SLOVENSKI STANDARD
SIST EN 17285:2020

01-oktober-2020

Železniške naprave - Akustika - Merjenje zvočnih opozoril pri vratih

Railway applications - Acoustics - Measuring of door audible warnings

Bahnanwendung - Akustik - Messung akustischer Türsignale von Eisenbahnfahrzeugen

Application ferroviaires - Acoustique - Mesurage des signaux audibles d'avertissement des portes

Ta slovenski standard je istoveten z: **EN 17285:2020**

ICS:

17.140.30	Emisija hrupa transportnih sredstev	Noise emitted by means of transport
45.060.20	Železniški vagoni	Trailing stock

SIST EN 17285:2020 **en,fr,de**

EUROPEAN STANDARD

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English Version

Railway applications - Acoustics - Measuring of door audible warnings

Application ferroviaires - Acoustique - Mesurage des signaux audibles d'avertissement des portes

Bahnanwendung - Akustik - Messung akustischer Türsignale von Eisenbahnfahrzeugen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 17285:2020) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2021, and conflicting national standards shall be withdrawn at the latest by February 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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1 Scope

This document specifies procedures to assess acoustic signals at passenger external doors applying to all kind of rolling stock. The following applies to this standard:

— this document refers to acoustical passenger information indicating the release, opening and closing of passenger doors;

— this document is applicable to tonal signals with defined frequency components levels and pulse sequences;

— this document is not applicable to spoken information or to signals comprising a sequence of impulses (such as a door finding signal).

NOTE Acoustic door signals are defined in EN 16584-2 “Design for PRM use”.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN IEC 60942, *Electroacoustics — Sound calibrators*

EN 61260 (series), *Electroacoustics — Octave-band and fractional-octave-band filters*

EN 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

EN 61672-2, *Electroacoustics — Sound level meters — Part 2: Pattern evaluation tests*

ISO 266, *Acoustics — Preferred frequencies*

ISO 1996-2:2017, *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp/ui

4 Symbols and abbreviations

RMS sum	The sum of the root mean squares of sound pressures $RMS\ sum = 10\lg\left(10^{L_{p1}/10} + 10^{L_{p2}/10} + .. + 10^{L_{pi}/10}\right)$ dB Where L_{p1}, L_{p2}, ... L_{pi} are a set of sound pressure levels
RMS average	average of the root mean square of sound pressures $RMS\ average = 10\lg\left(\frac{10^{L_{p1}/10} + 10^{Lp2/10} + .. + 10^{LpN/10}}{N}\right)$ dB Where $L_{p1}, L_{p2}\ ..L_{pN}$ are a set of sound pressure levels

5 Instrumentation and calibration

5.1 Instrumentation

Each component of the instrumentation system shall meet the requirements for a class 1 instrument specified in EN 61672-1.

The sound calibrator shall meet the requirements of class 1 according to EN IEC 60942.

Microphones with free-field characteristics shall be used. A suitable microphone windscreen may be used.

Where one-third octave frequency band analysis is required, the filters shall meet the requirements of class 1, according to EN 61260.

The compliance of the calibrator with the requirements of EN IEC 60942 shall be verified at least once a year. The compliance of the instrumentation system with the requirements of EN 61672-1 and EN 61672-2 shall be verified at least every 2 years. The date of the last verification of the compliance with the relevant European Standards shall be recorded.

5.2 Calibration

Before and after each series of measurements a sound calibrator meeting the requirements of class 1 according to EN IEC 60942 shall be applied to the microphone(s) for verifying the calibration of the entire measuring system at one or more frequencies over the frequency range of interest. If the difference between the two calibrations is more than 0,5 dB all the measurement results in between shall be rejected.

6 Interior tests

6.1 Enumeration of vestibule types

All the vestibules of a vehicle shall be classified into a number of vestibule types. The list of vestibule types is to be determined before measurements take place. For this purpose, the wavelength of sound in air at the lowest primary tone of the audible warning signal, λ_c, shall be calculated.

To make the list, vestibule types shall be distinguished on the basis of any one, or combination of, the following features.

a) Vestibules with single-panel or double-panel exterior doors are different types.

b) Regarding any solid wall, panel or partition adjacent to the body-side entrance doors that form the vestibule area, their acoustic effect as 'barriers' (influencing the sound propagation) shall be considered.

