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Specification for

Plastics safety glazing materials for use in road vehicles

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Foreword

This standard has been prepared under the direction of the Automobile Standards Committee, at the request of the Department of Transport and organizations connected with the motor vehicle construction industry. It complements BS AU 178 “*Specification for road vehicle safety glass*” but more particularly it gives credence to The Motor Vehicles (Construction and Use) Regulations 1978: Regulation 26 and the definition in those regulations for safety glazing.

Hitherto, no standard has existed for the United Kingdom that defines the performance and use expected of plastics materials for glazing in road vehicles. In addition to safety, it is considered to be realistic that plastics glazing materials should maintain various other levels of quality and therefore tests not relating to safety are included.

Plastics materials may be flexible or rigid as specified by this standard and in the form of flat sheet, patterned sheet, or thermo-formed shaped panels.

It is recognized that this standard covers a relatively new area, not previously standardized, and that it may be necessary to amend the requirements resulting from the initial experience in its use. In due course, requirements for complete product assemblies, including fixings, may be added.

Certification. Attention is drawn to the certification facilities described on the inside back cover of this standard.

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 and ii, pages 1 to 20, 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.

Amendments issued since publication

Amd. No.	Date of issue	Comments

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Contents

	Page
Foreword	Inside front cover
1 Scope	1
2 Definitions	1
3 Plastics glazing characteristics	2
4 General requirements	2
5 Purpose of tests	3
6 Particular requirements	4
Appendix A Marking	6
Appendix B Flexible/rigid categorization test	6
Appendix C Tests for optical qualities	6
Appendix D Ball impact test for mechanical strength of rigid plastics materials	7
Appendix E Humidity test	8
Appendix F Flammability test	8
Appendix G Dimensional stability after heating test	10
Appendix H Light degradation test	10
Appendix J Abrasion resistance test	11
Appendix K Chemical resistance test for rigid plastics materials	13
Appendix L Ball impact test for mechanical strength of flexible plastics materials	13
Appendix M Chemical resistance test for flexible plastics materials	14
Appendix N Head form impact test	14
Appendix P Minimum sectional thickness test	15
Figure 1 — Arrangement of rigidity/flexibility test	16
Figure 2 — Support for ball tests	16
Figure 3 — Example of combustion chamber with test piece holder and drip tray	17
Figure 4 — Test piece	18
Figure 5 — Diagram of abrading instrument	18
Figure 6 — Hazemeter	19
Figure 7 — Head form	19
Figure 8 — Support for test pieces (head form test)	20
Table 1 — Categorization and schedule of tests	5
Table 2 — Material thickness and height of drop for ball impact test	8
Table 3 — Readings required for abrasion resistance test	12

1 Scope

This British Standard specifies requirements for plastics safety glazing materials for use in motor vehicles and trailers, e.g. windows, partitions, rooflights and wind deflectors. Limited requirements are included for the durability of these materials.

NOTE Plastics glazing materials are not permitted for windscreens of motor vehicles, other than those exceptions permitted by The Motor Vehicle (Construction and Use) Regulations 1978.

The requirements of the standard are not applicable to the following.

- a) Miscellaneous items within or attached to a road vehicle that may be construed as glazing materials, e.g. instrument dial fronts, rear vision mirrors and lighting covers.
- b) Glazing materials resistant to ballistics or to manual attack. (See BS 5051-2 and BS 5544 respectively.)
- c) Methods of mounting for plastics glazing materials.
- d) Plastics materials that are used to join together panels of glass to form laminated safety glass as specified in BS AU 178 or any laminates comprising both glass and plastics materials.

NOTE The titles of publications referred to in this standard are listed below.

