
Železniške naprave - Oprema tirnih vozil - Preskusi na udarce in vibracije

Railway applications - Rolling stock equipment - Shock and vibration tests

Bahnanwendungen – Betriebsmittel von Bahnfahrzeugen – Prüfungen für Schwingen und Schocken

Applications ferroviaires - Matériel roulant - Essais de chocs et vibrations

Ta slovenski standard je istoveten z: EN IEC 61373:2026

get full document from standards.iteh.ai

ICS:

17.160	Vibracije, meritve udarcev in vibracij	Vibrations, shock and vibration measurements
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

SIST EN IEC 61373:2026**en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 61373

September 2026

ICS 45.060.01

Supersedes EN 61373:2010; EN 61373:2010/AC:2017-09

English Version

**Railway applications - Rolling stock equipment - Shock and
vibration tests
(IEC 61373:2026)**

Applications ferroviaires - Matériel roulant - Essais de chocs
et vibrations
(IEC 61373:2026)

Bahnanwendungen - Betriebsmittel von Bahnfahrzeugen -
Prüfungen für Schwingen und Schocken
(IEC 61373:2026)

This European Standard was approved by CENELEC on 2026-08-21. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 61373:2026 (E)**European foreword**

The text of document 9/3266/FDIS, future edition 3 of IEC 61373, prepared by TC 9 "Electrical equipment and systems for railways" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61373:2026.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2027-09-30 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2029-09-30 document have to be withdrawn

This document supersedes EN 61373:2010 and all of its amendments and corrigenda (if any).

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

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 61373:2026 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-27	-	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60068-2-47	-	Environmental testing - Part 2-47: Test - Mounting of specimens for vibration, impact and similar dynamic tests	EN 60068-2-47	-
IEC 60068-2-64	2008	Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance	EN 60068-2-64	2008
+ A1	2019		+ A1	2019
ISO 3534-1	-	Statistics - Vocabulary and symbols – Part 1: General statistical terms and terms used in probability	-	-

Sample Document

get full document from standards.iteh.ai



IEC 61373

Edition 3.0 2026-07

INTERNATIONAL STANDARD

Railway applications - Rolling stock equipment - Shock and vibration tests

Sample Document

get full document from standards.iteh.ai

CONTENTS

FOREWORD	5
INTRODUCTION	7
1 Scope	8
2 Normative references	9
3 Terms, definitions, symbols and abbreviated terms	9
3.1 Terms and definitions	9
3.2 Symbols and abbreviated terms	11
4 General	12
5 Order of testing	14
6 Test conditions	15
6.1 General	15
6.2 Method of mounting and orientation of equipment under test	15
6.3 Reference and check points	17
6.3.1 General	17
6.3.2 Fixing point	17
6.3.3 Check point	17
6.3.4 Reference point	17
6.3.5 Measuring point	18
6.4 Mechanical state and functioning during test	18
6.4.1 Mechanical state	18
6.4.2 Functional tests	18
6.4.3 Performance tests	18
6.4.4 Lifetime assessment	18
6.5 Reproducibility for random vibration tests	19
6.5.1 General	19
6.5.2 Acceleration spectral density (<i>ASD</i>)	19
6.5.3 Root mean square value (<i>RMS</i>)	19
6.5.4 Probability density function (<i>PDF</i>)	19
6.5.5 Duration	20
6.6 Measuring tolerances	20
6.7 Recovery	20
7 Initial measurements and preconditioning	21
8 Functional random vibration tests	21
8.1 Test severity and frequency range	21
8.1.1 General	21
8.1.2 Body mounted – Category 1 Class A	22
8.1.3 Body mounted – Category 1 Class B	24
8.1.4 Bogie mounted – Category 2	26
8.1.5 Axle mounted – Category 3	30
8.2 Duration of the functional random vibration tests	32
8.3 Functioning during tests	32
9 Simulated long-life tests at increased random vibration levels	32
9.1 Test severity and frequency range	32
9.1.1 General	32
9.1.2 Body mounted – Category 1 Class A	33
9.1.3 Body mounted – Category 1 Class B	33