   — A vestibule may have barriers or partial barriers on either side. Such a barrier is only considered if it is immediately adjacent to the body-side door(s).

   — A partial barrier is distinct from a full barrier if there is an opening in it for passenger access (aisle).

   — Two panels either side of an aisle shall be considered to constitute one partial barrier.

   — Any internal door shall be considered closed.

   — Any panel or wall not extending further than λc from the interior side walls surface in the main passenger accommodation area of the vehicle shall not be considered.

   — Any panel or wall extending no higher than the 1,2m shall not be considered.

   A vestibule type can therefore have 0, 1 or 2 barriers, each of which can be full or partial. No other property of the barrier than 'full' or 'partial' shall be considered.

c) A difference in the mounting of the sounder to the vehicle structure will cause a change in the point mechanical impedance of the structure. Such a difference might be between a mounting mid-panel or close to any structural component that would act as a stiffener.

d) The sounder location changes according to the following criteria.

   The height above the floor changes by more than 30 cm,

   The sounder location lies within or outside a distance of $\lambda_c/4$ from a junction of floor, ceiling or panel surfaces. There are two separate cases of such a junction,

   — it is mounted close to two surfaces or,

   — it is mounted close to three surfaces.

No other criteria shall be used as they affect the sound pressure level less significantly.

A difference between vestibules in any of these features shall cause a new vestibule type to be added to the list of types.

6.2 Environmental conditions

The door opening of the vehicle shall be at least 5 m away from reflecting walls or roof of any building. There are no requirements on the external ground conditions or ground height.

Care shall be taken to ensure that noise from other sources, e.g. other vehicles or industrial plants and due to external wind, does not influence the measurements significantly.

For fixed-level sounders, the background noise level $L_{pAeq,T}$ measured over T = 20 s of each measurement position shall be at least 10 dB below the level of the warning signal (L_{pAF}, L_{pAFmax} and, possibly, $L_{pAeq,T}$, see 6.4).

For adaptive-level sounders, the effective background noise is controlled under the measurement procedure itself – see Annex B.

6.3 Vehicle conditions

The unit shall be at standstill.

Surfaces shall present their normal operational acoustic properties.

As long as the background noise level requirement in 6.2 is fulfilled, any operational condition of auxiliary equipment shall be accepted.

6.4 Measured quantities

The measured acoustic quantities are L_{pAF}, L_{pAFmax} and, if required, $L_{pAeq,T}$, with T as time of the sounder event duration. For the assessment of tones, narrow band frequency analysis shall be applied.

NOTE Such a requirement is generally specified by legislation or contract.

