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Incorporating Corrigendum No.1



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Specification for retroreflecting number plates

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Contents

	Page
Foreword	iii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Marking and design	3
4.1 Marking	3
4.2 Design	3
4.3 Fixing instructions	3
5 Performance of background and characters	3
5.1 Background	3
5.2 Characters	3
5.3 Contrast in NIR between characters and background	4
6 Testing	4
<i>Table 1 — Test schedules</i>	4
<i>Figure 1 — Dimensions and layout of sample unit required for testing</i>	5
7 Colorimetry	5
<i>Table 2 — Daylight chromaticity and luminance factor limits</i>	5
8 Visible light retroreflection	6
<i>Table 3 — Minimum coefficient of retroreflection, R_R of the retroreflective background</i>	6
<i>Figure 2 — Arrangement of apparatus for measuring the coefficient of retroreflection</i>	7
9 Resistance to bending	7
<i>Figure 3 — Number plate bend test arrangement</i>	8
10 Resistance to solvents	8
11 Thermal resistance	9
12 Resistance to impact	9
13 Resistance to abrasion	9
14 Resistance to corrosion	9
15 Resistance to weathering	10
15.1 General	10
15.2 Visual appearance	10
15.3 Colour fastness	10
15.4 Coefficient of retroreflection	10
15.5 Effect of dirt	10
<i>Figure 4 — Test arrangements for measurement of the coefficient of retroreflection of wet specimens</i>	11
Annex A (informative) Adhesive attachment of number plates	12
Annex B (informative) Guidance for drilling through number plates	14
Annex C Determining effective contrast in the infrared spectrum between characters and retroreflective background	15
<i>Figure C.1 — Infrared image of plate sample and resultant contrast histogram</i>	17
<i>Table C.1 — Tabulation of test reports</i>	17
Annex D Method of test for impact resistance	18
<i>Figure D.1 — Apparatus for impact resistance test</i>	18
<i>Figure D.2 — Number plate holding fixture</i>	19
Annex E Method of test for thermal resistance	21
<i>Figure E.1 — Sample support stand for thermal resistance test</i>	21

Annex F	Method and apparatus for accelerated artificial weathering tests	22
	<i>Table F.1 — Temperature</i>	22
Annex G	Procedure for preparing a dirty number plate for test purposes	23
	Bibliography	24

Summary of pages

This document comprises a front cover, an inside front cover, pages I to IV, pages 1 to 24, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 28 February 2018. It was prepared by Technical Committee AUE/1, *Vehicle lighting and signalling*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS AU 145d:1998, which is withdrawn. This standard was first published in 1967 and revised as BS AU 145a:1972. Subsequent revisions produced BS AU 145b:1989 and BS AU 145c:1995.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- emphasizing the need where possible to avoid fixings in the readable area (use of adhesives);
- the introduction of photometric testing after surface abrasion and scratch resistance;
- further clarification of the colour of characters; and
- adequate contrast between background and characters in NIR wavelengths has been added as a requirement to demonstrate compatibility with automatic number plate recognition (ANPR) systems.

Text introduced or altered by Corrigendum No.1 is indicated in the text by the tags C1 C1.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity with this British Standard. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Test laboratory accreditation. Users of this British Standard are advised to consider the desirability of selecting test laboratories that are accredited to BS EN ISO/IEC 17025 by a national or international accreditation body.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard specifies requirements for retroreflecting number plates for vehicles, including requirements for:

- a) colorimetric and photometric properties;
- b) adequate contrast between background and characters in NIR wavelengths to demonstrate compatibility with automatic number plate recognition (ANPR) systems; and
- c) resistance to bending, impact, abrasion, corrosion, solvents, weathering and extremes of temperature.

The British Standard does not specify requirements for number plates fitting, which is prescribed by statutory regulations.

NOTE 1 The appropriate regulations of The Road Vehicles (Display of Registration Marks) Regulations 2001 (as amended) [1] specify requirements for fixing, size and type of letters, numbers and spacings of retroreflecting number plates.

NOTE 2 Retroreflecting number plates can be manufactured from any material which performs satisfactorily in service, providing the requirements of this British Standard are met.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions 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.

Standards publications

[BS 245](#), *Specification for mineral solvents (white spirit and related hydrocarbon solvents) for paints and other purposes*

BS 2869, *Fuel oils for agricultural, domestic and industrial engines and boilers – Specification*

BS EN ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance*

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

BS EN ISO 11664-1, *Colorimetry – Part 1: CIE standard colorimetric observers*

BS EN ISO 11664-2, *Colorimetry – Part 2: CIE standard illuminants*

Other publications

[N1] CIE Publication No. 15: *Colorimetry*.

[N2] CIE Publication No. 54.2: *Retroreflection definition and measurement*.

3 Terms and definitions

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

3.1 character

letter or number making up part of a vehicle registration mark

3.2 coefficient of luminous intensity, R

quotient of the luminous intensity of the retroreflector in the direction of observation by the illuminance at the retroreflector on a plane perpendicular to the direction of the incident light

3.3 coefficient of retroreflection, R_A

quotient of the coefficient of luminous intensity of a plane retroreflecting surface by its area

3.4 entrance angle

angle characterizing the angular position of the retroreflector with respect to the direction of the incident light

3.5 luminance factor

ratio of the luminance of the surface element in the given direction to that of a perfect reflecting or transmitting diffuser identically illuminated

[SOURCE: CIE Publication No. 17.4: *International Lighting Vocabulary* [2]]

NOTE This applies to the part of the electromagnetic spectrum which is visible to the human eye, i.e. photopic vision.

