SLOVENSKI STANDARD
SIST EN 15153-2:2014

01-marec-2014

Nadomešča:
SIST EN 15153-2:2007

Železniške naprave - Zunanje vidne in zvočne opozorilne naprave za vlake - 2. del: Opozorilne sirene

Railway applications - External visible and audible warning devices for trains - Part 2: Warning horns

Bahnanwendungen - Optische und akustische Warneinrichtungen für Schienenfahrzeuge - Teil 2: Signalhörner

Applications ferroviaires - Dispositifs d'avertissement optiques et acoustiques pour les trains - Partie 2: Avertisseurs sonores

Ta slovenski standard je istoveten z: **EN 15153-2:2013**

ICS:

03.220.30	Železniški transport	Transport by rail
93.100	Gradnja železnic	Construction of railways

SIST EN 15153-2:2014 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15153-2

January 2013

ICS 45.060.10

Supersedes EN 15153-2:2007

English Version

Railway applications - External visible and audible warning devices for trains - Part 2: Warning horns

Applications ferroviaires - Dispositifs externes d'avertissement optiques et acoustiques pour les trains - Partie 2: Avertisseurs sonores

Bahnanwendungen - Optische und akustische Warneinrichtungen für Schienenfahrzeuge - Teil 2: Signalhörner

This European Standard was approved by CEN on 10 November 2012.

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Foreword

This document (EN 15153-2:2013) 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of an identical text or by endorsement, at the latest by July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.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 supersedes EN 15153-2:2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

The main changes with respect to the previous edition are:

— technical requirements have been brought in line with the conventional TSIs;

— UIC frequencies (660 Hz; 370 Hz) have been included;

— clarification of the measurement height for the sound pressure level requirement.

This series of documents *Railway applications — External visible and audible warning devices for trains* consists of the following parts:

— *Part 1: Head, marker and tail lamps;*

— *Part 2: Warning horns.*

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, 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 was produced following a review of EN 15153-2:2007 to incorporate the requirements of rolling stock TSIs.

1 Scope

This European standard defines warning horn requirements which deliver the required audibility of approaching trains, including high speed and conventional rail and excluding road, metro and self-contained systems. For this purpose, the following requirements are included:

— functional and technical requirements of the warning horn as a component,

— functional and technical requirements of the integration of warning horns into the vehicle, and

— test requirements.

Operational requirements for warning horns have been excluded.

NOTE The requirements for the control of warning horns can be found in prEN 16186-1.

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.

prEN 16186-1, *Railway applications — Driver's Cab — Part 1: Visibility, layout, access*

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

3 Terms and definitions

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

3.1
warning horn
device or assembly capable of producing the specified audible warning tones

3.2
vehicle front
leading edge of the train in its operational condition

Note 1 to entry: This would be the extreme front edge of any of the following - couplers, buffers, structures and vehicle profile.

3.3
C-weighted sound pressure level
$L_{pCeq,T}$
sound pressure level obtained using the frequency weighting C, given by the following formula:

$$L_{pCeq,T} = 10\lg\left(\frac{1}{T}\int_0^T \frac{p_C^2(t)}{p_0^2}\,dt\right)$$

where

$L_{pCeq,T}$ is the C-weighted equivalent continuous sound pressure level, in dB;

$p_C(t)$ is the C-weighted instantaneous sound pressure, in Pa

T is the measurement time interval, in s;

p_0 is the reference sound pressure in Pa ; $p_0 = 2 \times 10^{-5}$ Pa

3.4
contractors
organisations responsible for:

— the design, manufacture or supply of the warning horn, and

— the purchase, installation or use of the warning horn

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

HS RST TSI Technical Specification for Interoperability relating to the rolling stock subsystem of the trans-European high-speed rail system

CR RST TSI Technical Specification for Interoperability relating to the rolling stock subsystem of the trans-European conventional rail system

5 Requirements

5.1 General

Trains shall be fitted with one or more warning horns on the leading vehicle.

All locomotives shall be fitted with warning horn(s) for each direction of travel.

Consideration shall be given to the location of the warning horns, taking into account the possible exposure of staff to excessive noise.

NOTE The aim is to control the risk of accidental hearing damage when a horn is sounded at a time when a person is working close to the horn.

