SLOVENSKI STANDARD
SIST EN 15551:2009

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Železniške naprave - Železniška vozila - Odbojniki

Railway applications - Railway rolling stock - Buffers

Bahnanwendungen - Schienenfahrzeuge - Puffer

Applications ferroviaires - Matériel roulant ferroviaires - Tampons

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45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 15551:2009) 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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

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Introduction

The main purpose of normative documents used until now for the delivery of buffers (UIC leaflets, national standards) was a complete definition of the acceptance procedures and of the buffers characteristics which were to be verified.

Product qualification was sometimes mentioned but the procedures used and the product characteristics to be verified during qualification were not given.

This European Standard addresses all buffer characteristics that are assembly characteristics and finished product characteristics and do not arise from a choice of design parameters such as diameters, interferences, materials etc.

The buffer and its components are delivered by suppliers that operate a quality system.

NOTE The quality systems used should offer equivalence with EN ISO 9001.

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.

For coaches the technical content at present is limited to that given in UIC 528:2007.

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 at the coupling interface with other interoperable rolling stock. It covers the functionality, interfaces and testing procedures, including pass fail criteria, for buffers.

NOTE 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 only according to RID.

The requirements of this European Standard also apply to locomotives and passenger coaches which have to meet the crashworthiness requirements of EN 15227 for buffers in 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 according to RID are not applicable to locomotives and passenger coaches.

Diagonal buffers are excluded from this European Standard.

For vehicles which have to comply with crashworthiness requirements (locomotives, cab cars or passenger coaches according to EN 15227, tank wagons according to RID), typically crashworthy buffers (buffers with a deformable housing and/or the need for an opening in their mounting flange) or buffers which form part of a combined system consisting of a special buffer (e.g. middle flange buffer) and a deformation element are used. For these types of buffers, interoperability is possible, but 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.

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.

EN 1369, *Founding — Magnetic particle inspection*

EN 1370, *Founding — Surface roughness inspection by visualtactile comparators*

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

EN 10204:2004, *Metallic products — Types of inspection documents*

prEN 12663-2, *Railway applications — Structural requirements of railway vehicle bodies — Part 2: Freight wagons*

EN 15085-5, *Railway applications — Welding of railway vehicles and components — Part 5: Inspection, testing and documentation*

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

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:2003)*

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 constituted by housing, elastic system, buffer head and flange fitted at each side of the end of wagons which have to be in contact with other interoperable rolling stock

NOTE For this European Standard, buffer means side buffer.

3.2
housing
assembly consisting of a plunger, a buffer base and an anti-rotation device but without elastic system

NOTE Casing or body are other words for housing, but only housing is used in this European Standard.

3.3
plunger
movable part of the housing consisting of a sliding and guiding tube and an active face named buffer head

3.4
base
part of the housing fixed to the wagon headstock

NOTE The base consists of a guiding tube and a supporting plate (flange)

3.5
anti-rotation device
device preventing the rotation of the plunger around the longitudinal axis of the buffer

3.6
elastic system
system allowing the reversible deflection of the plunger and absorbing energy during buffing or running operation

