

STATEMENT

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Determination of sound absorption coefficients in a reverberation room according to ISO 354, and 11654

Test object

Grey sound absorbing profiled wool quilt.

Date of test

2004-08-11

Arrival of test objects

The test object arrived at test date.

Results

The sound absorption coefficient (α_s) and the practical sound absorption coefficient (α_p) are given below. The weighted sound absorption coefficient (α_w) and the sound absorption classes have been calculated according to EN ISO 11654 and the results are given in table 1. The results are valid for the tested objects only.

Moisture: 91%RH

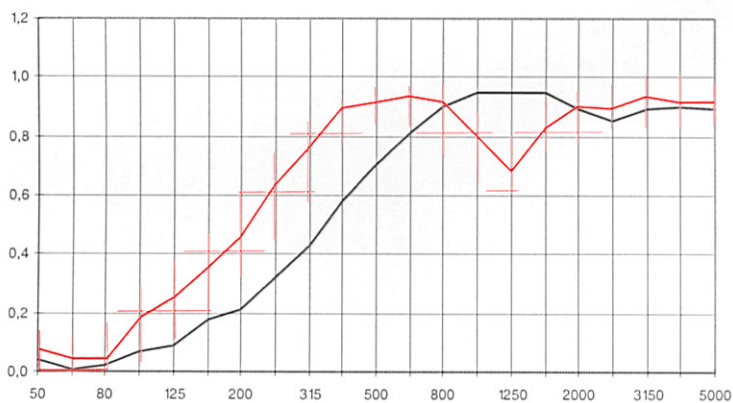
Temp: 23 deg C

Table 1 - Results

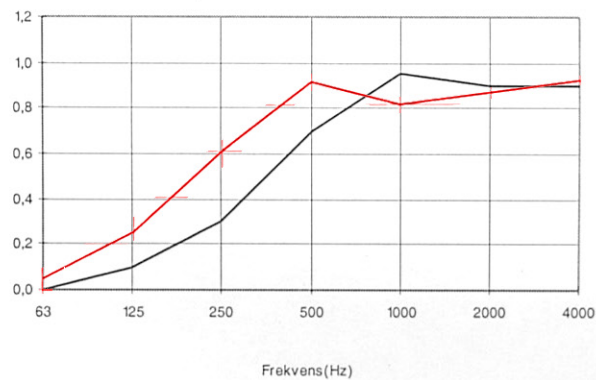
Test object:	EN ISO 11654	
	Absorption class	α_w
Single (Wool quilt) Mounting depth: 80mm	C	0,6 (MH)
Single (Wool quilt) Mounting depth: 160mm	B	0,85

Mounting depth 160mm:

Mounting depth 80mm:



Absorbtionsspektrum



Frekvens (Hz)	α_s
50	0,04
63	0,01
80	0,02
100	0,07
125	0,09
160	0,18
200	0,21
250	0,32
315	0,43
400	0,58
500	0,70
630	0,81
800	0,90
1000	0,95
1250	0,95
1600	0,95
2000	0,89
2500	0,85
3150	0,89
4000	0,90
5000	0,89

Frekvens (Hz)	α_p
63	0,00
125	0,10
250	0,30
500	0,70
1000	0,95
2000	0,90
4000	0,90

Frekvens (Hz)	α_s
50	0,07
63	0,04
80	0,04
100	0,18
125	0,25
160	0,35
200	0,45
250	0,62
315	0,75
400	0,89
500	0,91
630	0,93
800	0,91
1000	0,79
1250	0,67
1600	0,81
2000	0,89
2500	0,88
3150	0,92
4000	0,90
5000	0,90

Frekvens (Hz)	α_p
63	0,05
125	0,25
250	0,60
500	0,90
1000	0,80
2000	0,85
4000	0,90

Tester gjorda av SP (Sveriges provnings- och forskningsinstitut).

Measurement method

The measurements have been carried out according to SS-EN 20354:93 (ISO 354:1985). 4 loudspeakers and 6 microphones have been used giving 24 different combinations. For empty room 3 decays have been used for averaging the time and for test objects 5 decays have been used, for each combination of loudspeaker and microphone.

The absorption coefficient α_s has been evaluated from:

$$\alpha_s = \frac{55.3 V}{c \cdot S} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

where

- V = Volume of the reverberation room (m³)
- S = Area of the test object (m²)
- c = Speed of sound in air (m/s)
- c = 331 + 0.6t
- t = Temperature in the air (°C)
- T₁ = Reverberation time of the room without test object (s)
- T₂ = Reverberation time of the room with test object (s)

Measurement uncertainty

From a world wide Round Robin¹⁾, in which SP took part, with 23 participating laboratories from 11 countries, the following measurement uncertainty has been calculated

Frequencies	
(Hz)	Uncertainty
100-630	± 0,15
800-1250	± 0,10
1600-2500	± 0,15
3150-5000	± 0,20

¹⁾ The figures are calculated from twice the standard deviations, rounded to the nearest 0,05. The data from the Round Robin is documented in a letter from the ASTM to the participating laboratories.

