Measurement Report
BuzziTile 3D

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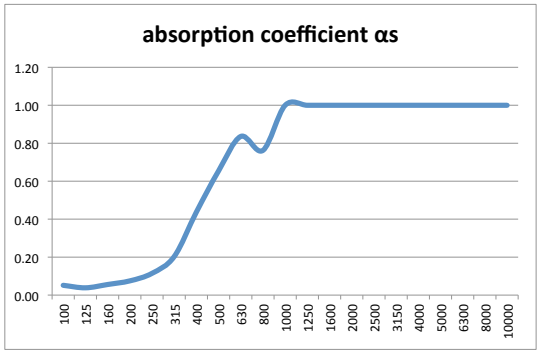
SUMMARY



NRC	***0.70***	Noise Reduction Coefficient
Class	***C***	
SAA	***0.67***	Sound Absorption Average
α_w	***0.45***	***(MH)***

Hz	α_s
125	*0.05*
250	*0.13*
500	*0.64*
1000	1.00
2000	1.00
4000	1.00

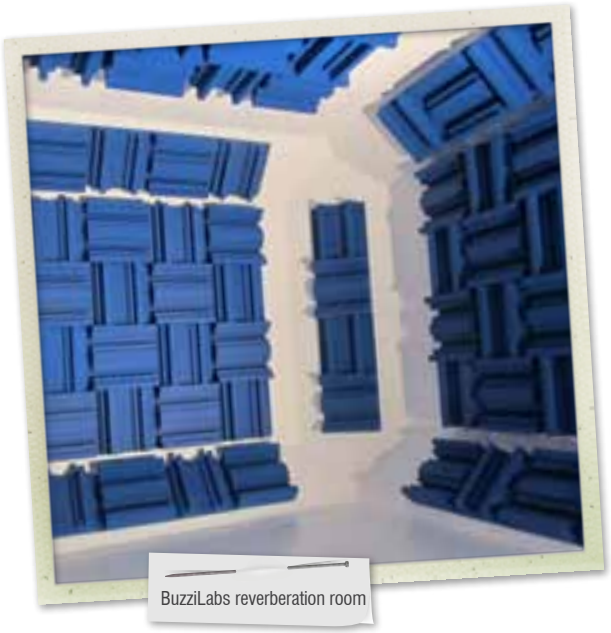
Classification of sound absorbers NEN-EN-ISO 11654	
A	0.90 | 0.95 |1.0
B	0.80 | 0.85
C	0.60 | 0.65 | 0.70 | 0.75
D	0.03 | 0.55
E	0.15 | 0.25

1. THE REVERBERATION ROOM

The BuzziLabs reverberation room:
A diffuse field is created in this room using 188 QRD diffusers so that the absorption range of the product can be accurately determined. This room contains a fixed set-up for the speaker and the three positions for the microphone.

Reverberation room dimensions (in mm): 5818 (l) x 3716 (b) x 2965 (h)

Capacity of reverberation room minus the total volume of the diffusers (in m^3): 64



BuzziLabs reverberation room

2. THE MEASURING EQUIPMENT

The following equipment is used to take the measurements:

- Fuzz measure acoustic measurement software
- Beyer Dynamic MM1 microphone
- Motu Microbook II sound card
- Spherical speaker type Mx 12
- Measuring instrument class 1 NTI acoustics

3. THE MEASURING STANDARDS

The measurements are taken and the calculations are made in accordance with the guidelines in the following standards:

NEN-ISO 354	Acoustics – Measurement of sound absorption in a reverberation room
NEN-EN-ISO 11654	Acoustics – Sound absorbers for use in buildings. Rating of sound absorption
ASTM-C324-90a	Standard Test Method for sound absorption and sound absorption coefficients by the reverberation room method

4. THE MEASURING METHOD

To determine the absorption coefficient, the method laid down in standard NEN-EN-ISO 354:2003 Acoustics – Measurement of sound absorption in a reverberation room is used.

The measurement concept is as follows: the reverberation time of the reverberation room is measured without test objects. After this, the reverberation time of the room is measured with the products or materials to be tested. On the basis of the difference in reverberation time, measured in third-octave bands, and the surface area of the product, it is possible to calculate the absorption value of the product to be tested at the requested frequency.
The following comparison is used for this calculation:

$A_1 = ((55.3 \times V) / c \times T_1) - 4Vm_1 \quad [m_2]$

Where:

V = volume of the empty reverberation room [m^3]

T_1 = reverberation time in the empty reverberation room [sec]

m_1 = power attenuation coefficient in the reverberation room in accordance with: $m = \alpha / (10 - \lg(e))$ [m-1]
where α = attenuation coefficient calculated in accordance with ISO-9613-1

c = speed of the sound in accordance with: $c = 331 + 0.6t$ [m/s]
where t = temperature in degrees Celsius

This is repeated with the product to be tested in the reverberation room in accordance with:

$A_2 = ((55.3 \times V) / c \times T_2) - 4Vm_2 \quad [m_2]$

Where:

V = volume of the empty reverberation room [m^3]

T_2 = reverberation time in the reverberation room with the object [sec]

m_2 = power attenuation coefficient in the reverberation room in accordance with: $m = \alpha / (10 - \lg(e))$ [m-1]
where α = attenuation coefficient calculated in accordance with ISO-9613-1

c = speed of the sound in accordance with: $c = 331 + 0.6t$ [m/s]
where t = temperature in degrees Celsius

Owing to the irregular volume of the BuzziLabs reverberation room, the length of the signal path is limited, which means that the power attenuation coefficient is negligible. The formula will therefore be rewritten as:

$A = ((55.3 \times V) / c \times T)$

The total sound absorbing surface area A is calculated by:

$A = A_2 - A_1 = A = ((55.3 \times V) / c \times T_2) - ((55.3 \times V) / c \times T_1)$

The absorption coefficient can be calculated by:

$\alpha = A / S$

Where S [m_2] is the total product surface area.

5. PRODUCT DESCRIPTION

The sound absorption measurements are carried out for the following product:

Name: BuzziTile 3D

6. THE MEASURING CONDITIONS

The following conditions are observed in the rooms when the measurements are taken:

BuzziLabs reverberation room

Temperature	17 °Celsius
Air pressure	1011 hPa
Background noise	28 dBA

7. RESULTS

The results measured are given in third-octave bands. The octave bands are calculated by taking the average of the third-octave bands per octave band.

The NRC value is calculated in accordance with ASTM-C324-90a and the α_w in accordance with ISO 11654.
The absorption coefficients obtained may not be seen as a material property.
The way in which the material is attached, among other things, influences the absorption coefficient to be obtained.

frequency	$\alpha_{s1/3}$	α_s	NRC	α_w	SAA
25	0.00				
31.5	0.00	0.00			
40	0.00				
50	0.00				
63	0.02	0.03			
80	0.05				
100	0.05				
125	0.04	0.05			
160	0.06				
200	0.07				
250	0.11	0.13			
315	0.20				
400	0.44				
500	0.65	0.64	0.70	0.45	0.67
630	0.84		Class	(MH)	
800	0.76		C		
1000	1.00	1.00			
1250	1.00				
1600	1.00				
2000	1.00	1.00			
2500	1.00				
3150	1.00				
4000	1.00	1.00			
5000	1.00				
6300	1.00				
8000	1.00	1.00			
10000	1.00				
12500	0.97				

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