3.6 near infrared (NIR)

part of electromagnetic spectrum between 780 nm and 1 400 nm given as the CIE IR-A spectral region

NOTE Most modern ANPR systems operate in the near infrared region in a wavelength range 780 nm to 940 nm.

3.7 observation angle

angle by which the direction of observation of the retroreflector differs from the direction of incident light

3.8 readable area

single rectangular area on a number plate occupied by the registration characters plus a margin on all sides

3.9 retroreflecting number plate

plate or other device displaying the registration mark of the vehicle and where the background retroreflects and the registration mark and any other text, image or border does not

NOTE This has the same meaning as "registration plate" as defined by the Road Vehicles (Display of Registration Marks) Regulations 2001 (as amended) [1].

3.10 retroreflection

reflection in which the reflected rays are preferentially returned in directions close to the opposite of the direction of the incident rays, this property being maintained over wide variations of the direction of the incident rays

4 Marking and design

4.1 Marking

Each number plate shall be permanently and legibly marked, using any opaque colour that is in contrast to the background of the plate and which renders the marks nonretroreflective, with the following information outside the readable area:

- a) the number of this British Standard, i.e. BS AU 145e¹⁾ and means of identifying the component supplier or manufacturer; and
- b) the name and postcode only of the number plate supplying outlet (for layout of the sample unit for testing, see [Clause 6](#)).

NOTE For the avoidance of doubt, website addresses (unless this is the sole trading name of the company), telephone numbers and logos should not be used.

There shall be no other marking on plates in use, other than the two to seven characters specified in the Road Vehicles (Display of Registration Marks) Regulations 2001 (as amended) [1], unless expressly permitted by the Secretary of State for Transport.

4.2 Design

The complete retroreflecting background area of the number plate shall be a continuous and substantially flat surface, except that an integral raised or depressed border, of width and height not exceeding 5 mm and 2 mm, respectively, is permitted around the number plate periphery.

4.3 Fixing instructions

Adequate fixing instructions shall be provided to avoid damage to the number plate or alteration of the readable area when it is being fitted to a vehicle.

NOTE 1 Piercing number plates is not recommended. Non-mechanical fixing techniques such as adhesive pads are preferred (see [Annex A](#)). Mechanical fixings may be used to mount number plates to vehicles if other methods are not possible. In this case, holes need to be correctly drilled (see [Annex B](#)) and placed if possible in the area outside the readable area of the number plate.

NOTE 2 The Road Vehicles (Display of Registration Marks) Regulations 2001 (as amended) [1] prohibit the fixing of a registration plate to a vehicle in a manner which has the effect of changing the appearance or legibility of any of the characters.

5 Performance of background and characters

5.1 Background

Retroreflective materials used for the background shall conform to [Clause 8](#). The daylight colour of the retroreflecting background shall be as follows:

- a) front facing: white;
- b) rear facing: yellow.

5.2 Characters

5.2.1 The registration characters shall not be removable.

¹⁾ Marking BS AU 145e:2018 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 solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity. Evidence of conformity to this standard can be provided by a third party.

5.2.2 The complete surface of each registration character shall be one shade of black (see [Clause 7](#)).

NOTE The limits in [Clause 7](#), [Table 2](#) define what constitutes black and require a very low luminance level. Variation below 0.05 in luminance factor does not affect the performance of the plate.

5.3 Contrast in NIR between characters and background

When tested in accordance with [Annex C](#), the following conditions shall be met for all samples:

- a) $P1 < d \sqrt{C1}$; and
- b) $P2 > \text{than } d$; and
- c) $P2 - P1 > 200$.

NOTE ANPR systems operate using edge detection and optical character recognition which rely on the contrast between the characters and the retroreflective background.

6 Testing

The tests required to verify conformity with [Clause 7](#) to [Clause 15](#) shall be carried out in the sequence specified in [Table 1](#).

Each test shall be carried out on a sampling unit comprising:

- a) a pair of retroreflecting number plates, with markings and dimensions as shown in Figure 1, one with a white and one with a yellow retroreflecting background; or
- b) in the case of a motorcycle plate, one sample number plate with the markings and dimensions shown in Figure 1 and with a yellow retroreflecting background,

as used, with the B and 8 (see Figure 1) in the format and size specified in the Road Vehicles (Display of Registration Marks) Regulations 2001 (as amended) [1].

The area of the black square shall be sufficient to give accurate retroreflection readings of black print.

A schedule shall accompany every sample unit detailing the materials used in its construction.

Table 1 — Test schedules

Number of samples and tests	Clause	Test schedule				Total
		1	2	3	4	
No. of sample units required		1	1	3	1	6
1 Colorimetric test	7	T	—	—	—	
2 Retroreflection test	8	T	—	—	—	
3 Resistance to bending	9	T	—	—	—	
4 Resistance to solvents	10	T	—	—	—	
5 Thermal resistance	11	—	T	—	—	
6 Resistance to impact	12	—	—	T	—	
7 Resistance to abrasion	13	—	—	T	—	
8 Resistance to corrosion	14	—	—	T	—	
9 Resistance to weathering	15	—	—	—	T	
10 Opacity of characters in NIR	5.3	T	T	T	T	
"T" indicates that testing is necessary.						