SLOVENSKI STANDARD
oSIST prEN 15227:2017

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Železniške naprave - Zahteve za zagotavljanje pasivne varnosti vagonskih grodov pri trčenju

Railway applications - Crashworthiness requirements for railway vehicle bodies

Bahnanwendungen - Anforderungen an die Kollisionssicherheit von Schienenfahrzeugkästen

Applications ferroviaires - Exigences d'aptitude à la collision relatives aux caisses des véhicules ferroviaires

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45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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English Version

Railway applications - Crashworthiness requirements for railway vehicle bodies

Applications ferroviaires - Exigences de sécurité contre collision pour caisses des véhicules ferroviaires

Bahnanwendungen - Anforderungen an die Kollisionssicherheit von Schienenfahrzeugkästen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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

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European foreword

This document (prEN 15227:2016) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15227:2008+A1:2010.

This document has been prepared under a mandate given to CEN/CENELEC/ETSI 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.

Additionally to a general editorial reordering of clauses and text the technical changes with respect to the previous edition are listed below:

a) applicable vehicle types (Clause 1);

b) modified definitions and examples for crashworthiness design categories (5.1);

c) definition of trainsets to be assessed (5.2);

d) assessment of trainset which is only operated in one direction (5.2);

e) new requirements for locomotives with heavy duty couplers (5.4.2 and C.2);

f) mandatory requirement for locomotives with centre cabs to fulfil design collision scenario 3 (5.4);

g) additional reference obstacle for design collision scenario 3 for crashworthiness design category C-IV (5.4.5 and C.6);

h) exclusion of gangways from survival space (6.3.2);

i) mandatory requirement that the survival space for the driver shall be inside the cab (6.3.3);

j) modified survival space requirements for driver’s seat (6.3.5);

k) elimination of deceleration limits for design collision scenarios 3 (6.4.1);

l) modified deceleration limits for design collision scenarios 1 and 2 (6.4.1);

m) modified requirement for obstacle deflectors with respect to gauge limits (6.5.1);

n) specified energy absorption values for obstacle deflectors (6.5.1);

o) new requirements for lifeguards (6.6);

p) modified obstacle geometry for design collision scenario 3 for crashworthiness design category C-III (C.3);

q) modified reference train for individual coach design (D.4).

If a vehicle has been successfully assessed using the previous edition of this standard, and the technical changes of the new edition of EN 15227 do not affect this assessment, the vehicle may be regarded to conform to the new standard. Otherwise it is sufficient to assess only the modified technical requirements and new requirements.

Introduction

The objective of the passive safety requirements described in this European Standard is to reduce the consequences of collision accidents. The measures considered in this European Standard provide the last means of protection when all possibilities of preventing an accident have failed. It provides a framework for determining the crash conditions that railway vehicle bodies can be designed to withstand, based on the most common risks.

This European Standard adds to the basic strength requirement defined in EN 12663-1 by setting additional requirements for structural passive safety in order to increase occupant safety in case of collisions.

In the event of a collision, application of this European standard provides protection for the occupants of new designs of crashworthy vehicles through the preservation of structural integrity, reducing the risk of overriding and limiting decelerations. This protection does not extend to interactions between the occupants and the vehicle interior or to occupants of other rail vehicles, to other railway employees and customers who are not in vehicles, or to third parties.

1 Scope

This European Standard is applicable to new designs of locomotives and passenger carrying rolling stock (such as tram, metro, suburban, mainline and high-speed trains) taking into consideration the recommendations given in Annex E on the application of the standard (migration rule), and sets out crashworthiness requirements for new passenger rolling stock and locomotives with the exception of the following types:

— on track machines (OTMs);

— infrastructure inspection vehicles;

— vehicles reserved for a strictly historical or touristic use.

This European Standard identifies common methods of providing passive safety that may be adapted to suit individual vehicle requirements.

This European Standard specifies the characteristics of reference obstacle models for use with the design collision scenarios.

