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Railway applications – Rolling stock equipment – Shock and vibration tests

Applications ferroviaires – Matériel roulant – Essais de chocs et vibrations

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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RAILWAY APPLICATIONS – ROLLING STOCK EQUIPMENT – SHOCK AND VIBRATION TESTS

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

This second edition cancels and replaces the first edition, issued in 1999 and constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

– change of the method to calculate the acceleration ratio which has to be applied to the functional ASD value to obtain the simulated long-life ASD value;
– addition of the notion of partially certified against this standard;
– suppression of Annex B of the first edition due to the new method to calculate the acceleration ratio;
– addition of guidance for calculating the functional RMS value from service data or the RMS value from ASD levels of Figures 2 to 5.

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The text of this standard is based on the following documents:

FDIS	Report on voting
9/1386/FDIS	9/1397/RVD

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

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

The tests contained within this standard 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 standard have been derived from actual service measurements submitted by various bodies from around the world.

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

Engineering judgement and experience is required in the execution and interpretation of this standard.

This standard is suitable for design and validation purposes; however, it does not exclude the use of other development tools (such as sine sweep), which may 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 may be performed on prototypes in order to gain design information about the product performance under random vibration. However, for test certification purposes the tests have to be carried out on equipment taken from normal production.

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RAILWAY APPLICATIONS – ROLLING STOCK EQUIPMENT – SHOCK AND VIBRATION TESTS

1 Scope

This International Standard 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 has to withstand 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 a) above, is used in this standard 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. However, other standards exist and may be used with prior agreement between the manufacturer and the customer. In such cases test certification against this standard will not apply. Where service information is available tests can be performed using the method outlined in Annex A. If the levels are lower than those quoted in this standard, equipment is partially certified against this standard (only for service conditions giving functional test values lower than or equal to those specified in the test report).

Whilst this standard 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, the supplier and customer can agree on the test levels at the tender stage. It is recommended that the frequency spectra and the shock duration/amplitude be determined using the guidelines in Annex A. Equipment tested at levels lower than those quoted in this standard cannot be fully certified against the requirements of this standard.

An example of this is trolleybuses, whereby body-mounted trolleybus equipment could be tested in accordance with category 1 equipment referred to in the standard.

This standard applies to single axis testing. However multi-axis testing may be used with prior agreement between the manufacturer and the customer.

The test values quoted in this standard have been divided into three categories dependent only upon the equipment's location within the vehicle.

Category 1 Body mounted

Class A Cubicles, subassemblies, equipment and components mounted directly on or under the car body.

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Class B Anything mounted inside an equipment case which is in turn mounted directly on or under the car body.

NOTE 1 Class B should be used when it is not clear where the equipment is to be located.

Category 2 Bogie mounted

Cubicles, subassemblies, equipment and components which are to be mounted on the bogie of a railway vehicle.

Category 3 Axle mounted

Subassemblies, equipment and components or assemblies which are to be mounted on the wheelset assembly of a railway vehicle.

NOTE 2 In the case of equipment mounted on vehicles with one level of suspension such as wagons and trucks, unless otherwise agreed at the tender stage, axle mounted equipment will be tested as category 3, and all other equipment will be tested as category 2.

The cost of testing is influenced by the weight, shape and complexity of the equipment under test. Consequently at the tender stage the supplier may propose a more cost-effective method of demonstrating compliance with the requirements of this standard. Where alternative methods are agreed it will be the responsibility of the supplier to demonstrate to his customer or his representative that the objective of this standard has been met. If an alternative method of evaluation is agreed, then the equipment tested cannot be certified against the requirement of this standard.

This standard is intended to evaluate equipment which is attached to the main structure of the vehicle (and/or components mounted thereon). It is not intended to test equipment which forms part of the main structure. Main structure in the sense of this standard means car body, bogie and axle. There are a number of cases where additional or special vibration tests may be requested by the customer, for example:

a) equipment mounted on, or linked to, items which are known to produce fixed frequency excitation;

b) equipment such as traction motors, pantographs, shoegear, or suspension components which may be subjected to tests in accordance with their special requirements, applicable to their use on railway vehicles. In all such cases the tests carried out should be dealt with by separate agreement at the tender stage;

c) equipment intended for use in special operational environments as specified by the customer.

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.

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-47:2005, *Environmental testing – Part 2-47: Tests – 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*

ISO 3534-1:2006, *Statistics – Vocabulary and symbols – Part 1: Probability and general statistical terms*

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APPLICATIONS FERROVIAIRES – MATÉRIEL ROULANT – ESSAIS DE CHOCS ET VIBRATIONS

AVANT-PROPOS

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La Norme internationale CEI 61373 a été établie par le comité d'études 9 de la CEI: Matériels et systèmes électriques ferroviaires.

Cette deuxième édition annule et remplace la première édition, parue en 1999, dont elle constitue une révision technique.

Les principaux changements techniques par rapport à l'édition précédente sont les suivants:

– changement de la méthode pour calculer le taux d'accélération qui doit être appliqué à la valeur fonctionnelle de la densité spectrale d'accélération (ASD) pour obtenir une valeur simulée d'ASD sur le long terme;
– ajout de la notion de certification partielle par rapport à la norme;
– suppression de l'Annexe B de la première édition compte tenu de la nouvelle méthode de calcul du taux d'accélération;

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– ajout de recommandations pour le calcul de la valeur efficace fonctionnelle à partir des données de service, ou de la valeur efficace à partir des niveaux d'ASD des Figures 2 à 5.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
9/1386/FDIS	9/1397/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

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