British Standards

BS 2869, *Petroleum fuels for oil engines and burners.*

BS 4040, *Specification for petrol (gasoline) for motor vehicles.*

BS 5051, *Security glazing — Part 2: Specification for bullet-resistant glazing for exterior use.*

BS 5544, *Specification for anti-bandit glazing (glazing resistant to manual attack).*

BS AU 178, *Specification for road vehicle safety glass.*

International Commission on Illumination (CIE)

Publications

Publication CIE No. 15 (E-1.3.1) 1971 — Colorimetry — Official recommendations of the International Commission on Illumination Proceedings of the 1931 meeting of the International Commission on Illumination (CIE) available from the National Illumination Committee of Great Britain, The Library, Thorn EMI Lighting Ltd., Great Cambridge Road, Enfield, Middlesex EN1 1UL.

The Pharmaceutical Society of Great Britain

Martindale — The Extra Pharmacopoeia

Legislation

Road Traffic Act 1972

The Motor Vehicle (Construction and Use) Regulations 1978

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)

2.2

trailer

a vehicle drawn by a motor vehicle

2.3

glazing

plastics materials performing the same or a similar function to that of glass

2.4

opaque glazing material

a material having the same or similar structural characteristics as glazing defined in 2.3 but pigmented, coloured or surface treated to preclude the transmittance of light

2.5

plastics material

a material based on a high relative molecular mass (molecular weight) organic polymeric substance that may be used either in its raw material state or in combination with other chemical additives to modify the properties of the raw material

2.6

plastics glazing materials

glazing materials of a form as defined in 2.5 constructed or treated, or combined with other materials such that if fractured they do not fly into fragments likely to cause severe injury

2.7

sample

a safety glazing product selected as representative of a manufacturer's production and submitted for test

2.8

test piece

an article subjected to a test procedure, that may either be specially prepared for the purpose or cut from a sample

NOTE In appropriate cases, a complete plastics glazing product may serve as a test piece.

2.9

principal characteristic

a characteristic that materially changes the optical and/or mechanical properties of a plastics glazing material in a way that has significance in the application of the material in a vehicle

2.10

secondary characteristic

a characteristic that could materially change the optical and/or mechanical properties of a plastics glazing material in a way that has significance in the application of the material in a vehicle

2.11

allowed locations

locations permitted under Regulation 26 of the Motor Vehicles (Construction and Use) Regulations 1978

3 Plastics glazing characteristics

3.1 General. A plastics glazing product is defined by its principal and secondary characteristics. (See 3.2 and 3.3 for a complete list applying to all plastics glazing 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.

Specimens of plastics exhibiting differences only as regards the secondary characteristics referred to in 3.3 may be considered as of the same type; certain tests are explicitly stipulated in the test conditions.

NOTE *Degree of safety.* One plastics glazing material may be superior for protection against one type of hazard while another may be superior against another type, although they may vary in some of their more general properties. Since accident conditions are not standardized, no one type of plastics glazing material can be shown to possess the maximum degree of safety under all conditions and against all conceivable hazards.

3.2 Principal characteristics. For the purposes of this British Standard the principal characteristics (see 2.9) shall be as follows:

- the trade name or mark of the manufacturer to indicate the process of manufacture;
- the nature and manufacturer of the material (polymethyl methacrylate, polyvinyl chloride, polycarbonate, etc.);
- the shape and dimensions (length, width, radius of curvature);
- the number of layers of material;
- the nominal and combination thickness;
- the special treatment of the material.

3.3 Secondary characteristics. For the purposes of this British Standard the secondary characteristics (see 2.10) shall be as follows:

- the colouring of the material;
- the method of manufacture of the product;
- the surface treatment of the product.

4 General requirements

4.1 General. The tests described shall determine whether a plastics glazing material has certain desirable properties for its acceptance as being suitable for vehicle glazing.

SAFETY NOTE. *Minimizing personal injuries.* It is essential that all plastics glazing products are such that in the event of fracturing, the danger of personal injuries is reduced to a minimum.

4.2 Categories of plastics glazing materials.

For the purposes of this standard plastics materials used for the glazing of motor vehicles and their trailers shall be divided into eight categories, as follows.

