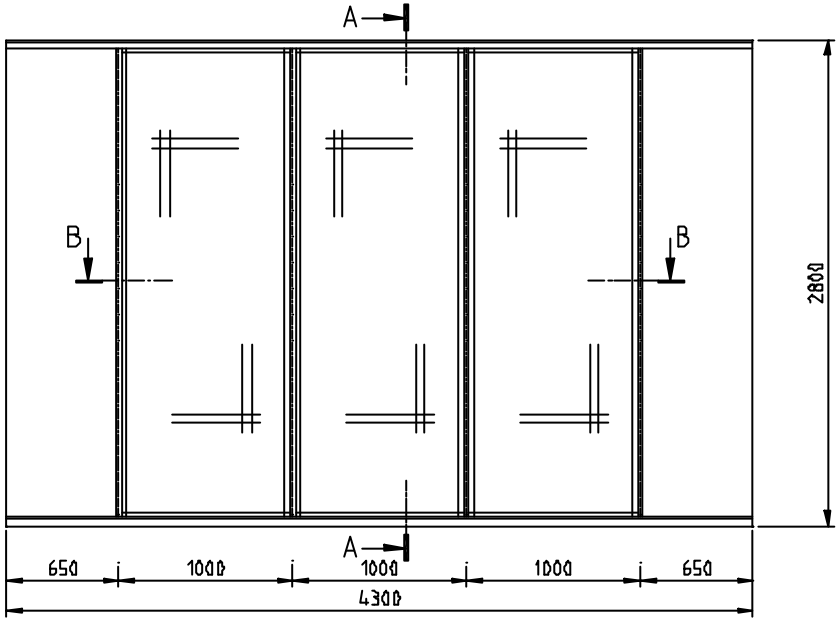

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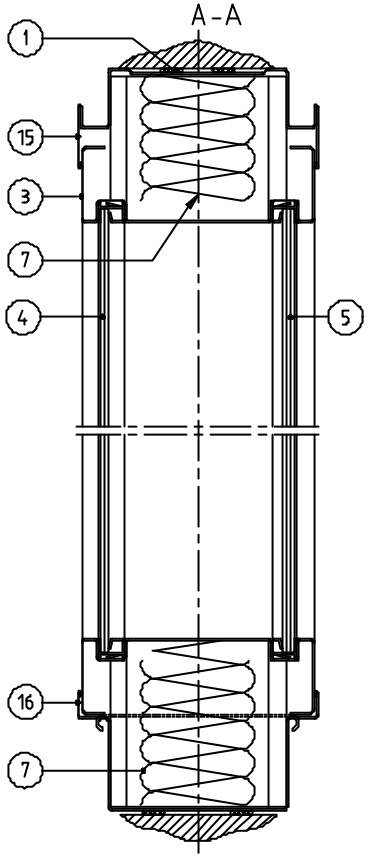

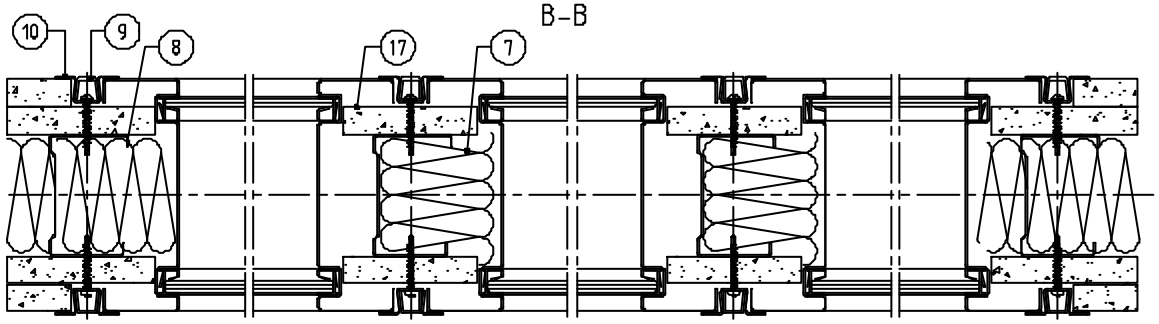

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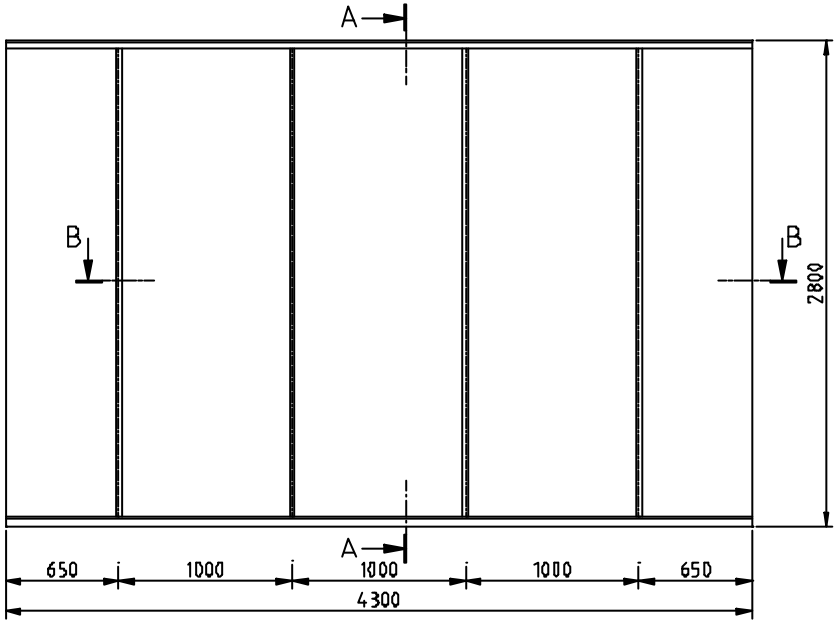

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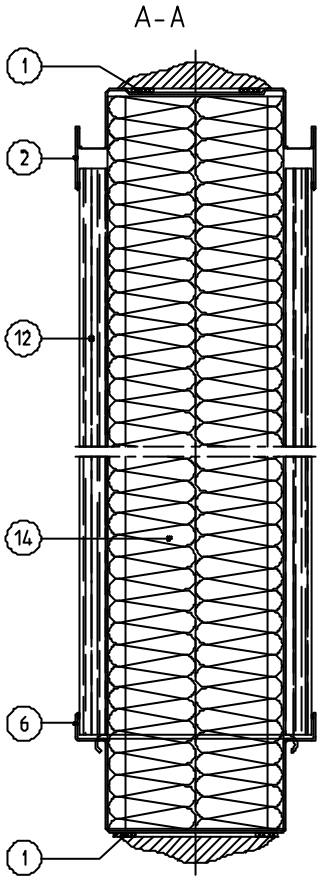

