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Time 300 and Tibet are produced acc. to identical specifications.

Therefore the results obtained for Tibet are useable for Time 300.

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M60 836/12 nm/ftn  
2005-06-27

## **Curtain fabric Tibet 167 Manufacturer Kvadrat A/S**

**Measurement of  
sound absorption acc. to EN ISO 354**

**Test Report No. M60 836/12**

Client:	Kvadrat A/S Lundbergsvej 10 DK – 8400 Ebeltoft
Date of report	June 27, 2005
Date of measurements	June 17, 2005
Acoustic consultant:	Dipl.-Ing. (FH) Andreas Niermann
Number of pages :	In total 13 pages: 5 pages of text 2 pages of Appendix A 4 pages of Appendix B 1 pages of Appendix C 1 page of Appendix D

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## 1 Task

On behalf of the Kvadrat A/S company, DK – 8400 Ebeltoft, the sound absorption according to EN ISO 354 has to be measured for the curtain fabric, type Tibet 167, which is the same construction as type Time, Tirane and Trim but in a different colour.

## 2 Test object

On June 6, 2005 we received the material to be tested.

The tested material is described by the manufacturer as follows:

- curtain fabric
- manufacturer Kvadrat A/S
- type Tibet 167
- material 100 % Trevira CS

Müller-BBM has measured as follows:

- area specific mass  $m'' = 185 \text{ g/m}^2$
- thickness  $t = 0.53 \text{ mm}$

## 3 Sound absorption

### 3.1 Measurement conditions

The fabric was tested in two ways: not folded and folded with an extra fabric quantity of 100 %. The assembly of the test objects was carried out by Müller-BBM. The test constructions were built as G100-constructions according to EN ISO 354. The fabric was assembled once not folded in 3 curtains and once folded in 6 curtains, each dimensioned width x height = 1400 mm x 2940 mm.

The fabrics were freely suspended. The clear distance between fabric and the wall was 100 mm. The whole construction was built without lateral frame. The curtains were fixed directly without a joint underneath the ceiling by means of a L60 metal beam. The clear distance between the floor and lower border of the curtain was approx. 840 mm. Between the curtains were no open gaps.

The figures in appendix B show details of the constructions. The test certificates in appendix A give a detailed description.

### 3.2 Execution of the measurements

The measurements were effected and evaluated according to EN ISO 354 "Measurement of sound absorption in a reverberation room", edition 12-2003.

The measurements were carried out on June 17, 2005 in the reverberation room of the Müller-BBM company in Planegg. The reverberation room has a volume of approx. 200 m<sup>3</sup> and a surface of approx. 216 m<sup>2</sup>.

Six omnidirectional microphones and two loudspeakers were installed in the reverberation room. In order to improve the diffusivity, seven composite sheet metal boards (1.2 m x 1.4 m) and six composite sheet metal boards (1.2 m x 1.2 m) were suspended curved and irregularly.

In all tests, pink noise was used as a test signal.

The climatic conditions during the measurements are stated in the test certificate, appendix A. The different dissipation during the sound propagation in the air was taken into account according to EN ISO 354, chapter 8.1.2.3 regarding ISO 9613-1 "Acoustics – Attenuation of sound during propagation outdoors", edition 1996-06.

The test equipment listed in appendix D was used for the measurements.

Table 1 in appendix C shows the measured reverberation times in the reverberation room with and without test object.

### 3.3 Measurement results

The measurement results shown in the following table 1 are also described in the test certificates in appendix A.

In addition to the sound absorption coefficients  $\alpha_s$  in single third-octave bands, the practical sound absorption coefficients  $\alpha_p$  in octave bands, which are calculated from these values, are stated. The weighted sound absorption coefficient  $\alpha_w$  is determined as a single number value from the practical sound absorption coefficients  $\alpha_p$  from 250 Hz to 4000 Hz. The practical and weighted sound absorption coefficient were calculated according to DIN EN ISO 11654 "Acoustics – Sound absorber for use in buildings – Rating of Sound absorption", edition July 1997.

