

TEST REPORT

This Test Report may only be reproduced in full.
The test results are valid for the tested object only.



Fibertex Nonwovens A/S

Laboratory measurements of sound absorption coefficient

Page 1 of 10 pages

Appendix, 5 pages

Report no.: P2.039.12

Glostrup, October 12th 2012

Project: 35.3715.01

Client:

Fibertex Nonwovens A/S
Svendborgvej 16
DK- 9220 Ålborg

Claimant:

Per Holst Rasmussen

Phone: 96 35 35 58 / 40 70 41 90

Executed by:

Søren Andersen

Technical responsible:

Checked by:

Søren Damgaard Kristensen


Søren Damgaard Kristensen

Ver. 2011.11.04 PHe

Summary:

On September 8th-9th 2011 Grontmij A/S, Acoustica has performed reverberation chamber measurements of the sound absorption coefficient of various textile products, manufactured by Fibertex Nonwovens.

The following has been measured:

Measurement of sound absorption coefficient in compliance with DS/EN ISO 354. The weighted sound absorption coefficient and the sound absorption class have been determined in compliance with DS/EN ISO 11654.

No.	Material	Mounting	Area S [m ²]	Sound abs. coefficient α_w	Sound abs. class
A1	FiberAcoustic 75	45 mm cavity, enclosed periphery	10,5	0,25	E(H)
A2	FiberAcoustic 75	200 mm cavity, enclosed periphery	10,5	0,45	D
A3	FiberAcoustic 450	45 mm cavity, enclosed periphery	10,5	0,45	D(MH)
A4	FiberAcoustic 450	200 mm cavity, enclosed periphery	10,5	0,85	B



Acoustica Acoustics · Noise · Vibrations

.Grontmij A/S
.Granskoven 8
.DK – 2600 Glostrup

Phone .+45 4348 6060
Direct phone .+45 4348 4631
Mobile phone .+45 2723 4631

Web www.grontmij.dk
E-mail sra@grontmij.dk
File P2.039.12

CVR-nr. 48233511 (tax)

TABLE OF CONTENTS		PAGE
1	INTRODUCTION	3
2	OBJECT	3
3	PROCEDURE	3
3.1	Methods used	3
3.2	Rating of sound absorption class	3
3.3	Reverberation chamber information	4
3.4	Equipment	4
3.5	Temperature and humidity	4
4	RESULTS	4
 Appendix		
Appendix A	Measurement result	6
Appendix B	Measurement result	7
Appendix C	Measurement result	8
Appendix D	Measurement result	9
Appendix E	Measurement equipment used	10

1 INTRODUCTION

Grontmij A/S, Acoustica has been commissioned by Fibertex Nonwovens A/S to perform reverberation chamber measurements of the sound absorption coefficient of two different nonwoven textile products, each mounted in front of an enclosed cavity with two different cavity depths.

2 OBJECT

The measurement objects are nonwoven textiles of a felt type. The textile is mounted on a timber frame, made by 45 mm timber studs. The surface area of the studs have been subtracted the total surface area when calculating the sound absorption coefficients of the measured material.

The products are designated:

Fibertex FiberAcoustic 75
Fibertex FiberAcoustic 450

The latter three numbers refer to the surface weight of the material (70 g/m² and 451 g/m² respectively).

3 PROCEDURE

3.1 Methods used

The measurements were performed according to DS/EN ISO 354, using the interrupted noise method and a broadband pink noise signal with 1/3-octave band filters. Three speaker positions and four microphone positions were used. In each microphone position the reverberation time was measured as an average of four measurements.

3.2 Rating of sound absorption class

The practical sound absorption coefficient and the sound absorption class are determined according to DS/EN ISO 11654 and are distributed on the following classes:

Sound absorption class	α_w
A	0,90; 0,95; 1,00
B	0,80; 0,85
C	0,60; 0,65; 0,70; 0,75
D	0,30; 0,35; 0,40; 0,45; 0,50; 0,55
E	0,25; 0,20; 0,15
Not classified	0,10; 0,05; 0,00

If the practical sound absorption coefficient exceeds the reference curve in one or more frequency bands by more than 0,25, one or more shape indicators are added:

Shape indicator	The sound absorption coefficient is 0,25 greater than the reference curve in the octave band:
(L)	250 Hz
(M)	500 Hz and/or 1000 Hz
(H)	2000 Hz and/or 4000 Hz

3.3 Reverberation chamber information

The reverberation chamber used for the measurements is located at DTU Elektro, Ørsted Plads, Bygning 355, Rum 005, DK - 2800 Kgs. Lyngby. The chamber is fitted with several sound diffusing elements on the walls. Furthermore during the measurements, the chamber was equipped with a total of 12 transparent freely suspended sound diffusors. According to DTU, the volume of the room is 215 m³.