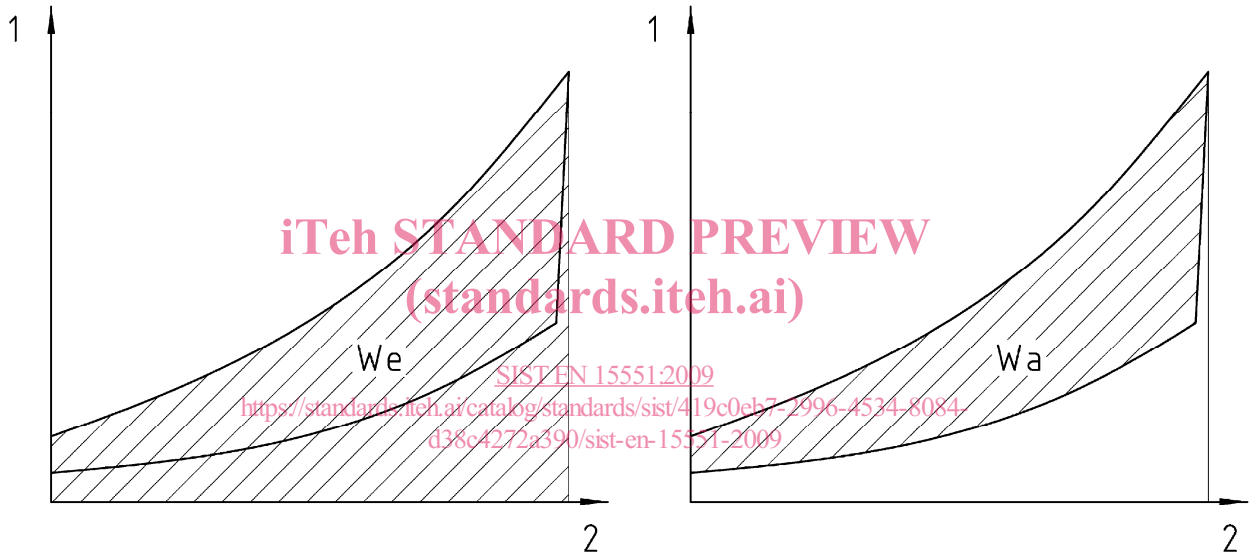
NOTE Spring system is another common word for elastic system.

3.7
stored energy
W_e
energy (W_e) stored by a buffer for a given elasticity stroke

NOTE The stored energy is represented, on the force-stroke diagram, by the area lying between the compressive curve, the axis of the abscissa and the straight line, perpendicular to the axis, corresponding to the stroke under consideration, see Figure 1.

3.8
absorbed energy
W_a
energy (W_a) absorbed by a buffer for a given elasticity stroke

NOTE The absorbed energy is represented, on the force-stroke diagram, by the area lying between the compressive curve and the return curve, see Figure 1.



Key

1 force in kN

2 stroke in mm

W_e stored energy in kJ

W_a absorbed energy in kJ

Figure 1 — Force-stroke diagram for stored and absorbed energy

3.9
dynamic working capacity
stored energy under dynamic test conditions obtained during the impact between two wagons

3.10
damping
A
ratio of absorbed energy divided by stored energy

NOTE It is calculated using the following equation:

$$A = \frac{W_a}{W_e} \times 100$$

where:

A is the damping;

W_a is the absorbed energy;

W_e is the stored energy.

3.11
crashworthy buffer
buffer with an additional function to allow plastic deformation to absorb energy for abnormal impacts

4 Classification and designation

4.1 General

Buffers are classified according to their stroke and their dynamic energy capacity W_{ed}.

4.2 Buffers with buffer stroke 105 mm (Categories A, B and C)

These buffers are classified according to their dynamic energy capacity W_{ed} as specified in Table 1.

Table 1 — Buffer stroke 105

Buffer category	Dynamic energy capacity W_{ed}
A	≥ 30 kJ
B	≥ 50 kJ
C	≥ 70 kJ

4.3 Buffers with buffer stroke 110 mm

Buffers with a stroke of 110 mm are generally used on coaches to protect them against buffing impacts at speeds of up to 10 km/h.

Designation is reserved for this issue of the European Standard.

NOTE UIC 528 does not specify a designation for this buffer.

4.4 Long stroke buffer 150 mm

Wagons used for carriage of impact-sensitive goods may be fitted with 150 mm stroke buffers in order to maintain the accelerations exerted on goods at the lowest level possible while complying with the minimum requirements of prEN 12663-2.

NOTE The possibilities for use of hydrodynamic buffers are described in ERRI Report B36/RP 30.

150 mm-stroke buffers are designated by the letter "**L**".

4.5 Interaction coupling/buffer

To ensure that the train is able to negotiate curves at 150 m radius safely, the static characteristics of draw gears and buffers should be coordinated.

NOTE Refer to prEN 15839 for details.

