BS EN 15153-2:2013

BSI Standards Publication

# Railway applications — External visible and audible warning devices for trains

## Part 2: Warning horns

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**National foreword**

This British Standard is the UK implementation of EN 15153-2:2013. It supersedes BS EN 15153-2:2007 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee RAE/4, Railway Applications - Rolling stock systems, to Subcommittee RAE/4/-/7, Railway Applications - Lighting.

The UK committee draws users' attention to the distinction between normative and informative elements, as defined in Clause 3 of the CEN/CENELEC Internal Regulations, Part 3.

Normative: Requirements conveying criteria to be fulfilled if compliance with the document is to be claimed and from which no deviation is permitted.

Informative: Information intended to assist the understanding or use of the document. Informative annexes do not contain requirements, except as optional requirements, and are not mandatory. For example, a test method may contain requirements, but there is no need to comply with these requirements to claim compliance with the standard.

When rounded values require unit conversion for use in the UK, users are advised to use equivalent values rounded to the nearest whole number. The use of absolute values for converted units should be avoided in these cases. For example:

190 km/h has an equivalent value of 120 mile/h

A list of organizations represented on this committee can be obtained on request to its secretary.

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**Compliance with a British Standard cannot confer immunity from legal obligations.**

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EUROPEAN STANDARD

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# EN 15153-2

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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.



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

**Management Centre: Avenue Marnix 17, B-1000 Brussels**



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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.

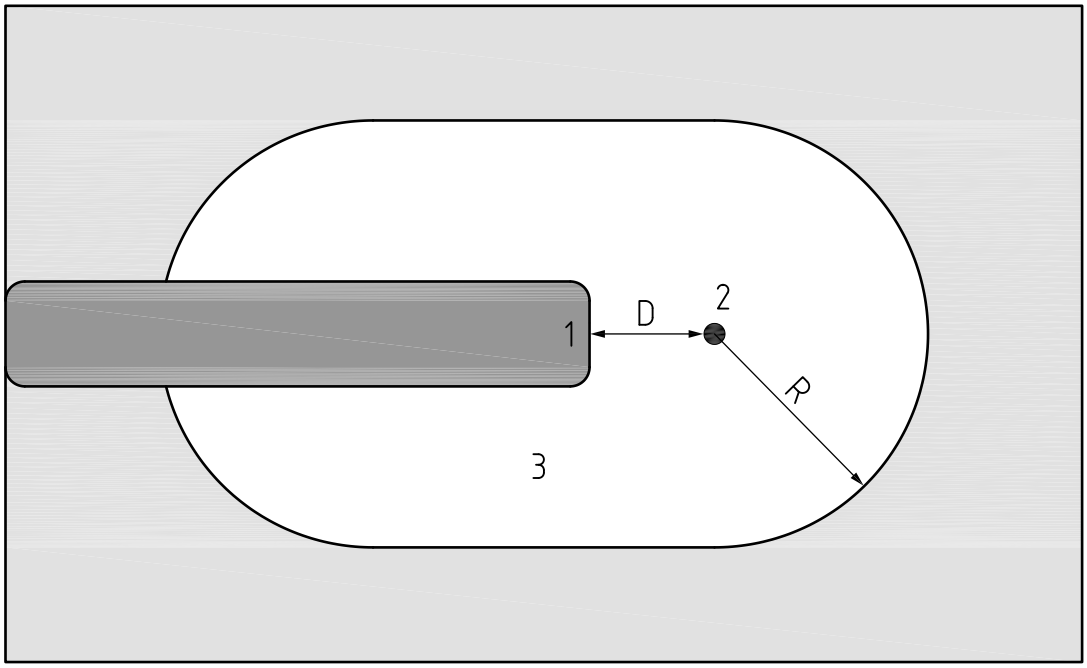
### 5.5 Impact protection

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:

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

where

$f(\theta)$ is the frequency measured when the horn is sounded, in Hz

$\theta$ is the ambient temperature during test, in °C.

Regarding the sound pressure level, the arithmetic mean value of the series of $L_{pCeq}$ shall be calculated.

### 6.5 Test report

The test results shall be documented in a test report and shall as a minimum include the following details:

a) reference to this European Standard;

b) description of the environmental conditions of the test site location:

   1) acoustical environment (presence of obstacles, ground cover);

   2) meteorological conditions: ambient temperature, humidity, wind speed, wind direction and precipitation;

   3) background sound pressure level;

c) description of the horn (type and serial number(s), and mounting arrangements of the horns);

d) description of the horn test conditions (conditions of energy source, actuation device used, and the duration of the evaluation time);

e) description of the instrumentation (type of acquisition system, type of microphone);

f) measurement positions;

g) number of sample measurements;

h) test results:

   1) the frequency values and sound pressure levels of all measurement samples shall be stated;

   2) the mean values of the test results in h) 1) shall be stated;

i) other useful information applicable to the tests.

This list is not exhaustive and the test report shall include any relevant additional detail that is specific to the test. In the case of additional tests all relevant information shall be given, such as snow conditions.

