INTERNATIONAL STANDARD

ISO 3381

Third edition
2021-09

Railway applications — Acoustics — Noise measurement inside railbound vehicles

Applications ferroviaires — Acoustique — Mesurage du bruit à l'intérieur des véhicules circulant sur rails

Reference number
ISO 3381:2021(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 256, *Railway applications*, in collaboration with ISO Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 3381:2005), which has been technically revised.

The main changes compared to the previous edition are as follows:

— new structure of the document to align it with the structure of ISO 3095;

— an improved selection process of the measurement positions – see Clause 5;

— new measurement procedures for noise in driver's cab – see Clause 7;

— improved specifications of the vehicle conditions for the different types of tests - see 6.4, 7.3, 8.4 and 9.4;

— an improved assessment of the tonality - see 6.7, 8.7 and 9.8.2.

— an improved indirect assessment of the track acoustic characteristics – see 8.3.4, 9.3 and Annex C;

— precisions for measurement in specific environments (tunnels, …) – see Annex D;

— an assessment of measurement uncertainties – see Annex E.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Railway applications — Acoustics — Noise measurement inside railbound vehicles

1 Scope

This document specifies the measurement method and conditions to obtain reproducible noise levels on-board all kinds of vehicles operating on rails or other types of fixed track, hereinafter conventionally called "unit", except for track maintenance vehicles in working modes.

This document is applicable to type testing. It does not include all the instructions to carry out monitoring testing or evaluation of noise exposure of passengers or drivers over a whole journey.

This document is not applicable to guided buses.

It provides measurement procedures for vehicle interior noise (in general, a vehicle type test is carried out using only a selected subset of these tests):

— when the vehicle is moving at constant speed;

— when the vehicle is stationary;

— when the vehicle is accelerating or decelerating;

— in the driver's cab when an external warning horn is sounding (specifically required for European Union regulation application)

It does not provide measurement procedures for:

— audibility or intelligibility of any audible signals;

— assessment of warning devices other than warning horns.

The assessment of noise exposure of train crew due to operational conditions is not in the scope of this document.

The results can be used, for example:

— to characterise the noise inside these units;

— to compare the internal noise of various units on a particular track section;

— to collect basic source data for units.

The test procedures specified in this document are of engineering grade (grade 2), the preferred grade for noise declaration purposes as defined in ISO 12001. If test conditions are relaxed, for example as they are for monitoring of in-service trains, then the results are no longer of engineering grade.

The procedures specified for accelerating and decelerating tests are of survey grade (grade 3).

2 Normative references

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

ISO 1996-1:2016, *Acoustics — Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures*

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

IEC 60942, *Electroacoustics — Sound calibrators*

IEC 61260-1, *Electroacoustics — Octave-band and fractional-octave-band filter — Part 1: Specifications*

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

EN 15153-2:2020, *Railway applications — external visible and audible warning devices — part 2: warning horns for heavy rail*

EN 15461:2008+A1:2010, *Railway applications — Noise emission — Characterization of the dynamic properties of track sections for pass by noise measurements*

EN 15610, *Railway applications — Acoustics — Rail and wheel roughness measurement related to noise generation*

3 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:

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

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

3.1
unit
rolling stock which is subject to the application of this document

Note 1 to entry: A unit can be composed of several powered or unpowered vehicles, or cars.

3.2
type test
<noise measurement inside railbound units> measurement performed to prove that, or to check if, a unit delivered by the manufacturer complies with the noise specifications

3.3
acoustic roughness
$r(x)$
variation of the height of the rail running surface associated with rolling noise excitation, expressed as a function of distance x along the rail

[SOURCE: EN 15610:2019]

3.4
track decay rate
rate of attenuation of vibration amplitude of either vertical or lateral bending wave motion in the rail as a function of the distance along the rail

Note 1 to entry: The track decay rate is represented by a one-third octave spectrum of values expressed in decibels per metre (dB/m) representing attenuation over distance.

[SOURCE: EN 15461:2008+A1:2010]

3.5
acoustic track characteristics
ATC
characteristics of the track that are defined in terms of acoustic rail roughness and *track decay rates* (3.4)