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Railway applications - Rolling stock equipment - Shock and vibration tests

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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 (ASD) 19
6.5.3 Root mean square value (RMS) 19
6.5.4 Probability density function (PDF) 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

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 ASD 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 RMS values from ASD values or levels 59
D.1 General 59
D.2 Calculation of the functional RMS value from the service data 59
D.3 Calculation of the RMS values from ASD 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

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 ASD 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 – ASD spectra 23
Figure 7 – Category 1 – Class B – Body-mounted – ASD spectra 26
Figure 8 – Category 2 – Bogie mounted – ASD spectra 28
Figure 9 – Category 2 – Bogie mounted – Validity plan for default ASD spectra 29
Figure 10 – Category 3 – Axle mounted – ASD 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 – ASD 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

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 RMS 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

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Railway applications - Rolling stock equipment - Shock and vibration tests

FOREWORD

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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;

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, shoegear, 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.