# Annex A
(informative)

# Summary of testing requirements

**Table A.1 — Interoperability constituent and sub-system testing requirements**

| **Feature to be tested (all sub-clauses included)** | **Test on sample horn (interoperability constituent)** | **Test on sample horn plus associated components to represent an installation on a train (sub-system)** |
|---|---|---|
| 5.1 Requirements general | | x |
| 5.2.1 Acoustic requirements - frequency | x | |
| 5.2.2 Acoustic requirements - sound pressure level | | x |
| 5.3 Operation | No requirement | |
| 5.4 Energy supply | | x |
| 5.5 Impact protection | | x |
| Annex B (if applicable) | x | |
| Annex C (if applicable) | | x |
| Annex D (if applicable) | | x |

# Annex B
(informative)

# Test of the horn under snow conditions

## B.1 Test conditions

The tests may be carried out in a climatic chamber or outdoors if comparable test conditions are available.

The contractors should agree on the ambient temperature and the characteristics of the snow required for this test. For example, a realistic snowing of the horn with powder snow should be ensured. Further test conditions should be in accordance with 5.1.

## B.2 Test procedure

Tests may be conducted using a single horn independent from a vehicle.

Snowing of the horn should be performed for 30 min continuously. The intensity of snowing should be adjusted in a way that a snow thickness of at least 1 cm is built up. A realistic snowing of the horn with dry snow (particle size of the snow flakes approximately 20 µm) should be ensured.

The accumulation of snow in the horn should be documented. Afterwards the sound pressure level should be measured in accordance with 6.3.

Furthermore the delay between activating the horn and achieving the maximum sound pressure level should be measured.

## B.3 Acceptance criteria

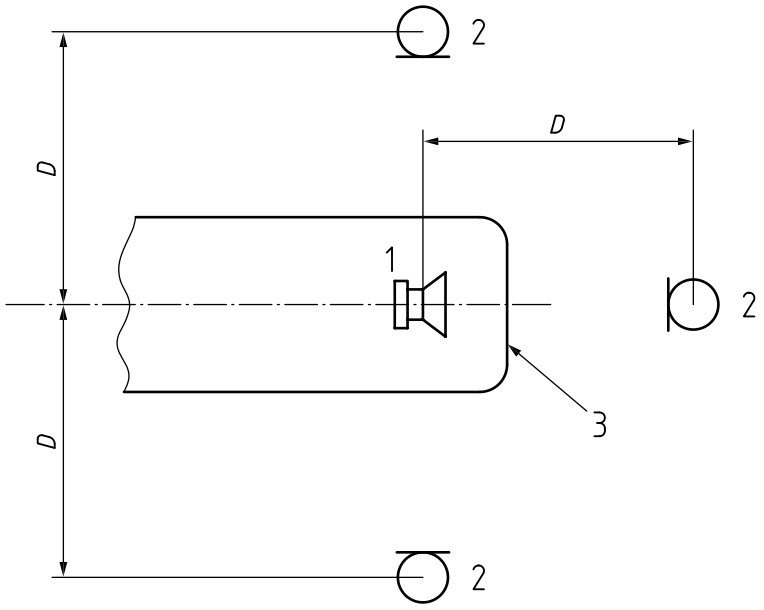
The maximum acceptable reduction of the sound pressure level with snow conditions compared with normal conditions (ambient temperature + 20 °C) should be 8 dB. Other reductions may be acceptable subject to maintaining operational safety.

The delay between activating the horn and achieving the maximum sound pressure level should not exceed 1 s.

# Annex C
(informative)

# Lateral sound pressure tests

In order to minimise environmental impact, it is advisable that the C-weighted sound pressure level from the mounted horn, when measured not less than 5 m from both sides of the train, is at least 5 dB lower than the level measured in front of the train; see Figure C.1.




$D \geq 5$ m

**Key**

1 horn position
2 measurement positions
3 front of vehicle

**Figure C.1 – Lateral measurement positions**

# Annex D
(informative)

# A-deviation

**A-deviation:** National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN-CENELEC national member.

This European Standard falls under Directive 2008/57/EC.

NOTE (from CEN-CENELEC IR Part 2:2011, 2.17) Where standards fall under EU Directives, it is the view of the Commission of the European Communities (OJ No C 59; 1982-03-09) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted except under the safeguard procedure provided for in the relevant Directive.

A-deviations in an EFTA-country are valid instead of the relevant provisions of the European Standard in that country until they have been removed.

| **Deviation** | |
|---|---|
| Country:<br><br>GB | National Regulation:<br><br>It is permissible for rolling stock for national use only, to comply with the following sound pressure levels: 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 86 dB and 94 dB, when tested in accordance with 6.3. Trains intended for international use shall be compliant with the horn sound pressure levels as stipulated in this European Standard. |

# Annex ZA
(informative)

## Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC

This European Standard has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the Directive 2008/57/EC[1)].

