DELTA Test Report

TEST Reg. no. 100

Measurement of sound absorption coefficient for Gyptone Xtensiv Quattro 75, suspended 200 mm

Performed for Saint-Gobain Denmark A/S, Gyproc

DANAK 100/2417
Project no.: 118-28723

17 August 2018

DELTA – a part of
FORCE Technology
Venlighedsvej 4
2970 Hørsholm
Denmark

Tlf. +45 72 19 40 00
Fax +45 72 19 40 01
www.delta.dk
VAT no. 55117314

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Title
Measurement of sound absorption coefficient for Gyptone Xtensiv Quattro 75, suspended 200 mm

Journal no.	Project no.	Our ref.	Date of test
DANAK 100/2417	118-28723	RSHS/LSS/ilk	26-06-2018

Client
Saint-Gobain Denmark A/S, Gyproc
Hareskovvej 12
4400 Kalundborg
Denmark

Client ref.
Jesper Friis Pedersen

Summary

Laboratory measurements of the sound absorption coefficient were carried out in a reverberation room according to the test method of EN ISO 354:2003.

Product: Gyptone Xtensiv Quattro 75, suspended 200 mm
Thickness: 10 mm
Mounting depth: 200 mm

The panels were placed in a frame on the concrete floor of the reverberation room.

The test results per one-third octave and per octave are shown in tabular form and graphically on the graph sheets together with the weighted sound absorption coefficient α_w and the absorption class according to EN ISO 11654:1997.

Descriptions of reverberation room and test procedure are found in the Appendix 1.

Remark

The test results apply only to the objects tested.

The measurements have been carried out by Rasmus Stahlfest Holck Skov.

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Rasmus Stahlfest Holck Skov
Specialist, Acoustics

Lars Sommer Søndergaard
Specialist, Acoustics

1. Introduction

At the request of Saint-Gobain Denmark A/S, Gyproc measurements of the sound absorption coefficient in a reverberation room were carried out for a ceiling product.

2. Description of the test specimen based on the client's specifications

Product:	Gyptone Xtensiv Quattro 75, suspended 200 mm
Thickness:	10 mm
Module size:	10 panels: 2400 mm × 285 mm
	10 panels: 1200 mm × 285 mm

3. Mounting in the laboratory

The panels were placed as a plane on a concrete floor in a frame with the size 3.60 m × 2.85 m. The panels were supported in longitudinal joints by a light aluminium U-profile.

Mounting depth: 200 mm (Type E-200 mounting).

Both the air gap and the edges of the test specimen were enclosed by a 22 mm wooden frame.

All joints between the test specimen and the frame as well as between the frame and the concrete floor were sealed with tape.

The test specimen was placed so that no part of it was closer than 1 m to any edge of the boundary of the room.

Photo of specimen in the laboratory can be seen in Appendix 2.

4. Test method

The measurements were carried out according to the test method of EN ISO 354:2003: "Measurement of Sound Absorption in a Reverberation Room".

The sound absorption coefficient was calculated from the reverberation times measured with and without the test specimen.

The measurements were performed in Room 005, Building 355 at the Technical University of Denmark. Brief descriptions of the reverberation room and test procedure are found in Appendix 1.

5. Instrumentation

The following instruments were used for the test:

Instrument	Type	DELTA No.	Calibration	
			Last	Next
Sound Level Meter / Analyser	B&K 2270	1498L	2017-07-18	2019-07-18
Measuring Microphone	B&K 4144	1256L	2017-09-21	2019-09-21
Measuring Microphone	GRAS 40EN 1”	1616L	2017-09-21	2019-09-21
Microphone Preamplifier	B&K 2619	719L	2017-09-22	2018-09-22
Microphone Preamplifier	B&K 2619	464T	2018-01-03	2019-01-03
Microphone Power Supply	B&K 2807	722L	2014-04-16	2018-08-01
Sensor for Temperature and Humidity	EBRO EBI 20-TH1	1618L	2017-12-08	2019-12-08
Acoustic calibrator	B&K 4231	1158L	2018-04-19	2018-10-19

6. Measurement conditions

The reverberation time was recorded in 6 microphone positions, each placed in the range 1.55 m to 2.85 m above the floor. The number of sound source positions was two.

