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Železniške naprave - Požarna zaščita na železniških vozilih - 2. del: Zahteve za obnašanje materialov in sestavnih delov v požaru

Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behavior of materials and components

Bahnanwendungen - Brandschutz in Schienenfahrzeugen - Teil 2: Anforderungen an das Brandverhalten von Materialien und Komponenten

Applications ferroviaires - Protection contre les incendies dans les véhicules ferroviaires - Partie 2: Exigences du comportement au feu des matériaux et des composants

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English Version

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Foreword

This document (EN 45545-2:2013) 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of an identical text or by endorsement, at the latest by September 2013, and conflicting national standards shall be withdrawn at the latest by March 2016.

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This document supersedes CEN/TS 45545-2:2009.

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.

This series of European standards *Railway applications — Fire protection on railway vehicles* consists of:

— Part 1: General;

— Part 2: Requirements for fire behaviour of materials and components;

— Part 3: Fire resistance requirements for fire barriers;

— Part 4: Fire safety requirements for railway rolling stock design;

— Part 5: Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles;

— Part 6: Fire control and management systems;

— Part 7: Fire safety requirements for flammable liquid and flammable gas installations.

According to the CEN/CENELEC Internal Regulations, the national standards organisations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

EN 45545-2 has been developed from existing fire safety regulations for railway vehicles from the International Union of Railways (UIC) and different European countries.

In using the operation and design categories defined in EN 45545-1, the requirements laid down in this part take into account the current operating conditions for European public rail transport.

1 Scope

This part of EN 45545 specifies the reaction to fire performance requirements for materials and products used on railway vehicles as defined in EN 45545-1.

The operation and design categories defined in EN 45545-1 are used to establish hazard levels that are used as the basis of a classification system.

For each hazard level, this part specifies the test methods, test conditions and reaction to fire performance requirements.

It is not within the scope of this European Standard to describe measures that ensure the preservation of the vehicles in the event of a fire.

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 13238, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 45545-1:2013, *Railway applications — Fire protection on railway vehicles — Part 1: General*

EN 45545-3, *Railway applications — Fire protection on railway vehicles — Part 3: Fire resistance requirements for fire barriers*

EN 45545-5:2013, *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*

EN 50305:2002, *Railway applications — Railway rolling stock cables having special fire performance — Test methods*

EN 50306, *Railway applications — Railway rolling stock cables having special fire performance*

EN 50264, *Railway applications — Railway rolling stock power and control cables having special fire performance*

EN 50382, *Railway applications — Railway rolling stock high temperature power cables having special fire performance*

EN 60332-1-2, *Tests on electric and optical fibre cables under fire conditions — Part 1-2: Test for vertical flame propagation for a single insulated wire or cable — Procedure for 1 kW pre-mixed flame*

EN 60332-3-24, *Tests on electric and optical fibre cables under fire conditions — Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables — Category C*

EN 60584-1, *Thermocouples — Part 1: Reference tables*

EN 60695-2-11, *Fire hazard testing — Part 2-11: Glowing/hot-wire based test methods — Glow-wire flammability test method for end-products*

EN 60695-11-10, *Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test methods*

EN 61034-1, *Measurement of smoke density of cables burning under defined conditions — Part 1: Test apparatus*

EN 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements*

EN ISO 1182, *Reaction to fire tests for products - Non-combustibility test (ISO 1182)*

EN ISO 1716:2010, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716:2010)*

EN ISO 4589-2, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test (ISO 4589-2)*

EN ISO 5659-2, *Plastics — Smoke generation — Part 2: Determination of optical density by a single-chamber test (ISO 5659-2)*

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

EN ISO 9239-1, *Reaction to fire tests for floorings — Part 1: Determination of the burning behaviour using a radiant heat source (ISO 9239-1)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

EN ISO 12952-2, *Textiles — Assessment of the ignitability of bedding items — Part 2: Ignition source: match-flame equivalent (ISO 12952-2)*

ISO 5658-2:2006, *Reaction to fire tests — Spread of flame — Part 2: Lateral spread on building and transport products in vertical configuration*

ISO 5660-1, *Reaction-to-fire tests — Heat release, smoke production and mass loss rate — Part 1: Heat release rate (cone calorimeter method)*

ISO/TR 9705-2, *Reaction-to-fire tests — Full-scale room tests for surface products — Part 2: Technical background and guidance*ISO 11054, *Cutting tools — Designation of high-speed steel groups*

ISO 19702, *Toxicity testing of fire effluents — Guidance for analysis of gases and vapours in fire effluents using FTIR gas analysis*

ISO 2592, *Determination of flash and fire points — Cleveland open cup method*

ISO 2719, *Determination of flash point — Pensky-Martens closed cup method*

NF X70-100-1, *Fire tests — Analysis of gaseous effluents — Part 1: methods for analysing gases stemming from thermal degradation*

NF X70-100-2, *Fire tests — Analysis of gaseous effluents — Part 2: tubular furnace thermal degradation method.*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 45545-1:2013 apply.

