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Technical and Test Institute for Construction Prague
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Central Laboratory – Teplice Testing Laboratory
Testing facility address: Tolstého 447, 415 03 Teplice
tel.: +420 602 115 450, e-mail rubas@tzus.cz, www.tzus.eu
L 1018.3

Testing Laboratory No. 1018.3
accredited by the Czech Accreditation Institute in accordance with ČSN EN ISO/IEC 17025:2018

TEST PROTOCOL

No. 040-067119

- Measurement of speech level reduction in micro-offices according to ISO 23351-1: 2020

Customer:	HON, a.s.
Address:	Srbská 347/2, Dejvice, 160 00 Prague 6
Company ID:	47682523
Manufacturer:	HON, a.s.
Address:	Srbská 347/2, Dejvice, 160 00 Prague 6
Test specimen:	Telephone box CUBE CALL
Order:	Z040210085

Number of test report pages including the cover page: 5 Annexes/pages:2/4

Prepared by:

Ing. Pavel Rubáš, Ph.D.
Test Engineer – Specialist

Approved by:

TECHNICKÝ A ZKUŠEBNÍ ÚSTAV STAVEBNÍ PRAHA, s.p. Akreditovaná zkušební laboratoř č. 1018.3 ZÚS Zkušebna Teplice Centrální laboratoř

Ing. Pavel Bartoš
Deputy Head of the testing laboratory

Copy No.: 2
Number of copies: 3

Teplice, 07 April 2021

Testing laboratory stamp No. 1018.3

Declaration: **1)** The test results presented in this report only relate to the tested object and do not replace any other documents.
2) This report may not be reproduced in any form other than in its entirety without the written consent of the testing laboratory.
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:	VZ040210516
Sample:	Telephone box CUBE CALL, see Annex No. 2
Order:	dated 24/02/2021
Delivery date:	11/03/2021
Sampling site:	The sample was delivered by the client to the Teplice testing laboratory
Sampling method:	Samples were taken by employees of TZÚS Praha, s. p. – Teplice branch from the delivered package.
Sample preparation method:	Acoustics – Measurement of speech level reduction of furniture ensembles and enclosures – Part 1: Laboratory method The telephone box was delivered by the manufacturer. The sample was visually inspected upon acceptance in accordance with the submitted specification. The sample composition was found to correspond to the submitted description. Data on sample composition were taken from the specification provided by the manufacturer. The sample size, weight and other parameters are for information, inspection and documentation purposes only. The sample was tempered in the laboratory for 24 hours at 25°C. Assembly and installation of the sample was performed by employees of HON, a. S.

The test results apply to the sample as received.

2. Testing methods

Identification of the testing method		Name of the testing 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 in micro-offices

Supplementation, deviations or exclusions from the standard procedure or application of non-standard methods: not applied

Other relevant standards:

ČSN EN ISO 3741:2011	00000Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms

3. Test results

Tests performed on:	16 March 2021
Testing location:	Reverberation room TZUS Prague, s.p., Teplice branch
Tests performed by:	Ing. Pavel Rubáš, Ph.D. (Test Engineer – Specialist) Bc. Marie Hartlichová (Test Engineer)

The details of the testing conditions and of the testing equipment used are given in the test records. The instrumentation and gauges are validated and calibrated as specified in the Teplice Testing Laboratory validation/calibration schedule.

3.2 Data declared by manufacturer

See Annex No. 2

3.3 Technical description of the test

The measurement took place in the laboratory reverberation room of building acoustics TZUS s.p. in Teplice.

The reduction in speech level was measured according to ISO 23351-1:2020. The standard describes a laboratory method to compare different types of furniture configurations and boxes with regard to their ability to reduce the speech level of the user speaking inside the product (box). According to this standard, the sound power level is measured in two configurations: 1) without box and 2) with box. During configuration 1), the test sound signal is generated by a sound source in an empty room, with the box outside the reverberation room. During configuration 2), the test sound signal is generated by a sound source inside the box in the user's position. Reduction in speech level is the difference between sound power levels measured in two configurations in octave frequency bands from 125 Hz to 8,000 Hz. The reduction in speech level is a single-digit value that expresses the corresponding reduction in the sound power level weighted by filter A (human ear) in the entire frequency range from 125 Hz to 8,000 Hz. The standardised method is applicable to closed boxes and to open furniture assemblies used by one or more users. According to ISO 23351-1:2020, a method that uses the equivalent absorption area of the reverberation test room was used. This method is called the direct method.

The sound power level of the tested sound source in each one-third octave band under reference meteorological conditions is calculated according to the following formula:

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

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 of the reverberation test room, in square metres;

c is speed of sound, in metres per second, at air temperature in reverberation test room

θ, in degrees of 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
reference values used for sound pressure level and level
of acoustic power and it is a function of the characteristic air impedance
under reference conditions at the time and place of measurement:

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

C_2 is correction for radiating impedance, in decibels, which is the correction that converts

the current acoustic performance under meteorological conditions at the time and place of measurement into

acoustic performance at reference meteorological conditions; the value shall be obtained from the relevant test method, but if there is no test code for

sound available, the following equation is valid for a monopole source and it is the mean value for other resources,

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

where

p_s is the static pressure in the test room at the time of the test, in kilopascals;
$p_{s,0}$ 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 achieved by the test box is determined as