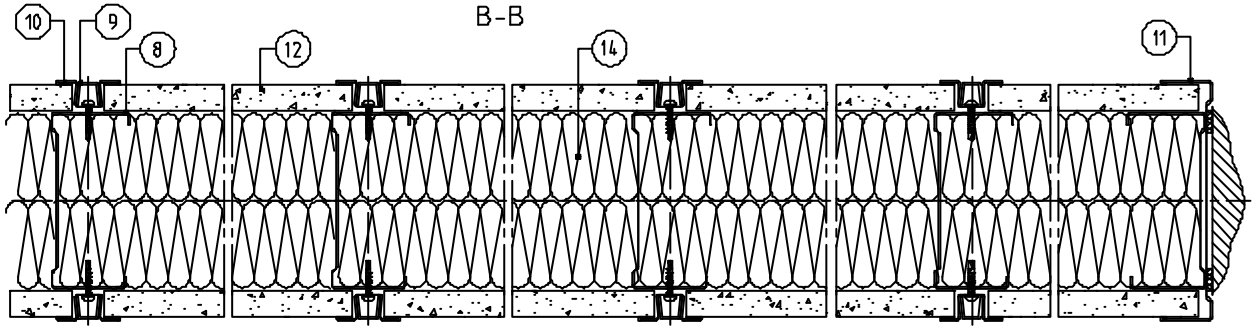

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TOLERANTIES ±0,5 mm TENZIJ ANDERS AANGEGEVEN

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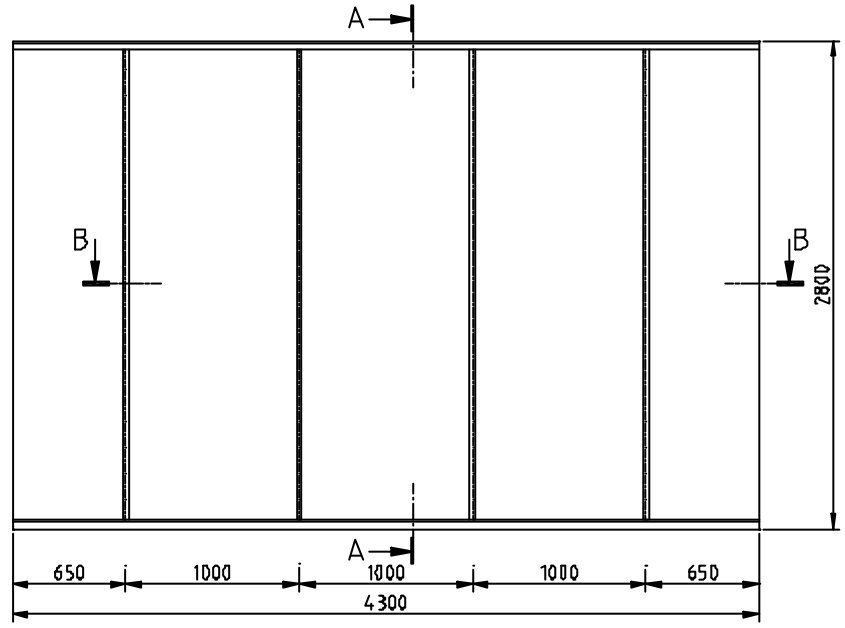

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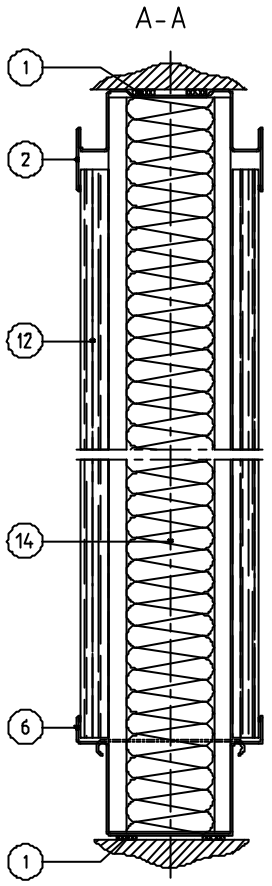

