

## SOUND ABSORPTION MEASUREMENTS FOR NORDGRÖNA REINDEER MOSS ABSORBER ACCORDING TO SS-EN ISO 354:2003 AND SS-EN ISO 25269:2013

### ABSTRACT

The sound absorption for Nordgröna Reindeer Moss sound absorber has been measured according to the reverberation room method (SS-EN ISO 354:2003) and evaluated according to SS-EN ISO 25269:2013.

Test object	$A_{obj}$ [m <sup>2</sup> Sabine]						
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Nordgröna Reindeer moss absorber 0,5x0,5 m	0.0	0.1	0.2	0.4	0.5	0.5	0.5

### 1. CUSTOMER

Nordgröna AB, Norbergsgatan 6, 223 54 Lund  
Contact: Joris Oudendijk, joris.oudendijk@nordgrona.com, 0737-416 475.

### 2. ASSIGNMENT

To measure sound absorption area for one product from Nordgröna according to SS-EN ISO 354:2003 and evaluate the results according to SS-EN ISO 25269:2013.

### 3. TEST SPECIMEN

The reindeer moss absorber consists of a hard board with compressed and uncompressed moss on top. The moss is treated to make it fire resistant, anti-static and to prevent it from drying out. Each wall panel measures approximately 510x510x85 mm.



Figure 1: Front and side view of the Nordgröna reindeer moss absorber.

### 4. MEASUREMENT PROCEDURE

The absorption measurements were performed according to the standard SS-EN ISO 354:2003. The measurements were made with three speaker positions and four microphone positions. The results for absorption coefficient were evaluated according to SS-EN ISO 25269:2013. The test specimen area fulfils the requirements in SS-EN ISO 354:2003.

The measurements were performed by Johan Jernstedt 2014-11-13 in the Akustikverkstan reverberation room in Skulptorp, Skövde, Sweden.

## 5. MEASUREMENT EQUIPMENT

Table 1 lists the equipment used during the measurements. The equipment fulfils class 1 according to SS-EN 61672-1, 60942 and 61260. Date for the latest calibration is available in the instrument journal of Akustikverkstan.

Instrument	Manufacture and type	Serial number	Internal designation
Measurement computer	HP ZBook		DA02
Front end	National Instruments NI 9234	195551B-01L-1918620	AN05
Microphone	Roga MI-17	592	MI04
Microphone	Roga MI-17	593	MI05
Microphone	Roga MI-17	594	MI06
Microphone	Roga MI-17	595	MI07
Speaker	IMA Kub 1	8	HÖ7
Speaker	IMA Kub 1	9	HÖ8
Speaker	IMA Kub 1	10	HÖ9
Equalizer	Monacor MEQ-2152	-	Lab
Amplifier	Denon POA-2200	-	Lab

Table 1: Equipment used during the measurements.

## 6. RESULTS

The sound absorption area for the wall panels is listed in table 2. Detailed measurement results are available in the measurement protocols belonging to this report 14-140-M1 and 14-140-M2. The protocols contain the same data, but the graph scaling is changed in M2 to increase readability, as the actual size of the test object is very small (0.26 m<sup>2</sup>). This is a deviation from ISO 354.

The results are only valid for the tested samples.

Test object	$A_{obj}$ [m <sup>2</sup> Sabine]						
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Reindeer moss absorber 0,5x0,5 m	0.0	0.1	0.2	0.4	0.5	0.5	0.5

Table 2: Results according to SS-EN ISO 25269:2013 for the wall panels.

## 7. MEASUREMENT UNCERTAINTY

The uncertainties for the sound absorption area measurements are concluded from the values in table 3 multiplied with the test specimen area. The uncertainties represent one standard deviation.

<b>50 Hz</b>	<b>63 Hz</b>	<b>80 Hz</b>	<b>100 Hz</b>	<b>125 Hz</b>	<b>160 Hz</b>	<b>200 Hz</b>
± 0,10	± 0,08	± 0,07	± 0,06	± 0,05	± 0,04	± 0,03
<b>250 Hz</b>	<b>315 Hz</b>	<b>400 Hz</b>	<b>500 Hz</b>	<b>630 Hz</b>	<b>800 Hz</b>	<b>1 kHz</b>
± 0,03	± 0,03	± 0,03	± 0,03	± 0,03	± 0,03	± 0,03
<b>1,25 kHz</b>	<b>1,6 kHz</b>	<b>2 kHz</b>	<b>2,5 kHz</b>	<b>3,15 kHz</b>	<b>4 kHz</b>	<b>5 kHz</b>
± 0,03	± 0,03	± 0,03	± 0,03	± 0,03	± 0,03	± 0,03

Table 3: Measurement uncertainty regarding absorption factor for each 1/3 octave band.

This report must always be used in its complete form, but the measurement protocols may be used independently.

