

Plenty Wall Pod

Airborne sound insulation

Report MR-10244150.01

Determination of Sound Insulation acc. to ISO 16283 part 1 and 3


Date: 2016-12-13

Revised

Written by: Leevi Toratti

Reviewed by: Klas Hagberg

Approved by: Klas Hagberg

Assignment number: 10244150	Measurements Plenty Wall Pod : MR-10244150.01 Plenty Wall Pod – Airborne sound insulation	
Date: 2016-12-13		
Revised:		
Operator: Leevi Toratti		

Plenty Wall Pod Airborne Sound Insulation

CLIENT


Abstracta AB
Elin Nork

CONSULTANT

WSP Acoustics
Box 13033
402 51 Göteborg
Visit: Ullevigatan 19
Tel: +46 (0)10 722 50 00
Fax: +46 (0)10-722 74 20
WSP Sweden AB
Org no: 556057-4880
Place of the board: Stockholm
www.wspgroup.se

CONTACT

Klas Hagberg	tel. +46(0)10-722 71 66
Leevi Toratti	tel. +46(0)10-722 72 37

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SUMMARY

The results show that the Plenty Wall Pod reduces the sound by approximately 34-36 dB, when the door is properly sealed.

The ventilation channel on the floor level in the Plenty Wall Pod causes a minor sound leakage. This could be improved for example by locating the ventilation channel in the back wall of the booth which is expected to be less exposed to disturbing noise from outside.

As a comparison it is normally not possible to achieve more than maximum 15 dB reduction from one side to another when dividing two spaces by office screens, even if carefully installed.

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COMMISSION

WSP Acoustics has been commissioned to measure the airborne sound insulation of two different sizes of Plenty Wall Pod booths. The test specimens were located at Abstracta AB Showroom in Lammhult, Sweden.

The measurements were carried out 2016-12-12 by Leevi Toratti from WSP Acoustics.

TEST CONDITIONS


Test specimen

The test specimens were located in Abstracta AB Showroom in Lammhult, Sweden. The Showroom is large ($>300 \text{ m}^3$) and contains a considerable amount of sound absorbing materials in the ceiling, but also furniture and screens.

During measurements the Plenty Wall Pod booths were empty. The smaller size booth had one glass wall and a glass door (see Picture 1). All the other surfaces were treated with sound absorbing material. The bigger size booth had one glass wall with a glass door (see Picture 2). All the other surfaces were treated with sound absorbing material.



Picture 1: The small size Plenty Wall Pod. Estimated volume approximately $2,4 \text{ m}^3$.

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Picture 2: The large size Plenty Wall Pod. Estimated volume approximately 4,7 m³.

Measurements


There is no standard dedicated for this type of measurements. The measurement procedure was therefore decided prior to the measurements according to following:

Measurements will be carried out according to the principles in ISO 16283 part 3 which implies that we evaluate $R'_{w,45}$. This measure enables the estimation of the expected sound pressure level inside the room if the level outside is known, and vice versa. The measure also enables the comparison of various similar modules.

Additionally, the volume of the test specimen is small and it is not possible to carry out reverberation time measurements inside the pod. Therefore only **level difference** (no correction for reverberation time) is evaluated.

Calculations of single number values are made according to ISO 717, part 1.

To conclude – the evaluation will be expressed as level difference D_w and the sound level outside the pod is collected and averaged over the wall surface of the pod. Inside the pod the sound level is taken as an average value with a moving microphone (swept by the operator) as specified in the standard. See also Annex 1.

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RESULTS

The level difference between the sending room and the test specimen has been determined by the field measurement standard mentioned above. The results are presented in appendix 2 - 4 and are summarized in Table 1.

The smaller Plenty Wall Pod was measured several times with various treatments to change its characteristics. The different treatments included a) extra insulation in the door frame, b) additional particle board in the wall insulation and double door seals. However, the changes did not have a noticeable effect on the sound insulation and therefore the measurement results for the different treatments are not individually presented in this report.