3.4 Equipment

The used measuring equipment is shown in appendix E.

3.5 Temperature and humidity

During the measurements the temperature was 19-20°C and the humidity was varying from 64-66%

4 RESULTS

The measured reverberation times T_{20} (in seconds) are shown in the table below.

Measurement no.	A0	A1	A2	A3	A4
	Empty room	FR PET 70	FR PET 70	FR PET 451	FR PET 451
Frequency [Hz]		cavity: 45 mm	cavity: 200 mm	cavity: 45 mm	cavity: 200 mm
100	8,4	8,4	8,2	8,3	5,9
125	8,6	8,3	7,7	8,0	5,6
160	8,8	8,7	6,8	7,3	3,8
200	7,8	7,3	5,7	6,0	3,3
250	7,1	6,7	4,9	5,3	2,9
315	6,7	6,3	4,3	4,5	2,5
400	6,7	5,5	3,6	3,9	2,4
500	6,3	5,0	3,2	3,2	2,3
630	6,1	4,3	3,1	2,8	2,3
800	5,6	3,6	3,3	2,4	2,4
1000	5,1	3,0	3,4	2,2	2,5
1250	4,7	2,7	2,9	2,0	2,2
1600	4,5	2,4	2,7	1,9	2,1
2000	4,1	2,2	2,6	1,8	2,1
2500	3,6	2,1	2,3	1,7	1,9
3150	3,0	2,0	2,0	1,6	1,7
4000	2,5	1,9	1,8	1,6	1,5
5000	2,2	1,7	1,6	1,4	1,4

The table below shows the measured sound absorption coefficients together with the sound absorption classes. Detailed results are shown in appendix A

No.	Material	Mounting	Area S [m ²]	Sound abs. coef- ficient α_w	Sound abs. class
A1	FiberAcoustic 75	45 mm cavity, enclosed periphery	10,5	0,25	E(H)
A2	FiberAcoustic 75	200 mm cavity, enclosed periphery	10,5	0,45	D
A3	FiberAcoustic 450	45 mm cavity, enclosed periphery	10,5	0,45	D(MH)
A4	FiberAcoustic 450	200 mm cavity, enclosed periphery	10,5	0,85	B

Measurement result of sound absorption coefficient

Client: Fibertex Nonwovens A/S
 Svendborgvej 16
 DK - 9220 Ålborg

Measurement: A1
Date of meas.: 09-09-2011
Performed by: SRA

Object description

FiberAcoustic 75, mounted in front of a 45 mm cavity with enclosed periphery

Measurement method

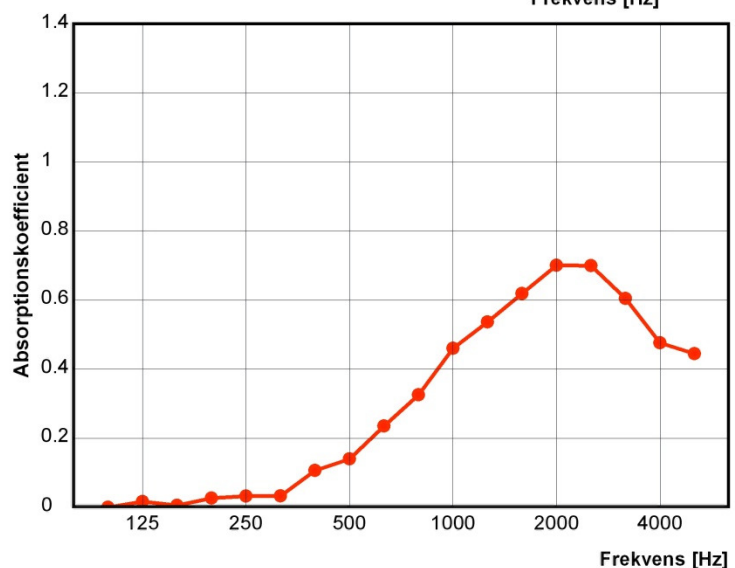
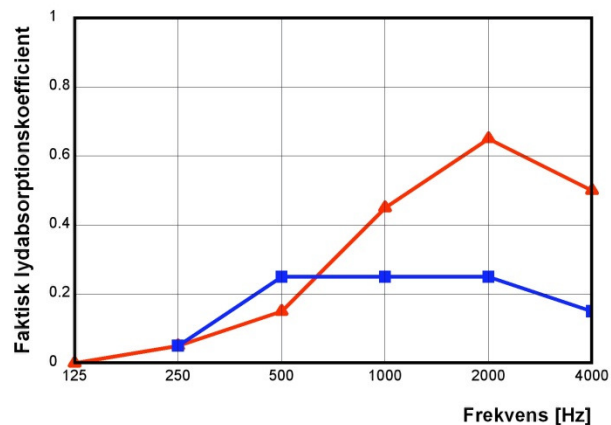
The measurements were performed according to DS/EN ISO 354, and the weighted sound absorption coefficient as well as the sound absorption class are determined according to DS/EN ISO 11654

