BRITISH STANDARD

BS 5378-2:1980
(Reprinted, incorporating Amendments Nos. 1 and 2)

Safety signs and colours —

Part 2: Specification for colorimetric and photometric properties of materials

UDC 003.62:614.8:62-777.6

Cooperating organizations

The Personal Safety Equipment Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations.

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British Rubber Manufacturers' Association
British Safety Council
British Steel Industry*
Cement Makers' Federation
Chemical Industries Association*
Council of Ironfoundry Associations
Department of Industry, National Engineering Laboratory
Electricity Supply Industry in England and Wales*
Engineering Employers' Federation*
Engineering Equipment Users' Association
Federation of Civil Engineering Contractors
Glass Manufacturers' Federation
Health and Safety Executive*
Industrial Safety (Protective Equipment) Manufacturers' Association*
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Institution of Civil Engineers
Institution of Industrial Safety Officers
Institution of Production Engineers
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Light Metal Traders Organization
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National Radiological Protection Board
Royal Society for the Prevention of Accidents*
Trades Union Congress

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

British Non-ferrous Metals Federation
British Sign Association
Chartered Institution of Building Services
Chief and Assistant Chief Fire Officers' Association
Department of Health and Social Security
Institution of Fire Engineers
Ministry of Defence
Paintmakers Association of Great Britain Ltd.
Individual expert

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Foreword

This revision of BS 5378 has been prepared under the direction of the Personal Safety Equipment Standards Committee and consists of three Parts, which may be purchased separately. BS 5378:1976 has been withdrawn.

Over many years, widely different codes and systems of safety signs have been developed.

This British Standard specifies a system for giving health or safety information that keeps the use of words to a minimum. The need for such a system has arisen due to the increase in international trade and travel and the development of work forces that do not share a common language.

Attention is drawn to the fact that education and training is an essential part of any system for giving health or safety information.

BS 5378 was originally published in 1976 and was based upon the draft international standard ISO/DIS 3864 issued by the International Organization for Standardization (ISO). Since publication of that draft, the EEC has issued a Directive (77/576/EEC) "Council Directive of 25 July 1977 on the Approximation of the Laws, Regulations and Administrative Provisions of the Member States relating to the provision of safety signs at places of work".

The Directive is based upon the ISO work.

The international standard, ISO 3864, was published in 1984 and covers the same subject matter as Parts 1 and 2 of BS 5378, but it is not identical with them. Attention is drawn in this Part of BS 5378 to the main differences between the publications.

BS 5378-1, which deals with basic principles and gives examples of safety signs, is in line with the EEC Directive (77/576/EEC) and was prepared in anticipation of the preparation of the Safety Signs Regulations 1980 (Sl 1980 No. 1471).

BS 5378-3 has been produced to cover additional requirements.

This Part of BS 5378 gives guidance on preferred sizes of signs in Appendix A and specifies the colorimetric and photometric properties of materials. These are not specific requirements of the EEC Directive, but are recommendations supplementary to it. ISO 3864-1984 includes requirements for colorimetric and photometric properties which, for blue colours, are more restrictive than the requirements of this Part of BS 5378. The technical committee responsible for the preparation of this British Standard, and for monitoring the ISO work, did not agree with the restriction imposed on blue colours in ISO 3864-1984 but the ISO limits have been indicated, for information, in this standard.

The colour areas for all other ordinary surface colours, retroreflecting surface colours and fluorescent red and orange-red are identical with those specified in ISO 3864-1984.

This Part of BS 5378 allows photoluminescent white to be used as an alternative to ordinary white or retroreflecting white. The colour area for photoluminescent white under normal illumination is specified, but the performance characteristics of this material upon removal of normal illumination are not specified.

NOTE BS 5378-1 is called up in the Safety Signs Regulations 1980 (Sl 1980 No. 1471).

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 9 and a back cover.

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1 Scope

This Part of this British Standard specifies the colorimetric and photometric properties of materials and gives the preferred sizes for safety signs complying with the requirements of Part 1.