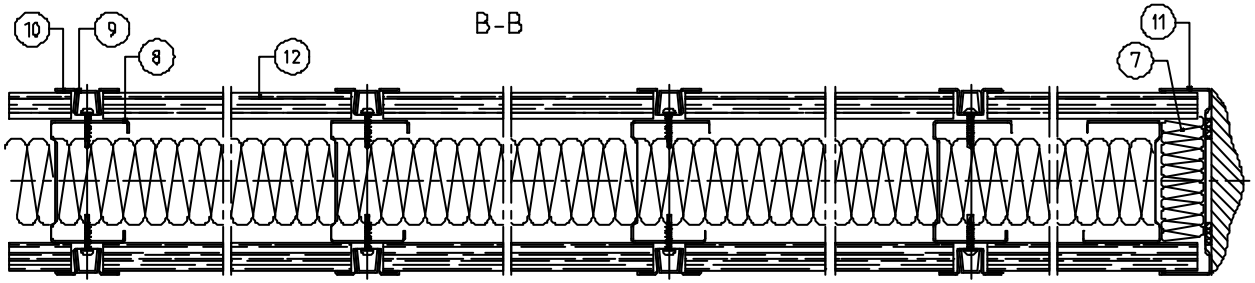

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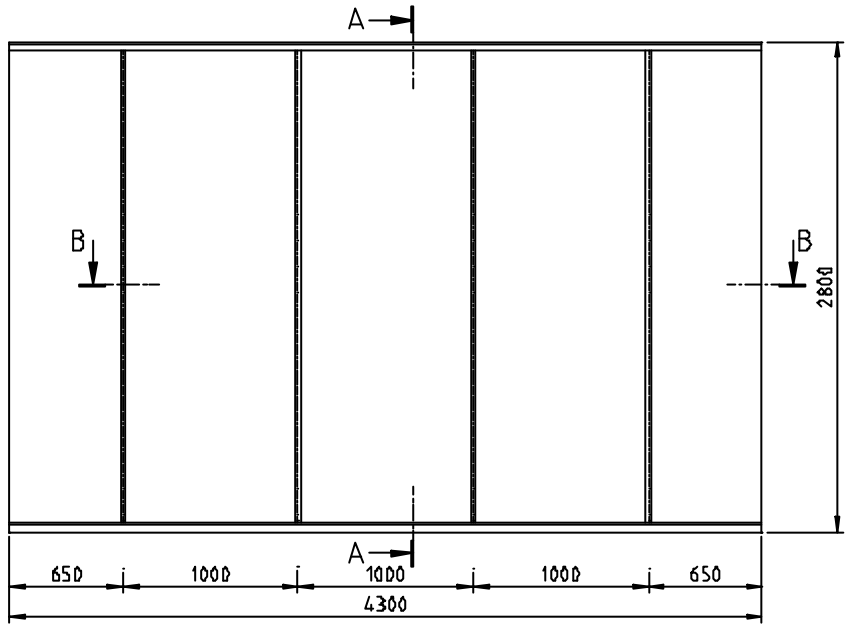

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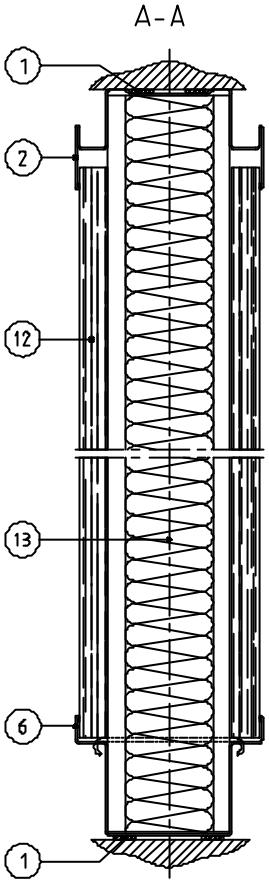

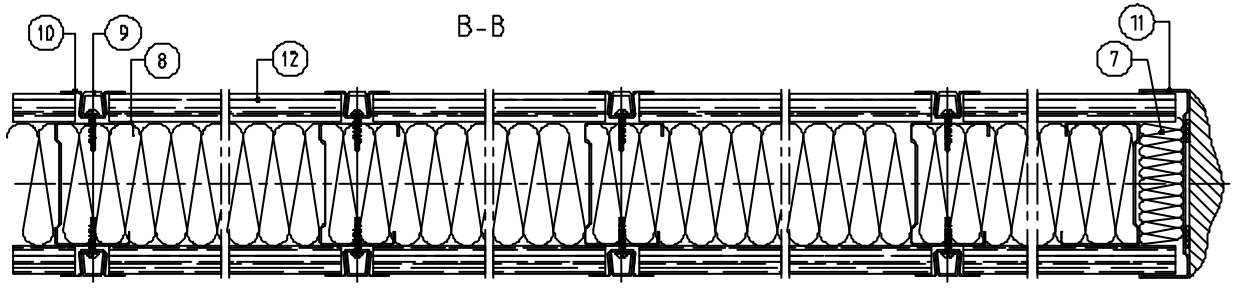

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TOLERANTIES ±0.5 mm TENZIJ ANDERS AANGEGEVEN			
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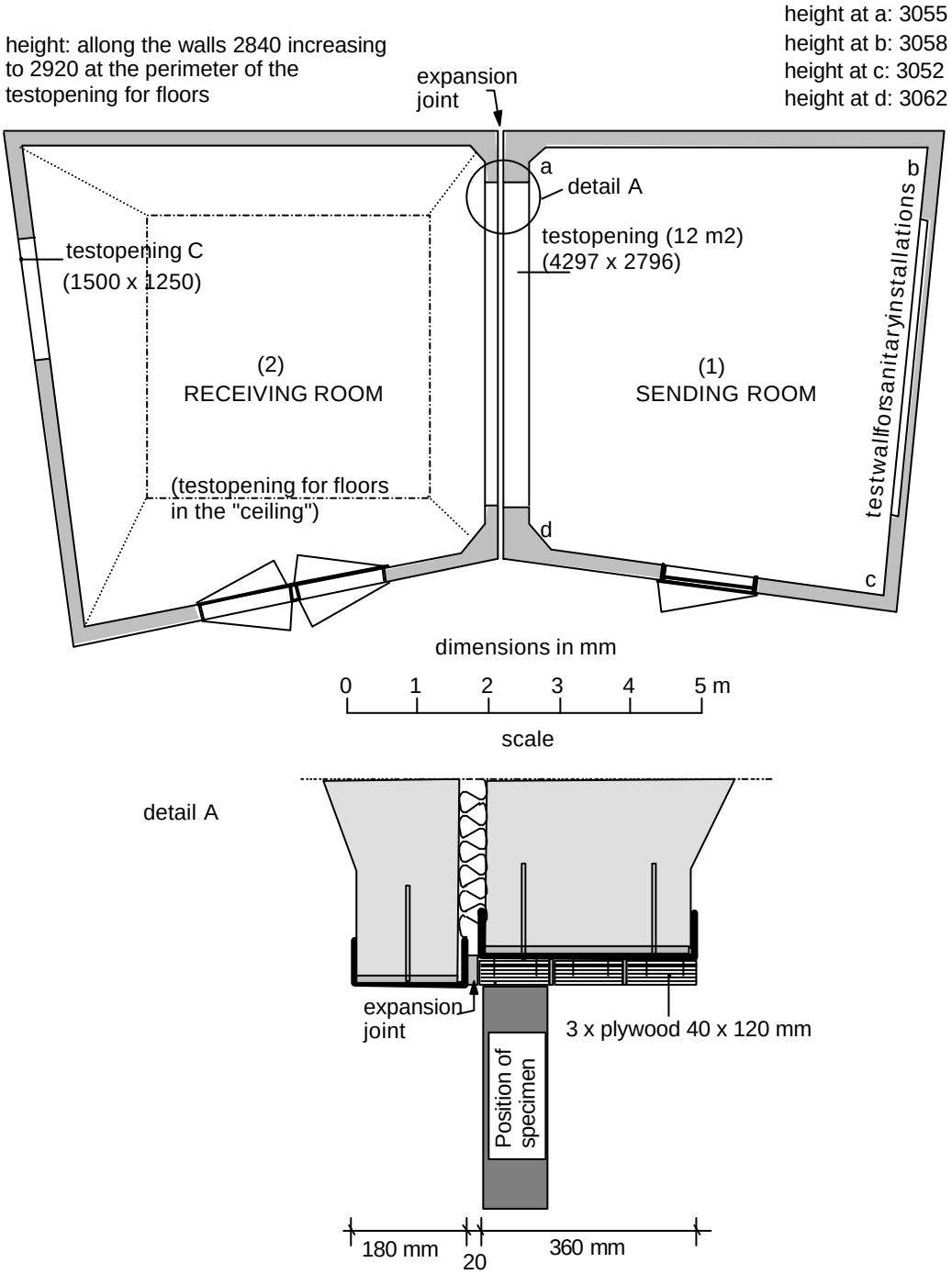
SOUND INSULATION TEST FACILITIES

