

Specification for

Road vehicle safety glass

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Automobile Standards Policy Committee (AUE/-) to Technical Committee AUE/10, upon which the following bodies were represented:

- Association of British Glass Repair Operators
- Automobile Association
- British Plastics Federation
- British Railways Board
- Department of Transport
- Department of Transport (Transport and Road Research Laboratory)
- Flat Glass Manufacturers' Association
- Glass and Glazing Federation
- National Caravan Council Ltd.
- Society of Motor Manufacturers' and Traders Ltd.
- Windscreen and Glass Repairer's Association
- Windscreen Repair Equipment Manufacturers' and Suppliers' Association

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Foreword

This British Standard has been prepared under the direction of the Automobile Standards Policy Committee. It supersedes BS AU 178:1980 which is withdrawn. This new edition of BS AU 178 has been produced to align the standard with ECE (United Nations Economic Commission for Europe) Regulation 43.

This edition introduces technical changes but it does not reflect a full review or revision of the standard, which will be undertaken in due course.

Differences in the text between this edition and BS AU 178:1980 are indicated by a line in the margin.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 36, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for safety glass for installation either as windscreens or as other windows or as partitions in motor vehicles and trailers (see 2.1 and 2.2). This standard also specifies test requirements.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1 Motor vehicle

A mechanically propelled vehicle intended or adapted for use on roads (Road Traffic Act 1972).

2.1.1

m₁ vehicle

a vehicle used for the carriage of passengers and comprising no more than 8 seats in addition to the driver's seat

NOTE A list of EEC and UN-ECE vehicle categories with definitions is given for information in Appendix K.

2.2

trailer

a vehicle drawn by a motor vehicle (Road Traffic Act 1972)

2.3

slow moving vehicle

an industrial or agricultural tractor capable of a speed not exceeding 30 km/h on level ground

2.4

toughened glass

a glass consisting of a single layer that has been subjected to special treatment to increase its mechanical strength and to condition fragmentation after shattering

2.5 Laminated glass

A glass consisting of two or more layers held together by one or more interlayers of plastics material. Laminated glass may be either ordinary (see 2.5.1) or treated (see 2.5.2).

2.5.1

ordinary laminated glass

laminated glass in which none of the layers of glass of which it is composed has been treated

2.5.2

treated laminated glass

laminated glass in which at least one of the layers of glass of which it is composed has been specially treated to increase the mechanical strength and to condition fragmentation after shattering

2.6 Group of windscreens

Windscreens of different sizes and shapes that can be considered to have the same characteristics for mechanical properties, fragmentation and resistance to the environment tests.

2.6.1

flat windscreen

a windscreen with no curvature

2.6.2

curved windscreen

a windscreen that is curved in at least one direction

2.7

principal characteristic

a characteristic that substantially changes the optical and/or mechanical properties of a safety glass with regard to its application to a vehicle. The trade name or mark of the manufacturer is also a principal characteristic (see 3.2)

2.8

secondary characteristic

a characteristic that significantly but not substantially changes the optical and/or mechanical properties of a safety glass with regard to its application to a vehicle (see 3.3). The significance of the change is judged in relation to the indices of difficulty (see 2.9)

2.9

indices of difficulty

a two-stage grading applying to the variation in practice of each secondary characteristic. Table 1 shows the characteristics to which the indices relate; a change from index (1) to index (2) requires additional testing

2.10

developed area of a windscreen

the minimum rectangular area of glass from which a windscreen can be developed

2.11

inclination angle of a windscreen

the angle included between a vertical line and the straight line passing through the top and bottom edges of the windscreen, these lines being defined in a vertical plane containing the longitudinal axis of the vehicle

NOTE 1 Measurement of the inclination angle is based on a vehicle standing on level ground; the vehicle is in running order, complete with fuel, coolant, lubricant, tools and spare wheel (if provided as standard equipment by the vehicle manufacturer) including the mass of a driver and, in the case of passenger cars, of one front seat passenger (taking 75 + 0, -1 kg per passenger).
NOTE 2 Vehicles equipped with hydropneumatic, hydraulic or pneumatic suspension or a device for automatic levelling according to load should be tested in the normal running condition specified by the manufacturer.

