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DETERMINATION OF ACOUSTIC ABSORPTION COEFFICIENT IN LABORATORY CONDITIONS

1 CLIENT

Ewona Finland Oy, Jarmo Koivisto. Tender July 4, 2017.

2 DESCRIPTION OF THE COMMISSION

Sound absorption coefficient α_s was measured for one specimen (**Ewona Acustica Excellence 50 mm**) within 100–5000 Hz according to ISO 354:2003. Four different installations (**Type A, E100, E200 and E400**) were tested. Sound absorption class was determined according to EN ISO 11654:1997.

3 RESULTS

Detailed results are presented in Annex 1.

4 SIGNATURES

A handwritten signature in blue ink, appearing to read 'V. Hongisto'.

Valtteri Hongisto
research group leader

A handwritten signature in blue ink, appearing to read 'Jarkko Hakala'.

Jarkko Hakala
research engineer

Turku University of Applied Sciences
Technology, Environment and Business
Indoor Environment, Acoustics

ANNEXES

- Annex 1 – Test results (4 pages)
- Annex 2 – Structure drawing (1 page)
- Annex 3 – Mounting of specimen (1 page)
- Annex 4 – Measurement arrangements (1 page)

Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

Specimen id: Ewona Acustica Excellence 50 mm
Type A mounting (no airgap behind the specimen)

Manufacturer: Ewona Finland Oy

Client: Ewona Finland Oy

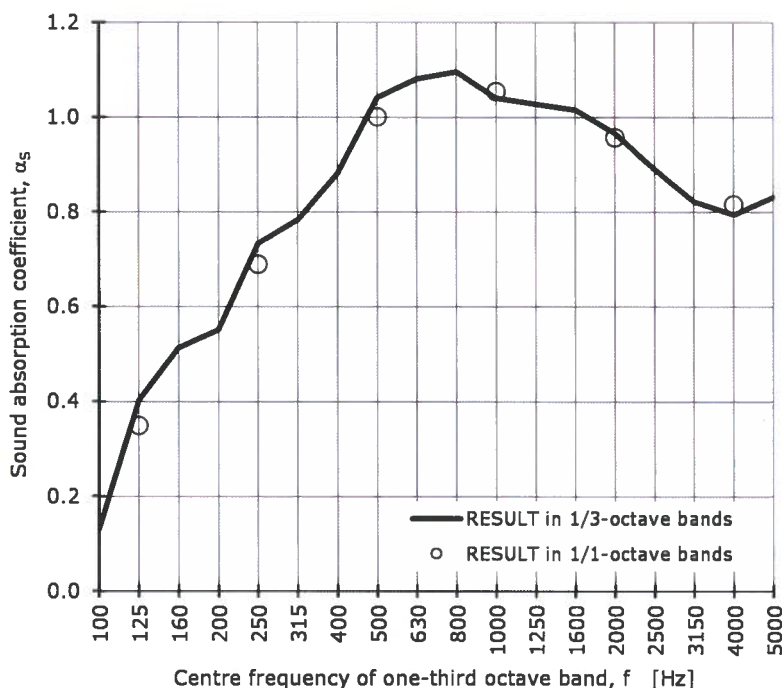
Contact person: Jarmo Koivisto

Mounting by: Jarkko Hakala

Test laboratory: Turku University of Applied Sciences, Indoor environment, acoustics
Lemminkäisenkatu 14-18 B, 20520 Turku, Finland. www.turkuamk.fi

Specimen area: 10.6 m² Test room volume: 155 m³
Temperature of test room: 23 23 °C (without / with specimen) Room boundary area: 179 m²
Relative humidity: 68 73 % (without / with specimen) Test date: 16.8.2017
Atmospheric pressure: 101 102 kPa (without / with specimen) Test file identification: T160817a

f (Hz)	1/3 α_s	1/1 α_s	1/1 α_p	
100	0.13			
125	0.40	0.35	0.35	**
160	0.51			**
200	0.55			
250	0.73	0.69	0.70	
315	0.78			
400	0.88			
500	1.04	1.00	1.00	
630	1.08			
800	1.09			
1000	1.04	1.05	1.05	
1250	1.03			
1600	1.01			
2000	0.97	0.96	0.95	
2500	0.89			
3150	0.82			
4000	0.79	0.82	0.80	
5000	0.83			