The test rooms meet the requirements of ISO-140-3.
Additional data:
- volume of the receiving room: 111 m3
- volume of the source room: 94 m3
- area of the test specimen: 12,0 m2

Both rooms are isolated for vibrations by using a so called room-in-room construction. Flanking transmission is thus minimised.

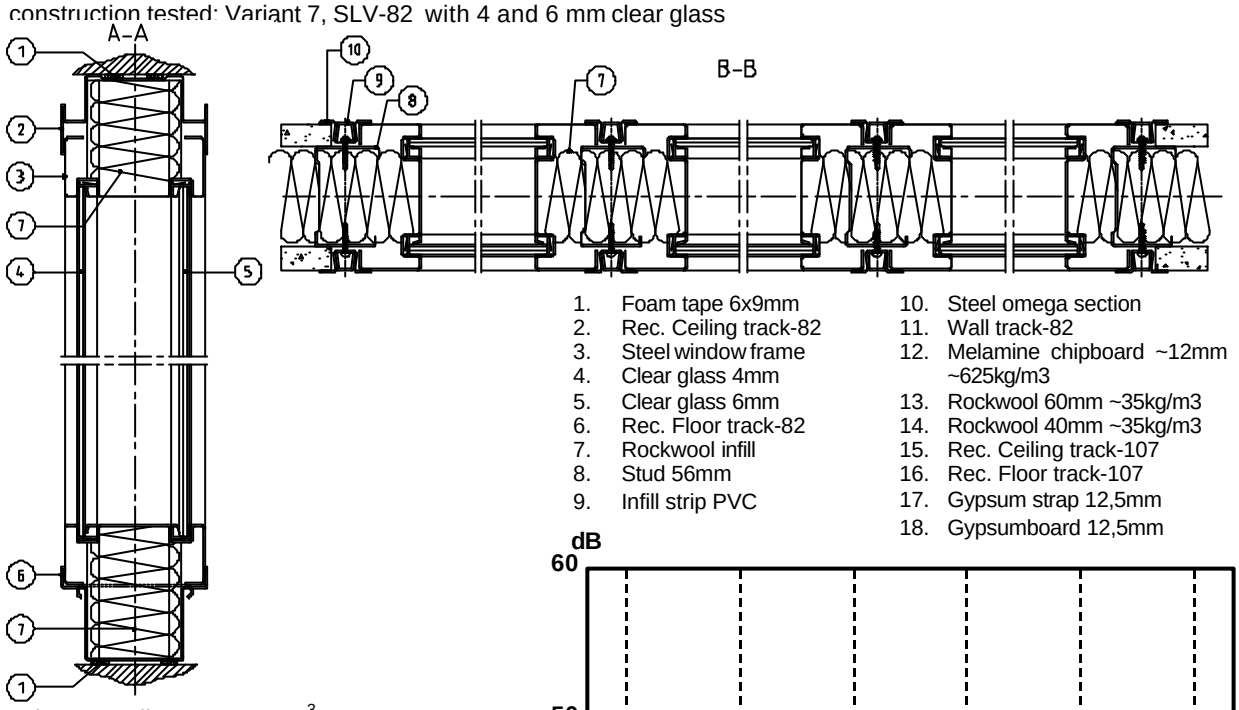


MEASUREMENT OF THE SOUND INSULATION ACCORDING TO ISO 140-3:1995

principal: Maars Holding BV

QUALIFIED BY STERLAB Reg. Nr L334

construction tested: Variant 7, SLV-82 with 4 and 6 mm clear glass



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8. Stud 56mm
9. Infill strip PVC
10. Steel omega section
11. Wall track-82
12. Melamine chipboard ~12mm ~625kg/m3
13. Rockwool 60mm ~35kg/m3
14. Rockwool 40mm ~35kg/m3
15. Rec. Ceiling track-107
16. Rec. Floor track-107
17. Gypsum strap 12,5mm
18. Gypsumboard 12,5mm