This European Standard also specifies the requirements and methods for demonstrating that the passive safety objectives have been achieved by comparison with existing proven designs, numerical simulation, component or full-size tests, or a combination of all these methods.

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 12663-1, *Railway applications — Structural requirements of railway vehicle bodies – Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)*

EN 15663, *Railway applications - Definition of vehicle reference masses*

3 Terms and definitions

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

3.1 General definitions

3.1.1
active safety
systems and measures which take actions that aim to prevent a collision occurring

3.1.2
collision mass
effective vehicle mass used for collision simulations

3.1.3
collision speed
v_C
velocity difference between trains or train and obstacle at the start of the collision

3.1.4
crashworthiness
ability to mitigate the consequences of a collision in a controlled manner and reduce the risk of injury to the occupants

3.1.5
crumple zone
part of the vehicle body (usually at the vehicle ends) which is designed to deform in a controlled manner and absorb energy

3.1.6
design collision scenario
collision scenario derived from accident analysis that is applicable for design and assessment

3.1.7
energy absorbing device
device which is attached to the vehicle structure, designed to deform in a controlled manner and absorb energy (e.g. energy absorbing coupler)

3.1.8
full-size test
test where the specimen is made using full-size components from the vehicle being assessed

3.1.9
heavy duty coupler
centre couplers conforming to the Willison (e.g. SA3) or Janney (AAR standard) principles

3.1.10
leading end
end of a vehicle which in normal service can be the front of a train

3.1.11
level crossing speed
v_{LC}
applicable vehicle speed at level crossing

3.1.12
lifeguard
structural element positioned in front of a wheel with the objective of preventing small obstacles from passing between the wheel and the rail

3.1.13
normal European operating conditions
operating conditions comparable to those described by the documents listed in the bibliography

3.1.14
passive safety
structural design characteristics intended to reduce the consequences of an accident

3.1.15
survival space
space to be preserved for passengers and staff inside a rail vehicle in case of a collision

3.1.16
workshop environment
location outside of the normal operational environment, typically a dedicated maintenance facility

3.2 Rolling stock definitions

3.2.1
coach
vehicle for general operation (3.2.4) without traction, capable of carrying passengers

Note 1 to entry: coaches are therefore also restaurant cars, sleeping cars, couchettes, etc.

3.2.2
driving trailer
vehicle with a driving cab, without traction equipment, for general operation (3.2.4)

Note 1 to entry: A coach equipped with a driver's cab may also be called a 'driving coach'. A van equipped with a driving cab may also be called a 'driving van'.

3.2.3
fixed formation
train formation that can only be reconfigured within a workshop environment

3.2.4
general operation
operation using a selection of vehicles which may be of different types in a train formation which is not defined at the design stage

3.2.5
locomotive
vehicle with at least one driving cab for general operation (3.2.4) (or combination of several vehicles) to provide traction power for a train, not intended to carry a payload and with the ability to operate independently

3.2.6
power head
vehicle for general operation (3.2.4) to provide traction power which is located at one end of a train, with a driving cab and is not intended to be uncoupled during normal operation

3.2.7
railcar
vehicle that can operate independently and is capable of carrying a payload (passengers or luggage/mail or freight)

3.2.8
reference train
train configuration that is used for the assessment and validation of locomotives (3.2.5), power heads (3.2.6), driving trailers (3.2.2) and coaches (3.2.1) that do not form part of a trainset (3.2.10)

3.2.9
train
operational formation consisting of one or more vehicles or trainsets (3.2.10)

3.2.10
trainset
fixed formation of vehicles that can operate independently as a train and which can only be reconfigured within a workshop environment

3.2.11
tramway
rail network exclusively or predominately for passengers, which operates in areas accessible to the public and road traffic and operation is typically by line-of-sight

3.3 Definitions for tramway operation

3.3.1
integrated on-street tramway
tramway where the rails are laid in the road and the area occupied by the rails is capable of being used by other vehicles or by pedestrians