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

where

$L_{W,P,1,i}$ is the sound power level in decibels radiated from the reference box when measured in a configuration without a sample;
$L_{W,P,2,i}$ is the sound power level in decibels radiated from the reference box when measured in a configuration with a 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 standardised speech sound power level, $L_{W,S,1}$ in line with Table 1. In this case, the sound power level radiated by the test specimen $L_{W,S,2,i}$ (box), is determined by the formula:

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

Table 1 Unweighted levels of acoustic performance of gender-unspecified 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) emitted by the measured sample (box) in the range 125 Hz to 8,000 Hz is determined according to:

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

where

A_i are weights of filter A individual for octave bands

The reduction in speech level is determined by

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

where $L_{W,S,A,1}$ = 68.4 dB is the acoustic power of human speech weighed by filter A (human ear) in the range

from 125 Hz to 8,000 Hz.

3.4 Instruments and gauges used

Norsonic type 118 – Integration sound-level meter of accuracy 1 complying with EC 60651, 60804, 61672-1, and 61260, primary memory for 2,500,000 pieces of data. Serial number 31991, 8012-OL-10112-20, valid till: 08/03/2022

Microphone Norsonic type 1225 and pre-amp type 1205, serial No. 72839, test sheet No. test sheet: 8012-OL-10113-20, valid till: 08/03/2022

Norsonic acoustic calibrator, type 1251, serial No.: 31612. This meter complies with the requirements of IEC 942, 8012-KL-10116-20, valid till: 08/03/2022

Combined thermometer, moisture meter and barometer Testo 622, serial No. 39507662/506, registration No. 431, Calibration data sheets: temperature No. 2021/0366 valid till 21 January 2026, relative humidity No. 2021/0365 valid till 21 January 2026, atmospheric pressure No. 0243/2021 valid till 21 January 2026

Sound field excitation set, Norsonic hemisphere, type 250 (120 dB)

Laser distance meter BOSCH DLE 40 Professional e. No. 310

Measuring tape No. 478

3.5. Measurement of speech level reduction in micro-offices according to ISO 23351-1:2020, test method in scope of accreditation

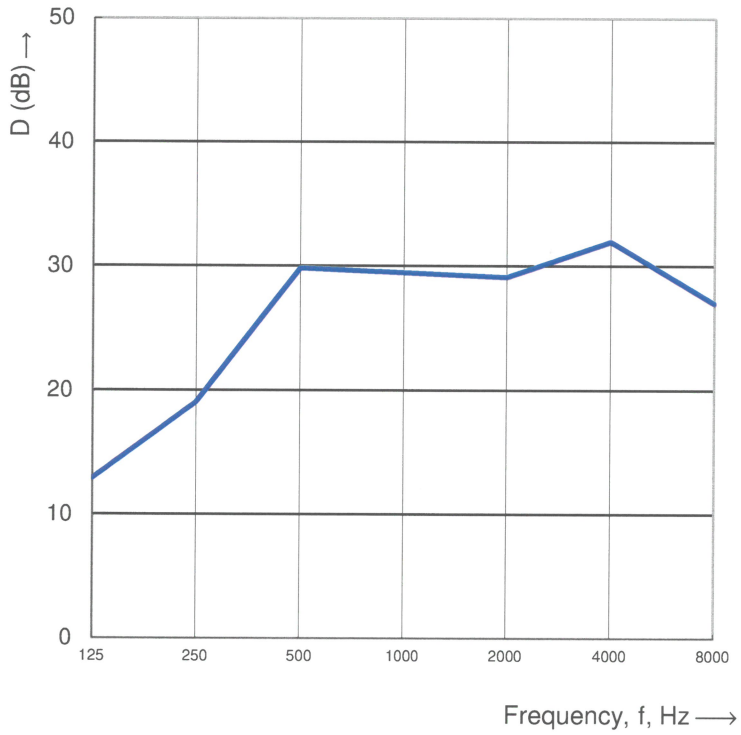
Sample number and description of the sample / Property	Units	Determined value	
		$D_{S,A}$ / Categories according to Annex D	Widespread measurement uncertainty
VZ040210516 Telephone box CUBE CALL Detailed description is available in Annex No. 2 Speech level reduction achieved by the box	dB	**30.7** / **A**	± 2

The extended measurement uncertainty mentioned is a product of the standard measurement uncertainty and the coefficient of extension k = 2, which corresponds to the coverage probability of approx. 95% for normal distribution. The expanded measurement uncertainty was determined pursuant to ČSN EN ISO 12999-1:2015.

END OF PROTOCOL

Determination of speech level reduction according to ISO 23351-1

Product:	VZ040210516
Operating conditions:	common
Manufacturer:	HON, a.s. Srbská 347/2, Dejvice, 160 00 Prague 6
Test laboratory:	LASA Teplice
Name of the operator:	Ing. Pavel Rubáš, Ph.D.
Test date:	16.03.2021



Frequency	Speech level reduction
f **Hz**	D **dB**
125	13,0
250	19,1
500	29,8
1 000	29,5
2 000	29,1
4 000	32,0
8 000	27,0
$D_{S,A}$	**30,7**

Key

f 1/1-octave frequency band
D level reduction
DS,A speech level reduction

Appendix No. 1 to Report No. 040-067119

Classification of enclosures according to speech level reduction, DS,A **A**