In the bigger Plenty Wall Pod a minor leakage through the ventilation channel at the floor level was detected. Measurements were carried with and without sealing the ventilation channel.

Airborne Sound Insulation

Table 1: Measured airborne sound insulation.


Test specimen	Level difference	Comment *
	D_w [dB]	
Plenty Wall Pod, smaller size	36	Annex 02
Plenty Wall Pod, bigger size	34	Annex 03
Plenty Wall Pod, bigger size (with sealed ventilation channel)	35	Annex 04

*) D_w , evaluated here is not explicitly defined in ISO 16283-3 but is used here as the level difference obtained by the element loudspeaker method. $D_{45^\circ} = L_{1s} - L_2 - 1,5$ dB. This definition is similar to the apparent sound reduction index R'_{45° except that the partition surface and the sound absorption area in the receiving room are not taken into account.

DISCUSSION

During measurements the doors of the booths were mounted properly with no noticeable leakage between the door and the doorframe. It is however important to assure that the doors are mounted properly and fully sealed before every installation.

Sealing the ventilation channel in the bigger Plenty Wall Pod improved the sound insulation only by 1 dB, which is a minor improvement. However, the leakage through the ventilation channel is located in the frequency range of speech and thus the perceived improvement in sound insulation might be bigger than what the measurements reveal. Therefore, it is recommended that the ventilation channel is

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better insulated or located in the back wall of the booth which is expected to be less exposed to disturbing noise from outside.

The sound pressure level in the receiving room is assumed to be dominated by sound transmission through the partitions directly exposed to loudspeaker noise.

ANNEX 01 – Measurement procedure

The measurement conditions were not perfect concerning sound insulation measurements. Usually the sound field outside the test specimen (the sending room) is either approximately diffuse (room to room measurement), or direct (facade measurement). For the current measurement it was not obvious which approximation that should be applied. The measurements were carried out as facade noise insulation measurements according to ISO 16283-3. The façade approximation was decided to represent the most reliable result, since the sending room could not be considered to be diffuse and the sound energy was therefore not evenly distributed.

Measurement equipment

The following instruments were used for the test:

Tabell 1: Measurement equipment

Instrument	Manufacturer	Type	Serial no
Real time analyzer	Brüel & Kjær	2260	2399652
Microphone	Brüel & Kjær	4189	2631353
Calibrator	Brüel & Kjær	4231	1883456
Amplifier	Norsonic	NOR280	2803903
Loudspeaker	Norsonic	NOR276	2765556

The instruments are calibrated with traceability to national and international references according to our quality system which meets the requirements in SS EN ISO/IEC 17025.

Loudspeaker position

The loudspeaker was placed approximately 1 m above the floor at a distance approximately 5 m from the microphone positions. Sound incidence was approximately 45° to two of the partition surfaces. Only these two surfaces were directly exposed to loudspeaker noise. See Figure 1.

