

RAUDTEEALASED RAKENDUSED. RAUDTEEEVEEREM.
PUHVRID

Railway applications - Railway rolling stock - Buffers

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 15551:2017 sisaldab Euroopa standardi EN 15551:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 15551:2017 consists of the English text of the European standard EN 15551:2017.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 11.01.2017.	Date of Availability of the European standard is 11.01.2017.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 45.060.01

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Railway applications - Railway rolling stock - Buffers

Applications ferroviaires - Matériel roulant ferroviaire
- Tampons

Bahnanwendungen - Schienenfahrzeuge - Puffer

This European Standard was approved by CEN on 24 September 2016.

CEN 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 CEN 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 CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword.....	7
Introduction	9
1 Scope.....	10
2 Normative references.....	10
3 Terms and definitions	11
4 Classification and designation.....	14
4.1 General.....	14
4.2 Buffers with buffer stroke 105 mm (Categories A, B and C).....	14
4.3 Buffers with buffer stroke 110 mm	14
4.4 Long stroke buffer 150 mm	14
4.5 Crashworthy Buffers	15
4.6 Interaction coupling/buffer	15
5 Requirements	15
5.1 General.....	15
5.2 Fixing on vehicle and interchangeability	17
5.3 Buffer dimensions.....	18
5.4 Mechanical characteristics of buffers	19
5.5 Elastic systems	20
5.5.1 Types of elastic systems.....	20
5.5.2 Static characteristics.....	21
5.5.3 Dynamic characteristics	22
5.5.4 Type testing.....	22
5.6 Marking.....	22
6 Housing.....	24
6.1 Plunger and base	24
6.2 Buffer head	24
6.2.1 Materials.....	24
6.2.2 Boundary dimensions	24
6.2.3 Standard dimensions of buffer head.....	25
6.3 Type and series tests.....	26
7 Crashworthy buffers	28
7.1 On wagons.....	28
7.2 On other vehicles.....	28
Annex A (normative) Maximum space envelope of buffer	29
A.1 Requirements for space envelope of buffer	29
A.1.1 Buffers for freight wagons	29
A.1.2 Buffers for coaches	32
A.2 Notes on the definition of envelopes for overall dimensions of Buffers for freight wagons	33
A.2.1 General.....	33
A.2.2 Study relating to definition of the envelope.....	34
Annex B (normative) Mechanical characteristics of buffers – Test methods	36
B.1 General.....	36

B.2	Test methodology	36
B.2.1	General	36
B.2.2	Force F1	37
B.2.3	Force F2	37
B.2.4	Force F3	37
B.2.5	Force F4	37
B.2.6	Force F5	37
B.2.7	Force F6	38
B.3	Test documentation	38
Annex C (normative)	Requirements for elastic systems	40
C.1	Rubber elastomer or other elastomer elastic systems	40
C.1.1	General	40
C.1.2	Metal inserts	40
C.1.3	Constituents of rubber elastomer and/or other elastomer systems	40
C.1.4	Static characteristics of the sets	42
C.1.5	Dynamic characteristics of the sets	42
C.1.6	Bonding	42
C.1.7	Marking	42
C.1.8	Inspection and tests	42
C.2	Friction spring/ring spring	44
C.2.1	Manufacturer's marks	44
C.2.2	Flexibility test	44
C.2.3	Endurance test	45
C.2.4	Static characteristics for friction spring/ring spring	45
C.2.5	Dynamic characteristics for friction spring/ring spring	45
C.3	Hydrodynamic or hydrostatic systems	45
C.3.1	General	45
C.3.2	Absorbing energy medium	46
C.3.3	Static tests of capsules	46
C.4	Combined elastic systems	46
Annex D (normative)	Testing of static characteristics of buffers	47
D.1	Test principle	47
D.2	Test procedure	47
D.3	Measurements	47
Annex E (normative)	Dynamic testing	48
E.1	Dynamic testing of buffer	48
E.1.1	General	48
E.1.2	Temperature effects	50
E.2	Dynamic characteristics of 105 mm stroke buffer	50
E.2.1	Test programme	50
E.2.2	Category A	52
E.2.3	Category B	52
E.2.4	Category C	53
E.2.5	Comments on the test conditions	53
E.3	Dynamic characteristics of 150 mm stroke buffer	53
E.3.1	General	53
E.3.2	Comments on test conditions	54
E.4	Dynamic characteristics of 110 mm stroke buffer	55
Annex F (normative)	Endurance testing under service load for elastic system	56
F.1	Aim of the test	56
F.2	Test principle	56