In order to minimise environmental impact, warning horns should be orientated along the longitudinal axis of the vehicle.

It is permissible for trains to be fitted with additional audible warning devices.

5.2 Acoustic requirements

5.2.1 Frequency

The notes of the audible warning horns are intended to be recognisable as being from a train and not be similar to warning devices used in road transport, factories or other common warning devices. The warning horn frequencies shall be selected from the following options:

a) Two separately sounded warning horns. The fundamental frequencies of the warning horn notes shall be:

high note: 370 Hz ± 20 Hz

low note: 311 Hz ± 20 Hz

b) Two separately sounded warning horns. The fundamental frequencies of the warning horn notes shall be:

high note: 660 Hz ± 30 Hz

low note: 370 Hz ± 20 Hz

It is permissible for these horns to be sounded simultaneously.

c) Two warning horns sounded simultaneously. The fundamental frequencies of the notes shall be:

high note: 470 Hz ± 25 Hz

low note: 370 Hz ± 20 Hz

d) Three warning horns sounded simultaneously. The fundamental frequencies of the notes shall be:

high note: 622 Hz ± 30 Hz

middle note: 470 Hz ± 25 Hz

low note: 370 Hz ± 20 Hz

Where a second sound is required for cases c) and d), this shall be a separately sounded note of 370 Hz ± 20 Hz.

In the case of trains intended for national use only, the deviation in Annex D is permissible.

5.2.2 Sound pressure level

The C-weighted sound pressure level $L_{pCeq,T}$ produced by each horn sounded separately (or in a group if designed to sound simultaneously) shall be between 101 dB and 109 dB when measured and verified in accordance with the requirements defined in Clause 6.

In the case of trains intended for national use only, the requirements of Annex D may apply.

5.3 Operation

The controls for warning horns shall be in accordance with prEN 16186-1.

5.4 Energy supply

Warning horns shall be operated using an energy source that is readily available on the vehicle carrying the horn. The horn shall meet the technical requirements of this European Standard over the full range of energy levels encountered on the vehicle in its normal operational condition. Where agreed between contractors, the horn shall be operational over an extended range of energy levels.

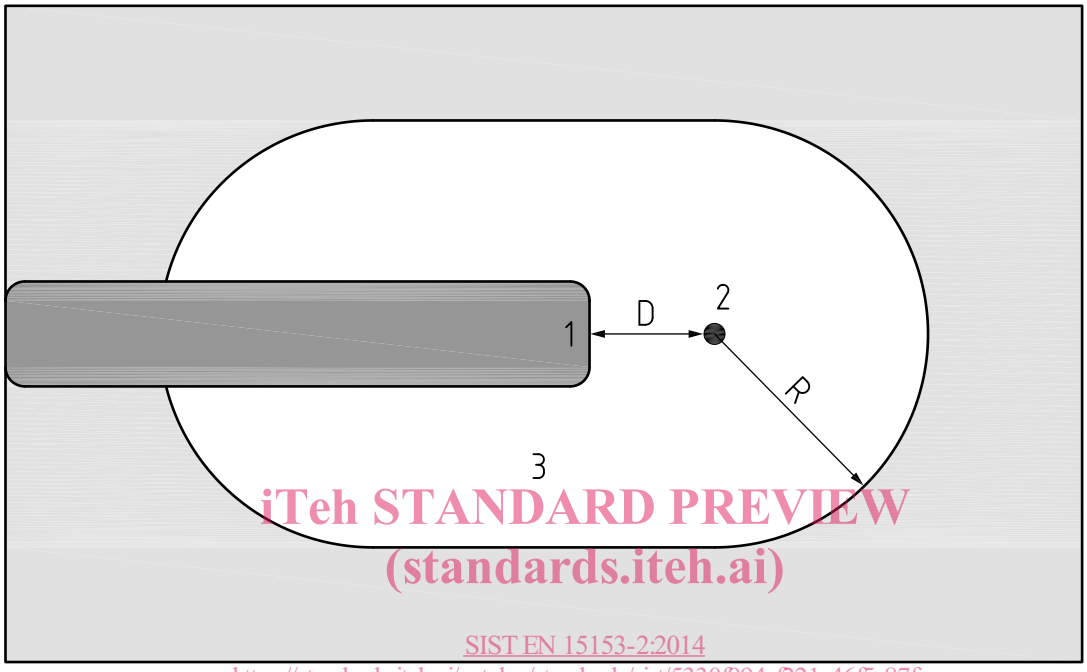
5.5 Impact protection

Warning horns and their control systems should be protected, so far as it is practicable, from impact and subsequent blockage by airborne objects such as debris, dust, snow, hail and birds. Where such protection features are used, the acoustic requirements shall apply with any protection features in place.