Johan Jernstedt

Master of Science, Civil engineering

Revised by Pontus Thorsson, 2014-11-21

## APPENDIX 1: MEASURED REVERBERATION TIMES

Frequency (Hz)	Empty	Nordgröna Reindeer Moss Panel 50x50 cm
50	9.13	9.22
63	8.54	8.11
80	8.24	7.56
100	6.75	6.23
125	5.99	5.51
160	5.16	4.67
200	5.16	4.51
250	5.39	4.37
315	5.56	4.30
400	5.38	3.84
500	4.87	3.47
630	4.29	2.95
800	4.77	3.07
1000	4.51	3.05
1250	3.97	2.78
1600	3.71	2.65
2000	3.29	2.41
2500	2.98	2.25
3150	2.55	2.01
4000	2.20	1.77
5000	1.73	1.47

Number of objects	0.00	8
Temperature (°C)	15.6	15.1
RH (%)	54.9	59.0

## APPENDIX 2: INFORMATION ABOUT THE REVERBERATION ROOM

The reverberation room is rectangular, measuring Length x Width x Height = 5,85 x 4,65 x 7,35 m. The room volume is 200 m<sup>3</sup> and the total area of the walls, ceiling and floor is 209 m<sup>2</sup>. There are 22 diffusors (size 0,775 x 1,25 m) randomly installed in the room. The reverberation time between 50 and 200 Hz is controlled with membrane absorbers on the walls.

The test specimens were put on the floor according to figure B2.1.

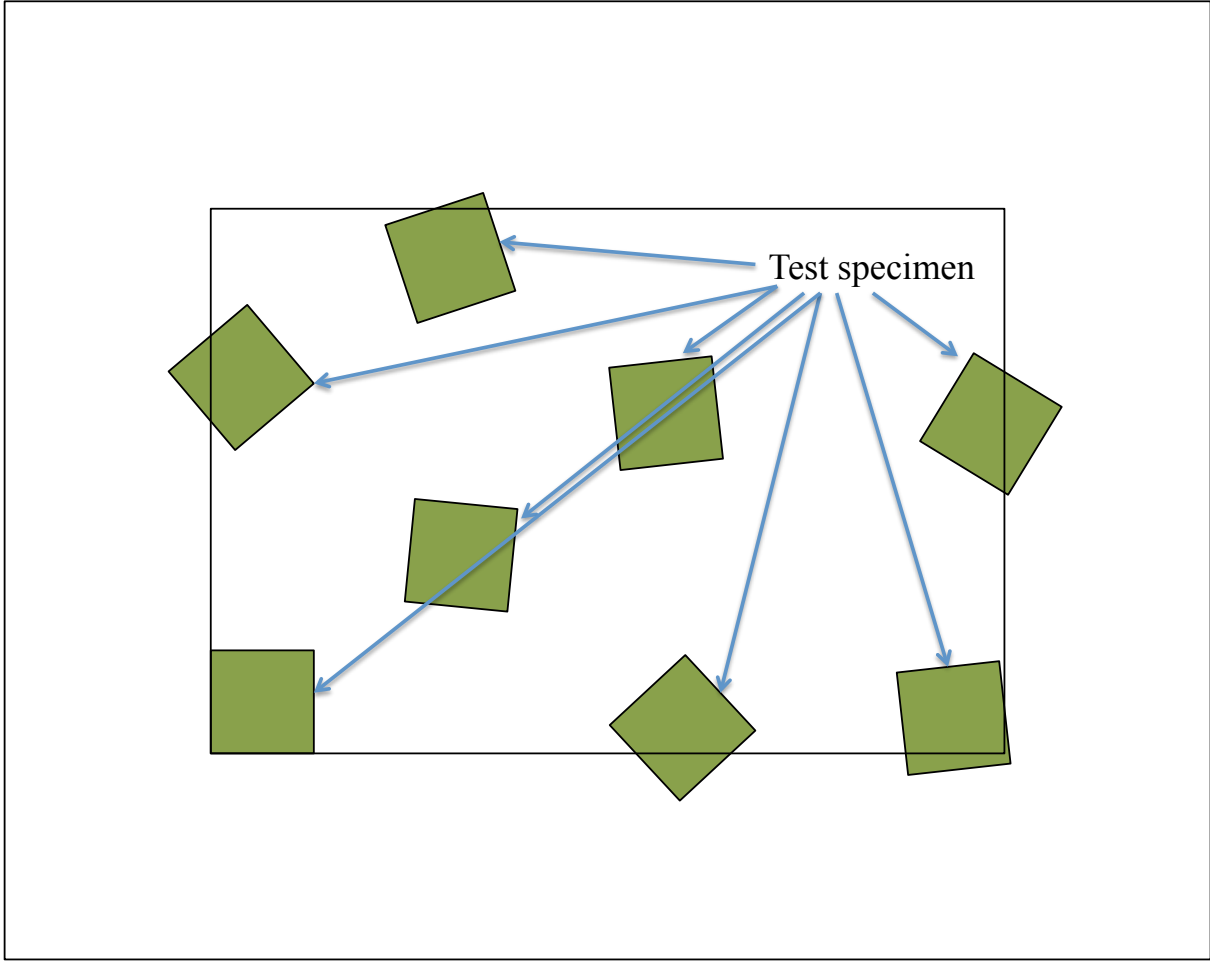


Figure B2.1: Plane drawing of the reverberation room with the test specimens put on the floor.