6.5 Measurement procedure

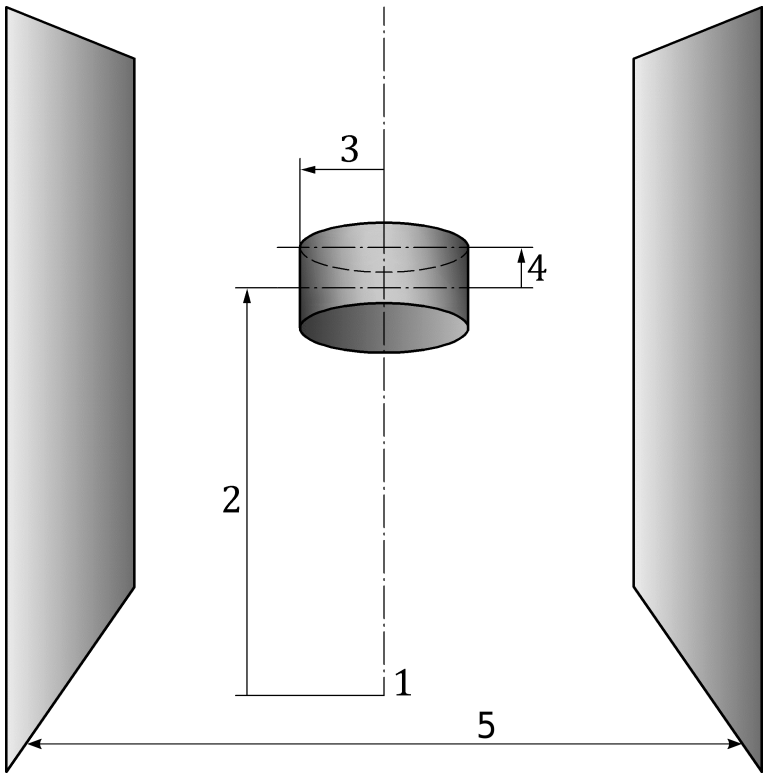
6.5.1 General

Separate procedures are defined below for measuring: the sound pressure level of the signal in the vehicle, the duration of the signal, the pulse rate and the frequency content. The first of these procedures, described in 6.5.3, shall be carried out *in situ* in the vehicle. The pulse rate (6.5.4) and frequency content (6.5.5) may alternatively be determined from measurements made of the door sounder component separately under prescribed laboratory conditions – see Annex C.

6.5.2 Measurement positions for measurements in the vehicle

For the interior tests two alternative microphone arrangements are allowed.

Arrangement 1 (preferred): A single microphone shall be located so as to maximize the measured sound pressure level within the volume defined at the height of 1,5 m (±0,1 m) above the vehicle floor and anywhere within a lateral distance of 0,25 m from a point on the mid-plane of the vestibule normal to the centre-line of the door opening. That is, within the cylindrical volume indicated in Figure 1.



Key

1 mid way between the doors
2 height: 1,5 m
3 lateral distance: 0,25 m
4 range: ± 0,1 m
5 door openings

Figure 1 — Arrangement 1 with one microphone

Arrangement 2: Eight microphones shall be equally distributed in a circle of radius 0,25 m about a point 1,5 m in height above the vehicle floor and opposite the centre of the door opening and in the vertical mid-plane of the vehicle. Measurements shall be made (1) for the circle in the horizontal orientation and (2) for the circle in any vertical orientation.

6.5.3 Sound pressure level measurement and duration of the signal

For fixed level sounders, the whole of the following procedure shall be followed. For adaptive level sounders the procedure shall be used only to measure the timing, pulse-rates and frequencies.

In a case of an adaptive level device, a measurement shall be carried out to ensure that the sounder level is adapted to the ambient noise level. The measuring procedure for adaptive door sound devices is described in Annex B.

For at least one measurement position the time history of L_{pAF} shall be produced for the whole door opening signal and for the whole door closing signal. This shall be used to determine the timing and duration of this time history in relation to the time at which the door operation was initiated.

For all measurement positions the following shall be produced while the door is stationary (fully open, fully closed). The noise of the operation of the door itself is thereby omitted from the following results:

a) L_{pAFmax} for the door opening signal taken from the part of the signal with the door closed;

b) L_{pAFmax} for the door closing signal taken from the part of the signal with the door open;

c) If required, the $L_{pAeq,T}$ shall also be evaluated, where T is 5 pulses of the signal taken from the part of the signal with the door closed.

NOTE Such a requirement is generally specified by legislation or contract.

For microphone arrangement 2, the results of a), b) and c) shall be the RMS average over all the microphone positions.

The results of a), b) and c) shall be used as the result for the measurement over the total duration of the sound event. This method excludes contamination by noise generated by the door mechanism.

The requirements can involve testing the door for each of the cases in which the door is actuated and not actuated.

6.5.4 Pulse rate measurement

This test may be performed on sound pressure measurements made on the door sounder component in a suitable environment other than the vehicle (see Annex C).

To count the number of pulses per second a visual representation of the pulsing of the sounder noise shall be produced.

NOTE A time history plot of $L_{pAeq,T}$ where T is 10 ms will present a clear pulse up to 10 pulses per second. A plot of L_{AF} will not. Alternatively, a spectrogram with a sufficient time resolution can be produced by many software packages. This has been found to provide a clear representation of pulse count.

6.5.5 Frequency properties of the signal

This test may be performed on sound pressure measurements made on the door sounder component in a suitable environment other than the vehicle (see Annex C).

To determine the frequency of tones within the signal a narrow band power spectrum shall be produced that has a resolution of up to 20 Hz.

NOTE The frequency can also be found in a spectrogram produced for the purpose of pulse rate estimation in 6.5.4.

6.5.6 Tonal prominence assessment

If required, an assessment of the relative audibility of different tones shall be carried out as described in Annex A.

NOTE Such a requirement is generally specified by legislation or contract.