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Bürogemeinschaft
Prof. Dr.-Ing. Birger Gigla
Prof. Dr. rer. nat. Jürgen Tchorz

Weberkoppel 67
D-23562 Lübeck
www.isoakustik.com

Test report ML24-1

Speech level reduction of enclosures - ISO 23351-1

Customer	Berlin Acoustics Torstraße 164 10115 Berlin
Test specimen	Meeting booth „Berlin Acoustics Meet“
Measurement date	28.06.2024
Reporting date	04.07.2024
	J. Tchorz
Contents:	

Standards

DIN EN ISO 3741	Akustik – Bestimmung der Schallleistungs- und Schallenergiepegel von Geräuschquellen aus Schalldruckmessungen – Hallraumverfahren der Genauigkeitsklasse 1 (ISO 3741:2010); Deutsche Fassung EN ISO 3741:2010
ISO 23351-1	Acoustics —- Measurement of speech level reduction of furniture ensembles and enclosures —- Part 1: Laboratory method (2020)

1 Task and test specimen

On behalf of Berlin Acoustics, the speech level reduction of the Berlin Acoustics Meet meeting booth was to be determined in accordance with ISO 23351-1. The booth was delivered and set up by the client on June 28, 2024.

1.1 Meeting booth Berlin Acoustics Meet

The meeting booth (external dimensions without door handle 2.04 x 1.37 x 2.15 m WxDxH) is made of wood with sound-absorbing material on the inside of the walls and textile flooring. One of the four walls is made entirely of glass, with the left half being permanently glazed and the right half opening as a door. The interior consists of two fixed benches and a table top. According to the manufacturer, an additional stool is part of the standard equipment of the meeting cabin and was placed in the cabin for measurement. 230 V sockets, a light switch and the lighting are located under the ceiling. Slots for air inlet and outlet for ventilation are located on the sides of the floor and in the ceiling. The levelling feet under the base plate were set to the lowest position for measurement.

2 Test procedure

According to ISO 23351-1, the sound power of a sound source is measured in third octave bands with and without enclosure of the sound source in the reverberation room. The measurements are repeated for a second position of the enclosure. The sound power levels are summarized in octave bands from 0.125 - 8 kHz. This results in the level reductions D in octave bands due to the enclosure. These level reductions are applied to a normalized octave spectrum of speech. The difference between the A-weighted total level of the unattenuated speech spectrum and the A-weighted attenuated speech spectrum, averaged over both positions, gives the speech level reduction $D_{S,A}$ [dB] as a single number according to ISO 23351-1.

The speech level reduction $D_{S,A}$ can be classified according to the following table from ISO 23351-1 Annex D:

Classification	A+	A	B	C	D	unclassified
$D_{S,A}$ [dB]	>33	>30	>25	>20	>15	≤ 15

3 Measurement conditions

The measurements were carried out in the reverberation room at Lübeck University of Applied Sciences (see Appendix C for details). The level measurements to determine the sound power using the direct method in accordance with DIN EN ISO 3741:2010 were carried out at 6 fixed microphone positions in the reverberation room. The onmidirectional sound source (dodecahedron) was located at the same positions in the reverberation room with and without the test object. Sound level measurements in third octaves from 0.1 - 10 kHz were carried out with two different positions of the booths (distance $>$1.7 m from the center of the booth to the center of the booth). Pink noise was used as the measurement signal. The measurement duration was 30 s in each case.

The reverberation time measurements required to calculate the sound power were carried out with four microphone and three loudspeaker positions. For each of the twelve possible combinations of these positions, three reverberation time measurements were carried out with pink noise switched off. The reverberation times were determined individually and the average reverberation time was calculated.

Contrary to the specifications in ISO 23351-1, a distance of less than 1 m between the test specimen and the nearest diffuser could not be maintained in all test positions.

The measuring devices used are listed in Appendix B.

Speech level reduction of enclosures according to ISO 23351-1

Customer: Berlin Acoustics
10115 Berlin

Test specimen: Meeting booth „Berlin Acoustics Meet“

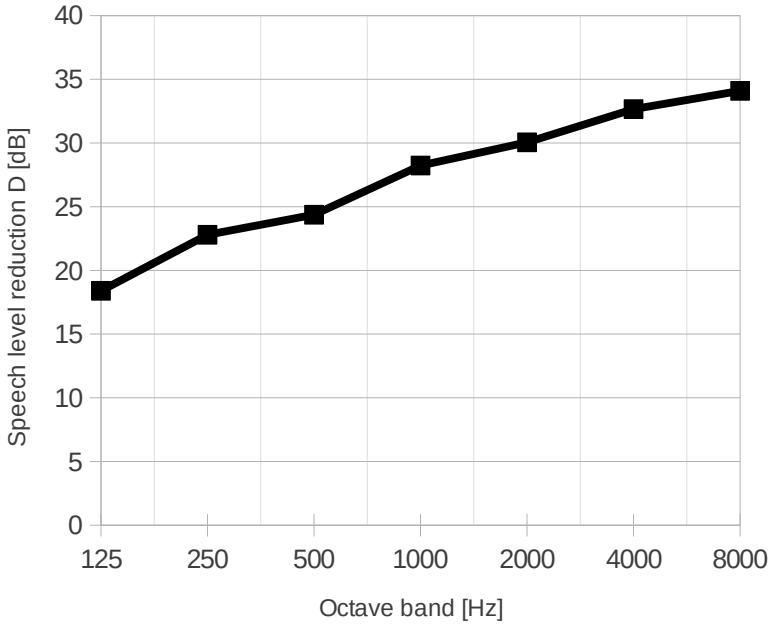
Test procedure: The measurements were carried out in accordance with ISO 23351-1.