IEC 61373:2026 © IEC 2026

9.1.4	Bogie mounted – Category 2	34
9.1.5	Axle mounted – Category 3.....	35
9.2	Duration and acceleration ratio of the simulated long-life vibration tests	36
10	Shock tests.....	38
10.1	Pulse shape and tolerance.....	38
10.2	Velocity change	38
10.3	Mounting.....	38
10.4	Repetition rate	38
10.5	Test severity, pulse shape and direction	38
10.6	Number of shocks	39
10.7	Functioning during tests.....	40
11	Transportation and handling	40
12	Final measurements and acceptance criteria	40
12.1	Final measurements.....	40
12.2	Acceptance criteria	40
13	Test exemption	41
14	Report	41
15	Test certificate.....	42
16	Disposal	42
Annex A (informative) Explanation of service measurements, measuring positions, methods of recording service data, summary of service data, and method used to obtain random test levels from acquired service data.....		43
A.1	General.....	43
A.2	Standard measuring positions used for axle, bogie and body-mounted categories.....	43
A.3	Service data obtained from rail operators and equipment manufacturers utilizing a two-page questionnaire	44
A.4	Method used to obtain <i>ASD</i> values from the acquired service data	45
A.5	Summarized service data obtained	46
A.6	Method to compute the acceleration ratio to be used for long-life tests	48
A.7	Long-life test levels obtained from functional test levels using the method in Clause A.6	56
Annex B (informative) Figure identifying general location of equipment on railway vehicles and their resulting test category		57
Annex C (informative) Example of a type test certificate		58
Annex D (informative) Guidance for calculating <i>RMS</i> values from <i>ASD</i> values or levels.....		59
D.1	General.....	59
D.2	Calculation of the functional <i>RMS</i> value from the service data	59
D.3	Calculation of the <i>RMS</i> values from <i>ASD</i> levels of Figure 6 to Figure 10	60
Annex E (informative) Guidance for numerical validation of structural parts of cubicles.....		61
E.1	General.....	61
E.2	Software	61
E.3	Model validity.....	61
E.3.1	General	61
E.3.2	Coordinate system.....	61
E.3.3	Assumptions	61
E.3.4	Boundary conditions	62
E.4	Modal analysis.....	62
E.4.1	General	62

IEC 61373:2026 © IEC 2026

E.4.2	Post processing	62
E.4.3	Criteria	62
E.5	Shocks	62
E.5.1	General	62
E.5.2	Loading	62
E.5.3	Post processing	63
E.5.4	Acceptance criteria	63
E.6	Random vibration	63
E.6.1	General	63
E.6.2	Post processing	64
E.6.3	Acceptance criteria	67
Annex F (informative)	Urban vehicles operating on pneumatic tyres	69
F.1	General	69
F.2	Specific layout of urban vehicles operating on pneumatic tyres	69
F.3	Functional random vibration <i>ASD</i>	70
Bibliography		73
Figure 1	– Gaussian distribution	10
Figure 2	– Test sequence	14
Figure 3	– Management of resilient mounts during testing	15
Figure 4	– Example of transfer function magnitude	16
Figure 5	– Cumulative PDF tolerance bands	20
Figure 6	– Category 1 – Class A – Body-mounted – <i>ASD</i> spectra	23
Figure 7	– Category 1 – Class B – Body-mounted – <i>ASD</i> spectra	26
Figure 8	– Category 2 – Bogie mounted – <i>ASD</i> spectra	28
Figure 9	– Category 2 – Bogie mounted – Validity plan for default <i>ASD</i> spectra	29
Figure 10	– Category 3 – Axle mounted – <i>ASD</i> spectra	31
Figure 11	– Pulse shape and limits of tolerance for half-sine pulse	39
Figure A.1	– Standard measuring positions used for axle, bogie (frame) and body	43
Figure A.2	– Typical fatigue strength curve	48
Figure A.3	– Acceleration ratio as function as number of cycles during long life test N_T	50
Figure A.4	– Default acceleration ratio as function as long-life test duration d_{LLT} for categories 1 and 2	51
Figure A.5	– Default acceleration ratio as function as long-life test duration d_{LLT} for category 3	52
Figure B.1	– General location of equipment on vehicles	57
Figure D.1	– <i>ASD</i> spectrum	60
Figure E.1	– Stress value on element, frequency response analysis	64
Figure E.2	– Power spectral density, acceleration and stress $\sigma_{PSD}(f)$	65
Figure F.1	– General location of equipment on vehicles operating on pneumatic tyres	70
Table 1	– Test severity and frequency range for functional random vibration tests of category 1 Class A	24
Table 2	– Test severity and frequency range for functional random vibration tests of category 1 Class B	26

