



SLOVENSKI STANDARD

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Železniške naprave - Zahteve za sposobnost vožnje tirnih vozil v primeru požara

Railway applications - Requirements for running capability in case of fire on board of rolling stock

Bahnanwendungen - Anforderungen an die Fahrfähigkeit im Brandfall an Bord von Bahnfahrzeugen

Applications ferroviaires - Exigences en matière d'aptitude au roulement en cas d'incendie à bord des véhicules ferroviaires

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EUROPEAN STANDARD
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**Railway applications -
Requirements for running capability in case of fire on board of rolling
stock**

Applications ferroviaires -
Exigences en matière d'aptitude au
roulement en cas d'incendie à bord des
véhicules ferroviaires

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This document (EN 50553:2012) has been prepared by CLC/TC 9X, "Electrical and electronic applications for railways".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-01-23
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-01-23

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and supports essential requirements of EU Directives 96/48/EC (HSR) and 2001/16/EC (CONRAIL), both recast by 2008/57/EC (RAIL).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

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Introduction

The purpose of this European Standard is to define requirements for running capability under fire conditions which are applicable to railway rolling stock with passengers, so that a train will be able to reach a "safe area" as defined in the Safety in Rail Tunnels TSI (TSI SRT) 1.1.3.

Specifically, this standard is intended to clarify and rationalise the requirements for rolling stock running capability in the EN 45545 series (Operation Categories 2, 3 and 4) and in the TSI SRT (Fire Safety Categories A and B). It is also intended to define specific technical measures, compliance with which will allow a 'Presumption of Conformity' with the TSI SRT to be made by the Notified Body assessing the Rolling Stock.

NOTE 1 In several cases it might appear that requirements are included which are duplicating requirements given in the EN 45545 series and/or which are dealt with in other ways by the EN 45545 series. This is not the intention and is not the case. The EN 45545 series introduces running capability functional requirements but does not generally define how they are to be met nor to what level of performance. Also, a number of requirements which are included in the EN 45545 series, would be relevant to, or suitable for, running capability use but are not identified for this use within the TS. It is therefore necessary to include requirements which are apparently duplicating the EN 45545 series in this standard but which actually do not duplicate the TS when examined in detail. If desired it should be possible, when converting EN 45545 to an EN, to include these requirements during the process which would allow them to be removed from this standard.

Reference to Annex A shows that it is necessary for this standard specifically to address 4.2.5.5 of the TSI SRT.

This standard considers the requirement to "improve the probability that a passenger train with a fire on board will continue to operate..." in a "reasonably practicable" context. It is understood that "train" includes all vehicles such as locomotives and power cars which are associated with the passenger vehicles.

Requirements for running capability cannot be defined without a knowledge of other fire characteristics of the train, specifically its reaction to fire and fire resistance specification. The assumption is made that the fire standard applied is the EN 45545 series or any standard for which technical equivalence can be demonstrated.

NOTE 2 In defining conditions to assure running capability it is only the intention to define requirements which allow the train to remain capable of controlled movement. The general safety level of the train when operating under these conditions (for example the level of lighting within the saloon) is not within the scope. Matters such as this are dealt with in other standards (including, but not limited to, the EN 45545 series).

The standard defines requirements based on a philosophy which recognises that stopping a train is not itself a life-threatening event. It is therefore not required to have running capability for all fires; only those fires which may cause serious injury and/or develop to threaten life.

For example, situations such as the combustion of an individual electrical component inside a technical cabinet meeting criteria for fire resistance in accordance with the EN 45545 series, do not attract running capability requirements under this standard. In a similar manner, if any fire is extinguished with no reignition during the relevant period of the incident, it is deemed that there is no longer a requirement for running capability and the train can be stopped (as if it was a non-safety threatening technical fault). These examples illustrate how the impracticability of addressing all thermal events that could stop a train is circumvented by the philosophy applied.

Compliance with the running capability requirements for any relevant system function is derived from one or more of the following:

- absence of a relevant fire;
- assuring system function under the fire;
- assuring system function for a redundant array under the fire;
- extinguishing the fire;
- assuring sufficient remaining Tractive Effort under the fire.

NOTE 3 This document does not cover requirements regarding maintenance, cleaning or prevention of arson. Nevertheless these are important considerations in the management of fire safety and must be recognised by those using this standard. They may be covered appropriately by the Maintenance requirements of Technical Specifications for Interoperability and the Safety Management Systems of Railway Undertakings.

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1 Scope

This European Standard defines requirements for running capability under fire conditions which are applicable to passenger carrying railway rolling stock.

In particular, technical measures are specified, compliance with which will contribute to conformity with the Directive and the relevant Technical Specifications for Interoperability (TSI).

The standard specifies the fire conditions:

- for which it is not necessary to define running capability requirements as there is no significant potential for serious injury or threat to life;
- for which it is reasonable to expect trains to continue to run in a controlled manner;
- for which it is not reasonably practicable to define requirements which give complete assurance of running in a controlled manner, due to the exceptional nature of the fire incident.