F.3	Test results to be obtained	56
F.4	Test procedure	57
F.4.1	Endurance test assembly.....	57
F.4.2	Preliminary static test.....	57
F.4.3	Endurance test	58
F.4.4	Final static test	58
Annex G (normative)	Endurance testing under buffing load for life-cycle simulation	59
G.1	Endurance tests for elastic systems for wagons	59
G.1.1	Aim of the test.....	59
G.1.2	Test principle.....	59
G.1.3	Test results to be obtained	59
G.1.4	Test procedure.....	59
G.1.5	Delivery of elastic systems.....	61
G.2	Endurance tests for elastic systems for coaches.....	62
G.2.1	General.....	62
G.2.2	Tests under alternating loads.....	62
G.2.3	Repeated buffing tests.....	63
G.2.4	Conditions to be observed	63
Annex H (informative)	Guidelines for buffer head materials	64
H.1	Example of test program requirements for verification of buffer head materials	64
H.2	Buffer head materials.....	65
Annex I (normative)	Calculation of the width of buffer heads.....	67
I.1	General.....	67
I.1.1	Introduction	67
I.1.2	Comments on the preparation of the formulae in this annex.....	67
I.1.3	Track.....	67
I.1.4	Vehicle.....	67
I.2	Data used in the calculation	68
I.3	Calculation	68
Annex J (normative)	Crashworthy buffers for tank wagons.....	72
J.1	Requirements on crashworthy buffers	72
J.1.1	Objectives.....	72
J.1.2	Additional requirements.....	72
J.2	Test procedure for crashworthy buffers	72
Annex K (normative)	Maximum space envelope of crashworthy buffers.....	74
Annex ZA (informative)	Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC	77
Bibliography	80
Figures		
Figure 1	— Force-stroke diagram for stored and absorbed energy	13
Figure 2	— Mounting of buffers with non-metallic insert or head (top view for freight wagons).....	17
Figure 3	— Fixing dimensions of 105 mm and 150 mm stroke buffers for interchangeability	18
Figure 4	— Points of application of forces.....	20
Figure 5	— Location of the mark.....	22
Figure 6	— Marking	23

Figure 7 — Boundary dimensions and minimum surface of buffer heads.....	25
Figure A.1 — Dimension of the maximum space envelope of buffer – Side view	29
Figure A.2 — Cross section A – A.....	30
Figure A.3 — Cross section B – B.....	30
Figure A.4 — Cross section C – C	30
Figure A.5 — Cross section D – D	31
Figure A.6 — Cross section E – E	31
Figure A.7 — Cross section F – F	32
Figure A.8 — Dimension of the buffer: Cross sections G – G, H – H, K – K and L – L	32
Figure A.9 — Dimension of the maximum space envelope of buffer for coaches – Side view.....	33
Figure B.1 — Location of measurement.....	36
Figure B.2 — Tool for application of force F3.....	37
Figure F.1 — Definition of heights	56
Figure F.2 — Representation of the stored energy.....	57
Figure F.3 — Endurance test under service load.....	58
Figure G.1 — Determination of the buffer strokes for endurance test.....	60
Figure I.1 — The position of the bogie vehicles in the track	70
Figure I.2 — The position of the other vehicles (non bogie vehicles) in the track.....	71
Figure K.1 — Dimension of the maximum space of the buffer	74
Figure K.2 — Cross section A – A	75
Figure K.3 — Cross section B – B	75
Figure K.4 — Cross section C – C	75
Figure K.5 — Cross section D – D	76
Figure K.6 — Dimension of the buffer: Cross section E – E, F – F, G – G and H – H.....	76
Tables	
Table 1 — Buffer stroke 105 mm	14
Table 2 — Testing on buffers or their components.....	16
Table 3 — Buffer dimensional characteristics.....	18
Table 4 — Proof loads for buffers	19
Table 5 — Static characteristics	21
Table 6 — Standard widths of buffer heads	26
Table 7 — Type and series tests	27
Table B.1 — Measurement protocol (example).....	39
Table C.1 — Characteristics of the constituents	40
Table C.2 — Nature of inspections and tests.....	43
Table C.3 — Number of flexibility tests per batch of springs.....	45