5 Requirements

5.1 General

Two buffers shall be fitted at each vehicle end with the same elastic system, category, head dimension, stroke and type of housing.

Housings which differ only in the buffer head plate material or insert are considered to be identical.

NOTE When a non-metallic insert or head is provided on one of the 2 buffers per wagon end, it should be placed diagonally according to Figure 2.

Key

1 Buffer with metallic head

2 Buffer with non-metallic insert or head

Figure 2 — Mounting of buffers with non-metallic insert or head (top view for freight wagons)

5.2 Fixing on vehicle and interchangeability

The buffers shall be fixed to the vehicle headstock by means of four bolted M 24 fasteners.

For 105 mm and 150 mm stroke buffers for freight wagons, dimensions and spacing needed on headstock for the buffer support plate for interchangeability are given in Figure 3.

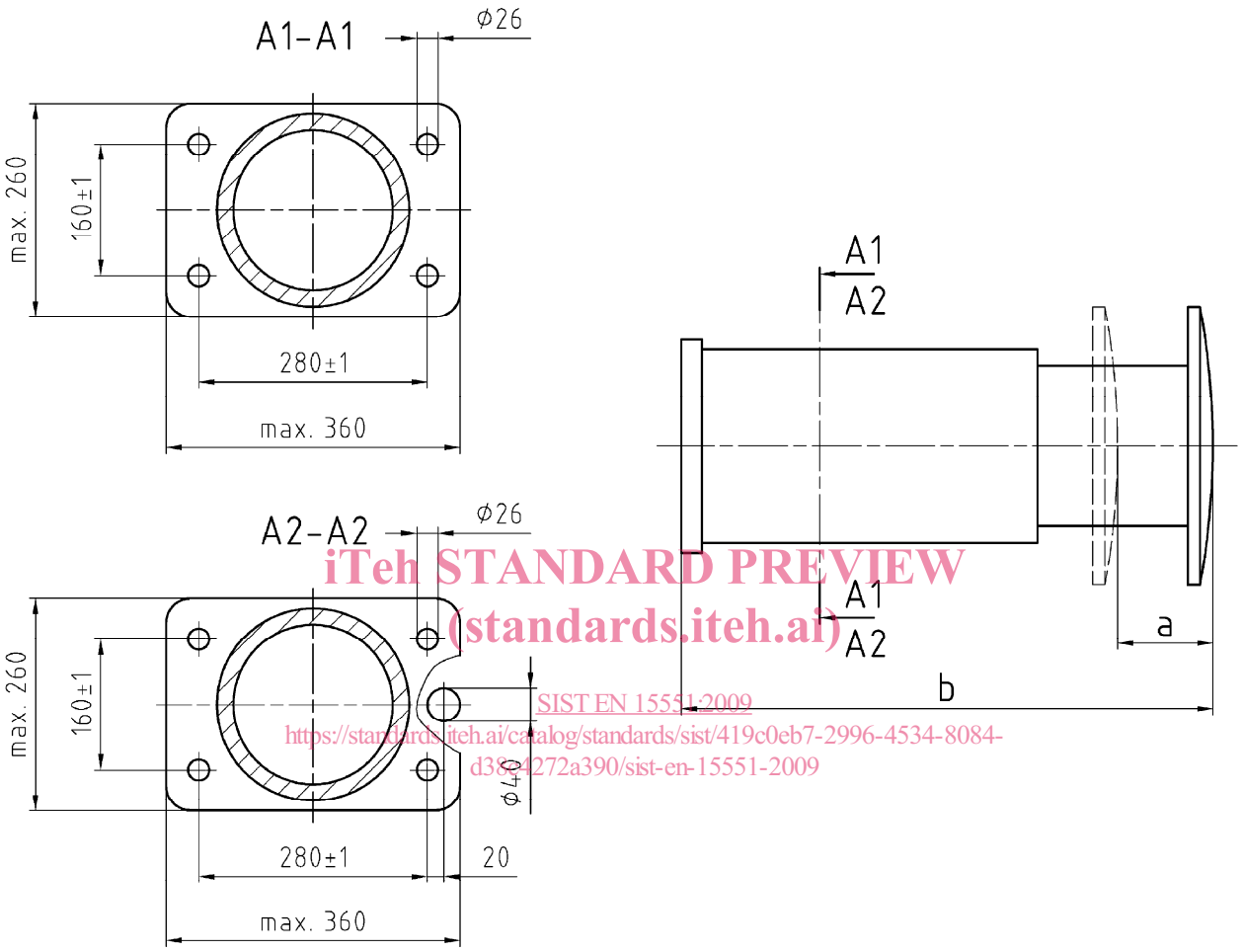
The 105 mm stroke buffer flange shall cover the location for the pin (see cross section A1-A1 of Figure 3). This pin is to prevent the fixing of a 105 mm stroke buffer where a long stroke buffer is required.