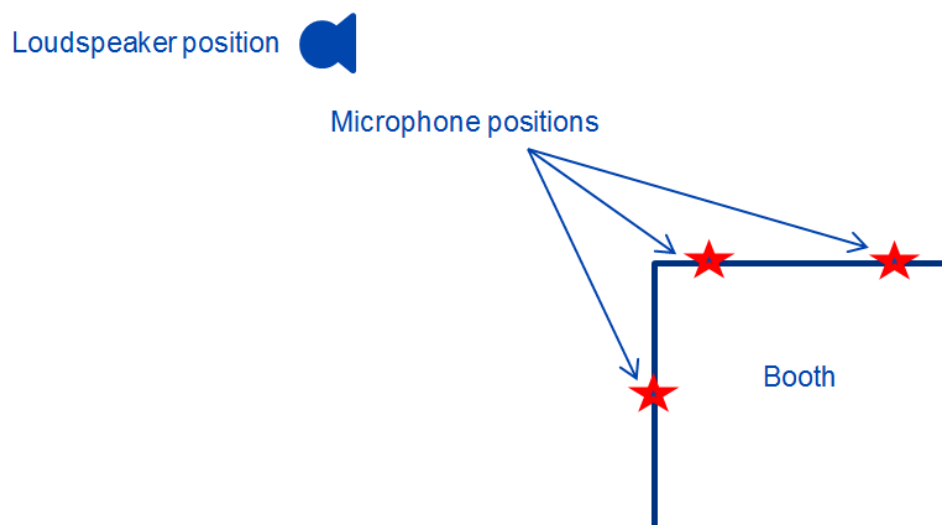


Figure 1 - Measurement set-up, from above.

Microphone positions

The sound pressure level inside the receiving room was manually scanned in accordance with ISO 16283 -3.

For measurement of sound **level difference** “ D_{45° ” the microphone was directly mounted on the surface of the test specimen in accordance with ISO 16283-3. Minimum of three samples were made. Two at the glass front and one at the other surface directly exposed to loudspeaker noise. See Figure 1.

Frequency range

The frequency range covered comprises the 1/3 octave bands with center frequencies 50–5000 Hz. When calculating weighted level differences the frequency range 100-3150 Hz is used.

Background levels

If the background noise level is low, generally at least 10 dB lower than measured 1/3 octave band values in the receiving room, no correction is carried out. If the difference between the measured levels in the receiving room and the background sound levels is less than 10 dB correction is carried out to compensate for the background level.

Evaluation

Weighted level difference D_w (or rather $D_{w, 45^\circ}$) is obtained from measured 1/3-octave band levels by calculation according to ISO 171-1.

Measurement uncertainty

The measurement results are not corrected for measurement uncertainty when comparing to requirements.

Client: Abstracta AB

Measurement date: 2016-12-12

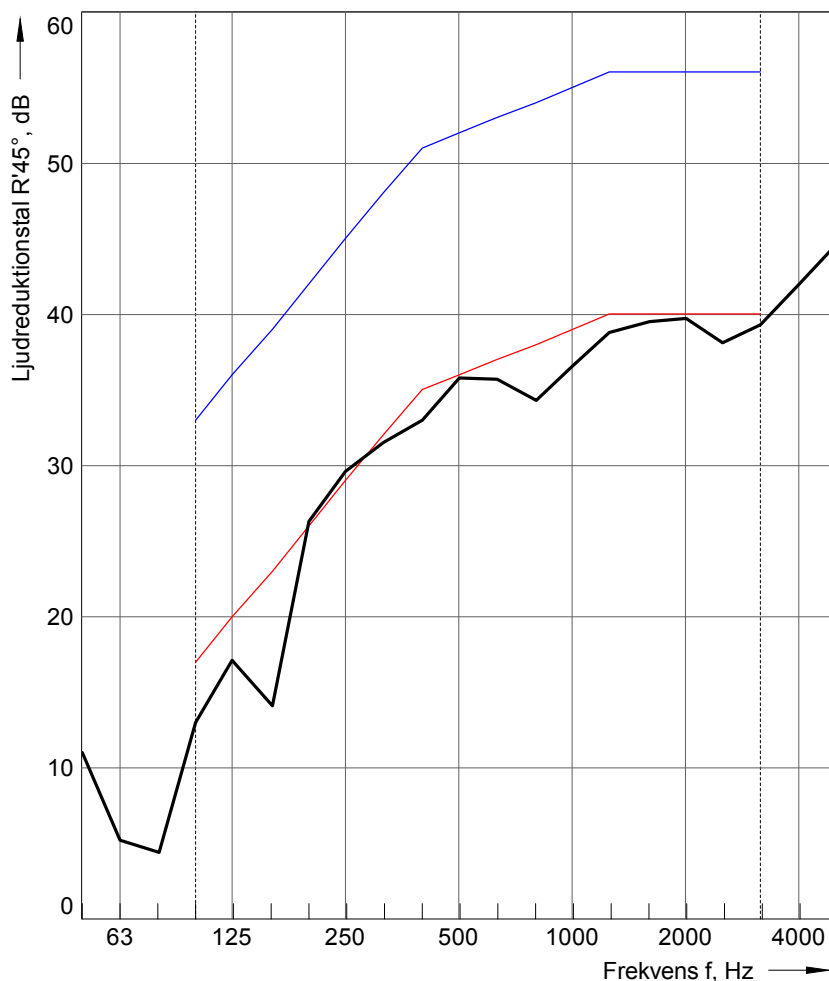
Construction and comments:

Plenty Wall Pod (V = 2,4 m³).

"Facade" insulation measurements.

No correction for the reverberation time.

	D 1/3 octave dB
50	11,0
63	5,2
80	4,4
100	13,0
125	17,1
160	14,1
200	26,3
250	29,6
315	31,5
400	33,0
500	35,8
630	35,7
800	34,3
1000	36,6
1250	38,8
1600	39,5
2000	39,7
2500	38,1
3150	39,3
4000	42,0
5000	44,6



Dw = 36 dB

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ANNEX 03 - Sound level difference

Client: Abstracta AB

Measurement date: 2016-12-12

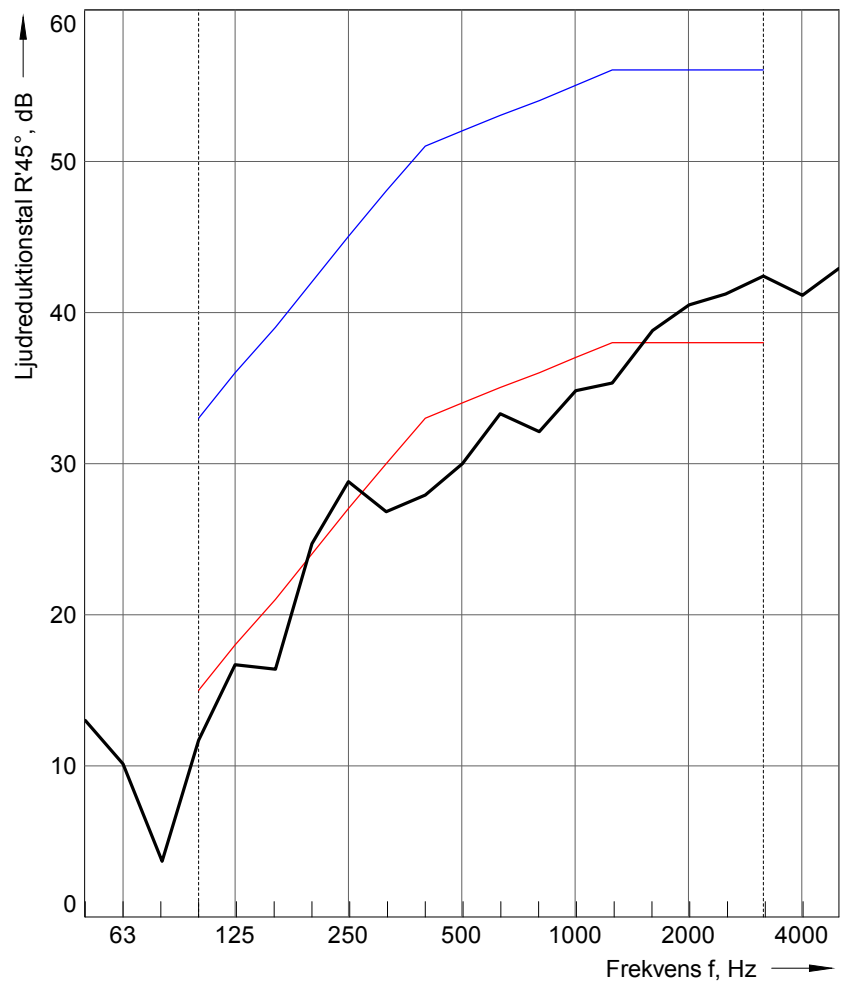
Construction and comments:

Plenty Wall Pod (V = 4,7 m³).

