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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 23340

Railway applications — Windscreens for trains

*Applications ferroviaires — Vitres frontales pour véhicules
ferroviaires*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 269, *Railway applications*, Subcommittee SC 2, *Rolling stock*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Railway applications — Windscreens for trains

1 Scope

This document specifies the functional requirements for rail vehicle windscreens, including type testing, routine testing, and inspection methods for main line railway systems and urban guided transport.

This document applies to windscreens made of laminated glass, which is the most commonly used material but also to other materials, subject to the performance requirements being satisfied.

For on-track machines (OTMs) when in transport mode (self-propelled or hauled) the requirements of this standard are applicable. OTMs in working configuration are outside the scope of this document.

Determination of the size, shape, orientation, and position of windscreens is outside the scope of this document.

This document does not specify requirements for the interfaces between the windscreen and the vehicle. Accordingly this document does not address issues relating to installation, structural integrity, and crashworthiness.

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.

ISO 48-2:2018, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 2: Hardness between 10 IRHD and 100 IRHD*

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

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

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

ISO 3917:2016, *Road vehicles — Safety glazing materials — Test methods for resistance to radiation, high temperature, humidity, fire and simulated weathering*

ISO 4892-2:2013, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 6362-2, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 2: Mechanical properties*

ISO/CIE 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO/CIE 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

ISO/CIE 11664-3, *Colorimetry — Part 3: CIE tristimulus values*

ISO 12543-5:2021, *Glass in building — Laminated glass and laminated safety glass — Part 5: Dimensions and edge finishing*

ISO 13468-1:2019, *Plastics — Determination of the total luminous transmittance of transparent materials — Part 1: Single-beam instrument*

ISO 14782, *Plastics — Determination of haze for transparent materials*

ISO/FDIS 22575, *Railway applications — General vocabulary*

ISO 22752:2021, *Railway applications — Bodyside windows for rolling stock*

ISO 22752:2021, *Railway applications — Bodyside windows for rolling stock*

IEC 60571, *Railway applications - Electronic equipment used on rolling stock*

CIE 15, *Colorimetry*

CIE 38, *Radiometric and Photometric Characteristics of Materials and Their Measurement*

CIE S 004:2001, *Colours of light signals*

CIE S 004, *Colours of light signals*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/FDIS 22575, as well as the following 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>

3.1

glazing material

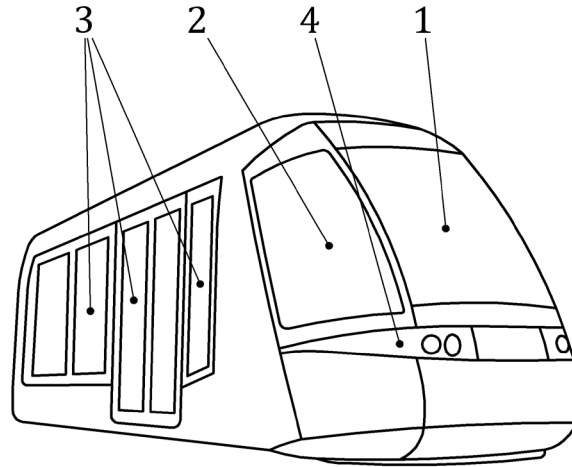
material that allows the transmittance of light

[SOURCE: ISO 22752:2021, 3.4]

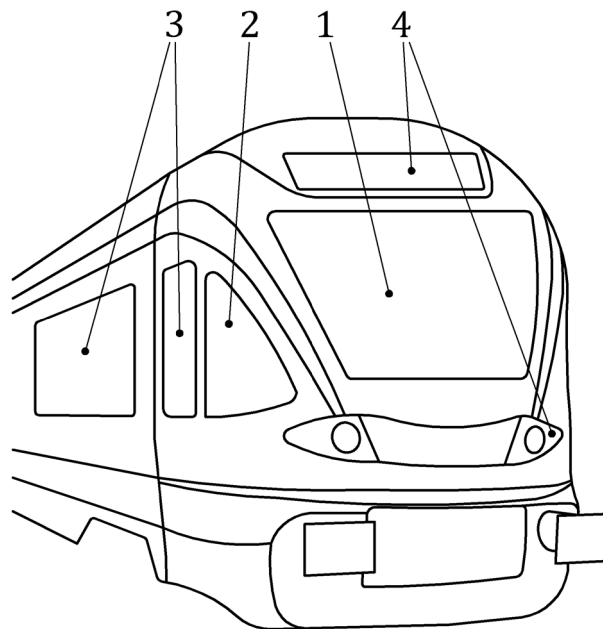
3.2

windscreen

glazing in front of a driver or passengers through which the track ahead can be observed



a) Urban rail



b) Heavy rail

Key

- 1 driver's windscreen (3.3)
- 2 side windscreen (3.4)
- 3 bodyside window
- 4 external glazing (for example covers for lights, information displays)

Figure 1 — Windscreen, window and glazing definitions

Note 1 to entry: [Figure 1](#) shows examples of the different types of windscreen, bodyside windows and external glazing.

3.3

driver's windscreen

windscreen used by a driver in service to observe the track and signals

3.4

side windscreen

additional glazing positioned at the side of a windscreen

3.5

passenger windscreen

windscreen primarily for passenger use in the leading ends of rail vehicles

3.6

vehicle end windows

windows at the ends of vehicles which are never at the leading end of the train in service

Note 1 to entry: Vehicle end windows can occasionally be at the leading end of the train operated at reduced speed (specified by the customer) in a yard.

3.7

primary vision area

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

Note 1 to entry: See [Figure 4](#).

3.8

secondary vision area

area of the *windscreen* ([3.2](#)) outside the *primary vision area* ([3.7](#)), through which the driver can also look from the driving position

Note 1 to entry: See [Figure 4](#).

3.9

peripheral area

area of the *windscreen* ([3.2](#)) outside the *secondary vision area* ([3.8](#))

Note 1 to entry: The peripheral area includes any screen-printed areas.

3.10

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 glazing

3.11

ultraviolet radiation

UV radiation

optical radiation for which the wavelengths are shorter than those for visible radiation

Note 1 to entry: The range between 100 nm and 400 nm is commonly subdivided into:

UV-A: 315 nm to 400 nm;

UV-B: 280 nm to 315 nm;

UV-C: 100 nm to 280 nm.

Note 2 to entry: A precise border between ultraviolet radiation and visible radiation cannot be defined, because visual sensation at wavelengths shorter than 400 nm is noted for very bright sources.

[SOURCE: IEC 60050-845:2020 ED2:2020^[1] Entry 21-008 modified: Notes 3, 4 and 5 removed.]

3.12

spall

small glass particles which detach from the face of a windowpane when it is subjected to impact on the opposite side

Note 1 to entry: Spalling in this document describes the detachment of spall from the inside face of a windscreen or window, when the outer face is subjected to impact.

3.13

hot-spot

highly localised area where the temperature deviates significantly from the area surrounding it

3.14

inspector

person or persons that undertake the visual inspection of products

3.15

seat reference point

SRP

reference point at the back pan of a new seat design with a horizontal distance of 135 mm and vertical distance of 98 mm from the H point according to ISO 20176:2011^[2]

Note 1 to entry: See Figure 2 of EN 16186-1:2014^[3].

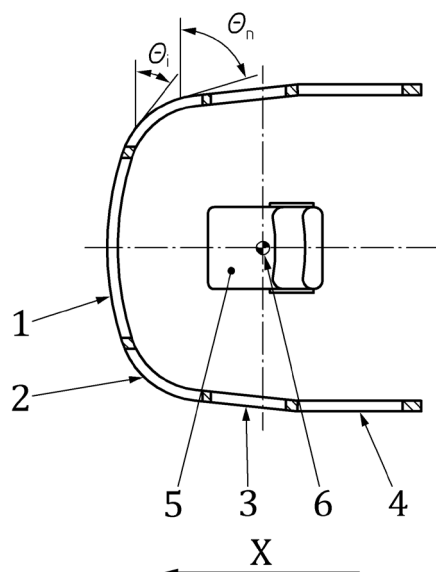
[SOURCE: EN 16186-1:2014^[3], 3.1.6, modified.]

4 Functional requirements

4.1 General

4.1.1 Windscreen classification

Windscreens are positioned to allow observation of the track and signals ahead of a vehicle. Additional side windscreens or windows may be provided to the side of the windscreen or windscreens (see Figure 2).



Key

- 1 windscreen
- 2 side windscreen

- 3 side windscreen (cab window forward of seat reference point, see 4.1.2)
- 4 bodyside window
- 5 driver's seat (or passenger seats, for example in automatic vehicles)
- 6 seat reference point (SRP)
- θ_i, θ_n plan view angles (for curved windscreens, values vary with position)
- X direction of travel

Figure 2 — Windscreens and side windscreens

The classification of rail vehicle glazing (windscreens, side windscreens or bodyside windows) affects the characteristics required and primarily depends on the orientation relative to the track. For the determination of a windscreen's orientation, only the parts of the glazing which if removed would create an aperture in the structure of the vehicle and expose the occupants of a vehicle to the outside shall be considered. Glazing that covers lights, information displays or extends over the structure for aesthetic purposes is therefore excluded.

If the projected forward-facing area determined according to Annex A is less than or equal to 0,065 m², and unless requirements for driver's cabs apply (see 4.1.2), then the glazing shall be considered to be a bodyside window and be in accordance with ISO 22752:2021.

For windscreens that can be considered to be forward facing (including those which are not required or intended for direct observation of the track and signals) the maximum and minimum plan view angles, θ (see Figure 2), shall be determined according to Annex A.

For driver's windscreens, with a central driving position, the plan view angle, θ may be assumed to be = 0°.

The maximum and minimum rake angles Φ shall be determined according to Annex A.

For curved windscreens the method set out in Annex A should be followed for the determination of plan view and rake angles.

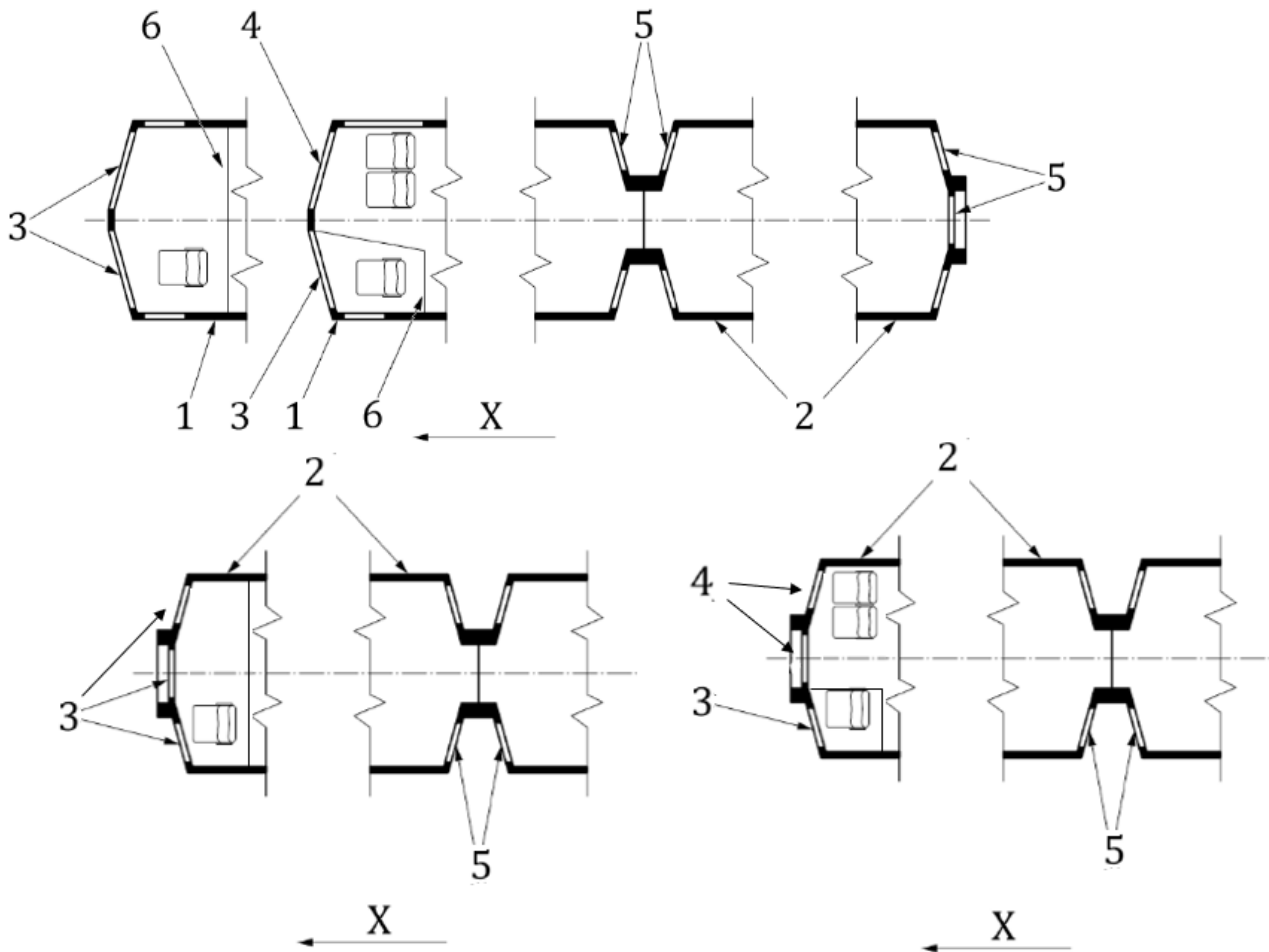
The maximum and minimum installation angles Ψ shall be determined from the maximum and minimum plan view angles θ and the maximum and minimum rake angles Φ using the relation $\cos(\Psi) = \cos(\theta) \cdot \cos(\Phi)$.

The maximum and minimum windscreen plan view angles, rake angles and installation angles shall form part of the technical specification for manufacture and testing.

Where samples are used to determine optical properties, the maximum installation angle shall be used (see for example 5.2).

Where samples are used to determine mechanical properties such as impact resistance, the minimum installation angle shall be used (see for example 6.1).

Figure 3 shows different types of windscreens and windows.



Key

- 1 leading vehicle (alternate cab types shown)
- 2 intermediate and/or end vehicles
- 3 driver's windscreen (s)
- 4 passenger windscreen
- 5 vehicle end windows
- 6 driver's cab partition wall
- X direction of travel

Figure 3 — Windscreens and body end windows

4.1.2 Driver's windscreens

All windows in driver's cabs that are fully or partially in front of the driver's seat reference point (SRP), measured in the longitudinal direction shall be considered as windscreens or side windscreens (see Figure 2). Exceptions according to Clause A.1 are acceptable if the angle is greater than 75 °.

Where two, or more, windscreens are fitted (for example two on either side of a cab end gangway) and only one of which is required to be a driver's windscreen, the requirements for driver's windscreens shall apply to both (or all) windscreens (see Figure 3).

For driver's windscreens, the plan view angle shall be determined using the points defining the primary vision area (see 4.2, see Zone A in Figure 4).

4.1.3 Passenger windscreens and vehicle end windows

Windscreens or side windscreens that are only provided for observation by passengers without occasional driver or crew member (e.g. in degraded mode, training or testing phase) shall be referred to as passenger windscreens (see [Figure 3](#)).

The following may be considered to be equivalent to body windows (see ISO 22752:2021^[4]) and therefore outside the scope of this document if agreed by contracted parties:

- forward facing vehicle end windows, located at an intermediate end of a vehicle, if they are shielded by an adjacent vehicle from the risk of a direct longitudinal impact (see [Figure 3](#));
- forward facing vehicle end windows, for example in body end doors, where people are not present during operation;
- vehicle end windows that only face to the rear in normal service (see [Figure 3](#)).

4.1.4 Contractual agreements

Where options are provided in this document, contracted parties should document the choices made. [Annex I](#) gives the list of items that should be recorded.

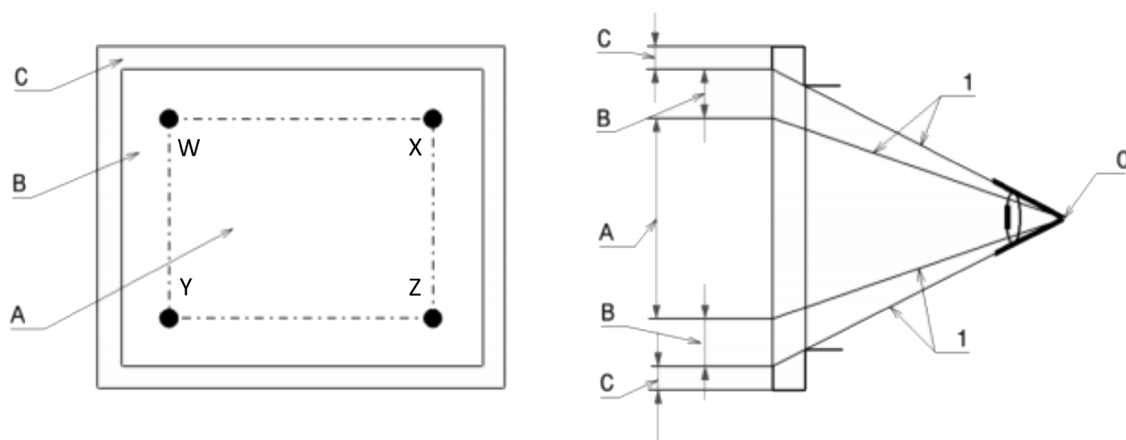
Both the definitive requirements specified throughout this document and the items documented in [Annex I](#) should be satisfied before a claim of compliance with this document can be made and verified.

4.2 Optical areas

A windscreen can be divided into a maximum of three optical areas as shown in [Figure 4](#).

A primary vision area shall be defined for driver's windscreens. The boundary between secondary and peripheral areas shall form part of the windscreen technical specification.

For other types of windscreen and glazing in the scope of this document a primary vision area may not be required and the boundaries between optical areas shall form part of the windscreen technical specification.



Key

- A primary vision area
- B secondary vision area
- C peripheral area

- 0 assumed eye position
 1 driver's sightlines
 W, X, Y, Z sightline intersection points

Figure 4 — windscreen optical areas

The four points W, X, Y and Z, shown on [Figure 4](#), represent the intersections between the windscreen and the driver's sightlines. These points are joined by lines as shown in [Figure 4](#) to define the primary vision area.

The definition of the driver's sightlines (for the observation of track and signals) is outside of the scope of this document. Data to define these points shall form part of the windscreen technical specification.

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

- elimination of distracting items from the field of vision;
- for windscreens that are bonded into position, to protect the bonded area from the effect of ultraviolet (UV) radiation;
- aesthetic purposes.

4.3 windscreen test requirements

4.3.1 General

The windscreen design shall be validated by satisfactory completion of the assessments and tests described in this document. [Table 1](#) contains a summary of the tests defined in this document.

Table 1 — Tests

Feature to be tested	Type test	Routine test	Periodic test
Appearance (see 5.1)	W	W	
Secondary images (see 5.2.1)	W		
Optical distortion (see 5.2.2)	W	W	
Haze (see 5.2.3)	S or W		
Transmittance (see 5.2.4)	S or W		S or W
Chromaticity (see 5.2.5)	S or W		
Impact (including spalling) (see 6.1)	S or W		
Residual visibility (see 6.2)	S		
Abrasion resistance (see 6.3)	S		
Gravelling ^a (see 6.4)	S		
Bullet resistance ^a (see 6.5)	S		
Heating (see 7.1)	W	W	
Ageing (see 7.2)	S or W		

Feature to be tested	Type test	Routine test	Periodic test
Voltage withstand	W	W	
S Sample W Complete windscreen ^a If required by the windscreen technical specification.			

4.3.2 Type tests

All type tests are listed in [Table 1](#).

If a windscreen is fitted with a heating device the following tests shall be repeated with the heating device in use:

- secondary images (see [5.2.1](#));
- optical distortion test (see [5.2.2](#)).

When type tests are repeated with the heating device in use:

- the heater shall be operated at its nominal voltage;
- thermal stabilization shall be reached before measurements are undertaken.

This requirement shall not apply to additional start-up heating provided for use on a stationary vehicle to accelerate the removal of ice or snow.

Test samples properties are summarized in [Annex F](#).

If a windscreen validated in accordance with this document is modified, where it can be shown, for a given type test, that the required performance is not affected, a new type test may not be required.

For passenger windscreens the following tests are optional:

- secondary images (see [5.2.1](#));
- haze (see [5.2.3](#));
- transmittance (see [5.2.4](#)), a minimum transmittance of 40 % may be accepted;
- chromaticity (see [5.2.5](#)).

4.3.3 Routine tests

Routine testing shall be undertaken during production on all windscreens for the following:

- appearance (see [5.1](#));
- optical distortion (see [5.2.2](#));
- heating (see [7.1](#));
- voltage withstand.

4.3.4 Periodic tests

Transmittance (see 5.2.4) shall be tested periodically at a frequency given in the windscreen technical specification.

4.4 Marking

The windscreen shall be permanently marked. The marking shall be readable and visible from inside the cab. The marking shall be readable without viewing aids and the minimum height of characters should be 3 mm.

The marking shall be outside of the primary vision area. If there are no conflicting requirements, it should be in the upper right hand corner of the windscreen.

As a minimum, the following information shall be included in the marking:

- name or logo of windscreen supplier;
- date of manufacture (month and the last two numerals of the year or a code by which this information can be identified).

The following information should be included in the marking:

- unique identification number (part number and serial number);
- nominal voltage and type of current (AC or DC) of the heater (if applicable);
- total power of the heater (if applicable);
- the applicable version of this document.

4.5 Service requirements

Windscreens shall be designed to withstand normal operational conditions, including induced static and dynamic loadings and environmental conditions such as temperature and humidity, when installed in a railway vehicle.

Requirements for use in a specific environment which are in addition to the requirements set out in this document shall form part of the windscreen technical specification.

A heating system should be incorporated in a driver's windscreen for de-icing and de-misting so that the driver can maintain a clear external view in most weather and operating conditions. If such an integral heating system is provided it shall satisfy the requirements set out in 7.1.

Driver's windscreens, when impacted or cracked, shall have sufficient residual visibility to allow the train to be moved, subject to operational rules. This requirement shall be deemed to be satisfied by achieving the residual visibility requirements set out in 6.2.

Glazing edges shall be finished according to ISO 12543-5:2021, Clause 5.

NOTE 1 The purpose of the finished edges is to prevent injury to handlers of the glazing by sharp edges.

NOTE 2 For passenger windscreens, an anti-defenestration and a soft body impact test according to ISO 22752:2021 can be set out in the windscreen technical specification.

4.6 Storage and handling of finished windscreens

Windscreens should be stored in a well ventilated area, protected from the weather and out of direct sunlight.

Flat windscreens should be stored on a solid base in a vertical orientation, inclined at a rake angle of approximately 6 degrees. The windscreens should be continuously supported by brackets along each edge. The supporting brackets should be covered with soft material to prevent damage.

Storage for curved windscreens should follow the same principles adapted for the specific geometry of the product.

5 Visual and optical requirements

5.1 Appearance defects

5.1.1 General

Appearance defects (blemishes) are characteristics of one of the following elements of the windscreen or the processes in its manufacture:

- glazing material (s);
- interlayer(s);
- assembly;
- handling;
- anti-spall layer, if fitted.

To ensure an acceptable quality of vision to the driver, windscreens shall be inspected according to the procedure set out in 5.1.2. Any defects shall be classified according to 5.1.3 and the number and size of such defects shall not exceed the limits listed in 5.1.4.

5.1.2 Visual inspection procedure for appearance defects

Windscreens shall be inspected in a darkened test chamber equipped with a vertical luminous screen. The light from the luminous screen passing through the windscreen shall be used to determine by a visual inspection if there are defects in the windscreen. If defects are found, their type and size shall be recorded and the acceptability of the windscreen determined. The test arrangement is shown in Figure 5.