3.3.2
segregated on-street tramway
tramway where the rails are laid within the boundaries of the road and the area occupied by the rails may be crossed by pedestrians, and by other vehicles at designated crossing points, but is not normally shared with other road vehicles except vehicles for maintenance purposes

3.3.3
line-of-sight operation
operation where the speed of the vehicles is limited to enable the driver to stop within the distance they can see to be clear ahead

4 Crashworthiness design of railway vehicle structures

4.1 General principles

The risk of train collisions is primarily controlled by active safety systems and/or operational procedures. Where these systems are inadequate due to particular circumstances or due to external events, structural crashworthiness provides a set of passive safety measures that will reduce the consequences of an accident.

The objective is to provide a level of protection consistent with the most common collision risks through the application of the design collision scenarios specified in this document. It is not practical to design vehicle structures to protect the occupants against all possible accidents or to consider all possible vehicle combinations.

Normal European operating conditions are assumed. The design of new vehicles for use in passenger trains assumes operations with compatible rolling stock that also meet this European standard. It is recognized that operational requirements may require new crashworthy and existing non-crashworthy vehicles to exist in the same train but such combinations of vehicles are not required to comply with this European Standard.

The applicable design collision scenarios, and suitable parameters for normal European operations are given in 5.3.

Annex A gives additional information regarding the derivation of the design collision scenarios and describes situations when they may need to be modified and the processes that should then be followed.

If the operational conditions are such that a design collision scenario cannot occur, or there is evidence that the probability of it occurring or the associated risk is so low as to be broadly acceptable, there is no need to consider this design collision scenario in the vehicle design. These conditions should be set out in the vehicle specification.

NOTE Train control systems which segregate different types of traffic on the same system may satisfy this requirement.

If the system has characteristics that result in significant collision risks that are not addressed by the design collision scenarios considered in this European standard, they should also be considered in the form of additional design collision scenarios, which should form part of the vehicle specification.

The requirements apply to the vehicle body, and to those mechanical elements directly associated with it that may be used to absorb energy in a collision, such as couplers, drawgear and buffing systems. The requirements do not cover the safety features of doors, windows, system components or interior features except for specific issues relating to the preservation of survival space.

Not all vehicles in a train have to incorporate energy absorption, provided that passenger train configurations formed entirely of new vehicle designs comply as a whole with this European Standard.

4.2 Crashworthiness design objectives

To provide protection for the occupants of rail vehicles in the event of a collision, the requirements take into account the following objectives:

— absorption of collision energy in a controlled manner;

— reduction of the risk of overriding;

— maintenance of survival space and structural integrity of occupied areas;

— limiting deceleration;

— reduction of the risk of derailment and the consequences of hitting a track obstruction.

Specific requirements and assessment criteria to demonstrate that these objectives are satisfied are set out in Clauses 5, 6 and 7 (see 4.3).

As a by-product of providing occupant protection, the level of damage to the vehicle body is likely to be reduced in accidents. If more restrictive limits are intended to be placed on damage resulting from any of the design collision scenarios set out in Clause 5, these should be part of the vehicle specification and do not form part of the safety requirements set out in this European Standard.

4.3 Rail vehicle crashworthiness assessment process

For a new railway vehicle, the stages of the crashworthiness assessment process shall be:

— allocation of a crashworthiness design category (see 5.1);

NOTE For some vehicle types more than one crashworthiness design category may be applicable.

— determination of the relevant train assessment methods (see 5.2 and Annex D) and determination of the applicable design collision scenarios (see 5.3 and 5.4). If non-standard design collision scenarios are required, see Annex A for guidance on the methods that should be adopted;

— assessment of the applicable design collision scenarios with respect to the applicable crashworthiness design criteria (see 5.4, Clause 6 and Annex C);

— validation of the crashworthiness assessment (see Clause 7 and Annex B).