volume sending room: 94 m^3

volume receiving room: 111 m^3

surface area tested partition: 12 m^2

measured at: laboratory conditions

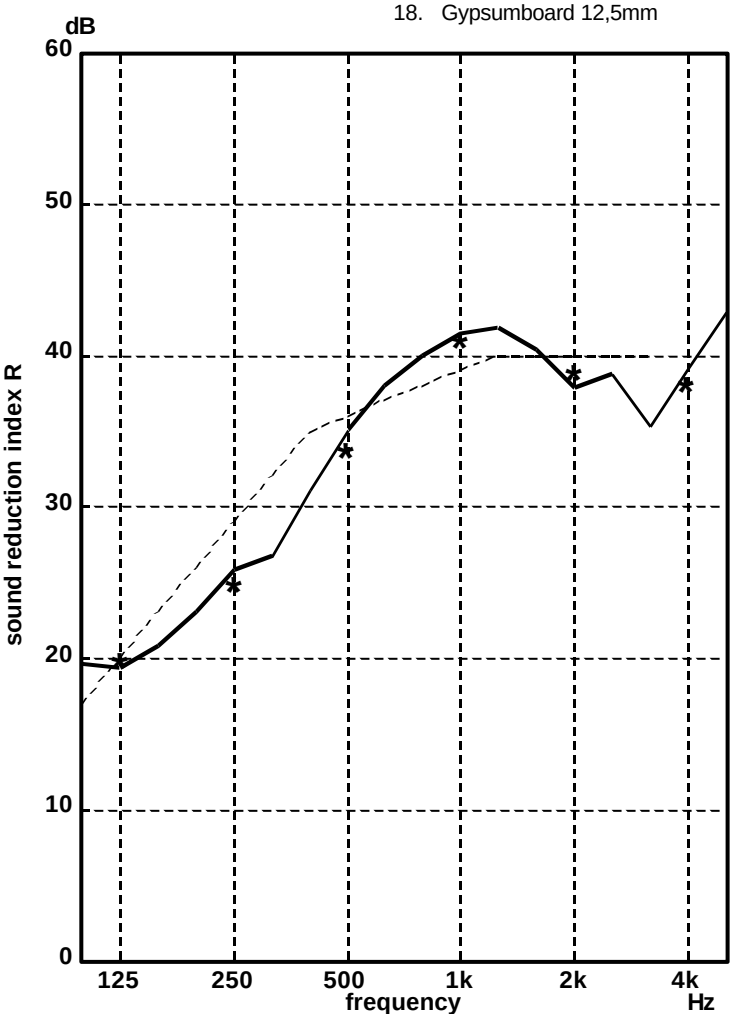
signal: broad-band noise

bandwidth: 1/3 octave

ISO 717-1:1996
$R_w(C;C_{tr})$ = 36(-2;-5) dB

NBN S 01-400:1977
category = IVa

NF S 31-051
R_{rose} = 35 dB(A)



	19.6	23.0	31.1	40.0	40.4	35.3	
1/3 oct.	19.3	25.8	35.1	41.4	37.8	39.2	dB
	20.8	26.8	38.0	41.8	38.8	42.9	
1/1 oct.	**19.9**	**24.9**	**33.8**	**41.0**	**38.9**	**38.1**	**dB**

* 1/1 oct.
——— 1/3 oct.
- - - - - - ref. curve (ISO 717)

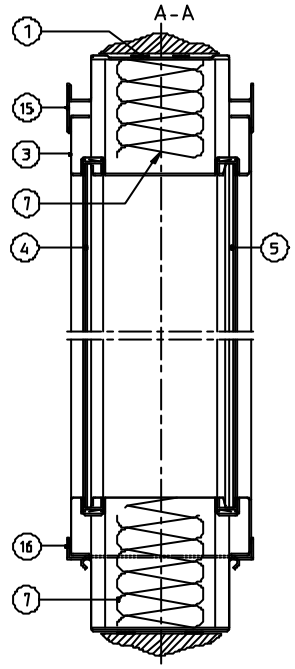
Mook, 22-05-2001

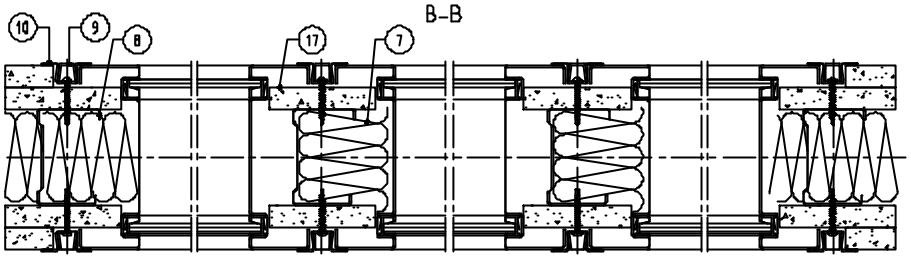
MEASUREMENT OF THE SOUND INSULATION ACCORDING TO ISO 140-3:1995

principal: Maars Holding BV

QUALIFIED BY STERLAB Reg. Nr L334

construction tested: Variant 8, SLV 107 with 4 and 6 mm clear glass





1. Foam tape 6x9mm
2. Rec. Ceiling track-82
3. Steel window frame
4. Clear glass 4mm
5. Clear glass 6mm
6. Rec. Floor track-82
7. Rockwool infill
8. Stud 56mm
9. Infill strip PVC
10. Steel omega section
11. Wall track-82
12. Melamine chipboard ~12mm ~625kg/m3
13. Rockwool 60mm ~35kg/m3
14. Rockwool 40mm ~35kg/m3
15. Rec. Ceiling track-107
16. Rec. Floor track-107
17. Gypsum strap 12,5mm
18. Gypsumboard 12,5mm

volume sending room: 94 m^3

volume receiving room: 111 m^3

surface area tested partition: 12 m^2

measured at: laboratory conditions

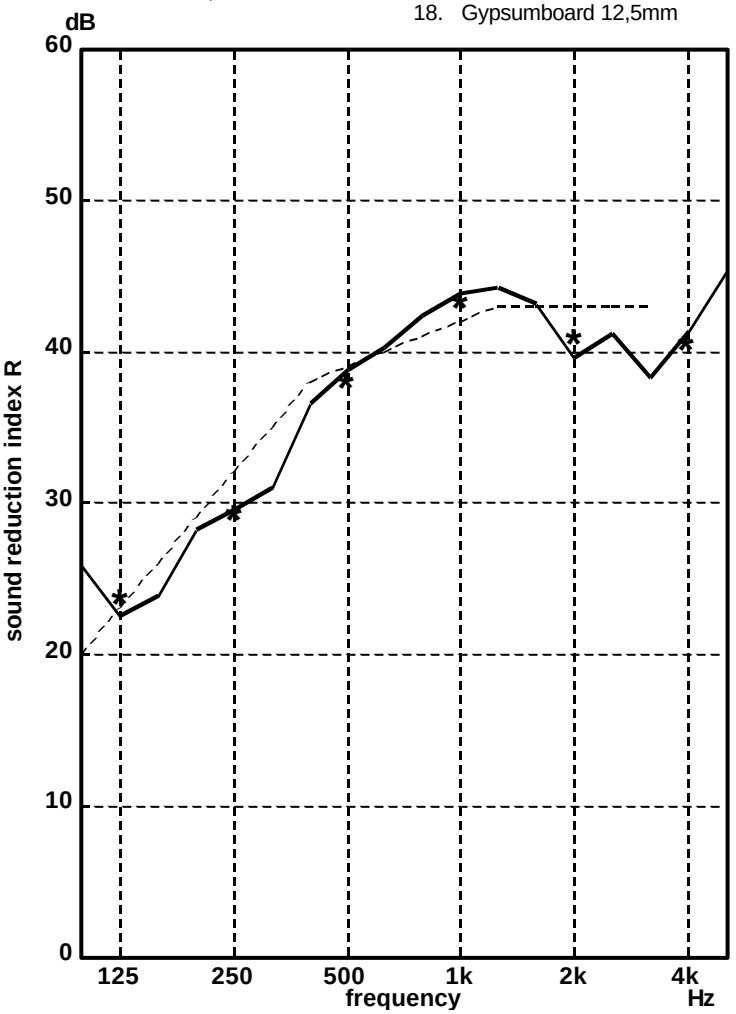
signal: broad-band noise

bandwidth: 1/3 octave

ISO 717-1:1996
$R_w(C;C_{tr})$ = 39(-1;-4) dB

NBN S 01-400:1977
category = IVa

NF S 31-051
R_{rose} = 38 dB(A)