The reverberation time T_1 per third octave of the room without test specimen and the reverberation time T_2 per third octave of the room with test specimen:

Frequency f [Hz]	Reverberation Time T_1 [sec.]	Reverberation Time T_2 [sec.]
100	6.78	3.87
125	7.15	3.92
160	7.46	3.98
200	7.09	3.09
250	7.01	2.79
315	6.83	2.80
400	6.75	2.77
500	6.43	2.59
630	6.19	2.53
800	5.67	2.60
1000	5.31	2.78
1250	4.97	2.51
1600	4.62	2.55
2000	4.20	2.53
2500	3.84	2.43
3150	3.19	2.19
4000	2.65	1.98
5000	2.32	1.79

Temperature and relative humidity in the reverberation room during measurements:

Room without test specimen: 21.1 °C, 64% RH. Date of test: 26 July 2018
Room with test specimen: 21.5 °C, 63% RH. Date of test: 26 July 2018

The correction of the absorption coefficient due to differences in temperature and relative humidity during measurements of T_1 (the reverberation time of the empty room) and T_2 (the reverberation time of the room with test specimen) was 0 at all frequencies.

7. Test results

The test result α_s per one-third octave from 100 Hz to 5000 Hz is shown in tabular form and graphically on Graph Sheet 1.

The calculated, practical sound absorption coefficient α_p per octave from 125 Hz to 4000 Hz is shown in tabular form and graphically on Graph Sheet 2 together with the weighted sound absorption coefficient α_w as well as the absorption class. These values are calculated in accordance with EN ISO 11654:1997.

8. Measurement uncertainty

Measurement uncertainty (90 % confidence interval) estimated from a Nordic intercomparison (Nordtest Project No. 1023-92) for the practical absorption coefficient α_p per octave:

Frequency [Hz]	Uncertainty
125	±0.15
250	±0.10
500	±0.05
1000	±0.10
2000	±0.10
4000	±0.10

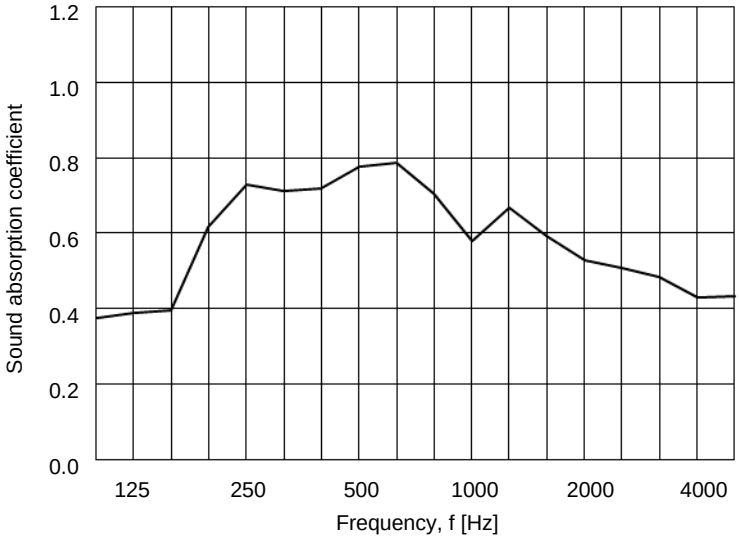
Laboratory measurement of sound absorption coefficient according to EN ISO 354:2003

Client: Saint-Gobain Denmark A/S, Gyproc, Hareskovvej 12, 4400 Kalundborg, Denmark
Date of test: 26 July 2018

Test specimen: Gyptone Xtensiv Quattro 75, suspended 200 mm
Thickness: 10 mm
Module size: 2400 mm × 285 mm (10 panels); 1200 mm × 285 mm (10 panels)
Mounting depth: 200 mm (Type E mounting)

