
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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Part 2: Requirements for fire behavior of materials and
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des composants

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

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

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prEN 45545-2:2018 (E)**European foreword**

This document (prEN 45545-2:2018) 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 45545-2:2013+A1:2015.

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.

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.

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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 are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 16989, *Railway applications — Fire protection on railway vehicles — Fire behaviour test for a complete seat*

EN 17084, *Railway applications — Fire protection on railway vehicles — Toxicity test of materials and components*

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+A1:2015, *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 50264, *Railway applications — Railway rolling stock power and control cables having special fire performance*

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 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 (IEC 60332-1-2)*

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 (IEC 60332-3-24)*

EN 60695-1-40, *Fire hazard testing — Part 1-40: Guidance for assessing the fire hazard of electrotechnical products — Insulating liquids (IEC 60695-1-40)*

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

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

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

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

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

EN ISO 1716:2018, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716:2018)*

EN ISO 2592, *Petroleum and related products — Determination of flash and fire points — Cleveland open cup method (ISO 2592)*

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

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 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) and smoke production rate (dynamic measurement)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at <http://www.electropedia.org/>

— ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Requirements

4.1 Essential fire safety objectives

The design of rolling stock and the products used shall have the objective 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 can 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 (HL1 to HL3) have been determined using 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 couchette and 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 A1 according to EN 13501-1;
 - all products described in commission decision 96/603/EC (as amended);
 - laminated glass where the internal organic layers are not exposed and the percentage mass of organic material is less than or equal to 6 %.
- b) products classified 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) electric cables meeting a requirement at two different diameters with identical formulations shall be considered to comply with the requirement at all intermediate diameters;
- e) a product, other than an electric cable, meeting a requirement at two different thicknesses with identical formulation and density (of each layer) shall be considered to comply with the requirement at all intermediate thicknesses. A product meeting a requirement at the maximum testable thickness shall be considered to comply with the requirement at greater thicknesses.

a product, other than an electric cable, meeting a requirement at two different densities shall be considered to comply with the requirement at all intermediate densities. The material with a differing density shall have identical formulation and thickness;
- 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 or with substrates representative of the end use condition in accordance with 5.3;
- h) mechanical or electrical products contained in a technical cabinet do not need to be assessed 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 $\leq 2 \text{ m}^3$;
 - or the technical cabinet satisfies the requirements of integrity criterion E15 and insulation criterion I15 for surfaces adjacent to passenger area and staff area and integrity criterion E15 for 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;
 - the technical cabinet contains only mechanical or low power electrical equipment. The cabinet sheets are closed and made of aluminium, steel or glass. The enclosed volume is $\leq 0,1 \text{ m}^3$. Covered openings (e.g. by connectors or switches) are acceptable;
 - the technical cabinet sheet material is made of aluminium or steel and the enclosed volume is $\leq 0,5 \text{ m}^3$. For any individual surface of the cabinet, the total area of all openings in that surface shall be less than 1/1000 of the nominal surface area;
- i) all coating systems shall be tested in the end use condition. This means inclusion of levelling fillers at a thickness estimated for the mean end use application, primers and finish coatings with the specified coating thicknesses and number of layers;
- j) for organic coatings applied to non-metallic surfaces, the full specified test requirements are mandatory;
- k) for organic coatings applied to products conforming to 4.2 a), 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 $< 0,3 \text{ mm}$, or for interior products the nominal thickness of organic coating is $< 0,15 \text{ mm}$;
- l) 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

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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;

- m) 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**

Products compliant to Table 2 or Table 3 are excluded from the grouping assessment.

No requirements apply to products with a combustible mass of ≤ 10 g in touching contact only with a product compliant to Table 2 and Table 3.

To assess products within the grouping rules the following parameters have to be considered.

Products shall be assessed within the grouping rules if:

- the exposed area of each product is $\leq 0,2$ m²; and
- the combustible mass of each product is > 10 g or they are in touching contact to another unclassified combustible product; and
- the horizontal distance is ≤ 20 mm and the vertical distance is ≤ 200 mm to a combustible product not assessed to Table 2, Table 3 or R24 according to rule 2; and
- they are not fully separated by a product compliant with the fire integrity requirement of 5.3.7.

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

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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.

This principle also applies to single products that meet the requirements of 4.3.1.

4.3.3 Rule 2

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

- ≤ 500 g for interior grouped products;

or

- ≤ 2000 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 4.3.1 again.