		25.8	28.2	36.5	42.3	43.1	38.2
1/3 oct.		22.5	29.5	38.8	43.8	39.6	41.3 dB
		23.8	31.0	40.2	44.2	41.2	45.3
1/1 oct.		**23.8**	**29.4**	**38.2**	**43.4**	**41.1**	**40.7 dB**

* 1/1 oct.
——— 1/3 oct.
- - - - - - ref. curve (ISO 717)

publication is permitted for the entire page only

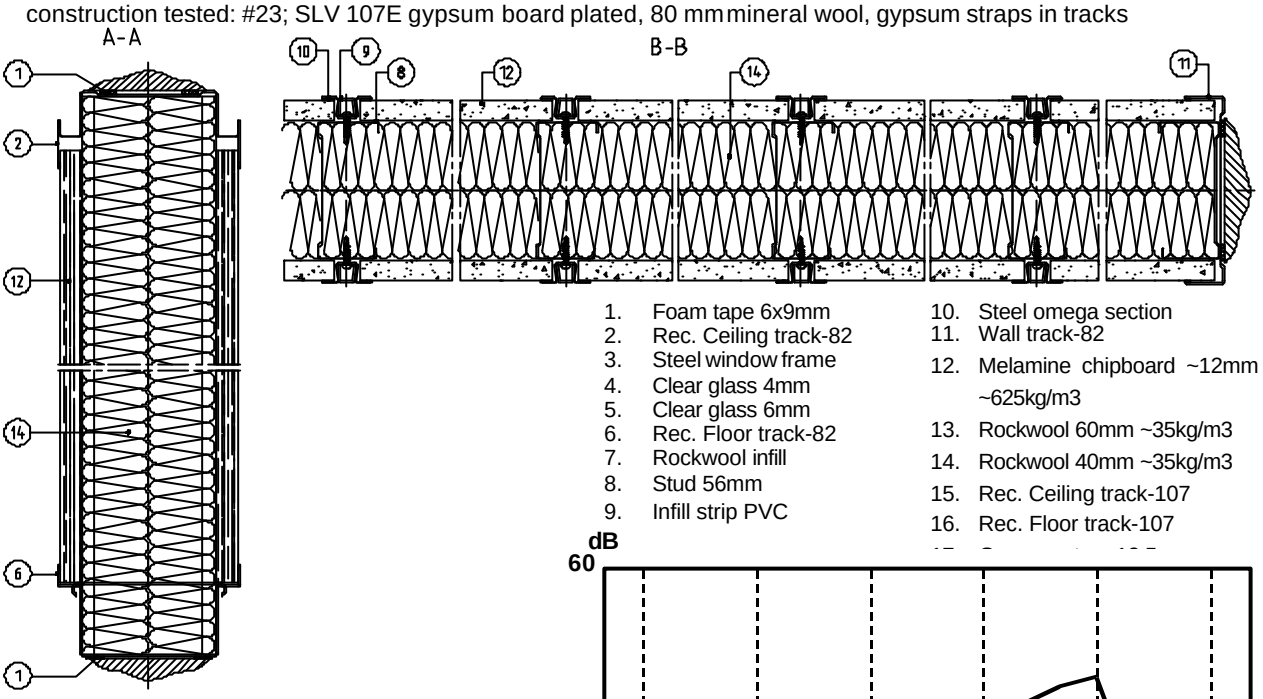
Mook, 23-05-2001

MEASUREMENT OF THE SOUND INSULATION ACCORDING TO ISO 140-3:1995

principal: Maars Holding BV

QUALIFIED BY STERLAB Reg. Nr L334

construction tested: #23; SLV 107E gypsum board plated, 80 mm mineral wool, gypsum straps in tracks



1. Foam tape 6x9mm
2. Rec. Ceiling track-82
3. Steel window frame
4. Clear glass 4mm
5. Clear glass 6mm
6. Rec. Floor track-82
7. Rockwool infill
8. Stud 56mm
9. Infill strip PVC
10. Steel omega section
11. Wall track-82
12. Melamine chipboard ~12mm ~625kg/m3
13. Rockwool 60mm ~35kg/m3
14. Rockwool 40mm ~35kg/m3
15. Rec. Ceiling track-107
16. Rec. Floor track-107