IEC 61373:2026 © IEC 2026

Table 3 – Test severity and frequency range for functional random vibration tests of category 2.....	29
Table 4 – Test severity and frequency range for functional random vibration tests of category 3.....	32
Table 5 – Test severity and frequency range for 5 h simulated long-life random vibration tests of category 1 Class A.....	33
Table 6 – Test severity and frequency range for 100 h simulated long-life random vibration tests of category 1 Class A.....	33
Table 7 – Test severity and frequency range for 5 h simulated long-life random vibration tests of category 1 Class B.....	34
Table 8 – Test severity and frequency range for 100 h simulated long-life random vibration tests of category 1 Class B.....	34
Table 9 – Test severity and frequency range for 5 h simulated long-life random vibration tests of category 2.....	34
Table 10 – Test severity and frequency range for 100 h simulated long-life random vibration tests of category 2.....	35
Table 11 – Test severity and frequency range for 5 h simulated long-life random vibration tests of category 3.....	35
Table 12 – Test severity and frequency range for 100 h simulated long-life random vibration tests of category 3.....	36
Table 13 – Acceleration ratio and long-life test duration table (default values)	37
Table 14 – Test severity, pulse shape and direction.....	39
Table A.1 – Environment data acquisition summary of the test parameters	44
Table A.2 – Summary of the additional <i>RMS</i> acceleration levels obtained from the questionnaire.....	46
Table A.3 – Summary of collected data (category 1A).....	47
Table A.4 – Summary of collected data (category 1B).....	47
Table A.5 – Fatigue curves parameters considered for default acceleration ratio computation.....	49
Table A.6 – Acceleration ratio and long-life test duration table (default values).....	52
Table A.7 – Parameters for specific acceleration ratio computation (Example 1).....	54
Table A.8 – Parameters for specific acceleration ratio computation (Example 2).....	55
Table E.1 – Description of stress spectrum.....	66
Table F.1 – Test severity and frequency range for functional random vibration tests of category 1 Class A, urban vehicle operating on pneumatic tyres.....	71
Table F.2 – Test severity and frequency range for functional random vibration tests of category 1 Class B, urban vehicle operating on pneumatic tyres.....	71
Table F.3 – Test severity and frequency range for functional random vibration tests of category 2, urban vehicle operating on pneumatic tyres.....	72

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Railway applications - Rolling stock equipment - Shock and vibration tests

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61373 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. It is an International Standard.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) consideration of specific *ASD* spectra from onboard measurements and certification limited to the specific case;
- b) exclusion from the scope of applicability of traction motors and any substructure not equipped with electrical, electronic or pneumatic device;
- c) clarification for order of testing and typical test sequence, taking into account the possibility of simultaneous multi-axis testing;

IEC 61373:2026 © IEC 2026

- d) recommendation and guidance for removing resilient mounts of the equipment (if located between the equipment and the main structure) during the long-life test;
- e) qualification of the fixture device used to attach the equipment to the test bench;
- f) guidance for using a measuring point as a possibility to assess mechanical integrity;
- g) change of the method to calculate the acceleration ratio which shall be applied to the functional *ASD* value to obtain the simulated long-life *ASD* value;
- h) duration of long-life test can be set from 5 h to 100 h per axis, with corresponding acceleration ratio (default value) indicated in a table;
- i) clarification of the concept of structural integrity;
- j) description of test exemption cases, subassembly tests, and finite element analysis for structural parts of equipment (new Annex E);
- k) the lowest frequency f_1 of *ASD* spectra of Category 1 and Category 2 is fixed at 5 Hz as a default value, and the lowest frequency f_1 of *ASD* spectra of Category 3 is fixed at 10 Hz as a default value;
- l) update of *ASD* spectra for functional random vibration test: Table 1, Table 2, Table 3, Table 4, Table A.2 and Figure 6, Figure 7, Figure 8, Figure 10. This update was recommended in the Rail Safety and Standard Board research program document: "Vibration environment for rail vehicle mounted Equipment";
- m) new annex F dedicated on urban vehicle operating on pneumatic tyres.