2 References

The titles of the standards publications referred to in this Part of this standard are listed on page 9.

3 Definitions

For the purposes of this Part of this standard the following definitions apply.

3.1
colour boundary
a (straight) line in the CIE chromaticity diagram (CIE 45-15-200[1)]) separating the area of the permitted colours from that of the non-permitted colours

3.2
luminance factor
(at a point on the surface of a non-self-radiating body, in a given direction, under specified conditions of illumination.) Ratio of the luminance of the body to that of a perfect reflecting diffuser identically illuminated (CIE 45-20-200[1)])

3.3
coefficient of retroreflection (R^1)
(of a plane retroreflecting surface). The quotient obtained by dividing the luminous intensity (I) of the retroreflecting material in the direction of observation, by the product of the illuminance ($E\perp$) at the retroreflecting surface on a plane perpendicular to the direction of the incident light and its area (A)

$$R^1 = \frac{I}{E\perp \times A}$$

3.4
ordinary colour
a colour that is neither retroreflecting nor fluorescent

4 Colorimetric and photometric properties of the materials

4.1 Conditions

The physical requirements with which the materials comply shall be primarily related to daytime colour.

Colour measurements shall be made as specified in CIE Publication No. 15[2)] (reference **E.1.3.1**).

NOTE For the colorimetric measurements, the material is considered to be illuminated by daylight as represented by the Standard Illuminant D_{65} (CIE 45-15-145[3)]) at an angle of 45° with the normal to the surface and the observation is made in the direction of the normal (45/0 geometry).

The coefficient of retroreflection shall be measured in accordance with CIE Publication No. 7, 1960 volume D, pages 566 to 571[4)] using Standard Illuminant A, under the condition that the entrance and observation angles are in the same plane.

[1)] CIE (Commission Internationale de l'Eclairage) Vocabulary Publication No. 17, 1970, "International lighting vocabulary". CIE publications may be obtained from the National Illumination Committee of Great Britain, c/o The Library, Thorn Lighting Ltd., Great Cambridge Road, Enfield, Middlesex EN1 1UL. Tel. 01-363 5353.

[2)] CIE (Commission Internationale de l'Eclairage) Publication No. 15, 1971, "Colorimetry".

[3)] CIE (Commission Internationale de l'Eclairage) Publication No. 17, 1970, "International lighting vocabulary".

[4)] CIE (Commission Internationale de l'Eclairage) Publication No. 7, 1960, volume D, "Proceedings 14th session, Brussels".

4.2 Requirements

When measured under the conditions specified in **4.1**, each colour shall have chromaticity coordinates within the colour areas shown in Figure 1 or Figure 2, as appropriate. The *x* and *y* coordinates of the corner points of the colour areas, and the luminance factors required, shall be as specified in Table 1 or Table 2, as appropriate. The minimum coefficients of retroreflection for retroreflecting materials shall be as specified in Table 3.

The signs (including the colours) shall maintain the same meaning under all relevant lighting conditions.

NOTE 1 Retroreflecting materials: if, in practice, the photometric values of the retroreflecting materials drop below 50 % of the required minima given in Table 3, or if the chromaticity coordinates fall outside the boundaries in Table 1, the materials ARE NOT CONSIDERED SUITABLE FOR SAFETY USE.

NOTE 2 Fluorescent materials: if, in practice, the luminance factors of the fluorescent materials fall below 50 % of the required minima given in Table 2, or if the chromaticity coordinates fall outside the boundaries in Table 2, the materials ARE NOT CONSIDERED SUITABLE FOR SAFETY USE.

NOTE 3 Ordinary coloured materials: if, in practice, the chromaticity coordinates and luminance factors fall outside the boundaries in Table 1, the materials ARE NOT CONSIDERED SUITABLE FOR SAFETY USE.

NOTE 4 Details of colours that are known to comply with the requirements of this clause are given in Appendix B.

NOTE 5 Photoluminescent materials: if, in practice, the luminance factor of the photoluminescent materials falls below 50 % of the required minimum given in Table 2, or if the chromaticity coordinates fall outside the boundaries of Table 2, the materials ARE NOT CONSIDERED SUITABLE FOR SAFETY USE.