4 Requirements

4.1 Essential fire safety objectives

The design of rolling stock and the products used shall incorporate the aim of limiting fire development should an ignition event occur so that an acceptable level of safety is achieved.

If the objectives defined in Clause 4 of EN 45545-1:2013 are met, then there should be a high probability that in the event of a fire, passengers and staff will be able to escape from the fire unaided and be able to reach a place of safety.

Hazard levels (HL 1 to HL 3) have been determined using a product of the relation between operation categories and design categories defined in EN 45545-1, as described in Table 1. Hazard levels are used in Table 5 for Material Fire Safety requirement classification.

Table 1 — Hazard level classification

Operation category	Design category			
	N: Standard vehicles	A: Vehicles forming part of an automatic train having no emergency trained staff on board	D: Double decked vehicle	S: Sleeping and couchette vehicles
1	HL1	HL1	HL1	HL2
2	HL2	HL2	HL2	HL2
3	HL2	HL2	HL2	HL3
4	HL3	HL3	HL3	HL3

4.2 General

The following principles are applicable to all products:

a) products which comply with the highest level of reaction to fire performance and therefore need no further testing are:

   — products classified as A1 according to EN 13501-1;

   — all products described in commission decision 96/603/EC (as amended);

b) products classified as A2 – s1, d0 according to EN 13501-1 are considered compliant with regard to flame spread, heat release and smoke emission requirements only. The toxic emissions limit shall satisfy the requirements of R1 HL3 (CIT<0,75);

c) electrical cables which satisfy the fire safety requirements of EN 50306, EN 50264 or EN 50382 are considered to satisfy the requirements of R15 and R16 for the corresponding hazard level (no further testing required);

d) where a product has a continuous aluminium or steel substrate and where the thickness of the substrate metal is equal to or greater than defined in Table 7, it is sufficient to test the product with the thickness given in Table 7;

e) a product, other than an electric cable, meeting a requirement at two different thicknesses with identical formulations shall be considered to comply with the requirement at all intermediate thicknesses. Electric

cables meeting a requirement at two different diameters with identical formulations shall be considered to comply with the requirement at all intermediate diameters;

f) a test which qualifies any product or surface shall also qualify any product or surface which differs in colour and/ or pattern;

g) multi layer products shall be tested in the end use condition;

h) mechanical or electrical products contained in a technical cabinet may be considered as unclassified products if:

— the technical cabinet satisfies the requirements of integrity criterion E10, based on the definitions described in EN 45545-1 and EN 45545-3 and the enclosed volume is ≤ 2 m^3;

— or the technical cabinet satisfies the requirements of integrity criterion E15 and insulation criterion I15 to surfaces adjacent to passenger area and staff area and integrity criterion E15 to other surfaces, based on the definitions described in EN 45545-1 with no volume limitations;

— or the technical cabinet is protected by an automatic fire detection and fire extinguishing system;

i) all coating systems shall be tested in end use condition. This means inclusion of levelling fillers at a thickness estimated at mean end use application, primers and finish coatings with specified coating thickness and number of layers;

j) where a coating (including vinyls, films and their adhesives) is applied to aluminium or steel in the end use condition and where the thickness of the metal is greater than those defined in Table 7 it is sufficient to test the coating on the reference substrate defined in Table 7;

k) for coatings applied to non metallic surfaces, the full specified test requirements are mandatory;

l) for products which are classified in Table 2 as IN2, IN3A, IN3B, IN10, IN11, EX1C, EX5, EX6A, EX6B, EX8, EX11, or EL2, where surfaces have organic coatings applied on metal or glass surfaces, ISO 5658-2 or EN ISO 9239-1 flame spread tests shall be carried out, but other test requirements such as heat release, smoke emission and toxic gas emission tests are not required if the nominal coating thickness, including any surfacing filler for exterior products is < 0,3 mm, or for interior products the nominal thickness of organic coating is < 0,15 mm;

m) if ISO 5658-2 is required as part of a requirement set, but the end use condition of a product does not allow preparation of test specimens to the size defined in ISO 5658-2, then in the case of interior use, R6 is applicable instead of the designated requirement set, and in the case of exterior use, R9 is applicable instead of the designated requirement set;

n) if listed products are used in an application below the mass and area thresholds given in 4.3, they may be treated as non-listed products.