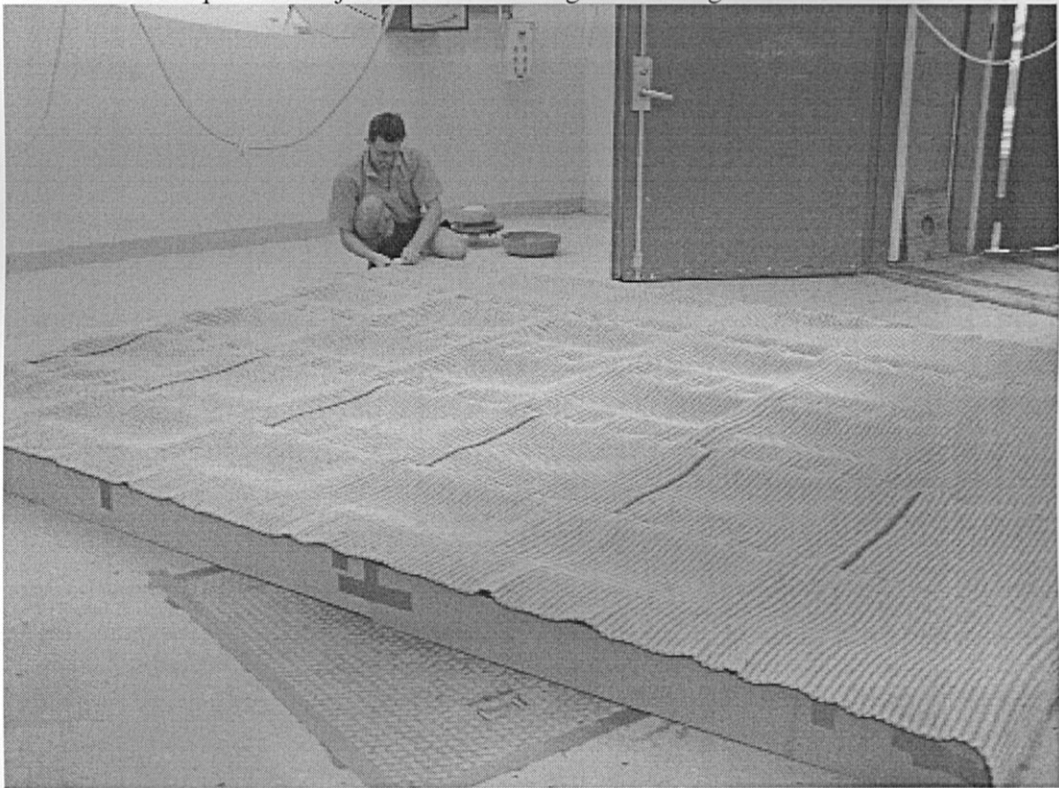
Test room

A reverberation room with the dimensions 7,64 m x 6,16 m x 4,25 m giving the volume 200 m³ and the total surface area 211 m² was used.

Mounting

The panels were placed on the floor or in a frame with the size 3 x 3,6 m. The edges were sealed with a wooden frame and a tape (made of an elastic woven material) to prevent air leakage. The mounting depth is the distance between the floor and the front surface (upper) of the test objects.

Picture of wool quilt test object before stretching and sealing.



List of instruments

Instrument	Manufacturer	Type	Serial no
Microphone	Brüel & Kjaer	4943	503327
Microphone	Brüel & Kjaer	4943	503326
Microphone	Brüel & Kjaer	4943	503325
Microphone	Brüel & Kjaer	4943	503324
Microphone	Brüel & Kjaer	4943	503323
Microphone	Brüel & Kjaer	4943	503322
Microphone Preamplifier	Brüel & Kjaer	2619	970996
Microphone Preamplifier	Brüel & Kjaer	2619	970948
Microphone Preamplifier	Brüel & Kjaer	2619	469905
Microphone Preamplifier	Brüel & Kjaer	2619	726792
Microphone Preamplifier	Brüel & Kjaer	2619	726825
Microphone Preamplifier	Brüel & Kjaer	2619	970968
Microphone Multiplexer	Norsonic	834	10050
Real-Time Analyzer	Norsonic	830	11533
Sound Level Calibrator	Brüel & Kjaer	4230	1410947
Programme	SP	Absorp	960627
Power amplifier	PA1		
Noise generator	NG1 (white noise)		
Loudspeakers	SP	HGT2, HGT7, HGT4, HGTtak	
Hygrometer	Vaisala	HM 132	42154
Temperature meter	Vaisala	HM 132	42154

SP Swedish National Testing and Research Institute
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