The text of this International Standard is based on the following documents:

Draft	Report on voting
9/3266/FDIS	9/3321/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This document covers the requirements for random vibration and shock testing items of pneumatic, electrical and electronic equipment or components (hereinafter only referred to as equipment) to be fitted on to railway vehicles. Random vibration and shock is the only method to be used for equipment or component approval.

The tests contained within this document are specifically aimed at demonstrating the ability of the equipment under test to withstand the type of environmental vibration conditions normally expected for railway vehicles. In order to achieve the best representation possible, the values quoted in this document have been derived from actual service measurements submitted by various contributing bodies from around the world.

This document is not intended to cover self-induced vibrations as these will be specific to particular applications.

Engineering judgement and experience are recommended in the execution and interpretation of this document.

This document is suitable for design and validation purposes; however, it does not exclude the use of other development tools (such as sine sweep), which can be used to ensure a predetermined degree of mechanical and operational confidence. The test levels to be applied to the equipment under test are dictated only by its location on the train (i.e. axle, bogie or body-mounted).

It should be noted that these tests can be performed on prototypes in order to gain design information about the product performance under random vibration. However, for test certification purposes, the tests are carried out on equipment taken from normal production.

The procedures and requirements defined in this document do not substitute or overrule any structural assessment required from other structural requirement standards. This document is not intended to be used as a proof of fatigue strength.

NOTE European Standards EN 12663 and EN 13749 are examples of such structural requirement standards.

1 Scope

This document specifies the requirements for testing items of equipment intended for use on railway vehicles which are subsequently subjected to vibrations and shock owing to the nature of railway operational environment. To gain assurance that the quality of the equipment is acceptable, it is exposed to tests of reasonable duration that simulate the service conditions seen throughout its expected life.

Simulated long-life testing can be achieved in a number of ways each having their associated advantages and disadvantages, the following being the most common:

- a) amplification: where the amplitudes are increased and the time base decreased;
- b) time compression: where the amplitude history is retained and the time base is decreased (increase of the frequency);
- c) decimation: where time slices of the historical data are removed when the amplitudes are below a specified threshold value.

The amplification method as stated in item a) above, is used in this document and together with the publications referred to in Clause 2; it defines the default test procedure to be followed when vibration testing items for use on railway vehicles.

Whilst this document is primarily concerned with railway vehicles on fixed rail systems, its wider use is not precluded. For systems operating on pneumatic tyres, or other transportation systems such as trolleybuses, where the level of shock and vibration clearly differ from those obtained on fixed rail systems, specific test levels can be considered. In that case, the frequency spectra and the shock duration and amplitude are computed in compliance with the guidelines in Annex A.

Annex F provides the functional random vibration load that can be considered by the user for urban vehicles operating on pneumatic tyres.

This document applies to single axis testing. However, multi-axis testing is possible.

The anchoring bolts at the fixing point(s) of the equipment are not evaluated in this document.

This document is intended to evaluate equipment which is attached to the main structure of the vehicle (and components mounted thereon). It is not intended to test equipment which forms part of the main structure. Main structure in the sense of this document means car body, bogie and axle.

The following items are out of scope of this document:

- the traction motors for railway vehicles;
- any mechanical substructure not equipped with electrical, electronic or pneumatic component.

Additional or special vibration tests for some specific equipment are not specified in this document, for example:

- a) equipment mounted on, or linked to, items which are known to produce defined frequency excitation;
- b) equipment such as pantographs, shoe gear, or suspension components which are known to be exposed to specific shock and vibration excitation;
- c) equipment intended for use in special operational environments as specified by the customer;
- d) transportation and handling tests.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60068-2-27, *Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock*

IEC 60068-2-47, *Environmental testing - Part 2-47: Test - Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-64:2008, *Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance*

IEC 60068-2-64:2008/AMD1:2019

ISO 3534-1, *Statistics - Vocabulary and symbols - Part 1: General statistical terms and terms used in probability*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60068-2-64, ISO 3534-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

random vibration

vibration the instantaneous value of which cannot be precisely predicted for any given instant of time

3.1.2

Gaussian distribution

continuous distribution with probability density function equal to:

$$P_x(x) = \frac{1}{\sigma \sqrt{2 \times \pi}} \times e^{\frac{-(x - \bar{x})^2}{2 \times \sigma^2}}$$

where

- σ is the standard deviation;
- x is the instantaneous value;
- $\bar{x}$ is the mean value of x .

Note 1 to entry: See Figure 1.