SLOVENSKI STANDARD
SIST EN 16286-2:2024

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Železniške naprave - Prehodni sistemi med vozili - 2. del: Meritve akustike

Railway applications - Gangway systems between vehicles - Part 2: Acoustic measurements

Bahnanwendungen - Übergangssysteme zwischen Fahrzeugen - Teil 2: Messung der Akustik

Applications ferroviaires - Système d'intercirculations entre véhicules - Partie 2: Mesures acoustiques

Ta slovenski standard je istoveten z: **EN 16286-2:2023**

ICS:

17.140.30	Emisija hrupa transportnih sredstev	Noise emitted by means of transport
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

SIST EN 16286-2:2024 **en,fr,de**

EUROPEAN STANDARD

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English Version

Railway applications - Gangway systems between vehicles - Part 2: Acoustic measurements

Applications ferroviaires - Système d'intercirculations entre véhicules - Partie 2: Mesures acoustiques

Bahnanwendungen - Übergangssysteme zwischen Fahrzeugen - Teil 2: Messung der Akustik

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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

Contents

Page

European foreword

This document (EN 16286-2:2023) 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of an identical text or by endorsement, at the latest by May 2024, and conflicting national standards shall be withdrawn at the latest by May 2024.

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.

This document supersedes EN 16286-2:2013.

In comparison with the previous edition, the following technical modifications have been made:

a) normative references have been updated;

b) terms and definitions have been revised;

c) requirements on measurement setup (now “test setup”) have been revised;

d) requirements on test procedure have been revised;

e) requirements on measurement tolerances (now “measurement uncertainties”) have been revised;

f) requirements on test report have been revised;

g) Annex A has been revised.

The EN 16286 series of European Standards, *Railway applications — Gangway systems between vehicles*, consists of the following parts:

— *Part 1: Main applications*;

— *Part 2: Acoustic measurements*.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

This document presents a measurement method to collect information about the noise insulation of rail bound vehicle gangway systems. These components need their own measurement procedure as the geometrical sound distribution situation is not in line with the basic assumptions of general standards about noise insulation measurements as provided for building elements, etc.

In this document, a number of different setups are described, which represent possible approaches to the ideal test situation. As the approaches can contradict the ideal sound fields, the document includes methods to assess the influence of reflections and other difficulties in order to reduce the uncertainties of these test methods to an acceptable amount in Annex A.

1 Scope

This document specifies a measurement method and conditions to obtain reproducible and comparable sound reduction indices of all kinds of rail bound vehicles' gangway systems as specified in EN 16286-1. The setup includes all components of the system mounted like this is done between two adjacent car bodies within the train, so that a person will be able to use the gangway system, consisting of e.g.:

— the bridge system (footplate);

— side panels;

— flexible components (bellows);

— mounting systems;

— elements to couple parts in the case of separable gangway systems.

The method is applicable to type testing of gangways.

This method is not applicable to:

— interior noise measurements in vehicles;

— structure borne noise measurements.

The type testing procedures specified in this document are of engineering grade (grade 2) in the frequency range from 100 Hz up to 5 000 Hz.

NOTE This is the preferred range for noise declaration purposes, as specified in EN ISO 12001. If test conditions are relaxed, the results are no longer of engineering grade (grade 2).

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

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

EN IEC 60942, *Electroacoustics - Sound calibrators*

EN ISO 266, *Acoustics - Preferred frequencies (ISO 266)*

EN ISO 3741, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms (ISO 3741)*

EN ISO 9614-1:2009, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points (ISO 9614-1:1993)*

EN ISO 10140 (all parts), *Acoustics - Laboratory measurement of sound insulation of building elements*

EN ISO 12999-1, *Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 1: Sound insulation (ISO 12999-1)*

EN ISO 15186-1, *Acoustics - Measurement of sound insulation in buildings and of building elements using sound intensity - Part 1: Laboratory measurements (ISO 15186-1)*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
sound pressure
p
root mean square (RMS) value of a fluctuating pressure superimposed on the static atmospheric pressure measured over a certain time period

3.1.2
sound pressure level
L_p
level given by the formula:

$$L_p = 10 \lg \left(\frac{p}{p_0}\right)^2 \quad (1)$$

3.1.3
average sound pressure level in the source room with the uncovered gangway
L_{p1}
ten times the logarithm to the base 10 of the ratio of the space and time average of the sound pressure squared to the square of the reference sound pressure, the space average being taken over the entire room with the exception of those parts where the direct radiation of a sound source or the near field of the boundaries (wall, window, etc.) is of significant influence

Note 1 to entry: For a complete definition, see EN ISO 10140-2.