Commenting on the measurement

The sound absorption coefficient deviates considerably (higher sound absorption) from the standard curve at high frequencies, which is indicated by (H) in the sound absorption class

Weighted sound abs. coefficient: $\alpha_w = 0,25$ Sound absorption class: E(H)

Frekv. [Hz]	Absorptionskoefficient		
	1/3-okt.	1/1-okt.	Ref.-kurve
100	-0,00	0,00	
125	0,02		
160	0,01		
200	0,03	0,05	0,05
250	0,03		
315	0,03		
400	0,11	0,15	0,25
500	0,14		
630	0,24		
800	0,33	0,45	0,25
1000	0,46		
1250	0,54		
1600	0,62	0,65	0,25
2000	0,70		
2500	0,70		
3150	0,60	0,50	0,15
4000	0,48		
5000	0,44		



	Temperatu-re	Relative humidity
Empty room (T ₁)	19°C	64%
Measurement A1 (T ₂)	19°C	64%

APPENDIX B

Measurement result of sound absorption coefficient

Client: Fibertex Nonwovens A/S
 Svendborgvej 16
 DK - 9220 Ålborg

Measurement: A2
Date of meas.: 09-09-2011
Performed by: SRA

Object description

FiberAcoustic 75, mounted in front of a 200 mm cavity with enclosed periphery

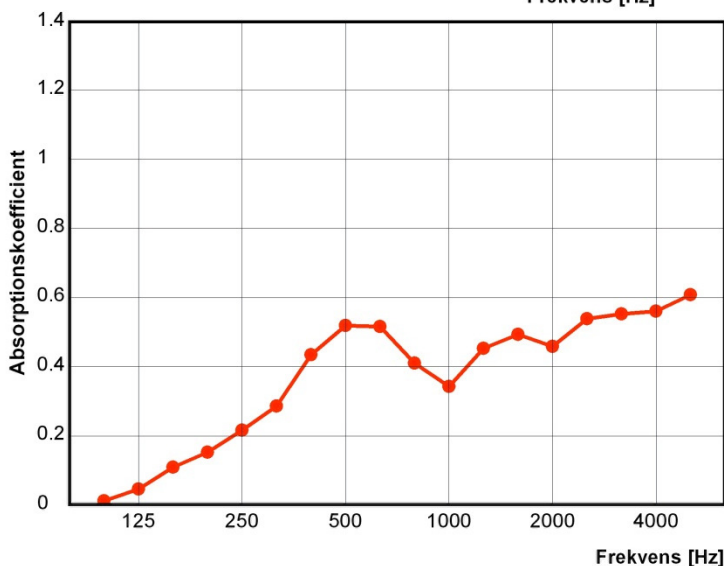
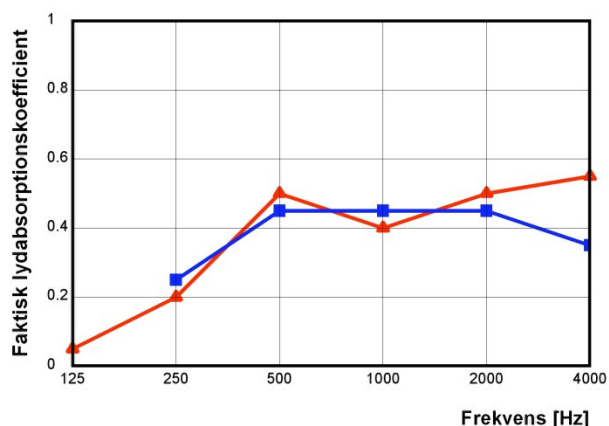
Measurement method

