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**Železniške naprave - Zgornji ustroj proge - Zagotavljanje varnosti med delom na progi - 2-2. del: Skupne rešitve in tehnologija - Zahteve za pregrade**

Railway applications - Track - Safety protection on the track during work - Part 2-2: Common solutions and technology - Requirements for barriers

Bahnanwendungen - Oberbau - Sicherungsmaßnahmen während Gleisbauarbeiten - Teil 2-2: Allgemeine Lösungen und Technologie - Anforderungen an Absperrungen

Applications ferroviaires - Voie - Protection et sécurité durant des travaux sur la voie - Partie 2-2: Solutions communes et technologie - Exigences relatives aux barrières

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**Ta slovenski standard je istoveten z: EN 16704-2-2:2016**

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**ICS:**

13.100	Varnost pri delu. Industrijska higiena	Occupational safety. Industrial hygiene
93.100	Gradnja železnic	Construction of railways

**SIST EN 16704-2-2:2017**

**en**

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EUROPEAN STANDARD

**EN 16704-2-2**

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2016

ICS 93.100

English Version

## Railway applications - Track - Safety protection on the track during work - Part 2-2: Common solutions and technology - Requirements for barriers

Applications ferroviaires - Voie - Protection et sécurité durant des travaux sur la voie - Partie 2-2: Solutions communes et technologie - Exigences relatives aux barrières

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## European foreword

This document (EN 16704-2-2:2016) 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of an identical text or by endorsement, at the latest by May 2017, and conflicting national standards shall be withdrawn at the latest by May 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This European Standard is one of the series EN 16704 "Railway applications – Track – Safety protection on the track during work" as listed below:

- Part 1: Railway risks and common principles for protection of fixed and mobile work sites
- Part 2-1: Common solutions and technology – Technical requirements for Track Warning Systems (TWS)
- Part 2-2: Common solutions and technology – Technical requirements for barriers
- Part 3: Competences of personnel related to work on or near tracks

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.

**EN 16704-2-2:2016 (E)****Introduction**

The purpose of this standard is to define and harmonize requirements for barriers to separate working zone and danger zone and to prevent workers from entering the danger zone unintentionally.

The purpose of this standard is not to define requirements:

- for structural separation to provide safe train operation in the area of a work site(1);
- for structural separation to provide safety on a work site during train operation(2).

NOTE Examples for exclusions:

(1) In case of crane operation on a work site the crane arm could hit or even intrude into the gauge of an open track and endanger the safety of train operation.

(2) A barrier does not protect workers from items falling from passing trains.

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## 1 Scope

This European Standard deals with requirements for barriers to give users the possibility to prevent workers from entering the danger zone unintentionally by the use of such barriers.

This standard defines minimum requirements and test procedures for these barriers concerning the dimensions, the stability and electrical properties.

This standard also gives recommendations for the marking (visual demarcation line) where a person would enter the danger zone.

For combinations of barriers and TWS see also EN 16704-2-1:2016.

This standard contains references to electrical hazards from third rail systems.

NOTE Urban rail systems do have the same situations but may have other individual track gauges. EN 16704-1 does not cover Urban rail systems. The use of barriers as a safety measure has the same intention independently of the kind of railway system.

This standard in particular does not deal with:

- risk assessment for safety protection on the track during work;
- hierarchy of safety measure for safety protection on the track during work;
- safety measure to provide safe working and safe train operation in the area of a work site;
- national safety regulations to plan and operate barriers in track;
- safety regulations and additional requirements e.g. due to national or operational rules or negotiation between the user and the manufacturer;
- electrical hazards by different potential of different electrified circuits.

## 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 364:1992, *Personal protective equipment against falls from a height - Test methods*

EN 1263-1, *Temporary works equipment - Safety nets - Part 1: Safety requirements, test methods*

EN 12811-2, *Temporary works equipment - Part 2: Information on materials*

EN 12811-3:2002, *Temporary works equipment - Part 3: Load testing*

EN 13374:2013, *Temporary edge protection systems - Product specification - Test methods*

EN 14067-4, *Railway applications - Aerodynamics - Part 4: Requirements and test procedures for aerodynamics on open track*

EN 50110-1, *Operation of electrical installations - Part 1: General requirements*

EN 50110-2, *Operation of electrical installations - Part 2: National annexes*

**EN 16704-2-2:2016 (E)**

EN 50122-1, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock*

EN 50122-2, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 2: Provisions against the effects of stray currents caused by d.c. traction systems*

