



Testing Laboratory No. 1018.3
accredited by the Czech Accreditation Institute as per ČSN EN ISO/IEC 17025:2018

REPORT

No. 040-074061

on test – Measurement of speech level reduction according to ISO 23351-1:2020

Contract owner: **HON a.s.**
Address: **Srbská 347/2, 160 00 Prague 6, Czech Republic**
Company ID: **47682523**
Manufacturer: **HON a.s.**
Address: **Srbská 347/2, 160 00 Prague 6, Czech Republic**
Test sample: **CUBE CALL NF acoustic telephone box**
Job order no.: **Z040230084**

Number of the Test report pages including the front page: 6
Number of annexes/pages: 2/3

Prepared by:



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Test Engineer – Specialist

Approved by:



Ing. Pavel Bartoš
Head of the Testing Laboratory

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Number of
printed copies: **3**



Teplice, on 14/03/2023

Declaration: 1) The test results given in this protocol relate only to the test item and do not replace other documents
2) This report may be reproduced only as a whole, otherwise the written permission of the testing laboratory is required.
3) The laboratory bears no responsibility for the result if it may have been affected by the information provided by the client.

1. Sample data

Sample No.:	VZ040230433
Sample:	CUBE CALL NF acoustic telephone both see Annex 2
Order no.:	from 21/02/2023
Date of delivery:	09/03/2023
Sampling location:	The sample was taken over from the customer to the Teplice Testing Facility
Sample collection method:	Samples were collected by the employees of TZÚS Praha, s. p. - Teplice branch from the delivered package.
Sample preparation method:	ISO 23351-1 Acoustics — Measurement of speech level reduction of furniture ensembles and enclosures — Part 1: Laboratory method. The enclosure to be measured was provided by the manufacturer. Upon receipt, the sample was inspected visually to verify the product type against the specifications submitted. The sample composition matched the description. Sample composition data were taken from manufacturer's documentation. The reported dimensions weights and other parameters serve the control and documentation purposes and are meant as informative only. The sample was tempered at 20 °C for 24 hours.

Information on the sample acceptance procedure including the name of the employee who took over the sample is included in the Sample Takeover Record, which is stored on the testing laboratory premises. The sampling plan and procedure and the name of the employee who made the sampling, if any, are included in the Sampling Record, which is also stored on the testing laboratory premises.

The test results refer to the sample as received.

2. Test methods

Testing method identification		Name of test method
ISO 23351-1:2020	Acoustics — Measurement of speech level reduction of furniture ensembles and enclosures — Part 1: Laboratory method	Measurement of speech level reduction

Any amendment, deviations or exclusions from the standard procedure or application of non-standard methods: none applied

Other relevant standards:

ČSN EN ISO 3741:2011	Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision methods for reverberation rooms
ISO 23351-1:2020	Acoustics — Measurement of speech level reduction of furniture ensembles and enclosures — Part 1: Laboratory method

3. Test Results

Tests performed on:	14/03/2023
Test site:	Teplice Testing Laboratory Reverberation chamber of TZUS Praha, s.p., Teplice branch
Tested by:	Ing. Pavel Rubáš, Ph.D. (Test Engineer – Specialist) Bc. Marie Hartichová (Test Engineer)



The information on the test conditions and the test equipment used is mentioned in the test report. The instrumentation including the meters are verified and calibrated as specified in the applicable Teplice Test Institute schedule

3.1 Technical description of the test

The measuring was performed in the reverberation room of the TZUS s.p. construction acoustics laboratory in Teplice.

The speech level reduction was measured according to standard ISO 23351-1:2020. The standard describes a laboratory method to compare various types of furniture ensembles and enclosures with regard to their ability to reduce speech level of a user speaking inside this product (enclosure). According to this standard, the sound power level is measured in two scenarios: 1) without the enclosure and 2) with the enclosure. During scenario 1), a test sound signal is generated by a noise source in an empty room while the enclosure is outside the reverberation chamber. With scenario 2), a test sound signal is generated by a noise source inside the enclosure in place of the user. Speech level reduction is the difference between the sound power levels measured in the two scenarios in 1/1-octave frequency bands from 125 Hz to 8 000 Hz. Speech level reduction is a single-number quantity that expresses the corresponding reduction in A-weighted (human ear) sound power level of standard speech within the entire frequency range from 125 Hz to 8 000 Hz. The normative method is applicable for enclosed enclosures and open furniture ensembles, which serve one or several occupants. According to ISO 23351-1:2020, the method utilizing the equivalent absorption area of the reverberation room, called the direct method, was selected.