6 Test requirements

6.1 Environmental test conditions

Where tests on the train are conducted, acoustic measurements of warning horns shall be carried out with the horns mounted to rail vehicles in an open, flat site, as shown in Figure 1. Neither acoustically reflective nor acoustically absorbing surfaces are allowed in the test site. Measurements on ice, snow and frozen soil or frozen ballast shall not be undertaken.



Key

D = 25 m

R ≥ 2D

1 front of train

2 measurement position

3 open area

Figure 1 — Open site for warning horn measurements

The weather conditions (ambient temperature, humidity, wind speed, wind direction and precipitation) shall be registered.

The $L_{pCeq,T}$ with T = 20 s of background noise at the measurement positions shall be at least 10 dB below the noise level obtained when measuring the noise from the horn in the presence of background noise. For frequency analysis, this difference shall be at least 10 dB in each frequency band of interest.

Where additional tests for the functionality of the horn under snow conditions are required, these shall be carried out according to the procedure described in Annex B.

6.2 Test equipment

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

The frequency analyzer shall be set up to provide frequency resolution no greater than 2 Hz.

A suitable microphone windscreen shall always be used during the tests.

The calibration of the measuring system shall be verified before and after each series of measurements. The adjustment of the measurement equipment shall use a class 1 sound calibrator that meets the requirements set out in EN 60942 and shall include the calibration at least at one frequency in the range of frequencies of interest. The measurement results shall be rejected if the difference between the adjustment results before and after calibration is greater than 0,5 dB.

The calibrator shall be verified against the requirements of EN 60942 with a frequency not greater than one year. All components of the measurement system shall be verified against the requirements of EN 61672-1 and EN 61672-2 with a frequency not greater than two years. The date of the last verification of the compliance of the calibrator with the relevant European Standards shall be recorded.

6.3 Test procedure

The requirements for the application of the tests for the sample horn plus associated components to represent an installation on a train (sub-system) and the tests on the train (system) are contained in Annex A.

As a minimum, sound pressure levels shall be measured at the energy level encountered on the vehicle at the time of the test. The sound pressure levels at the limits of the energy levels provided on the vehicle shall be extrapolated from the product data sheet. As a minimum, the sound pressure levels specified in 5.2.2 shall conform at the normal operational energy level used for the tests and at the energy limits on the railway vehicle in its normal operational condition.

NOTE 1 The energy levels provided on the vehicle are specified by the vehicle manufacturer.

Sound pressure levels shall be measured from each horn sounded separately or together in a group (if designed to sound simultaneously).

Sound pressure levels shall be measured at a distance of 25,0 m, with a relative tolerance of ± 0,8 % from the front of the train along the centre-line of the track, at a height of 1,6 m, with a relative tolerance of ± 3 % above the upper surface of the rail, and over a ground covering of ballast.

NOTE 2 Compacted and/or contaminated ballast will influence the results of this test.

Tests shall be conducted using each available actuation device that may be applied for operational service.

In the case of sound pressure levels, a minimum of three valid measurement samples shall be taken. The actuation device shall be operated continuously throughout each sound pressure level measurement. The evaluation shall apply over the acoustically stable part of each measurement. The duration of the evaluation for each measurement sample shall be not less than 5 s and not greater than 10 s. Between each measurement sample the horn shall be switched off. Compliance to 5.2.1 and 5.2.2 shall be achieved by each sample and the maximum spread of the samples shall be 3 dB.

If required, lateral sound pressure tests should be performed according to the requirements of Annex C.

Lateral sound pressure tests are not mandatory. If the contractor requires these tests, the measurements should be undertaken in accordance with the positional information set out in Annex C.

6.4 Data processing

The following temperature correction is required for the measured frequencies, if other than 20 °C:

$$f(20°C) = f(\theta)\sqrt{\frac{293}{273+\theta}}$$