Table 1 — Chromaticity coordinates and luminance factors for ordinary and retroreflecting colours[a]

Colour		Chromaticity coordinates of corner points determining the permitted colour area Standard illuminant D_{65} (45/0 geometry)				Luminance factor for		
						ordinary colours	retroreflecting colours[b]	
							Class 2	Class 1 (high performance)
		1	2	3	4			
Red	*x*	0.690	0.595	0.569	0.655	≥ 0.07	≥ 0.05	≥ 0.03
	y	0.310	0.315	0.341	0.345			
Yellow	*x*	0.519	0.468	0.427	0.465	≥ 0.45	—	—
	y	0.480	0.442	0.483	0.534			
Retroreflecting yellow	*x*	0.545	0.487	0.427	0.465	—	≥ 0.27	≥ 0.16
	y	0.454	0.423	0.483	0.534			
Green	*x*	0.230	0.291	0.248	0.007	≥ 0.12	—	—
	y	0.754	0.438	0.409	0.703			
Retroreflecting green	*x*	0.007	0.248	0.177	0.026	—	≥ 0.04	≥ 0.03
	y	0.703	0.409	0.362	0.399			
Blue	*x*	0.078	0.198	0.240	0.137	≥ 0.05		
	y	0.171	0.252	0.210	0.038			
Retroreflecting blue	*x*	0.078	0.150	0.210	0.137	—	≥ 0.01	≥ 0.01
	y	0.171	0.220	0.160	0.038			
White	*x*	0.350	0.300	0.290	0.340	≥ 0.75	—	—
	y	0.360	0.310	0.320	0.370			
Retroreflecting white	*x*	0.350	0.300	0.285	0.335	—	≥ 0.35	≥ 0.27
	y	0.360	0.310	0.325	0.375			
Black	*x*	0.385	0.300	0.260	0.345	≤ 0.03	—	—
	y	0.355	0.270	0.310	0.395			

[a] The chromaticity coordinates of corner points for ordinary blue colours in ISO 3864:1984 are identical with those for retroreflecting blue colours in this specification. Other requirements in Table 1 are identical with the ISO 3864:1984 requirements.

[b] The designations "class 2" and "class 1 (high performance)" are used for consistency with BS 873. The ISO 3864-1984 designations are "type 1" (for class 2) and "type 2 (high performance)" for class 1 (high performance).

Table 2 — Chromaticity coordinates and luminance factors for fluorescent and photoluminescent materials