The acoustic power level of the tested noise source in each one-third octave band at the reference environmental conditions is calculated using the following equation:

$$L_W = \overline{L_{p(ST)}} + \left\{ 10 \lg \frac{A}{A_0} \text{ dB} + 4,34 \frac{A}{S} \text{ dB} + 10 \lg \left(1 + \frac{S \times c}{8 \times V \times f} \right) \text{ dB} + C_1 + C_2 - 6 \text{ dB} \right\}$$

where $L_{p(ST)}$ is the corrected mean value of the time-averaged sound pressure in the one-third octave band in the test room during operation of the test sound source, in decibels;

A is the equivalent absorption area of the room, in square metres;

$$A = \frac{55,26}{c} \left(\frac{V}{T_{60}} \right)$$

A_0 1 m²;

S is the total surface area of the reverberation chamber, in square meters;

c is the speed of sound, in meters per second, at the air temperature in the reverberation

room θ , in degrees Celsius, at the time of the test,

$$c = 20,05 \sqrt{273 + \theta}$$

V is the volume of the reverberation test room, in cubic metres;

f is mean measurement frequency, in hertz;

C_1 is reference quantity correction, in decibels, which takes into account the difference between

the reference quantities used for the sound pressure level and the sound power level and is the function of the typical air impedance at the reference conditions at the time and location of the measurement:



$$C_1 = -10 \lg \frac{p_s}{p_{s,0}} \text{ dB} + 5 \lg \left(\frac{273,15 + \theta}{\theta_0} \right) \text{ dB}$$

C_2 is the radiation impedance correction, in decibels, which converts the actual sound power at the environmental conditions at the time and location of the measurement to the sound power at the reference environmental conditions, the value shall be obtained from the corresponding test code, however, if the test code for noise is not available, the following equation applies for a monopole type noise source and it is the mean value for other sources,

$$C_2 = -10 \lg \frac{p_s}{p_{s,0}} \text{ dB} + 15 \lg \left(\frac{273,15 + \theta}{\theta_1} \right) \text{ dB}$$

where

p_s is the static pressure in the test room at the time of the test, in kilopascals;
 $p_{s,0}$ is the reference static pressure, 101.325 kPa;
 θ_t is the temperature of air in the test room at the time of the test, in degrees Celsius;
 θ_0 314 K;
 θ_1 296 K.

The level of reduction by the tested enclosure is determine as follows

$$D_i = L_{W,P,1,i} - L_{W,P,2,i}$$

where

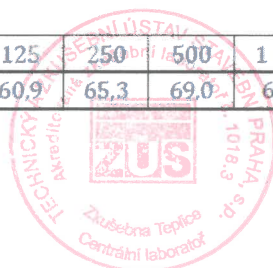
$L_{W,P,1,i}$ is the sound power level in decibels radiated from the reference enclosure when measured in the scenario without the sample;
 $L_{W,P,2,i}$ is the sound power level in decibels radiated from the reference enclosure when measured in the scenario with the sample;

The speech level reduction is determined using a mathematical transformation, where the sound power level $L_{W,P,1,i}$ is replaced by the normalized speed sound power level $L_{W,S,1}$ according to Table 1. In this case, the sound power level radiated by the test sample (enclosure) $L_{W,S,2,i}$ determined using the following formula:

$$L_{W,S,2,i} = L_{W,S,1,i} - D_i$$

Table 1 Unweighted sound power levels of gender non-specific speech

	f Hz						
	125	250	500	1 000	2 000	4 000	8 000
$L_{W,S,1}$ [dB re 1 pW]	60,9	65,3	69,0	63,0	55,8	49,8	44,5



The weighted sound power level (filter A – human ear) radiated by the measured sample (enclosure) within 125 Hz to 8 000 Hz is determined using:

$$L_{W,S,A,2} = 10 \log_{10} \left(\sum_{i=1}^7 10^{(L_{W,S,2,i} + A_i)/10} \right)$$

Where

A_i the A filter weightings for individual single-octave bands

The speech level reduction is determined using the following formula

$$D_{S,A} = L_{W,S,A,1} - L_{W,S,A,2}$$

where $L_{W,S,A,1} = 68.4$ dB is the A-weighted (human ear) human speech sound power within 125 Hz to 8 000 Hz.