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Tables ZA.1 for High Speed and Conventional Rail Locomotive and Passenger Rolling Stock, ZA.2 for High Speed and Conventional Rail Operations and ZA.3 for Conventional Rail – Rolling Stock – Noise confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

1) This Directive 2008/57/EC adopted on 17th June 2008 (amended by Directive 2011/18/EU of 1st March 2011) is a recast of the previous Directives 96/48/EC 'Interoperability of the trans-European high-speed rail system' and 2001/16/EC 'Interoperability of the trans-European conventional rail system' and revisions thereof by 2004/50/EC 'Corrigendum to Directive 2004/50/EC of the European Parliament and of the Council of 29 April 2004 amending Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system'

**Table ZA.1 — Correspondence between this European Standard, the Union Rail System, Subsystem Rolling Stock, TSI Locomotives and Passenger RST (Preliminary draft; Ref. IU-LOC_ PAS_TSI_draft; Version 0.5; Date 11/05/2012) and Directive 2008/57/EC**

| Clause/subclauses of this European Standard | Chapter/§of the TSI | Corresponding text, articles/§/annexes of the Directive 2008/57/EC | Comments |
|---|---|---|---|
| 5.2.1 Frequency<br>5.2.2 Sound pressure level<br>5.5 Impact protection | 4.2.7.2 Horn (Audible warning device<br>4.2.7.2.1 General<br>4.2.7.2.2 Warning horn sound pressure levels<br>4.2.7.2.3 Protection | Annex III<br>Essential Requirements<br>1 General Requirements<br>1.1 Safety<br>1.1.1<br>1.4 Environmental protection<br>1.4.4<br>2 Requirements specific to each subsystem<br>2.4 Rolling stock<br>2.4.3. Technical compatibility<br>2.6. Operation and traffic management<br>2.6.3 Technical compatibility | Some clauses of the standard EN 15153-2:2013 are quoted in the TSI and therefore mandatory.<br>On EN clauses 5.2.2 and 6: EN 15153-2:2013 (superseding EN 15153-2:2007) specifies modified test requirements together with consequently adapted sound pressure levels.<br>The HS+CR LOC&PAS TSI is still a draft subject to change without notice. |
| 6 Test requirements | 5.3. Interoperability constituent specification<br>5.3.9 Horns<br>6.1.3 Particular assessment procedures for Interoperability constituents<br>6.1.3.6 Horn (Clause 5.3.9)<br>6.2.3 Particular assessment procedures for Subsystems<br>6.2.3.17 Warning horn sound pressure levels (Clause 4.2.7.2.2) | | |

**Table ZA.2 – Correspondence between this European Standard, the HS TSI Operations (published in the Official Journal L 84 on 26 March 2008) and the CR TSI Operations (published in the Official Journal L 144 on 31 May 2011) and Directive 2008/57/EC**

| Clause/subclauses of this European Standard | Chapter/§of the TSI | Corresponding text, articles/§/annexes of the Directive 2008/57/EC | Comments |
|---|---|---|---|
| The whole standard is applicable | 4.2.2.2. Train audibility | Annex III<br>Essential Requirements<br>1 General Requirements<br>1.1 Safety<br>1.1.1<br>1.4 Environmental protection<br>1.4.4<br>2 Requirements specific to each subsystem<br>2.4 Rolling stock<br>2.4.3. Technical compatibility<br>2.6. Operation and traffic management<br>2.6.3 Technical compatibility | The HS and CR TSI will be revised for merging at short term. |

**Table ZA.3 — Correspondence between this European Standard, the Conventional Rail - Rolling Stock - Noise TSI (published in the Official Journal L 99 on 13 April 2011) and Directive 2008/57/EC**

| Clause/subclauses of this European Standard | Chapter/§of the TSI | Corresponding text, articles/§/annexes of the Directive 2008/57/EC | Comments |
|---|---|---|---|
| 5.2.2 Sound pressure level<br>6 Test requirements | 4.2.3. Interior noise of locomotives, multiple units and coaches fitted with a cab, Table 6<br>Annex F | Annex III<br>Essential Requirements<br>1 General Requirements<br>1.1 Safety<br>1.1.1<br>1.4 Environmental protection<br>1.4.4<br>2 Requirements specific to each subsystem<br>2.4 Rolling stock<br>2.4.3. Technical compatibility<br>2.6. Operation and traffic management<br>2.6.3 Technical compatibility | |

**WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.**

# Bibliography

[1] EN ISO 3095, *Railway applications — Acoustics — Measurement of noise emitted by railbound vehicles (ISO 3095)*

[2] GM/RT2484, Issue 2, April 2007, 'Audibility requirements for trains'[2)]

[3] AEATR–PC&E–2004-002, A. E. J. Hardy, 'Audibility of warning horns'.

[4] DIN 5566-2:2006, *Schienenfahrzeuge — Führerräume — Teil 2: Zusatzanforderungen an Eisenbahnfahrzeuge*[3)]

2) To be viewed free of charge on the RSSB website (www.rssb.co.uk).

3) To be purchased from: Beuth Verlag GmbH, D-10772 Berlin.

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