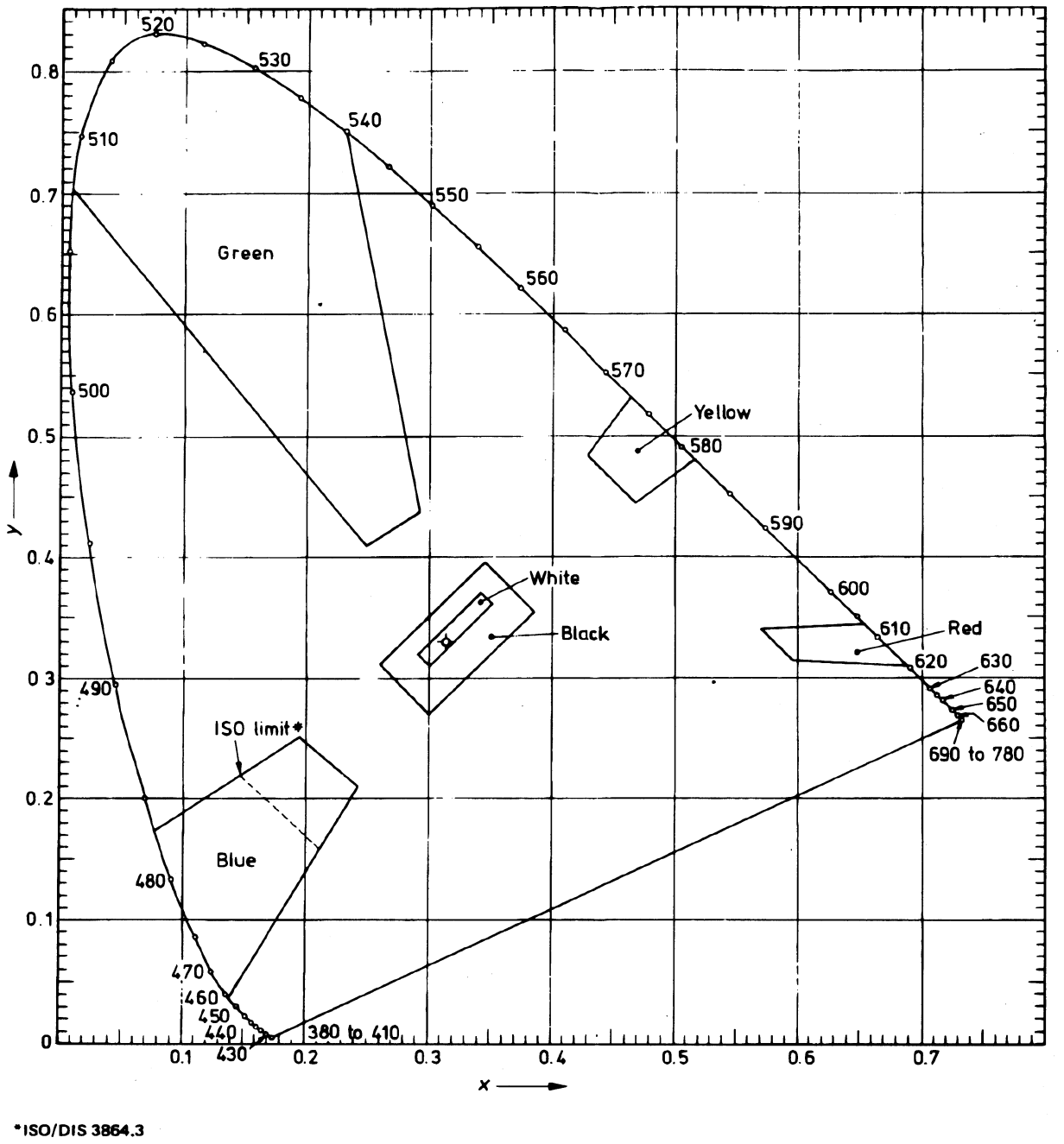
Colour		Chromaticity coordinates of corner points determining the permitted colour areas Standard illuminant D_{65} (45/0 Geometry)				Luminance factor
		1	2	3	4	
Fluorescent red and orange-red	*x*	0.690	0.595	0.535	0.610	≥ 0.25
	y	0.310	0.315	0.375	0.390	
Photoluminescent white	*x*	0.320	0.290	0.390	0.360	≥ 0.65
	y	0.335	0.365	0.405	0.435	

Table 3 — Coefficients of retroreflection

Observation angle	Entrance angle	Minimum coefficient of retroreflection[a] in cd/(lx m^2) Standard illuminant A									
		Class 2[b]					Class 1 (high performance)[b]				
		White	Yellow	Red	Green	Blue	White	Yellow	Red	Green	Blue
20′	5°	50	35	10	7	2	180	122	25	21	14
	30°	24	16	4	3	1	100	67	14	11	7
	40°	9	6	1.8	1.2	0.4	95	64	13	11	7
2°	5°	5	3	0.8	0.6	0.2	5	3	0.8	0.6	0.2
	30°	2.5	1.5	0.4	0.3	0.1	2.5	1.5	0.4	0.3	0.1
	40°	1.5	1.0	0.3	0.2	0.06	1.5	1.0	0.3	0.2	0.06

[a] For coloured parts of signs which are printed, the coefficient of retroreflection should be not less than 70 % of the values in Table 3.

[b] The designations "class 2" and "class 1 (high performance)" are used for consistency with BS 873. The ISO 3864:1984 designations are "type 1" (for class 2) and "type 2 (high performance)" for class 1 (high performance).