3.2 Data declared by the manufacturer

Photographic Documentation of the Test



Fig. 1 sample installed in the reverberation chamber



see Annex 2

3.3 Instruments and gauges used

Nor sonic type 118 – integrating sound level meter, accuracy class 1, compliant with standards IEC 60651, 60804, 61672-1, 61260, base memory for 2,500,000 data sets. Serial number 32127, registration number 302, 8012-OL-10050-22 valid until: 07/02/2024

Nor sonic type 118 – integrating sound level meter, accuracy class 1, compliant with standards IEC 60651, 60804, 61672-1, 61260, base memory for 2,500,000 data sets. Serial number 31991, registration number 279, 8012-OL-10048-22 valid until: 07/02/2024

Nor sonic type 1225 microphone and type 1205 pre-amplifier, serial number 92003, registration number 301, verification certificate no.: 8012-OL-10051-22 valid until: 07/02/2024

Nor sonic type 1225 microphone and type 1205 pre-amplifier, serial number 72839, registration number 280, verification certificate no.: 8012-OL-10049-22 valid until: 07/02/2024

Nor sonic type 1251 acoustic calibrator, serial number 31612, registration number 281. This gauge meets the requirements of IEC 942, 8012-KL-10052-22 valid until: 07/02/2024

Pesto 622 combined hygrometer and barometer, serial number 39507662/506, registration number 431, calibration certificates: temperature No. 2021/0366 valid until 21/01/2026, relative humidity No. 2021/0365 valid until 21/01/2026, atmospheric pressure no. 0243/2021 valid until 21/01/2026

Sound field excitation set – Norsonic type 2 hemisphere, registration number 530

BOSCH DLE 40 Professional laser range finder, reg. no. 310, calibration certificate VÚGTK/41526/2017 valid until 27/09/2024

Tape measure – 5 m, reg.no. 515 valid, calibration certificate 0116D001/21 until 28/01/2031

4 Measurement of speech level reduction according to ISO 23351-1:2020, test method within the scope of accreditation

Sample number and sample description	Units	Determined value	
		$D_{S,A}$	Expanded measurement uncertainty
Characteristics		Category according to Annex D	
VZ040230432 CUBE CALL NF acoustic telephone both see Annex 2	dB	33.3 A+	2.2

The given expanded uncertainty of measurement is the product of the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which corresponds to the coverage of approximately 95 % for normal distribution. The expanded measurement uncertainty was determined pursuant to ČSN EN ISO 23351-1:2020.

Annexes

Annex 1 Evaluation according to ISO 23351-1

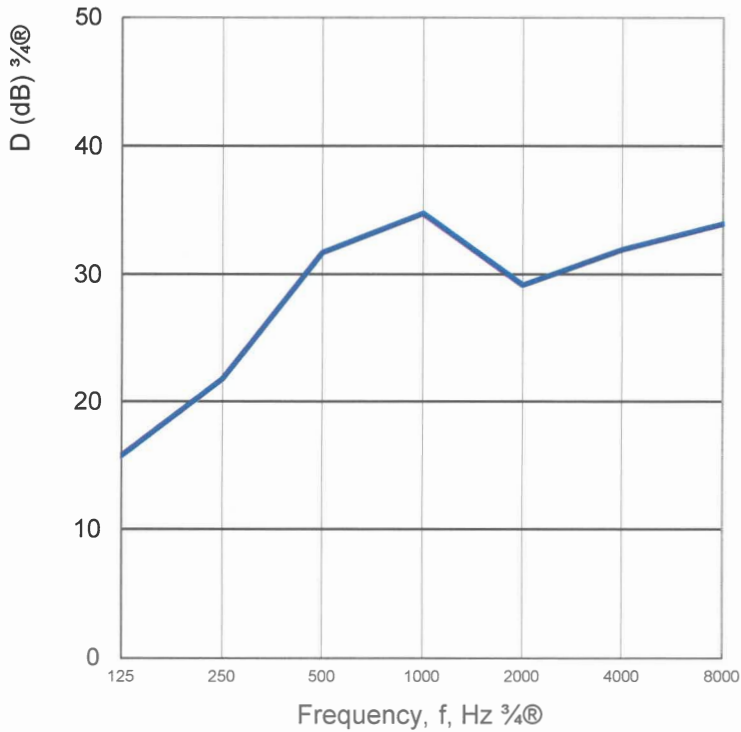
Annex 2 Technical Documentation



END OF REPORT

Determination of speech level reduction according to ISO 23351-1

Product: CUBE CALL NF acoustic telephone both see Annex 2
Operating conditions: common
Manufacturer: HON a. s., Srbská 347/2, 160 00 Prague 6
Test laboratory: Reverberation chamber
Name of the operator: Bc. Marie Hartlichová
Test date: 14.03.2022



Frequency	Speech level reduction
f	D
Hz	dB
125	15,7
250	21,8
500	31,7
1 000	34,8
2 000	29,2
4 000	32,0
8 000	34,0
D_{S,A}	33,3

Key

f 1/1-octave frequency band
D level reduction
D_{S,A} speech level reduction

Classification of enclosures according to speech level reduction, D_{S,A}

A+

Annex 1 to Report No. 040-074061