The measurements were performed according to DS/EN ISO 354, and the weighted sound absorption coefficient as well as the sound absorption class are determined according to DS/EN ISO 11654

Commenting on the measurement

Weighted sound abs. coefficient: $\alpha_w = 0,45$ Sound absorption class: D

Frekv. [Hz]	Absorptionskoefficient		
	1/3-okt.	1/1-okt.	Ref.-kurve
100	0,01	0,05	
125	0,05		
160	0,11		
200	0,15	0,20	0,25
250	0,22		
315	0,29		
400	0,43	0,50	0,45
500	0,52		
630	0,52		
800	0,41	0,40	0,45
1000	0,34		
1250	0,45		
1600	0,49	0,50	0,45
2000	0,46		
2500	0,54		
3150	0,55	0,55	0,35
4000	0,56		
5000	0,61		



	Temperatu-re	Relative humidity
Empty room (T ₁)	19°C	64%
Measurement A1 (T ₂)	19°C	65%

Measurement result of sound absorption coefficient

Client: Fibertex Nonwovens A/S
 Svendborgvej 16
 DK - 9220 Ålborg

Measurement: A3
Date of meas.: 08-09-2011
Performed by: MAQ

Object description

FiberAcoustic 450, mounted in front of a 45 mm cavity with enclosed periphery

Measurement method

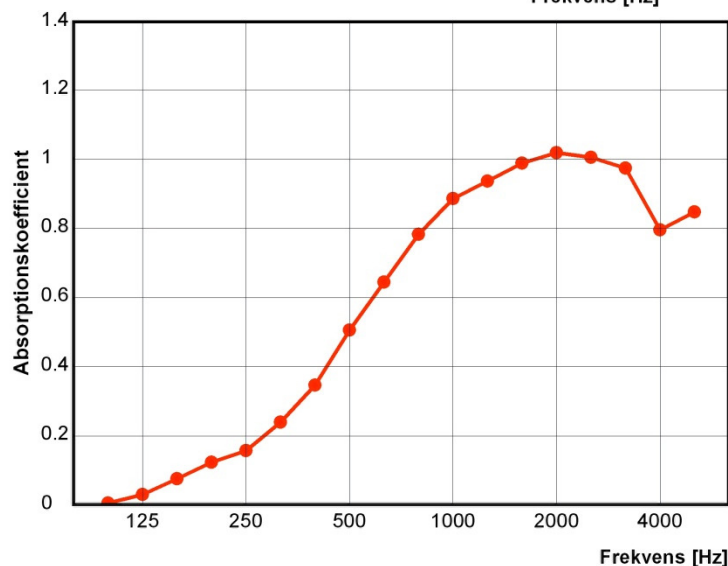
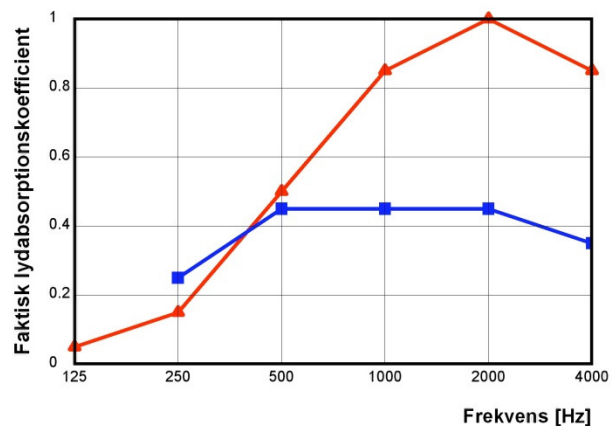
The measurements were performed according to DS/EN ISO 354, and the weighted sound absorption coefficient as well as the sound absorption class are determined according to DS/EN ISO 11654

Commenting on the measurement

The sound absorption coefficient deviates considerably (higher sound absorption) from the standard curve at mid- and high frequencies, which is indicated by (MH) in the sound absorption class

Weighted sound abs. coefficient: $\alpha_w = 0,45$ Sound absorption class: D(MH)

Frekv. [Hz]	Absorptionskoefficient		
	1/3-okt.	1/1-okt.	Ref.-kurve
100	0,01	0,05	
125	0,03		
160	0,08		
200	0,12	0,15	0,25
250	0,16		
315	0,24		
400	0,35	0,50	0,45
500	0,51		
630	0,64		
800	0,78	0,85	0,45
1000	0,89		
1250	0,94		
1600	0,99	1,00	0,45
2000	1,02		
2500	1,01		
3150	0,97	0,85	0,35
4000	0,80		
5000	0,85		