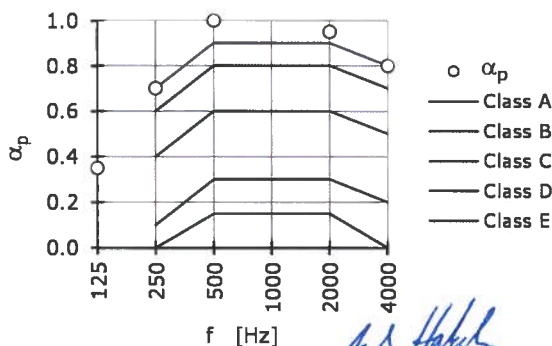


Absorption class (EN ISO 11654)
A

** Total absorption area of the empty test room is higher than ISO 354 requires.

The uncertainty of the test result is higher than ISO 354 expects.

FINAS
Finnish Accreditation Service
T293 (EN ISO/IEC 17025)



Jarkko Hakala
Jarkko Hakala
research engineer
test performer

Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

Specimen id: Ewona Acustica Excellence 50 mm
Type E100 mounting (50 mm airgap behind the specimen)

Manufacturer: Ewona Finland Oy

Client: Ewona Finland Oy

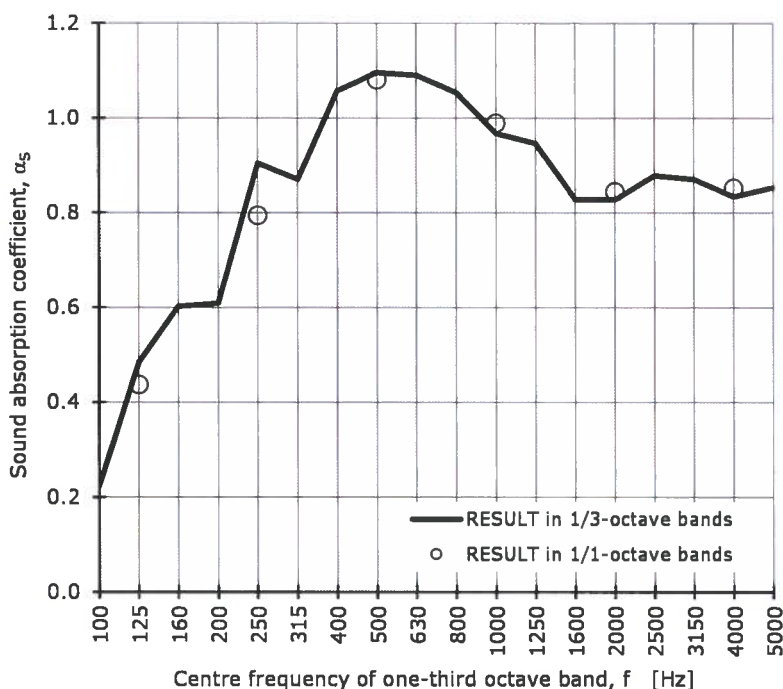
Contact person: Jarmo Koivisto

Mounting by: Jarkko Hakala

Test laboratory: Turku University of Applied Sciences, Indoor environment, acoustics
Lemminkäisenkatu 14-18 B, 20520 Turku, Finland. www.turkuamk.fi

Specimen area: 10.6 m² Test room volume: 155 m³
Temperature of test room: 23 23 °C (without / with specimen) Room boundary area: 179 m²
Relative humidity: 68 72 % (without / with specimen) Test date: 15.8.2017
Atmospheric pressure: 101 102 kPa (without / with specimen) Test file identification: T150817a

f (Hz)	1/3 α_s	1/1 α_s	1/1 α_p	
100	0.22			
125	0.49	0.44	0.45	**
160	0.60			**
200	0.61			
250	0.90	0.79	0.80	
315	0.87			
400	1.06			
500	1.10	1.08	1.10	
630	1.09			
800	1.05			
1000	0.97	0.99	1.00	
1250	0.95			
1600	0.83			
2000	0.83	0.84	0.85	
2500	0.88			
3150	0.87			
4000	0.83	0.85	0.85	
5000	0.85			