volume sending room: 94 m^3

volume receiving room: 111 m^3

surface area tested partition: 12 m^2

measured at: laboratory conditions

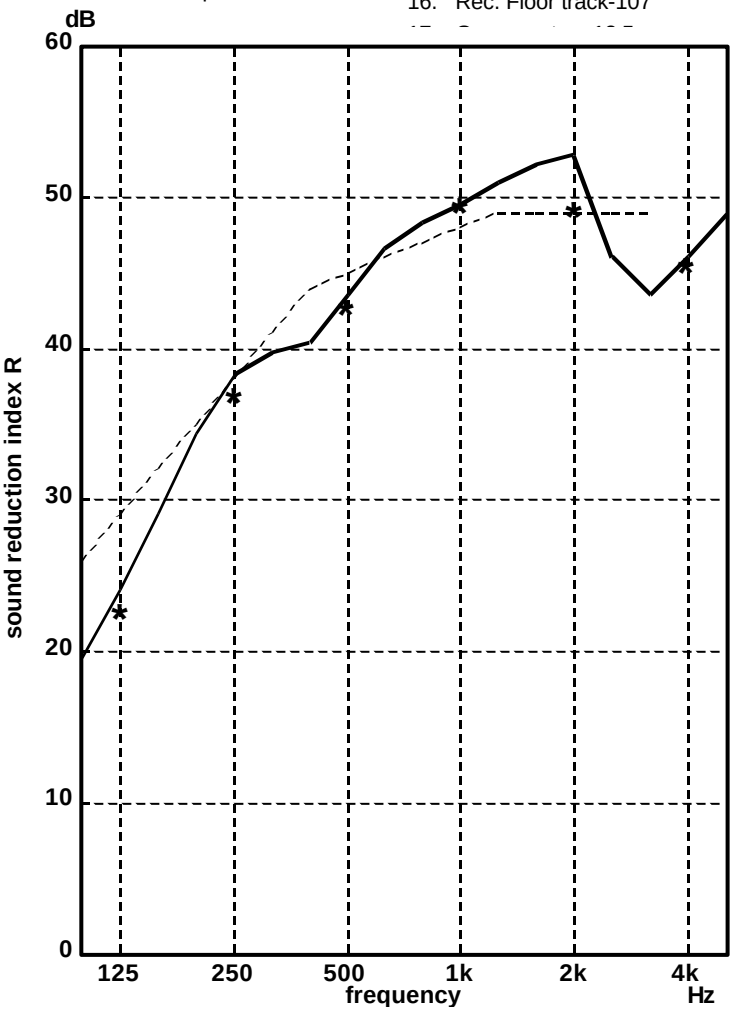
signal: broad-band noise

bandwidth: 1/3 octave

ISO 717-1:1996
$R_w(C;C_{tr})$ = 45(-2;-8) dB

NBN S 01-400:1977
category = IIIa

NF S 31-051
R_{rose} = 43 dB(A)



		19.6	34.4	40.4	48.3	52.1	43.5
1/3 oct.		24.1	38.3	43.5	49.5	52.8	46.1 dB
		29.1	39.7	46.6	51.0	46.1	48.8
1/1 oct.		**22.7**	**36.9**	**42.8**	**49.5**	**49.2**	**45.6 dB**

* 1/1 oct.
——— 1/3 oct.
- - - - - - ref. curve (ISO 717)

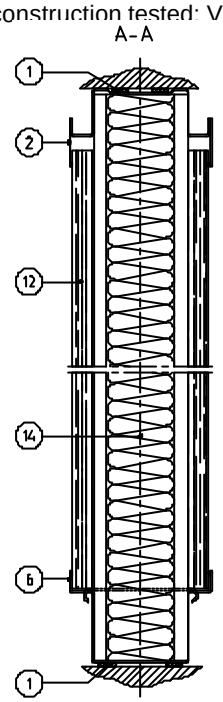
Mook, 06-12-2002

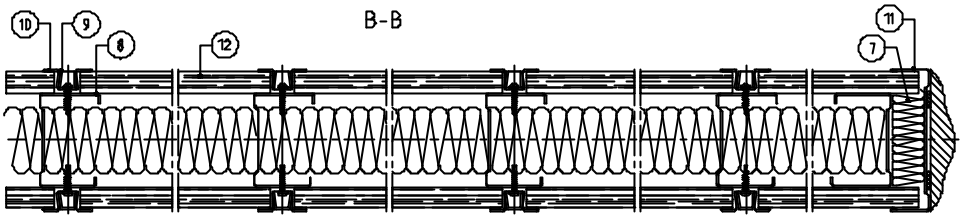
MEASUREMENT OF THE SOUND INSULATION ACCORDING TO ISO 140-3:1995

principal: Maars Holding BV

QUALIFIED BY STERLAB Reg. Nr L334

construction tested: Variant 5, SLV-82 with 12mm melamine chipboard panels and 40mm mineral wool





1. Foam tape 6x9mm
2. Rec. Ceiling track-82
3. Steel window frame
4. Clear glass 4mm
5. Clear glass 6mm
6. Rec. Floor track-82
7. Rockwool infill
8. Stud 56mm
9. Infill strip PVC
10. Steel omega section
11. Wall track-82
12. Melamine chipboard ~12mm ~625kg/m3
13. Rockwool 60mm ~35kg/m3
14. Rockwool 40mm ~35kg/m3
15. Rec. Ceiling track-107
16. Rec. Floor track-107
17. Gypsum strap 12,5mm
18. Gypsumboard 12,5mm

volume sending room: 94 m^3

volume receiving room: 111 m^3

surface area tested partition: 12 m^2

measured at: laboratory conditions

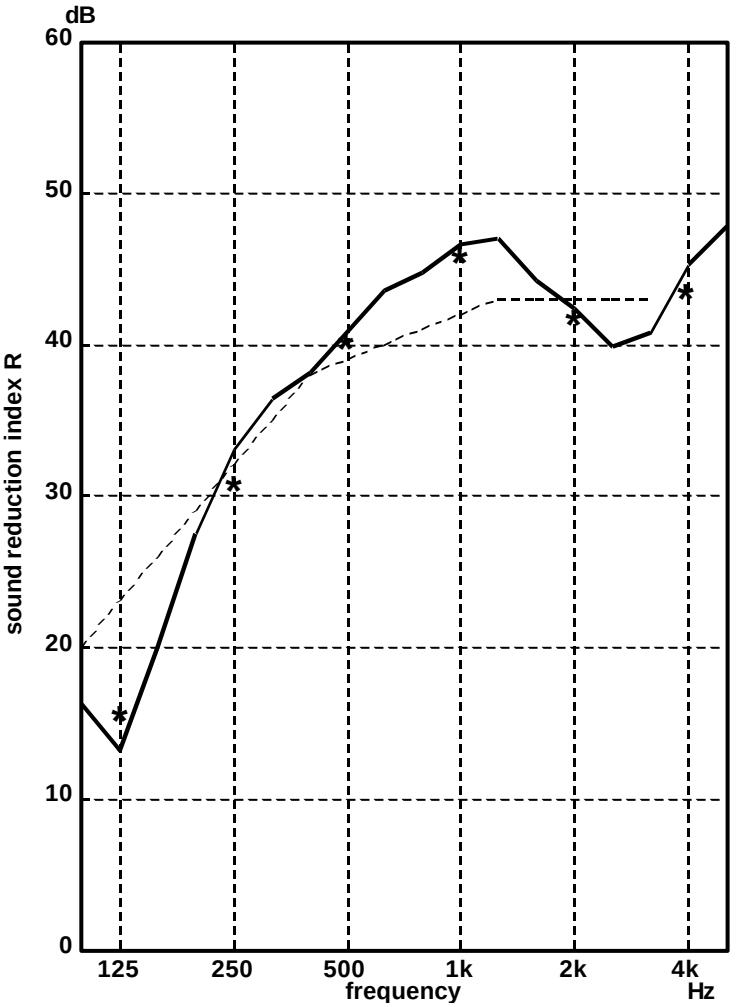
signal: broad-band noise

bandwidth: 1/3 octave

ISO 717-1:1996
$R_w(C;C_{tr})$ = 39(-3;-9) dB

NBN S 01-400:1977
category = IVa

NF S 31-051
R_{rose} = 36 dB(A)