**Table 1.** Practical sound absorption coefficient  $\alpha_p$  according to DIN EN ISO 11654

Construction	Octave centre frequency $f$ / Hz						Test certificate Appendix A, page
	125	250	500	1000	2000	4000	
Curtain fabric Tibet 167 Kvadrat A/S 100 mm air gap, not folded	0.00	0.10	0.35	0.50	0.35	0.45	1
Curtain fabric Tibet 167 Kvadrat A/S 100 mm air gap folded 100 %	0.10	0.25	0.50	0.60	0.55	0.65	2

**4 Remark**

This test report may only be published and copied as a whole including all of its appendixes. The publishing of extracts requires the prior written consent of Müller-BBM GmbH.



Dipl.-Ing. (FH) Andreas Niermann

**MÜLLER-BBM**

Accredited Test Laboratory  
according to ISO/IEC 17025



DAP-PL-2465.10

# Sound absorption coefficient ISO 354

## Measurement of sound absorption in a reverberation room

**Client:** Kvadrat A/S  
DK 8400 Ebeltøft

**Test specimen:** Curtain fabric "Tibet 167" Kvadrat A/S  
100 mm air gap, 6 curtains, folded 100 %

**Details about the fabric**

- curtain fabric
- Manufacturer Kvadrat A/S
- Type upholstery fabric "Tibet 167"
- 100 % Trevira CS
- area specific mass app.  $m'' = 185 \text{ g/m}^2$
- no side of the fabric to be preferred, almost equal
- air flow resistance acc. to EN 29053: not tested

**Mounting details**

- Mounting type G100 according to ISO 354
- arranged in 3 curtains, each dimensioned width x height = 1400 mm x 2940 mm
- Test surface  $S = 4120 \text{ mm} \times 2880 \text{ mm}$
- freely suspended, folded 100 %
- clear distance to the wall 100 mm
- construction without lateral frame
- fixed directly without joint underneath the ceiling by means of a L60 metal beam
- clear distance between floor and lower border of the curtain app. 840 mm
- no open gaps between the curtains

Room: Reverberation room E  
Volume: 199.60 m<sup>3</sup>  
Size: 11.87 m<sup>2</sup>  
Date of test: 2005-06-17

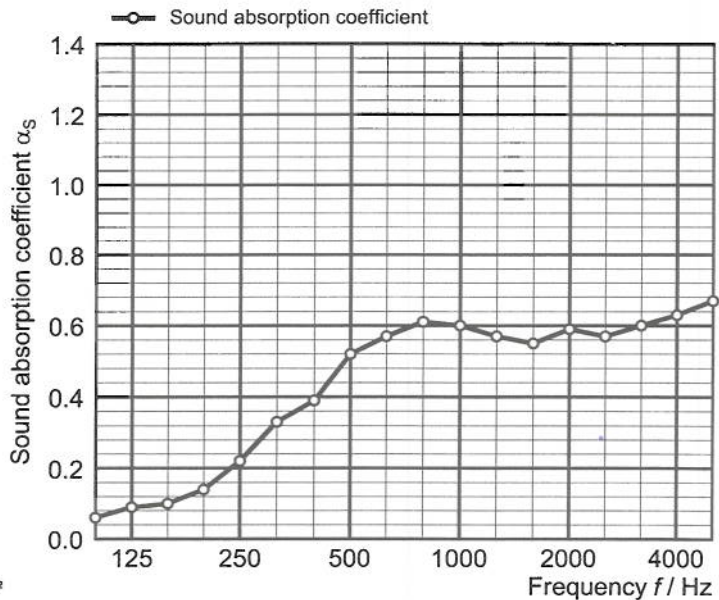
	$\Theta$ [°C]	r. h. [%]	B [kPa]
with specimen	22.5	50	96.0
without specimen	23.2	49	96.0

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2465.10

Frequency [Hz]	$\alpha_s$ 1/3 octave	$\alpha_p$ oktave
100	0.06	0.10
125	0.09	
160	0.10	
200	0.14	
250	0.22	0.25
315	0.33	
400	0.39	
500	0.52	0.50
630	0.57	
800	0.61	
1000	0.60	0.60
1250	0.57	
1600	0.55	
2000	0.59	0.55
2500	0.57	
3150	0.60	
4000	0.63	0.65
5000	0.67	