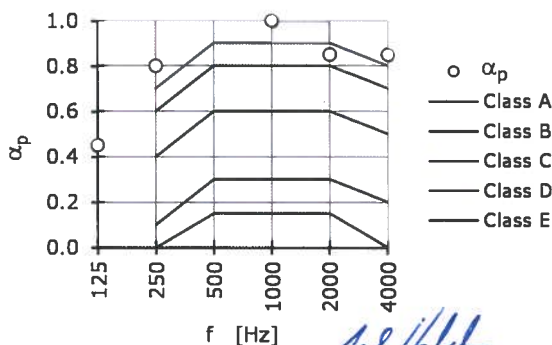


Absorption class (EN ISO 11654)

A

** Total absorption area of the empty test room is higher than ISO 354 requires.

The uncertainty of the test result is higher than ISO 354 expects.



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Jarkko Hakala
Jarkko Hakala
research engineer
test performer

Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

Specimen id: Ewona Acustica Excellence 50 mm
Type E200 mounting (150 mm airgap behind the specimen)

Manufacturer: Ewona Finland Oy

Client: Ewona Finland Oy

Contact person: Jarmo Koivisto

Mounting by: Jarkko Hakala

Test laboratory: Turku University of Applied Sciences, Indoor environment, acoustics
Lemminkäisenkatu 14-18 B, 20520 Turku, Finland. www.turkuamk.fi

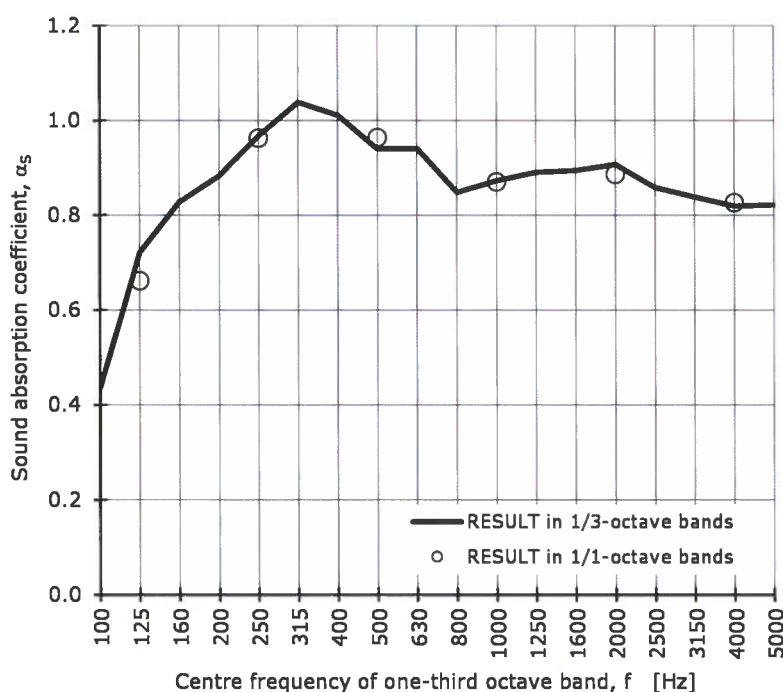
Specimen area: 10.6 m² Test room volume: 155 m³

Temperature of test room: 23 °C (without / with specimen) Room boundary area: 179 m²

Relative humidity: 68 % (without / with specimen) Test date: 14.8.2017

Atmospheric pressure: 101 kPa (without / with specimen) Test file identification: T140817a

f (Hz)	1/3 α_s	1/1 α_s	1/1 α_p	
100	0.44			
125	0.72	0.66	0.65	**
160	0.83			**
200	0.88			
250	0.97	0.96	0.95	
315	1.04			
400	1.01			
500	0.94	0.96	0.95	
630	0.94			
800	0.85			
1000	0.87	0.87	0.85	
1250	0.89			
1600	0.89			
2000	0.91	0.89	0.90	
2500	0.86			
3150	0.84			
4000	0.82	0.83	0.85	
5000	0.82			



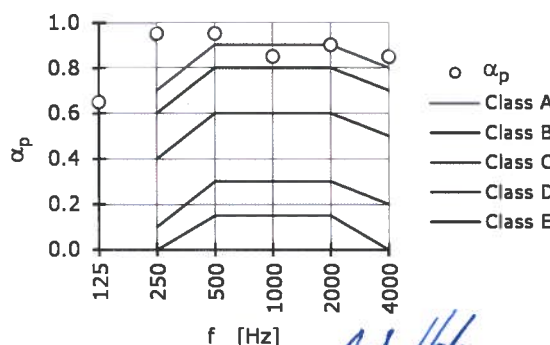
Absorption class (EN ISO 11654)

A

** Total absorption area of the empty test room is higher than ISO 354 requires.

The uncertainty of the test result is higher than ISO 354 expects.