EN 50122-3, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 3: Mutual Interaction of a.c. and d.c. traction systems*

EN 50125-3:2003, *Railway applications - Environmental conditions for equipment - Part 3: Equipment for signalling and telecommunications*

EN ISO 13857, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857)*

**3 Terms and definitions**

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

**3.1  
danger zone**  
area where a person, material or equipment can be struck by a railway vehicle or exposed to injury or fatality due to wind drag

**3.2  
separation**  
method to keep apart the working zone and the danger zone of the adjacent track/operational track and to prevent workers from entering unintentionally into the danger zone

Note 1 to entry: Measures of separation are barriers, (steel) walls, work wagons, etc.

**3.3  
visible separation**  
marking of the beginning of the danger zone by visual demarcation lines e.g. by bands

**3.4  
preventive separation**  
separation that prevents unintentional entering of workers into the danger zone e.g. by a barrier

**3.5  
barrier**  
common technical solution to realize preventive separation by a set of components to separate working zone and danger zone and to prevent workers from entering the danger zone unintentionally

**3.6  
marking/visual demarcation line**  
common technical solution to achieve limited separation by marking (visual demarcation line) of where a person would enter the danger zone

Note 1 to entry Separation by marking (visual demarcation line) is not an autonomous and independent measure for safety protection on the track during work (see Clause 8).



### 3.7 module

smallest entity of a barrier consisting of fixing and extendable devices, vertical and horizontal components (to be defined by the manufacturer in the manual)

### 3.8 extendable device

adjustable component to realize different distances to the track or different heights above the rail

### 3.9 principal guardrail / upper horizontal component

continuous horizontal component forming the top of the barrier

### 3.10 intermediate guardrail/intermediate horizontal component

guardrail positioned between the principal guardrail and the working surface

### 3.11 intermediate protection

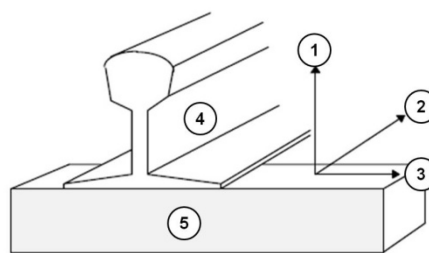
protection barrier formed (e.g. as a fencing structure or a safety net) between the principal guardrail and the working surface

### 3.12 post/vertical component

principal vertical component to which horizontal components are attached

### 3.13 axis

axis used in this standard are explained in Figure 1



#### Key

- 1 vertical
- 2 longitudinal, horizontal
- 3 transversal
- 4 rail
- 5 sleeper/bearer/slab track

Figure 1 — Track section plus position name and three axes

## 4 Specification of barriers

For the purposes of this document the following specifications apply.

**Table 1 — Specification of parameters for barriers**

		type	
		barrier	marking
<b>requirement</b>	clause	value or objective prevention of unintentional entering into the dangerous zone	objective limitative separation only, marking of the border of the danger zone by a visual demarcation line
<b>max. length of components</b>	5.1	$l_{\max} \leq 3,20$ m	not specified
<b>min./max height</b>	5.6	defined by national rules (see also Annex A)	not specified
<b>static stability test-load max. deflection <math>\delta</math></b>	6.4.2.2.1 6.4.2.2.2 6.4.2.2.3	0,3 kN 50 mm	not specified
<b>dynamic stability (oscillation) dynamic stability (vibration)</b>	6.4.3 6.4.4	0,3 kN $\rightarrow$ 0 kN 2 mm	not specified
<b>dynamic stability (aerodynamic)</b>	6.4.5	additional approval (calculation or testing) for a speed > 160 km/h	not specified
<b>electric requirements</b>	6.6	no unintended influence on the signalling resistance between horizontal components: min. 50 k $\Omega$ at 500 V AC resistance between vertical components: min. 50 k $\Omega$ at 500 V AC	not specified
<b>3rd rail hazards</b>	6.9	structure or net (max 40 mm mesh) or other adequate measures according to the risk analysis	not specified
<b>marking</b>	7	red/white yellow/black blue	see Clause 7

NOTE Separation by marking (visual demarcation line) is not an autonomous and independent measure for safety protection on the track during work (see Clause 7).