This principle also applies to single products that exceed the mass limits of Rule 1.

4.3.4 Rule 3

If the combustible mass of the grouped products exceed 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 4.3.1.

This principle also applies to single products that exceed the mass limits of Rule 2.

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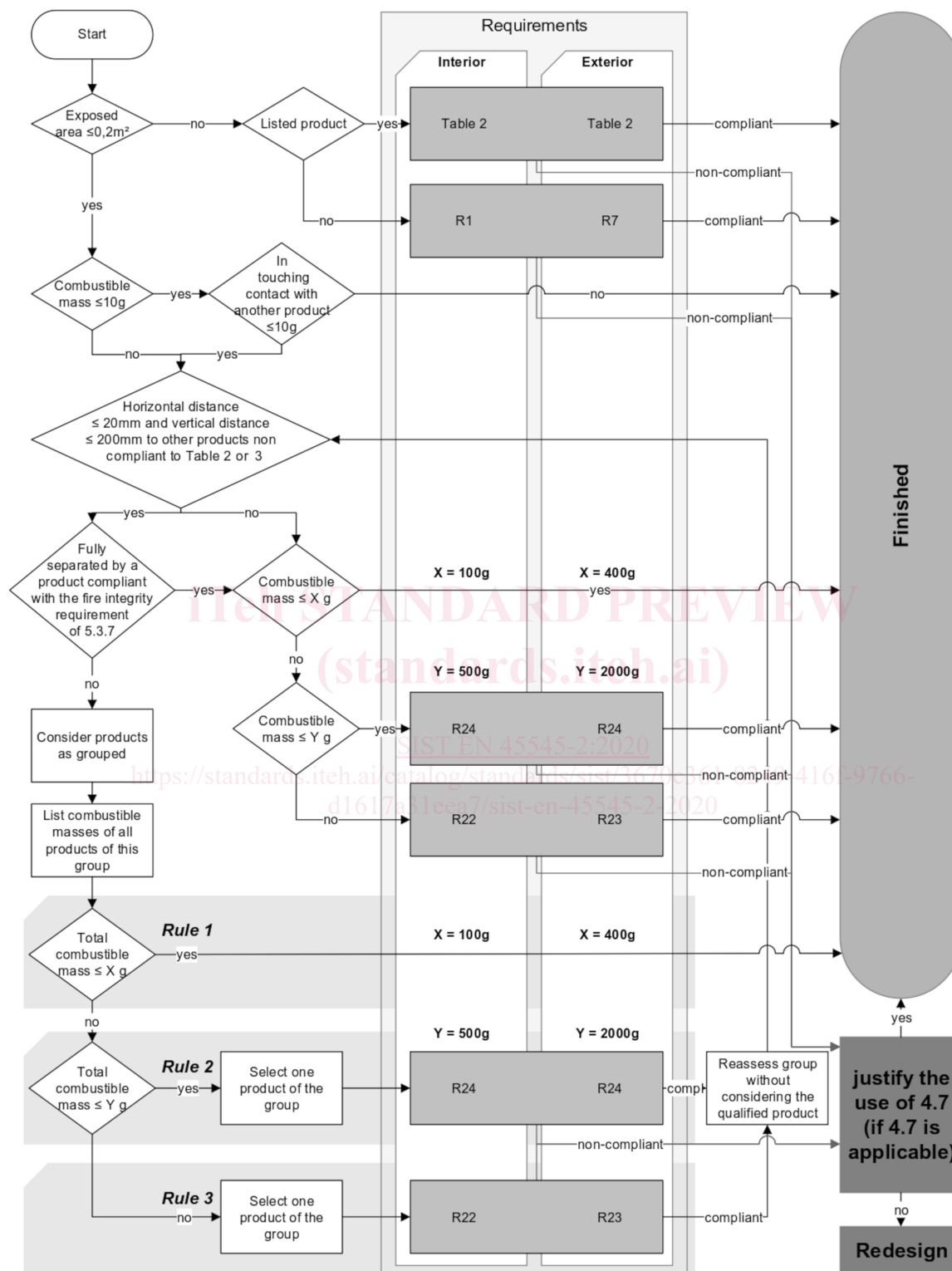


Figure 1 — Assessment process – Grouping rules

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, electro technical 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 R28. The content of each requirement set is listed in Table 5.

When assessing a passenger area seat design, results from all F1 tests (F1, F1A, F1B, F1C, F1D, F1E) are required for complete validation.

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

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