		16.2	27.6	38.1	44.7	44.2	40.8	
1/3 oct.		13.1	33.1	40.9	46.6	42.4	45.2	dB
		20.0	36.4	43.5	47.0	39.8	47.8	
1/1 oct.		**15.6**	**30.9**	**40.3**	**46.0**	**41.8**	**43.6**	**dB**

* 1/1 oct.
——— 1/3 oct.
- - - - - - ref. curve (ISO 717)

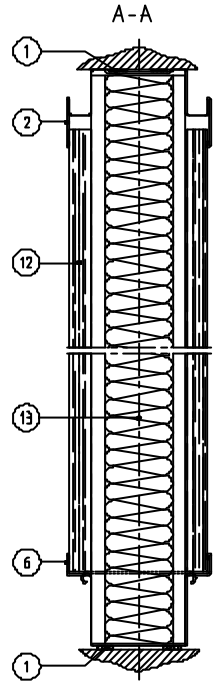
Mook, 21-05-2001

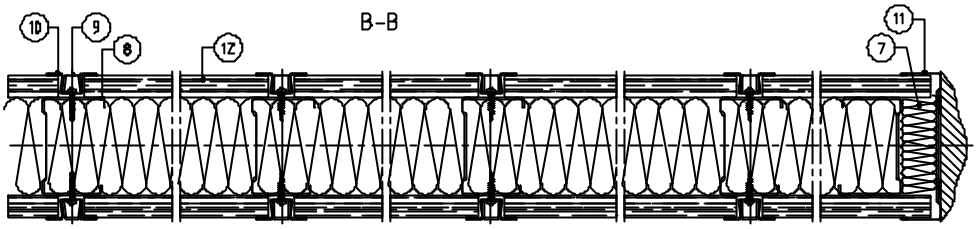
MEASUREMENT OF THE SOUND INSULATION ACCORDING TO ISO 140-3:1995

principal: Maars Holding BV

QUALIFIED BY STERLAB Reg. Nr L334

construction tested: Variant 6, SLV-82 with 12mm melamine chipboard panels and 60mm mineral wool





1. Foam tape 6x9mm
2. Rec. Ceiling track-82
3. Steel window frame
4. Clear glass 4mm
5. Clear glass 6mm
6. Rec. Floor track-82
7. Rockwool infill
8. Stud 56mm
9. Infill strip PVC
10. Steel omega section
11. Wall track-82
12. Melamine chipboard ~12mm ~625kg/m3
13. Rockwool 60mm ~35kg/m3
14. Rockwool 40mm ~35kg/m3
15. Rec. Ceiling track-107
16. Rec. Floor track-107
17. Gypsum strap 12,5mm
18. Gypsumboard 12,5mm

volume sending room: 94 m^3

volume receiving room: 111 m^3

surface area tested partition: 12 m^2

measured at: laboratory conditions

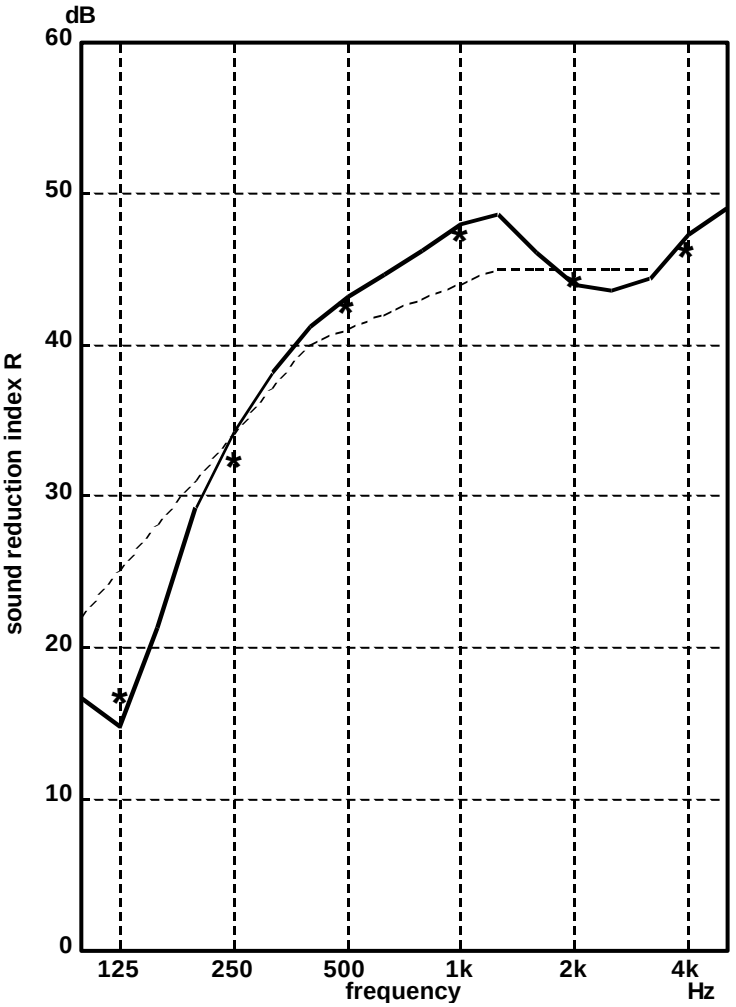
signal: broad-band noise

bandwidth: 1/3 octave

ISO 717-1:1996
$R_w(C;C_{tr})$ = 41(-4;-10) dB

NBN S 01-400:1977
category = IVa

NF S 31-051
R_{rose} = 38 dB(A)



	16.6	29.2	41.2	46.2	46.1	44.3	
1/3 oct.	14.7	34.3	43.1	47.9	43.9	47.2	dB
	21.3	38.1	44.6	48.6	43.5	49.0	
1/1 oct.	**16.8**	**32.4**	**42.7**	**47.4**	**44.4**	**46.4**	**dB**

* 1/1 oct.
——— 1/3 oct.
- - - - - - ref. curve (ISO 717)

Mook, 21-05-2001