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Jarkko Hakala
Jarkko Hakala
research engineer
test performer

Determination of acoustic absorption coefficient according to ISO 354:2003 in laboratory conditions

Specimen id: Ewona Acustica Excellence 50 mm
Type E400 mounting (350 mm airgap behind the specimen)

Manufacturer: Ewona Finland Oy

Client: Ewona Finland Oy

Contact person: Jarmo Koivisto

Mounting by: Jarkko Hakala

Test laboratory: Turku University of Applied Sciences, Indoor environment, acoustics
Lemminkäisenkatu 14-18 B, 20520 Turku, Finland. www.turkuamk.fi

Specimen area: 10.6 m²

Temperature of test room: 23 23 °C (without / with specimen)

Relative humidity: 68 70 % (without / with specimen)

Atmospheric pressure: 101 101 kPa (without / with specimen)

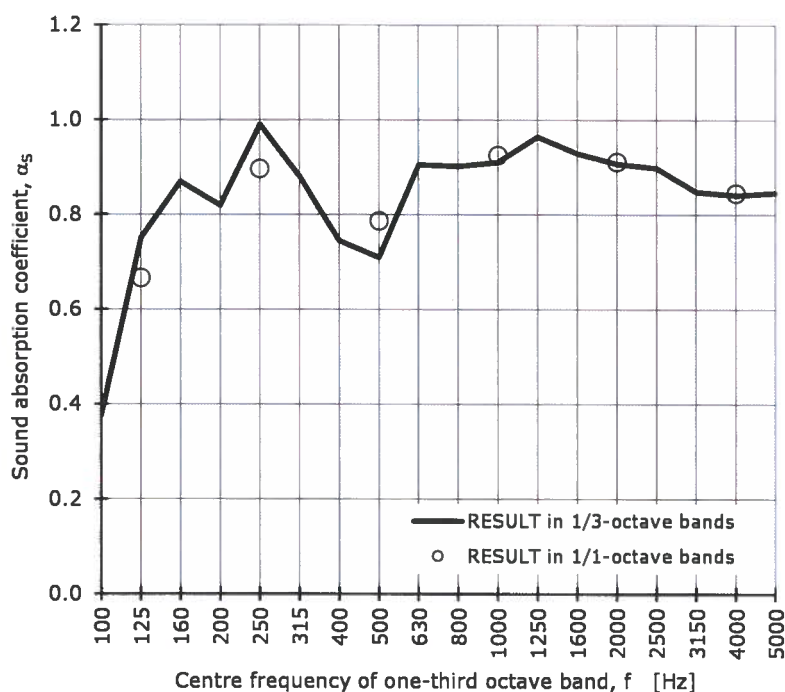
Test room volume: 155 m³

Room boundary area: 179 m²

Test date: 11.8.2017

Test file identification: T110817a

f (Hz)	1/3 α_s	1/1 α_s	1/1 α_p	
100	0.38			
125	0.75	0.67	0.65	**
160	0.87			**
200	0.82			
250	0.99	0.90	0.90	
315	0.88			
400	0.74			
500	0.71	0.79	0.80	
630	0.91			
800	0.90			
1000	0.91	0.93	0.95	
1250	0.96			
1600	0.93			
2000	0.91	0.91	0.90	
2500	0.90			
3150	0.85			
4000	0.84	0.85	0.85	
5000	0.85			



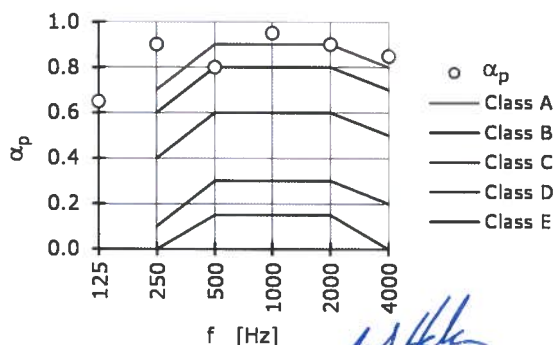
Absorption class (EN ISO 11654)