Table C.4 — Characteristics of absorbing energy medium	46
Table E.1 — Standard high-sided open wagon	48
Table E.2 — Characteristics and requirements with regard to both the test set-up and measuring and technical assessment	49
Table E.3 — Wagons – Buffers with a stroke of 105 mm, Definition of dynamic tests	51
Table E.4 — Definition of dynamic tests	54
Table E.5 — Dynamic characteristics of 110 mm stroke buffers	55
Table G.1 — Hydrodynamic buffers.....	62
Table G.2 — Hydrostatic buffers	62
Table H.1 — Verification of buffer head materials.....	64
Table H.2 — List of selection of existing buffer head materials	66
Table I.1 — Vehicle specification and valid methodology	69
Table ZA.1 — Correspondence between this European Standard, the Commission Regulation concerning the technical specification for interoperability relating to the subsystem ‘rolling stock – freight wagons’ of the rail system in the European Union and repealing Commission Decision 2006/861/EC, as amended by Commission Regulation (EU) 2015/924 (published in the Official Journal L 150, 17.06.2015, p.10); and Directive 2008/57/EC.....	78
Table ZA.2 — Correspondence between this European Standard, the Commission regulation (EU) No 1302/2014 of 18 November 2014 concerning the technical specification for interoperability relating to the ‘rolling stock locomotives and passenger rolling stock’ of the rail system in the European Union (published in the Official Journal L 356, 12.12.2014, p.228) and Directive 2008/57/EC	79

European foreword

This document (EN 15551:2017) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2017 and conflicting national standards shall be withdrawn at the latest by July 2017.

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

This document supersedes EN 15551:2009+A1:2010.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

NOTE After the publication of EN 16839, *Railway applications — Rolling stock — Head stock layout*, as a European Standard, the overlapping content and all items not pertinent to the product "Buffer" will be removed from this document.

Compared with EN 15551:2009+A1:2010, the following main changes have been done:

- a) the "Introduction" was checked upon and revised;
- b) Clause 1 "Scope" was revised;
- c) Clause 2 "Normative references" as well the final "Bibliography" were checked upon and revised;
- d) Clause 3 was modified:
 - 1) damping (3.11) was deleted and the calculation of damping in 3.8;
 - 2) definitions of stored energy and absorbed energy for static and dynamic condition were added as 3.12 to 3.15;
 - 3) the term "technical specification" was added as 3.16;
- e) the term "elastic device" was replaced by "elastic system";
- f) the classification of crashworthy buffers was added as new Subclause 4.5;
- g) tests for type tests and series tests were defined in the new Table 2 and modified in Table 7;
- h) the static requirements in Table 5 have been changed;
- i) Table C.2 "Nature of inspection and tests" was revised;

- j) for friction and ring springs the two Subclauses C.2.4 "Static characteristics" and C.2.5 "Dynamic characteristics" were added;
- k) Annex E was revised with the specification of the high sided test wagons;
- l) Table H.1 was revised and new materials were added;
- m) Annex I was modified to be analogous to prEN 16839 (this annex will be deleted after EN 16839 is published);
- n) in Annex J, the test for crashworthy buffers was modified;
- o) the following figures were modified:
 - 1) Figure 1 — Force-stroke diagram for stored and absorbed energy;
 - 2) Figure 2 — Mounting of buffers with non metallic inserts or heads;
 - 3) Figure 6 — Marking;
 - 4) Figure 7 — Boundary dimensions and minimum surface of buffer heads;
 - 5) Figure A.1 — Dimension of the maximum space envelope of buffer – Side view;
 - 6) Figure B.1 — Location of measurement;
 - 7) Figure K.1 — Dimension of the maximum space of the buffer;
- p) editorial modifications were carried out.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard is based on UIC 526-1, UIC 526-3, UIC 527-1, UIC 528, UIC 573, UIC 827-1 and UIC 827-2.