Note 2 to entry: L_{p1} is used for determination of the sound reduction index.

3.1.4
average sound pressure level in the source room with the covered gangway
L_{p1}^*
ten times the logarithm to the base 10 of the ratio of the space and time average of the sound pressure squared to the square of the reference sound pressure, the space average being taken over the entire room with the exception of those parts where the direct radiation of a sound source or the near field of the boundaries (wall, window, etc.) is of significant influence

Note 1 to entry: L_{p1}^* is used for qualification of the sound field according to Annex A.

3.1.5
sound reduction index
R
ten times the logarithm to the base 10 of the ratio of the sound power W_1 incident on the test specimen to the sound power W_2 transmitted through the specimen

$$R = 10 \lg \frac{W_1}{W_2} \tag{2}$$

Note 1 to entry: The expression “sound transmission loss” is also in use.

3.1.6
sound intensity
I
time-averaged rate of flow of sound energy per unit area oriented normal to the local particle velocity which is a vectorial quantity equal to

$$\vec{I} = \frac{1}{T}\int_0^T p(t) \cdot \vec{u}(t)\,\mathrm{d}t \tag{3}$$

3.1.7
normal sound intensity
I_n
component of the sound intensity in the direction normal to a measurement surface defined by the unit normal vector $\vec{n}$:

$$I_\mathrm{n} = \vec{I} \cdot \vec{n} \tag{4}$$

3.1.8
normal sound intensity level
L_In
ten times the logarithm to the base 10 of the ratio of the unsigned value of the normal sound intensity to the reference intensity I_0, as given by

$$L_\mathrm{In} = 10 \lg \frac{I_\mathrm{n}}{I_0} \tag{5}$$

where

$$I_0 = 10^{-12}\,W/\mathrm{m}^2 \tag{6}$$

3.1.9
surface pressure-intensity indicator
F_pI
difference between the sound pressure level L_p and the normal sound intensity level L_In on the measurement surface, both being time and surface averaged:

$$F_\mathrm{pI} = L_\mathrm{p} - L_\mathrm{In} \tag{7}$$

Note 1 to entry: This general notation is in accordance with EN ISO 9614-2. In EN ISO 9614-1, the notation F_2 is used.

$$F_\mathrm{pI} = 10 \lg \left[\frac{1}{S_\mathrm{m}} \sum_c S_{\mathrm{m}c}\, 10^{0{,}1\,L_{\mathrm{p}c}}\right] - L_\mathrm{In} \tag{8}$$

Note 2 to entry: Formula (8) is used for the purpose of this document; see 6.4.7.

3.1.10
pressure-residual intensity index
δ_{pI0}
difference between the indicated sound pressure level L_p and the indicated sound intensity level L_I when the intensity probe is placed and oriented in a sound field such that the sound intensity is zero

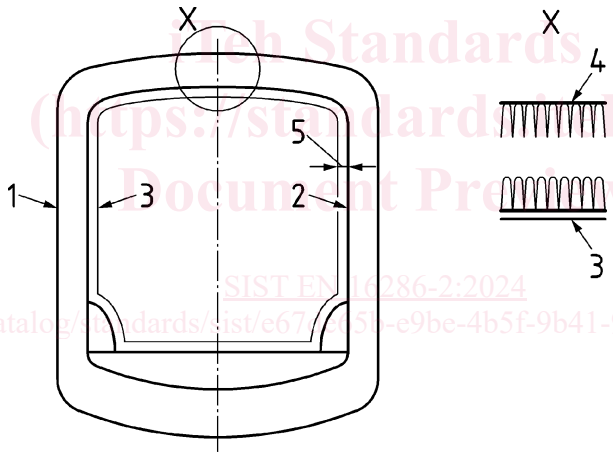
Note 1 to entry: Details for determining δ_{pI0} are given in EN 61043:

$$\delta_{pI0} = \left(L_p - L_I\right)$$

3.1.11
source side area of the test specimen
S
contour area of the test specimen at the source side

Note 1 to entry: See Figure 1 and Figure 2.

3.1.12
measurement surface
S_m
surface in parallel to the gangway contour totally enclosing the test specimen on the receiving side, scanned or sampled by the probe during the measurements



Key
1 gangway surface at source side
2 gangway surface at receiving side
3 measurement surface S_m
4 contour area of the test specimen at the source side S
5 distance d between contour area of the receiving side and the measurement surface S_m

Figure 1 — Measurement surface S_m for intensity measurements inside the gangway and contour area of the outer source side S