Test area: 10.2 m²
Room volume: 215 m³
Room surface: 305 m²

Frequency f [Hz]	α_s
100	0.38
125	0.39
160	0.39
200	0.62
250	0.73
315	0.71
400	0.72
500	0.78
630	0.79
800	0.70
1000	0.58
1250	0.67
1600	0.59
2000	0.53
2500	0.51
3150	0.48
4000	0.43
5000	0.43



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Lars Sommer Søndergaard, Acoustics

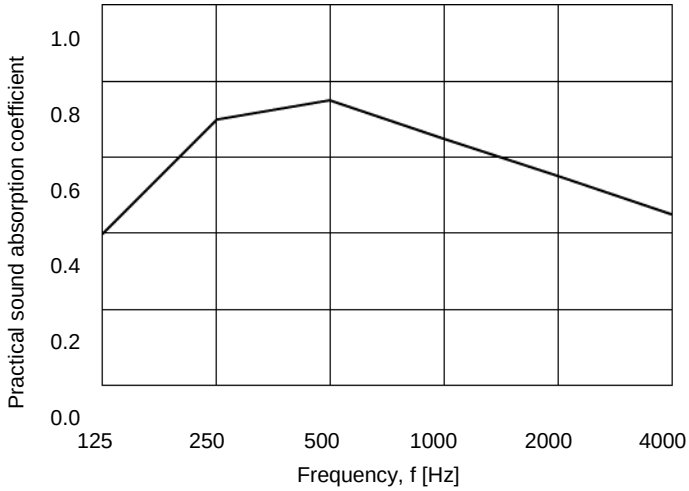
Laboratory measurement of sound absorption coefficient according to EN ISO 354:2003

Client: Saint-Gobain Denmark A/S, Gyproc, Hareskovvej 12, 4400 Kalundborg, Denmark
Date of test: 26 July 2018

Test specimen: Gyptone Xtensiv Quattro 75, suspended 200 mm
Thickness: 10 mm
Module size: 2400 mm × 285 mm (10 panels); 1200 mm × 285 mm (10 panels)
Mounting depth: 200 mm (Type E mounting)

Test area: 10.2 m²
Room volume: 215 m³
Room surface: 305 m²

Frequency f [Hz]	α_p
125	0.40
250	0.70
500	0.75
1000	0.65
2000	0.55
4000	0.45



Practical sound absorption coefficient, weighted sound absorption coefficient, and absorption class according to EN ISO 11654:1997:

$\alpha_w = 0.60(L)$ Absorption class C

DELTA – a part of FORCE Technology, 17 August 2018

Lars S. Søndergaard

Lars Sommer Søndergaard, Acoustics

Description of reverberation room

The measurements are performed in a reverberation room (Room 005, Building 355 at the Technical University of Denmark) with walls, ceiling, and floor of 300 mm in situ cast concrete. Length, width, and height of the room are 7.85 m, 6.25 m, and 4.95 m, respectively. The volume of the room is approx. 215 m³, and the total surface area is approx. 305 m². Sound diffusion elements of concrete, of damped steel plate, and of acrylic sheets are placed in the room.

Test procedure

Measurement of sound absorption according to EN ISO 354:2003 is carried out in a reverberation room. The reverberation time is measured with and without the test specimen, and the sound absorption coefficient is evaluated using Sabine's formula.

The test signal used is broad band pink noise emitted successively by two loudspeakers located in two opposite corners of the room. The reverberation time is measured in six microphone positions for each loudspeaker. For each microphone/loudspeaker position three repeated excitations are used. One-third octave filters (100-5000 Hz) are included in the receiving equipment.

The reverberation time is evaluated from the averaged slope of the decay curve over a range from 5 dB to 25 dB below the steady state level.