◦ Equivalent sound absorption area less than 1.0 m<sup>2</sup>

$\alpha_s$  Sound absorption coefficient according to ISO 354

$\alpha_p$  Practical sound absorption coefficient according to ISO 11654

Rating according to ISO 11654:

**Weighted sound absorption coefficient  $\alpha_w = 0.50$  (H)**

Sound absorption class: D

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Appendix A

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# Sound absorption coefficient ISO 354

## Measurement of sound absorption in a reverberation room

**Client:** Kvadrat A/S  
DK 8400 Ebeltoft

**Test specimen:** Curtain fabric "Tibet 167" Kvadrat A/S  
100 mm air gap, 3 curtains, not folded

**Details about the fabric**

- curtain fabric
- Manufacturer Kvadrat A/S
- Type upholstery fabric "Tibet 167"
- 100 % Trevira CS
- area specific mass app.  $m' = 185 \text{ g/m}^2$
- no side of the fabric to be preferred, almost equal
- air flow resistance acc. to EN 29053: not tested

**Mounting details**

- Mounting type G100 according to ISO 354
- arranged in 3 curtains, each dimensioned width x height = 1400 mm x 2940 mm
- Test surface  $S = 4120 \text{ mm} \times 2880 \text{ mm}$
- freely suspended, not folded
- clear distance to the wall 100 mm
- construction without lateral frame
- fixed directly without joint underneath the ceiling by means of a L60 metal beam
- clear distance between floor and lower border of the curtain app. 840 mm
- no open gaps between the curtains

Room: Reverberation room E  
Volume: 199.60 m<sup>3</sup>  
Size: 11.87 m<sup>2</sup>  
Date of test: 2005-06-17

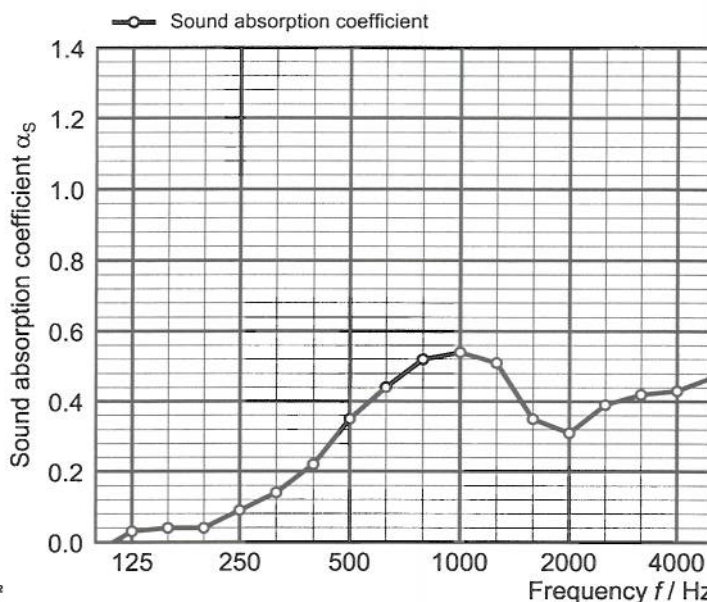
	$\Theta$ [°C]	r. h. [%]	$B$ [kPa]
with specimen	22.5	50	96.0
without specimen	23.2	49	96.0

Accredited testing laboratory  
according to ISO/IEC 17025



2465.10

Frequency [Hz]	$\alpha_s$ 1/3 octave	$\alpha_p$ oktave
100	-0.03	
125	0.03	0.00
160	0.04	
200	0.04	
250	0.09	0.10
315	0.14	
400	0.22	
500	0.35	0.35
630	0.44	
800	0.52	
1000	0.54	0.50
1250	0.51	
1600	0.35	
2000	0.31	0.35
2500	0.39	
3150	0.42	
4000	0.43	0.45
5000	0.47	