This document is a preview generated by EVS

1 Scope

This European Standard defines the requirements for buffers with 105 mm, 110 mm and 150 mm stroke for vehicles or units which use buffers and screw coupling. It covers the functionality, interfaces and testing procedures, including pass fail criteria, for buffers.

NOTE 1 Typically, buffers with a stroke of 105 mm are used on freight wagons and locomotives, buffers with a stroke of 110 mm are used on coaches and locomotives and buffers with a stroke of 150 mm are used on freight wagons.

It defines the different categories of buffers, the space envelope, static and dynamic characteristics and energy absorption.

It includes a calculation method to determine the minimum size of the buffer head to avoid override between buffers.

It defines the static and dynamic characteristics of the elastic systems.

It also defines the requirements for buffers with integrated crash elements (crashworthy buffers) for tank wagons for dangerous goods.

The requirements of this European Standard also apply to buffers of locomotives and passenger coaches which need to meet the crashworthiness requirements of EN 15227 for normal service only. The properties for the energy absorbing function are defined in EN 15227 and the requirements specified in Clause 7 for tank wagons for dangerous goods are not applicable to the buffers of these locomotives and passenger coaches.

Diagonal buffers are excluded from this European Standard.

For the crashworthy buffers of locomotives, cab cars or passenger coaches according to EN 15227, and tank wagons for dangerous goods or buffers which form part of a combined system consisting of a special buffer and a deformation element, interchangeability with freight wagon buffers is not required, and therefore the requirements of 5.2 (Fixing on vehicle and interchangeability), 5.3 (Buffer dimensions) do not apply, those of 5.4 (Mechanical characteristics of buffers) and 5.6 (Marking) apply with restrictions.

NOTE 2 For tank wagon subjected to dangerous goods regulation, see [35].

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1370, *Founding — Examination of surface condition*

EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10168, *Steel products — Inspection documents — List of information and description*

EN 10204, *Metallic products — Types of inspection documents*

EN 10243-1, *Steel die forgings — Tolerances on dimensions — Part 1: Drop and vertical press forgings*

EN 12663 (all parts), *Railway applications — Structural requirements of railway vehicle bodies*

EN 15227, *Railway applications — Crashworthiness requirements for railway vehicle bodies*

EN ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1)*

EN ISO 148-2, *Metallic materials — Charpy pendulum impact test — Part 2: Verification of testing machines (ISO 148-2)*

EN ISO 148-3, *Metallic materials — Charpy pendulum impact test — Part 3: Preparation and characterization of Charpy V-notch test pieces for indirect verification of pendulum impact machines (ISO 148-3)*

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868)*

EN ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1)*

EN ISO 6507-2, *Metallic materials — Vickers hardness test — Part 2: Verification and calibration of testing machines (ISO 6507-2)*

EN ISO 6507-3, *Metallic materials — Vickers hardness test — Part 3: Calibration of reference blocks (ISO 6507-3)*

EN ISO 6507-4, *Metallic materials — Vickers hardness test — Part 4: Tables and hardness values (ISO 6507-4)*

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1)*

EN ISO 11469, *Plastics — Generic identification and marking of plastics products (ISO 11469)*

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 815-1, *Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures*

ISO 815-2, *Rubber, vulcanized or thermoplastic — Determination of compression set — Part 2: At low temperatures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

buffer

absorber device of compressible type, comprising a housing and an elastic system, fitted at each side of the end of vehicles which need to be in contact with other rolling stock

Note 1 to entry: For this European Standard, buffer means side buffer.