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Graphical symbols — Safety colours and safety signs —

Part 4: Colorimetric and photometric properties of safety sign materials

Symboles graphiques — Couleurs de sécurité et signaux de sécurité — Partie 4: Propriétés colorimétriques et photométriques des matériaux des signaux de sécurité

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 3864-4 was prepared by Technical Committee ISO/TC 145, *Graphical symbols*, Subcommittee SC 2, *Safety identification, signs, shapes, symbols and colours*.

This part of ISO 3864, together with ISO 3864-1:—, cancels and replaces ISO 3864-1:2002, which has been technically revised.

ISO 3864 consists of the following parts, under the general title *Graphical symbols — Safety colours and safety signs*:

— *Part 1: Design principles for safety signs and safety markings*

— *Part 2: Design principles for product safety labels*

— *Part 3: Design principles for graphical symbols for use in safety signs*

— *Part 4: Colorimetric and photometric properties of safety sign materials*

Introduction

This part of ISO 3864 has been prepared to provide manufacturers/suppliers of safety signs and test laboratories and instrument manufacturers with specifications of the colorimetric and photometric properties of safety signs comprising different types of material and with test methods.

Consistent use of this part of ISO 3864 will assist in improving knowledge of safety-sign requirements and in furthering understanding of the performance of various types of safety signs in everyday use.

This part of ISO 3864 is intended to be used by all Technical Committees within ISO charged with developing specific safety signing for their industry, to ensure that there is only one set of colorimetric and photometric requirements and test methods for safety signs.

Note that some countries' statutory regulations may differ in some respect from those given in this part of ISO 3864.

Graphical symbols — Safety colours and safety signs —

Part 4: Colorimetric and photometric properties of safety sign materials

IMPORTANT — The electronic file of this document contains colours which are considered to be useful for the correct understanding of the document. Users should therefore consider printing this document using a colour printer.

1 Scope

This part of ISO 3864 establishes the colorimetric and photometric requirements and test methods for the colours of safety signs to be used in workplaces and public areas. It provides the colorimetric and photometric specifications for the named safety and contrast colours prescribed in ISO 3864-1.

The physical requirements that safety signs have to meet are primarily related to daytime colour and normally lit environments. This part of ISO 3864 also includes the colorimetric requirements and test methods for safety signs and phosphorescent material which also operate in unlit environments.

This part of ISO 3864 is applicable to all locations where safety issues related to people need to be addressed. However, it is not applicable to signalling used for guiding rail, road, river, maritime and air traffic and, generally speaking, to those sectors subject to a regulation that may differ.

The colorimetric and photometric properties of retroreflective safety signs, retroreflective materials combined with fluorescent or phosphorescent materials, or luminous safety signs activated by a radioactive source are not specified in this part of ISO 3864.

2 Normative references

The following referenced documents are indispensable for the application 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 3864-1: —[1)], *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 17724:2003, *Graphical symbols — Vocabulary*

CIE 15, *Colorimetry*

CIE 69, *Methods of characterizing illuminance meters and luminance meters: Performance, characteristics and specifications*

1) To be published. (Revision of ISO 3864-1:2002)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17724 and the following apply.

3.1
colour region
boundary values of x, y chromaticity coordinates of the CIE 2° standard colorimetric observer and luminance factor or luminance for the named colour

3.2
contrast
C
difference in luminance factors of the graphical symbol and its background, divided by the larger luminance factor β_a, where β_b is the smaller luminance factor

$$C = (\beta_a - \beta_b) / \beta_a$$

3.3
contrast colour
colour that contrasts with the safety colour in order to make the safety colour more conspicuous

3.4
externally illuminated safety sign
safety sign that is illuminated, when required, by an external source

3.5
internally illuminated safety sign
safety sign that is illuminated, when required, by an internal source

3.6
luminance contrast
k
luminance of the contrast colour, L_1, divided by the luminance of the safety colour, L_2, where L_1 is greater than L_2

$$k = L_1 / L_2$$

[ISO 17724:2003, definition 43]

3.7
luminance factor
β
ratio of the luminance of the surface element in a given direction to that of a perfect reflecting or transmitting diffuser identically illuminated

[ISO 17724:2003, definition 44]

3.8
maintained safety sign
sign in which the integral lamps are energized at all times when normal or emergency mode of operation is required

3.9
non-maintained safety sign
sign in which the integral lamps are in operation only when the power supply to the normal lighting fails

3.10
object colour
named colour of safety sign elements specified in terms of chromaticity coordinates x, y of the CIE 2° standard colorimetric observer and either luminance factor or luminance

3.11
ordinary material
material which is neither retroreflecting nor fluorescent nor phosphorescent nor involves powered light emission nor is activated by a radioactive source

3.12
phosphorescent material
material incorporating phosphors that, if excited by UV or visible radiation, store energy, which is emitted as light over a period of time

3.13
safety colour
specific colour with special properties to which a safety meaning is attributed

[ISO 17724:2003, definition 66]

4 Requirements

4.1 General

All colorimetric and photometric requirements apply to the materials as used in the finished sign.