*ISO/DIS 3864.3

Figure 1 — Boundaries for red, yellow, green, blue, white and black ordinary surface colours

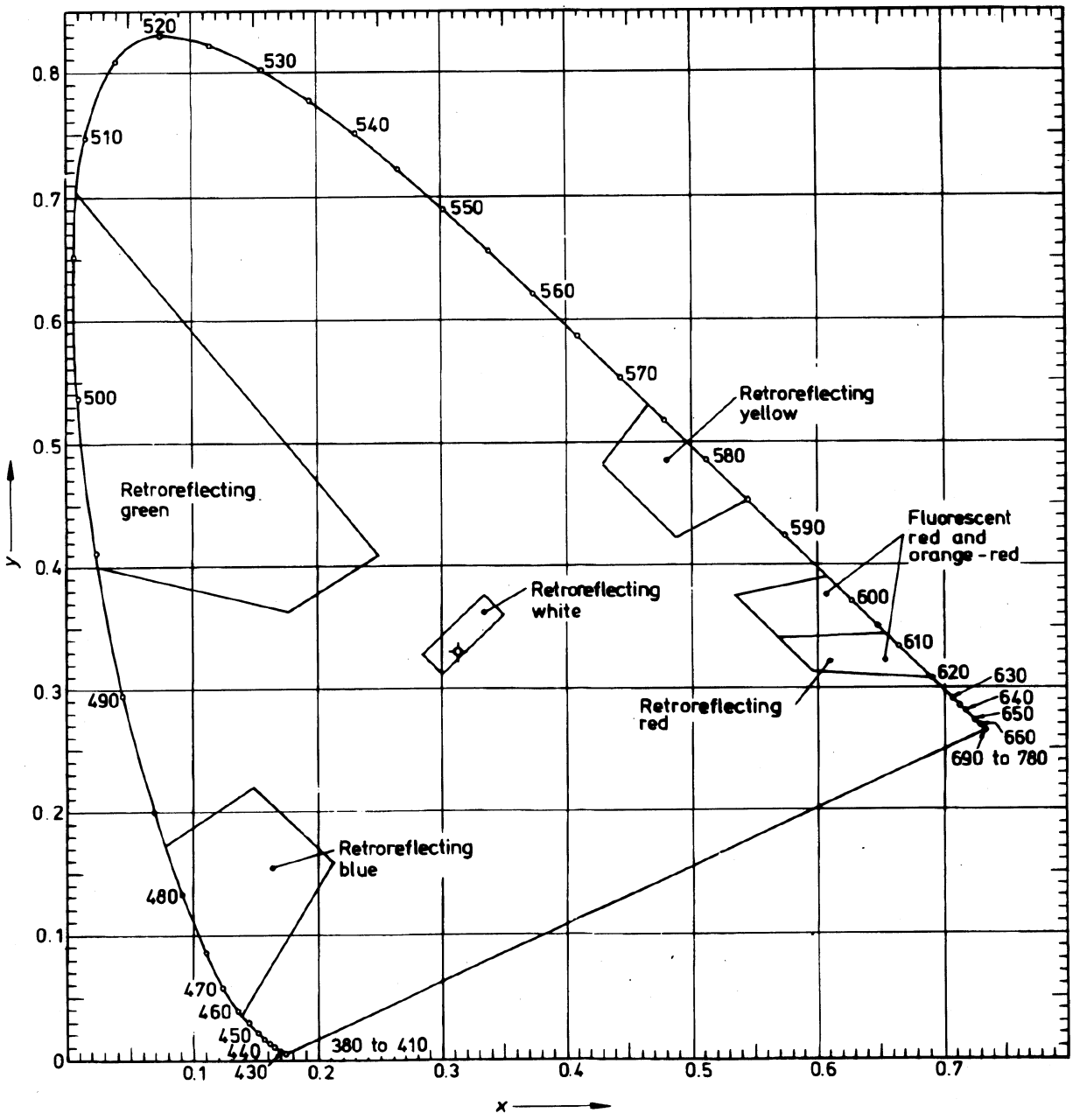


Figure 2 — Boundaries for retroreflecting surface colours and for fluorescent red and orange-red

Appendix A
Preferred dimensions of single safety signs

The preferred dimensions of safety signs (see clause **5** of BS 5378-1:1980) and preferred letter sizes are given in Table 5 and Table 6 respectively with reference to Figure 3.

If lettering is to be used on a supplementary sign, it is recommended that the letter size be in accordance with Table 6. The values given in the table are the height of a lower case letter "x".

Appendix B
Colour references

The colours detailed in Table 4 are selected from the framework for reference colour coordination for building purposes given in BS 5252 and are known to comply with the requirements of **4.2**. In order to ascertain the availability of the colours in the particular material selected for use in safety signs, reference should be made to relevant standards for colour ranges for particular materials, i.e. BS 4800, BS 4900, and BS 4901 (which use the same identification code as BS 5252). References to the colours in BS 381C are also given, since this standard has been in use for many years and employs a different identification code. This list is not intended to imply that the BS 5252 colours and the BS 381C colours are equivalent, but does indicate that each of the colours listed satisfies the requirements of **4.2**.

Table 4 — Colour references

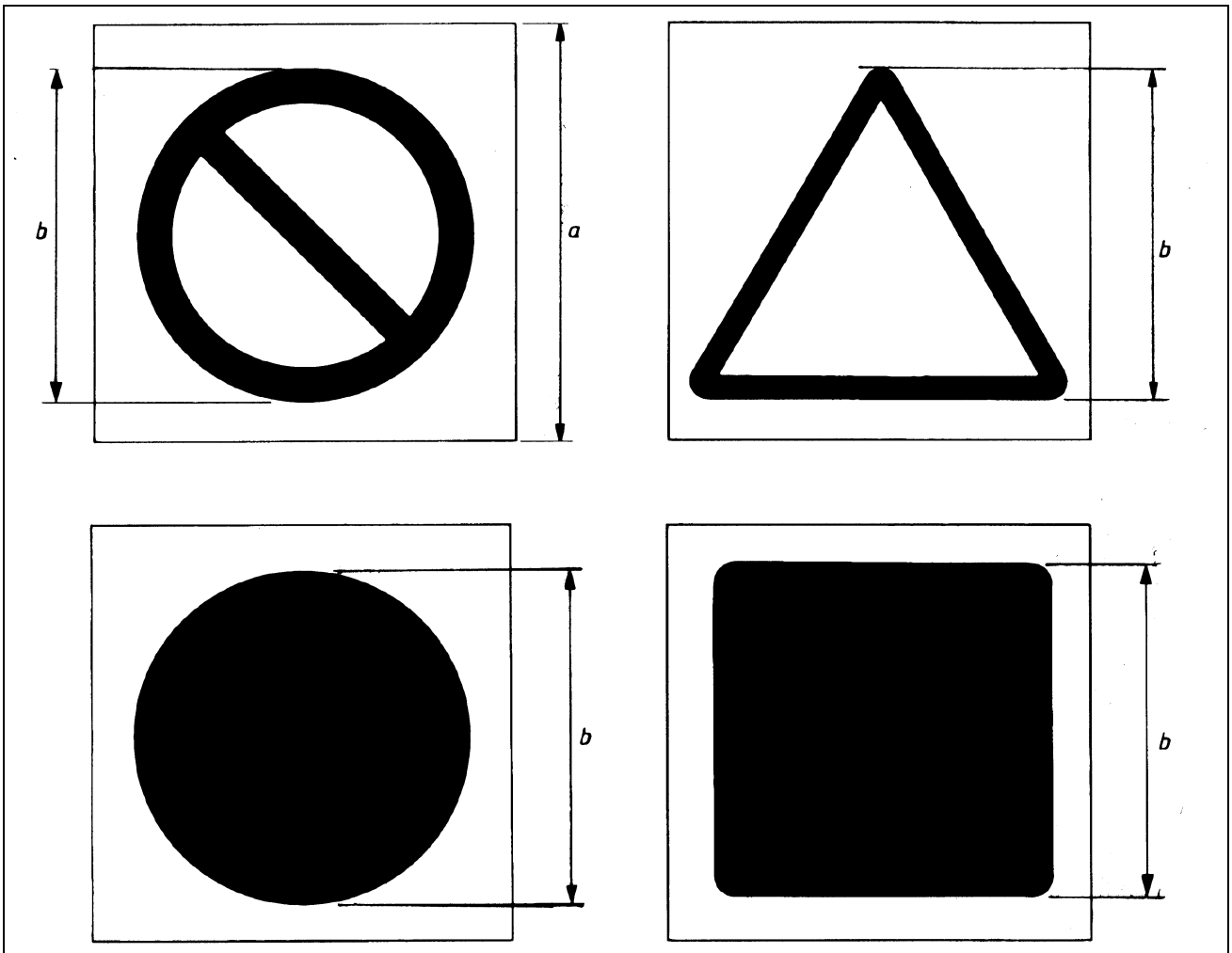
Colour	BS 5252 reference	BS 381C reference
Red	04E53	537 G 539 G
Yellow	08E51 10E51 10E55	355 G or M 309 G or M
Green	14E53	228 G
Blue	18D45[a] 20D44[a] 20D45[a] 18E53 20E53 20E56	104 G[a] or M[a] 107 G[a] 108 G 109 G[a] 166 G or M[a]
NOTE G = Gloss, M = Matt.		
[a] These colours are outside the range of blue colours complying with (draft) ISO requirements (see foreword and the footnote to Table 1).		