- Category A: maximum impact with optical requirement.* Plastics glazing materials that comply with the requirements for rigid plastics materials that may be used in any allowed location.
- Category B: medium impact with optical requirement.* Plastics glazing materials that comply with the requirements for rigid plastics materials that may be used in any allowed location including partitions and forward facing windows, the inner surfaces of which are at an angle greater than 30° to the longitudinal vertical plane of the vehicle.
- Category C: minimum impact with optical requirement.* Plastics glazing materials that comply with the requirements for rigid plastics materials that may be used in any allowed location not requiring a higher level of impact performance.
- Category D: maximum impact with no optical requirement.* Plastics glazing materials that comply with the requirements for rigid plastics materials that may only be used in an allowed location not required for driving visibility.
- Category E: medium impact with no optical requirement.* Plastics glazing materials that comply with the requirements for rigid plastics materials that may only be used in an allowed location not required for driving visibility including partitions and forward facing windows, the inner surfaces of which are at an angle greater than 30° to the longitudinal vertical plane of the vehicle.
- Category F: minimum impact with no optical requirement.* Plastics glazing materials that comply with the requirements for rigid plastics materials that may be used in any allowed location not required for driver visibility nor requiring a higher level of impact performance.
- Category G: flexible with optical requirement.* Plastics glazing materials that comply with the requirements for flexible plastics materials that may be used in any allowed location.

h) *Category H: flexible with no optical requirement.* Plastics glazing materials that comply with the requirements for flexible plastics materials that may only be used in an allowed location not required for driving visibility.

4.3 Environmental resistance. The material shall be resistant to the incidents to be expected in normal traffic and to atmospheric and heat conditions, chemical action and abrasion.

NOTE 1 The abrasion resistance of post-coated components is judged on the basis of similarly post-coated flat sheet test pieces. In the design of these components it is, therefore, necessary to ensure that the shape and design does not make any subsequent coating operation difficult to achieve, thus giving rise to areas of the surface that have differing abrasion resistance characteristics.

NOTE 2 This standard includes requirements relating to durability of plastics safety glazing materials. If, however, materials are subjected to exceptional or unusual circumstances such as undue scratching or abrasion, unsatisfactory methods of cleaning, chemical attack, or excessive ultraviolet radiation from an artificial source, the durability may be affected. If it is required to make provision for such circumstances, additional requirements should be agreed between the purchaser and the vendor.

NOTE 3 This standard does not cover practices or methods of mounting glazing materials. In general, plastics materials have higher coefficients of expansion than glass and therefore require more care in the design mounting arrangements. In addition, plastics materials may be hygroscopic and would be subject to dimensional change in service. It is therefore essential that materials are installed under normally expected conditions of temperature and humidity.

4.4 Marking. All plastics glazing products shall comply with the marking requirements specified in Appendix A.

4.5 Test conditions. Unless otherwise stated for a particular test, tests shall be conducted at $20 \pm 5^\circ\text{C}$ and $60 \pm 20\%$ r.h. Samples and test pieces shall be held under these conditions for 48 h immediately prior to test.

4.6 Thickness. Plastics safety glazing material shall be within $\pm 10\%$ of its nominal thickness.

4.7 Cleaning and maintenance instructions. Each product or component shall be supplied with instructions indicating suitable methods of cleaning and maintenance.

5 Purpose of tests

5.1 Flexible/rigid categorization test. The purpose of this test is to establish whether a plastics glazing material is categorized as flexible or rigid at the thickness under test, and hence to which series of tests it is to be subjected.

5.2 Optical qualities

5.2.1 Light transmission test. The purpose of this test is to establish that the light transmittance is not below a specified value.

5.2.2 Optical distortion. The purpose of this test is to verify that a plastics material does not cause distortion of objects seen through it to an extent likely to confuse the driver.

