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SWEDISH STANDARDS INSTITUTE

Järnvägar – Gångvägar mellan fordon – Del 2: Akustiska mätningar

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

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Denna standard är framtagen av kommittén för Järnvägar, SIS/TK 254.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16286-2

March 2013

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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

This European Standard was approved by CEN on 16 February 2013.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 16286-2:2013) 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of an identical text or by endorsement, at the latest by September 2013, and conflicting national standards shall be withdrawn at the latest by September 2013.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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

— *Part 1: Main applications*

— *Part 2: Acoustic measurements*

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

Introduction

This European Standard 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 standard, a number of different setups are described, which represent possible approaches to the ideal test situation. As the approaches may contradict the ideal sound fields, the standard 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 European Standard specifies a measurement method and conditions to obtain reproducible and comparable sound reduction indices of all kinds of rail bound vehicles' gangway systems defined in EN 16286-1. The setup should include 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 case of separable gangway systems.

If separable gangway systems shall be measured, the whole system between two adjacent car bodies should be used.

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 European Standard are of engineering grade (grade 2) in the frequency range from 100 Hz up to 5 kHz; that is the preferred range for noise declaration purposes, as defined in EN ISO 12001. If test conditions are relaxed, the results are no longer of engineering grade.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ENV 13005, *Guide to the expression of uncertainty in measurement*

EN 60942, *Electroacoustics — Sound calibrators (IEC 60942)*

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

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

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 10140-2, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation (ISO 10140-2)*

EN ISO 10140-4:2010, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 4: Measurement procedures and requirements (ISO 10140-4:2010)*

EN ISO 10140-5, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment (ISO 10140-5)*

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 and definitions

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

3.1
sound pressure
p
root mean square (RMS) value of a fluctuating pressure superimposed on the static atmospheric pressure measured over a certain time period, expressed in Pa

3.2
sound pressure level
L_p
level given by the formula:

$$L_p = 10 \log (p/p_0)^2 \text{ dB} \quad (1)$$

where

L_p is the sound pressure level in dB;

p is the RMS sound pressure in Pa;

p_0 the reference sound pressure; p_0 = 20 μPa

Note 1 to entry Adapted from ISO 1996-1.

3.3
average sound pressure level in a source room
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 This quantity is given in decibels.

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

3.4
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:

$$R = 10 \log \left(\frac{W_1}{W_2} \right) \text{dB} \quad (2)$$

Note 1 to entry The expression "sound transmission loss" is also in use.

3.5
sound intensity
I
time-averaged rate of flow of sound energy per unit area oriented normal to the local particle velocity; this is a vectorial quantity which is equal to:

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

where

$p(t)$ is the instantaneous sound pressure at a point, in Pascals;

$\vec{u}(t)$ is the instantaneous particle velocity at the same point, in meters per second;

T is the averaging time, in seconds

Note 1 to entry Sound intensity is measured in watts per square meter.

3.6
normal sound intensity
I_n
component of the sound intensity in the direction normal to a measurement surface defined by the unit normal vector $\vec{n}$:

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

where

$\vec{n}$ is the unit normal vector directed out of the volume enclosed by the measurement surface

3.7
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:

$$L_\mathrm{In} = 10 \log \frac{I_\mathrm{n}}{I_0} \text{ dB} \tag{5}$$

where

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

3.8
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:

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