The TSI SRT defines running capability requirements in respect of fires within technical areas/equipment only. However for general guidance the scope of this standard is extended to include fires from non-technical causes within passenger/staff areas which may impact train system functions adjacent to and/or passing through the affected area. This extension of applicability significantly increases the number of system functions which are potentially at risk and therefore requires that the "reasonably practicable" principles be extended to this new condition.

The standard does not consider situations where a primary non-fire incident is likely to immobilise the train by definition; for example major mechanical defect leading to derailment, even when fire then occurs.

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2 Normative references

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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 3-7 +A1	2004 2007	<i>Portable fire extinguishers — Part 7: Characteristics, performance requirements and test methods</i>
EN 54	Series	<i>Fire detection and fire alarm systems</i>
EN 403	2004	<i>Respiratory protective devices for self-rescue — Filtering devices with hood for escape from fire — Requirements, testing, marking</i>
EN 15663	2009	<i>Railway applications — Definition of vehicle reference masses</i>
CEN/TS 45545-1	2009	<i>Railway applications — Fire protection on railway vehicles — Part 1: General</i>
CEN/TS 45545-2	2009	<i>Railway applications — Fire protection on railway vehicles — Part 2: Requirements for fire behaviour of materials and components</i>
CEN/TS 45545-3	2009	<i>Railway applications — Fire protection on railway vehicles — Part 3: Fire resistance requirements for fire barriers</i>
CEN/TS 45545-4	2009	<i>Railway applications — Fire protection on railway vehicles — Part 4: Fire safety requirements for railway rolling stock design</i>
CLC/TS 45545-5	2009	<i>Railway applications — Fire protection on railway vehicles — Part 5: Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles</i>

CEN/TS 45545-6	2009	<i>Railway applications — Fire protection on railway vehicles — Part 6: Fire control and management systems</i>
CEN/TS 45545-7	2009	<i>Railway applications — Fire protection on railway vehicles — Part 7: Fire safety requirements for flammable liquid and flammable gas installations</i>
EN 50155	2001	<i>Railway applications — Electronic equipment used on rolling stock</i>
EN 50200	2006	<i>Method of test for resistance to fire of unprotected small cables for use in emergency circuits</i>
EN 50216-5	2002	<i>Power transformer and reactor fittings — Part 5; Liquid level, pressure and flow indicators, pressure relief devices and dehydrating breathers</i>
+ A1	2002	
+ A2	2005	
+ corr Oct.	2006	
+ A3	2006	
EN 50362	2003	<i>Method of test for resistance to fire of larger unprotected power and control cables for use in emergency circuits</i>
EN 60310	2004	<i>Railway applications — Traction transformers and inductors on board rolling stock (IEC 60310:2004)</i>
EN 61034-1	2005	<i>Measurement of smoke density of cables burning under defined conditions — Part 1: Test apparatus (IEC 61034-1:2005)</i>
EN ISO 15540	2001	<i>Ships and marine technology — Fire resistance of hose assemblies — Test methods (ISO 15540:1999)</i>
IEC 60331-3	2009	<i>Tests for electric cables under fire conditions — Circuit integrity — Part 3: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV tested in a metal enclosure</i>
ISO/TR 9705-2	2001	<i>Reaction to fire tests — Full scale room tests for surface products — Part 2: Technical background and guidance</i>

3 Terms and definitions

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

3.1 fire scenarios

3.1.1

type 1 fire

fire which, due to its size and/or location, presents no significant risk of serious injury or threat to life and for which it is not necessary to define running capability requirements

3.1.2

type 2 fire

fire which, due to its size and/or location, presents a risk of serious injury and/or threat to life and for which it is reasonably practicable to define running capability requirements

3.1.3

type 3 fire

fire which, due to its size and/or location, presents a risk of serious injury and/or threat to life but for which it is not reasonably practicable to assure running capability

3.1.4

reference Type 2 fire

fire which has the power vs. time profile of Ignition source 5 of CEN/TS 45545-1; 75kW for 2 minutes followed by 150 kW for 8 min

3.2 electrical power supplies

3.2.1

supply line

refer to CLC/TS 45545-5

3.2.2

traction circuit

refer to CLC/TS 45545-5

3.2.3 auxiliary supplies

3.2.3.1

auxiliary circuit

refer to CLC/TS45545-5

3.2.3.2

train power supply

refer to CLC/TS45545-5

3.2.3.3

battery supply circuit

refer to CLC/TS45545-5

3.3

equipment required for running capability

parts of the equipment required to assure the system function required for running capability

Note 1 to entry: For example, relevant parts of the brake system, control cables, power input and output cables, electrical/mechanical devices, the cooling circuit, auxiliary devices for feeding the blower motors and the air supply.

3.4

tractive effort (N)

sum of all the traction forces between the train and the track

3.5

fire resistance terminology (examples)

E15 and/or I15 are durations of Integrity (E) and Insulation (I) respectively

Note 1 to entry: Refer to CEN/TS 45545-3:2009, 6.1.