4.3 Grouping rules

4.3.1 General

No requirements apply to products with a combustible mass of < 10 g not in touching contact with another unclassified product. To assess products the following parameters have to be considered. Products shall be considered as grouped if:

— the exposed area of each product is < 0,2 m^2; and

— they are not compliant to the applicable requirements of Table 2; and

— the combustible mass of each product is > 10 g or they are in touching contact to another combustible product; and

— the horizontal distance to a product non compliant to Table 2 is < 20 mm or the vertical distance to a product non compliant to Table 2 is < 200 mm; and

— they are not fully separated by a product compliant with the fire integrity requirement of 5.3.6.

The combustible masses of the products in this group shall be summed.

The assessment process described in 4.3.2 to 4.3.4 is visualized in the flow chart in Figure 1.

4.3.2 Rule 1

If the total combustible mass of the grouped products is

— < 100 g for interior grouped products;

or

— < 400 g for exterior grouped products;

no requirements apply to the products of this group.

4.3.3 Rule 2

If the combustible mass of the grouped products exceeds the limits stated in Rule 1, but is

— < 500 g for interior grouped products;

or

— < 2 000 g for exterior grouped products;

one combustible product of this group has to be tested according to R24.

If this product is compliant to R24 it shall not be considered for further assessment of this group. The remaining products in this group shall be assessed starting with Rule 1, 4.3.2, again.

4.3.4 Rule 3

If the combustible mass of the grouped products exceeds the limits stated in Rule 2, one product of the group shall be tested according to the requirements of non-listed products given in 4.5, Table 3.

If this product is compliant to the requirements of Table 3 it shall not be considered for further assessment of this group. The remaining products in this group shall be assessed starting with Rule 1, 4.3.2, again.

