SLOVENSKI STANDARD
oSIST prEN ISO 3381:2019

01-december-2019

Železniške naprave - Akustika - Merjenje hrupa v tirnih vozilih (ISO/DIS 3381:2019)

Railway applications - Acoustics - Noise measurement inside railbound vehicles (ISO/DIS 3381:2019)

Bahnanwendungen - Akustik - Geräuschmessungen in spurgebundenen Fahrzeugen (ISO/DIS 3381:2019)

Applications ferroviaires - Acoustique - Mesurage du bruit à l'intérieur des véhicules circulant sur rails (ISO/DIS 3381:2019)

Ta slovenski standard je istoveten z: **prEN ISO 3381**

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

oSIST prEN ISO 3381:2019 **en,fr,de**

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Railway applications — Acoustics — Noise measurement inside railbound vehicles

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

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European foreword

This document (prEN ISO 3381:2019) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN ISO 3381:2011.

The main changes with respect to the previous edition are listed below:

— modular structure;

— assessment of the reference track section with reference to EN 15610 (rail roughness) and EN 15461 (track decay rates);

— introduction of an improved indirect assessment of the track acoustic characteristics;

— new Cabnoise specification;

— improved selection process of the measurement positions;

— improved specifications of the vehicle conditions for the different types of tests;

— an improved assessment of the tonality.

Railway applications — Acoustics — Noise measurement inside railbound vehicles

1 Scope

This document specifies the measurement method and conditions to obtain reproducible and comparable 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.

NOTE For constant speed tests the concept of “comparability” needs further caution, as this term is used as well to classify the measurement precision grade related to track roughness and track decay rates given in this document. Nevertheless, the measurement may be acceptable as type test on a track of controlled acoustic quality, but not compliant to the track specification given in this document.

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:

— 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.

NOTE In general, a vehicle type acceptance test would require only a selected subset of these tests to be performed.

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 may 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), that is the preferred one for noise declaration purposes, as defined in EN ISO 12001. If test conditions are relaxed for example as done 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.

2 Normative references

The following referenced documents are indispensable for the application 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.

DIN 45681:2005, *Acoustics — Determination of tonal components of noise and determination of a tone adjustment for the assessment of noise immissions*

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

EN 15610:2019, *Railway applications — Noise emission — Rail roughness measurement related to rolling noise generation*

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 12001, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code*

ISO 1996-1, *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, *Electroacoustics — Octave-band and fractional-octave-band filters*

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

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

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:

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

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

3.1
unit
generic term used to name the rolling stock which is subject to the application of this document

Note 1 to entry: A unit may be composed of several motored or unmotored vehicles, or cars.

3.2
type test for noise emission of 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]

3.4
acoustic roughness spectrum
amplitude of the acoustic roughness expressed as a function of the wavelength λ

3.5
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: It is represented by a one-third octave spectrum of values expressed in decibels per metre (dB/m) representing attenuation over distance.

[SOURCE: EN 15461]

3.6
Acoustic Track Characteristics (ATC)
characteristics of the track that are defined in terms of acoustic rail roughness and track decay rates

3.7
test section
specific section of track that is associated with a particular set of measurements

3.8
reference track section
portion of track on which the track decay rates and the acoustic roughness levels are controlled

Note 1 to entry: On this section of track, decay rates and acoustic rail roughness levels should be measured directly and should be compliant to the default specifications as given in Annex E.

3.15
impulsive sound
sound characterized by one or more brief bursts of sound pressure and that is such that the duration of a single impulsive noise is usually less than 1 s

Note 1 to entry: Definition adapted from ISO 1996-1

Note 2 to entry: Examples: Blowoff valve, relay switches.

Note 3 to entry: The quantification of impulsiveness is set out in Annex B.

3.16
intermittent sound
sound that occurs at regular or irregular time intervals and is such that its duration is short

Note 1 to entry: Definition adapted from ISO 1996-1.

Note 2 to entry: Examples: compressors, fans, doors.

3.17
tonal sound
sound characterized by a single frequency component or narrow band components that emerge audibly from the total sound

[SOURCE: ISO 1996-1]

4 Instrumentation and calibration

4.1 Instrumentation

Each component of the instrumentation system shall meet the requirements for a class 1 instrument specified in IEC 61672-1.

Note 1 to entry In the case of measurements of survey grade this requirement is relaxed to class 2 instruments.

The sound calibrator shall meet the requirements of class 1 according to IEC 60942.

Microphones with free-field characteristics shall be used. A suitable microphone windscreen should be used.

Where one-third octave frequency band analysis is required, the filters shall meet the requirements of class 1, according to IEC 61260.

The compliance of the calibrator with the requirements of IEC 60942 shall be verified at least once a year. The compliance of the instrumentation system with the requirements of IEC 61672-1 and IEC 61672-2 shall be verified at least every 2 years. The date of the last verification of the compliance with the relevant European Standards shall be recorded.