3.6

relevant period of the incident

period of the incident up to the time when the train has reached a "safe area" as defined in TSI SRT 1.1.3

3.7

system function (for equipment defined in 3.4)

function of a system including all aspects of the command and control arrangements for the system

3.8

technical cabinet

refer to CEN/TS 45545-6

3.9

decision box

running capability compliancy test in Figure 1. The number of the Decision Box reflects its position in the flow chart cascade process

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3.10**redundant array**

arrangement whereby a system function is assured by two or more independent systems and which continues to be fully assured when one of the systems fails

3.11**running capability (in case of a fire on board)**

ability of a train to reach a "Safe Area" (TSI SRT 4.2.2.6.1) in case of a fire on board

3.12**degraded mode**

state whereby less than nominally 100% of the system function capability can be achieved

4 Symbols and abbreviated terms

For the purposes of this document, the following symbols and abbreviations apply.

TSI	Technical Specification for Interoperability
TSI SRT	Safety in Railway Tunnels TSI (see Bibliography)
TSI HS RST	High Speed Rolling Stock TSI (see Bibliography)
CFD	Computational Fluid Dynamics
ATP	Automatic Train Protection
m	Design mass [kg] under payload according to EN 15663
t	Time [s] https://standards.iteh.ai/catalog/standards/sist/69b1847b-1a48-49cd-8276-1a71057235f1/sist-en-50553-2012
g	The vertical acceleration due to gravity; taken as 9,81 m.s ⁻² .
v_0	Initial velocity [m.s ⁻¹]
v_{lim}	Speed limit on the line [m.s ⁻¹]
i	Gradient of line [mm per m]
ρ	Curve radius of the line [m]
x	Distance from the beginning of the line under consideration to the position of the head of the train [m]; (thus $i(x)$ and $\rho(x)$)
l_t	Length of line under consideration [m]
	NOTE The length of the line under consideration is equal to the length of the structure, (for example tunnel or elevated structure), plus the length of the train.
$R(v)$	Running resistance as a function of velocity [N]
a, b, c	Coefficients ("a" [N]; "b" [Ns.m ⁻¹]; "c" [Ns ² .m ⁻²])
$F(v)$	Tractive effort [N] between the train and the track as a function of velocity
γ	Acceleration [m.s ⁻²]
Am	The Optical Density as defined in EN 61034-1

5 Methodology

5.1 Principles

It is not considered necessary to accommodate the spontaneous occurrence of two or more independent fires, therefore a single fire occurrence only shall be considered. The train is assumed to be in its normal operational state at the start of the analysis.

NOTE "Normal operational state" means that the train is assumed to have no defects which affect its running capability at the start of the analysis.

In defining requirements for running capability with a fire on board the train, the following must be considered:

- It is necessary to recognise that stopping a train is not, in itself, a life-threatening event and hence stopping a train with a fire which is either contained or will be extinguished, is also not life-threatening. Thus it is important only to define requirements for running capability for those fires which have the potential to cause serious injury and/or threaten life.
- It is possible to imagine fire incidents of such severity, possibly a severe arson event or fuel related catastrophic equipment failure, that there is no significant probability of the train systems surviving and of the vehicle continuing to function. For such incidents it is not reasonably practicable to define requirements which will assure the running capability of the train. It should however be recognised that requirements defined to mitigate the effects for these incidents on a lesser scale, which will occur during the fire development towards the extreme scale, will have beneficial effects in these extreme cases but that these benefits are not at a defined level.

Given these principles it is necessary to define a classification system for fires, as the nature of the fire needs to be known before any judgement in respect of practicability can be made. The various fires which may occur are therefore placed into one of three types as defined in 3.1.

At some stage when considering fires and the sources of fire, specific pieces of equipment will be examined. It is necessary to recognise that it is possible for a piece of equipment to be both a source of fire as well as impacted by fire and that a clear distinction should be made between these two situations in the analysis.

Annex E shows the clauses relevant to specific system functions.

5.2 Fire Classification Scheme

5.2.1 Type 1 Fires

Typical Type 1 fires are Ignition Models 1-4 of CEN/TS 45545-1, Annex A and these ignition models, in the context of trains constructed to EN 45545, present no significant risk because they are not considered to be large enough to pose a risk in themselves and fire will not develop.

Thus for Type 1 fires there are no running capability requirements.

NOTE An example of a "no requirement" situation would be a fire within a small equipment case containing safety critical signalling equipment. The fire would be represented by CEN/TS 45545-1 Ignition model 4 and whilst the fire within the case would cause the signalling equipment to fail and hence cause the train to stop, the fire hazard will be very small generally either due to the containment afforded by the case or due to the flame retardant nature of the materials within the case. Both of these situations are defined under CEN/TS 45545-2.

5.2.2 Type 2 Fires

Type 2 fire events are related, for example, to luggage fires, vandalised seat fires, some diesel fires and also to significant arson events. These fires present a significant risk but are of a scale such that it is reasonably practicable to define requirements for the protection of train system functions so as to assure a defined level of running capability.

Thus for Type 2 fires: