



**SLOVENSKI STANDARD**  
**SIST EN 15152:2007**

**01-november-2007**

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**Železniške naprave - Vetrobrani v komandnih kabinah hitrih vlakov**

Railway applications - Front windscreens for train cabs

Bahnanwendungen - Stirnfenster von Führerräumen

Applications ferroviaires - Vitres frontales des cabines pour trains

**Ta slovenski standard je istoveten z: EN 15152:2007**

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ICS 45.060.10

English Version

## Railway applications - Front windscreens for train cabs

Applications ferroviaires - Vitres frontales des cabines des trains

Bahnanwendungen - Frontscheiben von Führerräumen

This European Standard was approved by CEN on 13 July 2007.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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

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## Foreword

This document (EN 15152:2007) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2008 and conflicting national standards shall be withdrawn at the latest by February 2008.

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 Directives 96/48 as modified by EU Directive 2004/50.

For relationship with EU Directive 96/48, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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## 1 Scope

This European Standard specifies the functional requirements for cab windscreens of high speed trains including testing and conformity assessment. The same requirements can be applied to the windscreens of other types of rolling stock if some of the performance criteria are adjusted to suit the application. Such changes should be based on national standards or infrastructure controller's regulations where they exist.

This European Standard does not specify all interfaces between the windscreen and the vehicle.

This European Standard does not apply to the renewal of windscreens of high speed rolling stock already in operation.

## 2 Normative references

The following referenced documents are indispensable for the application 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 2155-9, *Aerospace series — Test methods for transparent materials for aircraft glazing — Part 9: Determination of haze*

EN 50125-1, *Railway applications — Environmental conditions for equipment — Part 1: Equipment on board rolling stock*

EN ISO 4892 (all parts), *Plastics — Methods of exposure to laboratory light sources*

ISO 3537, *Road vehicles — Safety glazing materials — Mechanical tests*

ISO 3538:1997, *Road vehicles — Safety glazing materials — Test methods for optical properties*

ISO 6362-2:1990, *Wrought aluminium and aluminium alloy extruded rods/bars, tubes and profiles — Part 2: Mechanical properties*

CIE 15:2004, *Colorimetry*<sup>1)</sup>

CIE 38:1977, *Radiometric and photometric characteristics of materials and their measurement*<sup>1)</sup>

CIE S 004:2001, *Colours of light signals*<sup>1)</sup>

## 3 Terms and definitions

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

### 3.1

#### **high speed train**

train which is designed to operate at speeds equal to or greater than 190 km/h

NOTE This includes Class 1 and Class 2 high speed trains as defined in the HS TSI RS.

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1) To be purchased from: International Commission of Illumination, CIE Central Bureau, Kegelgasse 27, A-1030 Wien.

**3.2****windscreen**

transparent pane built wholly or partly into external walls or doors positioned transversely to the running direction and used for observing the tracks and signals ahead of the train

**3.3****primary vision area (area A)**

area of the windscreen through which track and signals shall be visible from the driving position

**3.4****secondary vision area (area B)**

area of the windscreen outside the primary vision area through which the driver may also be required to look

**3.5****peripheral area (area C)**

area of the windscreen outside the secondary vision area

**3.6****secondary image separation**

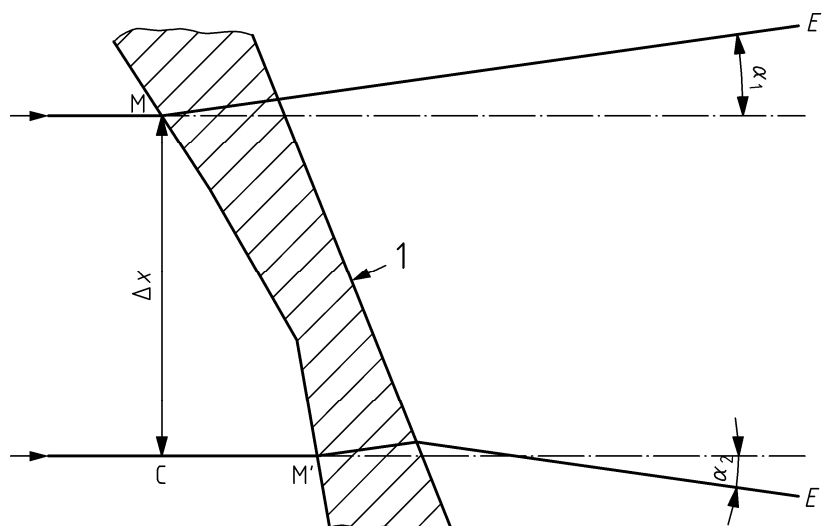
angular separation between the primary and the brightest secondary images (due to internal reflection) of a distant light source or object when viewed through a windscreen

**3.7****optical distortion (in a given direction)**

algebraic difference  $\Delta\alpha$  in angular deviations  $\alpha_1$  and  $\alpha_2$  measured between two points M and M' on the surface of the windscreen, the distance between them being such that their projections on a plane at right angles to the direction of vision are separated by a given distance  $\Delta x$  (see Figure 1).

NOTE 1  $\alpha_1 - \alpha_2$  is the optical distortion in the direction MM'. The sign of the angles shall be considered to achieve a correct value of  $\Delta\alpha$ .  $\Delta x = MC$  is the distance between two straight lines parallel to the direction of vision, and passing through the points M and M'.

NOTE 2 Anti-clockwise deviation should be regarded as positive, and clockwise deviation as negative.

**Key**

1 windscreen

**Figure 1 — Diagrammatic representation of optical distortion**

[ISO 3538:1997]

**3.8**

**Ultra-Violet radiation**

electromagnetic radiation of a wavelength shorter than that of visible light and which, for the purposes of this document, is described as having wavelengths between 200 nm and 400 nm

**3.9**

**spalling**

particles or pieces of the inner ply of the windscreen that may be propelled into the cab as a result of an object striking the outside surface

**4 Functional requirements**

**4.1 General**

The windscreen shall be able to withstand the normal operational conditions including environmental conditions according to EN 50125-1.

The peripheral area may be deliberately obscured (in whole or in part) e.g. by silk-screen printing for any of the following reasons:

- aesthetic purposes;
- elimination of distracting items from the driver's field of vision;
- for windscreens that are glued into position, to protect the glued area, if necessary, from the effect of Ultra-Violet (UV) radiation. In this case, the obscuration shall not permit more than 0,1 % of incident UV light to reach the glued area.

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**4.2 Specific performance requirements**

**4.2.1 General**

The windscreen has three optical areas:

- A: primary vision area;
- B: secondary vision area;
- C: peripheral area.

The extent of these areas is described in 5.2.

**4.2.2 Secondary image separation**

In the case of more than one secondary image, a maximum of one secondary image is to be evaluated. The image to be considered is that which appears brightest to an observer looking through the windscreen from the driving position.

The secondary image separation shall not exceed:

- maximum 15 min of arc in area A;
- maximum 25 min of arc in area B.



See 6.2.1 for the test method.

#### 4.2.3 Optical distortion

The limit of optical distortion shall be:

- maximum 2 min of arc in area A;
- maximum 6 min of arc in area B.

See 6.2.2 for the test method.

#### 4.2.4 Haze

The maximum value of haze shall be 2,5 % for a new windscreen.

See 6.2.3 for the test method.

#### 4.2.5 Luminous transmittance

The minimum value of luminous transmittance for areas A and B shall be:

65 % when viewed horizontally through the windscreen in its mounted position.

See 6.2.4 for the test method.

#### 4.2.6 Chromaticity

The windscreen shall not affect the colour of light transmitted through the windscreen to an extent that will cause the driver to misread signals.

The minimum requirement for this European Standard is that the windscreen shall not cause a colour shift so that a red signal lamp observed to lie within coordinates of the CIE 1931 Colour Diagram as illustrated in CIE S 004 (0,700; 0,295), (0,705; 0,295), (0,720; 0,280), (0,715; 0,280) would appear, when viewed through the windscreen, to lie outside a zone with co-ordinates (0,680; 0,305), (0,695; 0,305), (0,730; 0,270), (0,715; 0,270).

See 6.2.5 for the test method.

If an additional requirement to support recognition of yellow signals is specified for the train to which the windscreen is to be fitted, then the further criterion shall be as follows:

The windscreen shall not cause a colour shift such that a yellow signal lamp observed to lie within co-ordinates (0,590; 0,410), (0,575; 0,410), (0,612; 0,382), (0,618; 0,382), would appear, when viewed through the windscreen, to lie outside a zone with co-ordinates (0,560; 0,440), (0,546; 0,426), (0,612; 0,382), (0,618; 0,382).

#### 4.2.7 Impacts

The windscreen shall be able to resist the impact of an object accidentally or deliberately hitting the windscreen.

This shall be demonstrated by the test requirements as defined in 6.2.6.

#### 4.2.8 Residual visibility after breakage

The windscreen, when impacted or cracked under requirement 4.2.7, shall remain in its position and have sufficient residual visibility for the train to be driven to a place of safety.

#### 4.2.9 Spalling

The driver shall be protected from spalling.

This shall be demonstrated by the test requirements as defined in 6.2.7.

#### 4.2.10 Resistance against abrasion

The interior and exterior surface materials of a windscreen shall be able to withstand abrasion. The resulting change of haze after abrasion shall not exceed 2 % for the test of the outside surface and 8 % for the test of the inside surface.

The test requirements are defined in 6.2.8.

#### 4.2.11 Resistance against fire

The design of the windscreen shall be such as to minimise the risk of combustion or production of toxic smoke. If the relevant fire protection requirements of applicable European or national standards are not technically achievable with functionally suitable materials, then it is acceptable to use state-of-art products until and unless a suitable compliant material is developed. The supplier shall demonstrate to a responsible certification body that any such products used are indeed suitable in accordance with this clause.

#### 4.2.12 Resistance to repeated impact from small particles (gravelling)

The risk of this type of damage will vary according to train speed, the aerodynamic conditions on the exterior of the driving cab and the construction of the infrastructure on which the train will operate. It is therefore the choice of the customer whether to demand that resistance to gravelling is demonstrated.

If a resistance to gravelling is required, then the test requirements shall be as defined in 6.2.9.

### 4.3 Additional requirements

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#### 4.3.1 Appearance

##### 4.3.1.1 General

Appearance defects (blemishes) are specifically characteristics of one of the following elements of the windscreen:

- glass;
- interlayer;
- anti-spall layer;
- assembly;
- handling.

To ensure an acceptable quality of vision to the driver, the number and size of such defects shall not exceed the limits listed in 4.3.1.3.

See 6.3.1 for the test methods.

#### 4.3.1.2 Definition and classification of defects

Defects are divided into three categories according to their importance:

- negligible;
- minor;
- major.

Table 1 is used to classify defects according to their characteristics.

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Table 1 — Classification of defects

	Negligible	Minor	Major
<b>Point defects</b>			
Bubble: Air pocket, sometimes coloured entrapped in glass	$d \leq 0,8 \text{ mm}$	$0,8 \text{ mm} < d \leq 2 \text{ mm}$	$d > 2 \text{ mm}$
Impurities: Small impurity in glass or interlayer, or an embedded particle	$d \leq 0,8 \text{ mm}$	$0,8 \text{ mm} < d \leq 2 \text{ mm}$	$d > 2 \text{ mm}$
Spot: Local translucent area on interlayer	$d \leq 0,8 \text{ mm}$	$0,8 \text{ mm} < d \leq 2 \text{ mm}$	$d > 2 \text{ mm}$
Surface defect: Blemish caused by minor impact or abrasion (e.g. between two sheets of material during storage)	$d \leq 0,8 \text{ mm}$	$0,8 \text{ mm} < d \leq 2 \text{ mm}$	$d > 2 \text{ mm}$
<b>Anti-spall layer specific defects</b>			
Skin blister: Localised deformation of the transparent surface	$d \leq 1,5 \text{ mm}$	$1,5 \text{ mm} < d \leq 3 \text{ mm}$	$d > 3 \text{ mm}$
Cord: A relatively thick and very obvious thread of material	$L \leq 5 \text{ mm}$	$5 \text{ mm} < L \leq 10 \text{ mm}$	$L > 10 \text{ mm}$
Coating drip: Uneven thickness of final coating	$d \leq 5 \text{ mm}$	$5 \text{ mm} < d \leq 10 \text{ mm}$	$d > 10 \text{ mm}$
<b>Linear defects:</b> Defects where the length to width ratio is high. The dimension given is the direct distance between the extremities of the defect.			
Scratch, chipped scratch: Superficial scratch, rectilinear or curvilinear, with shelling to each side of the scratch	-		All dimensions
Fine scratch or other linear defect detectable by touch	$d \leq 13 \text{ mm}$	$13 \text{ mm} < d \leq 40 \text{ mm}$	$d > 40 \text{ mm}$
Hairline scratches hardly detectable by touch but visible on the surface	All dimensions	-	
Print of attenuated (repaired) scratch	$d \leq 13 \text{ mm}$	$13 \text{ mm} < d \leq 40 \text{ mm}$	$d > 40 \text{ mm}$
Lint, fibre, hair: Elongated impurity entrapped between glass ply and interlayer when laminating	$d \leq 13 \text{ mm}$	$13 \text{ mm} < d \leq 40 \text{ mm}$	$d > 40 \text{ mm}$
Streak, mark (drag) trace: Whitish area in the interlayer, hardly detectable under daylight condition	Any dimension, but one that does not attract the eye at 3 m from the product	If attracting the eye at 3 m from the product and having total surface $\leq 8 \text{ cm}^2$	If attracting the eye at 3 m from the product and having total surface $> 8 \text{ cm}^2$