	Temperatu-re	Relative humidity
Empty room (T ₁)	19°C	64%
Measurement A1 (T ₂)	19°C	66%

APPENDIX D

Measurement result of sound absorption coefficient

Client: Fibertex Nonwovens A/S
 Svendborgvej 16
 DK - 9220 Ålborg

Measurement: A4
Date of meas.: 08-09-2011
Performed by: MAQ

Object description

FiberAcoustic 450, mounted in front of a 200 mm cavity with enclosed periphery

Measurement method

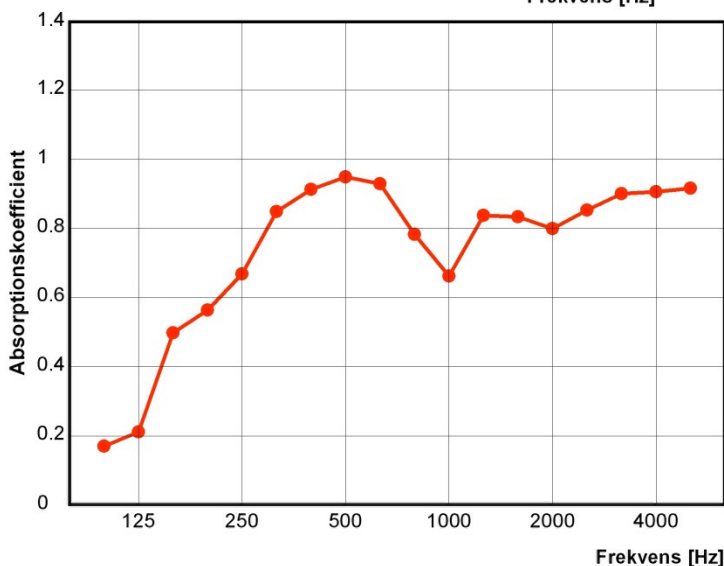
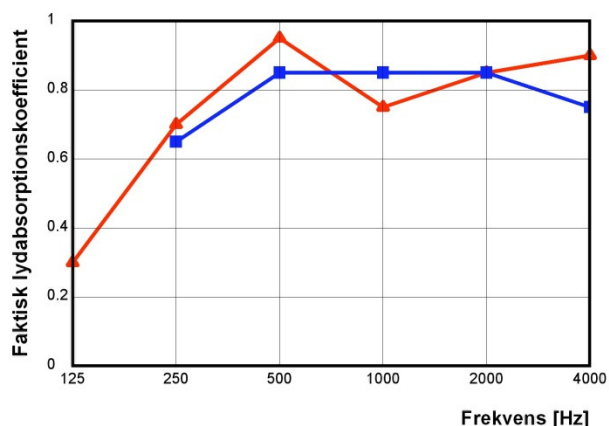
The measurements were performed according to DS/EN ISO 354, and the weighted sound absorption coefficient as well as the sound absorption class are determined according to DS/EN ISO 11654

Commenting on the measurement

The sound absorption coefficient deviates considerably (higher sound absorption) from the standard curve at mid- and high frequencies, which is indicated by (MH) in the sound absorption class

Weighted sound abs. coefficient: $\alpha_w = 0,85$ Sound absorption class: B

Frekv. [Hz]	Absorptionskoefficient		
	1/3-okt.	1/1-okt.	Ref.-kurve
100	0,17	0,30	
125	0,21		
160	0,50		
200	0,56	0,70	0,65
250	0,67		
315	0,85		
400	0,91	0,95	0,85
500	0,95		
630	0,93		
800	0,78	0,75	0,85
1000	0,66		
1250	0,84		
1600	0,83	0,85	0,85
2000	0,80		
2500	0,85		
3150	0,90	0,90	0,75
4000	0,91		
5000	0,92		



	Temperatu-re	Relative humidity
Empty room (T ₁)	19°C	64%
Measurement A1 (T ₂)	19°C	66%

APPENDIX E

Measurement equipment used

Designation	Make	Type	ACA no.	Latest check	Next check
Sound level meter	Brüel & Kjær	2260	678	07-10-2010	07-10-2012
Microphone 1/2"	Brüel & Kjær	4189	991	05-01-2011	05-01-2013
Calibrator	Brüel & Kjær	4231	798	13-12-2010	13-12-2011
Omni directional speaker	Lab. for Akustik		600		
Power amplifier	LAB GRUPPEN	IP 450	947		