Table 5 — Preferred sizes of signs

Modular height of sign plate, *a* mm	Diameter or height of geometric shape of safety sign, *b* mm
75	60
100	80
150	120
225	180
300	240
600	480
750	600
900	720
1 200	960
NOTE The modular sizes are taken from BS 4011.	

Table 6 — Preferred letter sizes

Diameter or height of geometric shape of safety sign, *b* mm	Height of letter "x" mm
60	5.0
80	6.6
120	10.0
180	15.0
240	20.0
480	40.0
600	50.0
720	60.0
960	80.0



a is the modular height of a sign plate, for a safety sign or supplementary sign.
b is the diameter or height of the geometric shape of a safety sign.

Figure 3 — Measured dimensions for signs

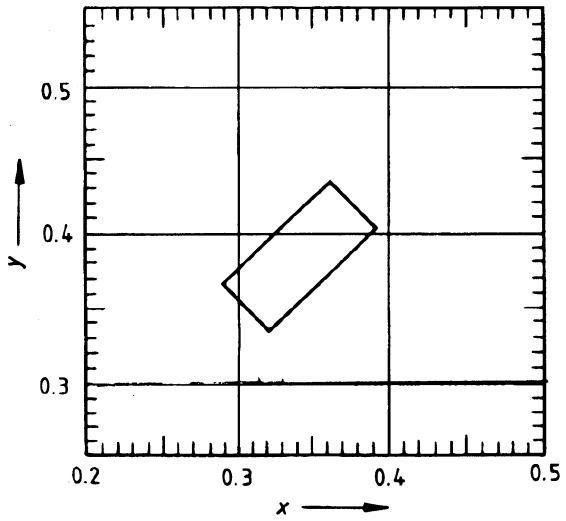


Figure 4 — Boundary for photoluminescent white

Standards publications referred to

BS 381C, *Colours for specific purposes*.

BS 873, *The construction of road traffic signs and internally illuminated bollards*.

BS 4011, *Recommendations for the co-ordination of dimensions in building. Co-ordinating sizes for building components and assemblies*.

BS 4800, *Paint colours for building purposes*.

BS 4900, *Specification for vitreous enamel colours for building purposes*.

BS 4901, *Specification for plastics colours for building purposes*.

BS 5252, *Framework for colour coordination for building purposes*.

ISO 3864, *Safety colours and safety signs*.

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