The safety colours and contrast colours for the geometric shape of safety signs and the graphical symbols for particular types of safety signs are given in ISO 3864-1.

The requirements are based on the CIE 2° standard colorimetric observer, as specified in CIE 15.

Where the requirement involves the colour of the sign material under external illumination, the requirements are based on CIE Standard illuminant D65 at either an angle of 45° with the normal to the surface and the observation made in the direction of the normal (45°a:0° geometry) or normal to the surface and observation made in the direction of 45° to the surface (0°:45°a geometry).

Requirements and test methods are given for safety signs in lit and unlit conditions.

NOTE Information on colour characteristics of externally illuminated, internally illuminated and phosphorescent materials is given in Annex A.

Safety signs without an integral source of light are required to be externally illuminated for their intended function.

Internally illuminated safety signs are classified as “maintained” (integral light source is powered) or “non-maintained” (sign is externally illuminated when the integral light source is unpowered, but in an emergency condition the integral light source is powered). If the sign is intended to be dimmed, the requirements need to be met under this condition as well.

Phosphorescent safety signs have applications in both lit and unlit environments. For example, during an emergency, the excited phosphorescent materials emit light over a period of time.

Requirements are specified in terms of colour region for each named colour.

Requirements for safety signs comprised of ordinary materials are specified in 4.2.1. Requirements for non-maintained internally illuminated safety signs are specified in 4.2.2 (when the integral light source is not powered) and in 4.3 (when the integral light source is powered). Requirements for maintained internally

illuminated safety signs are specified in 4.3. Requirements for phosphorescent safety signs under external illumination are specified in 4.2.3.

The materials are no longer considered suitable for safety use if, while in use, the chromaticity coordinates and/or luminance factor fall outside the colour regions given in Table 1 for the type of safety sign material, or the chromaticity coordinates and/or luminance or luminance contrast fall outside the ranges given in Tables 2 and 3 for the type of safety sign.

For classification purposes by manufacturers, the performance requirements and the test method for the emission colour of phosphorescent materials are given in Annex B.

4.2 Object colour under external illumination

4.2.1 Safety sign comprising ordinary materials

When the object colour is tested in accordance with 5.2.1, the chromaticity coordinates of each colour shall fall within the relevant colour region specified in Table 1, as illustrated in Figure 1. The luminance factor for each colour shall be as specified in Table 1.

4.2.2 Unpowered internally illuminated safety signs under external illumination

When an unpowered internally illuminated safety sign is tested in accordance with 5.2.2, the chromaticity coordinates of each colour shall fall within the relevant colour region specified in Table 1, as illustrated in Figure 1. The luminance factor for each colour shall be as specified in Table 1.

4.2.3 Phosphorescent safety signs under external illumination

When the phosphorescent material substrate, or phosphorescent material with colour printed on the phosphorescent surface, is tested in accordance with 5.2.3, the chromaticity coordinates of each colour shall fall within the relevant colour region specified in Table 1, as illustrated in Figure 1. The luminance factor for each colour shall be as specified in Table 1.

4.3 Object colour of powered internally illuminated safety signs

When the object colour of a powered internally illuminated safety sign is tested in accordance with 5.3, the chromaticity coordinates of any test patch of each colour shall fall within the relevant colour region specified in Table 2, as illustrated in Figure 2. The luminance for each colour shall be as specified in Table 2.

The luminance contrast, k, shall be as specified in Table 3.

The ratio of minimum luminance to maximum luminance within either white or the safety colour shall be greater than 1:5. If the luminance of the safety sign is greater than 100 cd/m^2, the ratio of minimum to maximum luminance within the colour shall be greater than 1:10.

In the application of powered internally illuminated safety signs in normal lighting conditions, higher luminance values of the signs should be appropriate to the luminous environment for legibility. The criteria for luminance contrast and the ratio of luminances within each colour shall be met.

The requirements of this clause shall also apply to non-maintained internally illuminated safety signs when the integral light source is powered.

Table 1 — Colour regions: chromaticity coordinates and luminance factor for object colours of ordinary materials, phosphorescent materials and unpowered internally illuminated safety signs under external illumination

Colour region	Corner points of colour region CIE Standard illuminant D65 CIE 2° standard colorimetric observer					Luminance factor β	
		1	2	3	4	Minimum	Maximum
Red	x	0,705	0,592	0,574	0,663	0,07	0,2
	y	0,295	0,291	0,351	0,337		
Yellow	x	0,475	0,538	0,470	0,427	0,45	0,70
	y	0,525	0,462	0,424	0,472		
Green	x	0,201	0,285	0,170	0,026	0,11	0,25
	y	0,776	0,441	0,364	0,399		
Blue	x	0,078	0,180	0,225	0,137	0,05	0,2
	y	0,171	0,239	0,184	0,038		
Phosphorescent yellow-white contrast	x	0,310	0,310	0,420	0,340	0,65	
	y	0,340	0,480	0,480	0,370		
White	x	0,350	0,295	0,285	0,340	0,75	
	y	0,360	0,305	0,315	0,370		
Black	x	0,385	0,300	0,260	0,345		0,03
	y	0,355	0,270	0,310	0,395		