A

** Total absorption area of the empty test room is higher than ISO 354 requires.

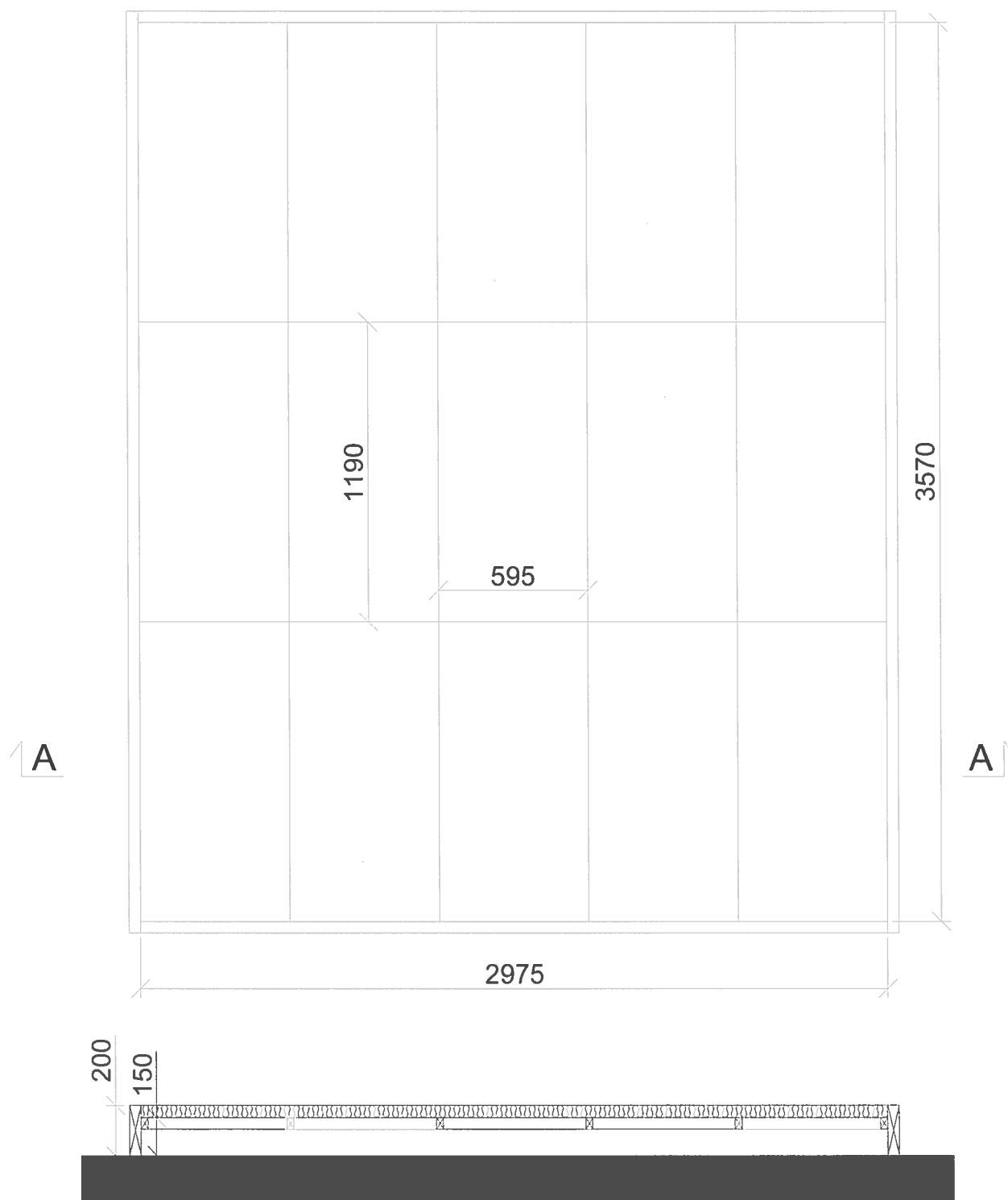
The uncertainty of the test result is higher than ISO 354 expects.