The meeting booth was set up in the reverberation room and connected to the power supply.
The ventilation was switched off. An omnidirectional sound source (dodecahedron) was set up in the booth between the table and the right-hand bench at seat height (120 cm). The power amplifier was located on the cabin floor and was supplied with power via one of the sockets in the cabin.
The door was closed during the measurement.

Room: Reverberation room 17-0.13, Lübeck University of Applied Sciences
Volume: 186,4 m³ Surface: 206 m²

Temperature: 18,8 ± 0,5°C Measurement date: 28.06.24
Humidity: 78,8 ± 2,5 %RH
Air pressure: 1021 ± 1 hPa

f [Hz]	D [dB]
125	18,4
250	22,8
500	24,4
1000	28,2
2000	30,1
4000	32,7
8000	34,1



Speech level reduction and classification according to ISO 23351-1: $D_{S,A}$ = 25,3 dB Class: B

The results are only valid for the tested sample configuration. Changes in size, geometry or materials can lead to significant changes in the specified results.

A Illustrations of the test setup

Abbildung 1: Meeting booth Berlin Acoustics Meet

B Measurement devices

Sound analyser	Norsonic Nor850	SN: 8501139
Software	Norsonic Nor850	Version 2.3
Mikrophone set	G.R.A.S. 46AF	SN: 538509
Mikrophone set	G.R.A.S. 46AF	SN: 538510
Mikrophone set	G.R.A.S. 46AF	SN: 538511
Mikrophone set	G.R.A.S. 46AF	SN: 538512
Calibrator	Norsonic Nor 1256	SN: 125626682
Power amplifier	Norsonic Nor280	SN: 2804705
Dodecahedron	Norsonic Nor276	SN: 2766283

C Reverberation room

The reverberation room has a volume of 186.4 m³. The total surface area is 206 m². Five curved metal panels are suspended to increase the diffusivity. Three of these panels have a surface area of 2.43 m² each, two of the panels an area of 1.31 m² each. This results in a total surface area of the diffusers on both sides of diffusers of 19.82 m². Figure 2 shows the floor plan of the reverberation room.

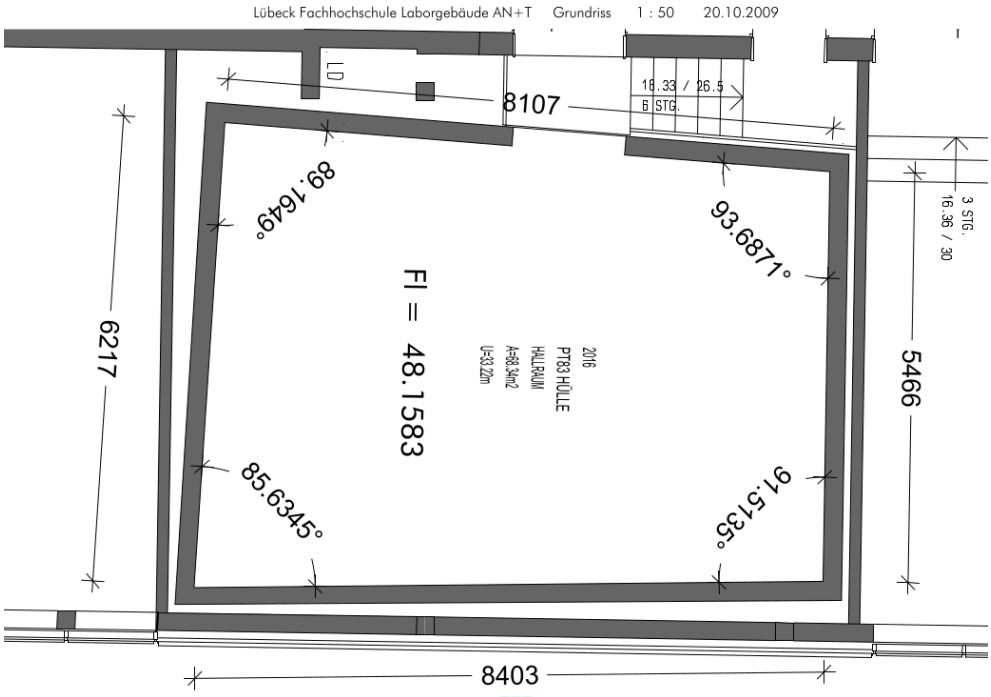


Abbildung 2: Floor plan of the reverberation room at Lübeck University of Applied Sciences