• Equivalent sound absorption area less than 1.0 m<sup>2</sup>

$\alpha_s$  Sound absorption coefficient according to ISO 354

$\alpha_p$  Practical sound absorption coefficient according to ISO 11654

Rating according to ISO 11654:

**Weighted sound absorption coefficient  $\alpha_w = 0.35$**

Sound absorption class: D

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Appendix A

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Curtain fabric Tibet 167 kvadrat A/S

figure 1: test construction made of 3 curtains, not folded front view (not scaled)

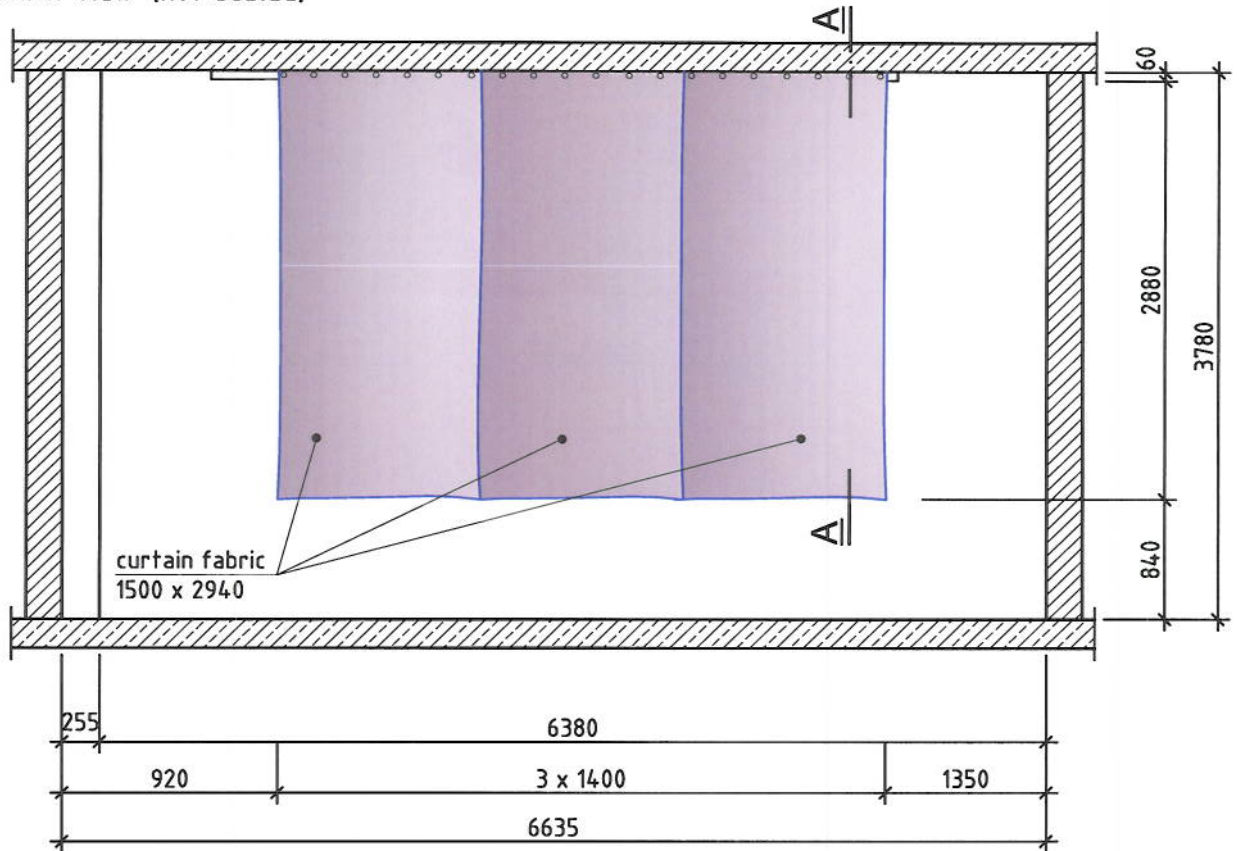
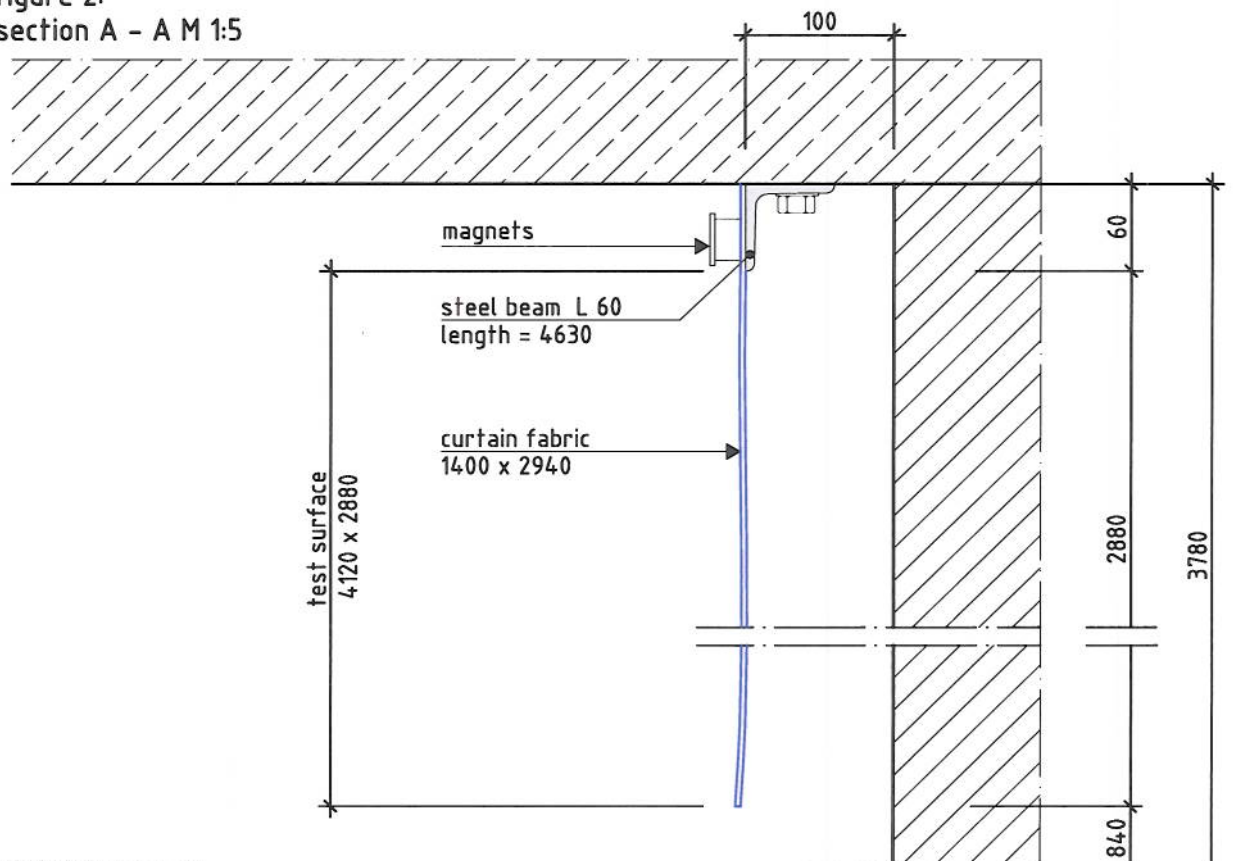