5.3 Mechanical strength

5.3.1 Ball impact test. The purpose of this test is to assess the mechanical strength of plastics materials.

5.3.2 Low temperature ball impact test. The purpose of this test is to assess the mechanical strength of plastics materials at low temperatures.

5.3.3 Head form impact test. The purpose of this test is to assess the mechanical strength of plastics materials to high levels of impact performance.

5.4 Resistance to the environment

5.4.1 Humidity test. The purpose of this test is to determine whether a plastics material withstands the effect of humidity in the atmosphere over an extended period of time, without significant defects.

5.4.2 Flammability test. The purpose of this test is to determine whether a plastics material has a sufficiently low burning rate.

5.4.3 Dimensional stability after heating test. The purpose of this test is to establish whether a plastics material retains its contours after exposure to an elevated temperature under stated humidity conditions.

5.4.4 Light degradation test. The purpose of this test is to establish whether a plastics material is either significantly damaged, discoloured, or if its light transmission is seriously affected, under exposure to radiation over an extended period of time.

5.4.5 Abrasion test. The purpose of this test is to determine that the resistance to abrasion of a plastics material achieves a specified value.

5.4.6 Chemical resistance test. The purpose of this test is to establish whether a plastics material is sufficiently resistant to attack from various chemicals with which it is likely to come into contact.

5.5 Minimum sectional thickness test. The purpose of this test is to assess the minimum sectional thickness of a glazing sample manufactured from flat sheet.

5.6 Tests applicable only to flexible plastics materials

5.6.1 Ball impact test. The purpose of this test is to assess the mechanical strength of a flexible plastics material.

5.6.2 Low temperature ball impact test. The purpose of this test is to assess the mechanical strength of a flexible plastics material at low temperature.

5.6.3 Chemical resistance test. The purpose of this test is to establish whether a flexible plastics material is sufficiently resistant to attack from various chemicals with which it is likely to come into contact.

6 Particular requirements

6.1 General. The particular requirements for each of the eight categories of plastics safety glazing materials listed in 4.2 shall be as specified in 6.2 to 6.7 and given in Table 1.

6.2 Category A or B: rigid plastics materials for use in allowed locations required for driver visibility. When tested as described in Appendix B, Appendix C, Appendix D, Appendix E, Appendix F, Appendix G, Appendix H, Appendix J, Appendix K, Appendix N and Appendix P, where applicable, category A or B plastics materials shall comply with the criteria specified in these appendices.

6.3 Category C: rigid plastics materials for use in allowed locations not requiring a high level of impact performance. When tested as described in Appendix B, Appendix C, Appendix D, Appendix E, Appendix F, Appendix G, Appendix H, Appendix J and Appendix K, category C plastics materials shall comply with the criteria specified in these appendices.

6.4 Category D or E: rigid plastics materials for use in allowed locations not required for driver visibility. When tested as described in Appendix B, Appendix D, Appendix E, Appendix F, Appendix G, Appendix H, Appendix K, Appendix N and Appendix P, where applicable, category D or E plastics materials shall comply with the criteria specified in these appendices.

6.5 Category F: rigid plastics materials for use in allowed locations not requiring a high level of impact performance nor required for driver visibility. When tested as described in Appendix B, Appendix D, Appendix E, Appendix F, Appendix G, Appendix H, Appendix J and Appendix K, category F plastics materials shall comply with the criteria specified in these appendices.

6.6 Category G: flexible plastics materials for use in allowed locations required for driver visibility. When tested as described in Appendix B, C.1 and C.2 and Appendix E, Appendix F, Appendix H, Appendix L and Appendix M, category G plastics materials shall comply with the criteria specified in these appendices.

6.7 Category H: flexible plastics materials for use in allowed locations not required for driver visibility. When tested as described in Appendix B, Appendix E, Appendix F, Appendix H, Appendix L and Appendix M, category H plastics materials shall comply with the criteria specified in these appendices.