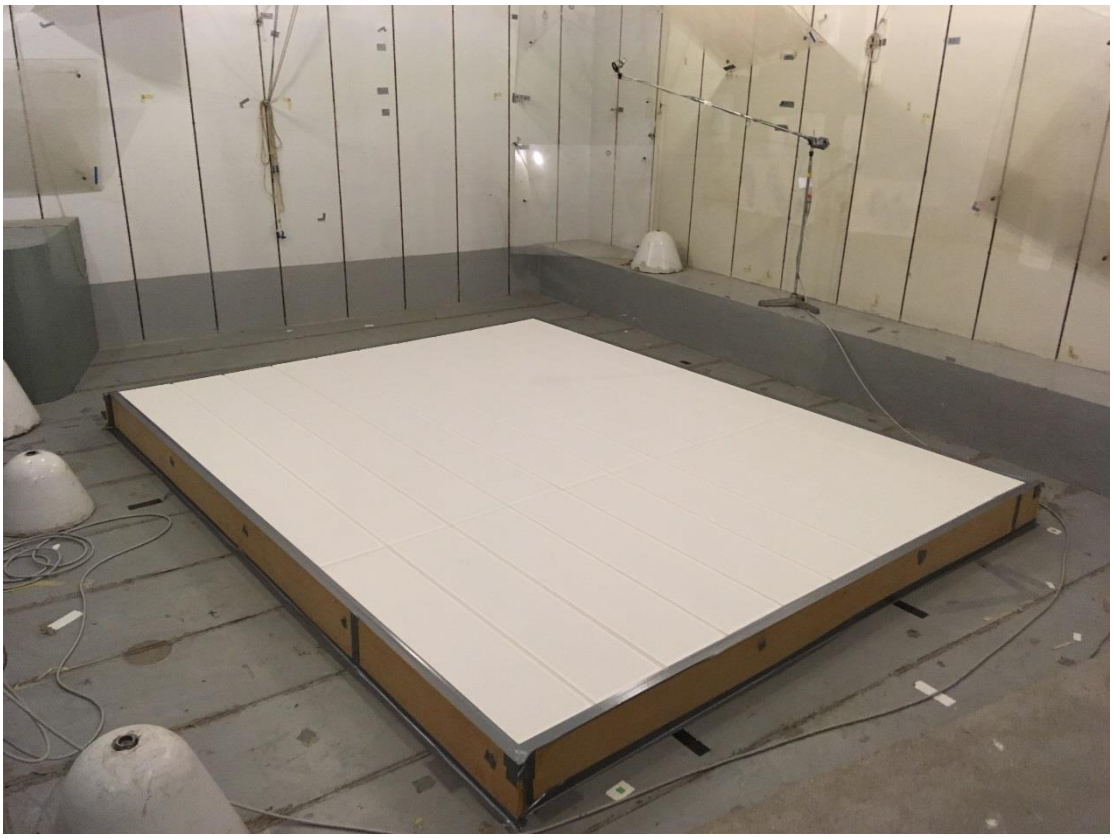
The sound absorption coefficient α_s is calculated using the following formula:

$$\alpha_s = \frac{55.3 \cdot V}{c \cdot S} \cdot \left(\frac{1}{T_2} - \frac{1}{T_1} \right) - \frac{4V}{S} \cdot (m_2 - m_1)$$

where V = Volume of the empty reverberation room [m³]
c = Velocity of sound in air [m/s]
S = Area of the test specimen [m²]
T_1 = Reverberation time of the empty reverberation room [s]
T_2 = Reverberation time of the reverberation room after the test specimen has been introduced [s]
m_1 = Attenuation coefficients due to air absorption during measurement of T_1 (m^{-1})
m_2 = Attenuation coefficients due to air absorption during measurement of T_2 (m^{-1})

The attenuation coefficient of sound in air varies with relative humidity, temperature, and frequency. During a series of measurements of reverberation times T_1 and T_2, the relative humidity and the temperature are held as constant as possible. A correction term as given in the formula above is applied. The correction is based on data from ISO 9613-1:1993.

Photo of specimen in the laboratory



Gyptone Xtensiv Quattro 75 mounted in the laboratory.