figure 2: section A - A M 1:5



Curtain fabric Tibet 167 kvadrat A/S

figure 3: test construction made of 6 curtains, folded 100% front view (not scaled)

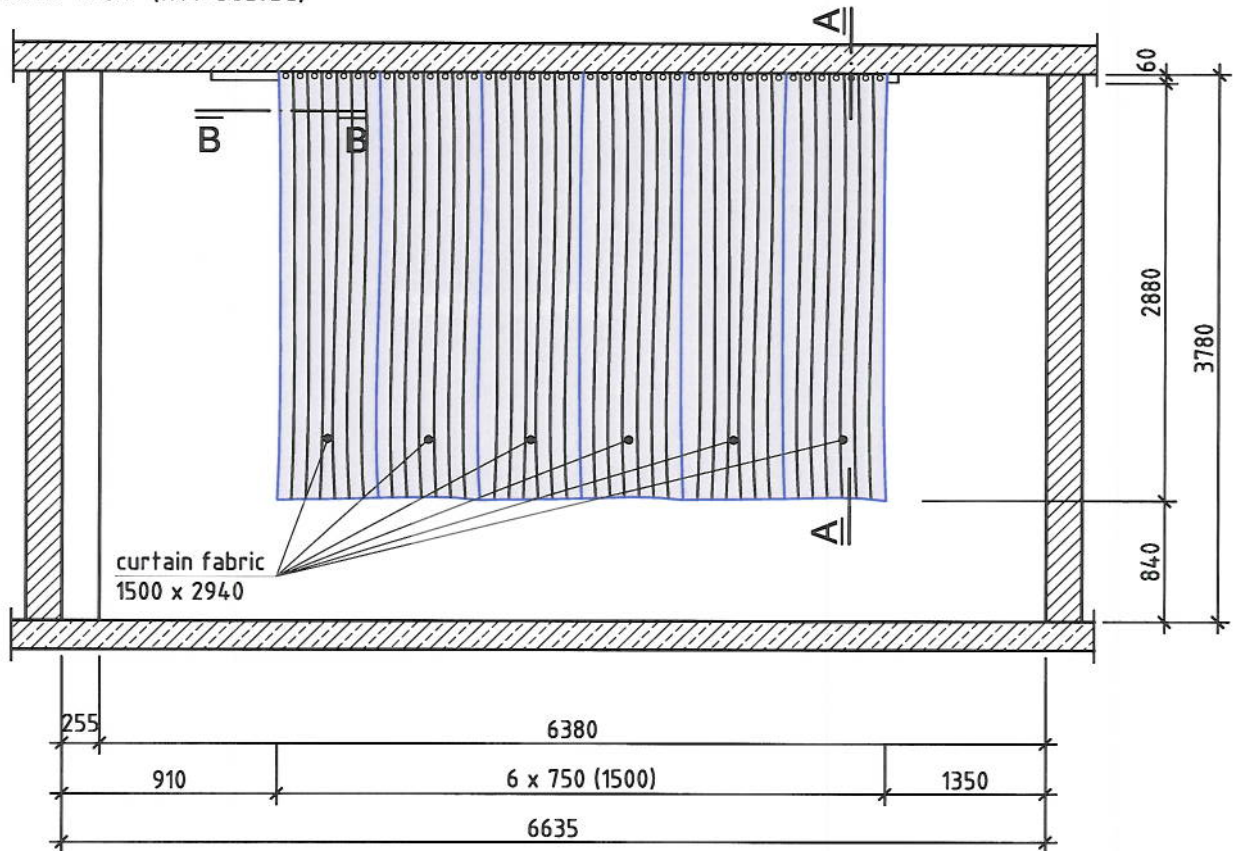


figure 4: section B - B M 1:5

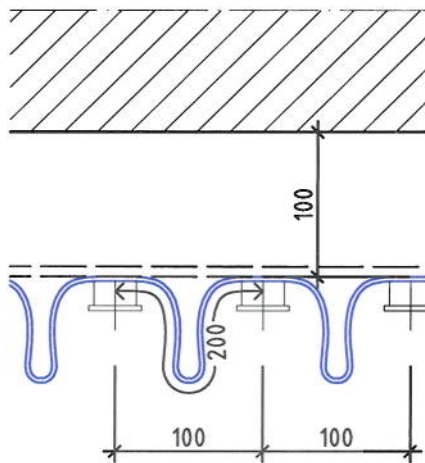
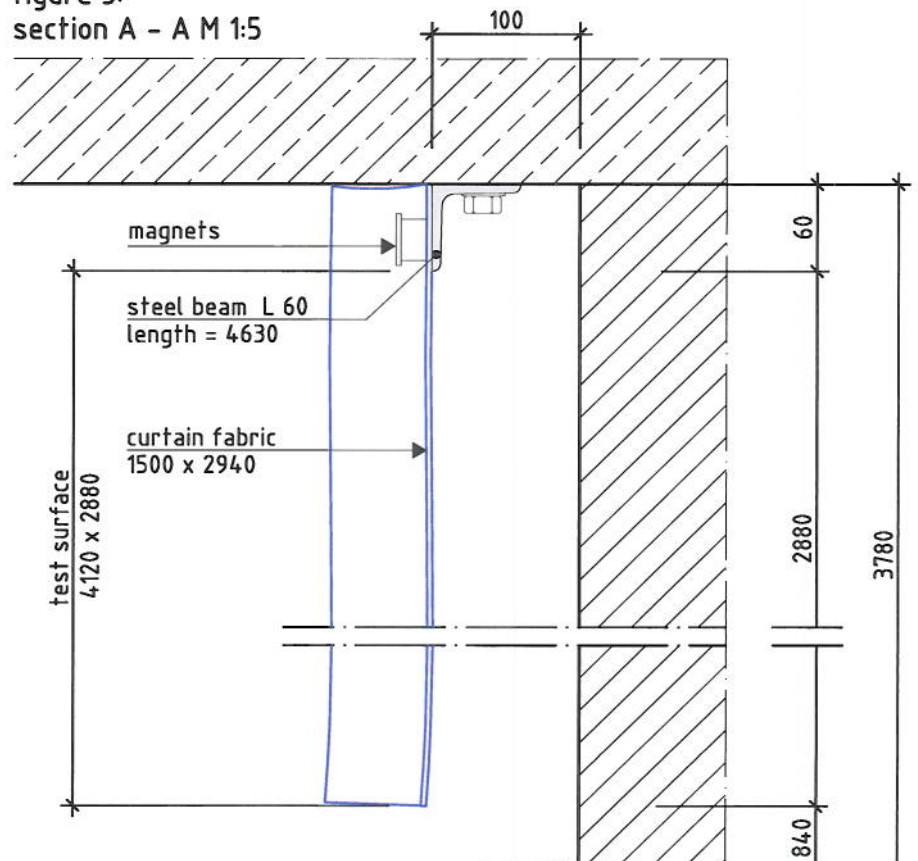
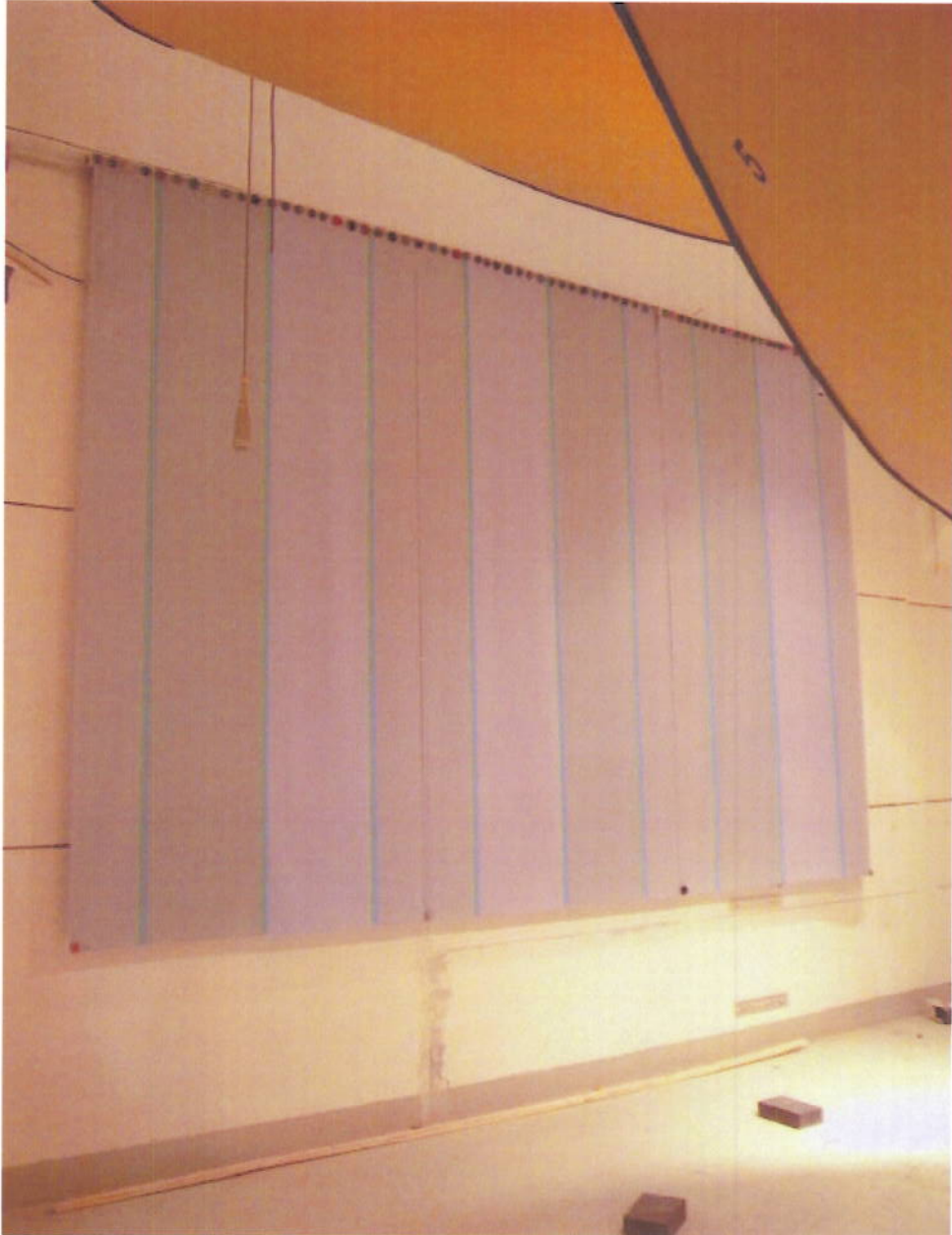