## 5 Requirements for barriers

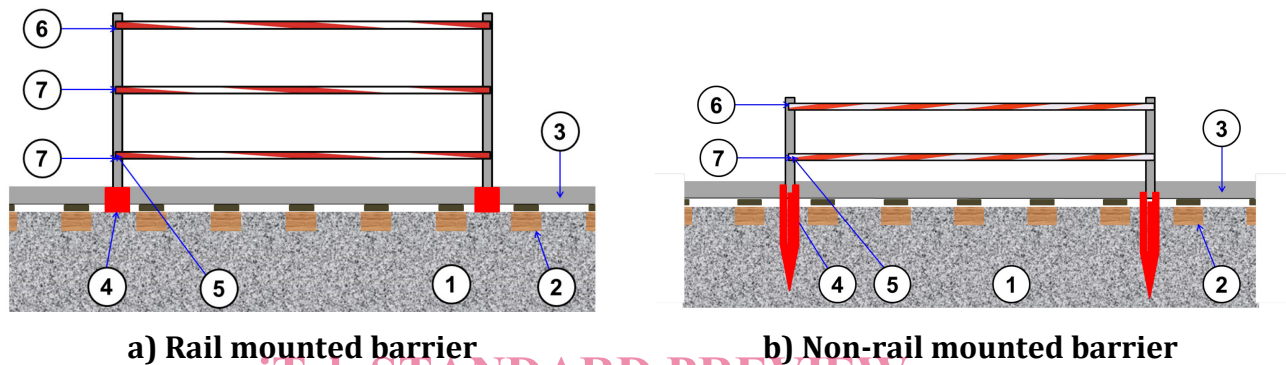
### 5.1 General

Barriers shall comprise at least:

- a principal guardrail, and
- an intermediate guardrail or an intermediate protection (e.g. net, plate, mesh).

The mounting of TWS components on the barrier should be considered by the manufacturer.

Examples for barriers with rail mounted and non-rail mounted fixing are shown in Figure 2.



#### Key

- 1 ballast
- 2 sleeper and rail fastening
- 3 rail
- 4 rail/track mounted fixing
- 5 extendable device with vertical components
- 6 principal guardrail
- 7 intermediate guardrail

**Figure 2 —Examples for a module and components of a barrier**

Barriers shall comply with all requirements of Clause 5 up to Clause 8.

All values (e.g. for height or distances) refer to straight horizontal tracks with a gauge of 1435 mm without rail cant. For other track gauges it is recommended to use Annex B to convert the distance in Figure 3 to other reference points.

NOTE 1 For special situations (e.g. rail cant, 3rd rail) a risk assessment according to EN 16704-1:2016 may be required. As a result other and/or additional measures could be necessary.

Barriers shall have no sharp or jagged edges.

Barriers shall be usable on switches and crossings (e.g. by special attachment devices).

Barriers shall be constructed in a way that the track circuit system is not affected and accidental electrical hazards are minimized (for details see 6.6).

**EN 16704-2-2:2016 (E)**

It shall be possible to mount, position and remove all components easily and:

- preferably from outside of the track, and
- preferably without removing ballast or anti-vibration devices mounted to the rail.

The various associated components shall allow quick assembly and disassembly.

The construction shall allow during use:

- temporary demounting of single modules;
- variation of the distance to the track;
- the removal of horizontal components without a tool in case of emergency.

Components made of electrical non-conductive material shall have a length not exceeding 3,20 m. Components made of metal or other electrical conductive material shall have a length not exceeding 2,00 m.

NOTE 2 In case of a maximum length of 3,20 m the distance from the track does change only in a range of  $f = 1$  cm to 2 cm, even in small curves ( $R = 80$  m) [ $f$  approximately  $\text{length}^2 / (8R)$ ].

It shall be possible to adjust the length of a module in a range of 0,4 m minimum (e.g. by adjustable horizontal components or by variable fixing points for the horizontal components).

**5.2 Horizontal components**

Principal and intermediate guardrails shall have a minimum cross-section height of 35 mm (see Figure 4).

If intermediate guardrails are provided, any gap shall be so dimensioned that a sphere of 470 mm diameter will not pass through the protection. If there are no intermediate guardrails or if it is not continuous, the intermediate protection shall be so dimensioned that a sphere with a diameter of 250 mm will not pass through it.

**5.3 Mounting of horizontal components at different transversal distances**

It shall be possible (e.g. by extendable devices) to position the horizontal components at transversal distances at least at 1,90 m, 2,00 m, 2,10 m, 2,20 m, 2,30 m, 2,40 m and 2,50 m ( $\pm 20$  mm) (see Figure 3) measured from centre of the track to the inner part of the barrier at the level of the horizontal components.