4.2 Calibration

Before and after each series of measurements a sound calibrator meeting the requirements of class 1 according to IEC 60942 shall be applied to the microphone(s) for verifying the calibration of the entire measuring system at one or more frequencies over the frequency range of interest. If the difference between the two calibrations is more than 0,5 dB all the measurement results in between shall be rejected.

5 Measurement positions

5.1 Definition of areas

5.1.1 Definition of area types

Area types are distinguished by their purpose, for example: passenger areas, seating (first class, standard class), standing areas (including aisles), gangway, driver's cab, train manager compartment, galley, lavatories, entrance, lobbies, restaurant, quiet, sleeping or resting areas.

The broadness of the definition of an area depend upon the vehicle type. For example, for trams and metros, it may be appropriate to define a 'passenger area' that does not distinguish between seating and standing areas.

5.1.2 Division of the unit into areas

The entire unit shall be divided into areas that must be discrete, each area being of a single type.

NOTE Further to the separation into areas of a single type, the areas may also help to divide the unit into separate acoustic spaces within the unit (e.g. seating area over a bogie, seating area close to a vestibule, ...). In dividing the unit into areas, bear in mind two objectives: 1) the efficiency of identifying similar areas to reduce the measurement effort, and 2) compatibility with the level of detail in the stated noise criteria.

No area shall cross the boundaries of an acoustic space (partition, wall, doors, ...).

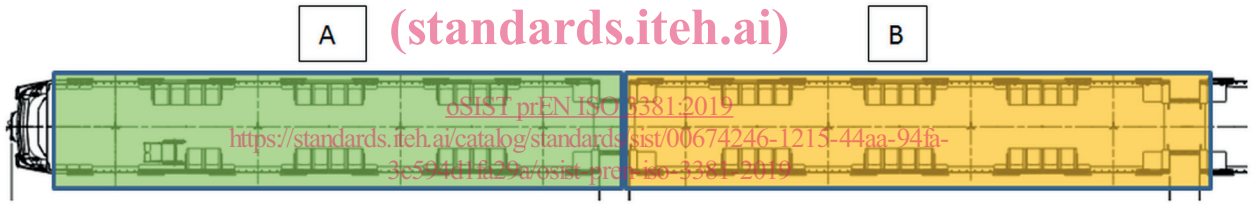
For example, in double-deckers, decks shall be considered as separate areas.

5.1.3 Selection of areas to be assessed

Where there is no specification of the area types to be assessed, a minimum selection may be assumed that the noise criteria apply only to areas of the types with permanent passenger seats.

The number of discrete areas to be characterized by measurement may be reduced by identifying discrete areas that are similar in terms of their use, approximate size, acoustic boundaries, and noise sources.

Figure 1 — Example of a possible choice dividing a DMU into 10 areas A to J

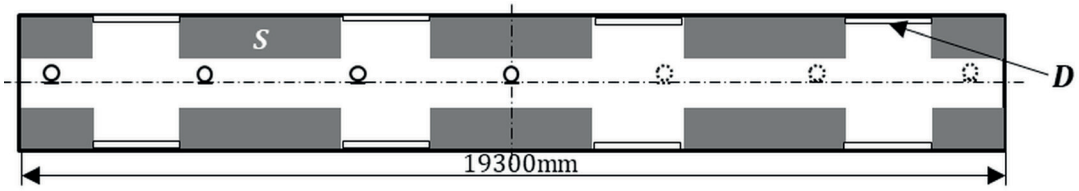


Key

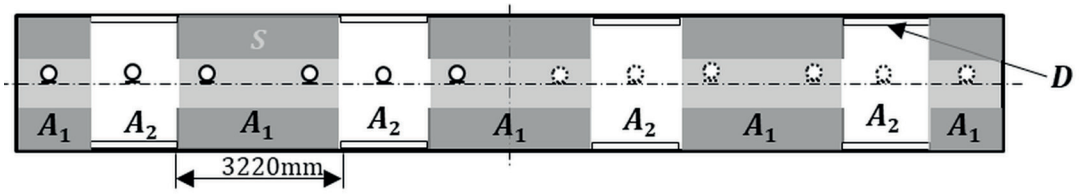
A motor car

B trailer car

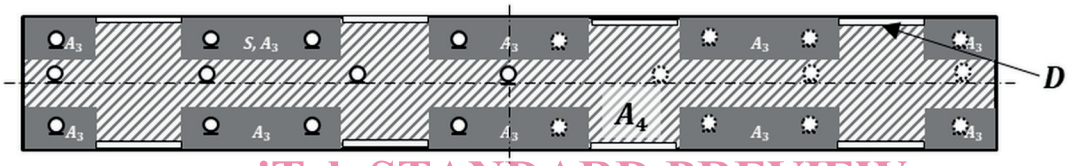
Figure 2 — Example of definition of areas (A & B) in the case of a metro: the gangway between the 2 cars is open, not considered as a specific area and included in the area B



a) Case 1: Defined as a single "passengers'" area, specified for a single unit



b) Case 2: Longitudinally divided into two areas (area with seats, vestibule area)



c) Case 3: Divided into two areas (seating/standing area)

Key

S	seat	A_2	vestibule area
D	passenger door	A_3	seating area
A_1	area with seats	A_4	standing area

Figure 3 — Example of definition of areas and measurement positions for commuter units

5.2 Measurement positions

Each discrete area that is to be assessed shall be divided into equal segments of maximum length 3 m along the unit and each segment shall contain at least one measurement position.