The 150 mm stroke buffer flange shall have a location for the pin (see the location in cross section A2-A2 of Figure 3).

For vehicles which have to comply with crashworthiness requirements (locomotives, cab cars or passenger coaches according to EN 15227, tank wagons according to RID), which use crashworthy buffers 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. For these vehicles, a different fixation of the buffers (e.g. concerning position of flange, bolt diameter, quantity of bolts and their position) may be used, and Figure 3 is not applicable.

Dimensions in millimetres



Key

A1 section is for 105 mm stroke buffer

A2 section is for long stroke buffer

a is the stroke 105 mm or 150 mm

b is the buffer length (see Table 2)

Figure 3 — Fixing dimensions of 105 mm and 150 mm stroke buffers for interchangeability

5.3 Buffer dimensions

Common dimensional characteristics for all buffer categories are provided in Table 2.

Table 2 — Buffer dimensional characteristics

Dimensions in millimetres

	Stroke 105 mm buffer	Stroke 110 mm buffer	Stroke 150 mm buffer
Stroke **a**	105_{-5}^{0}	110_{-5}^{0}	150_{-5}^{0}
Buffer length **b**	620	650	665

The spacing of the buffer is specified in Annex A.

The buffer shall be equipped with an anti-rotation device avoiding free rotation on longitudinal axis. The maximum allowed rotation is set at ± 2° for buffer when they are new.

The width of the buffer head shall be as specified in 6.2.

For locomotives, cab cars or passenger coaches according to EN 15227 equipped with crashworthy buffers or buffers which form part of a combined element consisting of a special buffer and a deformation element, a different position of the fixation flange and a spacing of bolts different from Figure 3 may be used, and the buffer length b defined in Table 2 is not applicable.

5.4 Mechanical characteristics of buffers

The entire buffer unit fitted to the wagon shall be capable of withstanding the loads specified in Table 3:

Table 3 — Proof loads for buffers

	Force F_i for stroke 105 mm and 150 mm	Force F_i for stroke 110 mm
Longitudinal force (centred) F1, exerted on the buffer head	≥ 2 500 kN	≥ 1 250 kN
Longitudinal force (off-centre) F2, exerted on the buffer head	≥ 500 kN	≥ 300 kN
Vertical force F3, exerted on the body of the buffer	≥ 200 kN	≥ 200 kN
Total longitudinal force F4, exerted by the base plate of the buffer on a test frame	≥ 2 500 kN	≥ 1 250 kN
Longitudinal force F5 for buffer heads > 450 mm, exerted on the buffer head	≥ 250 kN	-------
Life-cycle test on customer request, force F6	≥ 250 kN	-------

Conditions governing the application of these forces are set out in Figure 4.

The corresponding test methods are specified in Annex B.

After each of the tests F1, F2, F3 and F5, the buffer shall continue to be in a condition that allows normal functioning, and any permanent deformation shall fall within the tolerance range stipulated for manufacture. In addition, the diameters measured on the main buffer components shall not have changed by more than 0,2 %.

After Test F4, the base plate shall not show any permanent deformation.

After Test F6, no visible cracks shall appear.