"Facade" insulation measurements.

No correction for the reverberation time.

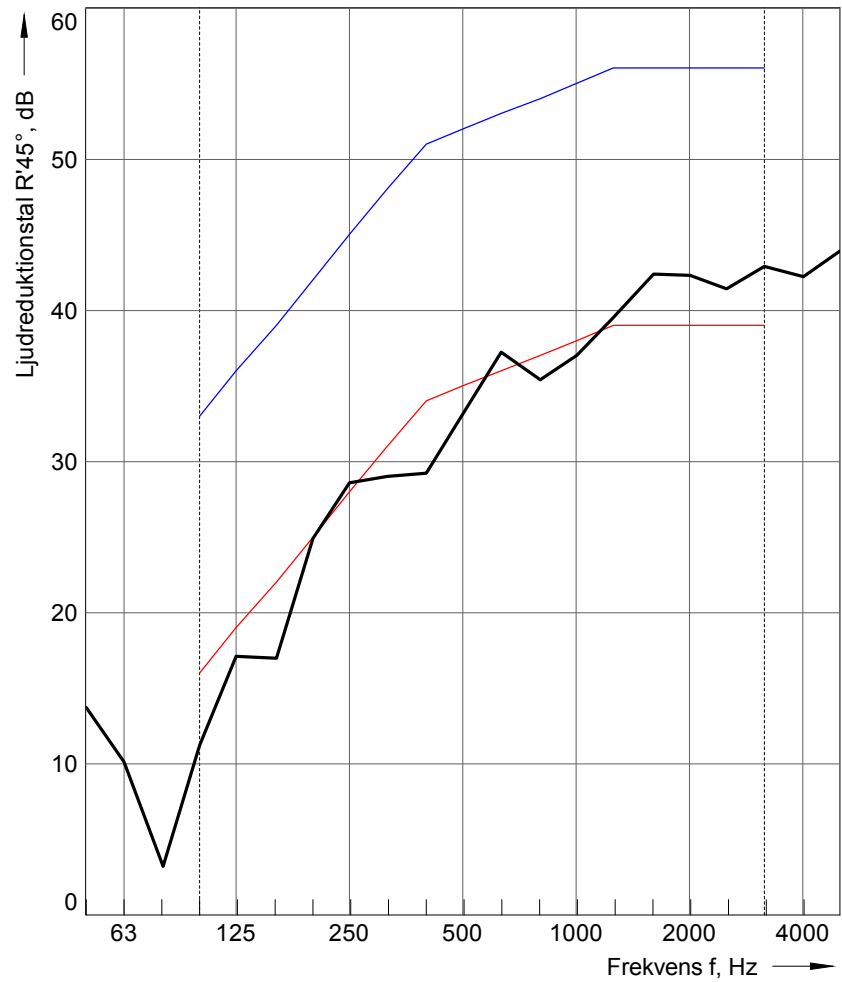
	D 1/3 octave dB
50	13,0
63	10,1
80	3,7
100	11,7
125	16,7
160	16,4
200	24,7
250	28,8
315	26,8
400	27,9
500	30,0
630	33,3
800	32,1
1000	34,8
1250	35,3
1600	38,8
2000	40,5
2500	41,2
3150	42,4
4000	41,1
5000	42,9



Dw = 34 dB

ANNEX 04 - Sound level difference

	D 1/3 octave dB
50	13,7
63	10,1
80	3,2
100	11,2
125	17,1
160	17,0
200	24,9
250	28,6
315	29,0
400	29,2
500	33,2
630	37,2
800	35,4
1000	37,0
1250	39,5
1600	42,4
2000	42,3
2500	41,4
3150	42,9
4000	42,2
5000	43,9



Dw = 35 dB