NOTE This document leaves the freedom to choose measurement locations over a seat or between seats at the same height in order to provide a representative sample of an area.

Measurement positions shall not be located closer than 0,3 m to a wall, screen or door.

NOTE This microphone position is representative of the sound field heard by passengers.

Additional measurement positions may be defined but shall be reported separately and not as part of the characterization of an area.

5.3 Measurement height

5.3.1 Seating position

In areas, other than the driver's cab, that contain permanent seats, the measurement height shall be set to 1,2 m above the floor at the seat location.

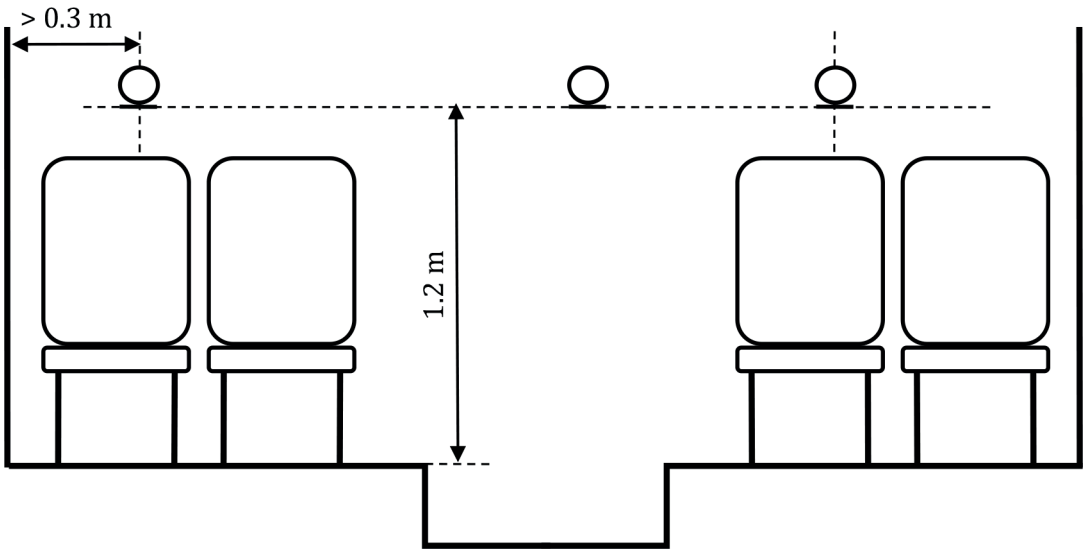


Figure 4 — Examples of possible measurement positions for a seating area

5.3.2 Standing position

In standing areas, other than the driver's cab, measurements shall be located at a height of 1,6 m above the floor.

5.3.3 Lying position

At locations, where people are supposed to rest in horizontal position, the microphone positions shall be 0,2 m above the support.

5.3.4 Driving position

When the cab contains more than one set of complete driving controls, the test shall be carried out at each of these positions. This is not necessary at auxiliary driving positions where a full set of controls is not present.

In a driver's cab area, the seated measurement position height shall be set at 0,80 m ± 0,05 m vertically above the centroid of the unloaded seat surface, moved 0,25 m in lateral direction.

In addition, a minimum distance of 0,3 m from the nearest wall shall be kept. The precise location of the microphone shall be recorded.

If the seat height is adjustable, this adjustment shall be set at midrange. The height of this nominal position for the driver's seat above the floor shall be recorded.

For the warning horn test (see Clause 7), the measurement shall be carried out at eight evenly spaced microphone positions in a horizontal plane at the height of a seated driver’s ears, at a radius of 0,25 m, while the external warning horn is sounding. Where one or more of the required eight measurement positions is either not possible to realise because of the presence of structural elements, or where it is within 0,2 m of an acoustically-reflective surface, a measurement shall not be required at that position. The number of discrete measurement locations shall then be reduced accordingly to $N < 8$. In case a headrest presents a hindrance to mounting the microphones, it is permissible to remove the headrest or to use a measurement height as close as possible to the specified measurement height.

If not defined elsewhere, the level of the driver's ear for standing operation shall be taken as 1,6 m above the floor.