Table 1 — Secondary characteristics (showing indices of difficulty (1) and (2) where appropriate)

1	2	3	4	5	6
Test prescribed	Windscreens			Windows other than windscreens	
	Toughened	Ordinary laminated and plastics-coated laminated	Treated laminated	Toughened	Laminated
Fragmentation ^a	Nature of material ^{ah} Float and sheet identical — separate approval for plate	No test	As for toughened windscreens ^a	As for toughened windscreens ^a	No test
Mechanical strength	No tests	Secondary characteristics not involved	As for ordinary laminated windscreens	Float or sheet (1) Plate (2)	As for ordinary laminated windscreens
				Clear (1) Tinted (2)	
Behaviour under impact of the head	Secondary characteristics not involved	Secondary characteristics not involved	As for ordinary laminated windscreens	As for toughened windscreens ^d	As for ordinary laminated windscreens
High temperature	No test	Clear interlayer ^e (1) Tinted interlayer ^e (2)	As for ordinary laminated windscreens	No test	As for ordinary laminated windscreens
Resistance to radiation	No test	Clear interlayer (1) Tinted interlayer (2)	As for ordinary laminated windscreens	No test	As for ordinary laminated windscreens
		Tinted glass (1) Clear glass (2)			
Light transmission	Clear (1) Tinted (2)	Clear interlayers ^e (1) Tinted interlayer ^e (2)	As for ordinary laminated windscreens	Clear (1) Tinted (2)	As for ordinary laminated windscreens
		Clear glass ^e (1) Tinted glass ^e (2)			

Table 1 — Secondary characteristics (showing indices of difficulty (1) and (2) where appropriate)

1	2	3	4	5	6
Test prescribed	Windscreens			Windows other than windscreens	
	Toughened	Ordinary laminated and plastics-coated laminated	Treated laminated	Toughened	Laminated
Optical distortion	Plate and float (1) Sheet (2)	Plate and float (1) Sheet (2)	As for ordinary laminated windscreens	^f	^g
	Type of vehicle ^b	Type of vehicle ^b			
Secondary image	Plate and float (1) Sheet (2)	Plate and float (1) Sheet (2)	As for ordinary laminated windscreens	^f	^g
	Type of vehicle	Type of vehicle			
Identification of colours	Each type of tint	Each type of tint	As for ordinary laminated windscreens		^g
Abrasion test ^c	No test	Dependent on material	Dependent on material	No test	Dependent on material
Humidity	No test	Clear interlayer (1) Tinted interlayer (2)	As for ordinary laminated windscreens	No test	Clear interlayer (1) Tinted interlayer (2)
^a Where a change is made from float or sheet glass to plate glass, or vice versa, the fragmentation tests shall be repeated. ^b When considering a group of windscreens, representative windscreens shall be chosen for test that have the greatest rate change of curvature and are intended for mounting at the greatest rake angle. ^c The abrasion test may be carried out when the material forming the outer surface of the windscreen is changed. ^d Test required for double-glazed units only. ^e Shade and/or obscuration bands. (1) not included; (2) included. ^f As for toughened windscreens if C.13 is applicable. ^g As for ordinary laminated windscreens if E.6 is applicable. ^h Shade or obscuration bands other than painted.					

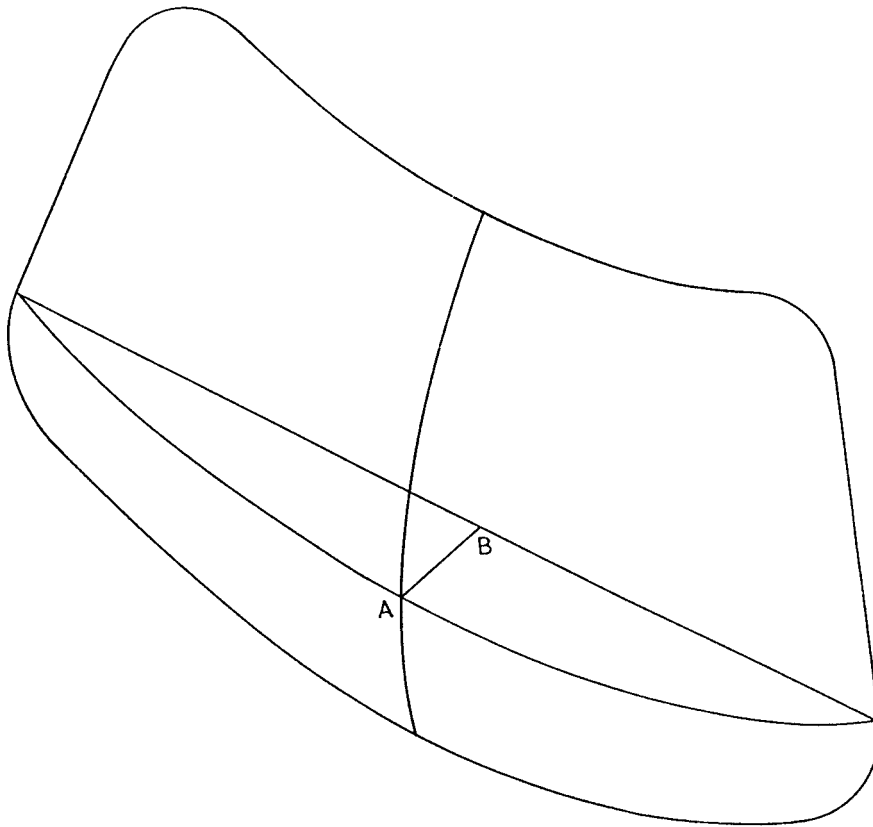


Figure 1 — Maximum height of segments, A–B, measured approximately normal to the glass

2.12
height of segment

the maximum dimension to the inner surface of the glass from a plane contacting the glass extremities, measured approximately normal to the glass (see Figure 1)

2.13
minimum radius of curvature

the approximate value of the smallest radius of windscreen arc measured in the most curved area of the windscreen

2.14
type of safety glass

safety glass, as defined in 2.4 and 2.5, not exhibiting any essential differences of a kind relating, in particular, to the principal and secondary characteristics listed in clause 3

2.15
secondary image

a spurious or ghost image, usually seen at night when the object being viewed is very bright in relation to its surroundings, e.g. the headlights of an approaching vehicle

2.16
sample

a safety glass product, selected as representative of a production batch, and submitted for test

2.17
test piece

an article, subjected to a test procedure, which may either be specially prepared for the purpose or cut from a sample; in appropriate cases a complete safety glass product may serve as a test piece

2.18
daylight opening

the clear and unobstructed aperture in the body of a vehicle into which a safety glass is fitted

2.19
secondary image separation

the angular distance between the apparent positions of the primary image and of the secondary image

3 Glazing characteristics

3.1 General

A safety glass product is defined by its principal and secondary characteristics. (See 3.2 and 3.3 for a complete list applying to all safety glass products.)

Although a change in principal characteristics implies a new type of product, it is recognized that, in certain cases, a change in shape and dimension does not necessarily require a complete set of tests to be carried out.

For certain of the tests as prescribed in the appendices, glasses may be grouped if it is evident that they have similar principal characteristics.

Specimens of glass exhibiting differences only as regards the secondary characteristics referred to in 3.3 may be considered as of the same type; certain tests may, however, be carried out on samples of such glass, if such tests are explicitly stipulated in the test conditions.

3.2 Principal characteristics

The principal characteristics referred to in 2.7 shall be as follows:

- a) the trade name or mark of the manufacturer;
- b) the shape and dimensions (length, width, height of segment and minimum radius of curvature) in the case of windscreens, and the category of shape (flat or curved) in the case of toughened windows other than windscreens;
- c) the number of layers of glass;
- d) the nominal thickness, e , in the case of windscreens, or category of thickness in the case of windows other than windscreens;
- e) the nominal thickness and the nature (foil or airgap) and the type of the interlayer(s), e.g. polyvinyl butyrate (PVB) or other plastics interlayer(s);
- f) the nature of the toughening (thermal or chemical);
- g) the special treatment of laminated glass.

3.3 Secondary characteristics (see Table 1)

The secondary characteristics referred to in 2.8 shall be as follows:

- a) the nature of the glass (plate, float or sheet);
- b) the colouring of the interlayer(s) (colourless or tinted);
- c) the colouring of the glass (colourless or tinted);
- d) the incorporation of electrical conductors;
- e) the incorporation of obscuration bands.

4 General requirements and application

4.1 All glass, including windscreen glass, shall be such that, in the event of shattering, the danger of personal injury is reduced to a minimum.

The glass shall be sufficiently resistant to conditions to be expected in normal traffic, and to atmospheric and heat conditions, chemical action and abrasion.

4.2 Windscreens shall, in addition, be sufficiently transparent, and not cause any noticeable distortions of objects seen through the windscreen or cause any confusion between the signalling colours normally used. In the event of the windscreen shattering, the driver shall still be able to see the road clearly so that he can brake and stop his vehicle safely.

4.3 The thicknesses of glass generally available in the United Kingdom for use in the automobile industry are given for information in Appendix H.

4.4 Safety glass application

4.4.1 The windscreens of slow moving vehicles shall be of zone toughened glass, uniformly toughened glass or high performance laminated glass.

4.4.2 The windscreens of M_1 and vehicle categories other than slow moving vehicles shall be either of zone toughened glass or high performance laminated glass.

4.4.3 The windows, other than windscreens, of all categories of vehicle shall be of high performance or standard laminated glass, or uniformly toughened glass.

5 Particular requirements

5.1 General requirements

All types of safety glass shall comply with the general requirements described in Appendix A. Depending on the category to which they belong, they shall, in addition, comply with the particular requirements stated in 5.2.1 to 5.2.7.

NOTE Tests need only be performed if the test authority requires them, having regard to the information already in its possession on the product and the materials used.

5.2 Particular requirements

5.2.1 For toughened glass windscreens, the requirements are specified in Appendix B.

5.2.2 For uniformly toughened glass windscreens in slow moving vehicles, the requirements are specified in Appendix C, the headform test is specified in B.6 and the optical requirements are specified in A.8.

5.2.3 For toughened glass windows other than windscreens, the requirements are specified in Appendix C.

5.2.4 For ordinary laminated glass windscreens, the requirements are specified in Appendix D.

5.2.5 For ordinary laminated glass windows other than windscreens, the requirements are specified in Appendix E.

5.2.6 For treated laminated glass windscreens, the requirements are specified in Appendix F.

5.2.7 For plastics-coated laminated glass windscreens, the requirements are specified in Appendix L.

6 Purpose of the tests

6.1 The following tests are specified in this British Standard.

6.1.1 Fragmentation

The purpose of this test is to:

- a) verify that the fragments and splinters produced after fracture are such as to minimize the risk of injury; and
- b) verify the transparency of windscreens after shattering.

6.1.2 Mechanical strength

6.1.2.1 Ball impact test

There are two forms of test, one using a 227 g ball and one using a 2.26 kg ball, as stated in **6.1.2.1.1** and **6.1.2.1.2**.

6.1.2.1.1 227 g ball test

The purpose of this test is to assess the adhesion of the interlayer in laminated glass, and the mechanical strength of toughened glass other than windscreens.

6.1.2.1.2 2.26 kg ball test

The purpose of this test is to assess the penetration resistance of laminated glass.

6.1.2.2 Head form test

The purpose of this test is to verify compliance with requirements relating to the limitation of injury in the event of impact against laminated glass other than windscreens, or the windscreen or double windows, and double-glazed units for use in side windows of buses or coaches.

6.1.3 Resistance to the environment

6.1.3.1 Abrasion test

The purpose of this test is to determine that the resistance to abrasion of a safety glass exceeds a specified value.

6.1.3.2 High temperature test

The purpose of this test is to verify that, when exposed to high temperature over an extended period of time, no bubbles or other defects occur in laminated glass.

6.1.3.3 Resistance to radiation test

The purpose of this test is to determine whether the light transmittance of laminated glass, when exposed to radiation over an extended period of time, is significantly reduced or whether the material is significantly discoloured.

6.1.3.4 Humidity test

The purpose of this test is to determine whether a laminated glass will withstand the effect of humidity in the atmosphere over an extended period of time without significant defects.

6.1.4 Optical qualities

6.1.4.1 Light transmission test

The purpose of this test is to determine whether the regular transmittance of light through safety glass exceeds a specified value.

6.1.4.2 Optical distortion test

The purpose of this test is to verify that objects viewed through a windscreen are not distorted to an extent likely to confuse the driver.

6.1.4.3 Secondary image separation test

The purpose of this test is to verify that the angular separation of the secondary image from the primary image does not exceed a specified value.

6.1.4.4 Identification of colours test

The purpose of this test is to verify that a windscreen does not cause confusion of colours seen through it.

7 Detailed schedule of tests for safety glass

7.1 Safety glass shall be subjected to the tests given in Table 2.

7.2 A safety glass product shall be deemed to comply with the requirements of this British Standard if all the requirements specified in the appropriate clauses indicated in Table 2 have been satisfied.

8 Application for approval and procedure on any subsequent modification of the product

The procedure for applying for approval of a category of glass, and the information it is necessary to provide with the application, are included in Appendix J. The procedure to be followed in the event of subsequent modification of the safety glass or group of windscreens for which approval was originally granted is also described in Appendix J.

Table 2 — Tests specified for the categories of glass defined in 2.4 and 2.5

Test	Windscreens			Other than windscreens		
	Zone toughened	Uniformly toughened	Ordinary laminated ^c	Treated laminated	Toughened	Laminated
Fragmentation test	B.3	C.2	—	F.4	C.2^d	—
Ball impact test for mechanical strength						
227 g	—	C.7	D.5.2	D.5.2	C.7.1^d	E.4
2.26 kg	—	—	D.5.1	D.5.1	—	—
Head form test (samples)	B.6.1.1	B.6.1.1	D.3	D.3	C.9^a	—
Head form test (test pieces)	or B.6.1.2	or B.6.1.2	D.4	D.4	—	E.3
Abrasion test	—	—	A.4	A.4	—	A.4
High temperature test	—	—	A.5	A.5	—	A.5
Resistance to radiation test	—	—	A.6	A.6	—	A.6
Humidity test	—	—	A.7	A.7	—	A.7
Light transmission test	A.8.1	A.8.1	A.8.1	A.8.1	A.8.1^b	A.8.1^b
Optical distortion test	A.8.3	A.8.3	A.8.3	A.8.3	—	—
Secondary image test	A.8.6	A.8.6	A.8.6	A.8.6	—	—
Identification of colours test	A.8.9	A.8.9	A.8.9	A.8.9	—	—

^a In the case of double glazed units only.

^b The provisions concerning optical qualities in **A.8** shall apply to windows that are necessary to comply with any requirements concerning the driver's field of view in all directions.

^c Plastics-coated laminated glass windscreens shall, in addition to the tests given in this column, be subjected to the tests specified in Appendix L.

^d When surface printing or conductors are present the test authority may select representative samples.

9 Marking

9.1 General

Identification marks on safety glass, complying with the requirements of **9.2**, **9.3** or **9.4** as appropriate, shall be arranged in close proximity to each other and to any relevant approval mark.

9.2 Marking on toughened safety glass

The following particulars shall be indelibly and distinctly marked by the manufacturer on every piece of toughened safety glass accepted for glazing in a land vehicle:

- the name, registered trademark or BS licence number of the manufacturer;
- in the case of uniformly heat toughened glass, the letter "T" or the word "tempered" or "toughened";

c) in the case of a zone toughened windscreen, the letters "WT";

d) in the case of a uniformly toughened safety glass windscreen for a slow moving vehicle, the letter "W";

e) the number of this British Standard, i.e. BS AU 178a¹⁾.

f) a mark identifying the date, at least to the nearest month, and the site of manufacture.

NOTE It is strongly recommended that, in case of asymmetrical windscreens, there should be an adhesive label on the windscreen indicating whether it is intended for a left-hand drive or right-hand drive vehicle.

¹⁾ Marking BS AU 178a on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

9.3 Marking on laminated safety glass

The following particulars shall be indelibly and distinctly marked by the manufacturer (except as indicated in 9.4) on every piece of laminated safety glass accepted for glazing in a land vehicle:

- a) the name, registered trademark or BS licence number of the manufacturer;
- b) in the case of a non-windscreen glass, the word “laminated” or the letter “L”;
- c) in the case of a windscreen, the words “laminated windscreen” or the letters “WL”;
- d) in the case of a treated laminated windscreen, the words “treated laminated windscreen” or the letters “WLT”;
- e) the number of this British Standard, i.e. BS AU 178a²⁾;
- f) a mark identifying the date, at least to the nearest month, and the site of manufacture.

9.4 Marking on laminated safety glass cut from stock sizes

In the case of laminated glass sheets in stock sizes that are supplied for cutting and fitting by stockists, the requirements of 9.4.1 to 9.4.3 shall apply.

9.4.1 The manufacturer shall apply to each sheet the appropriate markings as specified in 9.3.

9.4.2 The stockist, by agreement and arrangement with the manufacturer, shall ensure that every piece of glass cut from a stock size shall be indelibly and distinctly marked with the appropriate markings as specified in 9.3.

9.4.3 In addition, the stockist shall mark on every piece of glass cut from a stock size a means of identification of the stockist, details of which shall be supplied to the manufacturer concerned.

²⁾ Marking BS AU 178a on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.