figure 5: section A - A M 1:5



**Curtain fabric “Tibet 167” Kvadrat A/S**



**Figure 6.**

View of the mounted specimen in the reverberation room  
Test construction 1: 3 curtains, not folded, 100 mm air gap

**Curtain fabric “Tibet 167” Kvadrat A/S**



**Figure 7.**

View of the mounted specimen in the reverberation room

Test construction 2: 6 curtains, folded 100 %, 100 mm air gap

**Table 1.** Mean values of reverberation time  $T_1$  without and with  $T_2$  specimen

frequency f / Hz	Mean values of measured reverberation time			
	test construction 1		test construction 2	
	without specimen	with specimen	without specimen	with specimen
100	6.24	6.71	6.24	5.53
125	5.46	5.15	5.46	4.64
160	5.59	5.16	5.59	4.64
200	6.26	5.70	6.26	4.69
250	6.75	5.48	6.75	4.34
315	5.91	4.52	5.91	3.43
400	5.45	3.76	5.45	3.03
500	5.32	3.16	5.32	2.62
630	5.16	2.81	5.16	2.47
800	5.11	2.57	5.11	2.36
1000	5.08	2.51	5.08	2.38
1250	5.46	2.68	5.46	2.54
1600	5.29	3.14	5.29	2.53
2000	4.91	3.13	4.91	2.37
2500	4.43	2.69	4.43	2.29
3150	3.61	2.30	3.61	1.99
4000	3.00	2.04	3.00	1.77
5000	2.40	1.69	2.40	1.50

**List of test equipment****Sound absorption**

Name	Manufacturer	Type	Serial-No.
Building acoustics measurement system	Norsonic	121	26342
Amplifier	Norsonic	235	14582
Loudspeakers (2 x in the reverberation room)	Allsound LT	--	--
Microphones (6 x in the reverberation room)	Sennheiser	MD21N	102805
Aspiration psychrometer	Wilh. Lambrecht KG	761	450157
Software for measurement and evaluation	Müller-BBM	Bau 4	Version 1.4