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Jarkko Hakala
research engineer
test performer

ANNEX 2 – STRUCTURE DRAWING



Section A-A

Example of Type E200 mounting. The distance between the visible surface and floor is 200 mm.

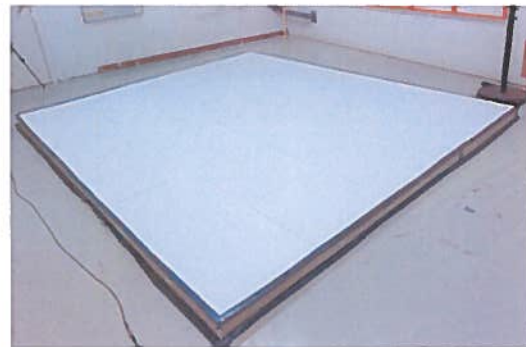
ANNEX 3 – MOUNTING OF SPECIMEN

The specimen was mounted on the floor of the reverberation room in conformance with **ISO 354:2003 Annex B**. The specimen was tested using three different distances between the visible surface of the specimen and the floor (Type E400: 400 mm; Type E200: 200 mm; Type E100: 100 mm). In addition, Type A mounting was tested where the specimen was mounted on the floor. The corresponding cavity thicknesses are 350, 150, 50 and 0 mm. Prefabricated frame was used in Type E mountings. The frame consisted of edges made of double layer plasterboard (400 mm), Kerto S 45x200 mm timber (200 mm), single layer of plasterboard (100 mm), and inner grid (595x595mm) made from 28x45 mm timber. In Type A mounting, the edges were covered with 50 mm plasterboard.

The side edges of the specimen were covered with adhesive tape as well the joint between floor and framework.



Specimen on the floor. Type A mounting.



Type E100 mounting.



Type E200 mounting.



Type E400 mounting.

ANNEX 4 – MEASUREMENT ARRANGEMENTS

1 Acoustical measurements

The test signal was produced to the test room using three fixed omnidirectional loudspeakers (6 x Seas W12CY001). The test signal (pink noise) was produced by a real time analyzer (Norsonic 121) and amplified with terminal amplifier (QSC 1300 W USA). The sound pressure level in the reverberation room was measured with a condenser microphone on a tripod (Bruel&Kjær 4190 equipped with a pre-amplifier Bruel&Kjær 2669).

The reverberation time at third-octave bands was measured with the real time analyzer (Norsonic 121) using 20 dB decay range. All frequency bands were measured using 2 sources simultaneously and 6 microphone locations. In every location 3 decays were measured. The total number of reverberation time measurements was 36.

The acoustical measurement equipment fulfilled the following IEC standards and grades of accuracy:

IEC 60651	Sound level meters (replaced by IEC 61672)	type 1
IEC 60804	Integrating sound level meters (replaced by IEC 61672)	type 1
IEC 61260	Octave-band and fractional-octave-band filters	class 1
IEC 60942	Sound level calibrators	class 1

The test laboratory operates in conformance with EN/ISO/IEC 17025.

2 Other measurements

The temperature, the ambient atmospheric pressure and the relative humidity of the measurement room were measured using an environmental measurement device (Thermo Recorder TR-73U). The specimen was weighed with a 150 kg precision weighing machine (PM 150). The dimensions of the specimen were measured with a roll meter (K-Prof).

3 The test room

The reverberation room was equipped with six fixed diffuser panels. The positions were selected randomly in respect with altitude, angle and position. The amount of diffusers and their arrangement fulfills the requirements of Annex A in ISO 354. The reverberation time of the reverberation room fulfills the requirements of ISO 354 for 155 m³ test room except for the third octave bands 160 and 200 Hz, where the reverberation time was at most 17 % below the minimum required reverberation time.

4 References to the ISO standards

Test: ISO 354:2003 (E) Acoustics - Measurement of sound absorption in a reverberation room, International Organization for Standardization, 2003, Genève, Switzerland.

SFS-EN ISO 11654:1997 (E) Acoustics - Sound absorbers for use in buildings - Rating of sound absorption, International Organization for Standardization, 1997, Genève, Switzerland.