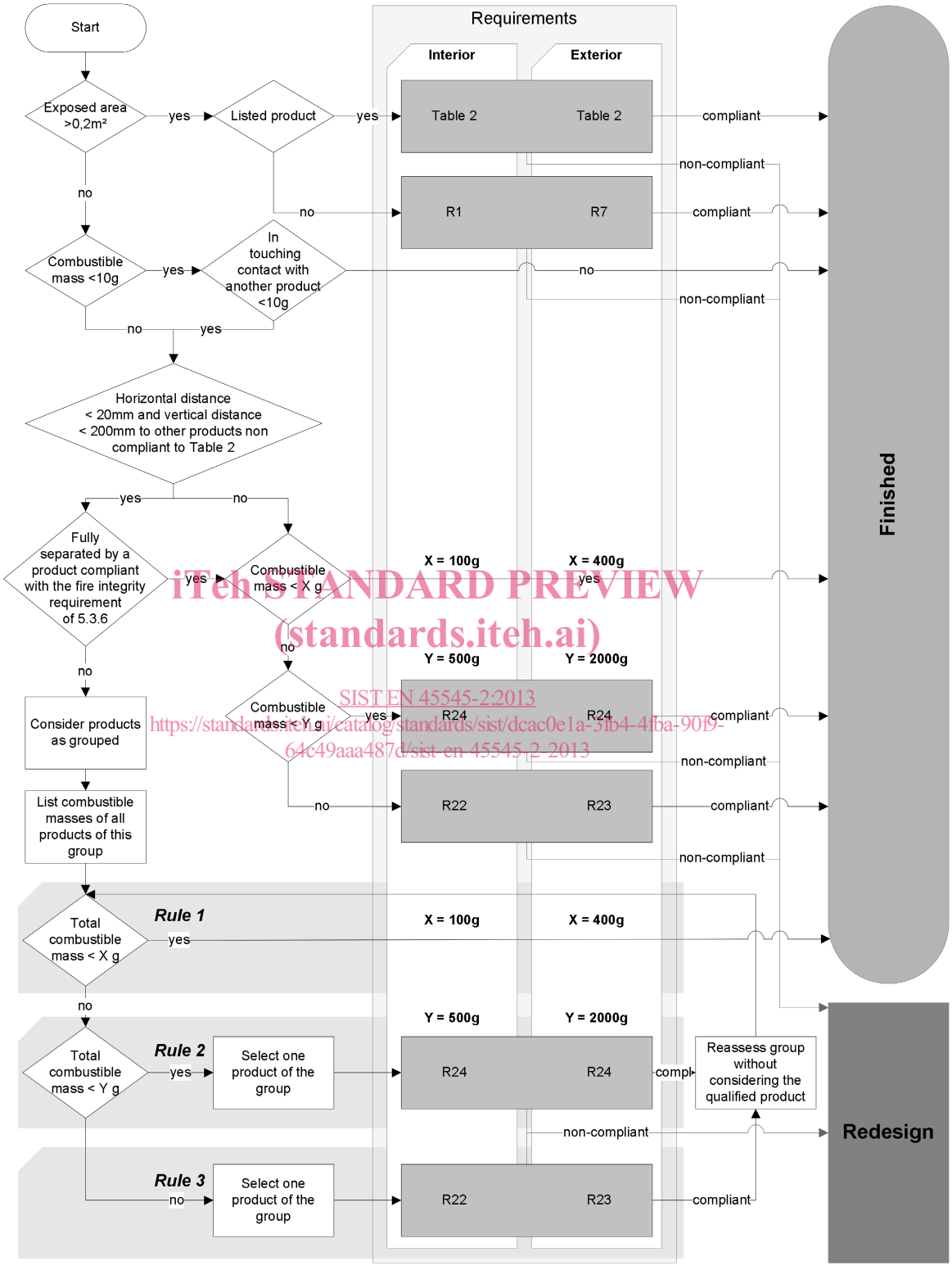

Figure 1 — Assessment process – Grouping rules

4.4 Listed products

The reaction to fire performance requirements of materials and components depend on their intrinsic nature but also:

— on the location of the materials or components within the design;

— on the shape and the layout of the materials;

— on the surface exposed and the relative mass and the thickness of the materials.

It is on this basis that the listed products have been classified and further differentiated into subgroups as follows:

— their general location (interiors or exteriors);

— their specific use (furniture, electrotechnical equipment or mechanical equipment).

Within the sub groupings, for each of the listed products, a set of requirements has been given which defines the ability of products to contain fire development to an appropriate degree considering the location, the exposed surfaces, their geometry and general disposition. Examples of different products are: ceiling panelling, floor composites, interior lighting, curtains, external body shell walls and underside and parts of the drive and suspension system.

The requirement sets for listed products are given in Table 2 and are designated R1 to R26. The content of each requirement set is listed in Table 5.

The column “Details” shows relationships to special requirements e. g. sample preparation and/or fire resistance.

Table 2 — Requirements of listed products *(1 of 7)*

Product No	Name	Details	Require-ment
IN	**Interiors**		
IN1A	Interior vertical surfaces	Interior components (structure and covering) such as side walls, front walls / end-walls, partitions, room dividers, flaps, boxes, hoods, louvres. Interior doors, interior lining of the front-/end-wall doors and external doors. Windows (including plastics and glazing) Insulation material and interior surface of body shell. Kitchen interior surfaces (except those of kitchen equipment).	R1
IN1B	Interior horizontal downward-facing surfaces	Interior components (structure and coverings) such as ceiling panelling, flaps, boxes, hoods, louvres. Insulation material and interior surface of body shell.	R1
IN1C	Interior horizontal upwards-facing surfaces	Interior components (structure and coverings) such as flaps, boxes, hoods, louvres. Insulation material and interior surface of body shell. Compliance with the requirements of R1 is also considered to be compliant for this requirement.	R10
IN1D	Interior surfaces within cavities	The surfaces may be horizontal or vertical.	R1
IN1E	External surfaces of enclosures containing technical equipment	Enclosures which are located inside the body shell NOTE Fire resistance requirements may apply to enclosures containing technical equipment – see 4.2 and EN 45545-3.	R1
IN2	Limited surfaces	— they shall have an area ≤ 0,20 m^2; — they shall have a maximum dimension in any direction on the surface ≤ 1 m; — they shall be separated from any other limited surface or strip by a distance of R1 compliant material greater than the dimension of the limited surface, measured in the same horizontal direction as the separation direction.	R2